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Technological Leadership and Foreign Investors' Choice of Entry Mode

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Developing country governments tend to favor joint ventures over other forms of foreign direct investment, believing that local participation facilitates the transfer of technology and marketing skills However, foreign investors who are technological or marketing leaders in their industries are more likely to invest in wholly owned projects than to share ownership. Thus in R&D-intensive sectors joint ventures may offer less potential for transferring technology and marketing techniques than wholly owned subsidiaries

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Summary findings

Developing country governments tend to favor joint ventures over other forms of foreign direct investment, believing that local participation facilitates the transfer of technology and marketing skills. Smarzynska assesses joint ventures' potential for such transfers by comparing the characteristics of foreign investors engaged in joint ventures with those of foreign investors engaged in wholly owned projects in transition economies in the early 1990s.

Unlike the existing literature, Smarzynska focuses on intra-industry differences rather than interindustry differences in R&D and advertising intensity.

Empirical analysis shows that foreign investors who are technological or marketing leaders in their industries are more likely to invest in wholly owned projects than to share ownership. This is true in high- and medium-technology sectors but not in industries with low R&D spending.

Smarzynska concludes that it is inappropriate to treat industries as homogeneous in investigating modes of investment. She also suggests that in sectors with high R&D spending joint ventures may present less potential for transfer of technology and marketing techniques than wholly owned subsidiaries.

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Technological Leadership and Foreign Investors' Choice of Entry Mode

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I. Introduction

During the last several decades, there has been a significant change in the attitudes of governments, especially those in developing countries, towards foreign direct investment (FDI). Rather than viewed as evil exploiters, foreign investors are now welcomed as a source of new technologies, better management and marketing techniques and creators of skilled jobs. Not all types of foreign investment, however, are perceived as equally beneficial to host countries. Governments tend to favor joint ventures (JVs) over other forms of FDI, since they believe that active participation of local firms facilitates the absorption of new technologies and marketing skills.[1] We leave aside the issue of whether this perception is true, and instead we attempt to compare the potential of JVs and wholly owned foreign subsidiaries for such transfers.

While the existing literature demonstrates that differences in R&D and advertising intensities *between* industries influence a foreign investor's choice of entry mode, we focus on patterns present *within* industries. We provide empirical evidence indicating that industry structure affects the choice of entry mode and thus treating industries as homogenous, as it was done in the earlier studies, is not appropriate. We find that JVs in manufacturing sectors tend to be undertaken by foreign investors possessing fewer intangible assets than their counterparts involved in wholly owned projects. We show that these effects are present in higher R&D industries but not in low technology sectors. Therefore, our findings suggest that JVs in more R&D intensive sectors may present a lower potential for transfers of technology and marketing skills than wholly owned foreign subsidiaries.

Theoretical literature suggests that costs involved in drafting and enforcing contracts guiding the transfers of proprietary know-how to JVs as well as the threat of knowledge dissipation may make shared ownership less attractive and encourage establishment of wholly owned subsidiaries. Firms differentiating their products through advertising may also seek full ownership to assure the quality of their products and prevent debasing of their trademarks.

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[1] See Beamish (1988), Blomström and Zejan (1991), Blomström and Sjöholm (1998). Such views have led some host countries to restrict the extent of foreign ownership or to offer special incentives to foreign investors undertaking JVs with local partners. For instance, in the 1980s restrictions on foreign ownership were present in China, India, Indonesia, Malaysia, Mexico, Nigeria, Pakistan, the Republic of Korea and Sri Lanka (UNCTC, 1987).

Empirical studies confirm these predictions by finding a negative relationship between industry or firm level R&D and advertising intensities and the probability of shared ownership (Stopford and Wells, 1972; Gatignon and Anderson, 1988; Gomes-Casseres, 1989; Asiedu and Esfahani, 1998).[2]

In contrast to existing research, we propose that the choice of entry mode depends not only on R&D or advertising intensity of a sector but also on an investor's endowment of intangible assets relative to the industry average (hereafter referred to as relative R&D and advertising intensity). Relative endowment of intangible assets may affect a firm's choice of entry mode in two opposing ways.

On the one hand, technological and marketing leaders in an industry may have a greater bargaining power in negotiations with local firms and authorities and may be able to secure more favorable terms of JV agreements. Thus, they are likely to gain more from such arrangements than industry laggards.[3] In R&D-intensive sectors, foreign technological leaders may also be so advanced compared to domestic firms that technology leakage may not pose a severe threat since local firms may be unable to use independently the knowledge acquired through a JV. Thus, we should expect to observe that industry leaders are more likely to share ownership than industry laggards.

On the other hand, if the gap between foreign and domestic firms does not guarantee protection against dissipation of intangible assets, industry leaders may be more averse to shared ownership than industry laggards. Moreover, they may use their bargaining power to negotiate sole ownership in countries where foreign ownership is restricted by the government. In that case, relative endowment of intangible assets would be positively correlated with the probability of full ownership. Thus, the theoretical predictions are ambiguous and an empirical investigation is necessary to shed some light on this issue.

In this study, we test whether intraindustry differences in intangible assets affect a foreign investor's choice of entry mode. We also examine whether these effects are the same in industries with different levels of R&D spending. In our analysis, we focus on manufacturing

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[2] R&D intensity is defined as expenditure on R&D expressed as a percentage of net sales. In the text, the terms "R&D expenditure," "R&D spending," and "R&D efforts" refer to R&D intensity. Sectors with a high average R&D intensity are described as high technology or R&D-intensive sectors.

[3] There exist evidence indicating that firms with higher R&D spending enjoy a greater bargaining power in negotiations with host country governments (see Stopford and Wells, 1972; UNCTAD, 1992).

industries and use a unique dataset on foreign investment projects in Eastern Europe and the former Soviet Union in the early 1990s. Our dataset is based on a worldwide survey of companies conducted by the European Bank for Reconstruction and Development (EBRD) and contains information on foreign investments in twenty-two transition economies.

We begin the analysis by estimating a model similar to those found in the earlier studies. As expected, we find that firm or industry level R&D spending and firm advertising expenditure are negatively related to the probability of a JV and positively correlated with the likelihood of a wholly owned project. Thus, we show that factors governing the choice of entry mode in transition economies are similar to those present in other regions.

To test our first hypothesis, we include in the model industry level R&D intensity as well as the ratio of a firm's R&D spending to the industry mean. The latter variable serves as a proxy for a firm's technological sophistication. We recognize that R&D intensity is not a perfect measure of a firm's intangible assets and that firms may have other intangible assets they are concerned about dissipating, such as distribution and marketing techniques. To take this into account, we add an analogous variable capturing sophistication of marketing techniques. Additionally, we control for other firm specific characteristics and progress of reform in a host country. We also improve over the existing studies by taking into account possible sample selection bias arising from the fact that the same firm characteristics affect both a firm's decision whether to invest and the choice of entry mode.

The empirical analysis supports our hypothesis that an investor's endowment of intangible assets relative to other firms in the industry influences their choice of entry mode. We find a negative relationship between an investor's technological and marketing sophistication and the probability of shared ownership. Thus, our results indicate that industry structure affects investors' behavior and industrial sectors should not be treated as homogenous in an examination of entry mode.

We also test whether these effects vary between industries by allowing for different coefficients in high/medium and low technology sectors. We show that the impact of technological and marketing sophistication on the choice of entry mode is statistically significant in the former but not in the latter group of industries. This finding is robust to different classifications of sectors.

This study is structured in the following manner. The next section reviews the related literature. In section III, we present our hypotheses, followed by a description of the dataset and the statistical models in section IV. The empirical results are discussed in section V. The concluding remarks close the paper.

II. Related Literature

Theory

The theory suggests that in order to compete successfully in a foreign market a firm must possess the so called ownership advantages that can take the form of a superior technology, proprietary knowledge, managerial and marketing skills and so on. A firm can earn rents on these assets through arm's length transactions (e.g., licensing, franchising, turnkey contracts) or by creating a subsidiary or engaging in a JV in a foreign country. Assessing the value of intangible assets is a difficult task and is associated with information asymmetry. The seller may not receive adequate payment since he may not be able disclose the full potential of future profits generated by a given technology to a prospective buyer without giving away private information on the technology itself (see Dunning, 1988). Thus, firms possessing more sophisticated technologies may face more uncertainty in pricing and may prefer wholly owned projects to JVs or arm's length transactions.

Furthermore, a wholly owned venture might be preferred to shared ownership in order to guard against leakage of sensitive information. For example, a foreign investor may be concerned that in the case of JV dissolution, the local partner will remain in possession of the technology acquired from the multinational and will become a competitor in third markets. The JV agreement may not offer a full protection against this possibility since it may be difficult to specify all contingencies in the contract.[4] Additionally, the local partner may use proprietary information obtained from the multinational in its own wholly owned operations, thus hurting

[4] A significant number of JVs terminate during the first few years of their existence. For instance, thirty-five out of ninety-two JVs examined by Kogut (1989) failed within seven years. Twenty-seven percent of JVs surveyed by Miller et al. (1996) were not expected to survive by their partners. Killing (1982) reported that thirty-six percent of partners rated the performance of their JVs as unsatisfactory.

the JV and the foreign partner (Gomes-Casseres, 1989).[5] The multinational may also fear that if the local partner controls the employment policy, it may not put enough effort into keeping key employees who may leave and reveal their knowledge of the production process to the competition.[6]

Firms investing heavily in advertising also have reasons to seek full ownership. A JV partner may have a strong incentive to free ride on the reputation of a foreign partner by debasing the quality of the product carrying the foreign trademark. In such a case, the local partner appropriates the full benefits of debasement while bearing only a small fraction of the costs (Caves, 1982; Horstmann and Markusen, 1987). Full ownership also allows foreign investors to retain control over the marketing strategy and eliminates the need to persuade the local partner about the optimal level and mix of marketing expenditure. In summary, the theory predicts that firms with greater intangible assets should prefer full ownership to JVs.

The preferences of a host country government regarding the extent of foreign ownership may differ from those of a multinational corporation. Therefore, the entry mode used may be a result of a bargaining process between the two parties (Gomes-Casseres, 1990). Studies of the bargaining approach predict that multinational corporations in R&D-intensive industries enjoy a greater bargaining power in negotiations with local authorities (Gomes-Casseres, 1990, see also UNCTAD, 1992).

Empirical evidence

Earlier empirical research on the relationship between intangible assets and the choice of entry mode found a negative correlation between firm or industry R&D intensity and the probability of shared ownership (Stopford and Wells, 1972; Gatignon and Anderson, 1988; Asiedu and Esfahani, 1998). Some studies, however, did not produce statistically significant results (e.g., Gomez-Casseres, 1989; Blomström and Zejan, 1991). Similarly, advertising intensity was shown to be negatively related to the probability of a JV (Gomes-Casseres, 1989 and 1990) but in some studies this relationship was not statistically significant (Hennart, 1991).

[5] Unilever's JV in Shanghai may serve as an example. The Chinese partner began to manufacture a washing detergent that had a similar formula and was packaged in a strikingly similar box as the Omo brand produced by the JV. (*The Economist*, April 19, 1997).

The only examination of entry modes used by foreign firms investing in Eastern Europe was undertaken by Meyer (1998). He analyzed characteristics of British and German companies engaged in minority and majority JVs and wholly owned projects in the region. For each of these categories, he estimated a logit model with the dependent variable equal to one if the particular entry mode was chosen and zero otherwise. He found a significant positive correlation between a firm's R&D intensity and the probability of a wholly owned subsidiary and a negative relationship with the likelihood of a JV. The latter effect was present in the case of minority, majority or all types of JVs combined.

Gomes-Casseres (1990) analyzed the choice between full and shared ownership in the context of bargaining theory. Among other variables, his model included industry level R&D spending as well as its interaction with a dummy variable for countries restricting the extent of foreign ownership. A positive correlation between the interaction term and the probability of a wholly owned subsidiary would indicate that investors in more R&D-intensive sectors can more easily negotiate full ownership. Neither of the two variables, however, turned out to be statistically significant.[7]

III. Hypotheses

In contrast to the earlier literature, we postulate that the choice of entry mode is influenced not only by R&D intensity of a given industry but also by R&D spending of a foreign investor *relative to* other firms within the sector. Thus, there exist both *inter* and *intraindustry* effects. However, the sign of the within industry effect is unclear.[8]

On the one hand, investors enjoying a technological lead in their sector are perceived as more attractive JV partners by local firms and governments. Thus, they are able to negotiate more favorable terms of a JV agreement. Additionally, industry leaders may be able to

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[6] In Bulgaria, the Commission for the Protection of Competition has investigated cases of violation of business secrets by former employees. Some of these cases have been brought by foreign companies operating in the country (Hoekman and Djankov, 1997).

[7] See Gomes-Casseres (1990) for a brief review of the earlier tests of the bargaining theory and a description of their limitations.

[8] Note that Cohen and Klepper (1992) showed that the distributions of R&D intensity *within* different industries "display a strikingly regular pattern" (p. 773).

undertake JVs with more successful local companies than foreign technological laggards.[9] Moreover, the technology gap between foreign leaders and domestic producers may be so large that even in the presence of knowledge transfer to a JV the threat of losing intangible assets may be minimal. Thus, industry leaders may be more willing to undertake JVs than industry laggards.

On the other hand, the technology gap may not be enough to prevent knowledge dissipation. Investors possessing technological advantage over other firms in their sector may potentially incur greater losses from knowledge dissipation than investors with less sophisticated technologies. It may also be more difficult to price cutting edge technologies than mature ones. Thus, shared ownership may be less appealing to industry leaders who may use their bargaining power to negotiate with the host country government an exemption from the restrictions on the extent of foreign ownership, should such restrictions be present.[10]

In summary, the theoretical predictions about the relationship between relative R&D intensity and the likelihood of a JV are ambiguous. Figures 1 and 2 in Appendix I illustrate the two scenarios described above. Each segment in the figures corresponds to one industry.

Note that alternatively we could adopt the assumption, often employed in the literature (e.g., Ethier and Markusen, 1996), that knowledge dissipation takes place regardless of the form a multinational corporation uses to service a local market. Thus, regardless whether the multinational enters through a wholly owned subsidiary or a JV with a local partner, it will lose its intangible assets after a certain time because of employee turnover. This loss is, however, likely to be more costly to a firm with more sophisticated technologies. Under this assumption, the question of interest is whether it is cheaper for the multinational to buy loyalty from employees of its wholly owned subsidiary or from a local partner. The literature (e.g., Ethier

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[9] In general, foreign investors tend to choose more successful local companies for acquisitions or JV arrangements. For instance, the analysis of firm level data showed that foreign investment in the Czech Republic flows to local firms of above-average size, initial profitability and initial labor productivity (Djankov and Hoekman, 1998).

[10] Foreign investors often take precautions against losses of their proprietary knowledge. Warhurst (1991) provides some examples of such efforts on the part of multinational corporations engaged in JVs in China. For instance, foreign experts training employees of the Chinese partner were reported to withhold certain technical knowledge, blueprints, etc. In one case, the Chinese company was not allowed to have access to the "'know-why' which would enable it to absorb fully and alter the technology for future needs" (p. 1063). In another case, the training of a Chinese team in the investor's home country took place in a rented section of a university and not in the company research center which may have been related in part "to a concern about protecting proprietary technology" (p. 1067).

and Markusen, 1996) shows that this depends on the parameters of the model.[11] Thus, again the theory provides us with ambiguous predictions.

Our second hypothesis is that the impact of relative R&D intensity may not be the same in all industries. It is plausible that relative R&D intensity plays an important role in high and medium but not in low technology sectors. In low R&D sectors, technological sophistication may be of lesser importance to potential local partners. At the same time, foreign investors may be less concerned about losing their technological superiority. Thus, there may exist no correlation between relative R&D intensity and the choice of entry mode in these industries. If this is the case, we will observe a relationship portrayed in Figure 3.

The figures also indicate that studies treating industries as homogenous, and thus ignoring the impact of relative R&D intensity, would produce a negative relationship between industry R&D efforts and the likelihood of a JV. A negative correlation would also be found if only a firm's R&D expenditure were included in the model. Hence, while the results of the earlier studies are consistent with the proposed framework, they capture only a part of the true relationship. If the data do not support our hypothesis, we should observe a negative correlation between the probability of a JV and firm or industry level R&D spending. However, the effect of relative R&D intensity should be insignificant.

One caveat of using relative R&D expenditure as a proxy for technological leadership is that R&D intensity is not a perfect measure of a firm's success in innovative activities. Furthermore, in low technology sectors differences between (small in general) R&D activities may not have strong effects. Finally, technology is not the only intangible asset firms may be concerned about losing. Leadership in terms of managerial techniques, marketing strategies and distribution skills may be far more important in some industries. To capture this effect, we will also control for the advertising intensity of an industry and relative advertising intensity of a firm.

Note that we assume here that all foreign investors have an option of engaging in a JV with a local partner, should they want to do so. Thus, the supply of local JV partners is not constrained, and the observed entry patterns are determined entirely by foreign investors' demand. Considering that the aggregate FDI inflows into transition economies were quite small

[11] Note that Ethier and Markusen (1996) focus on the choice between exporting, licensing and acquiring a subsidiary.

during the period covered by our sample, this assumption is quite realistic. Additionally, since most firms in our sample are relatively large, they most likely enjoyed an advantage in their search for local partners.[12]

We also assume that the available local partners fulfill some minimum standards set by foreign investors. Note that a difference in technological sophistication between foreign and local firms may be not be a serious obstacle to a successful JV agreement, since as surveys indicate local partners are expected to contribute their knowledge of market conditions, distribution networks and ability to deal with government officials, rather than to provide technological expertise (OECD, 1994).

In addition to proxies for intangible assets, the estimated model includes other variables. Blomström and Zejan (1991) mention that larger firms are more willing to take higher risks and are therefore more likely to engage in wholly owned projects than smaller companies. Thus, we control for a firm's size and expect to find that it is negatively correlated with the probability of a JV. Note, however, that the empirical investigations have often produced the opposite result (Blomström and Zejan, 1991; Meyer, 1998).[13] Stopford and Wells (1972) point out that more diversified firms tend to more tolerant towards minority ownership and are more likely to engage in JVs. This finding has been confirmed by Meyer (1998). Therefore, we also control for production diversification and anticipate a positive sign on its coefficient.

Usually, a major contribution of a local partner to a JV is the knowledge of the business environment in a host country. We can expect that as foreign investors learn more about local conditions, their need for a local partner declines (Kogut and Singh, 1988). Thus, we control for investor's regional experience and expect to obtain a negative sign. Note, however, that a study by Meyer (1988) produced a positive coefficient. Similarly, we take into account firm's international experience. As Blomström and Zejan (1991) show, firms with a greater experience in foreign operations are less likely to share ownership.

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[12] For instance, Brouthers and Bamossy (1997, p. 297) report that some state owned enterprises in the region had only limited knowledge of western firms, which led them to restrict their search for foreign JV partners to major, well-known western multinationals.

[13] We also experimented with including firm size relative to the industry average but this variable did not appear to be statistically significant and adding it to our regressions had little impact on other coefficients.

The choice between full and shared ownership is also likely to be influenced by the investment climate in a host country. On the one hand, having a local partner that is well connected with local authorities may be more useful in countries with less friendly attitude towards FDI. On the other hand, in economies with a more developed legal system and better corporate governance, foreign investor may be confident that potential disputes with local partners can be resolved fairly through the court system and thus they may be less averse to shared ownership. In summary, the relationship between business environment in a host country and the form of investment is ambiguous.

IV. Data and Statistical Models

The dataset used in this study is based on the EBRD survey of foreign investors supplemented with the information obtained from the *Worldscope* database.[14] In January 1995, a brief questionnaire was sent out to all companies (about 9,500) listed in *Worldscope*. Responses were obtained from 1,405 firms that answered questions regarding their investments in Eastern European transition economies and the former Soviet Republics, a total of twenty-two countries. The dataset contains information on both investors and non-investors.

In the case of investors, the type of entry mode for existing and planned projects in the region is known. The survey respondents were asked to classify each of their projects as a JV, acquisition or greenfield. For the purpose of this study, we consider all greenfield and acquisition projects not associated with JVs to be wholly owned.

The dataset does not include any information on the timing of each investment. Since the magnitude of FDI inflows was marginal before 1989, the information collected pertains mostly to the period 1989-94.[15] Table 1 presents the breakdown of entry modes for each of the host countries in the sample. Note that JVs outnumber wholly owned projects in all but one host country and they constitute sixty-two percent of all projects.

During the last decade, transition economies undertook dramatic liberalization of their FDI regimes. For instance, in the USSR a presidential decree issued as early as October 1990

[14] *Worldscope* is a commercial database that provides detailed financial statements, business descriptions, and historical pricing information on thousands of public companies located in more than fifty countries.

allowed foreign wholly owned companies to be established in the form of branches or subsidiaries. The decree also created the legal basis for foreign investors to buy out existing Soviet enterprises as these were privatized (McMillan 1996, p. 50). In Hungary, Act XXIV of 1988 on the Investment of Foreigners in Hungary allowed non-Hungarian companies to own equity up to 100% (WTO, 1998). In Poland, the 1988 Law on Economic Activity with the Participation of Foreign Parties permitted 100 per cent foreign equity participation (GATT, 1992).

To the best of our knowledge, in none of the countries in the sample there exists legislation specifically forbidding full ownership by foreign investors. It is possible, however, that in practice permissions for fully owned projects may be denied in some economies. To take this possibility into account, we include host country dummies in our model and show that this change does not strongly affect the results. In many transition economies, however, FDI in sectors such as production of military equipment and extraction of natural resources is subject to restrictions on the extent of foreign ownership.[16] Therefore, we exclude firms in the coal, gas and oil industry from our sample.

In our investigation, we take into account only manufacturing sectors since in many service industries, for instance, banking, insurance, telecommunications, there exist restrictions on the extent of foreign ownership. In others, such as accounting and public relations services, it may be extremely difficult to measure the endowment of intangible assets. Table 2 presents the percentage of foreign investors who chose a given entry mode in each industry. The figures indicate that JV is the dominant form of investment in a majority of industries. It is striking that in the drugs, cosmetics and healthcare products sector only twelve percent of all projects are JVs, while wholly owned subsidiaries account for eighty-eight percent of investments.[17] Similarly, wholly owned projects constitute eighty percent of all investments in the beverage sector. The drugs, cosmetics and healthcare products sector is the most R&D-intensive industry and in the beverage sector marketing activities play a very important role, thus the fear of losing intangible assets is a likely explanation of the underrepresentation of JVs.

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[15] Eastern European countries and the Soviet Union were virtually closed to foreign investment before 1989 (see Dunning and Rojec, 1993; Meyer, 1995; Hunya, 1997).

[16] See Dunning and Rojec (1993) for a description of these restrictions.

[17] If we consider the drugs sector (SIC code 283) only, the figures are ten and ninety percent, respectively.

Following the earlier studies, we will begin our analysis by estimating a probit model with the dependent variable taking on the value of one if investor *i* has engaged in a JV with a local partner in country *c*, and zero if the project was wholly owned. Thus, the number of observations will be equal to the number of projects undertaken in the region by all firms in the sample.[18]

We will improve over the existing literature by controlling for the possible sample selection bias. It is likely that the coefficient estimates from a model describing the choice between full and shared ownership are inconsistent because the model does not take into account what firms would undertake FDI in the first place. To address this issue, we will estimate a bivariate probit model accounting for sample selection. The first equation in the model will describe firm *i*'s decision to undertake FDI in country *c*, while the second one will model the choice between full and shared ownership.[19]

All explanatory variables employed in the estimation, with the exception of regional experience which comes from the survey, are taken from *Worldscope* and refer to 1993 or to the closest year for which the information is available. *Industry R&D intensity* is measured by R&D expenditure as a percentage of net sales. To find the industry averages we use figures for all firms listed in *Worldscope* in a given industry. The industry averages have been calculated at the three digit SIC industry classification.[20] To proxy for investor's technological sophistication we use r*elative R&D intensity* which is defined as the ratio of a firm's R&D intensity to the industry average.[21] *Industry advertising intensity* is measured by Sales, General and Administrative expenditure divided by net sales. This variable is a standard proxy for advertising intensity used in the literature. The industry average is again calculated at the three digit level. We define r*elative advertising intensity* as the ratio of a firm's advertising intensity to the industry average.

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[18] Note that the number of observations will be smaller than the number of projects in Table 1 because of missing firm specific information.

[19] This model was first proposed by Wynand and van Praag (1981). Boyes et al. (1989) used it for evaluation of credit scoring models. See Greene (1993, p. 664) for a brief description of the model.

[20] When calculating industry averages, we have removed two outliers from the drug sector and one from communications equipment industry. These firms reported R&D intensities equal to 16598, 1815 and 2560, respectively. All three firms reported sales below $500,000 thus they are likely to be start up companies. Note that the conclusions of the paper are remain unchanged even if this correction is not performed.

[21] If firm and industry level figures were both equal to zero, relative R&D intensity took on the value of one.

We use firm sales in millions of US dollars as a measure of *firm size*. *Diversification* is proxied by the number of four digit SIC codes describing a firm's activities. To control for *regional experience* we include a dummy variable taking on the value of one if a firm had a trading relationship with the region before transition and zero otherwise. *International experience* is measured by the share of foreign sales in a firm's total sales. Ideally, we would like to use the share of foreign assets in a firm's total assets. This would, however, severely reduce the size of our sample. Since the share of foreign sales is highly correlated with the share of foreign assets (.82), we believe that it can serve as a proxy for international experience. To capture the investment conditions in a host country, we use an index of *transition progress* defined as the average of EBRD transition indicators. Transition indicators rate the progress of a country's reforms in the following areas: price liberalization and competition, trade and exchange system, large-scale privatization, small-scale privatization, enterprise restructuring, and banking reform.[22] The values for 1994 for all host countries in the sample are presented in Table 1. In the selection equation of bivariate probit, we also control for the size of the local market as captured by the host's *GDP*. It is measured in millions of US dollars and the figures come from EBRD (1994).

To test whether the same effects are present in high and low technology sectors, we allow for different coefficients in the two groups of industries. The classification of industries is based on the average R&D intensity of each 3 digit SIC sector with two different cutoff values. Additionally, we employ the classification suggested Blomstrőm, Lipsey and Ohlsson (1991).

V. Empirical Findings

Comparison with the earlier studies

We begin our investigation by estimating a model comparable to those found in the earlier literature. This exercise allows us to establish whether the same factors affect foreign investors' choice of entry mode in transition economies as in other parts of the world. We employ a probit model with the dependent variable taking on the value of one, if the project takes the form of a JV with a local partner and zero if it is wholly owned. As the explanatory

[22] See EBRD (1994, p. 11) for a detailed description.

variables we include: an investor's size, R&D intensity, advertising intensity, a measure of production diversification and proxies for international and regional experience. Our results are presented in terms of marginal effects evaluated at the sample mean.

The estimates shown in the first column of Table 3 are consistent with those obtained in the earlier studies. They indicate that firms with higher R&D and advertising intensities as well as smaller firms are more likely to engage in wholly owned projects that in JVs. Regional experience, international experience and production diversification, however, do not appear to be statistically significant. Next, we add the transition index to the model and observe that everything else equal, investors are more likely to engage in JVs in countries less advanced in reform. Thus, we find support for the hypothesis that local partners are more useful in countries with less friendly investment climate. Including the transition index has little effect on the other variables in the regression.

Since many of the earlier studies used industry rather than firm level proxies for intangible assets, we also estimate a model which includes average R&D and advertising intensity for three digit SIC industries. The results, presented in the third and fourth columns of Table 3, indicate that firms in sectors characterized by high R&D spending are less likely to share ownership. Advertising intensity, however, does not appear to have a significant effect on the form of investment. We also find that investors with less international experience and those entering host countries less advanced in reform are more likely to undertake JVs. None of the other variables is statistically significant.

In summary, our results are broadly consistent with the findings of the earlier literature. We conclude that forces determining the entry mode of foreign investors in transition economies are similar to those operating in other parts of the world.

Summary statistics

The next step in our investigation is to compare the average R&D intensity of investors engaged in wholly owned projects with that of investors sharing ownership in each three digit SIC sector. We group sectors into high, medium and low technology, following the classification used by Blomstrom, Lipsey and Ohlsson (1991). See Appendix III for a description.

As Table 4 indicates, in all but one high technology industry investors engaged in wholly owned projects are on average more R&D intensive than those sharing ownership. This group consists of industries such as drugs, medical instruments and equipment, communications equipment, and others. In medium technology industries, which include industrial chemicals, motor vehicles, household appliances, etc., in half of the sectors in which both modes are present, investors engaged in wholly owned projects are characterized by higher level of R&D efforts. In low technology sectors, this is true in ten out of sixteen cases. In each of the three groupings, the average R&D intensity of firms with wholly owned projects is higher than that of firms engaged in JVs.

Testing the hypotheses

To test whether intraindustry differences in intangible assets affect the choice of entry mode, we include in the model the average R&D intensity of each industry as well as the ratio of a firm's R&D spending to the industry mean. We also add the corresponding variables for advertising intensity. The results of the probit model, presented in Table 5, lend support to our hypothesis. We find that firms with large R&D and advertising efforts relative to the industry average are more likely to undertake wholly owned projects than to engage in JVs. This finding holds when transition progress, host country dummies and dummies for European and US firms are included.

As before, we observe that JVs tend to be undertaken by firms in less R&D intensive industries. Additionally, smaller and more diversified firms as well as investors with less international experience prefer shared ownership to wholly owned projects. As before, transition progress has a negative marginal effect on the probability of a JV relative to wholly owned subsidiary. Industry advertising intensity, regional experience and dummies for European and American investors do not appear to be statistically significant. Note that with the exception of the international experience, which ceases to be significant at the conventional levels, the inclusion of host country dummies does not strongly affect the results.

A major drawback of employing the probit specification is that it takes into account firms that invested in the region but not those that decided against FDI. This may be a source of sample selection bias and may lead to inconsistent estimates. To the best of our knowledge, none of the previous studies has, however, addressed this issue. We correct for the sample

selection bias by estimating a bivariate probit model, where the first equation describes a firm's decision whether to invest in a host country while the second one focuses on the choice between full and shared ownership. The selection equation includes all variables used in the second stage as well as the market size of the host country proxied by the GDP. It has been shown that the market size is an important factor in the decision to undertake FDI. At the same time, it is unlikely to affect the choice of entry mode.

Table 6 presents the estimation results. They lead us to similar conclusions as the figures presented in the previous table. We find that firms which are leaders in terms of technology or marketing skills are more likely to undertake wholly owned projects than to share ownership. Thus, the data support our hypothesis that intraindustry differences in intangible assets are important and treating industries as homogenous is not appropriate. The signs and significance levels of the other coefficients are very similar to those found in the probit model. The only exception is production diversification which ceases to be statistically significant. In summary, taking sample selection into account does not have a large impact on the estimation results.

The results from the selection equation indicate that FDI is more likely to take place in countries with larger market size and more advanced reforms. More diversified and larger firms as well as those with greater regional and international experience are more likely to invest in the region. This is also true of firms in more advertising intensive industries. Relative endowments of intangible assets and industry level R&D spending do not have a statistically significant effect on the probability of investing. With the exception of industry R&D intensity, all these results are consistent with the stylized facts.[23]

So far we have shown that relative endowments of intangible assets affect an investor's choice of entry mode when all manufacturing sectors are taken into account. It is likely, however, that these effects differ between industries. As we mentioned before, technological leadership may play an important role in high technology industries but may be of little significance in low R&D sectors. To test this hypothesis, we reestimate our model allowing for different coefficients for high/medium and low technology sectors. We group sectors into the two categories based on the classification proposed by Blomstrőm, Lipsey and Ohlsson (1991).

[23] Smarzynska (1999) shows that foreign investors in transition economies are characterized by low, rather than high, R&D intensity and links this finding to weak protection of intellectual property rights.

We also use alternative grouping method based on the average R&D intensity of the sector with the R&D spending equal to one and two percent of net sales serving as the cutoff values.[24]

The results, presented in Table 7, indicate that relative R&D intensity and industry R&D spending affect the choice of entry mode in high and medium technology sectors but not in low technology industries. The difference between the coefficients underlying the marginal effects of relative R&D spending in the two groups of industries is significant at the five percent level in the first and the third column. Relative advertising expenditure influences the entry mode in both types of industries, though in the case of low technology sectors it is significant in only one regression. Firm size is negatively related to the probability of shared ownership in all industries. Transition progress, on the other hand, is significant at the conventional levels only in high and medium R&D sectors, though the underlying coefficients for two groups of industries are not significantly different from each other. In low technology sectors, more diversified firms are more tolerant towards shared ownership. So are investors without regional experience.[25]

Summing up, in this section we presented the empirical evidence indicating that differences in relative endowments of intangible assets *between firms within an industry* influence their choice of entry mode. We showed that technological and marketing leaders tend to avoid JVs and prefer to engage in wholly owned projects. We found that effect is mainly present in high and medium technology sectors.

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[24] Note that the average R&D intensity of all three digit SIC sectors is 1.29 percent of sales.

[25] Note that the equation we estimated includes the following R&D terms

$$Y_{ic}^{*} = \beta_0 + \beta_1 \frac{R\&D_{firm}}{R\&D_{ind}} + \beta_2 R\&D_{ind} + \ldots$$

$$Y_{ic} = 1 \text{ if } Y_{ic}^{*} > 0, \quad Y_{ic} = 0 \text{ otherwise}$$

It is possible that β_1 is a function of R&D intensity of an industry. For instance, it is conceivable that

$$\beta_1 = \alpha_0 + \alpha_1 R\&D_{ind}$$

then

$$Y_{ic}^{*} = \beta_0 + \alpha_0 \frac{R\&D_{firm}}{R\&D_{ind}} + \alpha_1 R\&D_{firm} + \beta_2 R\&D_{ind} + \ldots$$

$$Y_{ic} = 1 \text{ if } Y_{ic}^{*} > 0, \quad Y_{ic} = 0 \text{ otherwise}$$

The estimation of the above equation produced, however, insignificant coefficients α_0 and α_1.

VI. Concluding Remarks

The choice of entry mode by foreign investors has been of interest to both policy makers and researchers in the field of international business. The changing attitudes towards FDI, greater openness to foreign investment and lessening of restrictions on foreign ownership have increased the need for understanding the impact foreign investors have on host economies. Developing country governments are especially interested in the question of technology and know-how transfer resulting from FDI. To be able to assess the potential magnitude of such benefits, it is important to understand preferences of different types of investors with respect to the entry mode. This study sheds some light on this issue by analyzing entry modes chosen by foreign firms entering transition economies of Eastern Europe and the former Soviet Union in the early 1990s.

We contribute to the literature by formulating and providing empirical support for new hypotheses relating the intraindustry differences in R&D and marketing efforts to the choice of entry mode. We also make an improvement over the existing studies by taking into account the potential sample selection bias. Our results indicate that industry structure has a significant impact on foreign investment decisions and thus treating industries as homogenous in investigations of forces governing FDI flows may be inappropriate.

Our findings show that foreign investors that are technological and marketing leaders in their sectors are less likely to undertake JVs than firms lagging behind. This effect is the most prominent in high and medium technology industries. Thus, while it is widely believed that JVs with local firms are more conducive to transferring knowledge and know-how than wholly owned FDI projects, the potential magnitude of transfers from JVs in high R&D sectors may be smaller than that from fully owned subsidiaries.

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APPENDIX I

R&D intensity and probability of a joint venture

Figure 1

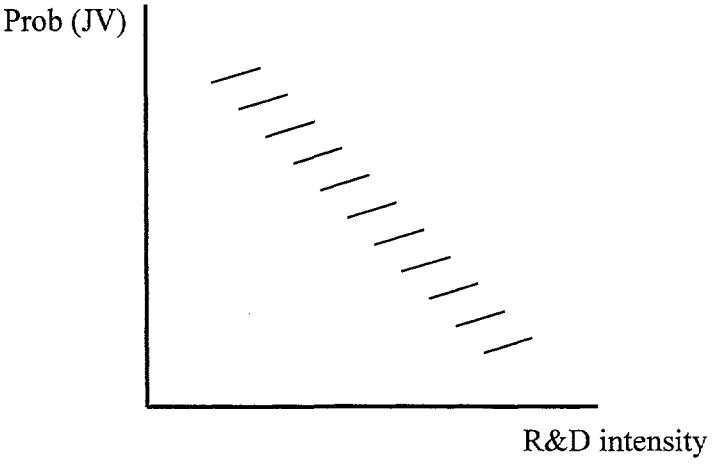


Figure 2

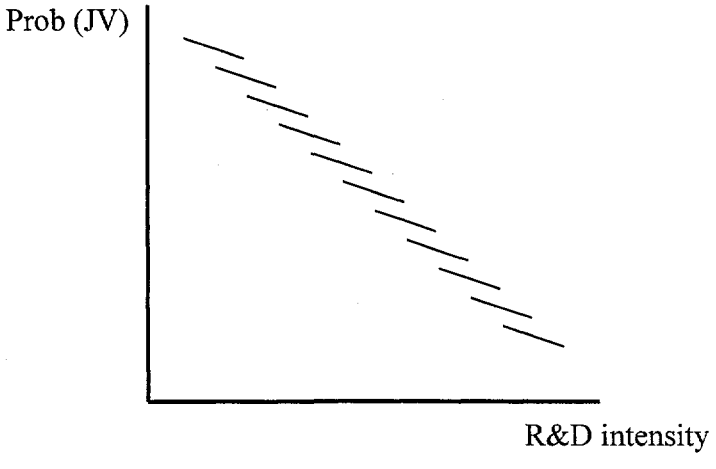
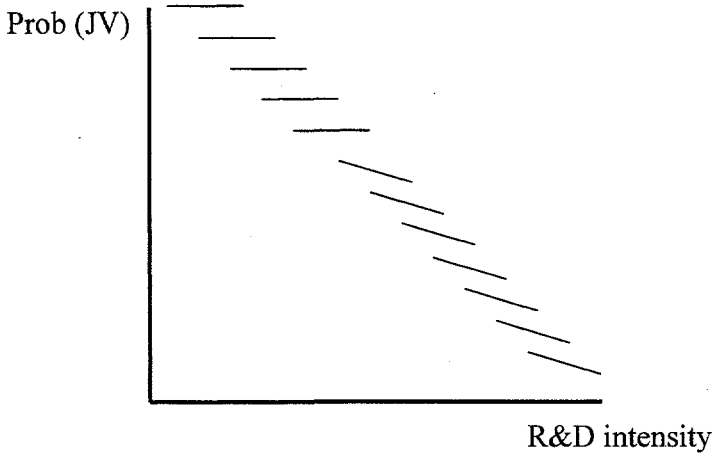


Figure 3



APPENDIX II

TABLE 1. Entry modes chosen by investors in the sample. Manufacturing sectors only

	No of JV projects in the sample	No. of wholly owned projects in the sample	Total no. of projects in the sample	Population (mn) 1993	Average of transition indicators 1994
Albania	3	1	4	3.2	2.50
Azerbaijan	1	1	2	7.4	1.33
Belarus	5	3	8	10.4	1.67
Bulgaria	16	13	29	8.5	2.50
Croatia	7	4	11	4.8	3.17
Czech	55	53	108	10.3	3.50
Estonia	16	8	24	1.5	3.33
FYR Macedonia	2	1	3	2.2	2.83
Georgia	4	2	6	5.4	1.33
Hungary	50	48	98	10.3	3.33
Kazakhstan	10	6	16	16.9	1.67
Latvia	13	6	19	2.6	2.83
Lithuania	8	5	13	3.7	3.00
Moldova	2	0	2	4.3	2.17
Poland	84	51	135	38.5	3.33
Romania	21	12	33	22.7	2.67
Russia	83	31	114	148.3	2.67
Slovakia	26	19	45	5.3	3.33
Slovenia	13	5	18	2.0	3.17
Turkmenistan	1	0	1	4.1	1.17
Ukraine	20	5	25	52.1	1.33
Uzbekistan	5	1	6	22.0	2.00
Mean or Total	**445**	**275**	**720**	**16.0**	**2.45**

TABLE 2. Entry modes chosen by investors in the sample. Industry breakdown

INDUSTRY	JVs as % of all projects in the industry	Wholly owned projects as % of all projects in the industry	Total
Drugs, cosmetics & health care products	12.1	**87.9**	100
Electronics	67.0	33.0	100
Aerospace	80.0	20.0	100
Chemicals	78.0	22.0	100
Machinery & equipment	68.8	31.3	100
Electrical	32.3	67.7	100
Automotive	60.0	40.0	100
Diversified	88.5	11.5	100
Metal	72.2	27.8	100
Metal products	65.4	34.6	100
Paper	67.6	32.4	100
Beverages	20.0	**80.0**	100
Food	61.7	38.3	100
Apparel	50.0	50.0	100
Textiles	55.6	44.4	100
Tobacco	100.0	0.0	100
Printing & publishing	60.0	40.0	100

TABLE 3. Probit model

	Marg effects	**Marg effects**	**Marg effects**	**Marg effects**
Firm R&D	**-0.0233*** **	**-0.0257*** **		
	(0.0067)	**(0.0068)**		
Industry R&D			**-0.0370*** **	**-0.0381*** **
			(0.0074)	**(0.0075)**
Firm ADV	**-0.0181*** **	**-0.0185*** **		
	(0.0035)	**(0.0035)**		
Industry ADV			0.0017	0.0010
			(0.0014)	(0.0015)
Diversification	0.0106	0.0116	0.0132	0.0136
	(0.0151)	(0.0153)	(0.0100)	(0.0101)
Reg. Experience	0.0507	0.0314	0.0382	0.0201
	(0.0681)	(0.0685)	(0.0427)	(0.0431)
Int'l Experience	-0.0007	-0.0003	**-0.0020*** **	**-0.0018** **
	(0.0012)	(0.0012)	**(0.0007)**	**(0.0007)**
Firm Size	**<.0001** **	**<.0001* **	<.0001	<.0001
	(0.0000)	**(0.0000)**	(0.0000)	(0.0000)
Transition index		**-0.1318** **		**-0.1478*** **
		(0.0516)		**(0.0387)**
No of obs	346	346	603	603
Chi 2	84.01	90.74	49.84	64.99
D.f.	6	7	6	7
Prob > chi2	0.00	0.00	0.00	0.00
Log L	-194.76	-191.39	-378.26	-370.68

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5% level, * significant at 10% level. <.0001 denotes coefficients with absolute value below .0001

TABLE 4. R&D intensity of FDI projects in 3 digit SIC industries

High technology sectors	SIC code	JVs	Wholly owned projects	All
Drugs	283	10.62	**15.71**	15.23
Measuring and controlling devices	382	9.94	9.08	9.61
Aircraft and parts	372	7.48	**9.44**	8.08
Communications equipment	366	5.60	**13.31**	7.06
Medical instruments and supplies	384	4.58	**5.07**	4.99
Electronic components and accessories	367	3.39	**5.63**	4.14
Computer and office equipment	357	4.09		4.09
Search and navigation equipment	381	3.20		3.20
Average		6.36	**12.67**	9.54

Medium technology sectors	SIC code	JVs	Wholly owned projects	All
Refrigeration and service machinery	358		7.26	7.26
Electric distribution equipment	361	7.26		7.26
Hose, belting, gasket and packing	305	6.00	6.00	6.00
Plastics materials and synthetics	282	4.65	**4.86**	4.71
Special industry machinery	355	4.22	**5.68**	4.70
Industrial inorganic chemicals	281	4.09	**6.23**	4.46
Motor vehicles and equipment	371	3.91	**4.49**	4.17
Railroad equipment	374	1.49	**4.60**	3.05
Household audio and video equipment	365	5.79	1.03	2.93
Metalworking machinery	354	2.68	2.56	2.66
Soap, cleaners and toilet goods	284	2.60		2.60
General industrial machinery	356	2.30		2.30
Ship and boat building and repair	373	2.14		2.14
Engines and turbines	351	2.11	2.11	2.11
Construction and related machinery	353	1.83	**2.49**	2.03
Industrial machinery, nec	359		1.75	1.75
Misc. manufactures	399	1.59	1.59	1.59
Misc. chemical products	289	1.31		1.31
Misc. plastic products, nec	308	1.22	0.11	1.11
Farm and garden machinery	352	0.00	**3.68**	0.74
Electric lightning, wiring equipment	364	0.67		0.67
Rubber and plastics footwear	302	0.00	0.00	0.00
Average		3.21	**3.76**	3.35

Low technology sectors	SIC code	JVs	Wholly owned projects	All
Printing trade services	279		5.25	5.25
Preserved fruits and vegetables	203	4.24		4.24
Broadwoven fabric mills, wool	223	4.00		4.00
Nonferrous rolling and drawing	335	1.54	**5.11**	3.16
Heavy construction, exc. highway	162		2.70	2.70
Electrical work	173	2.67		2.67
Copper ores	102	1.75	**2.84**	2.29
Cutlery, handtools and hardware	342	2.22	**2.28**	2.27
Nonresident building construction	154	1.25	**2.94**	1.93
Misc. food and kindred products	209		1.86	1.86
Sugar and confectionery products	206		1.83	1.83
Misc. metal ores	109	1.73		1.73
Manifold business forms	276	1.43		1.43
Misc. textile goods	229	1.40		1.40
Clay, ceramic and refractory minerals	145	1.35		1.35
Secondary nonferrous metals	334		1.34	1.34
Primary nonferrous metals	333	1.23	1.23	1.23
Iron ores	101		1.21	1.21
Misc. converted paper products	267	0.21	**1.34**	1.15
Misc. nonmetallic mineral products	329	0.76	**2.43**	1.13
Metal cans and shipping containers	341	1.20	0.79	0.99
Blast furnace and basic steel products	331	0.93		0.93
Meat products	201	0.79	**0.91**	0.85
Grain mill products	204	0.68	**1.10**	0.72
Glass and glassware pressed or blown	322		0.65	0.65
Misc. wood products	249	0.63	0.63	0.63
Paper mills	262	0.60	**0.67**	0.61
Dairy products	202	0.57		0.57
Highway and street construction	161	0.55		0.55
Fabricated structural metal products	344	0.00	**0.82**	0.55
Paperboard containers and boxes	265	0.44	0.33	0.40
Carpets and rugs	227		0.36	0.36
Cement, hydraulic	324	0.28		0.28
Fats and oils	207	0.15	0.15	0.15
Beverages	208	0.35	0.13	0.15
Gold and silver ores	104	0.00		0.00
Commercial printing	275		0.00	0.00
Average		0.87	**1.76**	1.28

TABLE 5. Probit model

	Marg effects	Marg effects	Marg effects	Marg effects
Relative R&D	**-0.0611****	**-0.0638****	**-0.0672****	**-0.0738*****
	(0.0262)	**(0.0263)**	**(0.0272)**	**(0.0279)**
Industry R&D	**-0.0462*****	**-0.0472*****	**-0.0542*****	**-0.0550*****
	(0.0106)	**(0.0106)**	**(0.0112)**	**(0.0113)**
Relative ADV	**-0.1782****	**-0.1934*****	**-0.2191*****	**-0.1800****
	(0.0718)	**(0.0724)**	**(0.0755)**	**(0.0770)**
Industry ADV	0.0000	-0.0008	0.0000	-0.0003
	(0.0023)	(0.0024)	(0.0025)	(0.0025)
Diversification	**0.0293***	**0.0314****	**0.0311***	0.0218
	(0.0152)	**(0.0153)**	**(0.0161)**	(0.0166)
Reg. Experience	0.1011	0.0824	0.0709	0.0866
	(0.0669)	(0.0673)	(0.0696)	(0.0714)
Int'l Experience	**-0.0025****	**-0.0022***	-0.0018	**-0.0033****
	(0.0012)	**(0.0012)**	(0.0012)	**(0.0013)**
Firm Size	**<.0001***	**<.0001***	**<.0001***	<.0001
	(0.0000)	**(0.0000)**	**(0.0000)**	(0.0000)
Transition index		**-0.1217****		
		(0.0508)		
US Parent				-0.1146
				(0.1917)
European Parent				0.1641
				(0.1861)
Host dummies	no	no	yes	yes
No of obs	346	346	345	345
Chi 2	66.31	72.18	86.51	97.34
D.f.	8	9	27	29
Prob > chi2	0.00	0.00	0.00	0.00
Log L	-203.61	-200.67	-192.94	-187.52

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5% level, * significant at 10% level. <.0001 denotes coefficients with absolute value below .0001

TABLE 6. Bivariate probit with sample selection

	Entry mode Equation Marg effects	**Investment Equation Marg effects**
Relative R&D	**-0.0698****	0.0003
	(0.0742)	(0.0330)
Industry R&D	**-0.0496*****	-0.0002
	(0.0298)	(0.0114)
Relative ADV	**-0.2297*****	0.0098
	(0.1899)	(0.0788)
Industry ADV	-0.0022	**0.0011*****
	(0.0072)	**(0.0025)**
Diversification	0.0247	**0.0025***
	(0.0442)	**(0.0169)**
Reg. Experience	0.0457	**0.0433*****
	(0.2049)	**(0.0702)**
Int'l Experience	**-0.0026***	**0.0007*****
	(0.0038)	**(0.0013)**
Firm Size	**<.0001****	**<.0001*****
	(0.0000)	**(0.0000)**
Transition index	**-0.1766*****	**0.0491*****
	(0.1585)	**(0.0443)**
Market Size		**<0.0001*****
		(0.0000)
No of obs		7152
Log L		-1225.16

Standard errors are reported in parentheses. *** significant at 1% level, ** significant at 5% level, * significant at 10% level. <.0001 denotes coefficients with absolute value below .0001

TABLE 7. Bivariate probit with sample selection. Marginal effects.

	Blomström et al. classification	**R&D = 1% cutoff**	**R&D = 2% cutoff**
High * Relative R&D	***-0.2275****	**-0.1271***	***-0.2828****
	(0.1601)	**(0.1162)**	***(0.1898)***
Low * Relative R&D	*-0.0305*	0.0390	*-0.0597*
	(0.1621)	(0.2423)	*(0.1290)*
High * Industry R&D	**-0.1049***	**-0.0535***	**-0.1140***
	(0.0400)	**(0.0318)**	**(0.0484)**
Low * Industry R&D	-0.0997	1.1569	-0.0997
	(0.3960)	(3.0105)	(0.3792)
High * Relative ADV	**-0.4345***	**-0.2837***	***-0.5281****
	(0.3127)	**(0.2321)**	***(0.3674)***
Low * Relative ADV	-0.2873	**-0.8189***	*-0.0984*
	(0.4282)	**(1.1316)**	*(0.3005)*
High * Industry ADV	-0.0014	-0.0028	-0.0026
	(0.0089)	(0.0077)	(0.0096)
Low * Industry ADV	-0.0122	-0.0071	-0.0091
	(0.0203)	(0.0664)	(0.0182)
High * Diversification	*-0.0163*	*0.0028*	*-0.0241*
	(0.0567)	*(0.0519)*	*(0.0638)*
Low * Diversification	***0.0794****	***0.1870****	***0.0552****
	(0.1013)	***(0.2066)***	***(0.0800)***
High * Reg. Exp.	*0.1760*	*0.1104*	0.1382
	(0.3044)	*(0.2391)*	(0.3627)
Low * Reg. Exp.	***-0.3374****	*-0.9271*	-0.1039
	(0.4880)	*(1.4678)*	(0.3454)
High * Int'l Exp.	-0.0007	-0.0022	0.0002
	(0.0049)	(0.0046)	(0.0059)
Low * Int'l Exp.	-0.0040	-0.0034	-0.0025
	(0.0076)	(0.0130)	(0.0070)
High * Firm Size	*<.0001*	**<.0001***	*<.0001*
	(0.0000)	**(0.0000)**	*(0.0000)*
Low * Firm Size	***-0.0001****	**-0.0001***	***-0.0001****
	(0.0001)	**(0.0001)**	***(0.0001)***
High * Transition	**-0.2308***	**-0.1896***	**-0.2163**
	(0.2102)	**(0.1736)**	**(0.2150)**
Low * Transition	-0.1705	-0.0973	-0.1305
	(0.3524)	(0.9443)	(0.3305)
No. Obs.	7152	7152	7152
Log L	-1159.79	-1188.00	-1156.67

APPENDIX III

Classification of Industries by Technology Level[26]

Low Technology

Grain mill, bakery products
Other food products
Beverages
Primary ferrous metals
Primary non-ferrous metals
Fabricated metal products
Lumber, wood, furniture
Paper, pulp, etc.
Printing and publishing
Textiles and apparel
Glass products
Stone and clay products
Tobacco

Medium Technology

Soap, cleansers, etc.
Industrial chemicals
Agricultural chemicals
Farm and garden machinery
Construction machinery
Other non-electrical machinery, except office and computing machinery
Household appliances
Radio, TV equipment
Motor vehicles and equipment
Transportation equipment other than aircraft and motor vehicles and equipment
Rubber products
Misc. plastic products
Other manufactures

High Technology

Drugs
Office and computing machinery
Electronic components
Communication equipment, except radio and TV equipment
Other electrical machinery
Aircraft
Instruments

[26] Source: Blomström, Lipsey and Ohlsson (1991, Appendix B, p. 233)

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