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DOMESTIC AND FOREIGN INVESTMENT BY SWEDISH MULTINATIONALS

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1. Introduction

Multinational corporations (MNCs) have become increasingly important in the global economy during the last couple of decades. Foreign direct investment (FDI) accounted in 1990 for more than 8 percent of world GDP compared with 5 percent in 1980. In many countries, MNCs also dominate domestic investment. This is especially the case for MNCs originating from small open economies such as Sweden, the Netherlands, Switzerland, etc. One interesting question is how these foreign activities of MNCs have affected the investment behavior in the home country.

Previous studies have tested the interaction between a MNC's operations at home and abroad in two different ways. First, the impact of overseas production on exports from the home country have been analyzed, i.e. flows of commodities have been related to each other. The results are not unambiguous. Lipsey and Weiss [1981, 1984], Swedenborg [1979, 1982], Blomström et al. [1988], etc. found a positive relationship. Using a new sample criteria and methodology, however, Svensson [1993] contradicted these results in the case of Sweden from 1974 to 1990. A negative net effect was here found of overseas production on Swedish exports. The positive effect of production abroad on exports of intermediate goods was

overshadowed by a negative effect on exports of finished goods. The negative net effect is especially strong when the foreign affiliate exports a large part of its sales to third countries.

The second kind of studies have related investment flows or capital stocks in different locations to each other, which is also the kind of interaction analyzed in this paper. Herring and Willett [1973] and Noorzoy [1980], using aggregated time series data, found a positive relationship between investment abroad and at home. Other studies, however, have taken some sort of capital constraint of the firm into account. Stevens [1969] and Severn [1972] argue that investment abroad and at home are substitutes in the U.S. case. Stevens and Lipsey [1992], using time series data on only seven U.S. firms, also concluded that there is some interaction between expenditures on investment at home and abroad. This substitution originates from the financial side, since rising costs of external finance force a firm to choose between investments in different locations.

Belderbos [1992], using pooled Dutch industry data, provided some indications of a degree of substitutability between domestic and foreign investment. An increase in the rate of return in a country will attract investment to this location, but the flow of investment will decrease in other locations via the capital constraint faced by the MNC.

In the 1980s, there was a huge increase in the outflow of foreign direct investment from Sweden to the EC. The EC market is the most important for Swedish firms and it is during the last decade that EC has undergone major changes. This paper uses a unique data set on individual Swedish MNCs for the years 1978, 1986 and 1990 to determine how FDIs in the EC have affected firms' propensity to invest in the home country. The model includes a financial constraint for MNCs which is consistent with the assumption that different investment projects are competing for scarce funds.

The paper is organized as follows. Section 2 discusses the theoretical motivations for interdependence between foreign and domestic investment. The data base and some descriptive statistics are also presented here. Section 3 contains the model specification and hypotheses for empirical testing. In section 4, the results are presented. The final section concludes.

2. Theoretical framework and description of the data base

For simplicity, we limit the discussion on interaction between foreign and domestic investment to the financial side of the firm. If an MNC faces a perfect financial market and has two production plants - one at home and one abroad - which are independent of each other with respect to the production processes, there can be no interaction between foreign and domestic investment. The MNC is able to raise an unlimited amount of capital at a constant rate of interest. In the real world, however, a number of complications arise. For example, there exists a possibility of bankruptcy and costs associated with this state. When the pool of internally generated funds is used, the firm faces an increasing cost of capital, e.g. as an inverse function of its solidity and profitability. In other words, different investment projects compete with each other for scarce funds. An investment project in a specific location will therefore raise the cost of capital for another project, i.e. the two investment decisions become interdependent. However, any constraint which is faced by the firm will create this interdependence. Due to this capital constraint, MNCs have a tendency to locate investment projects in countries where their profitability are the highest.

The data base on Swedish MNCs used in the empirical analysis has been built up by the Industrial Institute for Economic and Social Research in Stockholm. The data base has been updated about every fourth year since the mid 1960s and contains detailed information about all MNCs and every individual Swedish majority-owned foreign affiliate. This means that data on flows of production and exports, capital stocks, intra-firm trade, R&D, etc., are available. Three questionnaires (1978, 1986 and 1990) for the firms' investment in Sweden and in nine EC-countries are included in the tests since the study focuses on the interaction between FDI in the EC and the MNCs' investment behavior in the home country during the last decade.[1] It is true that there were capital market limitations in Sweden until 1986, but these did not undo the trade-off in investment at home and

[1] EC-countries: Germany, France, Belgium, the Netherlands, Italy, Great Britain, Denmark, Spain and Portugal. The two last countries are excluded from the 1978 survey, since they were not members in the EC.

abroad. The book value of real estate, machinery and equipment is used as a measure of a firm's capital stock (accumulated investments) in each country. Country specific data have primarily been collected from UN [1992a and 1992b] statistics.

Previous studies in this area have only considered countries where the firms actually have invested, i.e. only the decision to locate more or less FDI in given production plants has been studied. In this study, an observation is generated every time a firm has reported exports to a country in the previous questionnaire, i.e. a country may be included even if a firm has never invested in it.[2] As Table 1 shows below, firms tend to allocate FDI to markets to which they have previously

Table 1. ***Comparison between location of investment and earlier trade pattern of firms across industries in the EC for 1978, 1986 and 1990.***

Industry	No. of obs.	No of obs. to which the firms had previous exports	Percent
Food	3	2	67
Textile	6	2	33
Paper & pulp	49	48	98
Chemical	51	46	90
Iron & steel	22	22	100
Metal products	42	40	95
Machinery	75	75	100
Electronics	61	60	98
Transport	16	16	100
Others	26	23	88
All industries	351	334	95

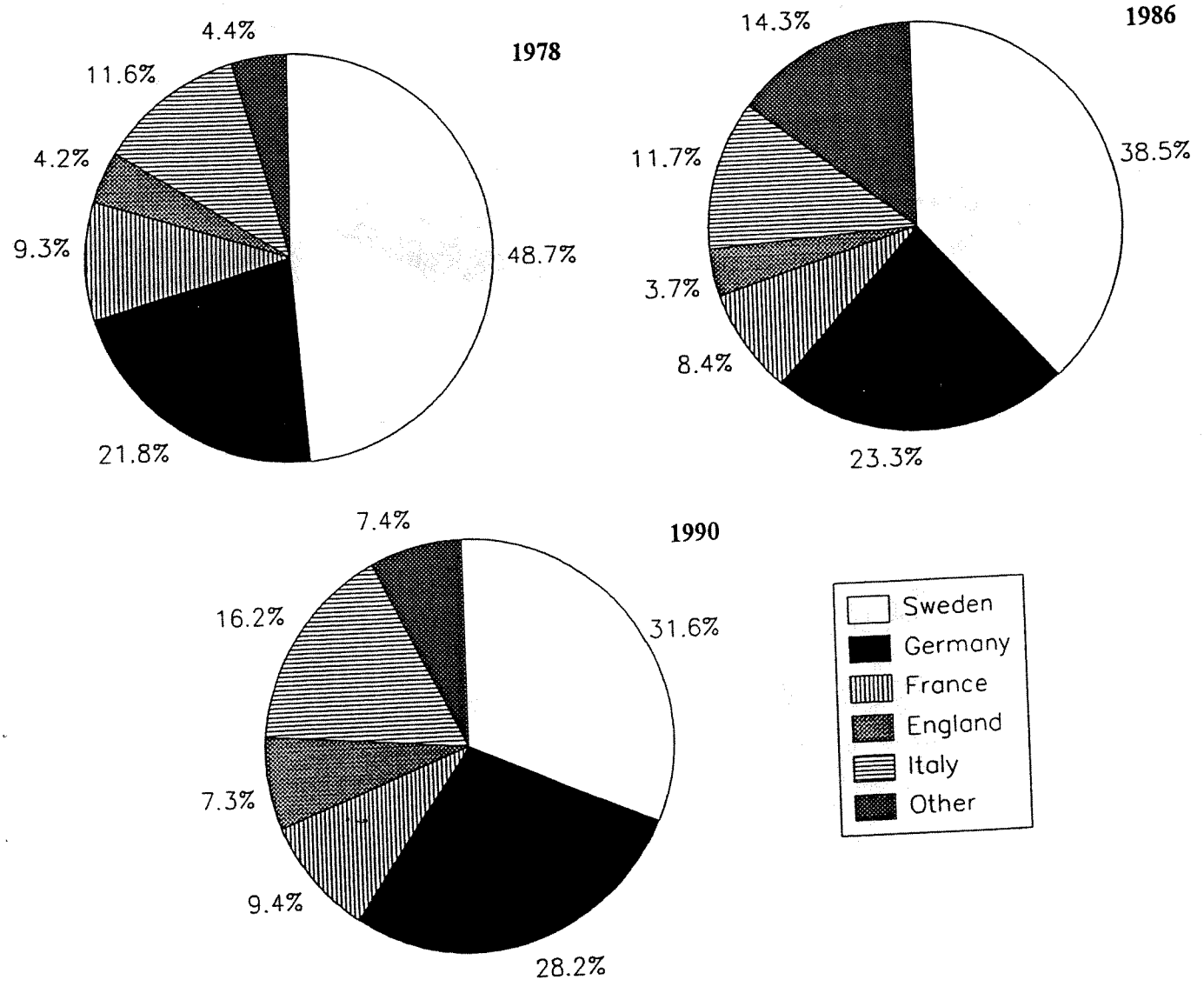
Note: Every time a firm has a capital stock in an EC-country, one observation is generated in the table. Only firms which are included in two succeeding surveys are analyzed in the table, i.e. observations for 1990 (1986 or 1978) are only included when a firm appears in the 1986 (1978 or 1974) survey as well.

[2] Of course, the observation of the capital stock in Sweden will always be included.

exported. Exceptions are industries where different barriers to trade have made exports impossible, as in the gas (chemical), concrete (others), food and textile industries. This suggests that countries to which firms export are strong candidates for FDI. The intuition is that a firm wants to reduce its risk exposure when allocating FDIs. If the firm already exports to a market, a certain amount of information has already been acquired.

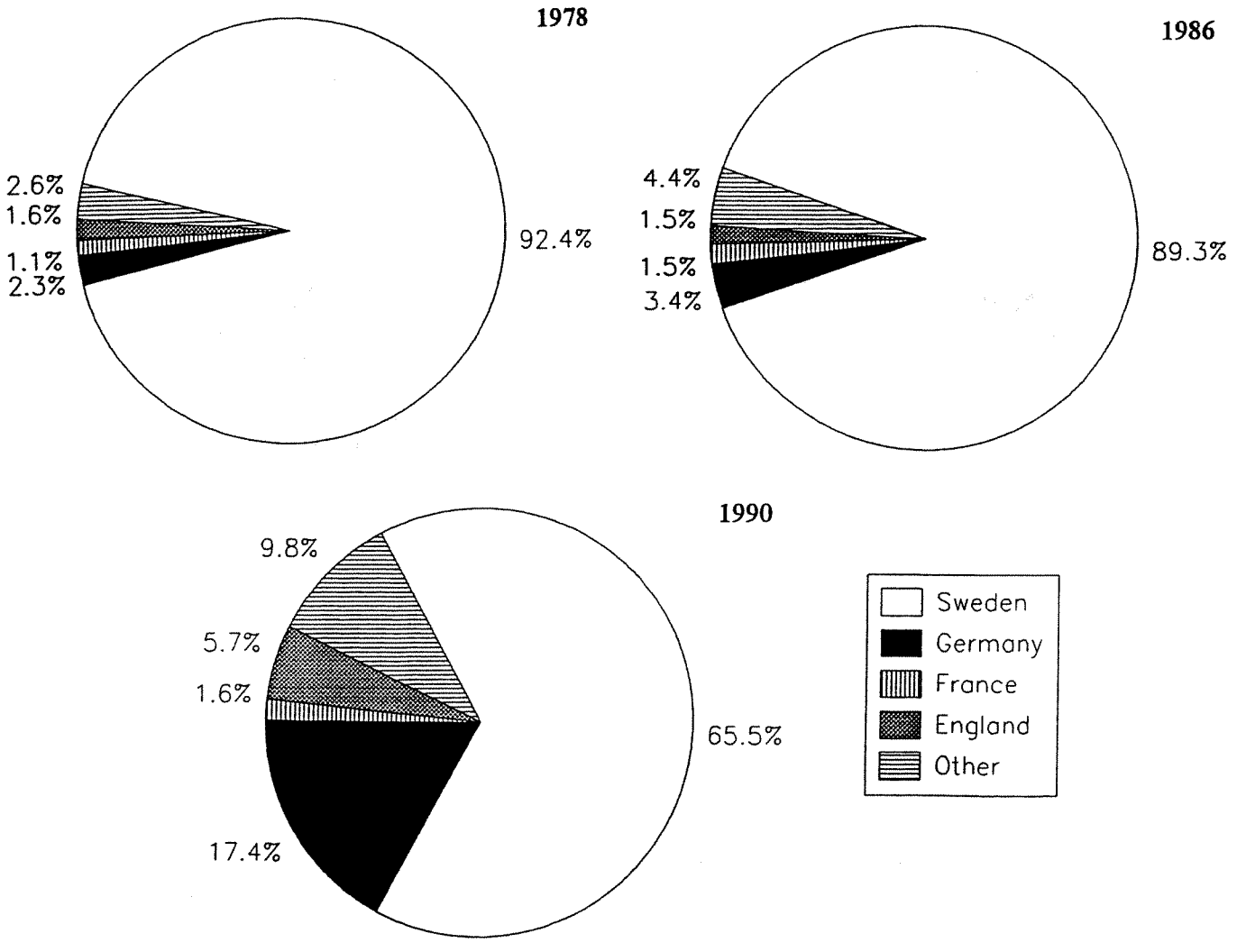
Figures 1 and 2 show the distribution of capital stocks in Sweden and the EC for two typical industries in which Swedish MNCs are operating. It should be noted that capital stocks in the EFTA, North and South America, etc are excluded.

Figure 1. ***Distribution of capital stocks in Sweden and different EC-countries 1978, 1986 and 1990. Machinery Industry.***



From the engineering industry we have chosen the machinery industry, which is the most internationalized industry for Swedish MNCs. The Swedish share has declined stepwise from 49 to 32 percent during a period of twelve years. Germany and Italy in particular have received an increasing share of FDIs in this industry. The other one is the paper & pulp industry, which is very capital intensive. It has always been dependent on raw materials in Sweden, which explains the large share of capital in the home country. The huge increase in FDIs to the EC during the late 1980s was primarily undertaken by firms in this industry. The share in the EC increased, in fact, from 11 to 35 percent between 1986 and 1990.

Figure 2. ***Distribution of capital stocks in Sweden and different EC-countries 1978, 1986 and 1990. Paper & pulp industry.***



3. Econometric specification and hypotheses for empirical testing

The relationship between home country exports and overseas production can be studied by directly relating the flows of goods to each other, if they have the same destination (see Svensson [1993]). The interaction between domestic and foreign direct investment may not be studied in a similar way, however. The reason is that FDI intended to increase sales on a foreign market does not necessarily directly influence investment in Sweden, since the latter may be directed for sales in Sweden. Investments are instead indirectly related to each other, in the sense that the sum of investment in different locations must equal the total of funds available to the MNC. Certainly, the firm can borrow funds in financial markets, but there are limitations on the solidity. This is the point of departure for the investment distribution model, partly adopted from Belderbos [1992], which is specified as:

$$k_{fmt} = \exp(\alpha_m + \beta' X_{mt} + \gamma' Z_{ft} + \epsilon_{fmt}) , \tag{1}$$

$$\gamma = \gamma_1 + D\gamma_2 , \quad D = \begin{cases} 1 & if \ m \neq h \\ 0 & if \ m = h \end{cases} , \tag{2}$$

$$C_{fmt} = \frac{k_{fmt}}{\sum_{m=1}^{M} k_{fmt}} C_{ft} . \tag{3}$$

$\mathbf{k_{fmt}}$ is an index of firm f's potential investment stock in market m at time t, where m=h,1,2,.....,M represents home country (h) and the EC-countries. The index, $\mathbf{k_{fmt}}$, is determined by different country and firm characteristics (equation 1). $\mathbf{X_{mt}}$ is the vector of country variables which are expected to affect the allocation of investment in different locations. The corresponding vector of parameters, β, should be the same for all countries. $\mathbf{Z_{ft}}$ is the vector of firm-specific variables which influence the level of investment. In this case, the corresponding vector of parameters, γ, is expected to differ between foreign locations and the home country, however (equation 2). The parameter equals γ_1 when considering the capital stock in the

home country and $\gamma_1+\gamma_2$ in the case of an EC-country. The residuals are assumed to have the properties $\epsilon \sim N(0,\sigma_\epsilon^2)$ and $E(\epsilon_i\epsilon_j)=0$ for $i \neq j$. The index $\mathbf{k_{fmt}}$ is then used to determine the distribution of the actual capital stock $\mathbf{C_{fmt}}$ for firm f in country m at time t (equation 3). $\mathbf{C_{fft}}$ is the aggregate capital stock for firm f in the EC and in Sweden at time t. It is necessary to include this equation, since it captures that $\mathbf{C_{fft}}$ is exogenous in the model. Furthermore, it shows how the capital stocks in different locations are interdependent on each other. Consider a firm which have **n** locations with potential capital stocks. Since we assumed that the size of the firm is exogenously given, the **n**th observation will be determined by the first **n-1** observations. Thus, it is sufficient to estimate only **n-1** observations. This will be attained if we relate the capital stock in a host country to the capital stock in the home country by rewriting equations (1), (2) and (3). We will then get:

$$\frac{C_{fmt}}{C_{fht}} = \frac{k_{fmt}}{k_{fht}} = \frac{\exp\left(\alpha_m + \beta' X_{mt} + (\gamma_1+\gamma_2)' Z_{ft} + \epsilon_{fmt}\right)}{\exp\left(\alpha_h + \beta' X_{ht} + \gamma_1' Z_{ft} + \epsilon_{fht}\right)} . \tag{4}$$

After rearranging the right hand side of equation 4 and taking the natural logarithm of both sides, we obtain:

$$\log\left(\frac{C_{fmt}}{C_{fht}}\right)^* = (\alpha_m - \alpha_h) + \beta'(X_{mt} - X_{ht}) + \gamma_2' Z_{ft} + \eta_{fmt} , \tag{5a}$$

$$\log\left(\frac{C_{fmt}}{C_{fht}}\right) = \begin{cases} \log\left(\frac{C_{fmt}}{C_{fht}}\right)^* & \text{if } \log\left(\frac{C_{fmt}}{C_{fht}}\right)^* > \mu \\ \mu & \text{if } \log\left(\frac{C_{fmt}}{C_{fht}}\right)^* \leq \mu \end{cases} . \tag{5b}$$

Equation (5a) is the reduced form of the model, and equations (5a) and (5b) are estimated by means of the "Tobit method" via maximum likelihood procedures (Tobin [1959]), since the dependent variable includes a large share of left censored observations (that is the reason why equation 5b is added). Log $(C_{fmt}/C_{fht})^*$ is a latent variable, which can be interpreted as an index of the relative capital stocks

in a foreign country and in the home country. A problem emerges, however, when we take the logarithm of a zero. Such observations are therefore given an arbitrary small number, μ.[3] The residuals η_{fmt} equal ϵ_{fmt}-ϵ_{fmt} and are assumed to have the desired properties $\eta \sim N(0,\sigma_\eta^2)$ and $E(\eta_i\eta_j)=0$ for $i \neq j$. It should be noted that the estimates of β and γ_2 are not to be interpreted as marginal effects. The parameter estimates must first be recalculated as described in McDonald and Moffitt [1980].[4] In order to get an interpretation of the parameter estimates, the elasticities and cross elasticities between the investment stock and some country variables X_m will also be calculated:

$$e\,(C_m\,,\,X_m) = \beta^*\,X_m\left(1 - \frac{C_m}{C_T}\right), \tag{6}$$

$$e\,(C_q\,,\,X_m) = -\,\beta^*\,X_m\left(\frac{C_m}{C_T}\right), \quad q \neq m\,. \tag{7}$$

The derivation of the elasticities can be found in appendix A. If a country's own elasticity is y percent (equation 6), this means that an increase of 1 percent in X_m, relatively the other countries, X_q, causes the capital stock in that country, C_m, to increase by y percent. The cross elasticity shows in a similar way the percentage change in the capital stock in country q, if X_m increases by 1 percent. Note that β^* is the marginal effect which can be derived from the parameter estimate and C_T is the aggregate capital stock of the firm in the EC and Sweden.

Since firms are expected to maximize profits, a country variable measuring profit margins in different countries has been included ($OIWS_{im}$-$OIWS_{ih}$). This is defined as Operating Income before depreciation divided with Wages and Salaries

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[3] $\mu=\log(\omega)$, where ω is an arbitrarily number which is just below the smallest non-zero observation of C_{fm}/C_{fh}. Some experiments were done with different arbitrarily numbers, but this only affected the results marginally.

[4] The marginal effect of e.g. $(X_{1m}-X_{1h})$ on $\log(C_{fm}/C_{fh})$, $dE(\log(C_{fm}/C_{fh}))/d(X_{1m}-X_{1h})$, simply equals $F(z)\beta_1$, where $F(z)$ is the cumulative normal distribution function and $z=Y'\theta/\sigma_\eta$. Y is a vector of independent variables and θ is the vector of estimated Tobit parameters. The z is calculated around the means of Y.

in industry i in country m minus operating income before depreciation divided with wages and salaries in the same industry in Sweden (i.e. the industry in which the firm is operating) and has been collected from UN [1992a] statistics. In fact, the numerator and the denominator are elements of value added. A high share of operating income in value added relative to the share of wages should attract investment, which means that a positive parameter estimate is expected.[5] Another variable measures the endowment of skilled labour in the host country relative to Sweden ($RSET_m$-$RSET_h$). It is defined as the number of Research Scientists, Engineers and Technicians per 1000s of the population and is taken from UN [1992b] statistics. Firms should take the supply of competent and educated workers into consideration when locating investment. Thus, the hypothesis is a positive parameter value. If the parameter estimate of one country variable (e.g. X_{1m}-X_{1h}) is significantly positive, this means that the higher the value of X_{1m} relative to X_{1h}, the higher should the capital stock in market m relative to the one in the home country be, and the higher is the probability that there is any capital stock at all in country m.

Some control variables which in earlier studies have been shown to affect the allocation of direct investment have also been included in the tests. The first one takes the relative size of the market into account (GDP_m-GDP_h). The greater the GDP, the larger the potential sales for a firm's products, i.e. the coefficient should be positive. Turning to control variables for different kinds of firms, Swedish firms tend to locate a larger share of their investment abroad as they expand, since the Swedish home market is relatively small. The size of the firm (C_{FT}) is defined as the aggregate capital stock available, but the interpretation of the coefficient is not the same as for the country parameters. We expect this coefficient to be positive, which means that the larger the size of the MNC, the higher the capital stock abroad relative to that in the home country, i.e. large MNCs are more likely to invest abroad. Note that it does not mean that large MNCs have a smaller capital stock in the home country relative to small MNCs. Finally, a control variable is included

[5] It should be noted that this ratio varies for different industries, primarily due to variation in the capital-labor ratio across industries. This is, however, not a problem of great concern, since the profitability in industry i in country m is always compared with the profitability in the same industry in country h. The capital-labor ratio should the same for a given industry irrespective of country..

to account for human capital within the firm (HC_f) and is measured as the average wage in the home country part of the MNC. It has been shown that knowledge-intensive firms have an advantage as compared to foreign local competitors, being able to produce more effecient. Furthermore, expansion abroad is easier for firms which base their competitiveness on skilled labor rather than raw materials or other typical Swedish inputs. The coefficient is expected to be positive.

By including additive dummy variables, it is possible to examine if there are any shifts in the level of the dependent variable over time and countries.[6] We will also examine if there are any industry-specific fixed effects which may explain the variation between firms. This is done by assigning additive dummies for different industries.[7]

4. Results of the estimation

Two variants of the model were estimated, one without (I) and another with (II) industry dummies. The log-likelihood ratios, which correspond to F-tests when using OLS, are satisfactorily high. The results in Table 2 show that profitability (OIWS) in different countries has a positive effect on investment. The parameter is positive and significant at the 1%-level in both runs. The other country variable (RSET), measuring the education level, has the expected positive impact and the parameter is significant at least on the 5%-level. Thus, the profitability and the education levels in different countries influence firms as they decide how to distribute their capital stock.

All control variables are significant on the 5%-level and have the expected effects. This means that investments are located to large countries in the EC where the potential sales for the firms are the best. Furthermore, it is primarily large and

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[6] When using time dummies, 1990 will always be the reference period. The EC-countries are divided in three groups according to geographical location when assigning dummies: Italy, Spain and Portugal (Region 1); France and Great Britain (Region 2); Germany, Denmark, Belgium and the Netherlands (Region 3). The last group is the reference group.

[7] The industries which are assigned dummies are: food, textile, paper & pulp, iron & steel, chemical, metal products, machinery, electronics and transport.

Table 2. ***Estimation results of the Tobit model.***

Method = Tobit	Dependent variable = log (C_{fm}/C_{fh})	
Independent variables	Model (I)	Model (II)
Intercept	-11.54 *** (1.89)	-10.54 *** (1.88)
($OIWS_{im}$-$OIWS_{ih}$)	2.61 *** (0.56)	1.99 *** (0.65)
($RSET_m$-$RSET_h$)	0.91 *** (0.31)	0.76 ** (0.30)
(GDP_m-GDP_h)	8.31 E-4 ** (3.29 E-4)	9.03 E-4 *** (3.32 E-4)
C_{ff}	5.72 E-7 *** (1.07 E-7)	6.70 E-7 *** (1.23 E-7)
HC_f	0.058 *** (0.017)	0.037 ** (0.018)
Log likelihood ratio	548.1	582.8
No. of observations	675	675
Left censored obs.	376	376

Note: Levels of significance are ''', '' and ' significant at 1, 5 and 10 percent respectively. Dummies for time, countries and industries are shown in appendix B, Table 5.

knowledge-intensive firms which prefer, or have the possibility, to allocate investment in the EC before Sweden.

The elasticities between $C_{m,q}$ and $OIWS_{im}$ respective $RSET_m$ for Sweden and four EC-countries in the machinery industry are shown in Tables 3 and 4. As expected, the own elasticities are larger than the cross elasticities, since it is primarily investments in Germany which are affected if the profitability changes there. If the profitability in Sweden increases (decreases) by 1 percent, given the profitability in other countries, the capital stock in Sweden increases (decreases) by 0.81 percent, and decreases (increases) by 0.48 percent in Germany and the other EC-countries. The corresponding figures for an increase in the profitability in Germany are 0.68 percent in the own country, and -0.28 in Sweden, the Netherlands, etc. The negative effect on capital stocks in other countries arises due

Table 3. ***Elasticities for the machinery industry. Profitability.***

$e(C_{m,q},X_m)$		Country variable X_m = $OIWS_{im}$				
		Sweden	Germany	Netherlands	France	G.Britain
C_{fm}	Sweden	0.81	-0.28	-0.02	-0.05	-0.08
	Germany	-0.48	0.68	-0.02	-0.05	-0.08
	Netherlands	-0.48	-0.28	0.62	-0.05	-0.08
	France	-0.48	-0.28	-0.02	0.31	-0.08
	G.Britain	-0.48	-0.28	-0.02	-0.05	1.06

to internal restrictions on the firm, financial or others. The effects of a change in the education level on investments in different countries in the machinery industry should be interpreted in a similar way (Table 4). The corresponding elasticities for the paper & pulp industry are shown in appendix B, Tables 6 and 7.

Table 4. ***Elasticities for the machinery industry. Education level.***

$e(C_{m,q},X_m)$		Country variable X_m = $RSET_m$				
		Sweden	Germany	Netherlands	France	G.Britain
C_{fm}	Sweden	1.35	-0.50	-0.04	-0.25	-0.06
	Germany	-0.80	1.20	-0.04	-0.25	-0.06
	Netherlands	-0.80	-0.50	1.55	-0.25	-0.06
	France	-0.80	-0.50	-0.04	1.58	-0.06
	G.Britain	-0.80	-0.50	-0.04	-0.25	0.80

5. Concluding remarks

In the case of Sweden during the 1980s, it has been shown that the large outflows of FDIs to the EC do have had implications for the firms' investment activities in the home country. The statistical analysis, based on the view that different investment projects compete for scarce funds, supports the hypothesis that foreign and domestic investment are substitutes in some degree. When the profitability or the education level of the labor force increases, profit-maximizing MNCs increase their investment in the country. A negative effect occurs on investments in other locations, since the MNC faces financial or other internal restrictions.

It would be interesting to develop the model further, i.e. to investigate what happens with the capital stock, if the absolute financial restriction on the MNC is relaxed. If the MNC is able to borrow funds on financial markets, to an increasing interest rate, one might expect a weaker negative impact on the capital stocks in other locations.

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Appendix A. Derivation of elasticities.

The elasticities are derived from the original model:

$$C_1 = \frac{k_1}{k_1 + \sum_{m=2}^{M} k_m} C_T \,, \tag{8}$$

$$k_1 = \exp(\alpha_1 + \beta' X_1 + \gamma' Z) \,, \tag{9}$$

where subindex for firms and timeperiods are suppressed. If we now take the derivate of C_1 with respect to X_1 we will get, via the quotient rule, the following result:

$$\frac{\delta C_1}{\delta X_1} = \left(\frac{\beta k_1 (k_1 + \sum_{m=2}^{M} k_m) - \beta k_1 k_1}{(k_1 + \sum_{m=2}^{M} k_m)^2} \right) C_T = \left(\frac{\beta k_1 \sum_{m=2}^{M} k_m}{(k_1 + \sum_{m=2}^{M} k_m)^2} \right) C_T \,. \tag{10}$$

The derivative $\delta C_1/\delta X_1$ equals, in fact, $\delta C_1/\delta k_1 \times \delta k_1/\delta X_1$, where $\delta k_1/\delta X_1 = \beta k_1$. It should also be noted that the cross derivative $\delta k_i/\delta X_j = 0$ for $i \neq j$. The marginal effect is then multiplied by X_1/C_1 in order to obtain the elasticity. C_1 is taken from equation (8) above.

$$\frac{\delta C_1}{\delta X_1}\frac{X_1}{C_1} = \left(\frac{\beta X_1 C_T k_1 \sum_{m=2}^{M} k_m (k_1 + \sum_{m=2}^{M} k_m)}{C_T k_1 (k_1 + \sum_{m=2}^{M} k_m)^2} \right) = \left(\frac{\beta X_1 \sum_{m=2}^{M} k_m}{k_1 + \sum_{m=2}^{M} k_m} \right) \tag{11}$$

This expression can be rewritten, since we know that:

$$\frac{\sum_{m=2}^{M} k_m}{k_1 + \sum_{m=2}^{M} k_m} = \frac{C_T - C_1}{C_T} \,. \tag{12}$$

The final expression for the elasticity will then get the appearance:

$$\frac{\delta C_1}{\delta X_1}\frac{X_1}{C_1} = \beta X_1\left(1 - \frac{C_1}{C_T}\right), \tag{13}$$

where β is the marginal effect which can be derived from the parameter estimate. C_1, C_T and X_1 are calculated for the means for a particular industry and country, but only for observations above the left limit in the dependent variable in order to correspond to the marginal effect β. The cross elasticities are derived in a similar way. First, the marginal effect on C_2 w.r.t. X_1 is calculated via the quotient rule:

$$\frac{\delta C_2}{\delta X_1} = \left(\frac{-\beta k_1 k_2}{(k_1 + \sum_{m=2}^{M} k_m)^2}\right) C_T, \tag{14}$$

which is used to derive the cross elasticity:

$$\frac{\delta C_2}{\delta X_1}\frac{X_1}{C_2} = \left(\frac{-\beta X_1 C_T k_1 k_2 (k_1 + \sum_{m=2}^{M} k_m)}{C_T k_2 (k_1 + \sum_{m=2}^{M} k_m)^2}\right) = \left(\frac{-\beta X_1 k_1}{k_1 + \sum_{m=2}^{M} k_m}\right). \tag{15}$$

After substituting:

$$\frac{k_1}{k_1 + \sum_{m=2}^{M} k_m} = \frac{C_1}{C_T}, \tag{16}$$

we will get the cross elasticity:

$$\frac{\delta C_2}{\delta X_1}\frac{X_1}{C_2} = -\beta X_1\left(\frac{C_1}{C_T}\right). \tag{17}$$

Appendix B

Table 5. ***Supplement to Table 2. Estimates of dummies.***

Method = Tobit	Model (I)		Model (II)	
Explaining dummies	Estimates	Std. errors	Estimates	Std. errors
T1978	-2.03 *	1.03	-1.12	1.08
T1986	1.18 *	0.65	1.27 **	0.63
Region 1	-1.40	1.01	-1.68 *	0.98
Region 2	-0.08	0.75	-0.24	0.73
B1	---	---	2.36	3.21
B2	---	---	-6.21 ***	2.21
B3	---	---	-0.56	1.04
B4	---	---	1.47	0.91
B5	---	---	0.37	1.03
B6	---	---	-4.32 ***	1.34
B7	---	---	-0.71	0.95

Note: Levels of significance ***, ** and * significant at 1, 5 and 10 percent respectively. The "T"-variables refer to time dummies and the "B"-variables refer to industry dummies. Region 1 is a dummy for Italy, Spain and Portugal and Region 2 for Great Britain and France.

Table 6. ***Elasticities for the paper & pulp industry. Profitability.***

$e(C_{m,q},X_m)$		Country variable X_m = $OIWS_{im}$				
		Sweden	Germany	Netherlands	France	G.Britain
C_{tm}	Sweden	0.56	-0.18	-0.07	-0.02	-0.06
	Germany	-1.55	0.96	-0.07	-0.02	-0.06
	Netherlands	-1.55	-0.18	0.88	-0.02	-0.06
	France	-1.55	-0.18	-0.07	0.43	-0.06
	G.Britain	-1.55	-0.18	-0.07	-0.02	1.28

Table 7. ***Elasticities for the paper & pulp industry. Education level.***

$e(C_{m,q},X_m)$		Country variable X_m = $RSET_m$				
		Sweden	Germany	Netherlands	France	G.Britain
C_{fm}	Sweden	0.62	-0.28	-0.12	-0.08	-0.04
	Germany	-1.71	1.48	-0.12	-0.08	-0.04
	Netherlands	-1.71	-0.28	1.53	-0.08	-0.04
	France	-1.71	-0.28	-0.12	1.82	-0.04
	G.Britain	-1.71	-0.28	-0.12	-0.08	0.71