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The Relationship Between Domestic and Outward Foreign Investment Revisited: The Impact of Industry-Specific Effects¹

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Abstract

The ambiguity reported in previous research as regards the effect of foreign direct investment (FDI) on domestic investments is shown to be related to how industries are organized. Based on a simple model including monitoring and trade costs, we argue that a complementary relationship should prevail in vertically integrated industries, whereas a substitutionary relationship can be expected in horizontally organized production. Applying iterative SUR-technique, the empirical analysis confirms a significant difference between the two categories of industries. To our knowledge, this is the first attempt to reconcile the inconclusiveness reported in previous empirical analyses.

Keywords: FDI , complementarities, substitutes, knowledge intensity

JEL codes: F12, F21, F23, G34

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1. Introduction

The tremendous increase in foreign direct investments (FDIs) that has been witnessed in the last couple of decades frequently stirs up political concern as regards its effects on home economies. In particular, the fears of “losing” jobs and reduced wages are often advanced and also seem to render some political pay-offs. Closely related, but less investigated, issue is the effects on home-country investment as firms decide to invest abroad.ⁱ Moreover, previous empirical findings are ambiguous where some studies conclude that FDI replace home country investment while others suggest a complementary relationship between the two.

The first papers to address the impact of FDI on home-country investment appeared in the 1970s (e.g., Herring and Willett 1973, Noorzoy 1980). Using time series data at the industry level for US firms during the early 1970s, they concluded that a *positive* relationship prevailed between investment at home and abroad. On the other hand, more recent studies have shown a *negative* relationship to exist between FDI and home-country investment (e.g., Belderbos 1992, Stevens and Lipsey 1992). In the latter study, the argument was that the firm’s capital constraints will make a foreign direct investment crowd out domestic investment.

Even though the 1990s studies were more technically sophisticated, they suffered from data restrictions as the analyses only comprised a limited number of firms, industries and years.ⁱⁱ To remedy this weakness, Feldstein (1995) implemented aggregate industry data and came to the conclusion that a one to one dollar relation exists between foreign and domestic investment; hence, each dollar invested abroad means one dollar less invested at home. In other words, a full substitutionary effect was found when the analysis was extended to comprise total flows.

Interestingly enough, these previous studies have neglected the influence of industry-specific effects. In this paper we analyze - theoretically and empirically - how organizational

differences across industries may influence the effect of FDI on home country investment. Our hypotheses are derived from a simple two-industry model, suggesting a substitutionary relationship between foreign and home-country investment in R&D-intensive, horizontally organized industries (henceforth denoted the Schumpeter industry) and a complementary investment pattern for vertically integrated industries, originating in traditional comparative advantage factors (called the Heckscher–Ohlin industry). In our econometric analysis we implement seemingly unrelated iterative estimation techniques for the period 1982–99. To our knowledge, with the possible exception of Braunerhjelm and Oxelheim’s (1996 and 2000) more explorative studies, there has been no analysis of the home-country effects of FDI where such industry-specific characteristics have explicitly been taken into account.

The empirical analysis will take advantage of a unique Swedish data-set which is cross-tabulated by industries and countries. Sweden is known as being one of the countries with most multinational corporations (MNC) per capita that have been engaged in foreign operations for a long time (UNCTAD 2002). We therefore believe that the Swedish case serves well to illustrate the question raised in this paper, i.e., the effect of FDI on home-country investment, and that the results can be generalized to other countries.

That the industries differ is clear from Figure 1. Obviously, FDI is predominantly undertaken by firms in the more R&D-intensive Schumpeter industries, suggesting strong sector-specific features in the investment pattern. Thus, to understand the relationship between FDI and home-country investment, it is decisive that the analysis is disaggregated to the industry level. As regard geographical proximity, which influences trade costs and knowledge about foreign markets, the differences across industries are less pronounced. Rather, irrespective of industry, FDI by Swedish firms has predominantly taken place in the European Union (EU) as illustrated in Figure 2.

INSERT FIGURES 1 and 2

The rest of the paper is organized as follows. The theoretical rationale for engaging in foreign operations is briefly presented in Section 2. Thereafter, Section 3 provides the definitions of the industries, the data set, the econometric specification and the empirical results. The main conclusions are summarized in Section 4.

2. The model

Consider a world consisting of two equally sized countries, home (H) and foreign (F), each hosting a Schumpeterian (SCH) and a Heckscher–Ohlin (HO) industry. The competitiveness of firms belonging to the former industry is based on their R&D-activities, while the latter derive their strength from traditional comparative advantages. In each industry, firms operate on markets characterized by imperfect competition, i.e., they are exposed to increasing returns to scale, and they compete by offering differentiated product variants of either Heckscher–Ohlin or Schumpeter goods.

As always, firms in the two industries have features of being both horizontally and vertically integrated.ⁱⁱⁱ However, the degree of vertical integration is most pronounced in the Heckscher–Ohlin industry, where raw material is extracted and processed at the lower end of the value-added chain and used as inputs in the production of the final goods. In the Schumpeter industry, vertical integration mainly takes the form of transferring headquarter services to identical production units. Thus, firms in the Schumpeter industry are primarily horizontally integrated, where one firm produces identical goods in all its units.

Firms in both industries supply both the home market and the foreign market, either through exports or through foreign direct investment (FDI). If the firms choose to invest abroad, the monitoring cost (m) of production will be positive, while home-country

production implies no such costs. On the other hand, exports are always subject to trade costs (t), supposedly composed by transportation costs and trade barriers. Even if pure trade costs are zero, transportation costs will always exceed zero.^{iv}

Assume that a representative firm i in the respective industry stands afore an investment decision. Economies of scale have already been fully exploited in the existing production units. Hence, the firms must decide whether to erect a new plant in the home country and export goods, or set up a new (alternatively, acquire an existing) plant abroad. Production in the Heckscher–Ohlin (HO) industry is characterized by being separable into two stages, where the upstream stage (intermediates) intensively uses a production factor where the home country has a comparative advantage. Hence, production associated with that particular stage is tied to the home country, whereas production of the final good may take place either in the home country or abroad. An increase in the final stage production by necessity implies an increase in home-country production in the intermediate stage (see the Appendix).

The profit maximization for a representative firm in the Heckscher–Ohlin industry can be described in the following way:

$$\pi = pq_{FP} - c_{FP}q_{FP} - c_{IP}q_{IP} - tq_{FP}^{EXP} - \tau q_{IP}^{EXP} - m \ln(1 + q_{FP}^F) - F, \quad (1)$$

where subscripts FP and IP denote the final and intermediate stage, respectively, and superscript EXP and F denote export and production abroad, while p and q equal unit price and quantity. Variable production costs are represented by c_{IP} and c_{FP} , where c_{FP} excludes costs for intermediary goods. The unit costs of exporting final and intermediary goods are denoted by t and τ . The expression $m \ln(1 + q_{FP}^F)$ in equation (1) represents monitoring costs, which are assumed to increase at a decreasing rate with foreign production. Finally F refers to fixed costs.

If we assume that production of the intermediary product can be expressed as a linear function of the final stage production, i.e.:

$$q_{IP} = \lambda q_{FP} \quad (2)$$

then,

$$\pi = pq_{FP} - cq_{FP} - tq_{FP}^{EXP} - \lambda\tau q_{FP}^F - m \ln(1 + q_{FP}^F) - F, \quad (3)$$

where $c = (c_{FP} + \lambda c_{IP})$. Increasing production at home and exporting the final good gives rise to the following first-order condition:

$$\partial\pi / \partial q_{FP}^{EXP} = p - c - t = 0 \quad (4)$$

$$p = c + t. \quad (5)$$

The corresponding condition for an increase in foreign production is:

$$\partial\pi / \partial q_{FP}^F = p - c - \lambda\tau - m/(1 + q_{FP}^F) = 0 \quad (6)$$

$$p = c + \lambda\tau + m/(1 + q_{FP}^F). \quad (7)$$

Profit maximization across the potential locations applies when the marginal profit of increased investment in production capacity at home equals the marginal profit of an increase in production capacity abroad. Hence, equalizing these two expressions yields:

$$t = \lambda \tau + m / (1 + q_{FP}^F) \quad (8)$$

or

$$t - m / (1 + q_{FP}^F) = \lambda \tau . \quad (9)$$

The choice of strategy will then be determined by the relation between costs associated with foreign production and costs of exports.^v

More precisely:

$t - m / (1 + q_{FP}^F) = \lambda \tau$, the firm is indifferent to production site

$t - m / (1 + q_{FP}^F) > \lambda \tau$, the firm will choose an FDI-strategy (10)

$t - m / (1 + q_{FP}^F) < \lambda \tau$, the firm will choose an export strategy

Hence, if the costs of exporting the final good, minus the increased costs of monitoring a multi-national production structure, exceed the costs of exporting the home-country intermediates to a foreign production unit, then the firm will invest abroad to expand its production of the final good. Investment in the home country will be limited to the production of intermediates (see the Appendix). If the relative costs of FDI as compared to exports go the other way, the firm will choose an export strategy and investments will increase in the home

country in both stages. Finally, if costs are identical for these two alternatives, the firm will be indifferent between whether to export or set up a foreign unit.

Now, consider the horizontally integrated firms in the Schumpeter industry. Similarly to the Heckscher–Ohlin firms, they can either choose an FDI or an export strategy. However, in the Schumpeter industry, there is no link between the different production stages. Hence, the decision of where to increase production depends on the relation between trade cost and monitoring costs, given identical production technologies in the respective country. Profit maximization of a representative firm in the Schumpeter industry can be described as:

$$\pi = pq - cq - tq^{EXP} - m \ln(1 + q^F) - F, \quad (11)$$

where p equals the unit price, c is variable costs and F the fixed cost. Increasing production at home and exporting the final product gives rise to the following first-order condition:

$$\partial \pi / \partial q^{EXP} = p - c - t = 0 \quad (12)$$

$$p = c + t. \quad (13)$$

The corresponding condition for an increase in foreign production is:

$$\partial \pi / \partial q^F = p - c - m/(1 + q^F) = 0 \quad (14)$$

$$p = c + m/(1 + q^F). \quad (15)$$

Just as in the Heckscher–Ohlin industry, comparing the increase in profits of production at home with the profits generated by undertaking FDI, clearly demonstrates that the relation between trade- and monitoring costs will determine the strategy of the firm. Thus:

$t = m/(1 + q^F)$, the firm is indifferent to production site

$t > m/(1 + q^F)$, the firm will choose an FDI-strategy (16)

$t < m/(1 + q^F)$, the firm will choose an export strategy

The simple model outlined above generates the following hypotheses as regards the relation between FDI and home-country investment in the respective industry:

First, when FDI takes place in the Heckscher–Ohlin industry, it is likely to have a complementary and positive impact on home-country investments due to its vertical production structure, where one stage is tied to the home country.

Second, the Schumpeter industry, displaying more of a horizontal structure, can be expected to choose one possible investment location at the expense of alternative investment locations. Therefore, a substitutionary relationship between FDI and home-country investment is expected in the Schumpeter industry.

3. Econometric model and results

The Swedish manufacturing sector has been classified into three types of industries denoted Heckscher–Ohlin (HO), Schumpeter (SCH) and Other, based on their respective R&D intensity (Table 1). The Heckscher–Ohlin industries comprise ISIC 32 (textile, wearing apparel and leather), 33 (wood and wood products), 34 (paper and pulp), and 37 (basic metal industries), while the Schumpeter industries comprise ISIC 35 (chemicals) and 38 (fabricated

metal products, machinery and equipment). The three sub industries ISIC 31 (food, beverage and tobacco), ISIC 36 (non-metallic mineral products) and ISIC 39 (other manufacturing industries) constitute Other industries, since these are characterized more by differences than by similarities to the other two industries. In particular, they have a history of heavy protection justifying a separate classification. Further specification in the composition of these aggregates is hindered by the lack of data.

INSERT TABLE 1

Econometric model

The increase in FDI has been spurred by changes that can be considered as exogenous at the firm level, such as deregulation, trade liberalization and integration. Since these changes can be expected to affect the three industries in a similar way, there is reason to believe that the residuals are correlated between the industries. We will therefore implement Zellner's (1962) iterated seemingly unrelated regression technique in the estimations. Because we do not know the exact nature of the relationship between foreign direct investment and domestic investment, and theory gives little guidance, we will use three different variable specifications. The first specification is simply expressed in absolute (real) levels, while the second equation captures the change between two consecutive years. Finally, we also run regressions on the percentage change in the variables between two consecutive years. More precisely, the estimated regressions are as follows:

$$\begin{aligned}
 GDI_{i,t} = & \alpha_{0,i} + \alpha_{1,i}FDIEU_{i,t} + \alpha_{2,i}FDIRW_{i,t} + \alpha_{3,i}EXP_{i,t-1} + \alpha_{4,i}REXR_t + \alpha_{5,i}D8699 + \\
 & + \alpha_{6,i}D9599 + u_{i,t}
 \end{aligned}
 \tag{17}$$

$$\begin{aligned}
GDI_{i,t} - GDI_{i,t-1} = & \beta_{0,i} + \beta_{1,i}(FDIEU_{i,t} - FDIEU_{i,t-1}) + \beta_{2,i}(FDIRW_{i,t} - FDIRW_{i,t-1}) + \\
& + \beta_{3,i}(EXP_{i,t-1} - EXP_{i,t-2}) + \beta_{4,i}REXR_t + \beta_{5,i}D8699 + \beta_{6,i}D9599 + \quad (18) \\
& + \beta_{7,i}D86 + \beta_{8,i}D95 + v_{i,t}
\end{aligned}$$

$$\begin{aligned}
(GDI_{i,t} - GDI_{i,t-1}) / GDI_{i,t-1} = & \gamma_{0,i} + \gamma_{1,i}(FDIEU_{i,t} - FDIEU_{i,t-1}) / FDIEU_{i,t-1} + \\
& + \gamma_{2,i}(FDIRW_{i,t} - FDIRW_{i,t-1}) / FDIRW_{i,t-1} + \gamma_{3,i}(EXP_{i,t-1} - EXP_{i,t-2}) / EXP_{i,t-2} + \quad (19) \\
& + \gamma_{4,i}REXR_t + \gamma_{5,i}D86 + \gamma_{6,i}D95 + w_{i,t}
\end{aligned}$$

The dependent variable, GDI, is gross domestic investment in Sweden. Among the explanatory variables, FDI is our key variable and we will distinguish between investments in the EU-region (FDIEU) and FDI by Swedish firms in the rest of the world (FDIRW). Total export by Swedish firms is denoted EXP, while REXR stands for the percentage change in Sweden's real effective exchange rate index. Indexes i and t denote the type of industry and the time (year), respectively.

There are two ways of supporting the foreign market, by export and foreign direct investment. The export variable (lagged one year) is included in the regressions to isolate the effect of the latter on home-country investment. We expect export to be positively associated with home-country investment. The real effective exchange rate is intended to control for differences in relative production costs in Sweden and foreign countries, where an increase in home-country costs is expected to reduce investments.

Time dummies have been included to capture the effect of the enlargement of the EU in 1986 and 1995. When the regressions are based on absolute levels, we need to include one time dummy for the period 1986–99 (D8699) and one for the period 1995–99 (D9599), since

the investment flows to the EU is likely to have permanently changed from 1986 and 1995 due to the increasing number of countries in the area. When we look at changes between years, we will also have to include one time dummy for 1986 (D86) and one for 1995 (D95) to take into account the fact that the number of countries in period t and $t-1$ are different for these two years. However, as we switch to percentage changes there is no reason to believe that the influence of the enlargement on the variable is permanent. Time dummies are therefore only needed for 1986 and 1995.

Since we only have access to a limited number of observations, to gain degrees of freedom we will reduce the number of estimated parameters in the systems, partly by removing the insignificant time dummy variables and partly by imposing constraints on the remaining parameters. This will be done in a backward elimination fashion, where the least significant variable is excluded from the regressions step by step, until only the significant time dummies remain.

As a complement to the regressions above, we will also estimate the system based on three-year moving averages to somewhat reduce the effect of the highly volatile investment pattern shown by firms mainly growing through the acquisition of other firms. When a favorable business opportunity occurs, this usually implies quite a substantial investment, while the periods between acquisitions will be characterized by relatively low investment levels.

Results

The Swedish Central Bank has provided unique data on foreign direct investment, while the data on gross domestic investment and export were obtained from Statistics Sweden. The exchange rate data comes from IMF and the GDP deflator from OECD.^{vi}

The results from the regressions are reported in tables 2 and 3. The only restriction imposed on the regressions in table 2 is that the parameter value of the exchange rate index, REXR, is bound to be the same for both the Heckscher–Ohlin and the Schumpeter industries in the first set of regressions (absolute levels).

INSERT TABLES 2 and 3

Foreign direct investment in the EU by the Heckscher–Ohlin industry has a positive impact on domestic investment for all variable specifications and is also significant for all specifications except the percentage change. This result supports our hypotheses of a complementary effect between foreign and domestic investment by the Heckscher–Ohlin industry. The foreign direct investment in the EU made by the Schumpeter industry has a significantly positive impact on domestic investment when we regress the level of FDI on domestic investment. However, in accordance with our hypothesis it then shifts to a significantly negative impact when the regression is based on percentage changes. Foreign direct investment in the rest of the world is less significant and gives more mixed results.

The lagged export has a positive effect on domestic investment for both the Heckscher–Ohlin industry and the Schumpeter industry for all specifications, and it is also significant for all specifications, except the Heckscher–Ohlin industry when the variables are defined as changes between two consecutive years. The real effective exchange rate has a positive impact on the Heckscher–Ohlin and Schumpeter industries, but is only significant in the estimation when based on absolute levels. In general, the explanatory power of the regressions is satisfying, especially for the Heckscher–Ohlin and Schumpeter industries, with R^2 values ranging from 0.54 to 0.82.

Next, looking at the regressions based on three-year moving averages, foreign direct investment in the EU has the expected sign and is also significant for the Heckscher–Ohlin industries, irrespective of the variable specification. For the Schumpeter industries, the impact of foreign direct investment in the EU on domestic investment is less clear-cut and turns from being weakly significantly positive when based on absolute levels to significantly negative when the variables are expressed as first differences. The relationship remains negative as we turn to percentage changes, but loses significance. Export, as expected, has a positive, and in most cases highly significant impact on domestic investment throughout the regressions, whereas the real exchange rate is only significant when the regressions are based on absolute levels.

Tables 4 and 5 confirm a significant difference between our categories of firms. Hence, this provides strong support for the allegation that industry-specific effects should be taken into consideration when analyzing the effects of FDI on home-country investments. Moreover, this also explains the seemingly inconclusive results in previous studies, i.e., it is likely to have reflected differences in the industrial structure.

INSERT TABLES 4 and 5

4. Concluding remarks

We have found industry-specific explanations to the seemingly inconclusive results in previous studies as regards the impact of FDI on home-country investments. Furthermore, it is shown how the effects differ depending on whether the estimations relate to absolute levels or changes. This is hardly surprising, considering that a given capital-stock in a country needs continuous investments for maintenance etc., thereby implying that a complementary

relationship is conceivable in absolute levels. However, measured as relative changes, this switch to a negative relationship in the Schumpeter industry. Our belief is that relative changes better capture the shift in investments between the home and foreign countries. Hence, as a general corollary, the analysis of the relation between outward FDI and its home-country effects should be disaggregated to the industry level, which has been neglected in most previous studies.

We will abstain from drawing any specific policy conclusions from our analysis. Basically, we consider FDI to be a mechanism that should foster an improved allocation of capital likely to benefit both home and host countries. However, we would like to stress the importance of disaggregating to the industry level in order to identify the forces that influence the effect of FDI on home countries. Different industrial structures across countries imply that the effect of FDI on indigenous investments will also differ. Without a disaggregation to the industry level, the coefficients expressing the relationship between home-country investment and FDI just become a hypothetical value inadequate for policy use.

Table 1. Research and development expenditures in Swedish multinationals, 1986, 1990, 1994 and 1998, R&D expenditure as a percentage of turnover

Industries	ISIC code	1986	1990	1994	1998
Food, beverages and tobacco	31	0.6	0.3	0.6	0.9
Textiles, wearing apparel and leather	32	0.1	0.9	1.0	1.6
Wood and wood products	33	1.9	0.3	2.2	0.3
Paper and pulp	34	0.7	0.9	0.9	0.9
Chemicals	35	6.7	6.8	9.3	n.a.
Non-metallic mineral products	36	1.0	0.5	0.5	0.4
Basic metal industries	37	1.2	0.8	0.7	0.9
Fabricated metal products, machinery and equipment	38	4.5	5.1	5.4	3.4

Source: Braunerhjelm and Ekholm (1998) and IUI databases.

Table 2. Results from the ITSUR estimation for the period 1982–99
Dependent variable: Gross Domestic Investment

	Absolute levels			Change in levels			Percentage change		
	H-O	SCH	OTHER	H-O	SCH	OTHER	H-O	SCH	OTHER
INTERCEPT	4 402 (1.63)	6 681*** (2.78)	2 295*** (2.77)	-113 (-0.16)	-126 (-0.16)	-65 (-0.32)	-3.25 (-0.76)	0.91 (0.38)	1.72 (0.61)
FDIEU	0.1155*** (6.17)	0.0863** (2.27)	-0.1850 (-1.45)	0.1088*** (3.86)	0.0450 (1.09)	0.1621 (1.45)	0.0229 (1.21)	-0.0310** (-2.65)	0.0142*** (2.98)
FDIRW	0.1603 (1.13)	-0.0364 (-1.48)	0.0154 (0.27)	-0.0804 (-0.31)	-0.0647** (-2.75)	-0.1102* (-1.82)	-0.0026 (-0.17)	0.0238*** (3.49)	-0.0200** (-2.52)
EXP	0.0937*** (4.76)	0.0654*** (7.40)	0.1984*** (4.27)	0.0396 (0.86)	0.0551** (2.13)	-0.0555 (-0.88)	1.5259*** (3.16)	0.5478* (2.11)	0.0964 (0.69)
REXR	210** (2.46)	210** (2.46)	37 (0.98)	103 (1.04)	19 (0.19)	11 (0.41)	-0.1440 (-0.27)	0.1278 (0.48)	-0.3187 (-0.87)
D86-99		1 870* (1.98)	1 027** (2.68)						
D95-99			-3 991*** (-7.44)			1 061** (2.63)			
D86				-3 535*** (-3.34)					
D95				8 657*** (3.68)	5 837* (2.02)		46.49*** (2.76)		16.11* (1.85)
No. of obs.	54	54	54	51	51	51	51	51	51
Haessel's ^a R ²	0.72	0.82	0.16	0.65	0.54	0.19	0.79	0.73	0.43
Berndt's ^a R ²		1.00			1.00			1.00	

Note: t-statistics in parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1 percentage level, respectively. In the case of levels, investment and export figures are expressed as absolute real values, changes refer to regressions based on first differences, while percentage change means that the regressions are based on percentage changes between two consecutive years.

^a See Haessel (1978), Berndt and Khaled (1979).

Table 3. Results from the ITSUR estimation for the period 1982–99, regressions based on three-year moving averages.
Dependent variable: Gross Domestic Investment

	Absolute levels			Change in levels			Percentage change		
	H-O	SCH	OTHER	H-O	SCH	OTHER	H-O	SCH	OTHER
INTERCEPT	-6 010 (-1.13)	9 101 (1.68)	3 899*** (8.34)	-363 (-0.53)	-912 (-0.85)	-237 (-0.70)	-3.55 (-0.67)	-2.56 (-0.74)	-0.43 (-0.12)
FDIEU	0.2367*** (7.17)	0.1149* (1.90)	0.5796*** (4.72)	0.1380*** (2.84)	-0.1287** (-2.43)	0.1208 (1.37)	0.0083* (1.88)	-0.0089 (-0.63)	0.0023 (0.57)
FDIRW	-0.1242 (-0.58)	0.0157 (0.28)	0.2571*** (3.24)	0.1847 (0.53)	-0.0999** (-2.52)	0.4821*** (8.20)	0.0382** (2.44)	-0.0013 (-0.18)	0.0560** (2.36)
EXP	0.1704*** (4.27)	0.0584*** (3.33)	0.0728*** (3.08)	0.2188*** (4.85)	0.1425*** (5.53)	0.0931* (1.98)	1.9369*** (3.42)	1.3577*** (4.34)	0.3902* (2.06)
REXR	165* (1.97)	263** (2.40)	87*** (4.72)	-82 (-0.86)	-56 (-0.48)	17 (0.47)	-0.7434 (-0.98)	-0.0534 (-0.13)	0.5534 (0.99)
D86-98		1 058 (1.18)	692** (2.46)						
D95-98			-1 921*** (-6.37)						
D95						-999*** (-5.25)	-73 (-2.49)		-28** (-2.74)
No. of obs.	48	48	48	45	45	45	45	45	45
Haessel's ^a R ²	0.90	0.92	0.92	0.80	0.59	0.19	0.77	0.73	0.37
Berndt's ^a R ²		1.00			1.00			1.00	

Note: t-statistics in parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1 percentage level, respectively. In the case of levels, investment and export figures are expressed as absolute real values, changes refer to regressions based on first differences, while percentage change means that the regressions are based on percentage changes between two consecutive years. All regressions have been Cochrane–Orcutt adjusted to account for serial correlation in the error terms.

^a See Haessel (1978), Berndt and Khaled (1979).

Table 4. Differences in the effect of FDI on home-country investments across industries and regions

	H-O / SCH	H-O / OTHER	SCH / OTHER
FDI in the European Union			
Absolute levels	0.58 (0.4532)	5.86** (0.0207)	3.97* (0.0541)
Change in levels	1.21 (0.2789)	0.24 (0.6295)	0.81 (0.3734)
Percentage change	5.81** (0.0214)	0.20 (0.6545)	15.29*** (0.0004)
FDI in the rest of the world			
Absolute levels	1.71 (0.1995)	0.69 (0.4120)	1.04 (0.3153)
Change in levels	0.00 (0.9530)	0.01 (0.9164)	0.57 (0.4572)
Percentage change	2.34 (0.1352)	0.92 (0.3451)	16.65*** (0.0003)

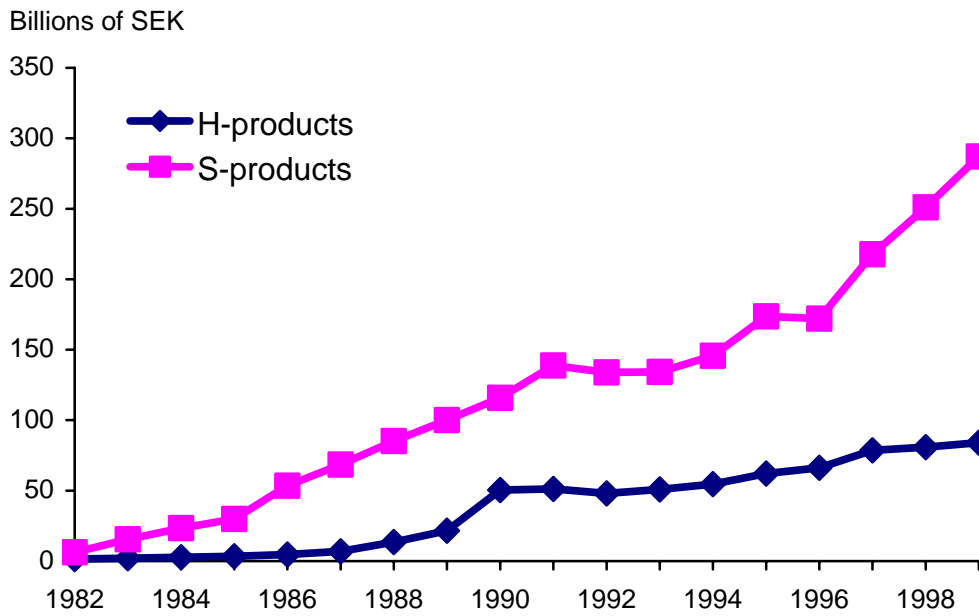
Note: The table reports F-statistics based on a Wald test performed on the regressions in table 2. The null hypothesis is that the FDI-coefficient from one industry is equal to that of another industry. Probabilities are given in parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1 percentage level, respectively. A significant F-value rejects the null hypothesis and thus indicates statistically significant differences between the coefficients for the two industries.

Table 5. Differences in the effect of FDI on home-country investments across industries and regions, regression based on three-year moving averages

	H-O / SCH	H-O / OTHER	SCH / OTHER
FDI in the European Union			
Absolute levels	4.10* (0.0529)	8.09*** (0.0084)	10.49*** (0.0032)
Change in levels	17.66*** (0.0003)	0.03 (0.8550)	9.21*** (0.0054)
Percentage change	1.32 (0.2609)	1.12 (0.3001)	0.58 (0.4520)
FDI in the rest of the world			
Absolute levels	0.32 (0.5769)	2.73 (0.1100)	5.36** (0.0284)
Change in levels	0.64 (0.4316)	0.72 (0.4029)	72.34*** (0.0000)
Percentage change	5.29** (0.0301)	0.40 (0.5330)	5.00** (0.0346)

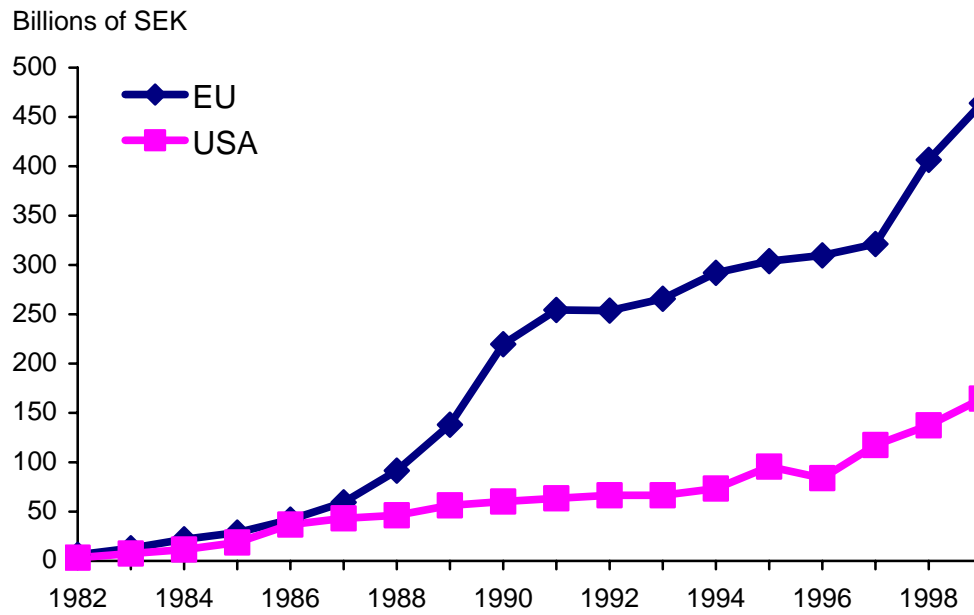
Note: The table reports F-statistics based on a Wald test performed on the regressions in table 3. The null hypothesis is that the FDI-coefficient from one industry equals that of another industry. Probabilities are given in parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1 percentage level, respectively. A significant F-value rejects the null hypothesis and thus indicates statistically significant differences between the coefficients for the two industries.

Figure 1. Accumulated total Swedish FDI in Heckscher–Ohlin industries and Schumpeter industries 1982–99, 1999 year prices.



Source: Own calculations based on data from the Swedish Central Bank and OECD.

Figure 2. Accumulated Swedish FDI in the EU and the United States 1982–99, 1999 year prices.



Note: The European Union consists of 14 countries for all years in the figure.

Source: Own calculations based on data from the Swedish Central Bank and OECD.

Appendix

Assume a Cobb-Douglas technology where firms in the HO-sector use capital, labor and intermediate products to produce goods (Q_{HO}^j). The production function is separable into two multiplicative sub-functions, V and Q_{IP} . V combines capital, labor and a technology factor, while Q_{IP} refers to intermediate products (IP),

$$Q_{HO}^j = V^j Q_{IP}(V^H, Q_{HO}^j) \quad j = H, F \quad (A1)$$

superscript H and F stand for home and foreign country respectively. Total differentiation yields

$$dQ_{HO}^j = dV^j Q_{IP} + V^j dQ_{IP} \quad (A2)$$

where

$$dQ_{IP} = (\partial Q_{IP} / \partial V^H) dV^H + (\partial Q_{IP} / \partial Q_{HO}^j) dQ_{HO}^j \quad (A3)$$

so

$$dQ_{HO}^j = dV^j Q_{IP} + V^j [(\partial Q_{IP} / \partial V^H) dV^H + (\partial Q_{IP} / \partial Q_{HO}^j) dQ_{HO}^j] \quad (A4)$$

in order to demonstrate the relationship between Q_{HO} and Q_{IP} , assume that $dV^j = 0$, then

$$dQ_{HO}^j = (\partial Q_{IP} / \partial Q_{HO}^j) dQ_{HO}^j V^j \quad (A5)$$

or

$$dQ_{HO}^j \left[1 - \left(\partial Q_{IP} / \partial Q_{HO}^j \right) V^j \right] = 0 \quad (\text{A6})$$

since we are interested in what happens to the production of intermediate goods when production in the final stage changes, we assume that $dQ_{HO}^j \neq 0$. Then

$$1 - \left(\partial Q_{IP} / \partial Q_{HO}^j \right) V^j = 0 \quad (\text{A7})$$

or

$$\partial Q_{IP} / \partial Q_{HO}^j = 1 / V^j > 0 \quad (\text{A8})$$

Thus, irrespective of whether production of the final stage increase in the home or the foreign country, home country production of the intermediate stage production must increase.

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Notes

1. A related strand of the literature on FDI has focused on the relation between exports and FDI. See Caves (1996) for a survey.

2. For instance, Stevens and Lipsey's study was based on a sample of seven U.S. multinationals for a period of 20 years, whereas Belderbos' study covered Dutch food and metal/electronics companies for the period 1978–84.

3. See Braunerhjelm (1998) for a description and an analysis of vertically and horizontally organized Swedish industries.

4. Trade costs can be expected to differ across industries and products, however. The more intangible goods are, the lower the trade costs. Consequently, head-quarter services in the Schumpeterian industry can be exchanged internationally without incurring any trade costs, whereas intermediates used in the Heckscher–Ohlin industry are always exposed to trade costs. These differences across industries and products will influence the location decision – i.e., whether investment will take place in the home country or abroad.

5. Since Heckscher-Ohlin industries typically have a larger share of total production at home than Schumpeter industries, the former will face higher marginal costs, given the same total production volume, and could therefore be expected to be less engaged in foreign direct investment (cf Figure 1)

6. All value variables are deflated with the implicit GDP deflator. The correlation matrix for the independent variables reveals no sign of multicollinearity. The correlation matrixes are available from the authors upon request.