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Agglomeration, Relative Wage Costs and Foreign Direct Investment—Evidence from Swedish MNCs 1974–1998

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Abstract This paper examines the relationship between agglomeration economies and relative wage costs in influencing location of multinational corporations. An inflow of firms to certain regions and industries is likely to increase demand for labor. If mobility of labor is low increased costs can be expected to deter additional inflows of firms, albeit agglomeration economies may compensate for higher wages. Despite its important policy implications this relationship has to our knowledge not been exposed to empirical testing. The empirical analysis finds that foreign direct investment has become increasingly sensitive to differences in wage cost across industrialized countries, but also that agglomeration economies related to knowledge externalities positively influences higher costs. The relative strength of these two forces impacts the spatial distribution of production.

Keywords FDI · agglomeration · relative costs

JEL classification F15 · F20 · F23

1 Introduction

The deregulation created by the European integration process—within as well as between nations—has turned the issue of firm location into a highly topical point on the political agenda in Europe. Integration makes firms more exposed to inter-country differences with respect to production costs, market size, knowledge spillovers, etc., thereby stiffening the competitive pressure under which firms operate. Similarly, differences in macroeconomic regimes and the institutional setting across countries also become more transparent. The spectacular growth in global foreign direct investment (FDI), and the European Union's (EU's) increasing involvement in this process since the 1980s and 1990s, leaves little doubt that regional integration does influence the location of firms.

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This brings up a number of questions concerning the current restructuring of the European industry and its spatial implications. According to mainstream new economic geography models, the basic determinants of firms' locations can be allotted trade/transport and production costs together with the degree of scale and agglomeration economies (Krugman 1991; Fujita, Krugman and Venables 1999).[1] These factors clearly allude to strategic FDI-decisions taken by profit-maximizing multinational corporations (Buckley and Casson 1976), as well as the OLI framework frequently imposed in the analysis of international business (Dunning 1977). This paper aims at making a contribution in that direction by examining the relationship between locations of multinational corporations, relative production costs and agglomeration economies.

Using country- and industry level data numerous studies have addressed how FDI influence home country employment and production, sensitiveness to wage differences, the impact of existing agglomerations on FDI, knowledge sourcing, etc.[2] However, to our knowledge, no empirical analysis has examined whether agglomeration economies may compensate for higher wage costs in the presence of the alleged lack of labor mobility in certain regions of the world. That would also influence the spatial distribution of production. In particular, can we expect Europe's more immobile labor market—where a shift in location of production is not accompanied by labor flows—to generate a more "fragmented" distribution of production as compared to other regions, particularly the U.S.?[3]

To examine these issues we will pool a unique data set on the location of foreign production by Swedish multinational corporations (MNCs), spanning the period 1974 to 1998, with host-country data (38 countries) for the same period classified on cost-, agglomeration- and policy variables. Swedish industry has been dominated by large MNCs with extensive—and geographically dispersed—international activities for a long time. Their strategies can, by and large, be expected to pertain also to firms originating in other countries.

The remaining part of the paper is organized as follows. In Section 2, the theoretical framework is presented and relevant previous findings are reviewed. The section ends with three derived hypotheses to be tested in the empirical part. The econometric method and the data are discussed in Section 3, while Section 4 presents the hypotheses on the explanatory variables. Section 5 contains the results from the empirical analysis, and, finally, Section 6 concludes.

2 Theoretical framework

Krugman's (1991) initial contribution has been followed by an impressive output of articles that have refined and modified modeling of economic geography.[4] In the first generation of

[1] See also Brainard (1993), Krugman and Venables (1995), Markusen (1995), Markusen and Venables (1995), Dunning (2002) and Buckley and Ghauri (2004). For a survey, see Braunerhjelm et al. (2000).

[2] For a broad survey, see Caves (2007).

[3] Blanchard and Katz (1992) show that the labor migration adjustment process works in the U.S. However, in Europe only about 1 percent of the EU workers are employed in a member state different from their home country. Even within the respective country, labor mobility is often limited. Obstfeld and Peri (1998) show that labor mobility is approximately twice as large in the U.S. compared to a number of European countries for the period 1980–1995. See also Braunerhjelm et al. (2000).

[4] Still, issues concerning the location of economic activities have been addressed since at least the 19th century (Marshall 1890; Weber 1909). For contemporary models and surveys of the literature, see Fujita et al. (1999), Braunerhjelm et al. (2000) and Fujita and Thisse (2002).

models, location was determined in an endogenous process based on production and trade costs, economies of scale and externalities originating in linkages to other firms and enlarged markets (pecuniary linkages), as well as knowledge spillovers (non-pecuniary linkages). Even small differences in size among regions and countries could generate a complete outward shift of the industrial sector in the smaller country. More sizeable market allows economies of scale to be exploited to a larger extent, which in turn enables firms to pay higher wages, leading to an inflow of labor, yielding a process of cumulative causation (Myrdal 1957; Venables 1996; Krugman and Venables 1996).

More recently the basic structure and mechanism of some of the mainstream economic geography models has been questioned. In particular, attention has been drawn to the underlying assumptions as regards the substitutability of factors of production and the cross-sectional distribution of trade costs. First, it is assumed that labor in the agricultural sector cannot take up work in the manufacturing sector. That clearly contradicts the massive influx of labor from the agricultural sector into the manufacturing sector that has been observed in most countries. Second, trade in agricultural goods is assumed to be costless, which also stands in sharp contrast with empirical observations. As shown by Davis (1998), dropping the latter assumption implies that the large market effect may be reverted.

Moreover, relocation is visualized as a process driven by labor migration, which may, to some extent, reflect the situation in the U.S., but does not conform to the European case. Rather, firms lead the way in altering the location of industrial activity. Puga (1999) argues that precisely the lack of international labor mobility can create convergence in terms of real wages, and a more even spatial distribution of production.[5] Given that trade costs are in the mid-range—not prohibitive to international exchange but clearly distinguished from zero—agglomeration will take place to exploit linkages to suppliers and customers. However, if firms' relocation of production is not paralleled by labor flows, then one can expect persistent wage differentials to arise or worsen, which ultimately should induce geographical dispersion of production.[6]

On the other hand, as noted by Combes and Overman (2004), increasing wage costs should also imply increasing demand that to some extent can be expected to counteract the negative effect of rising production costs. Hence, agglomeration economies could positively impact productivity through pecuniary and non-pecuniary spillovers, including employment savings. Empirical findings reveal that productivity gaps across agglomerations can be substantial: within countries the productivity differences between regions within the same country have been estimated to be in the range of 140% (Germany) to 30% (Italy) between the highest and lowest performers (Ciccone 2002).

Also Fujita, Krugman and Venables (1999) conclude that industrial agglomerations may generate higher wages but also higher demand. They stress that the imposed assumptions in the new economic geography models regarding the type and density of linkages between firms and industries, the degree of factor mobility and which factors of production that are assumed mobile, the sectoral adjustment costs and heterogeneity in demand and skill structure, do influence the derived theoretical predictions. Differences in that respect

[5] Income disparities across regions are wider in Europe than in the U.S. In Europe, about 25% live in so-called support areas (incomes are below 75% of the European average) which are entitled to support from the European Union, while only 2% live in corresponding areas in the U.S. (Quah 1996). At the same time, production is much more concentrated in the U.S. (Krugman 1991).

[6] Ottaviano and Thisse (2004) survey the literature on agglomeration, emphasizing the role of mobility, how different type of linkages influences the costs structure though market size effects and cost effects. See also Fujita and Krugman (2003).

determine the extent to which agglomeration economies will be offset by diseconomies and congestion effects.[7]

In the international business research tradition economic geography factors have been present since long, notably those included in the L(ocation)-variable in the OLI-paradigm. During the last few years there seems to be a tendency towards convergence in how to view the determinants of location in the economics and international business literature, respectively. Sethi et al. (2003) and Buckley and Ghauri (2004) stress the exploitation of differential wage levels as an increasingly important determinant of location as nations become more integrated. However, as pointed out by Sethi et al., excessive spatial concentration may also put an upward pressure on production costs, yielding fragmented production structures. Hence, location is driven by a cycle determined by efficiency seeking and market seeking. There are obvious connotations to the issues addressed in this paper, i.e. the relationship between agglomeration economies and production costs.[8]

To summarize, given the level of (mid-range) trade/transport cost and factors related to firm-specificity (knowledge etc.), location of firms into different countries can be viewed as a reflection of differences with regard to production costs, agglomeration economies and institutions. These factors influence the perceived profit opportunities at different location, given the capabilities of the firms. Thus, profit for firm i in country j can be modeled as a function of agglomeration and cost factors,

$$\pi_{ij} = \pi_{ij}(q_j, w_j, h_j, L), \tag{1}$$

where q is a composite of costs of intermediate goods (including trade costs) and production costs are measured as relative wages (w). The number of firms (h) in a country j at a specific period in time represents one side of agglomeration, which is complemented by the size of the labor market (L).

If, for whatever reason, profits differ across nations and relocation of firms is facilitated by a process of regional integration that remove previous obstacles to trade and cross-border investment, the spatial distribution of production can be expected to change over time through FDI (f),

$$\dot{f}_j = \lambda \pi_j(q_j, h_j, w_j, L), \tag{2}$$

where $\dot{f}$ denotes the time derivative of inward *FDI* to country j, λ is a constant exceeding zero (capturing all other elements that influence location, such as policy, size of market, culture, etc), and π is the profit function.[9]

In the short to medium range of time location is thus a function of profit which is affected by four forces: the extent of agglomeration and competition at the production market (h) and labor market (L) together with relative labor cost and costs of intermediate goods (w and q). It is noteworthy that these forces may push location in opposite directions. We can then formulate testable and alternative hypotheses depending on our assumptions regarding the degree of agglomeration economies, the extent of labor mobility and the ensuing effects on relative wages.

[7] See also Krugman (1999, 2002). Brezis and Krugman (1997) stress that agglomeration may be hampered if technologies differ.

[8] See also Vernon (1966), Head et al. (1995, 1999), Braunerhjelm and Svensson (1996).

[9] For the complete derivation of the general equilibrium solutions, see Braunerhjelm and Thulin (2005).

First, an increase in the number of firms which is not accompanied by a corresponding flow of labor is likely to increase the demand for labor, putting an upward pressure on wages. Moreover, an inflow of firms also implies that the number of locally produced varieties will increase and stiffen competition. As the local expenditure level remains unchanged, assuming labor to be immobile, firms will (on average) face lower demand. Hence, in this scenario agglomeration economies are weak and tend to lower profit (competition increase as do production cost), which means that inflow of firms will halt relatively soon or occur at the expense of other firms exiting or relocating to other regions. That in turn suggests that production will remain quite dispersed as forces mitigating concentration arise due to higher production costs.

H1 In countries (regions) characterized by low labor mobility, locations of MNCs will be positively influenced by the degree of agglomeration of production (h) but negatively affected by higher relative wage costs (w) which tends to erode profits and deter further agglomeration,

$$\dot{f}_j \geq 0 \text{ if } h_j > h_g \text{ and } \dot{f}_j \leq 0 \text{ if } w_j > w_g,\ j \neq g \tag{3}$$

However, a different path may be taken if an inflow of firms is paralleled by labor migration yielding lower production costs and stronger agglomeration. An inflow of workers and firms implies that regional expenditure on the respective variety produced locally increases, thereby mitigating the effect described above when each variety produced encounter lower demand. Hence, in this case agglomeration and cost factors will mutually reinforce the attractiveness of a region, i.e., generating a positive impact on profits and propel entry.

H2 In countries (regions) characterized by high labor mobility, locations of MNCs into country j will be unambiguously positively influenced by the degree of agglomeration of production and there will be no or weak signs of negative effects related to higher relative wages due to inflows of labor which tend to positively affect profits and reinforce agglomeration,

$$\dot{f}_j > 0 \text{ if } h_j > h_g \text{ and } \dot{f}_j \geq 0 \text{ if } w_j \leq w_g,\ j \neq g \tag{4}$$

Thus, the extent of industrial agglomeration into a nation depends on how profitability is influenced by an increase in the number of firms. Profitability—and location—can go either way, primarily depending on labor mobility, which not only influences production costs, but also demand and expenditure levels. However, it is also conceivable that strong agglomeration economies may compensate for higher relative wage costs through productivity and specialization effects.

H3 Countries (regions) characterized by strongly agglomerated industries may generate external economies that compensate for differences in relative wages, implying that higher production costs have no or insignificant impact on agglomeration,

$$\dot{f}_j > 0 \text{ if } \left(h_j > h_g\right) \geq \left(w_j > w_g\right),\ j \neq g \tag{5}$$

3 Empirical analysis: wages versus agglomeration

3.1 Econometric method

When firms decide where to locate production, the decision is taken in a step-wise fashion: First, choosing between all countries, firms decide in which country production should be located. Second, once that decision has been taken, the level of production at the respective location site is chosen. The Tobit method is then one conceivable statistical technique, applying maximum likelihood procedures. The estimates of the Tobit parameters reflect both changes in the probability of being above the limit, and changes in the value of the dependent variable if already above the limit. A decomposition of the effects is possible (McDonald and Moffitt 1980), but the problem is that the two separate effects will always have the same sign and significance. If we have reason to believe that the probability effects and the marginal effects differ, the appropriate estimation technique is a Heckman's two-step procedure (Fomby et al. 1986). For instance, the probability that a firm chooses a particular host country may be associated with the degree of openness rather than relative labor cost. However, once the host country has been chosen, openness may have a negligible effect on the marginal effect on production, whereas the influence of relative labor costs may be substantial. We will therefore apply the Heckman estimation technique in the following regressions.[10]

The dependent variable is defined as affiliate employment of firm i in industry b, located in country j at time t (AL_{ibjt}), divided by the firm's total employment (TL_{it}).[11] The variable (AL/TL) is characterized by a large number of zeroes, since both the countries where the firms have production, as well as those countries where they do not, are included in the database. The model to estimate is specified as:

$$\frac{AL_{ibjt}^{*}}{TL_{it}} = \beta_0 + Z'\beta_1 + \varepsilon_{ijt} \tag{6}$$

$$\frac{AL_{ibjt}}{TL_{it}} = \begin{cases} \frac{AL_{ibjt}^{*}}{TL_{it}} & \text{if} \quad \frac{AL_{ibjt}^{*}}{TL_{it}} > 0 \\ 0 & \text{if} \quad \frac{AL_{ibjt}^{*}}{TL_{it}} \leq 0 \end{cases} \tag{7}$$

[10] The location choice of firms is multinomial by nature and one way of accounting for this would be to estimate a multinomial logit or probit. However, the multinomial logit relies on a very strong assumption, the independence of irrelative alternatives, and the multinomial probit involves the evaluation of multiple integrals, something that is not feasible if the choice alternatives exceed three or four. Given these limitations, we believe that the best model to use is Heckman's two-stage estimation technique. An alternative would have been to estimate a structural model. However, our model differs from other recent empirical analyses on geographical structures and driving forces since we use firm level data regarding the location of production. See e.g. Hanson (1998) and Redding and Venables (2000). From the firm's point of view all variables used in the estimations are exogenous (except the firm's own R&D), implying that a reduced form estimation is appropriate.

[11] The division by total labor of the firm, TL_{it}, is a way of controlling for historical factors as well as economies of scale on the firm level. Moreover, problems of heteroskedasticity are then reduced. We prefer employment data, since production data are influenced by exchange rate movements, price differences, etc., which could distort the variables. We have also used relative unit labor cost as an explanatory variable, in order to control for productivity effects. Unfortunately, distributed on industries this variable is not available to the same extent. In the runs undertaken, it appears with the expected positive sign and is also weakly significant.

The residuals are assumed to have the properties $\varepsilon \sim N\left(0, \sigma_{\varepsilon}^2\right)$, $E(\varepsilon_{hjt}\varepsilon_{ijt})=0$ for $h\neq i$, $E(\varepsilon_{ijt}\varepsilon_{ikt})=0$ for $j\neq k$ but $E(\varepsilon_{ijs}\varepsilon_{ijt})\neq 0$ for $s\neq t$. If we had only included countries where affiliate production actually takes place, observations for which AL/TL=0 would be omitted, which is equivalent to omitting all observations for which $\varepsilon_{ijt} \leq -(\beta_0 + Z'\beta_1)$. This implies that if ε_{ijt} in the population has a zero mean and a constant variance, the sample error μ_{ijt} will not have these properties because observations have been systematically rather than randomly excluded.

The Heckman method implies that first, a probit function is estimated for all observations, i.e., both AL/TL>0 and AL/TL=0 are included in the regressions in order to obtain the probability effects. Then, the sample is restricted to observations for which AL/TL>0, and a standard OLS regression is run, in which the estimated correction variable, λ, is included:

$$\frac{\mathrm{AL}_{ibjt}}{\mathrm{TL}_{it}} = \gamma_0 + Z'\gamma_1 + \gamma_2\widetilde{\lambda}_{ijt} + v_{ijt} \tag{8}$$

The residuals are assumed to have the properties $v \sim N\left(0, \sigma_v^2\right)$, $E(v_{hjt}v_{ijt})=0$ for $h\neq i$, $E(v_{ijt}v_{ikt})=0$ for $j\neq k$ but $E(v_{ijs}v_{ijt})\neq 0$ for $s\neq t$.[12] The estimated γ's are here the marginal effects of the explanatory variables on overseas production.[13]

Since Heckman's lambda is included, the OLS equation will yield consistent parameter estimates. The estimated standard errors will, however, be inefficient since we use the estimated, rather than the actual, value of λ. A White (1980) correction for hetero-skedasticity is therefore required in order to obtain efficient standard errors of the estimated parameters.

3.2 Data

A database has been compiled consisting of detailed information on all Swedish MNCs in the manufacturing sector, including data for each foreign affiliate on six different occasions (1974, 1978, 1986, 1990, 1994 and 1998).[14]

Table 1 illustrates the number of parent companies, the country coverage, and the number of observations of affiliates aggregated to firm-group level in the respective host country. All parent companies with at least one producing foreign affiliate are included in

[12] This will not yield inconsistent parameter estimates. However, the efficiency of the parameter estimates will be reduced by this possible autocorrelation. In the model, we use unbalanced panel data and thus, a combination of a specific firm and a specific country is far from always included for all periods in the sample. This will partly reduce the autocorrelation problem. To further reduce the autocorrelation, we could specify fixed effects for each combination of firm and country in the form of additive dummies, but we would then suffer from a large loss of degrees of freedom and the estimation procedures would be complex.

[13] It should be noted that the probit and corrected OLS equations include the same explanatory variables in vector Z. A possible practical problem is then multicollinearity between Z and λ. There is no theoretical basis that such problems must arise, however, since the latter variable is a non-linear combination of Z, while OLS is a linear estimation technique. By excluding one of the firm variables in the OLS equation, it was verified that the results for the remaining parameter estimates were robust.

[14] According to the IMF (1999), a FDI arises when a firm "acquires a lasting interest in an enterprise operating in an economy other than that of the investor, the investor's purpose being to have an effective voice in the management of the enterprise". The criterion to have an effective voice means a 10% minimum ownership in the invested object. In the current data set, the definitions are somewhat stricter; to qualify as an MNC, the firm must have at least one consolidated (50% ownership) production unit abroad.

Table 1 Coverage of the data set on MNCs and number of observations

Year	Number of parent companies	Numbers of countries	Observations
1974	93	34	3,162
1978	101	34	3,434
1986	97	34	3,298
1990	112	34	3,808
1994	125	38	4,750
1998	85	38	3,230
Total	–	–	21,682

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

the data set for each of the years. Altogether, this yields almost 22,000 observations. The number of firms varies over time; hence, we have an unbalanced panel.[15]

These data will be pooled with country-level data for 38 host countries.[16] A fairly aggregated industry classification is used due to restrictions in the availability of data, and we have thus classified manufacturing production on eight industries in the respective host country.[17] These data allow a crude calculation of measures of relative agglomeration of manufacturing production and R&D, within the respective host country. Similarly, Hoover–Balassa indexes of absolute concentration of production in Europe have also been constructed (for the exact definition of these indexes, see Braunerhjelm and Thulin 2005).

The database also covers cost data, where the most important refer to relative wage per employee, distributed on industries for the respective host country. Furthermore, we have used data on distance, market size, factor endowments, and policy variables, such as corporate taxes, public expenditure shares, trade policies, etc. Even though considerable efforts have been made to collect data on all variables for the respective year, and to make data comparable across countries, industries and time, there are a few "holes" in the data set. Hence, the number of observations will differ in the regressions.

4 Hypotheses on the explanatory variables

As shown in Section 2, forces promoting the dispersion of production involve differences in relative production costs, to which extent factors of production are inter-regionally mobile,

[15] It is of course always possible to create a balanced panel from an unbalanced by excluding cross-section units that are not present in all time periods. However, if the cross-section units that enter or exit the panel differ in a systematic way from those who are present in all periods, this will give rise to biased estimates. In this study, the cross-section unit is the firm, and it is more than likely that firms that enter and/or exit the panel differ from those that remain in the panel throughout the whole period.

[16] These data are compiled from various sources—see references.

[17] Industry 1: Food products (311), Beverages (313); Industry 2: Industrial chemicals (351), Other chemicals (352), Petroleum refineries (353), Miscellaneous petroleum and coal products (354), Rubber products (355), Plastic products (356); Industry 3: Iron and steel (371), Non-ferrous metals (372), Fabricated metal products (381); Industry 4: Machinery, except electrical (382); Industry 5: Machinery, electric (383); Industry 6: Transport equipment (384); Industry 7: Paper and products (341), Printing and publishing (342); Industry 8: Tobacco (314), Textiles (321), Wearing apparel except footwear (322), Leather products (323), Footwear, except rubber or plastic (324), Wood products, except furniture (331), Furniture, except metal (332), Pottery, china, earthenware (361), Glass and products (362), Other non-metallic mineral products (369), Professional and scientific equipment (385).

and the level of trade costs. Profit-maximizing firms will co-locate with other firms if they can exploit agglomeration economies due to linkages to suppliers of intermediate products and customers, i.e., pecuniary linkages. Agglomeration may also take place because of less tangible linkages stemming from R&D and other knowledge-intensive activities, i.e. non-pecuniary linkages. Moreover, to fully reap the benefits of economies of scale, firms may chose to locate in countries with the most sizeable market.

The explanatory variables chosen are summarized in Table 2.

Referring to our theoretical framework (Eq. 2), they can be categorized on production costs (w and q), agglomeration (h), policy (e.g. τ) and control variables (λ). All variables are in logarithmic form and expressed in the same deflated currency, except when an alternative specification is explicitly stated. In the empirical model, we will focus on the relation between agglomeration and relative production costs (while controlling for other factors), and whether the impact of these factors differs between EU and the rest of the world.

Table 2 Definitions of explanatory variables used in the regressions

Cost variables (influencing w and q)	Agglomeration variables (influencing h)	Policy variables (influencing q and τ)	Other(control) variables (λ)
RW: Relative wage, measured as dollar per employed in a certain country and industry, compared to the same quota for Sweden. Industry level	AGGL: Relative agglomeration index based on production value. Industry level	EXPEND: Total public expenditure, percent of GDP. Country level	GDPC: GDP per capita expressed in current purchasing power adjusted dollars. Country level
	CONC: Absolute Hoover–Balassa index based on production value. Industry level [a]	EXPEDU: Public spending on education, percent of GNP. Country level	R&D: R&D expenditures, percent of total turnover. Firm level
	GDP: GDP expressed in 1995 year dollars. Country level	TAXCORP: Corporate taxes, percent of GDP. Country level	DIST: Distance between Stockholm and the other countries' capitals
	HOSTR&D: Number of scientists and engineers in the private business sector, percent of the total number of employed. Industry level	OPEN: The sum of imports and exports, percent of GDP. Country level	8698: Time dummy for 1986–1998
		IMPDUT: Import duties, percent of import value. Country level	8690: Time dummy for 1986–1990
		EU: Dummy for the countries in the European Union	9094: Time dummy for 1990–1994
			9498: Time dummy for 1994–1998

Sources: Data for the period 1974 to 1998 are collected from Barro and Lee (1996), IUI databases, various editions of OECD publications (1982, 1991, 1994, 1996a, b, c, 1997, 1998, 1999a, b, 2000a, b), Penn World Tables (1994), UNIDO (1997), and World Bank (2000)

[a] This variable could either be classified as belonging cost-variables, or to agglomeration variables

4.1 Cost variables

Relative wage (RW) costs are defined as the industry wage level per employee in the respective host country, divided by the corresponding industry wage in the home country, i.e., relative wage costs for industry b in country j at time t:

$$\mathrm{RW}_{bjt} = \frac{w_{bjt} \Big/ \mathrm{empl}_{bjt}}{w_{bst} \Big/ \mathrm{empl}_{bst}}, \tag{9}$$

where subscript s stands for Sweden and w and empl represent the total wage sum and employment respectively. Previous empirical findings are quite ambiguous when it comes to firms' "cost" elasticity of location. Yet, recent studies confer a negative impact of higher relative wages (Froot and Stein 1989; Braunerhjelm 1994; Slaughter 1995; Brainard and Riker 1997a, b; Hanson 1998; Hatzius 1998; Braconier and Ekholm 2000; Sethi et al. 2003).[18]

We expect increasing relative wage costs to have a negative effect on the location of affiliate production. Furthermore, we interact relative wages with a dummy denoting whether a host country belonged to the EU in the periods 1986–1990 (RW×EU×8690), 1990–1994 (RW×EU×9094) and 1994–1998 (RW×EU×9498), respectively. Presumably, differences in relative costs should become more important over time as integration proceeds and firms' exposure to such differences is intensified.

4.2 Agglomeration variables

The degree of agglomeration of production (AGGL) is measured as an industry's share of a host country's total manufacturing, in relation to the industry's share of manufacturing production for all countries. According to theory (Fujita et al. 1999), and supported by empirical evidence (Wheeler and Mody 1992; Head et al. 1995, 1999; Braunerhjelm and Svensson 1996; Nachum 2000), agglomerated production structures should have a positive impact on location.[19] Likewise, agglomerated R&D-structures (HOSTR&D) are expected to exert a positive impact on production, though in this case because of non-pecuniary linkages (knowledge spillovers).[20] We have also included the square of these variables (AGGL^2, $\mathrm{HOSTR\&D}^2$) in the regressions to allow for nonlinearities between agglomeration and the dependent variable.[21]

[18] It could be argued that immigration would alleviate restrictions on the supply of labor. Even though there has been an increase in migration, the major upward shift in the most recent decade, immigration is concentrated to a few countries and information is only available on net flows. In addition, data quality is basically weak, both with regard to quality and quantity. See OECD (2005, 2008) and Martin (2008).

[19] We also have data on input/output matrices for a limited number of countries, and price indexes for investment goods. However, none of these perform well in the regressions and are therefore not further discussed.

[20] For a theoretical modeling of these effects, see Martin and Ottaviano (1999). Fujita and Thisse (1996) allot agglomeration to the presence of Marshallian externalities, i.e., information spillovers in general, as well as specialized labor markets and other specialized non-tradable inputs.

[21] It should be noted that both production- and R&D-agglomeration are measured at the country/industry level. This is not optimal since many forces associated with agglomeration can be expected to work at much smaller geographical areas. However, due to the approach we have chosen for the empirical analysis we are forced to use this crude measure of agglomeration.

To separate between the effect of agglomeration and concentration, we include a Hoover–Balassa index on absolute concentration of industrial production (CONC), which is expected to have a positive impact on FDI.

Finally, among the agglomeration variables, we also include size of the respective host country's market (GDP), assumed to partly capture linkages in general, not least for downstream customers, partly being a proxy for economies of scale and home market effects.

4.3 Policy variables

We have also elaborated with a number of policy variables, stressing those related to trade costs and the level of taxes. Among the former, openness (OPEN) is defined as the share of exports and imports in relation to GDP, or host countries' import duties in relation to the total value of imports (IMPDUT). The trade costs variables are associated with some specific features. In particular, theory predicts a nonlinear relationship between trade costs and location of production. Either very low or very high trade costs generate geographically dispersed production structures, but in the medium range agglomeration will occur.

What can be said about the level of trade costs before the deepening of European integration was introduced in the mid-1980s? First, the flows of FDI have increased markedly since the mid-1980s. Second, as shown by Dunning (1997), FDI into the European Union displays a distinct pattern of concentration to the more sizeable core countries. The increase in intra-EU FDI suggests that trade costs have shifted from high to more medium range levels. Hence, we would expect an increased openness to be positively related to FDI, while increased import duties are likely to deter FDI.[22]

The expected impact of openness on FDI is corroborated by the empirical observations in Braunerhjelm and Lipsey (1998). However, it was also evident that production by Swedish firms in developing countries (e.g. in Latin America) occurred where markets have been sheltered by considerable tariff and non-tariff barriers. We therefore believe that tariff jumping could be a reason for FDI in more remote markets where knowledge about market conditions is limited. Thus, the sign of openness may alter for remote markets. To account for this effect, we interact openness with distance, defined as the distance between Stockholm and the respective host country's capitol. This interaction variable should negatively affect FDI. We thus retain the old tariff-jumping argument for FDI in more distant markets.

Our next policy variable concerns taxes. There are relatively few studies applying European data on taxes, but the issue has been carefully examined in numerous studies on location in the U.S.[23] For instance, Hines (1996) contends that a 1-percent increase in corporate taxes is associated with a difference in the share of manufacturing in the order of 10% between low- and high-tax U.S. states. Prior to that, Bartik (1985), Coughlin et al. (1991), and Hill and Munday (1992), provided evidence that investments—national as

[22] Brainard (1997) finds no influence of openness on FDI, whereas she reports a significant positive effect of trade barriers on FDI.

[23] See Graham and Krugman (1993) for a review of this literature. Note also, as pointed out by Kind et al. (1999), that the presence of agglomeration economies implies that tax revenue may increase or at least that a firm's sensitivity to differences in corporate taxes is diminished. Baldwin and Krugman (2000) forward similar arguments.

well as international—were affected by corporate taxes. Brainard also examines the effects of corporate taxes, but she finds that location is increasing in higher corporate taxes.

Two tax variables are implemented in the analysis. We commence by looking at the share of corporate taxes in relation to GDP (TAXCORP). In addition, since the quality on corporate tax data varies, we also use a proxy for the implicit overall taxation in a country defined as the size of public expenditure in relation to GDP (EXPEND). A non-linear relationship can also be expected here, i.e., some taxes are required to ensure that property rights are respected and enforced. However, in the current study, this is less likely to influence the estimations, at least when the EU-area is considered, since none of the EU-countries can be expected to have a public sector too small to guarantee basic functions such as a legal system, defense, etc. We expect both these variables to be negatively related to affiliate location by Swedish firms.

Also the level of education is likely to influence location. For efficiency and productivity reasons we believe that more educated individuals, measured as public spending on education in relation to GDP (EXPEDU), should attract entry by foreign firms.

Finally, we control for membership in the EU. A positive impact implies that the uncertainty of being an outsider in an integration process, taking place among a country's most important trading partners, may fuel FDI into that area. To control for this effect, an interaction dummy has been designed that captures whether a host country belonged to the EU in the periods 1986–1990 (EU×8690), 1990–1994 (EU×9094) and 1994–1998 (EU×9498). Since Sweden applied for membership in 1991 and became full member 1995, we expect this effect be positive for FDI by Swedish MNCs in the 1986 to 1990 period.

4.4 Control variables

To isolate the effects referring to our core variables (relative wage costs and agglomeration) we also have to control for the impact of several additional variables. On the country level, capital per labor may influence the wage level. Since we only have capital data for all the countries up to the beginning of the 1990s, we use GDP per capita (GDPC) which is highly correlated with the capital/labor ratio.[24] We expect a higher GDP per capita to positively influence location by MNCs.

Among the explanatory variables, only one relates to firm level data; the firms' R&D-intensity defined as total R&D-expenditure divided by total turnover (R&D). The reason is that theory predicts R&D-intensive firms to be most prone to internationalize production and there is also strong empirical support for this allegation (Caves 2007). Hence, in order to isolate the impact of the agglomeration and cost variables on location, we include firm's R&D-intensity as an explanatory variable in the first step (the selection equation) in the estimations. In addition, we have also included dummies to capture firm-, time- and region-specific effects in the regressions.[25]

[24] The correlation coefficient is larger than 0.80.

[25] Region 1 consists of countries in North America; region 2 of countries in Central- and South America; region 3 of countries in Europe; region 4 of countries in Eastern Europe; region 5 of Australia, New Zealand and Japan and region 6 of countries in Asia.

5 Regression results

The results are reported in Tables 3, 4 and 5. Several variables failed to attain significance, irrespective of the specification of the estimations, and will henceforth be disregarded.[26] We present the results for EU, Non-EU and the "World", where all 38 countries are included in the regressions.[27] The reasons are that we would like to separate between the effects accruing to the EU and other regions, since we expect that differences in labor-mobility should vary between regions. Moreover, as soon as we extend the analysis to countries outside EU, the restrictions on data availability become much more severe (for instance, data for HOSTR&D and EXPEND is lacking).

5.1 Agglomeration, relative wages and location of production

As shown in Tables 3, 4 and 5 the agglomeration variable (AGGL) related to production has the expected positive sign in all but two regressions. For the EU-region the agglomeration variable fails to reach significance, nor is there any evidence of a non-linear relationship between location and agglomeration in production.[28] In the case of EU, access to knowledge spillovers seems more important, as indicated by the significant and positive sign of the HOSTR&D variables and the squared version of this variable. Agglomeration in R&D affects both the locational choice and the level of production. Hence, gaining access to knowledge spillovers is one determinant of the locational choice of Swedish MNCs in the EU-regions, and there is no sign that this effect would suffer from potential diseconomies or congestion effects as witnessed by the positive squared HOSTR&D-variable.

As regards the country group referred to as non-EU countries, only the squared agglomeration variable ($AGGL^2$), is significant. This variable has a negative sign, indicating that the positive effects of agglomerated industries may be offset by negative diseconomies of agglomeration. This is likely to pick up general congestion effects that prevail in more condensed industrial areas in a number of middle- and low-income countries.

Finally, as we merge the two groups, the agglomeration variable is positive and highly significant throughout in Table 5, while its square is negative and significant for the level regressions. Since we cannot control for knowledge spillovers measured by R&D-expenditures, due to lack of availability for the non-EU countries, it is likely that the production agglomeration variable pick of some of the effects previously captured by the R&D-variable. Hence, this result has to be cautiously interpreted even though it confers a positive effect of agglomeration on investments by foreign firms.

Furthermore, both the size of the market (GDP supposed to capture linkages and scale effects on the country level as well as the importance of sizeable markets), and the variables

[26] These variables—with the exception of corporate taxes—have not been described above: input–output matrixes (available for a limited number of European countries), prices on intermediate products, prices on investment goods, corporate taxes and population density as a proxy for congestion. They did not influence the results in any other ways.

[27] We have extended EU somewhat to comprise also Norway and Turkey, due to these countries close links with EU.

[28] We also interacted high-tech (R&D-intensive) firms with R&D-agglomeration in the host countries. We failed to detect any relationship between these variables. The inclusion of this variable did also insert strong multicollinearity.

Table 3 Regression results, EU

	(1)		
	Heckman two-step estimation		
Independent variables	Probit Pr (*Y*)	OLS AL/TL	OLS* AL/TL
RW	−0.12 (0.13)	−0.51** (0.25)	−0.32 (0.25)
AGGL	0.05 (0.08)	0.21 (0.15)	0.16 (0.15)
$AGGL^2$	0.13 (0.09)	0.24 (0.22)	0.22 (0.23)
CONC	5.08** (2.19)	2.67 (3.21)	2.01 (3.24)
GDP	0.24*** (0.04)	0.38*** (0.07)	0.23*** (0.07)
HOSTR&D	0.63*** (0.16)	0.60** (0.28)	0.46* (0.28)
$HOSTR\&D^2$	0.04*** (0.01)	0.05** (0.02)	0.04* (0.02)
EXPEDU	1.03*** (0.20)	1.19*** (0.39)	0.86** (0.39)
EXPEND	−1.26*** (0.31)	−1.04* (0.59)	−0.74 (0.59)
OPEN	−0.35*** (0.12)	−0.63*** (0.25)	−0.32 (0.25)
GDPC	1.16*** (0.26)	1.70*** (0.55)	0.76 (0.56)
R&D	−0.01 (0.02)	–	–
Λ	–	1.47*** (0.10)	–
Adj. R^2	–		0.12
Wald statistic	3,436***		–
No of obs.	4,858		854
Left cens. obs.	4,004		–

Note: Standard errors in parentheses. All regressions include dummies for time and industries. In addition, the selection equation also includes firm specific effects. OLS* is a simple OLS regression, i.e., without taking into account the Heckman correction

*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$

measuring industrial concentration within EU (CONC), predominantly have a positive influence on the locational choice. That basically complies with expectations.

Interestingly enough, the impact of relative wages seems to differ between EU and other regions.[29] In EU the marginal effects are negative and significant at the five-percent level as regards the level of MNC activity (Table 3), whereas for non-EU countries the effect is positive, which is likely to contain productivity effects associated with higher wages (Table 4). In the estimations where all countries are included (Table 5), the estimated effect is negative in all regression but significant (weakly) in only one out of six regressions. As indicated by the interaction between the relative wage variable and the EU-dummy (RW × EU × YEAR), the negative effect of higher relative wages in EU on foreign location seems to be particularly pronounced in the period 1986 to 1990. Thereafter the effect and significance vanishes.

Thus, there seem to be inherent differences between EU and the rest of the world as far as the effects of agglomeration is concerned. Knowledge spillovers seem to be a dominant determinant of location in the EU-region, while higher relative wages have a negative impact on the level of production by foreign investors. For the world, the results suggest that agglomeration in production attracts location up to a certain level where diseconomies of agglomeration reaches a threshold that negatively influences further inward FDI.

[29] We also used relative unit labor costs as an alternative variable, which did not alter the overall results. Since data on relative unit labor costs is much more restricted, we prefer to use the relative wage cost variable.

Table 4 Regression results, non-EU

	(2)			(3)		
	Heckman two-step estimation			Heckman two-step estimation		
Independent variables	Probit Pr (*Y*)	OLS AL/TL	OLS* AL/TL	Probit Pr (*Y*)	OLS AL/TL	OLS* AL/TL
RW	0.15 (0.10)	0.28 (0.20)	0.21 (0.20)	0.33*** (0.11)	0.38* (0.22)	0.21 (0.22)
AGGL	−0.01 (0.09)	0.15 (0.17)	0.02 (0.17)	−0.02 (0.09)	0.15 (0.17)	0.02 (0.17)
$AGGL^2$	−0.15** (0.06)	−0.35** (0.15)	−0.25 (0.16)	−0.15** (0.06)	−0.35** (0.15)	−0.25 (0.16)
GDP	0.23*** (0.06)	0.42*** (0.13)	0.37*** (0.13)	0.35*** (0.07)	0.49*** (0.13)	0.37*** (0.14)
EXPEDU	0.27** (0.11)	0.47** (0.21)	0.33 (0.22)	0.31*** (0.11)	0.49** (0.21)	0.32 (0.22)
OPEN	−0.23 (0.14)	−0.22 (0.29)	−0.08 (0.29)	−2.18*** (0.47)	−1.29 (0.91)	−0.05 (0.90)
IMPDUT	0.34*** (0.08)	0.75*** (0.15)	0.59*** (0.15)	0.40*** (0.08)	0.79*** (0.15)	0.59*** (0.15)
OPEN×DIST	–	–	–	0.23*** (0.05)	0.13 (0.10)	−0.003 (0.10)
GDPC	0.48*** (0.15)	0.40 (0.31)	0.28 (0.31)	0.23 (0.16)	0.25 (0.33)	0.29 (0.34)
R&D	0.06 (0.04)	–	–	0.06 (0.04)	–	–
Λ	–	1.04*** (0.13)	–	–	1.06*** (0.13)	–
Adj. R^2	–		0.37	–		0.37
Wald statistic	1,147***		–	1,148***		–
No of obs.	9,929		612	9,929		612
Left cens. obs.	9,317		–	9,317		–

Note: Standard errors in parentheses. All regressions include dummies for time and industries. In addition, the selection equation also includes firm specific effects. OLS* is a simple OLS regression, i.e., without taking into account the Heckman correction

*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$

Table 5 Regression results, the "World"

Independent variables	(4)			(5)		
	Probit Pr (*Y*)	OLS AL/TL	OLS* AL/TL	Probit Pr (*Y*)	OLS AL/TL	OLS* AL/TL
RW	−0.03 (0.07)	−0.15 (0.14)	−0.24 (0.15)	−0.10 (0.07)	−0.20 (0.15)	−0.29* (0.15)
AGGL	0.16*** (0.05)	0.44*** (0.10)	0.26*** (0.10)	0.14*** (0.05)	0.42*** (0.10)	0.26*** (0.10)
$AGGL^2$	−0.02 (0.04)	−0.19** (0.10)	−0.08 (0.11)	−0.03 (0.04)	−0.20** (0.10)	−0.09 (0.11)
GDP	0.05* (0.03)	0.13** (0.06)	0.03 (0.06)	0.14*** (0.03)	0.21*** (0.07)	0.09 (0.07)
EXPEDU	0.54*** (0.07)	0.70*** (0.15)	0.47*** (0.15)	0.28*** (0.08)	0.46*** (0.16)	0.35** (0.17)
OPEN	−0.55*** (0.08)	−10.03*** (0.16)	−0.87*** (0.16)	0.40*** (0.14)	−0.20 (0.29)	−0.38 (0.30)
IMPDUT	−0.04*** (0.02)	−0.08** (0.03)	−0.07** (0.03)	−0.04** (0.02)	−0.07** (0.03)	−0.06* (0.03)
OPEN×DIST	–	–	–	−0.09*** (0.01)	−0.08*** (0.02)	−0.04*
RW×EU×8690	−0.07 (0.13)	−0.46* (0.26)	−0.35 (0.27)	−0.21 (0.14)	−0.58** (0.26)	−0.40 (0.27)
RW×EU×9094	0.09 (0.19)	0.39 (0.37)	0.37 (0.38)	0.08 (0.20)	0.38 (0.37)	0.38 (0.38)
RW×EU×9498	0.03 (0.26)	−0.38 (0.50)	−0.22 (0.52)	−0.05 (0.27)	−0.44 (0.51)	−0.26 (0.52)
EU×8690	−0.03 (0.08)	0.10 (0.16)	0.06 (0.16)	0.07 (0.08)	0.19 (0.16)	0.10 (0.17)
EU×9094	−0.11 (0.09)	−0.14 (0.18)	−0.07 (0.18)	−0.01 (0.10)	−0.05 (0.18)	−0.01 (0.19)
EU×9498	−0.34*** (0.12)	−0.65*** (0.24)	−0.65*** (0.24)	−0.21* (0.13)	−0.54** (0.24)	−0.57** (0.25)
GDPC	0.68*** (0.10)	0.84*** (0.22)	0.72*** (0.23)	0.51*** (0.10)	0.68*** (0.22)	0.65*** (0.23)
R&D	0.004 (0.02)	–	–	0.005 (0.02)	–	–
Λ	–	1.37*** (0.07)	–	–	1.36*** (0.07)	–
Adj. R^2	–		0.24	–		0.24
Wald statistic	1,865***		–	1977***		–
No of obs.	16,208		1,599	16,208		1,599
Left cens. obs.	14,609		–	14,609		–

Note: Standard errors in parentheses. All regressions include dummies for time, regions and industries. In addition, the selection equation also includes firm specific effects. OLS* is a simple OLS regression, i.e., without taking into account the Heckman correction

*$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$

5.2 Policy and control variables

The policy variables refer to trade costs, tax policies, education and EU membership. As regards expansionary fiscal policies (EXPEND, implicit tax pressure), it is shown in Table 3 to have a significant and negative effect on foreign entry by Swedish MNCs in EU (data is not available for other regions). Similarly, education (EXPEDU) exerts a strong positive effect on foreign location in almost all estimations (Tables 3, 4 and 5), irrespective of whether the probability of choosing a country or the level of production is considered.

As regards trade costs, this variable seems quite sensitive to the way it is inserted into the regressions. If we only apply openness (OPEN), a negative and clearly significant effect is obtained, which suggests that FDI occurs in order to jump tariff barriers (Table 3). A similar result is obtained if we add the share of import duties (IMPDUT) in relation to the import value, albeit this variable attains a much higher significance (Table 4).

Next, we introduce an interaction variable, which supposedly captures the different effect of trade policy (costs) for neighboring countries as compared to more distant markets. This variable is defined as the interaction between openness and distance (OPEN×DIST), where we argue that foreign affiliate production in remote places is negatively affected by openness. This modification influences the parameter values in the following ways. When we consider non-EU (Table 4), this seems to have little impact on the variables OPEN and IMPDUT, rather a positive influence is revealed. However, when all countries are considered (Table 5), the probability that open host countries will attract FDI now turns positive, while the effect of high import duties becomes negative; i.e., openness promotes entry by MNCs. This conforms to expectations and the observed pattern of foreign production by Swedish MNCs. Moreover, the interaction between openness and distance becomes negative and significant, implying that tariff-jumping may positively influence entry in more remote markets.[30]

Our final policy variable, which is a dummy reflecting whether a host country belongs to the EU, did not fare particularly well. Even though it appears with the expected positive sign in the period 1986–1990, it is not significant. Furthermore, in the subsequent period 1990–1994, it turns negative, an effect which remains and becomes significant in the period 1994–1998 in terms of the level of FDI. This probably reflects the general shift in FDI towards the U.S. in the latter part of the 1990s.

To control for potential simultaneity problems, we also estimated a recursive system. It is conceivable that agglomeration is a function of relative wage costs, policy variables, etc. Therefore, we first regressed all variables on agglomeration to obtain a predicted variable of agglomeration. In the subsequent step, the predicted value was used as an explanatory variable in a Tobit estimation. The drawback in applying this method is that we lose degrees of freedom, since our dependent variable is now defined by industry and country, not by firm and country. Hence, we have only implemented this technique to control for the robustness of the results obtained in the other regressions. The estimation of the recursive system will not be reported, but is naturally available upon request. The results indicated no simultaneity problems.

[30] We also tried with the interaction between import duties and distance, which yielded the expected positive and significant estimates. A high degree of multicollinearity was also inserted into the regressions, however. The correlation between the variables openness and import duties is −0.35.

6 Conclusions

Recent advances in economic theory predict that differences in production costs and agglomeration economies will influence the spatial distribution of economic activities. The extent to which these factors influence location, depends on the degree of integration across regions and countries, that is, trade costs are of importance. Throughout the post-war period, the dismantling of tariff and non-tariff barriers, paired with deregulation on the national level, have made formerly protected markets more exposed to international competition. This process gained momentum in the mid 1980s through global rounds of tariff reductions and the internal market program in Europe.

Through regression analysis, we have analyzed the relation between variables promoting agglomeration and dispersion of production by pooling unique firm level data on Swedish MNCs with country level data for the period 1974 to 1998. Several country level data are distributed on industries. We also included countries where the firms have no production. If omitting these observations, we are bound to introduce biasedness into the estimations, since the firm makes a step-wise decision when deciding to establish a foreign production subsidiary.

One clear result is that agglomeration factors do influence the location of production. At the same time, differences in relative wage costs are reported to have a negative effect on the location and production of MNCs in the EU. Considering the relatively modest mobility of the European labor force, this suggests that concentration to a limited number of regions within Europe is less likely, since an inflow of MNCs would tend to increase wages which would then deter further inflows of production. Alternatively, in countries outside the more homogenous Europe, differences in relative wage costs may also reflect differences in productivity.

In addition, economic policy variables were found to influence the outcome of the location of firms. First, an expansionary fiscal policy (high taxes) resulting in large public expenditures relative to GDP seems to be negatively associated with firms' locational decisions. Since this is not entirely due to the size of public expenditures, but more likely their composition, we control for education. The average spending on education is found to strongly increase the probability of inflows of FDI and also has a positive impact on the level of production. Finally, the effect of openness on location is more ambiguous even though there are indications that the effect is positive, except for more distant markets. We also controlled for market size and the relative abundance of capital, both of which were shown to exert a strong positive influence on MNC entry.

References

Baldwin, R., and Krugman, P., "Agglomeration, integration, and tax harmonization." CEPR Discussion Paper, No. 2630. London: CEPR, 2000.

Barro, R. J. and Lee, J.-W., "International measures of schooling years and schooling quality," American Economic Review, vol. 86, pp. 218–223, 1996.

Bartik, T., "Business location decisions in the United States: estimations of the effects of unionization, taxes and other characteristics of states," Journal of Business and Economic Statistics, vol. 3, pp. 14–22, 1985.

Blanchard, O. and Katz, L., "Regional evolutions," Brookings Papers on Economic Activity, vol. 1, pp. 1–75, 1992.

Braconier, H. and Ekholm, K., "Swedish multinationals and competition from high- and low-wage locations." Review of International Economics, vol. 8, pp. 448–461, 2000.

Brainard, S. L., "A simple theory of multinational corporations and trade with a trade-off between proximity and concentration." NBER Working Paper, No. 4269. Cambridge, MA: NBER, 1993.
Brainard, S. L., "An empirical assessment of the proximity/concentration trade-off between multinational sales and trade." American Economic Review, vol. 87, pp. 520–544, 1997.
Brainard, S. L. and Riker, D., "Are U.S. multinationals exporting U.S. jobs?" NBER Working Paper, No. 5958. Cambridge, MA: NBER, 1997a.
Brainard, S. L. and Riker, D., "U.S. multinationals and competition from low wage countries." NBER Working Paper, No 5959. Cambridge, MA: NBER, 1997b.
Braunerhjelm, P., Regional integration and the location of multinational corporations. Ph.D. Dissertation. The Graduate Institute of International Studies, Geneva, 1994.
Braunerhjelm, P., and Ekholm, K. (eds.), The Geography of Multinational Firms. Kluwer Academic, Boston, Dordrecht and London, 1998.
Braunerhjelm, P. and Lipsey, R., "Geographical specialization of U.S. and Swedish FDI activities," in Braunerhjelm, P., Ekholm, and K. (eds.), The Geography of Multinational Firms. Boston, Dordrecht and London (Kluwer Academic), 1998.
Braunerhjelm, P. and Svensson, R., "Host country characteristics and agglomeration in foreign direct investment," Applied Economics, vol. 28, pp. 833–840, 1996.
Braunerhjelm, P. and Thulin, P., "The trade-off between agglomeration forces and relative costs: EU versus the 'world'. Evidence from firm-level location data 1974–1998." CESIS Working paper no. 30. Stockholm: CESIS, 2005.
Braunerhjelm, P., Faini, R., Norman, V., Ruane, F., and Seabright, P., Integrations and the Regions of Europe: How the Right Policies Can Prevent Polarization, Monitoring European Integration Report No. 10. London: CEPR (2000).
Brezis, E. and Krugman, P., "Technology and the life cycle of cities," Journal of Economic Geography, vol. 2, pp. 369–383, 1997.
Buckley, P. and Casson, M., The Future of the multinational enterprise. London (MacMillan), 1976.
Buckley, P. and Ghauri, P., "Globalisation, economic geography and the strategy of multinational enterprises," Journal of International Business, vol. 35, pp. 81–98, 2004.
Caves, R., Multinational Enterprise and Economic Analysis, 3rd edition. Cambridge, Ma. (Cambridge University Press), 2007.
Ciccone, A., "Agglomeration effects in Europe," European Economic Review, vol. 46, pp. 213–227, 2002.
Combes, P.-P. and Overman, H., "The spatial distribution of economic activities in the European Union". Handbook of Regional and Urban Economics, Volume 4. Elsevier North Holland: Amsterdam and Boston, 2004.
Coughlin, C., Terza, J., and Arromdee, V., "State characteristics and the location of foreign direct investment in the United States," Review of Economics and Statistics, vol. 73, pp. 675–683, 1991.
Davis, D., "The home market, trade and industrial structure," American Economic Review, vol. 88, pp. 1264–1276, 1998.
Dunning, J., "Trade, location of economic activities and the MNE: A search for an eclectic approach," in Ohlin, B., Hesselborn, P.-O., and Wijkman, P.-M. (eds.), The Allocation of International Production, Proceedings of a Nobel symposium at Stockholm. London (MacMillan), 1977.
Dunning, J., "The European internal market program and the inbound foreign direct investments," Journal of Common Market Studies, vol. 35, pp. 1–30, 1997.
Dunning, J., "Perspectives on international business research: A profession autobiography fifty years researching and teaching international business," Journal of International Business Studies, vol. 33, pp. 817–833, 2002.
Fomby, T., Hill, C., and Johnson, S., Advanced Econometric Methods. New York (Springer), 1986.
Froot, K. and Stein, J., "Exchange rates and foreign direct investments: An Imperfect Capital Market Approach." NBER Working Paper, No. 2914. Cambridge, Ma.: NBER, 1989.
Fujita, M. and Krugman, P., "The new economic geography: past, present and future," Regional Science, vol. 83, pp. 139–164, 2003.
Fujita, M. and Thisse, J.-F., "Economics of agglomeration," Journal of the Japanese and International Economies, vol. 10, pp. 339–378, 1996.
Fujita, M. and Thisse, J.-F., Economics of Agglomeration. Cities, Industrial Location, and Regional Growth. Cambridge, UK (Cambridge University Press), 2002.
Fujita, M., Krugman, P., and Venables, A., The Spatial Economy: Cities, Regions and International Trade. Cambridge, MA (MIT), 1999.
Graham, E. and Krugman, P., "The surge in foreign direct investments in the 1980s," in Froot , K. (ed.), Foreign Direct Investment. Chicago, MA (MIT), 1993.

Hanson, G., "Market potential, increasing returns, and geographic concentration." CEPR Discussion Paper, No. 6429. London: CEPR, 1998.
Hatzius, J., "Domestic jobs and foreign wages: labour demand in Swedish multinationals," Scandinavian Journal of Economics, vol. 100, pp. 733–746, 1998.
Head, K., Ries, J., and Swenson, D., "Agglomeration benefits and locational choice: Evidence from Japanese manufacturing investments in the United States," Journal of International Economics, vol. 10, pp. 92–116, 1995.
Head, K., Ries, J., and Swenson, D., "Attracting foreign manufacturing: investment promotion and agglomeration," Regional Science and Urban Economics, vol. 29, pp. 197–218, 1999.
Hill, S. and Munday, M., "The U.K. regional distribution of foreign direct investment in the United States: Analysis and determinants," Regional Science, vol. 26, pp. 535–544, 1992.
Hines, J., "Altered states: Taxes and location of foreign direct investment in America," American Economic Review, vol. 86, pp. 1076–1094, 1996.
IMF, International Financial Statistics Yearbook. Washington (IMF), 1999.
Kind, H., Midelfart-Knarvik, K.-H., and Schjelderup, G., "Competing for capital in a lumpy world." NHH Discussion Paper, 7/99. Bergen: NHH, 1999.
Krugman, P., "Increasing returns and economic geography," Journal of Political Economy, vol. 99, pp. 483–499, 1991.
Krugman, P., "The role of geography in development," International Regional Science Review, vol. 22, pp. 142–161, 1999.
Krugman, P., "Where is the 'New Economic Geography'? in Clark, G., Feldman, M., and Gertler, M. (eds.), The Oxford Handbook of Economic Geography. Glasgow, Oxford (Oxford University Press), 2002.
Krugman, P. and Venables, A., "The seamless world: a spatial model of international specialization." CEPR Discussion Paper, No. 1230. London: CEPR, 1995.
Krugman, P. and Venables, A., "Integration, specialization, and adjustment," European Economic Review, vol. 40, pp. 959–967, 1996.
Markusen, J. R., "Incorporating the multinational enterprise in to the theory of international trade," Journal of Economic Perspectives, vol. 9, pp. 169–189, 1995.
Markusen, J. R. and Venables, A., "Multinational firms and the new trade theory." NBER Working Paper, No. 5036. Cambridge, MA: NBER, 1995.
Marshall, A., Principles of Economics. London (MacMillan), 1890.
Martin, J., Migration and The Global Economy: Some Stylized Facts. OECD (Paris), 2008.
Martin, P. and Ottaviano, G., "Growing locations: Industry location in a model of endogenous growth," European Economic Review, vol. 43, pp. 281–303, 1999.
McDonald, J. and Moffitt, R., "The uses of Tobit analysis," The Review of Economics and Statistics, vol. 62, pp. 318–321, 1980.
Myrdal, G., Economic Theory and Underdeveloped Regions. London (Duckworth), 1957.
Nachum, L., "Economic geography and the location of TNCs: Financial and professional service FDI to the USA," Journal of International Business Studies, vol. 31, pp. 367–385, 2000.
Obstfeld, M. and Peri, G., "Regional non-adjustment and fiscal policies," Economic Policy A European Forum, vol. 26, pp. 205–47, 1998.
OECD, Historical Statistics, 1960–1980. Paris (OECD), 1982.
OECD, Employment Outlook, July. Paris (OECD), 1991.
OECD, Employment Outlook, July. Paris (OECD), 1994.
OECD, Basic Science and Technology Statistics. Paris (OECD), 1996a.
OECD, The OECD Input–Output Database. Paris (OECD), 1996b.
OECD, Historical Statistics, 1960–1994. Paris (OECD), 1996c.
OECD, Basic Science and Technology Statistics. Paris (OECD), 1997.
OECD, DSTI (STAN Industrial Database). Paris (OECD), 1998.
OECD, Basic Science and Technology Statistics. Paris (OECD), 1999a.
OECD, OECD Economic Outlook, 65, June. Paris (OECD), 1999b.
OECD, OECD Economic Outlook, 68, December. Paris (OECD), 2000a.
OECD, Revenue Statistics, 1965–1999. Paris (OECD), 2000b.
OECD, Counting Immigrants and Expatriates in the OECD Countries: A New Perspective. Paris (OECD), 2005.
OECD, A Profile of Immigrant Population in the 21st Century: Data from OECD Countries. Paris (OECD), 2008.
Ottaviano, G. and Thisse, J.-F., "Agglomeration and economic geography," in Vernon Henderson, L and Thisse, JF (eds.), Handbook of Regional and Urban Economics, Volume 4. North Holland Amsterdam and Boston (Elsevier), 2004.

Penn World Tables 5.6., 1994.
Puga, D., "The rise and fall of regional inequalities," European Economic Review, vol. 43, pp. 303–335, 1999.
Quah, D., "Empirics for economic growth and convergence," European Economic Review, vol. 40, pp. 1353–1375, 1996.
Redding, S. and Venables, A., "Economic geography and international inequality." CEPR Discussion Paper, No. 2568. London: CEPR, 2000.
Sethi, D., Guisinger, S. E., Phelan, S. E., and Berg, D. M., "Trends in foreign direct investment flows: A theoretical and empirical analysis," Journal of International Business Studies, vol. 34, pp. 315–326, 2003.
Slaughter, M. J., "Multinational corporations, outsourcing, and American wage divergence." NBER Working Paper, No. 5235. Cambridge, Ma.: NBER, 1995.
UNIDO, Industrial Statistics Database 1997 3-digit ISIC, 1997.
Venables, A., "Equilibrium locations of vertically linked industries," International Economic Review, vol. 37, pp. 341–359, 1996.
Vernon, R., "International investment and international trade in the product life cycle," Quarterly Journal of Economics, vol. 80, pp. 190–207, 1966.
Weber, A., Theory of Location of Industries. Chicago (University of Chicago Press), 1909.
Wheeler, D. and Mody, A., "International investment location decisions—the case of U.S. firms," Journal of International Economics, vol. 33, pp. 57–76, 1992.
White, H., "A heteroscedasticity-consistent covariance matrix and a direct test for heteroscedasticity," Econometrica, vol. 48, pp. 817–838, 1980.
World Bank, World Development Indicators 2000. Washington (World Bank), 2000.