# Intra- and Inter-industry Linkages in Foreign Direct Investment: Evidence from Japanese Investment in Europe

by

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**Abstract:**

This paper studies the location choices of Japanese manufacturing and service firms in Europe between 1970 and 1995. We examine whether the presence of Japanese manufacturing (service) firms attracts other Japanese manufacturers (service providers), whether there exist inter-industry linkages between the two sectors, and how such intra- and inter-industry agglomeration effects have evolved over time. We find evidence of circular causation: in the 1970's the presence of Japanese manufacturing FDI in a particular location attracted other Japanese investors in both manufacturing and services. This effect was completely reversed in the 1980's and the first half of the 1990's. In this period, it was the presence of Japanese service companies that attracted manufacturing.

**Keywords:** foreign direct investment, manufacturing, services, circular causation, linkages

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## 1. Introduction

This paper studies the location choices of Japanese firms in Europe between 1970 and 1995. The firms in our sample are mainly from the manufacturing and service industries with a few from the primary sector. We examine whether there exist agglomeration effects within each sector (i.e. whether the presence of Japanese investment in a sector attracts other investment in the sector) as well as across sectors (e.g., manufacturing attracting services and vice versa). We also investigate how these effects have changed over time. We find that in the 1970's the presence of Japanese manufacturing FDI in a particular location attracted other Japanese investors in both manufacturing and services. This effect was completely reversed in the 1980's and the first half of the 1990's. In this period, it was the presence of Japanese service companies that attracted manufacturing. Our paper thus points to the importance of circular causation in FDI.

There is a large literature on the location choices of multinational manufacturing firms and, in particular, on the role of manufacturing agglomeration.[1] Studies have confirmed that agglomeration of manufacturing FDI from a particular source country attracts other manufacturing FDI to that location; more on these studies below. However, there has been relatively little research on the location choice of service firms or on agglomeration effects emanating from services. This is surprising for at least two reasons. First, services now account for a large, in some cases even dominant, share of total FDI. In the United States, for example, service FDI accounted for nearly 60% of the total stock of outbound FDI in 1995.[2] In our sample of Japanese foreign investment in

[1] See Caves (1996) and Markusen (1995).
[2] U.S. Department of Commerce, *Survey of Current Business*, various issues.

Europe around 80% of new investments in the 1990's were in services. So a study of service FDI is clearly warranted on its own merits.

Second, services are a key input in modern manufacturing and play an increasingly important part in facilitating global economic activity. Thus, ceteris paribus, the presence of service FDI in a given location should make it more attractive for manufacturers to locate there. Recent evidence, for instance, shows that while 46% of Japanese manufacturing affiliates in Europe procure some parts and materials from other Japanese firms within the same host country, nearly 50% of these affiliates finance their operations locally from Japanese-affiliated banks (JETRO, 1999). This suggests that the availability of services may be (at least) as important as access to manufactured inputs in overseas affiliate operations and thus cannot be ignored when examining multinational location choice. In addition, trade barriers for manufactured goods tend to be low and distances between countries short within Europe, so that agglomeration effects in manufacturing may not necessarily be confined to national borders. This is probably different for services, since they are relatively hard to trade both due to their nature and to government regulations. Given the importance of services in the manufacturing process, it may hence be that manufacturing firms seek out the presence of non-tradeables rather than other manufacturers when deciding where to locate.

While these examples are very suggestive about possible linkages between service FDI and manufacturing FDI, the fact is that we know relatively little about service FDI, how it interacts with manufacturing FDI, and how this interaction may have changed over time. The purpose of this paper is to begin to address some of these issues. We employ a firm-level data set that covers 3266 investments by Japanese multinational enterprises

(MNEs) into 17 European countries for the period 1970-1995. By including both manufacturing and non-manufacturing FDI, we are able to examine how agglomeration spills over and affects the investment decisions of firms in other industries. The length of the sample period allows us to examine the temporal sequence of the manufacturing-service relationship and determine whether manufacturing FDI leads to future service investment, or if in fact service FDI spurs future manufacturing investment.

The assumption implicit in our study of agglomeration effects is that firms from country $x$ may find it easier to do business with other firms from country $x$ than with local firms. For our Japanese FDI sample, this is suggested by the fact that many of the investors are members of vertical keiretsu (the big Japanese industrial groups that link manufacturers with their suppliers), or of horizontal keiretsu (conglomerates of companies centered on a Japanese bank).[3] The validity of this assumption has also been confirmed by other studies on agglomeration effects in FDI, which we will discuss in the literature review section. In a related context, Rauch (1999) presents evidence that common cultural ties, such as a common language or colonial ties, are an important determinant of trade in differentiated products for which there is no organized exchange. He argues that trade in such goods is organized by "networks" of traders from a similar cultural background. Gould (1994) finds evidence that bilateral U.S. trade is positively correlated with immigration from the trading partner. Gross (?) finds agglomeration effects in immigration: immigrants tend to go where there is a large population of previous immigrants from their home country.

[3] The importance of these keiretsu for FDI and trade has been investigated empirically by Ryan (2001), and in a recent theoretical paper by Spencer and Qiu (1999), among others.

In this paper we present evidence that agglomeration linkages extend across industries, with the effects of the linkages changing over time. In the 1970's, significant manufacturing-manufacturing and manufacturing-service links are found. That is, the presence of previously established Japanese manufacturing affiliates attracted subsequent Japanese investment into manufacturing as well as services. However, during the 1980's and 1990's, both of these links disappear and are replaced by a service-manufacturing agglomeration effect. This shows that manufacturing firms once attracted services, but now seek out services when considering the location for new FDI.

In the rest of the paper we proceed as follows. Section 2 briefly describes the relevant agglomeration literature as well as the role of services in manufacturing. Section 3 presents a theoretical model, while section 4 examines the data. A description of the empirical model and estimation results are provided in section 5, while section 6 concludes.

## 2. Literature Review

Our paper is related to two types of literature: the studies on agglomeration effects and linkages as well as studies examing FDI in services. How upstream industries producing intermediate goods may be attracted by downstream industries (and vice versa) has been explored in the new economic-geography literature.[4] This literature is based on the assumptions of increasing returns to scale in production and product differentiation, which imply a monopolistically competitive market structure. Baldwin (1999) finds that

[4] See Fujita, Krugman, and Venables (1999) for a recent survey and particularly the papers by Venables (1996), Puga and Venables (1996), and Markusen and Venables (1999).

these agglomeration effects arise from models via "circular causality", that is, agglomeration of industrial activity creates an environment for further agglomeration.

For FDI location choice, agglomeration effects are shown to be empirically significant under many different model specifications. This is shown, for example, by Wheeler and Mody (1992) as well as Devereux and Griffith (1998) for FDI by U.S. manufacturers and by Miscossi and Viesti (1991) and Smith and Florida (1994) for Japanese outward FDI. Smith and Florida's (1994) results also show tha -in-time" production methods of Japanese firms will lead to agglomeration. Han (1994) and Yamawaki, Thiran, and Barbarito (1995) find that agglomeration effects can extend beyond national borders and include European regions, while Head, Ries, and Swenson (1995, 1999) and Mayer and Mucchielli (1999) show that agglomeration effects influence investment choice at the sub-national level.

Recently the role of manufacturing agglomeration on FDI has been called into question. Stating that demand is typically not measured correctly, Head and Mayer (2000) show that by determining a firm's "potential market", demand considerations play a much more significant role than does manufacturing agglomeration.

Japanese trade and FDI in services has been examined by Fukao and Ito (2000). Other empirical studies of service FDI include UNCTC (1993), and a study by Buch (2000) on FDI by German banks. These papers regress service (banking) FDI or sales by foreign service affiliates on host GDP, non-service (non-banking) FDI, etc., and find that service FDI tends to follow FDI in non-service sectors. Raff and von der Ruhr (2001) examine the pattern of U.S. FDI in producer services and how this pattern might be

affected by informational barriers. It, too, finds evidence that non-service FDI attracts service FDI.

Another set of papers that we should mention here are those on trade in producer services by Markusen (1989) and Francois (1990a, 1990b, 1990c, 1993, 1995). These papers argue that service production is characterized by economies of scale and product differentiation and is best modeled as being monopolistically competitive. This suggests that services, too, can be explored in the new economic-geography framework and that for the purpose of our model we can treat them like any other differentiated intermediate input.

## 3. The Model

The model we construct here is a variant of the new economic geography models with increasing returns to scale and monopolistic competition. These models study agglomeration effects and market structure in long-run equilibrium, where free entry and exit of firms has led to zero profits in all locations and firms are hence indifferent about where to locate. By contrast, we want to study the location choice of individual firms in the short run when profits are still positive and may differ across potential locations. So our main departure from this literature is to assume a fixed number of firms in the industries under consideration.

Consider a region (e.g., Europe) consisting of countries 1,…, N. Foreign (e.g., Japanese) multinational enterprises (MNEs) want to locate in the region and each of them must decide on a country from which to supply the entire region. There are two industries: an upstream sector producing intermediate goods and a downstream sector producing goods for final consumption. In each industry, goods are differentiated. Consumers have Dixit-Stiglitz

preferences (i.e. constant elasticity of substitution (CES) utility) over (symmetric) varieties of consumption goods. Following Ethier (1982) we employ exactly the same love-of-variety approach for modeling (symmetric) varieties of intermediate goods (i.e., we use a CES aggregator). Both industries are monopolistically competitive, which in our particular case means that each firm has monopoly power with respect to its own variety, but does not take into account how its decisions affect the price index of the industry as a whole.

Since the basic structure of upstream and downstream industries in our model is the same we can save space by first examining profit maximization for a generic industry, and only in a second step turning to the differences between the two industries. Suppose that in this generic industry firms in country $j=1,\ldots,N$ produce $n_j$ varieties. Denote by $p_{ij}$ the price of a variety in country $i$ imported from country $j$ (including purchases of domestically produced goods). Expenditure minimization with respect to the different varieties yields a price index in country $i$, which takes the form

$$P_i = \left[\sum_{j=1}^{N} n_j p_{ij}^{1-s}\right]^{\frac{1}{1-s}} \tag{1}$$

where ó>1 is the elasticity of substitution between varieties. It also gives us the demand in country $i$ for a typical variety from country $j$:

$$x_{ij} = p_{ij}^{-s} P_i^{s} I_i, \tag{2}$$

where $I_i$ denote the total spending in country $i$ on goods from the (generic) industry.

The marginal cost of producing the generic good in country $j$ is $c_j$. We model the trade cost incurred by a firm in country j when it ships goods to country i as an iceberg cost and denote it by $t_{ij}$, meaning that a fraction $(t_{ij}-1)$ of goods melts in transit $(t_{jj}=1)$. It includes

transportation costs, tariff and non-tariff barriers, etc. Given the demand and cost specifications, a firm in country j earns a profit gross of fixed cost on its sales to country *i* of

$$\Pi_{ij} = (p_{ij} - c_j t_{ij}) x_{ij} \tag{3}$$

Taking into account that firms ignore the effect of their actions on the price index, profit maximization implies that price is a constant markup over marginal cost:

$$p_{ij} = \frac{s}{s-1} c_j t_{ij}. \tag{4}$$

Using (4) in (2) and substituting for the price index from (1), we can express the output sold in country $i$ by a typical country-$j$ firm from country as

$$x_{ij} = (c_j t_{ij})^{-s} \left[ \sum_{k=1}^{N} n_k (c_k t_{ik})^{1-s} \right]^{\frac{s}{1-s}} I_i, \tag{5}$$

and the corresponding gross profit of serving market *i* as

$$\Pi_{ij} = \frac{1}{s-1} (c_j t_{ij})^{1-s} \left[ \sum_{k=1}^{N} n_k (c_k t_{ik})^{1-s} \right]^{\frac{s}{1-s}} I_i. \tag{6}$$

Summing over all markets, the total gross profit of a typical firm located in country $j$ is

$$\Pi_j = \frac{c_j^{1-s}}{s-1} \sum_{m=1}^{N} \left[ \sum_{k=1}^{N} n_k (c_k t_{mk})^{1-s} \right]^{\frac{s}{1-s}} t_{mj}^{1-s} I_m. \tag{7}$$

This profit is decreasing in the production cost in country $j$ ($c_j$), the cost of exporting to the other countries in the region from $j$ ($t_{mj}$), and the number of competitors in each market ($n_k$). It is increasing in total spending $I_m$ in each of the $m$ countries served, with the biggest weight given to spending in country $j$ for which $t_{jj} = 1$. Profit is also increasing in the production and trading cost incurred by competing firms ($c_k$ and $t_k$, respectively).

Next consider how we have to modify the basic model to distinguish between upstream and downstream industries. Differences between the two industries arise on the demand and

on the cost side of equation (7). Spending on the final goods produced by the downstream industry depends on consumer preferences, income and population size in each country. The demand for intermediate goods, on the other hand, is a derived demand, which not only depends on the spending on final goods but also on the technology used by downstream firms and the prices of other factors used in downstream production. On the cost side we will assume that intermediate goods are produced from labor according to a linear technology. The marginal cost of an upstream firm located in country $j$, $c_j^u$ is hence equal to the unit labor cost in that country, $c_j^u = w_j$. Final goods are produced using local labor and the different varieties of intermediate goods. For simplicity we assume a technology, in which labor and an aggregate intermediate good are used in fixed and identical proportions. The marginal cost of producing downstream goods in country $j$, $c_j^d$, can then be written as

$c_j^d = w_j + P_j^u$, where $P_j^u$ is the price index for intermediates.

To take a closer look at this price index consider the generic price index in (1) and the profit-maximizing price of an individual variety in (4). In (4) we replace $c_j$ with $w_j$ and then substitute the resulting price into (1) to obtain

$$P_j^u = \left[\sum_{k=1}^{N} n_k (w_k t_{jk})^{1-s}\right]^{\frac{1}{1-s}}. \qquad (8)$$

We observe that the price index is decreasing in the number of intermediate-input producers and increasing in the unit wage and transport cost.

## 4. The Data

The data set on Japanese foreign direct investments from 1970 to 1995 was compiled from three separate volumes (1984/85, 1992, 1995) of Toyo Keizai Inc.'s *Japanese Overseas Investment: A complete listing by firms and countries* (JOI). For each investment, the JOI provides detailed information on several aspects of both the investing parent and its affiliates. For purposes of this study, we are concerned with the date and location of initial investment as well as the verbal description of each affiliate's main business line at the time of investment.

In most cases, the verbal descriptions allow for a determination of the affiliates activities only at a 2-digit SIC level. To improve the accuracy of the information on the SIC code identification, SIC codes for the Japanese parents were found in several editions of Dun and Bradstreet's *Principal International Businesses*, National Register's *Directory of Corporate Affiliations* and Diamond Lead's *Diamond's Japan Business Directory*. Affiliate main business line information was located in numerous publicly available European sources as well as from the main offices of most national foreign investment agencies (e.g. Irish Development Agency, Invest in France Agency, Invest in Sweden Agency). Use of these agencies significantly improves the reliability of the SIC identification coding and the consistency of information on foreign affiliate industrial classification. Main business lines reported in earlier SIC versions (1972, 1977) or in the European NACE format were converted to their 1987-SIC equivalent by standard classification concordances.

Given the richness of the data set described above, there are several empirical approaches consistent with the theoretical model from Section 2. From the raw data, we

have decided to construct a pseudo panel by aggregating the original data set while preserving the three original dimensions: time, industrial and regional distributions. Below is a description of the aggregating steps the reasons for the choices.

*4.1. Distribution by SIC-Categories.*

Although most affiliate data is available at the 4 -digit SIC level, we aggregate up to the 2-digit SIC level for two reasons. First, some entries were available only at the 2-digit level and we wanted to preserve the largest number of observations. Second, and more importantly, the variability in the number of firms investing in the same 4-digit SIC code is very small as in many instances observations are systematically equal to one making the results of hypothesis testing much less meaningful. Table 1 presents the industry distribution of new investments into our sample countries for the complete time period. Note that while investment occurs in all major industries. 85% of new Japanese investments during the 25-year period were in three sectors: (1) wholesale trade, (2) manufacturing, and (3) finance, insurance, real estate. More than 40% of the new investments by Japanese firms were made in wholesale trade (SIC 50, 51) and dominantly in the wholesale trade of durable goods (SIC 50). This is consistent with the establishment of distribution systems by Japanese firms for products such as automobiles or electronic goods and thus cross-fertilization.[5] Together, manufacturing and finance, insurance and real estate cover almost 45% of total new investment from 1970 to 1994 with a slightly larger share in financial services (22.2% vs 21.3% for manufacturing). Clearly, only a small share of the investments remains for the other sectors. In particular, service and retail trade industries represent only 7.6% and 1.8%, respectively, of overall

[5] In the raw dataset, more than 81% of investments by made by Japanese manufacturing firms are in 2-digit SIC codes different than their own. Most of these are investments into wholesale affiliates (SIC 50-51).

investment. Also, very few investments occur in the primary sector (i.e., agriculture, forestry, fisheries and mineral industries) since only 12 new investments were made during the 25 years. Similarly, construction represents a very small share of the sample with 0.9% or 31 new investments.

*4.2. Temporal Distribution.*

The second type of aggregation is over time. Figure 1 depicts the distribution over time of all the new investments by Japanese firms in Western Europe included in the sample.[6] During the first 15 years of the sample, from 1970 to 1984, the rate of entry by Japanese companies was quite steady as the yearly share of entries was on average 2.2% of the sample. During the next 8 years, the number of annual entries increased drastically and each year represents (on average) 7.9% of the sample. However, by 1993, the average yearly share of overall investment dropped to 1.9%.

When the time distribution is analyzed at the 2-digit SIC level, no clear pattern appears in terms of investment sequencing across industries. As it is clear from Figure 2, the complete spectrum of SIC categories is covered from the beginning of the period but with more or less intensity. In later years there is a denser distribution that corresponds to the larger number of new entries. Hence, the second type of aggregation is done by cumulating new investments over 5-year time periods, (i.e., 1970-74, 1975-79, 1980-84, 1985-89 and 1990-94) should not lead to a loss of information. In fact, some investment patters emerge when comparing these 5-year sub-periods. In the 1970's, investment in durable and non-durable wholesale goods (SIC 50, 51) dominated the investment

[6] While we cannot accurately identify what proportion of all new investments our sample captures we can say that out of a recorded sample of 3,616 individual investments, 3,266 had all the information necessary to conduct the empirical investigation. Observations cover more than 1100 firms that are or are not listed on the stock market.

decisions into Western Europe by Japanese firms. Some manufacturing industries (electric and electronic equipment, SIC 36) and some financial industries (mostly banks and insurance carriers, SIC 60 to 63) followed in intensity but only with one-sixth of the total cumulated entries. In the 1980's (Figure 4), Japanese MNEs diversified their investment portfolios. While most investment remained in wholesale trade, a growing share of investment occured in financial (SIC 60-67) and business services (SIC 73) as well as into additional manufacturing industries. Finally in the early 1990's (Figure 5), an even more homogenous pattern developed across the sectors. Such a development in the spread of new investments across a wide variety of industries through time may suggest that some cross-fertilization may have developed with time. As investments in some traditional sectors reached a critical level, other sectors may have developed to service the original ones leading to cross-fertilization. Hence, a glance at the pattern of initial investments by Japanese firms seems to be consistent with the premise of our investigation.

*4.3. Geographical Distribution*

The third level of aggregation concerns the geographical distribution. The sample covers 20 Western European countries, some of them very small with strong economic similarities between themselves or with a larger neighbor. Countries with only a handful of investments during the period were dropped and some other small countries were aggregated together in regions. The details are given in Appendix I, with Table 2 providing insight into the geographical dimension of the data set after aggregation. The largest number of the Japanese investments since 1970 took place in the United Kingdom and Ireland (30.4%) while the BeNeLux countries took 19.6%, as much as Germany

(19.5%) and much more than France which represents only 10.9% of new investments. All the other countries or region have attracted much smaller shares. Table 2 also reveals that the pre-sample distribution across regions differs slightly from the sample period, as Germany dominated new investments and the UK with Ireland were second. France was approximately at the same share as the BeNeLux countries. When decomposing the sample in the 5-year sub-periods, it is clear that there have been some slight variations in the distribution through time. For example, the UK had a maximum share of all new investments between 1985 and 1989; Germany was at the lowest in that period and had peaked a decade earlier, between 1975 and 1979. The share of investments in the BeNeLux region declined steadily since the early 1970's.

Hence, there are slight changes in the distribution across European countries. There is however, no reversal in terms of which countries are the main collectors of Japanese new investments. The variability through time suggests that country-specific factors may have played a role in Japanese firms' decision to locate new investments. Several of these will be taken into account in the empirical implementation.

## 5. Empirical Implementation

Equation (7) suggests three factors that should influence location decisions of service and manufacturing firms. The first factor is production cost, which should have a negative effect on location choice. Firms in the upstream industry face production costs in terms of unit labor costs. Downstream investors have to consider unit labor costs and the cost of intermediate goods, which is decreasing in the number of intermediate-input producers. The second factor is demand. Demand for downstream goods comes from

final consumers and should hence be positively correlated, for instance, with population size. The demand for upstream goods or services depends directly on the agglomeration of downstream firms (and indirectly on final demand, unit labor cost and technology). The third factor is competition form other firms in the same industry. Common to all three factors hence is that they depend on the cumulative number of previous investments.

An important issue is to what extent agglomeration effects spill over to other countries in the region. This is both relevant on the cost side, where imported intermediate goods lower the price index in a given location, and on the demand side, where access to customers in other countries raises the size of the market. How strong these spillovers would be depends on how easily a product is tradeable. So we would expect spillovers to be larger for manufactured goods than for services. Due to data limitations we do not consider these spillovers here.

The basic empirical specification consistent with the theoretical framework and the set up of the data set then is,

$$NUMF_{j,k,t} = c + a_j POP_{j,t} + b_j ULCOST_{j,t} + \sum_{k'=1}^{m} g_{k'} SECT_{k'} + \sum_{k'=1}^{s} d_{k'} CUMUL_{j,k',t-1} + e_{j,k,t},$$

where $NUMF_{j,k,t}$ is the number of investments made in region $j$ ($j$=1 to 8), 2-digit industry $k$ (k=1 to 62), during period $t$ ($t$=1 to 6); $POP_{j,t}$ is the population in region $j$; $ULCOST_{j,t}$ is the cost of labor in country $j$; $SECT_{k'}$ is a 1-digit sector dummy ($k'$=1 to 6) and $CUMUL_{j,k',t-1}$ is the cumulative number of investments already made in the same country $j$, 1-digit sector $k'$, at time $t-1$. In cases where no investment occurs, a zero is introduced

for the corresponding 2-digit SCI code. Hence the cross sectional dimension is constant at 496 observations (i.e., 62 SIC codes in 8 regions) in each five year sub-period.

Three types of hypotheses regarding the effect of past cumulative investments have been investigated. The first one concerns the analysis of the impact of all types of past investments on the location decision by new two-digit investments. The second one looks at the effect of same sector past investments (intra-sctoral agglomeration) and the third one investigates cross-fertilization (inter-sectoral agglomeration) effects.

*5.1. The Effect of all Cumulative Past Investments in the Region*

The results for the impact of all past investments in the region ($CUMALL_{j,t-1}$) are given in Table 3. The estimations were made first by pooling the sample over all sub-period and then for each five year sub-period independently. From the temporal distribution of investment detailed in section 4.2, it appears that location choice strategies may have changed through time. They are two possible reasons for such a change: first, the structure of Japanese investments in the destination country changed; and second, the Japanese economy has undergone various economic phases since 1970.

In Table 3's first column, the effect of aggregate Japanese investment on subsequent FDI is assumed to be identical across all sectors and there is no consideration for sector-specific effect except on the constant. Moreover all the sub-periods are pooled together and therefore there is no time-specific effect. The cumulative variable (CUMALL) is strongly significant thereby indicating previous Japanese investment in a Western European country does serve to attract new investments. To induce one new

investment in a given region, it is necessary to observe on average 143 past investments (See Table 7, upper panel).

In column 2, the hypothesis of identical agglomeration effects across sectors is relaxed. Sector-specific responses to all previous Japanese investment in the region are examined. Clearly, responses to previous Japanese investment vary across industries, New investments in sectors 5 and 6 are the most sensitive to the presence of Japanese firms in the country. Not surprisingly, they are service sectors (i.e., Trade and Finance, Insurance, Real Estate) and are likely to count on the benefits of the presence of Japanese firms in the region at the beginning of the implantation. The weakest effect is found in resource exploitation and construction (sector 1). This result is compatible with the argument that those activities may not have the same degree of freedom in terms of location decision and therefore have a weaker link with the presence of Japanese firms in the region. So, while 85 firms of all kinds are enough to induce a new investment in sector 6, almost ten times more, i.e., 500 are necessary, to induce a new investment in sector 1.

In columns 3 to 7 changes in the sector-specific response through time are investigated. It is clear that the presence of Japanese investments did not have a constant impact throughout the period. In particular, there is a clear difference between the 1975-1985 period and the rest of the sample. In the early 1970's and from the mid-the mid-1990's, the presence of established Japanese investments in the region mattered for new investments, with various degrees, for all sectors. In the middle sub-period (1980-1984) only firms established in sectors 5 and 6 were relevant (note that sector 6 is

weaker between 1975 and 1979). Hence, only the two sectors with the larger effect identified in the pooled sample retain some power throughout the 25-year period.

Now that it has been determined that the existence of Japanese regional investments matters for new investments it is worth investigating some more specific effects. Hence, the analysis turns to same-sector effect.

*5.2. The Effect of Same-Sector Cumulative Past Investments in the Region*

The second variable to be considered is the cumulative number of firms in the 1-digit sector of the new investments (identified at the 2-digit industry level), up to and including the preceding sub-period (CUMSECj,k',t-1). The results are given in Table 4. In column 1, past investments specific to the sector do matter on average and only 29 previous investments (see Table 7, lower panel) are necessary to attract a new one when they are in the same 1-digit sector. When each of the 6 sectors is identified separately, there are quite large variations in the degrees of dependence. Sectors 1 and 6 rely most on the existence of past investments in the same sector, i.e., need the smallest number of existing investment to settle (10, and 14 respectively). For resource exploitation and construction (sector 1), the responsiveness the small number of past investments in the same sector needed to attract new ones may, again, be related to location constraints. High fixed costs and constraint on settling where the source of production is may create the particularly strong dependence observed in that sector. The weakest dependence, i.e., the highest number of past investment required, is in manufacturing with 38. The high heterogeneity of industries in the manufacturing sector may explain the need for a larger number to create synergies. The counter- argument of more homogenous industries could

be made for financial services that are highly responsive as well. In short, hysteresis is stronger in resource exploitation, construction and financial activities than in manufacturing.

When the sample is divided into sub periods with differential effects for sectors, the pattern observed in Table 3 is not as clear anymore. In particular, in the early part of the sample sector-specific dependence is extremely weak.

From these first two cases, all past investments and all same sector investments, we have found that, first, the existence of Japanese firms in the region or country is relevant to the entry decision of new firms. Second, the effect of existing firms in the same sector is stronger than the general effect of all existing firms. Third, the effects are time-period specific. In the early 1970's, any type of firms was relevant to attract new investments in a region. As time passed, the effect of sector-specific investments became stronger even though it still varies a lot from on sector to the other. It must also be noted that there is no market-size effect (the population variable is not significant) and the cost of labor usually does not matter.

*5.3. The Cross-Fertilization Effect of Sector-Specific Cumulative Past Investments in the Region*

This section considers possible inter-industry agglomeration effects in the decision to invest by Japanese firms. As developed in the theoretical section, firms may be attracted by the presence of same-sector firms or by complementary industries when deciding to locate new investments in a region. Hence, this section analyses whether there is complementary and if so between which sectors. Again, the analysis is first

conditioned on the effects being identical through time and then each sub period is studied separately. The results for the whole sample are given in Table 5 and the results for the sub-samples are summarized in Table 6.

Starting with the full sample, relatively few cross-effects can be identified. The bottom section of Table 5 must be seen as answering the following question: Do past investments in sector *k'* (identified at the top of the column) have an impact in the location decision of new industrial investments? Overall, only firms already established in sector 4 (transportation and communication), in sectors 7 and 8 (business services) and to a lesser extent in sector 6 (finance and insurance) have an impact; new investments in resource extraction and construction and in manufacturing systematically take them into account. Also, new investments into finance and insurance are sensitive to the presence of existing investments in trade and in communication. These results suggest that industries in the primary and secondary sectors look for regions where services are available, especially business services and transportation and communication services. Industries in finance and insurance, however, settle in regions with a base in trade and transportation and communication services. Finally, business services and primary-sector industries are relevant for the location decision of investment in transport and communications.

Hence there are relatively few cross-effect when the whole sample is considered and some expected links do not exist. In particular, the presence of manufacturing firms does not influence any new investments. New investments are looking for services.

Table 6 gives an overview of the significant cross-effects through time.[7] A few general results can be drawn from the overall table in terms of sectoral patterns and time patterns.

Considering the sectoral pattern, the presence of past investments in financial, insurance and business services **are determinant** in attracting new investments in the primary and secondary sectors (i.e., signs are concentrated on the upper right quarter of the table). Conversely, former investments in resource extraction, construction and manufacturing do influence the location decision of firms wanting to invest in those services (i.e., signs are concentrated in the lower left quarter of the table). Second, the presence of primary industries is relevant for new investments in manufacturing. Third, remarkably over the whole period, no other industry is a determinant in the decision to invest in wholesale or retail trade and conversely, the presence of such firms has no influence in the decision to invest in other sectors. Fourth, transport and communication are relevant to all industries except those in the primary sector and those in the business services sector.

Further results emerge in relation to the time dimension. First, it appears that the importance of services for the primary and secondary sectors is a rather recent phenomenon (since the 1980's) and the converse relationship was dominant in the earlier years (in the 1970's). Second, primary industries have been relevant for secondary sector industries throughout the period while only recently had transport and communication have any relevance for some industries.

To summarize, there are several inter-industry agglomeration effects that influence investment, with these effects varying through time. In the earlier years, the

[7] Note that a generous level of significace at t01.0 was chosen to build Table 6.

presence of primary and secondary sector industries was important, while since the 1980's the presence of service industries have been relevant.

## 6. Conclusion

In this paper we examine the location choices of Japanese manufacturing and service FDI in Europe between 1970-1995. We particularly focus on inter- and intra-industry FDI linkages, especially between FDI in manufacturing and services. After presenting a model that examines the location choices of vertically linked firms, we find empirical evidence that there is circular causation in the location choices of manufacturing and service FDI. In the 1970's, intra-industry agglomeration effects were strong in the manufacturing sectors with manufacturing also attracting service FDI. However, the 1980's and early 1990's brought about a switch in inter-industry agglomeration effects. Manufacturing now appears to seek out the presence of services rather than other manufacturers when choosing FDI locations. This adds an additional step in Baldwin's (1999) circular causation in agglomeration, as we note not a manufacturing - manufacturing link, but rather a manufacturing - service - manufacturing process of investment.

There are a number of caveats in this paper which can serve as a basis for future research. The dataset provides us with the number of firms in a given industry, for which we aggregate to the two-digit SIC level. As such, this limits our ability to accurately measure the derived demand for upstream firms since, at this level of aggregation, one cannot determine whether firms in the same industry are horizontally or vertically related. In addition to this, we do not have a direct measure of locally-owned downstream firms

or of locally owned competitors. For services, however, this may not be such a cause for concern. Given the non-tradeable nature of many services, local production and competition influences may in fact be secondary to the firms necessity to locate in that area in order to service that market. In addition, a more precise measure of firms' access to other markets must be determinated. Finally, we also know that different corporate tax rates across potential host nations may have an effect on FDI location choice. However, Japan provides tax credits for taxes paid by Japanese MNEs abroad. Given that the net corporate tax rate in Japan is 52%, corporate taxes are unlikely to play a major role in the location decision (Hines,1996).

On the other hand, we do employ a longer time frame than previously examined, allowing us to capture the temporal patterns of Japanese FDI since 1970. The availabilty of local production and competition data is somewhat questionable for this time period, especially for service industries.

**Appendix I: Geographical Aggregation**

Countries have been aggregated in the following manner:

France;
Germany;
Italy;
Spain and Portugal;
Ireland, United Kingdom;
Belgium, The Netherlands and Luxembourg in the region called BeNeLux;
Norway, Sweden, Iceland, Finland, Denmark;
Switzerland and Austria.

Greece, Turkey and Cyprus have been dropped as they represent only 0.73% of the number of new investments done over the 25-year period.

**Appendix II: Definition of the variables.**

$CUMALL_{j,t-1}$ : sum of new investments in the same region (j) during all the preceding complete 5-year time spans.

$CUMSEC_{j,k',t-1}$: sum of new investments in the same region (j) and in the corresponding 1-digit SIC sector (k'), during all the preceding complete 5-year time spans.
The six sectors are (1) agriculture, forestry, fisheries, mineral and construction industries; (2) manufacturing; (3) transportation, communication and utilities; (4) wholesale and retail trade; (5) finance, insurance and real estate; (6) service industries.

$NUMF_{i,k,t}$ : number of new investments in particular region (j), in a given 2-digit SIC code level (k), during the 5-year sub-period t.

$POP_{j,t}$ : total population in the particular region (j) at the beginning of a given 5-year period (t). World Bank.

$REGION_j$ : Dummy equal to 1 for a given region or country of Western Europe; with j=Spain-Portugal; UK-Ireland; Belgique-The Netherlands-Luxembourg; Norway-Sweden-Iceland-Finland-Denmark; Switzerland-Austria; France; Germany; Italy.

$SECT_{k'}$ : Sectoral dummy with k'=1 to.

$RGDP_j$ : gross domestic product in volume, at 1991 ppp, in US$ (OECD).

$ULCOST_j$ : index of the unit labor cost in region j. When there are several countries in a region it is measured as a weighted average of national unit costs. The weight is the population size(OECD, WB).

$ULCRAT_{j,m}$ : relative labor cost in country j such that,

$$ULCRAT_{j,m,t} = \frac{ULCOST_{j,t}}{\sum_{m \neq j} w_m ULCOST_{m,t}}.$$

It is computed as the ratio of the unit labor cost in a given country (j) and the weighted average unit labor cost in the other countries (m  j). The weight is the population size (OECD, WB).

**Sources**

OECD. Organisation for Economic Cooperation and Development. *Analytical Database.* Paris.
WB. World Bank. *World Development Indicators.* Database. Washington.
CIA Factbook.

## References

Baldwin, R. (1999), "Agglomeration and endogenous capital," *European Economic Review* 43, 253-280.

Buch, Claudia M. (2000). "Why do Banks Go Abroad? Evidence from German Data," *Journal of Financial Markets, Institutions and Instruments* 9(1), 33-67.

Caves, Richard E. (1996), *Multinational Enterprise and Economic Analysis*, 2nd ed. Cambridge: Cambridge University Press.

Devereux, M. and R. Griffith (1998), "Taxes and the Location of Production : Evidence from a Panel of US Multinationals," *Journal of Public Economics* 68(3), 335-367.

Ethier, W. (1982), "National and International Returns to Scale in the Modern Theory of *American Economic Review* 73, 389-405.

Francois, Joseph, F. (1990a), "Producer Services, Scale, and the Division of Labor," *Oxford Economic Papers* 42, 715-729.

Francois, Joseph, F. (1990b), "Trade in Producer Services and Returns Due to Specialization Under Monopolistic Competition," *Canadian Journal of Economics* 23(1), 109-124.

Francois, Joseph, F. (1990c), "Trade in Nontradables: Proximity Requirements in the *Journal of International Economic Integration* 5(1), 31-46.

Francois, Joseph, F. (1993), "Explaining the Pattern of Trade in Producer Services," *International Economic Journal* 7(3), 23-31.

Francois, Joseph, F. (1995), "Dynamic Effects of Trade in Financial Services," *International Economic Journal* 9(3), 1-14.

Fujita, M., P. Krugman, and A. Venables (1999), *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge: MIT Press.

Fukao, Kyoji and Keiko Ito (2000), "Foreign Direct Investment and Service Trade: The Case of Japan," Hitotsubashi University, mimeo.

Gould, D.M. (1994), "Immigrant Links to the Home Country: Empirical Implications for *Review of Economics and Statistics* 76, 302 - 316.

Gross, D. (),
Han (1994)

Harris, C. (1954), "The Market as a "Factor in the Localization of Industry in the United States," *Annals of the Association of American Geographers* 64, 315-348.

Head, K. and T. Mayer (2000), "Non-Europe: The Magnitude and Causes of Market Fragmentation in Europe," *Weltwirtschaftliches Archiv* 136(2), 285-314.

Head, K. and T. Mayer (2000), "Market Potential and the Location of Japanese Investment in the European Union," University of British Columbia Working Paper.

Head, K., J. Ries and D. Swenson (1995), "Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States," *Journal of International Economics* 38, 223-247.

Head, K., J. Ries, and D. Swenson (1999), "Attracting foreign manufacturing: Investment *Regional Science and Urban Economics* 29, 197-218.

Japanese External Trade Organization (JETRO)(1999), *The 15th Survey on the Operations of Japanese-affiliated Manufacturing Companies in Europe and Turkey.*

Krugman, P. and A.J. Venables (1995), "Globalisation and the inequality of nations," *Quarterly Journal of Economics* 110, 857-880.

Markusen, J.R. (1989), "Trade in Producer Services and Other Specialized Intermediate *American Economic Review* 79, 85--95.

Markusen, J.R. (1995), "The Boundaries of Multinational Enterprises and the Theory of International Trade," *Journal of Economic Perspectives* 9, 169-189.

Markusen, J.R. and A.J. Venables (1999), "Foreign Direct Investment as a Catalyst for *European Economic Review* 43, 335-356.

Mayer T. and J-L. Mucchielli (1999), "La localisation a l'étranger des entreprises multinationales: une approche d'économie géographique hiérarchisée appliquée aux entreprises japonaises en Europe" *Economie et Statistique*, n°326/327, 159-176.

Miscossi, S. and G. Viesti (1991), "Japanese direct manufacturing investment in Europe," In A. Winters and A Venables, eds., *European Integration: Trade and Structure*, New York, Cambridge University Press.

Puga, D. and A.J. Venables (1996), "The Spread of Industry: Spatial Agglomeration in Economic Development," *Journal of the Japanese and International Economies* 10: 440-464.

Raff, H. and M. von der Ruhr (2001), "Foreign Direct Investment in Producer Services: Theory and Empirical Evidence," mimeo, University of Kiel.

Rauch, James E. (1999), "Networks versus Markets in International Trade," *Journal of International Economics* 48, 7 – 35.

Smith, D.F. and R. Florida (1994), "Agglomeration and Industrial location: An econometric analysis of Japanese-Affiliated Manufacturing Establishments in Automotive-Related Industries," *Journal of Urban Economics* 36, 23-41.

Spencer, Barbara J. and Larry D. Qiu (2001), "Keiretsu and Relationship-Specific Investment: A Barrier to Trade?" *International Economic Review* 42.

United Nations Centre on Transnational Corporations (UNCTC) (1989), *Foreign Direct Investment and Transnational Corporations in Services.*

United Nations Centre on Transnational Corporations (UNCTC) (1992), *Determinants of Foreign Direct Investment: A Survey of the Evidence.*

United Nations Centre on Transnational Corporations (UNCTC)(1990), *Transnational Corporations, Services, and the Uruguay Round.*

United Nations Centre on Transnational Corporations (UNCTC) (1993), *The Transnationalization of Service Industries.*

United Nations Conference on Trade and Development (UNCTAD)(1994), *Liberalizing Trade in Services: A Handbook*, United Nations; New York and Geneva.

United States Department of Commerce, *Survey of Current Business*, various issues from 1977-1996.

Venables, A.J. (1996), "Equilibrium Locations of Vertically Linked Industries," *International Economic Review* 37, 341-359.

Wheeler, D. and A. Mody (1992), "International Investment Location Decisions," *Journal of International Economics* 33, 57-76.

Yamawaki, H. (1993), "Location decisions of Japanese multinational firms in European manufacturing industries," In *European Competitiveness* ed. K. Hughes, 11-28. Cambridge: Cambridge University Press.

Yamawaki, H., J-M Thiran, and L. Barbarito (1998), "US and Japanese Multinationals in European Manufacturing: Location Patterns and Host Region/Country Characteristics," in K. Fukasaku, F. Kimura, and S. Urata (eds.), *Asia and Europe: Beyond Competing Regionalism*, Brighton: Sussex Academic Press.

## Table 1

## Distribution of New Investments at 2-Digit US-SIC Code in Western Europe

| SIC Code | DESCRIPTION | Share of first time Investments (%) |
|---|---|---|
| ***Agriculture, Forestry, and Fisheries*** | | ***0.2 (6 inv.)*** |
| 07 | Agricutural services | 0.2 |
| 09 | Fishing, hunting and trapping | 0.03 |
| ***Mineral Industries*** | | ***0.2 (6 inv.)*** |
| 13 | Oil and gas extraction | 0.2 |
| ***Construction Industries*** | | ***0.9 (31 inv.)*** |
| 15 | General building contractors | 0.7 |
| 16 | Heavy construction contractors | 0.1 |
| 17 | Special trade contractors | 0.2 |
| ***Manufacturing*** | | ***21.3 (701 inv.)*** |
| 20 | Food and kindred products | 0.6 |
| 21 | Tobacco manufactures | 0.03 |
| 22 | Textile mill products | 0.4 |
| 23 | Apparel and other textile products | 0.5 |
| 24 | Lumber and wood products | 0.03 |
| 25 | Furniture and fixtures | 0.2 |
| 26 | Paper and allied products | 0.4 |
| 27 | Printing and publishing | 0.2 |
| 28 | Chemical and allied products | 2.5 |
| 29 | Petroleum and coal products | 0.03 |
| 30 | Rubber and miscellaneous platics products | 1.4 |
| 32 | Stone, clay, glass and concrete products | 0.7 |
| 33 | Primary metal industry | 0.5 |
| 34 | Fabricated metal products | 0.7 |

| | | |
|---|---|---|
| 35 | Industrial machinery and equipment | 4.4 |
| 36 | Electrical and electronic equipment | 4.2 |
| 37 | Transportation equipment | 1.6 |
| 38 | Instruments and related products | 1.9 |
| 39 | Miscellaneous manufacturing industries | 0.9 |
| ***Transportation, Communication, and Utilities*** | | ***4.5 (150 firms)*** |
| 41 | Local and interurban passenger transit | 0.03 |
| 42 | Motor freight transportation and warehousing | 1.5 |
| 44 | Water transportation | 0.6 |
| 45 | Transportation by air | 0.6 |
| 47 | Transportation services | 1.6 |
| 48 | Communications | 0.2 |
| 49 | Electric, gas, and sanitary services | 0.1 |
| ***Wholesale Trade*** | | ***41.3 (1363 inv.)*** |
| 50 | Wholesale trade- durable goods | 34.7 |
| 51 | Wholesale trade-nondurable goods | 6.6 |
| ***Retail Trade*** | | ***1.8 (59 inv.)*** |
| 52 | Building materia ls, hardware, garden supply, & mobile | 0.03 |
| 53 | General merchandise stores | 0.4 |
| 54 | Food stores | 0.1 |
| 55 | Automotive dealers and gasoline service stations | 0.1 |
| 56 | Apparel and accessory stores | 0.03 |
| 57 | Furniture, home furnishing and equipment stores | 0.3 |
| 58 | Eating and drinking places | 0.7 |
| 59 | Miscellaneous retail | 0.2 |
| ***Finance, Insurance, and Real Estate*** | | ***22.2 (733 inv.)*** |
| 60 | Depository institutions | 2.7 |
| 61 | Nondepository institutions | 5.7 |
| 62 | Security, commodity brokers and services | 5.5 |

| | | |
|---|---|---|
| 63 | Insurance carriers | 1.5 |
| 64 | Insurance agents, brokers and services | 0.2 |
| 65 | Real estate | 1.6 |
| 67 | Holding and other investment offices | 5.1 |
| ***Service Industries*** | | ***7.6 (249 inv.)*** |
| 70 | Hotels, rooming houses, camps and other lodging places | 0.5 |
| 72 | Personal services | 0.03 |
| 73 | Business services | 3.1 |
| 75 | Automotive repair, services and parking | 0.1 |
| 76 | Miscellaneous repair services | 0.4 |
| 78 | Motion pictures | 0.1 |
| 79 | Amusement and recreational services | 0.2 |
| 80 | Health services | 0.03 |
| 82 | Educational services | 0.1 |
| 83 | Social services | 0.03 |
| 84 | Museums, art galleries, botanical & zoological garden | 0.03 |
| 87 | Engineering and management services | 2.9 |
| 88 | Private households | 0.03 |
| 89 | Miscellaneous services | 0.2 |
| ***Total number of observations*** | | ***3298*** |

## Table 2

## Distribution of Investments in Western Europe by Region

| Region | Share of Investments | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pre- 1970 | 1970-94 | 1970-74 | 1975-79 | 1980-84 | 1985-89 | 1990-94 |
| Austria & Switzerland | 6.1 | 5.0 | 5.5 | 9.1 | 8.1 | 4.4 | 3.0 |
| Belgium, Luxembourg, & the Netherlands | 13.0 | 19.6 | 26.7 | 21.1 | 16.3 | 20.5 | 17.5 |
| Denmark., Finland., Norway, Sweden, Iceland | 38.9 | 19.5 | 22.5 | 26.6 | 24.0 | 15.0 | 19.7 |
| France | 2.3 | 3.2 | 0.3 | 4.5 | 5.2 | 3.0 | 3.1 |
| Germany | 13.7 | 10.9 | 8.7 | 9.7 | 8.5 | 11.8 | 11.8 |
| Ireland & UK | 6.1 | 5.7 | 4.5 | 3.9 | 5.0 | 5.0 | 7.7 |
| Italy | 3.8 | 5.5 | 5.1 | 3.6 | 4.1 | 5.7 | 6.7 |
| Portugal & Spain | 16.0 | 30.4 | 26.7 | 21.4 | 28.8 | 34.5 | 30.4 |

## Table 3

## Effect of total cumulative number of established firms in the region

| | **70-94 1.** | **70-94 2.** | **70-74 3.** | **75-79 4.** | **80-84 5.** | **85-89 6.** | **90-94 7.** |
|---|---|---|---|---|---|---|---|
| C[a] | -.387 (1.1) | -.158 (0.5) | **3.566 (1.7)** | -.068 (0.1) | 1.303 (0.6) | **4.683 (1.4)** | .725 (0.1) |
| POP | .007 (1.2) | .007 (1.2) | **-.073 (1.7)** | .001 (0.1) | -.007 (0.3) | -.015 (0.8) | .012 (0.7) |
| ULCOST | .001 (0.3) | .001 (0.3) | **-.107 (1.5)** | .005 (0.3) | -.022 (0.5) | **-.057 (1.3)** | -.013 (0.1) |
| SECT1 | **-.603 (5.3)** | **-.188 (1.7)** | **-.230 (1.9**) | -.032 (0.3) | -.131 (1.0) | -.051 (0.1) | -.283 (0.7) |
| SECT23 | - | - | - | - | - | - | - |
| SECT4 | **-.347 (3.3)** | -.077 (0.7) | -.064 (0.5) | **-.117 (1.3)** | **-.261 (1.8)** | -.292 (0.8) | .181 (0.5) |
| SECT5 | **2.628 (4.9)** | **1.752 (3.1)** | .244 (0.2) | .253 (0.3) | -.013 (0.1) | 1.193 (0.6) | **2.367 (1.3)** |
| SECT6 | **1.728 (4.3)** | .006 (0.1) | **.356 (1.4)** | .068 (0.3) | .002 (0.1) | **-2.075 (1.7)** | **-1.700 (2.1)** |
| SECT78 | **-.429 (4.0)** | **-.209 (1.6)** | -.104 (1.1) | -.058 (0.6) | **-.210 (1.6)** | -.474 (1.2) | -.177 (0.4) |
| ***Region-wide effect*** | | | | | | | |
| CUMALL | **.007 (5.0)** | - | - | - | - | - | - |
| CUMALLsect1 | - | **.002 (1.9)** | **.198 (1.9)** | -.001 (0.1) | .005 (0.5) | **.007 (1.6)** | **.002 (1.8)** |
| CUMALLsect23 | - | **.005 (4.0)** | **.196 (1.9)** | .005 (0.7) | .008 (0.8) | **.012 (2.9)** | **.005 (2.9)** |
| CUMALLsect4 | - | **.003 (2.8)** | **.196 (1.9)** | .002 (0.3) | .008 (0.9) | **.011 (2.9)** | **.002 (1.8)** |
| CUMALLsect5 | - | **.012 (2.3)** | **.297 (2.5)** | **.033 (1.5)** | **.037 (1.7)** | **.025 (1.4)** | .009 (1.2) |
| CUMALLsect6 | - | **.019 (5.0)** | **.208 (2.0)** | .010 (1.0) | **.018 (1.5)** | **.056 (3.2)** | **.018 (4.0)** |
| CUMALLsect78 | - | **.003 (2.4)** | **.192 (1.9)** | .001 (0.1) | .007 (0.7) | **.012 (2.3)** | **.003 (1.7)** |
| $R^2$ adj. | .091 | .113 | .076 | .076 | .077 | .133 | .120 |
| n | 2480 | 2480 | 496 | 496 | 496 | 496 | 496 |
| DW | 1.64 | 1.65 | 1.81 | 1.77 | 1.74 | 1.71 | 1.60 |
| Schwarz Crit. | 3.259 | 3.249 | 2.457 | 2.319 | 3.137 | 4.022 | 3.697 |

[a] t-statistics in parentheses, computed from heteroscedastic-consistent standard errors. At 10% the critical level of significance is 1.3, and at 5%, 1.7.

## Table 4

## Effect of the 1-digit sector cumulative number of established firms on same sector

| | 70-94<br>1. | 70-94<br>2. | 70-74<br>3. | 75-79<br>4. | 80-84<br>5. | 85-89<br>6. | 70-94<br>7. |
|---|---|---|---|---|---|---|---|
| C | -.443 (2.1) | **-.407 (1.8)** | .045 (0.4) | -.120 (0.5) | .365 (1.0) | .393 (0.2) | -1.006 (0.1) |
| POP | **.007 (1.5)** | **.010 (2.3)** | .001 (0.2) | .001 (0.1) | .003 (0.4) | .013 (1.0) | .015 (1.2) |
| ULCOST | .004 (0.9) | **.004 (1.2)** | .006 (0.8) | .005 (0.9) | -.006 (0.7) | -.011 (0.4) | .003 (0.1) |
| SECT1 | .155 (0.7) | -.138 (1.1) | -.247 (1.3) | .038 (0.3) | -.147 (0.8) | .322 (0.6) | -.072 (0.1) |
| SECT23 | - | - | - | - | - | - | - |
| SECT4 | **-.305 (1.6)** | .005 (0.1) | -.014 (0.1) | -.048 (0.4) | -.024 (0.1) | .283 (0.6) | .447 (0.9) |
| SECT5 | **1.077 (2.4)** | **1.348 (2.1)** | .808 (0.7) | .377 (0.4) | .099 (0.1) | 2.011 (1.0) | 1.660 (0.7) |
| SECT6 | **1.741 (4.4)** | **.779 (2.7)** | **1.082 (1.9)** | .029 (0.1) | -.350 (1.0) | -.559 (0.6) | .244 (0.4) |
| SECT78 | .148 (0.8) | -.091 (0.7) | -.243 (1.0) | .040 (0.3) | -.123 (0.7) | -.144 (0.3) | .237 (0.5) |
| ***Same Sector Effect*** | | | | | | | |
| CUMSEC | **.035 (3.8)** | - | - | - | - | - | - |
| CUM1sect1 | - | **.097 (1.5)** | .251 (0.8) | -.051 (0.5) | .065 (0.5) | .285 (0.6) | **.164 (1.8)** |
| CUM23sect23 | - | **.026 (3.6)** | .029 (0.5) | **.042 (2.3)** | **.021 (1.6)** | **.052 (2.4)** | **.029 (2.5)** |
| CUM4sect4 | - | **.056 (3.0)** | -[b] | **.091 (1.9)** | **.054 (1.5)** | **.134 (2.7)** | **.047 (2.0)** |
| CUM5sect5 | - | **.028 (2.2)** | .123 (1.1) | .051 (1.2) | .052 (1.2) | .029 (1.0) | .025 (1.2) |
| CUM6sect6 | - | **.069 (4.9)** | -.001 (0.1) | **.089 (2.5)** | **.128 (2.8)** | **.282 (3.5)** | **.055 (4.0)** |
| CUM78sect78 | - | **.038 (2.0)** | **.158 (1.8)** | .016 (0.8) | .029 (1.1) | **.173 (1.6)** | **.036 (1.5)** |
| $R^2$ adj. | .114 | .123 | .069 | .085 | .089 | .175 | .138 |
| n | 2480 | 2480 | 496 | 496 | 496 | 496 | 496 |
| DW | 1.64 | 1.66 | 1.80 | 1.77 | 1.75 | 1.80 | 1.61 |
| Schwarz Crit. | 3.234 | 3.237 | 2.455 | 2.309 | 3.124 | 3.973 | 3.677 |

See notes Table 3.

**Table 5**
**Cross-effect of the 1-digit sector cumulative number of established firms**

| | **70-94 k==1 1.** | **70-94 k==2-3 2.** | **70-94 k==4 3.** | **70-94 k==5 4.** | **70-94 k==6 5.** | **70-94 k==7,8 6.** |
|---|---|---|---|---|---|---|
| C | **-.463 (1.9)** | -.366 (1.0) | -.161 (0.4) | -.110 (0.3) | **-.460 (1.8)** | **-.475 (1.9)** |
| POP | **.012 (2.6)** | **.010 (1.6)** | .007 (1.0) | .007 (1.0) | **.012 (2.4)** | **.014 (3.0)** |
| ULCOST | **.005 (1.4)** | .004 (0.8) | .002 (0.4) | .001 (0.2) | **.005 (1.4)** | **.006 (1.6)** |
| SECT1 | **-.181 (1.5)** | **-.158 (1.4)** | **.189 (1.5)** | **.143 (1.5)** | **-.207 (1.7)** | **-.309 (2.7)** |
| SECT23 | - | - | - | - | - | - |
| SECT4 | -.027 (0.2) | .044 (0.4) | -.027 (0.2) | -.073 (0.6) | -.065 (0.6) | **-.174 (1.5)** |
| SECT5 | **1.307 (2.0)** | **1.347 (2.1)** | **1.218 (1.7)** | **1.318 (2.1)** | **1.280 (1.9)** | **1.162 (1.7)** |
| SECT6 | **.791 (2.4)** | **.718 (2.1)** | **.426 (1.9)** | **.371 (1.7)** | **.715 (2.5)** | **.685 (2.2)** |
| SECT78 | -.130 (1.0) | -.123 (1.1) | -.143 (1.2) | **-.166 (1.6)** | -.150 (1.2) | **-.261 (2.2)** |
| ***Same Sector Effect*** | | | | | | |
| CUM1sect1 | **.086 (1.3)** | .064 (0.8) | -.033 (0.4) | **.114 (1.5)** | -.044 (0.7) | **-.132 (1.8)** |
| CUM23sect23 | **.017 (2.0)** | **.026 (3.2)** | **.017 (1.8)** | **.031 (2.5)** | **.014 (1.9)** | -.001 (0.1) |
| CUM4sect4 | **.084 (3.1)** | **.074 (2.2)** | **.063 (3.3)** | **.042 (1.5)** | **.061 (1.4)** | **.119 (2.6)** |
| CUM5sect5 | **.029 (1.6)** | .031 (1.2) | **.034 (1.5)** | **.029 (2.3)** | **.031 (1.7)** | **.031 (1.5)** |
| CUM6sect6 | **.074 (4.1)** | **.067 (4.0)** | .014 (0.5) | **.060 (4.0)** | **.069 (4.9)** | **.087 (3.0)** |
| CUM78sect78 | **.042 (1.8)** | .030 (0.9) | -.002 (0.1) | .030 (1.2) | .017 (0.6) | **.034 (1.8)** |
| ***Cross effect*** | | | | | | |
| $CUM_i$sect1 | - | .003 (0.4) | **.049 (2.2)** | .001 (0.3) | **.007 (2.6)** | **.038 (2.5)** |
| $CUM_i$sect23 | .115 (1.2) | - | **.049 (1.9)** | -.001 (0.3) | **.009 (2.1)** | **.059 (2.1)** |
| $CUM_i$sect4 | **-.131 (1.5)** | -.005 (0.5) | - | .003 (0.7) | -.001 (0.2) | **-.045 (1.7)** |
| $CUM_i$sect5 | -.088 (0.2) | -.008 (0.1) | -.064 (0.3) | - | .008 (0.3) | -.032 (0.3) |
| $CUM_i$sect6 | -.161 (0.6) | .005 (0.3) | **.383 (2.0)** | **.010 (1.7)** | - | -.081 (0.9) |
| $CUM_i$sect78 | -.039 (0.5) | .005 (0.2) | .068 (1.0) | .003 (0.8) | .006 (0.9) | - |
| $R^2$ adj. | .122 | .122 | .128 | .123 | .123 | .123 |
| N | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 |
| DW | 1.66 | 1.66 | 1.67 | 1.66 | 1.66 | 1.66 |
| Schwarz Crit. | 3.237 | 3.252 | 3.345 | 3.251 | 3.251 | 3.250 |

+See notes Table 3.

## Table 6
## Cross-effects through time

| ONTO SECTOR | | FROM SECTOR 1 | 2,3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|---|
| 1 | 70-74 | | + | n.a. | | + | |
| | 75-79 | | | | | | |
| | 80-84 | | | | | | |
| | 85-89 | | | + | | + | |
| | 90-94 | | | + | | + | + |
| 2,3 | 70-74 | | | n.a. | | | + |
| | 75-79 | + | | | | | |
| | 80-84 | + | | + | | + | + |
| | 85-89 | + | | | | + | + |
| | 90-94 | + | | + | - | + | + |
| 4 | 70-74 | + | + | | | - | + |
| | 75-79 | | | | | | + |
| | 80-84 | | | | | | + |
| | 85-89 | + | | | | + | |
| | 90-94 | | | | | | - |
| 5 | 70-74 | | | n.a. | | | |
| | 75-79 | | | | | | |
| | 80-84 | | | | | | |
| | 85-89 | | | | | | |
| | 90-94 | | | | | | |
| 6 | 70-74 | + | + | n.a. | | | + |
| | 75-79 | | - | | | | |
| | 80-84 | | - | | | | |
| | 85-89 | | + | + | | | + |
| | 90-94 | + | | + | | | |
| 7,8 | 70-74 | + | + | n.a. | | - | |
| | 75-79 | | | | | | |
| | 80-84 | | | | | + | |
| | 85-89 | + | | | | + | |
| | 90-94 | | | | | | |

# Table 7

## Number of firms necessary to attract a new investment in a region

| | Total | Resources, Construction<br>1 | Manufact-uring<br>2,3 | Transport. Communic. Utilities<br>4 | Trade<br>5 | Finance, Insurance, Real Estate<br>6 | Business Services<br>7,8 |
|---|---|---|---|---|---|---|---|
| ***All investments done in the region*** | | | | | | | |
| **1970-94** | **143** | **500** | **200** | **333** | **83** | **53** | **333** |
| **1970-74** | - | 5 | 5 | 5 | 3 | 5 | 5 |
| **1975-79** | - | - | - | - | 30 | - | - |
| **1980-84** | - | - | - | - | 27 | 25 | - |
| **1985-89** | - | 142 | 83 | 91 | 46 | 18 | 83 |
| **1990-94** | - | 500 | 200 | 500 | 111 | 56 | 333 |
| ***Same sector investments done in the region*** | | | | | | | |
| **1970-94** | **29** | **10** | **38** | **18** | **36** | **14** | **26** |
| **1970-74** | - | - | - | - | 8 | - | 6 |
| **1975-79** | - | - | 24 | 11 | 20 | 11 | - |
| **1980-84** | - | - | 48 | 19 | 19 | 8 | 34 |
| **1985-89** | - | - | 19 | 7 | 34 | 4 | 6 |
| **1990-94** | - | 6 | 34 | 21 | 40 | 18 | 28 |