

## A relational account of the causes of spatial firm mobility

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### Abstract

The existing literature on the spatial mobility of firms completely neglects the existence of inter-organizational relations (IORs). This is striking since there is a strong theoretical argument in the literature that firms with a high level of embeddedness in (localized) IORs are very unlikely to relocate. Therefore, the following research question is posed: *“To what extent is the level of embeddedness of firms in (localized) innovative inter-organizational relationships of influence on their propensity to relocate?”*

Based on ordered logit model it is shown empirically that there is a strong spatial lock-in effect of having a high degree centrality.

**Key words:** Firm relocation, spatial mobility, propensity to relocate, spatial lock-in, spatial inertia, inter-organizational relationships, embeddedness.

**JEL:** L14, R12, and R23

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## 1. Introduction

There is a plethora of literature dealing with the causes of the spatial mobility of firms (PELLENBARG *et al.* 2002). However, the vast majority of these papers focus primarily on geographical characteristics. The fact that most firms do not operate in isolation but are often engaged in inter-organizational relationships (IORs) and networks that influence their actions is largely neglected. This is especially striking since it is widely accepted in the scientific literature that exchanges within networks have an ongoing structure that both enables and constrains the behavior of its members (UZZI 1996; GRANOVETTER 1985). A possible constraining effect being involved in IORs and networks is spatial lock-in, also known as spatial inertia, of a firm (ROMO and SCHWARTZ 1995).

Following Granovetter (1985), the extent to which being involved in IORs and networks influences the spatial mobility of firms can be argued to be dependent on both the overall structure of the inter-organizational network in which the firm operates as well as on the characteristics of the dyadic relations of a firm. However, only weak empirical evidence is available for the proposed relationships between the level of a firm's participation in (localized) IORs and its propensity to relocate. The main goal of this research is to provide empirical insights into this relationship. Based on the above, the following research question has been formulated: *"To what extent is the level of embeddedness of a firm in (localized) innovative inter-organizational relationships of influence on its propensity to relocate?"*

The contributions of this paper to the literature are threefold. First, it adds a relational perspective to a field of literature that has so far been dominated by (economic) geographers. In order to do so, a multidisciplinary approach will be adopted in which the relative contribution of geographical and relational variables can be assessed. Second, it empirically explores a possible constraining effect of IORs and networks. Even though the possible constraining effects of networks are largely acknowledged, most empirical research in inter-organizational settings has focused on the enabling effects of network relations and network structures only (BRASS *et al.* 2004; KNOBEN *et al.* 2006). Finally, this research will empirically research the claim that several characteristics of a dyadic tie, and high levels of

organizational proximity in particular, can negate the need for geographical proximity in IORs. This claim is often made in the literature (e.g. TORRE and RALLET 2005), but has received little empirical attention so far. Therefore, this paper might provide an (onset to an) answer to an ongoing debate in the literature.

First, in Section two, the “classical” determinants of the propensity of firms to relocate will be presented. Subsequently, the concept of spatial lock-in will be discussed (Section three). In Section four, the dataset that has been used for this analysis will be presented and the methodology that is used to analyze the data will be discussed. In Section five, the main outcomes of the analyses will be presented and discussed. Finally (Section six), the implications of the findings will be discussed and put into a broader perspective.

## **2. Traditional drivers of relocation**

The causes of firm relocation have been studied extensively from a geographical point of view. These studies, generally, frame the relocation decision in terms of push, pull, and keep factors. Push factors are all factors that drive a firm away from its current location, such as lack of expansion space. Pull factors are factors that pull a firm towards a new location, such as a subsidy it might get when it relocates. Finally, keep factors are the inertial factors that keep a firm at its current location (also known as sunk costs), such as investments made in its labor force. It is generally assumed that a firm will only relocate when the combined push and pull factors exceed the threshold posed by the keep factors.

Four groups of factors, which incorporate the most commonly found determinants of firm relocation in the literature (c.f. VAN STEEN 1998), are included in this research. These factors will be used to estimate a baseline model in the empirical analysis which allows for a comparison of the explanatory power of relational variables and traditional drivers of relocation. These groups of factors are: firm internal characteristics, characteristics of the building, characteristics of the site, and characteristics of the region. The effect of these groups of variables on the propensity to relocate has been substantiated empirically in numerous empirical studies (e.g. BROUWER *et al.* 2004; VAN DIJK and PELLENBARG 2000; HOLL 2004; SCHMENNER 1980).

## *2.1 Firm internal characteristics*

The firm internal characteristics of a firm that are found to be of influence on its propensity to relocate are the growth rate of a firm, the geographical scale of its operations, and its previous relocation behavior. The impact of these characteristics on a firm's propensity to relocate will be discussed subsequently.

The growth rate of a firm is of importance for the propensity of firms to relocate since it gives an indication of the speed with which the firm is expanding. An expanding firm is likely to need more room and, therefore, is more likely to relocate (SCHMENNER 1980). On the other hand, a firm with a large negative growth rate is likely to relocate as well, since its current location will become too large and too expensive.

*H1: There is a U-shaped relationship between the growth rate of a firm and its propensity to relocate.*

The geographical scale of operations refers to the geographical scale within which the firm buys and sells its products/services. Previous research has shown that firms in industries with a tendency to buy and sell many products/services in their home region are less likely to move compared to firms that sell products throughout the country or even the world (SCHMENNER 1980). The main reason is that these firms are dependent on the local market and, therefore, have much to lose when they relocate.

*H2: The higher the level of localization of the scale of operations of a firm, the lower its propensity to relocate.*

Research has shown that firms that have moved recently (i.e. during the last two years) are unlikely to move, whereas firms that moved between 5 and 10 years ago show a higher propensity to move (again) (VAN STEEN 1998). The underlying train of thought is that firms, on average, outgrow their new location in approximately 5 to 10 years, which gives cause for another relocation (VAN DIJK and PELLENBARG 2000). This results in the following hypothesis.

*H3: Firms that have relocated in the last two years show a lower propensity to relocate, as compared to firms that did not relocate during this period.*

## *2.2 Characteristics of the building*

The characteristics of a firm's building that are found to be of influence on its propensity to relocate are the available room for expansion and the question whether or not a firm owns the building in which it is located.

The available room for expansion is considered to be one of the main drivers of firm relocation. Of all firms that relocate, 77% indicates that the main driver was the lack of room for expansion (VAN STEEN 1998: p.42).

*H4: Firms with insufficient room for expansion in their current building will face a higher propensity to relocate as compared to firms with enough room for expansion.*

Ownership of the building is of importance for a firm's propensity to move, since the costs and trouble of getting rid of the present building are much higher compared to firms that rent their building. Furthermore, the reverse might also be true, because firms will only decide to buy a building if they expect to stay at that location for a long time.

*H5: Firms that own their buildings will face a lower propensity to relocate as compared to firms that rent their building.*

## *2.3 Characteristics of the site*

Two characteristics of a site at which a firm is located are generally found to be of importance on a firm's propensity to relocate, namely the distance to infrastructural facilities and the type of area in which a firm is located.

The importance of the accessibility of the building seems logical, especially in countries plagued by congestion such as The Netherlands. It is generally found that firms that

are located nearby main infrastructural facilities will have a better accessibility and, therefore, will be less likely to move (BROUWER *et al.* 2004; HOLL 2004).

*H6: The longer the travel-time between a firm and main infrastructural facilities, the higher its propensity to relocate.*

The importance of the type of area a firm is located in is tied to the fact that certain types of areas face more congestion and face more problems with regard to accessibility regardless of the presence of infrastructural facilities (VAN DIJK and PELLENBARG 2000). Firms located in a city center can face large congestion problems and might decide to relocate to a location with better accessibility at the edge of the city (MEDDA *et al.* 1999). Firms located in residential areas are very often start-ups, which also face a high propensity to relocate. On the other hand, firms located in rural areas or at the borders of cities are likely to experience lower propensities to relocate.

*H7: Firms located in residential areas or city centers will face a higher propensity to relocate than firms located in rural areas or at city borders.*

#### *2.4 Regional characteristics*

Only a single regional characteristic is often found to influence on a firm's propensity to relocate, namely to type of region in which a firm is located. The type of region a firm is located in is of importance due to differences in economic activity and regional labor market situations between regions. As such, firms are more likely to move from the rural regions to the more urbanized regions (HOLL 2004). It should be noted, however, that this relationship is not expected to hold for all sectors (e.g. agriculture), but is primarily applicable to service sectors. This fact has several implications for the choice of the sampling frame which will be discussed in Section four.

*H8: The higher the level of urbanization of the region in which a firm is located, the lower its propensity to relocate.*

### *2.5 Control variable*

The size of a firm is sometimes found to be an important predictor of firm relocation as well. In general, relocating firms are smaller than non-relocating firms (VAN DIJK and PELLENBARG 2000). This is mainly due to the fact that the absolute costs of moving for small firms are much lower compared to large firms. However, the size of a firm is also known to affect the number of direct IORs a firm has (OLIVER and EBERS 1998). Therefore, the size of a firm is taken into account is a control variable.

### **3. Relational variables**

Besides the “classical” determinants of firm relocation discussed in the previous section, several other determinants of the spatial behavior of firms can be found in the literature on IORs. This field of literature focuses on the explanation of firm behavior through relational variables.

First, following Resource Dependence Theory (PFEFFER and SALANCIK 1978), it can be argued that a firm that makes extensive use of resources possessed or controlled by external actors for its innovative processes will become dependent on these actors. These dependencies, in turn, influence the behavioral options that are viable for firms. By themselves, the relationships in which these dependencies exist are non-spatial. However, since geographical proximity is assumed to facilitate the successful exchange of (especially tacit) knowledge through IORs (BRETSCHGER 1999; SAVIOTTI 1998), dependency on other firms can also lead to dependency on a certain geographical location, and thus to spatial lock-in (ROMO and SCHWARTZ 1995).

Second, the concept of transaction specific investments from transaction cost theory (WILLIAMSON 1981) also holds for investments in a location. This specific case of transaction specific investments is called “site specificity” (DYER 1996). The investments made in its present location, which can be seen as sunk costs, are, to a certain extent, specific to that location and will be lost once a firm decides to leave that location (e.g. FRIGANT and LUNG 2002; DYE 1994). This reasoning can be applied to both material investments (e.g. buildings)

and to more intangible costs, such as investments in (localized) IORs. As such, firms that have invested heavily in their IORs might face a disincentive to relocate.

Finally, similar arguments can be found in the literature on Territorial Innovation Models (for an overview, see: MOULAERT and SEKIA 2003). In this body of literature, regions are considered to be entities with a collective pool of knowledge, institutional structure, and social conventions in which a firm is embedded. Therefore, the development of (the capabilities of) firms will be both region- and path-dependent. These developments lead to dependence on localized inputs and production factors, which, in turn, might deter a firm from relocating even if doing so is beneficial from a cost perspective.

Even though the above presents arguments for the existence of the relationship between a firm's level of embeddedness and its propensity to relocate, more specific mechanisms are needed in order to formulate concrete hypothesis based on measurable concepts. For this purpose, the classical discussion of embeddedness by Granovetter (1985) offer several handholds. Granovetter states that the behavior of actors is influenced by both the overall structure of its network as well as by the characteristics of its dyadic relationships. In order to analyze the effect of the level of embeddedness on a firm's propensity to relocate, both aspects of embeddedness will have to be taken into account.

### *3.1 Overall network structure*

The effect of a firm's overall network structure refers to the fact that firms occupy a certain position in the network(s) in which they participate (e.g. central vs. peripheral). This structural positions has been shown to influence a firms' behavioral options (GNYAWALI and MADHAVAN 2001). In the literature, many different indicators for the network position of a firm can be distinguished. One of the most commonly used indicators of a firm's structural network position is the degree centrality of firm (e.g. AHUJA 2000). The degree centrality of a firm is simply measured by counting the total number of direct ties that a firm has.

The theoretical mechanism underlying the relation between the amount of direct ties that a firm has and its propensity to relocate is based on the need for stability in IORs. Resource exchange, and more specifically knowledge exchange, is facilitated by stable, long term, IORs (AHUJA 2000). A relocation might threaten this stability, which hampers the



functioning of these relationships and, ultimately, the performance of a firm. Therefore, firms are likely to be hesitant to relocate when they are involved in many IORs. The need for stability is strongest in direct relations that are based on knowledge exchange (rather than for example simple buyer-supplier relations), since such relations are characterized by high levels of uncertainty, strong appropriation concerns, and require high levels of trust (SAVIOTTI 1998). Therefore, the relationship between the number of IORs of a firm and its propensity to relocate can be mainly attributed to these, so called, direct innovative IORs. Based on the above, the following hypothesis has been formulated.

*H9: The more direct innovation IORs a firm has, the lower its propensity to relocate.*

Another structural characteristic of the ego-network of a firm which might influence its spatial behavior is the extent to which the ego-network is localized. Being dependent on localized partners (i.e. knowledge sources) might lead to spatial inertia because geographical proximity facilitates face-to-face contacts, which facilitate the transfer of tacit knowledge (BRETSCHGER 1999). As such, it can be argued that high degrees of localization of a firm's ego-network will lead to a lower propensity to relocate for a firm. Consequently, the following hypothesis has been formulated.

*H10: The higher the level of localization of a firm's external knowledge sources the lower its propensity to relocate.*

### *3.2 Characteristics of dyadic relationships*

Besides the structural characteristics described in the above, several dyadic characteristics that might influence a firm's level of embeddedness and thus its propensity to relocate can be found in the literature as well. First, not all IORs are equally important to firms. Therefore, the strength of a firm's direct innovative IORs is likely to influence the relation between the number of direct innovative ties a firm has and the overall level of localization on the one hand, and its propensity to relocate on the other hand.

The relationship proposed in the above is in contrast with the “strength of weak ties” argument posed by Granovetter (1973), and rather builds on the argument of the “strength of strong ties”. This argument basically states that strong ties will have the largest effect on an actor’s (in this case a firm’s) behavior, since strong ties carry more value to a firm especially in uncertain situations, such as innovative projects (KRACKHARDT 1992).

*H11: The stronger a firm’s innovative IORs, the larger the negative effects of the amount of direct innovative IORs and the localization of external knowledge sources on its propensity to relocate.*

Second, the necessity of geographical stability for successful inter-organizational knowledge exchange is not undisputed in the literature. Several authors claim that high levels of organizational proximity may facilitate knowledge exchanges over large and changing geographical distances (for an overview, see: TORRE and RALLET 2005). Organizational proximity can be defined as “*the set of routines – explicit or implicit – which allows coordination without having to define beforehand how to do so. The set of routines incorporates organizational structure, organizational culture, performance measurements systems, language and so on*” (RALLET and TORRE 1999). High levels of organizational proximity are argued to generate the capacity to transfer tacit knowledge and other non-standardized resources despite large geographical distances (BURMEISTER and COLLETIS-WAHL 1997).

If this claim holds, participation in direct innovative IORs will not necessarily have an effect on the spatial behavior of firms, since a firm can maintain its IORs just as easily from a different geographical location if the level of organizational proximity is high enough (MORGAN 2004).

*H12: The higher the level of organizational proximity between a firm and innovative IORs, the smaller the negative effects of the amount of innovative IORs and the localization of external knowledge sources on its propensity to relocate.*

Based on the studies above, the following conceptual framework is constructed (Figure 1). In the next sections, the operationalization of these theoretical concepts will be discussed.

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Insert Figure 1 here

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#### **4. Measurement and data-collection**

The dependent variable in the model is the propensity of a firm to relocate. The relocation propensity of a firm will be measured by the scale developed by van Steen (1998), which is also used by Van Dijk and Pellenbarg (2000) and Brouwer et al. (2004). Van Steen (1998) developed an 8 point scale (see Figure 4 for a precise description of this scale) which reflects how likely a firm is to relocate within the next two years.

The relational variables that deal with the overall structure of a firm's ego network are the number of direct innovative IORs and the level of localization of a firm's external knowledge sources. In order to obtain information with regard to these variables, respondents were first asked to report the total number of innovative IORs they had. Furthermore, respondents were asked to report on the total number of organizations the firm used as external knowledge sources, and the number of these organizations that were located within 20 kilometers of the respondent's firm. From these answers, the percentage of a firm's external knowledge sources that can be considered localized can be computed.

In order to obtain information about the characteristics of the dyadic relations of a firm, respondents were asked to answer several questions about the main innovative IOR of a firm. This approach has been chosen since a survey has insufficient space to question all innovative IORs of a firm in detail. Moreover, the problem of non-response becomes exceedingly large when firms are asked about characteristics of more than one IOR. The approach of focusing on the main innovative IOR of a firm has been adopted from the Community Innovation Survey (CIS).

The strength of the main IOR of a firm is measured by using the dimensions of tie strength discussed by and Gilsing and Nooteboom (2005), which are basically inter-organizational translations of the dimensions of inter-personal tie strength proposed by Granovetter (1985). The scope of the tie, the level of formal control, the specific investments

in mutual understanding, the duration of the tie, and the frequency of (face-to-face) interaction are used as measures of tie strength.<sup>1</sup> The first four items are measured by asking a firm's response (on a 5-point likert scale) to statements about these dimensions of tie strength. The last two items are measured by asking firms about the duration of the relation with their focal IOR and the frequency of their contacts with this partner.

These items were analyzed with a factor analysis (see Figure 2). From this factor analysis, it becomes clear that the concept of tie strength consists of 2 separate dimensions, namely intensity of a tie, and the form of a tie. The first factor contains items that describe the intensity of the interaction two actors, whereas the second factor contains items that describe the functional form in which the interactions take place. Both dimensions are used separately in the final analysis.

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Insert Figure 2 here

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The level of organizational proximity between the focal firm and its main direct localized IOR is measured by asking firms (on a 5 point likert scale) to reply on statements with regard to whether or not the main IOR has the same other partners (relation dimension), the same organizational norms and values (institutional and cultural dimension), and the same organizational structure (structural dimension). These dimensions correspond to the most common and complete definition of organizational proximity (KNOBEN and OERLEMANS forthcoming; BOSCHMA 2005; TORRE and RALLET 2005).

These dimensions were analyzed with a factor analysis (see Figure 3). From this factor analysis, it becomes clear that the concept of organizational proximity is indeed captured by these three dimensions (i.e. they form a single factor).

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Insert Figure 3 here

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The growth rate of a firm is measured by looking at the change in the number of employees (in FTE's) over the last two years (HAVNES and SENNESETH 2001).

The scale of operations is determined by asking the respondent what share of its total input and output is tied to its home region, which is determined as a circle around the firm with a 20km radius. This is in line with measurements used in earlier studies (e.g. OERLEMANS *et al.* 2001).

The previous relocation behavior of the firm is measured by asking respondents to map the total spatial history of the firm. Data is collected on the year of the relocation(s), the municipality of origin, and the municipality of destination (similar to: VAN DIJK and PELLENBARG 2000).

The available room for expansion is measured by asking whether or not there is sufficient room for expansion in the current building of the firm, which is identical to the approach used in earlier research by Van Steen (1998).

Ownership of the building is determined by asking whether or not the firm is the owner of the building it is currently established in (identical to: VAN DIJK and PELLENBARG 2000).

The importance of the accessibility of the building is measured by asking the respondent about the average travel time between the firm and the nearest highway and the nearest train station. This approach is slightly more sophisticated than the distance measures that are normally used (e.g. VAN DIJK and PELLENBARG 2000), since it uses travel time, rather than straight line distance measures. As such, this measure represents the concept of accessibility better.

The type of area a firm is located in will be determined on the basis of the 6 digit postal code of the responding firm. On the basis of its postal code, it will be determined whether a firm is located in a rural area, a city centre, at the edge of a city, or in a residential area. This approach is identical to the one used by van Dijk and Pellenbarg (2000) and corresponds to the categorization that is used in the theoretical literature concerning firm relocation as well.

The type of region a firm is determined by using the level of urbanization of the municipality the firm is located in. These data has been obtained from the Dutch Central Bureau of Statistics. Their scale of urbanization distinguishes between 5 levels of urbanization, ranging from heavily urbanized through un-urbanized.

In order to collect information with regard to the measurement discussed in the above, a questionnaire was mailed to all firms in the automation services sector in The Netherlands with more than 5 full-time employees. A single sector design has been chosen since there are large differences in relocation propensity between sectors. The automation service sector was chosen since it is a fairly dynamic sector in which firm relocations are relatively common (as compared to for example manufacturing or wholesale) and it is a sector in which IORs are relatively common as well. Furthermore, the automation services sector is a relatively “footloose” sector, due to the high level of ICT-usage in this sector (VAN DIJK and PELLENBARG 2000). If a spatial lock-in effect of embeddedness could be found in such a sector, this would prove a strong test of the hypothesized effects.

A list of all relevant firms and their addresses were obtained from the Dutch Chamber of Commerce (CoC). After purging the list for empty holdings, bankruptcies, firms with several subsidiaries with the same address, and duplicates, 2.553 firms remained. A questionnaire was sent to all of these firms by mail. Unfortunately, due to the limitations of the database of the CoC, no reliable names of contact person were available. Therefore, the questionnaires were sent to the managing director of all firms.

Ultimately, 203 firms returned a useable questionnaire (a response rate of 8%). Even though this seems like a low response rate, comparable response rates were obtained in similar micro level studies. Oerlemans and Meeus (2005), for example, obtained a response rate of 8%, whereas Rooks *et al.* (2005) achieve a response rate of 8,4%. Both studies used a similar research approach and were conducted in the same field of science. Additionally, from several meta-analyses of response rates (e.g. COOK *et al.* 2000; BARUCH 1999; KLASSEN and JACOBS 2001) it may be concluded that, besides the general downward trend in response rates caused by “saturation” of respondents and lack of time, several other explanations can be given for the relatively low response rates. Most importantly, Baruch (1999) finds that surveys mailed to individuals (and about individual characteristics) have a much higher response rate than surveys mailed to organizational representatives. Klassen and Jacobs (2001) find that SMEs, of which the sector sampled in this research is mainly composed,

generally respond less to surveys as compared to their larger counterparts. When taking all of these aspects into account the response rate of 8% is not unexceptional.

Nevertheless, the fact that a large group of firms did not respond raises the question whether or not the data might suffer from a sample bias. Therefore, a non-response analysis has been performed. A group of 179 non-respondents were approached by telephone and asked to give answers to several key-questions from the questionnaire. These key questions included the relocation propensity, the size of the firm and the presence of innovative IORs. These questions were asked since they include the dependent variable and the main (hypothesized) independent variable. Moreover, firm size was included since it is a variable that is likely to contain bias. Of these 179 firms, 130 were willing to cooperate (response rate of 73%). When asked about the reason for their non-response, the vast majority of the firms (61%) indicated that they had never received the questionnaire. This high percentage can be explained by the fact that the CoC database did not contain reliable information about contact persons. Most other respondents indicated that they had no time to answer the questionnaire (32%). Other answers given included a principal decision never to cooperate with surveys (5%) or the fact that the survey contained too many confidential questions (2%). The data obtained from these non-respondents allows for a detailed comparison of the respondents and the non-respondents and provide valuable information with regard to the representativeness of the data. A comparison of the data from the non-respondents and the respondents can be found in Figure 4.

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Insert Figure 4 here

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From Figure 4 it can be derived that there are no significant differences between the respondents and the non-respondents with regard to the variables under scrutiny. The fact that firms with a very low propensity to relocate are a little bit underrepresented as respondents might be explained by the fact that firms with this characteristic might be less interested in the topic and, therefore, are less inclined to return the questionnaire. Luckily, however, this difference is not statistically significant.

For several other variables, the respondents could be compared to the whole population, since these variables could be extracted from the CoC database. A comparison between the respondents and the entire population with regard to these variables can be found in Figure 5.

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Insert Figure 5 here

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From Figure 5 it can be derived that, for the variables under scrutiny, there is no difference between the respondents and the sample as a whole. Both the spatial distribution and the past relocation behavior of the respondents seems to be representative for the population as a whole. On the basis of Figures 4 and 5, it can be concluded that there do not seem to be any structural differences between the respondents and the non-respondents. Therefore, there is no indication of sample bias in the data.

The structure of the measurement of the dependent variable has some implications for the methodology that can be used to analyze these data. The dependent variable consists of eight categories. Even though these categories represent chances that a firm will relocate in the coming two years, the unit distance between the observed variables does not carry any significance. For this type of data, ordered logit models are the most suitable methodology (NORUŠIS 2004). This methodology has been used in earlier studies with an identical dependent variable as well (e.g. VAN DIJK and PELLENBARG 2000; BROUWER *et al.* 2004).

The ordered logit model is based on the following specification (VERBEEK 2004: p.203):

$$y_i^* = \beta x_i' + \varepsilon_i$$

Where  $x_i$  is a set of explanatory variables and  $\varepsilon_i$  is the disturbance term. Finally,  $y_i^*$  is the unobserved probability that a firm will relocate in the coming two years. What is observed can be written as:



$$\begin{aligned}
y_i &= 0 \text{ if } y_i^* \leq \mu_0, \\
y_i &= 1 \text{ if } \mu_0 < y_i^* \leq \mu_1, \\
y_i &= 2 \text{ if } \mu_1 < y_i^* \leq \mu_2, \\
&\dots\dots\dots \\
y_i &= 7 \text{ if } y_i^* \leq \mu_6.
\end{aligned}$$

Where the  $\mu$ 's are unknown parameters to be estimated with the  $\beta$ 's. Each respondent has its own  $y_i^*$ , which is determined by the measured  $x_i$ 's and the unobserved factors  $\varepsilon_i$ . Each respondent chooses the category of  $y$  that represents its  $y_i^*$  most closely.

When fitting an ordinal regression model, it is assumed that the relationships between the independent variables and the logits are the same for all logits. This assumption can be tested with the so called "test of parallel lines". Ordinal regression is an appropriate methodology when the value of this test is above 0,10 (NORUŠIS 2004: p.74).

## 5. Empirical results

The results of the analyses described in the above are presented in Figure 6. Six different models have been estimated. Two for all responding firms (model 1 and 2) and two for only the firms with at least one direct innovative IOR (model 3 through 6). Model 1 serves as a baseline models. In this model, only the "traditional" drivers of firm relocation have been incorporated and all respondents have been included. Model 2 expands model 1 by incorporating the structural characteristics of a firm's ego network. Model 3 is another baseline model, but this time it has been estimated for a sub-sample of firms with at least one direct innovative IOR only. This sub-sample has been made to be able to include the moderating effects of the relational variables proposed in the theoretical section of this paper. Since firms without any direct innovative IORs do not score on these variables at all, they had to be excluded from this analysis. Model 4 is equivalent to model 2, but specified to the subset of firms with at least one direct innovative IOR. Finally, model 5 and 6 incorporate the moderating effects of the relational variables proposed in hypothesis 11 and 12.

From Figure 6, it becomes clear that ordinal regression is indeed the appropriate technique to analyze these data, as the value of the test of parallel lines is sufficiently high for all models. Moreover, all models fit the data well, as can be derived from the significance

levels and the differences in log-likelihood between the restricted model and the estimated model, which is also reflected in the relatively high levels of the pseudo-R<sup>2</sup>.

In order to compare models, the Akaike's Information Criterion (AIC) has been calculated for each of the models. The AIC provides information about the explanatory power of a model relative to the number of parameters that has been used (SAKAMOTO 1991). The lower the AIC, the better the model. From Figure 6 it can be derived that model 2 is the best fitting model for the entire sample, whereas model 5 is the best fitting model for the sub sample of firms with at least one direct innovative IOR. This indicates that the addition of relational variables has significantly increased the explanatory power of the models.

Next, the estimation results for each of the categories of variables distinguished earlier will be discussed.

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Insert Figure 6 here

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### *5.1 Firm internal characteristics*

With regard to the "traditional" drivers of relocation, some interesting results are obtained. First, the relationship between the growth rate of a firm and its propensity to relocate is highly significant, but seems to follow an inverse U-shape, rather than the hypothesized U-shape. The implication of this finding is that firms who performed either very poorly (i.e. are shrinking) or extremely well (i.e. quadrupled in size within 2 years) are very unlikely to relocate. The former might be explained by the fact that poorly performing firms lack the financial resources to relocate, but it is harder to interpret the latter finding. It might be the case that firms that grow at such enormous rates employ other strategies to accommodate their growth (such as mergers and takeover). However, the available data do not offer any clear empirical explanation for this phenomenon. So even though highly significant effects have been found, hypothesis one is rejected.

Second, producing for a highly localized market seems to reduce a firm's likelihood to relocate, whereas drawing mainly from localized inputs does not. These findings substantiate the importance of proximity to markets for the location preferences of firms and confirm the predictions made in hypothesis two.

Third, previous relocation within the last two years indeed seems to lower the likelihood of (another) relocation. Therefore, hypothesis three is confirmed.

### *5.2 Characteristics of the building*

Previous research found that the characteristics of the building in which a firm is housed are important predictors of a firm's propensity to relocate. The findings presented in Figure 6 partly substantiate these findings. Firms that experience a lack of expansion room face a much higher propensity to relocate as compared to firms with enough room to expand. Furthermore, firms that own the building in which they are housed report a lower propensity to relocate. However, this last effect is only significant at the 10% level and does not appear in all estimated models. As such, hypothesis four is confirmed, whereas hypothesis five is only partly confirmed.

### *5.3 Characteristics of the site*

The characteristics of the site seem to play a peripheral role as determinants of a firm's propensity to relocate. Only the accessibility of a firm's location by train seems to be of importance, and only for the sub-sample of firms with one or more direct innovative IORs. These weak effects of the accessibility of a site might be explained by the characteristics of the country in which this data was gathered. The Netherlands is a rather small country with a very dense road and railway network. Therefore, the vast majority of firms are located very close to these infrastructural facilities. Earlier research into the relationship between accessibility and the relocation propensity of firms in The Netherlands indeed found (almost) no effects of the level of accessibility of a site (VAN DIJK and PELLENBARG 2000), whereas for other countries in which this relationship has been tested, significant effects are found (e.g. for Portugal in HOLL 2004). Therefore, hypothesis seven is rejected, whereas hypothesis six is only partly (and weakly) confirmed.

### *5.4 Characteristics of the region*

The characteristics of the region in which a firm is located do seem to be of importance for a firm's propensity to relocate. Firms that are located in regions with a higher level of

urbanization show, *ceteris paribus*, significantly lower relocation propensities than firms in more rural areas. The finding provides support for hypothesis eight.

### *5.5 Relational variables*

With respect to hypothesis 9, strong support is found in the data. In all models in which the variable has been included, a significant negative effect of the amount of direct innovative IORs on a firm's propensity to relocate is found. This indicates that firms with a high degree centrality indeed experience a spatial lock-in effect as a result of their structural network position. Moreover, it is a clear indication that being involved in large amounts of IORs does not only hold benefits for the participating firms, but also constrains their (in this case spatial) behavior.

With regard to the percentage of localized external sources mixed results are obtained. In model 2, 4 and 5, the sign of this variable is, as expected, negative, but insignificant. However, in model 5, this coefficient is significant and carries the expected negative sign. It may be concluded that, relative to other firms that make use of external knowledge sources, firms that use predominantly localized external knowledge sources experience a somewhat lower propensity to relocate. However, the fact that the effect of the total amount of IORs is much stronger (in terms of significance) than the effect of the localization of external knowledge sources indicates that the effect of a firm's overall ego network structure on its propensity to relocate can be mainly attributed to its degree centrality rather than to the level of localization of its ego network.

The characteristics of the main IOR of a firm seem to matter only for localized relations. From the comparison of model 4, 5, and 6 it can be concluded that both high levels of organizational proximity as well as having highly formalized IORs can negate the spatial lock-in effects of relying heavily on localized external knowledge sources. However, the intensity of a relation does not seem to strengthen the spatial lock-in effect. These findings indicate that organizational proximity can indeed facilitate knowledge transfers over large(r) geographical distances, whereas very formalized ties do not seem to require geographical proximity at all. Furthermore, when comparing model 5 and 6 with model 4 it becomes evident that the negative coefficient of the total number of direct innovative IORs a firm has is larger

when the analysis is corrected for the characteristics of the main IOR of the firm. This finding also indicates that part of the spatial lock-in effects of a firm's overall network structure can be negated by dyadic characteristics. On the whole, these findings support hypothesis 9 and partly support hypothesis 10, 11, and 12.

## **6. Conclusions**

The research presented in this paper set out with the aim to assess the relative contribution of adding relational variables to a field of research that has been dominated by economic geographers. Moreover, it tried to shed some light on the possible constraining effects of IORs, which is a largely neglected topic in the literature. Finally, it set out to provide an onset of an empirical answer to the question whether a high levels of organizational proximity is a substitute for geographical proximity in IORs.

With regard to the first point, this research shows that, even when all geographical variables that previous research has shown to be of importance are included, relational variables are significant additions to the model. This does not indicate that the relational variables are better predictors of a firm's propensity to relocate than the "classical" determinants, but it does signal that they provide a valuable addition to these determinants. The fact that variables based on two different scientific disciplines jointly explain a large part of the variance of a firm's propensity to relocate is strong support for inter-disciplinary approaches. Searching for more topics in which economic geography and organization science can jointly explain the behavior of firms might therefore be a promising endeavor.

With regard to the second point it can be concluded that there seems to be a clear spatial lock-in effect of a firm's structural position in its ego-network. From these findings it can be derived that being part of many direct innovative IORs can indeed constrain the actions of firms. However, the results also indicate that the spatial lock-in effect caused by a strong localization of external knowledge sources can be negated by introducing very formal control mechanisms in these relationships or by (actively building) high levels of organizational proximity. These findings point at the importance of "managing" the structure of a firm's direct relationships to (partly) negate the constraining effects of being involved in these relations.

Whereas most existing studies focused on the enabling effects of networks, this research has shown that the benefits of being involved in IORs come at a cost. Being involved in IORs limits the spatial mobility of firms and ties them to their current location, even though relocation might carry significant benefits for the firm.

Finally, with regard to the third point, based on the findings presented in this paper it can be concluded that high levels of organizational proximity indeed are a substitute for geographical proximity. The spatial lock-in effect of geographical embeddedness can be negated by organizational proximity. However, the spatial lock-in effect of structural embeddedness seems to be unaffected by high levels of organizational proximity. These findings point at an intricate relationship between different types of embeddedness and the role of different types of proximity. Therefore, the findings with regard to the relation between organizational and geographical proximity presented in this paper should merely be seen as the starting point for future research into this topic.

### **Endnotes**

<sup>1</sup>: Gilsing and Nootboom (2005) also use the level of trust as a determinant of tie strength. Unfortunately, questions about the level of trust between the firm and its focal IOR did not carry any demarcating value. Therefore, this dimension is left out of this analysis.

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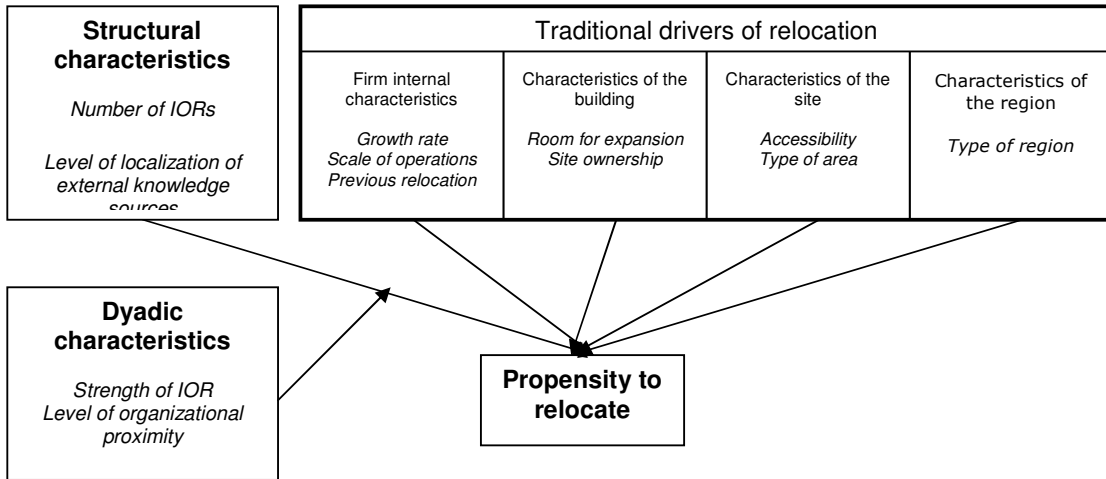
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**Figure 1. Conceptual framework**



**Figure 2. Factor analysis: Tie strength**

Variable	Factor	
	IOR intensity	IOR form
Scope	0,676	
Contact frequency	0,671	
Face to face contacts	0,618	
Level of specific investments	0,576	
Duration		0,733
Level of informal control		0,754

Cronbach's alpha	0,548	0,457
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KMO measure	0,639
Test of Sphericity	54,801
Significance	0,000
% of variance explained	52,099

**Figure 3. Factor analysis: Organizational proximity**

	<b>Factor</b>
<b>Variable</b>	Organizational Proximity
Cultural proximity	0,859
Structural proximity	0,848
Relational proximity	0,453

Cronbach's alpha	0,558
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KMO measure	0,541
Test of Sphericity	47,075
Significance	0
% of variance explained	55,383

**Figure 4. Non-response analysis**

	<b>Respondents</b>	<b>Non-Respondents</b>	<b>Difference</b>	<b>Significance</b>
<b>Propensity to relocate</b>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>p-value</i>
0 (0%)	31	38	7	0,36 <sup>a</sup>
1 (1 to 11%)	22	19	-3	
2 (11 to 25%)	13	10	-3	
3 (26 to 50%)	8	7	-1	
4 (51 to 75%)	7	5	-2	
5 (76 to 90%)	6	5	-1	
6 (91 to 99%)	3	3	0	
7 (100%)	12	12	0	
Mean	2,2	2,1	-0,1	
	<b>Respondents</b>	<b>Non-Respondents</b>	<b>Difference</b>	<b>Significance</b>
<b>Size of the firm</b>				
<i>Mean</i>	23,5	33,5	5,9	0,21 <sup>b</sup>
<i>Variance</i>	1603,3	7253,2		
<b>Presence of innovative partnerships</b>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
<i>Mean</i>	56	51	-5,00	0,29 <sup>c</sup>
<i>a: Mann-Whitney U-test</i>				
<i>b: T-test</i>				
<i>c: Phi-test</i>				

**Figure 5. Respondents compared to whole population**

	<b>Total Sample</b>	<b>Response</b>	<b>Difference</b>	<b>Significance</b>
<b>Spatial distribution (by province)</b>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>p-value</i>
<i>Drenthe</i>	1,4	1,0	-0,4	0,18 <sup>a</sup>
<i>Flevoland</i>	2,7	2,5	-0,2	
<i>Friesland</i>	1,6	2,0	0,4	
<i>Gelderland</i>	11,6	13,4	1,8	
<i>Groningen</i>	2,3	1,5	-0,8	
<i>Limburg</i>	3,5	5,5	2,0	
<i>Noord-Brabant</i>	14,1	20,9	6,8	
<i>Noord-Holland</i>	20,6	14,4	-6,2	
<i>Overijssel</i>	4,6	5,0	0,4	
<i>Utrecht</i>	13,0	10,9	-2,1	
<i>Zeeland</i>	0,6	0,5	-0,1	
<i>Zuid-Holland</i>	24,1	22,4	-1,7	
<b>Relocation behavior</b>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
% Movers (last 2 years)	23,2	23,9	0,7	0,82 <sup>a</sup>
% Movers (last 5 years)	39,3	40,8	1,5	0,66 <sup>a</sup>
<i>a: Chi-square test</i>				

**Figure 6. Ordered logit regression results**

	All respondents		Respondents with one or more IORs only			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<b>Firm internal characteristics</b>						
Growth rate	1,700***	1,748***	1,716**	1,895**	2,261**	1,452*
Growth rate squared	-0,398***	-0,404***	-0,401**	-0,439**	-0,509***	-0,360**
Localization of operations (inputs)	0,046	0,061	-0,009	0,019	0,090	0,042
Localization of operations (output)	-0,249**	-0,216*	-0,334*	-0,561***	-0,317*	-0,556***
Previous relocation (past 2 years)	-0,528*	-0,544*	-0,751*	-0,864**	-0,805*	-0,916*
Firm size (ln)	-0,268*	-0,215	-0,301	-0,006	-0,020	-0,023
<b>Characteristics of the building</b>						
Lack of room for expansion	2,374***	2,436***	2,249***	2,656***	2,968***	2,740***
Site ownership	-0,605*	-0,624*	-0,789	-0,728	-0,797	-1,026*
<b>Characteristics of the site</b>						
Travel time to nearest highway	-0,026	-0,027	-0,024	-0,021	0,027	-0,002
Travel time to nearest public transport hub	0,016	0,022	0,035	0,047*	0,045*	0,056**
Type of area	-0,171	-0,232	0,033	-0,050	0,193	0,155
<b>Characteristics of the region</b>						
Level of urbanization	-0,174	-0,213*	-0,319*	-0,395**	-0,422**	-0,415**
<b>Structural characteristics</b>						
Total # of IORs		-0,186**		-0,561***	-0,640***	-0,641***
% of localized external sources		-0,764		-1,363	-1,704**	-1,392
<b>Relational characteristics</b>						
Organizational proximity * # of IORs					-0,052	
Tie strength (intensity) * # of IORs					0,023	
Tie strength (form) * # of IORs					-0,013	
Organizational proximity * % localized external sources						1,364*
Tie strength (intensity) * % localized external sources						0,74
Tie strength (form) * % localized external sources						1,302**
<b>Model statistics</b>						
-2 Log likelihood	652,931	646,485	354,838	335,282	312,703	320,634
Restricted Log likelihood	734,135	734,135	409,882	409,882	394,429	394,429
Test of parallel lines	0,555	0,177	1,000	1,000	1,000	1,000
Nagelkerke's Pseudo R-squared	33,5%	36,6%	38,6%	49,6%	54,2%	53,9%
Significance	0,000	0,000	0,000	0,000	0,000	0,000
Akaike's Information Criterion (AIC)	676,931	674,485	378,838	363,282	346,703	354,634
N	203	203	109	109	109	109