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* This study is a part of the project financed by the TEKES (National Technology Agency of Finland). I am grateful to Eija Ahola from TEKES for comments and to Satu Nurmi who has prepared the linked data for my use. The usual disclaimer applies.

**Labour Institute for Economic Research, Pitkänsillanranta 3A, 00530 Helsinki.
E-mail: eero.lehto@labour.fi

Helsinki 2004

ISBN 952–5071–91–X
ISSN 1457–2923

ABSTRACT

We have estimated a multilogit model for the probabilities that a firm will acquire or become a target in different M&A categories, which are defined according to the distance between an acquiring firm and a target. We discovered that such characteristics of a firm that can be regarded as an indication of a good monitoring capacity or ability to internalise the potential synergies of M&As increase the probability that the firm acquires a distant firm. Respectively, such factors that ease the monitoring of a firm's quality increase the probability that the firm becomes a target in a distant M&A.

Key words: Mergers and acquisitions, home bias, monitoring

JEL codes: D8, G34, R30

TIIVISTELMÄ

Tämä tutkimus on jatkoa edelliselle työpaperille (No 195), joka vertasi eri yrityskauppatyyppejä toisiinsa. Nyt estimoidaan todennäköisyyksiä sille, että yritys tulee olemaan osallisena – joko ostajana tai kohteena – tietyn tyyppisessä yrityskaupassa sen sijaan, että yritys ei tarkasteluvuonna tule olemaan osallisena missään yrityskaupassa. Tarkastelun laajentaminen koskemaan myös yrityskauppojen ulkopuolelle jääneitä yrityksiä kasvatti havaintojen lukumäärää huomattavasti. Vaikka aineisto rajattiin koskemaan vain yrityksiä, jotka sisältyvät Tilastokeskuksen tilinpäätösaineistoon, havaintojen lukumäärän nousi jopa yli 200 000:teen vuosina 1989–2000.

Tässä tutkimuksessa arvioidaan, miten yritysten ominaisuudet vaikuttavat todennäköisyyteen, että yritys tulee olemaan osallisena tietyntyyppisessä yrityskaupassa. Tutkimus tuo siten esiin tekijöitä, jotka vaikuttavat ensinnäkin siihen, että yrityskauppa ylipäätänsä syntyy. Toiseksi tutkimus tuo esiin tekijöitä, jotka vaikuttavat siihen, että yrityskauppa toteutuu tietyntyyppisenä. Koska yrityskaupat ryhmitellään seutukuntien sisäisiin, seutukuntien välisiin ja kansainvälisiin, on yrityskauppojen alueulottuvaisuus edelleen huomion kohteena. Analysoitaessa todennäköisyyttä, että yritys tulee yrityskaupan kohteeksi on yhtenä yrityskaupparyhmänä lisäksi lähinnä yrityksen sisäisiksi luonnehdittavat omistusjärjestelyt.

Tämän tutkimuksen tulokset osoittavat, että ostavan yrityksen korkeasti koulutetun henkilökunnan osuuden nousu lisää todennäköisyyttä, että yritys ostaa toisen yrityksen. Eniten ostavan yrityksen henkilökunnan koulutustason nousu lisää kuitenkin halukkuutta ostaa yritys ulkomailta. Tutkimustulokset viittaavat myös siihen suuntaan, että ostavan yrityksen korkeasti koulutetun (muu kuin tekninen koulutus) henkilökunnan osuuden kasvu lisäisi enemmän seutukuntien välisten kuin sisäisten kauppojen todennäköisyyttä. Näiden tulosten voidaan tulkita kuvastavan sitä, että koulutustason nousu lisää ostavan yrityksen kykyä tehdä havaintoja kaukanakin sijaitsevan kohteen todellisesta arvosta. Toiseksi tulos osoittanee, että korkeasti koulutettu työvoima tekee mahdolliseksi madaltaa niitä yrityskulttuurista ja paikallisuudesta määräytyviä esteitä sisäistää sellaisen yrityskaupan synergiaetuja, joissa kohde sijaitsee erimerkiksi ulkomailla.

Ostajayrityksen T&K-investoinneista kertyvä T&K-pääoma lisää vain kansainvälisten yrityskauppojen todennäköisyyttä. Tämä tulos kuvannee sitä, että T&K:lla karttuva tietopääoma lisää ostajayrityksen kykyä ottaa vastaan uutta tietoa ja arvioida kohdeyritystä, vaikka kohde sijaitsisi kaukanakin.

Analyysi yrityskaupan kohteeksi joutumisesta osoitti, että T&K:lla kartutetun tietopääoman hallussapito lisää kohteeksi joutumista kaikissa yrityskaupparyhmissä. T&K vaikuttaa kuitenkin eniten todennäköisyyteen tulla ulkomaisen yrityksen ostamaksi. Myös seutukuntien välistenkin kauppojen todennäköisyyttä tämä muuttuja lisää enemmän kuin seutukunnan sisäisten kauppojen todennäköisyyttä. Tämä tuloksen voidaan ajatella kuvastavan sitä, että tietopääomaa voidaan arvioida myös kaukaa ja että sen yhteinen hyväksikäyttö uudessa ja laajemmassa omistuksessa ei kohtaa helposti aluerajoja.

Tämä tutkimus myös paljasti, että jos yrityksen henkilökunta on muuten kuin teknisesti korkeasti koulutettua, se joutuu pikemminkin paikallisen yrityksen kuin seutukunnan ulkopuolella tai ulkomailla sijaitsevan yrityksen ostamaksi. Tämän tulos kuvannee sitä, että kaukana sijaitsevan kohteen arvioiminen vaikeutuu, kun inhimillisen pääoman merkitys korostuu.

1. INTRODUCTION

In this empirical study we focus on the reasons of mergers and acquisitions (M&As) and, on the other hand, on the differences between various types of M&As which are classified according to the location of an acquirer with respect to a target. The M&A categories considered are intra-regional, inter-regional, cross-border and (internal) rearrangements (for targets only). We estimate the probability that a certain type of M&A occurs both from the acquirer's and from the target's point of view. As noticed by Böckerman and Lehto (2003), the home bias – which says that acquiring firms tend to purchase targets which are located nearby – is also typical of Finnish M&As under consideration. We then address the question as to whether such factors exist that alleviate the influence of home bias.

General reasons behind M&As

Let us first consider the general reasons behind M&As. The empirical findings of, for example, Hall (1990) and Lehto and Lehtoranta (2003) state that by means of M&As firms tend to internalise the potential synergies by transferring knowledge or tend to increase market power, as shown by Gugler et al. (2003). M&As, as an integral part of corporate control strategy, are also used as a means to affect manager-shareholder conflict and discipline managers (see, for example, Schleifer and Vishny, 1988).

In this empirical study we stress the transfer of technology as a motive of M&As. We think that M&A can be a practical means to transfer knowledge when contractual schemes such as licensing are ruled out, owing to imperfections in information and consequent non-contractibility (see Agion and Tirole, 1994). Trading with knowledge assets is also often impossible, because it can be human-embodied and tacit by nature as is emphasized by Kogut and Zander (1992) and Spender (1996).[1] Firms also lean on M&As because it is possible that in the contractual arrangement and in the more informal relationship, in which the transfer mechanism of knowledge spillovers is often based on trust and reciprocity (see, Nonaka and Takeuchi, 1995), the receiver of the knowledge cannot be safeguarded against appropriation uncertainties and opportunism (see Pisano (1990) and DeBresson and Amesse, 1991).

The empirical evidence also supports the idea of the central role of technology transfers in M&As. Earlier research has shown that M&A activity is highest in the industries in which

[1] See also the discussion in Hämäläinen and Schienstock (2001).

the R&D intensity is highest (see Lemelin, 1982; MacDonald, 1985 and Hall, 1990). It also looks, at least in the Finnish data, as if both parties of an M&A are inclined to invest in R&D (see Lehto and Lehtoranta, 2003).[2] The fact that the acquirer also invests in R&D is interpreted as describing the situation in which a firm's own R&D strengthens the firm's 'absorptive capacity' to utilise the delivered knowledge delivered, as well as to take advantage of that knowledge which spills over, as suggested by Cohen and Levinthal (1990) (see also and Kim and Dahlman, 1992).

We also consider whether some other motives exist behind M&As. It has been argued that leveraged acquisitions put pressure on the firm to use its cash flow to serve the long-term debt at the expense of investments (see Hall, 1990). The empirical findings, however, tell us that indebtedness decreases a firms probability to acquire (see Jensen, 1998; Tremblay and Tremblay, 1998; Blonigen and Taylor, 2000 and Lehto and Lehtoranta, 2003). This finding may rather reflect the imperfections of the market in financing risky M&As. An M&A can also be used to discipline the loss-making managers into improving a firm's profitability (see Palepu, 1986). This would suggest that unprofitable firms are more easily acquired than other firms. There are good grounds for assuming that a firm's size also positively contributes to the probability that a firm acquires or is acquired. The empirical findings also support this assumption (see Blonigen and Taylor, 2000 and Lehto and Lehtoranta, 2003).

Geographical structure of M&As

We also analyse in this study why a firm falls into some of the defined M&A categories. Earlier literature on the geography of M&As has discovered that the short distance is an important factor which promotes takeover activities. This is shown by Green and Gromley (1984), Green (1987) and Green (1990), who consider the U.S. pattern and by Green and McNaughton (1989), and Aliberti and Green (1999), who investigate the Canadian pattern in takeovers across regions. The studies which also consider the regional aspect of M&As mainly focus on aggregate variables. Then the geographical distance is explained by the characteristics of the locations of the firms involved in M&As. Considering the background characteristics of the German regions, Rodriguez-Pose and Zademach (2003), for example, found that the distance between an acquiring firm and its target plays an important role in the dynamics of M&A activity. Using gravity approach, Ashcroft et al. (1994) discovered

[2] Investigating U.S. electronic and electrical equipment firms, Blonigen and Taylor (2000) obtained a result, according to which firms tend to choose either "make" or "buy" strategies in R&D.

that the M&A flows between the regions were found as being positively related to their size and negatively related to the distance.

Rather few studies have considered the factors which have an effect on the importance of the distance between a target firm and an acquirer. Di Giovanni (2003) estimated a gravity model in which cross-border merger flows are also explained by the bilateral distance and costs to transmit information (proxied by telephone traffic). Portes and Rey (1999) explained cross-border equity flows by telephone traffic in a similar setting.

Before going into the empirical framework in which the spatial aspect of M&As is examined, we should be able to give an answer to the question about the forces which have an impact on the distance between an acquirer and a target firm. Theory does not provide many explanations about the relevance of the home bias in M&As, according to which firms which are located close to each other tend to merge. One motivation for the short distance between an acquirer and an acquired firm is based on competition implications. Levy and Reitzes (1992) show that when product differentiation depends on the distance between a customer and a firm, the merger of nearby firms eases competition more than the merger of distant firms, as a consequence of which near by firms tend to merge. Another explanation addresses the possibilities to internalise synergy gains of M&As through the utilization of common assets. The common use of an asset possessed by an acquirer or a target may, however, have geographical limits. One can imagine that this concerns human capital and many kinds of tangible assets in network industries and various service industries. This topic is explored more closely by Böckerman and Lehto (2003).

We also think that asymmetric information may be the most important reason for the phenomenon, according to which the parties of M&A tend to be located close to each other. The literature on knowledge spillovers stresses that the tacit and human-embodied nature of knowledge has a central role in knowledge transfers (see, for example, Nonaka and Takeuchi, 1995 and Morgan, 2004). The transmission of tacit knowledge, however, presumes face-to-face contact or other mechanisms that require spatial proximity (von Hippel, 1994 and Morgan, 2004). It is then logical to assume that the geographical restrictions which govern the transmission of knowledge also reflect the conditions under which a potential acquirer assesses the value of a target. This says that an increase in the distance between a target and an acquirer impairs the quality of the monitor which concerns the value of the target.

According to recent empirical findings (see Jaffe et al., 1993; Grünfeld, 2002; Keller, 2002; Maurseth and Verspagen, 2002 and Greuntz 2003), geographical proximity increases the positive impact of external knowledge on the firm's outcome. According to this, a firm's ability to absorb the knowledge, which is located far away, is difficult. As concerns M&As, the findings above hint that it really becomes more difficult to evaluate the value of a target when it is located far from an acquirer.

Theory, on the other hand, suggests that if the assessment of the expected value of the target is unbiased and the firms are risk-neutral, imprecise information will not generate a home-bias. Gehrig (1993) considers a situation in which domestic risk-averse investors observe the payoffs of domestic firms with higher precision than risk-averse foreign investors. The foreigner's estimate of the expected return is unbiased but the large variance around the mean makes a foreign target risky. This model leads to home bias, according to which the investments abroad are, in an equilibrium, much less than what the optimal diversification of an investment portfolio would suggest. But this result requires investors to be risk-averse.

As concerns acquisitions, the decision-makers are the firms and not the single investors, and so the assumption of the actor's risk-averseness is no longer well founded. Gordon and Bovenberg (1996) explain the home bias puzzle in the setting in which risk-neutral foreign investors buy shares from risk-neutral domestic owners. They rely on the assumption, according to which such a firm specific output shock arises which only the domestic owners learn about afterwards. Due to this asymmetry, only the targets that yield the lowest returns are offered to foreigners who, being aware of this, however, may find it profitable to buy foreign firms, if the foreign discount rate is below the domestic rate. Lehto (2004) considers a situation in which a target firm is sold to several potential acquirers. One of the potential acquirers is assumed to be uninformed. The lack of information is assumed to appear as a bias between the actual value and expected value. It is shown that in this setting the informational asymmetry leads to a situation in which the better informed acquirers tend to buy a target.

On hypotheses and empirical testing

Hypothesising the M&A behaviour, we consider that a potential acquirer which is located far from a target is not so well informed about a target firm's value as an acquirer which is located close to a target firm. This creates the home bias. But there exist, however, such firm-specific factors that have an impact on the relevance of the distance between an acquirer and a target firm. We think that the distance does not matter so much if an

acquirer's capacity to accurately evaluate the value of a target firm even from afar is strengthened. Respectively, the factors which make a target transparent so that its value is easily assessed, are supposed to increase the probability of M&As in which the distance between a target and an acquirer is long. To investigate the validity of the above hypothesis related to the accuracy of monitoring, it is highly important in the empirical analysis to specify the variables that describe the monitoring capacity of an acquirer and ease in monitoring a target. We use the educational level of an acquirer's staff or the R&D compiled in an acquiring firm as a proxy of monitoring capacity. Considering the ease in monitoring a target, we think that it is more difficult to monitor human capital (proxied by the educational level) than, for example, such knowledge assets as patents.

There are also some other reasons for which the parties of M&As tend to be located close to each other. We think that potential synergies are not necessarily internalised in an efficient way if the "language" of an acquiring firm and the target firm is incompatible. As Breschi and Lissoni (2001) have suggested there exist "epistemic" communities whose communication in the exchange of technical and scientific messages is tacit and which therefore act as exclusionary devices. The geographical frontiers of these communities (or knowledge networks) set regional limits to the transmission of knowledge and to the internalisation of synergies. It is possible that the increase in education also helps to relieve geographical restrictions, in this respect, too.

In M&As firms may also internalise synergy gains through a common use of assets possessed either by an acquiring company or by a target company. But the geographical restrictions associated with common use may then favour the M&As of closely located firms. So, we also examine whether the possession of such assets whose common use may increase profits and whose utilisation may have geographical limits, plays any role in M&As. We also think that distant M&As are more risky because they are based, as a rule, on more imprecise information than close M&As. From this and from the imperfections of the financing market it follows that indebted acquirers tend to buy closely located targets.

As far as the patents possessed either by an acquirer or by a target are concerned, we state that the possession of patents hardly sets any geographical barriers to M&As, because their value can be evaluated from far away, too. But owing to the ease with which to license patents and trade in them, patents can hardly motivate firms toward M&As. We, however, empirically test to see whether patents have any impact on M&As that have occurred.

Our study contributes to the previous empirical literature in several respects. The main contribution of this study is related to the analysis which concerns the geographical structure of M&As. We estimate a multilogit model in which the likelihood of M&As in different categories is explained. We discovered that a rise in the staff's educational level tends to increase the probability of M&As. This impact is largest in the probability of cross-border M&As, and in the case of highly educated staff with technical qualifications, this result concerns only cross-border M&As. The increase in R&D-intensity also seems to increase only the probability of cross-border M&As. The results obtained are interpreted as describing the fact that education and the learning related to R&D-activity increase a firms' ability to assess distant targets and to internalise the potential synergies of distant M&As. Considering the characteristics of targets, we found that R&D intensity only increases the probability of cross-border M&As. This may indicate that the firms whose R&D-intensity is high possess knowledge capital whose common utilisation does not reach geographical limits. A rise in the staff's educational level, on the other hand, tends to increase only the probability of close M&As. We interpret this result as stemming from the difficulty to evaluate the value of the distant target when human capital has great significance.

2. DATA

The data set on mergers and acquisitions is gathered from the *Talouselämä* magazine. The magazine contains all mergers and acquisitions in which the majority share of a Finnish firm is acquired or in which a Finnish firm acquires a majority share of another firm. All M&As in which the turnover of both parties exceeds 0.5 million euros are included. The data set also includes transactions in which only one section of a target firm is bought. The M&A data set of this study covers the period from 1989 to 2000.

To analyse the likelihood for different types of M&As we form an outcome variable which classifies each firm in the data as belonging only to one M&A category; the categories are *intra-regional*, *inter-regional*, *cross-border*, not involved in M&A and *rearrangement* (only for target firms). The data includes only such acquirers that are old firms. The classification is hierarchical in the sense that the outcome is always cross-border when an acquirer or target has been a part of a cross-border M&A. An outcome is inter-regional when a firm has been involved in an inter-regional M&A and not in a cross-border M&A. An outcome is intra-regional when a firm, in addition to being an intra-regional M&A, has not been a part of an inter-regional or a cross-border M&A. In order to be classified as a rearrangement, a

target cannot have been a part of any other type of an M&A. Because we also consider non-M&A firms, it has been necessary to give each firm a unique status. We also think that the firm-specific requirements of being part of an M&A become stricter when the distance between an acquiring firm and a target firm lengthens.

In the fourth category for the targets, called *rearrangements* belong those ownership arrangements as a consequence of which a new firm is created and in which an old business ID changes into a new ID. Management buy-outs and such divestitures in which the ownership changes and a new firm is created typically belong to this group. In most rearrangements another firm does not necessarily obtain the target firm. Also in a few combination mergers in which a new firm is founded (being an acquirer) and in which the location of a target with respect to an acquirer is unclear, the old firms are classified as rearranged targets. In internal rearrangements the distance between a target and a purchaser is non-existent, and in the rest of these cases the distance is unclear.

By intra-regional is meant a domestic M&A in which both an acquirer and an acquired firm are located in the same NUTS4 region. The so-called NUTS4 regions consist of commuting areas and the number of these regions in Finland is 85. In the inter-regional M&As an acquiring firm and a target firm are then located in different NUTS4 regions. In the cross-border M&As a Finnish firm is bought by a foreign firm. Because we have firm specific information only about domestic firms, we take into account only the domestic firms that are purchased by foreign firms. Such incidences in which a firm has purchased several targets within a year are classified as being one outcome. The same concerns the incidences in which a target company or its share has also been bought more often than once during a year.

The distribution of M&A incidences is reported in Table 1. In the data set which is not restricted by the R&D survey (owing to the inclusion of the R&D variable), the number of firms which are not involved in any M&A in the year concerned total about 233 000 in the years 1989–2000. The inclusion of the R&D variable lowers the respective number of all observations to about 51 000.

Table 1. The number of incidences in different M&A-categories.

	Intra-regional	*Inter-regional*	*Cross-border*	*Rearrangement*	*Total*
Acquirers (data without R&D variable)	384	626	390	0	1400
Targets (data without R&D variable)	390	664	237	188	1479
Acquirers (R&D variable included)	258	522	349	0	1129
Targets (R&D variable included)	242	454	169	148	1013

Comparing the frequencies of different incidences in Table 1, we can conclude that in domestic M&As Finnish firms have more often been targets than acquirers, and that in cross-border M&As the situation is reversed. It seems that the capital net-flow outside Finland has been partly implemented through M&A activity.

The M&A data obtained is linked to various data sets of Statistics Finland, which also decreases the number of the observations in which a specified outcome variable is non-zero. Of the matched data sets the Business Register provides information about the turnover, industry-levels and other firm characteristics such as the firm's age. Actually, we specify the industries to which each firm belongs by using the Finnish (two-digit) TOL2 classification. In our new classification industries are divided into 18 separate groups. The number of different industry-levels is limited, because of the small number of M&A incidences in some TOL2 groups. The defined industry codes are used to control the impact of industry-specific factors.

From the Financial Statements Data we obtained information about the firm's indebtedness, gross profit-ratio and the size of the fixed tangible assets. Information about the personnel's education is obtained from Employment Statistics, which is also maintained by Statistics Finland. The patent variables originated from the comprehensive registers of the National Board of Patents and Registration of Finland and the information about R&D expenditures that is used to calculate firms' R&D stock is obtained from the R&D Survey of Statistics Finland. The data size of linked data is restricted by the Financial Statements Data.

3. METHOD

We estimate the multinomial logit model (multilogit) (see Greene, 2000). Consider outcomes 1,2, …, m which describe the type of M&A. Let m = 3. Let y then be an outcome variable so that y = 1, 2 or 3 and let X denote explanatory variables. In the multilogit model we estimate coefficients β_i – which correspond to each category i = 1, 2 and 3 – in the probabilities

$$\Pr ob(y=1) = \frac{1}{1 + e^{X\beta_2} + e^{X\beta_3}}$$

$$\Pr ob(y=2) = \frac{e^{X\beta_2}}{1 + e^{X\beta_2} + e^{X\beta_3}}$$

$$\Pr ob(y=3) = \frac{e^{X\beta_3}}{1 + e^{X\beta_2} + e^{X\beta_3}}.$$

Above, we have set $\beta_1 = 0$, and so coefficients β_2 and β_3 measure the change relative to y = 1 group. This kind of normalization is necessary to remove the indeterminacy in the model. Group y = 1 is called a comparison group or a base group.

The relative probability of y = 2 is then $\frac{\Pr ob(y=2)}{\Pr ob(y=1)} = e^{X\beta_2}$.

Interpreting the results one must then take into consideration which group is chosen as a base group. In the case considered, for example, coefficient vector β_2 tells of the impact of X on the probability that y = 2 occurs instead of y = 1. In all regressions of this study, "no M&A" -outcome is considered as the comparison group.

Because the same firm can fall into several M&A categories in several periods, the data set analysed includes observations which are not independent. We therefore adjusted the standard errors using the Huber and White robust estimator of variance.

4. THE SELECTION OF VARIABLES AND TESTABLE HYPOTHESES

We then explore more closely the hypotheses which are to be tested with the explanatory variables of Table 2. The firm's size, proxied by the TURNOVER variable, is expected to increase the likelihood that a firm acquires. The larger resources to buy and, presumably, the greater number of opportunities to find appropriate targets have an effect in this direction. Because, in our data, a target can also mean an independent entity of a larger firm, the scale variable is also assumed to have a positive effect on the probability that a firm becomes a target in M&A. In addition, the larger the firm is, the more expertise it has to make accurate monitors about the target firm, and for this reason, we assume that TURNOVER increases, in particular, the likelihood of cross-border acquisitions.

Every domestic firm is assigned to one region. The actual geographical operating space in domestic regions enlarges with the number of establishments (MULTI). By shortening the distance and improving the ability to monitor the domestic target and, on the other hand, having a positive effect on the ease in monitoring a target, MULTI is expected to increase domestic and, in particular, inter-regional M&As concerning both the probability that a firm acquires and is acquired. The dummy variable EXPORT that describes whether a firm has exported or not, is a proxy of the firm's presence in foreign countries, and therefore we assume that EXPORT increases the likelihood of cross-border M&As for both acquirers and targets. We also expect that foreign owned firms (FOREIGN) become more easily acquired by foreign firms, because the targets are then already present in foreign countries.

A firm's R&D intensity (RDINT) or the staff's educational level (EDU1 and EDU2), being proxies of the firm's capacity to absorb new knowledge, are assumed to increase the likelihood that a firm acquires. As Lehto and Lehtoranta (2003) have shown, this ability has a positive influence on M&As, one important motivation of which is to transfer new knowledge. Because EDU1 and EDU2 also describe a firm's ability to monitor the target, these variables are assumed to relieve the home bias in M&As and increase the likelihood that a domestic firm acquires a foreign firm. Monitoring the target is assumed to become more difficult when the personnel of the target company consists of highly educated workers with specific skills, and so we expect that the M&As of such firms are not so likely to occur or occur only within the same region. It is rather difficult to say whether it is easy to monitor the value of R&D capital from afar, too, and whether a target's RDINT therefore increases the likelihood that a firm is acquired.

The communication gap between a target and an acquirer increases in distance and in the importance of the human-embodied knowledge. We believe that this gap is, however, narrowed by the educational level of an acquirer's staff. From this it also follows that EDU1 and EDU2 increase the likelihood that a firm acquires a distant target.

As far as the common utilization of assets is concerned, one may also expect that the common utilization of R&D capital by either party of an M&A does not reach the geographical limits so easily as the common utilization of tangible fixed capital (FIXED). For these reasons RDINT is expected to increase and FIXED to decrease both the probability that a firm acquires and the probability that a firm is acquired in distant M&A categories.

Owing to the ease in contracting on patents or trading them, we do not think that the possession of patents (PATENTS1 ns PATENTS2) motivates a firm to acquire another firm. The ease in monitoring targets could increase in a target's age (AGE), and so we expect that AGE increases the probability that a distant target is acquired.

M&As are more likely within regions that contain a great number of firms (NUMBER). Therefore we also control the number of firms that are located in the same region. NUMBER by definition will increase the probability of intra-regional M&As at the expense of other M&A types.

We also consider the impact of the firm's profitability (PROFITS) and indebtedness (DEBT) on M&A activity. Insofar as acquisitions are a mechanism by which a firm's manager who fails to maximize its market value is replaced, as Palepu (1986) states, PROFITS should have a negative impact on the likelihood that a firm is acquired. Imperfections in the financial markets could explain the influence of PROFIT and DEBT on the probability that a firm acquires. Because M&As and, in particular, distant M&As are risky investments, it is evident that this risk raises the price of external finance or restricts its availability. For these reasons, we expect that the firm which acquires remote domestic firms or foreign firms should have a strong balance sheet with low indebtedness and good profitability.

Table 2. Description of the variables.

Variables	*Definition/measurement*
AGE	The age of a firm is measured in years. The variable is the employment-weighted average of the ages of the firm's plants.
MULTI	The company consists of several establishments = 1, otherwise = 0.
FOREIGN	The majority share is in foreign ownership = 1, otherwise = 0.
EXPORT	The firm has exported=1, otherwise = 0.
TURNOVER	A log of the turnover of a firm
PROFITS	Gross margin divided by the turnover of a firm
DEBT	Short- and long-term debts divided by the total assets of a firm
FIXED	Fixed tangible assets divided by the total assets of a firm
EDU1	The share of highly educated with technical qualifications of the total number of employees in a firm
EDU2	The share of highly educated (excluding the number of highly educated with technical qualifications) of the total number of employees in a firm
RDINT	A log of [(R&D stock +1)/turnover].[3] R&D stock of a company that is estimated based on the previous R&D expenditures (see Lehto and Lehtoranta, 2003).
PATENTS1	The number of domestic patents that the firm currently owns
PATENTS2	The number of U.S. registered patents that the firm currently owns
NUMBER	A log of the number of firms whose turnover is over 0.5 million euros[4] in the same region
INDUSTRY	18 industry levels
YEARS	12–1

To control the impact of technological and regulatory shocks – which Andrade et al. (2001) consider a major reason for the occurrence of mergers – we also include 18 "TOL2-based" industry level dummies in the models under consideration. Owing to the inclusion of these dummies, the focus is concentrated on the variation within industries. Because the industry dummies, on the other hand, also remove that kind of inter-industry variation that is explained by the factors which are important for this study, we decided to report the estimation results with industry dummies and without them.

[3] Transformation R&D stock + 1 is used, because some of the firms have not invested in R&D and the stock is zero.

[4] This restriction is the same restriction as the one used by the *Talouselämä* magazine in its listings of mergers.

5. RESULTS

We estimate a multilogit model for the firms which have been a part of M&As (as an acquiring firm or as a target firm) and for other firms which have not been part of M&As. We first esimate models which include RDINT (Tables 3 and 4). Then we replace RDINT by patent variables (see Tables A1 ands A2), by which the number of observations increases, because the R&D survey no longer limits the size of the data. The robustness of the results is tested by estimating all models with and without industry-level dummies. The results are reported as marginal effects and the time period is 1989–2000. All models include unreported year dummies. In all estimations, the firms who have not been a part of M&As (no M&A group) are the comparison group. The descriptive statistics of the data is given in the Appendix in Tables A3 and A4. The statistics in the data about targets is not much different from the data set about acquirers, and so we report only the statistics about acquirers. Omitting RDINT enlarges the data set with additional observations (firms) that have, on the average, only one establishment, do not export and are small, indebted, fairly profitable, young and not foreign owned.

Let us first focus on the results concerning the probability that a firm acquires. The TURNOVER variable as a proxy of a firm's size has a positive impact on the probability that a firm will acquire in all categories as expected (Tables 3 and A1). The impact of MULTI – as an indicator of the firm's geographical space – also has a positive impact. EXPORT increases the probability of cross-border M&As and this also corresponds to expectations. The negative impact of a firm's age (AGE) is rather surprising, and not according to expectations. This result may be an indication of the M&A wave[5] that even occurred in Finland in the late nineties and in 2000 when, in particular, young ICT-service firms rapidly expanded by purchasing other firms. The negative coefficient of FOREIGN in Tables 3 and A1 shows that a firm who is owned by foreigners is not independent enough to make acquisition decisions in a similar fashion as domestically owned firm.

Earlier, Lehto and Lehtoranta (2003) discovered that R&D-capital possessed by a firm increases the likelihood that a firm acquires another firm. This result seems to be valid only for cross-border M&As (see Table 3). The hypothesis about the positive impact of educational requirements (measured by EDU1 and EDU2) on the probability that a firm acquires also seems to be verified. The impact of EDU1 and EDU2 is strongest on the

[5] M&A wave in late 1990s was also experinced in many other countries (see, for example, Evenett, 2003).

probability of cross-border M&As in Tables 3 and A1. As we have expected, patent variables have no positive impact on the acquisition probabilities under consideration.

Table 3. Multinominal logit model for acquirers.

Model 1: Pseudo R^2 = 0.2382; Model 2: Pseudo R^2 = 0.2566
Number of observations = 50883. Base group is no-M&A.

	Intra-regional		*Inter-regional*		*Cross-border*	
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
TURNOVER	0.420**	0.462**	0.597**	0.611**	0.967**	1.010**
	(6.00)	(6.58)	(10.04)	(10.20)	(13.80)	(14.48)
NUMBER	0.502**	0.512**	-0.119**	-0.097**	0.025	0.082
	(9.20)	(8.74)	(-2.90)	(-2.17)	(0.42)	(1.30)
EDU1	0.291	-0.846	0.371	-1.241*	2.267**	0.870
	(0.60)	(-1.40)	(0.72)	(-1.95)	(4.36)	(1.34)
EDU2	0.556	-0.483	2.073**	1.407**	3.577**	2.308**
	(0.73)	(-0.49)	(4.07)	(2.76)	(5.88)	(2.73)
RDINT	-0.034	-0.022	0.069	0.034	0.409**	0.308**
	(-0.45)	(-0.28)	(1.08)	(0.49)	(5.23)	(3.60)
FIXED	-0.215	-0.681*	-0.495*	-1.002**	-2.085**	-2.366**
	(-0.61)	(-1.81)	(-1.65)	(-3.04)	(-4.09)	(-3.99)
DEBT	-1.115**	-1.035**	-0.267	-0.139	-2.207**	-2.278**
	(-4.88)	(-3.63)	(-1.22)	(-0.63)	(-5.95)	(-5.92)
PROFITS	0.040	0.042	-0.004*	-0.003	-0.007**	-0.007**
	(0.44)	(0.47)	(-1.74)	(-0.96)	(-2.94)	(-2.34)
AGE	-0.028**	-0.020	-0.038**	-0.032**	-0.009	-0.010
	(-2.21)	(-1.44)	(-3.71)	(-3.00)	(-0.61)	(-0.57)
FOREIGN	-0.653**	-0.482*	-0.252	-0.074	-2.002**	-1.868**
	(-2.53)	(-1.87)	(-1.35)	(-0.40)	(-5.17)	(-4.94)
MULTI	0.908**	0.834**	1.252**	1.161**	0.529**	0.450**
	(5.12)	(4.61)	(8.99)	(8.26)	(2.76)	(2.37)
EXPORT	-0.051	0.233	0.089	0.365**	1.148**	1.269**
	(-0.30)	(1.33)	(0.70)	(2.31)	(6.07)	(6.04)
INDUSTRY	Not included	Included	Not included	Included	Not included	Included

Notes: z-stat in parentheses. ** (*) indicates that the parameter estimate is statistically significant at the 5 (10) percent significance level.

The results reported in Tables 3 and A1 also tell us that the likelihood that a firm acquires decreases in the firm's indebtedness (DEBT) as in Lehto and Lehtoranta (2003). We also discovered that the fixed capital possessed by an acquiring firm (FIXED) decreases the probability of cross-border M&As as an indication of some geographical limits in the common use of fixed capital. A negative impact of PROFITS is against expectations. The possible explanation for this result is the same as for the negative sign of the AGE variable: the M&A wave, by which firms have grown at the expense of their short-run profitability.

Let us then consider the probability that a firm becomes a target. According to the results (Tables 4 and A2), a firm's size (TURNOVER) and the geographical reach (MULTI) positively contributes to the likelihood under consideration. The positive impact of EXPORT on remote M&As is also in line with our expectations. That TURNOVER and EXPORT also have a strong positive impact on the probability of rearrangements may reflect the fact that a couple of large companies – which have been targets in an arrangement in which a new firm has been founded – have been classified as rearrangements.

That a firm with high RDINT easily becomes a target in M&As and that this concerns cross-border M&As in particular also corresponds to expectations. The impact of EDU2 is positive only in the intra-regional and rearrangements categories which may indicate that monitoring the value of the target from afar is difficult when the weight of human capital in the value of a firm is remarkable. Without the RDINT variable the impact of EDU1 becomes positive (see Table A2). EDU1 can then be interpreted as being a proxy of knowledge capital.

Table 4. Multinominal logit model for target firms.

Model 1: Pseudo R^2 = 0.1195; Model 2: Pseudo R^2 = 0.1606
Number of observations = 50917. Base group is no-M&A.

	Intra-regional		*Inter-regional*		*Cross-border*		*Rearrangement*	
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
TURNOVER	0.488**	0.464**	0.526**	0.491**	0.709**	0.726**	0.660**	0.646**
	(8.13)	(7.59)	(12.20)	(10.68)	(11.13)	(10.07)	(10.68)	(9.70)
NUMBER	0.414**	0.397**	-0.166**	-0.145**	-0.124**	-0.075	-0.031	0.006
	(7.74)	(7.13)	(-5.02)	(-4.16)	(-2.09)	(-1.20)	(-0.56)	(0.11)
EDU1	0.555	-0.655	0.471	-0.788	1.266**	0.811	1.035	-0.073
	(1.14)	(-1.02)	(1.12)	(-1.43)	(2.43)	(1.33)	(1.09)	(-0.05)
EDU2	0.998*	0.160	0.639	-0.255	-1.072	-1.584	2.327**	1.986*
	(1.65)	(0.24)	(0.84)	(-0.30)	(-0.62)	(-0.84)	(2.29)	(1.79)
RDINT	0.149**	0.080	0.230**	0.177**	0.420**	0.372**	0.218**	0.113
	(2.24)	(1.16)	(4.04)	(2.82)	(6.27)	(4.94)	(3.04)	(1.44)
FIXED	-0.918**	-1.171**	-0.198	-0.649**	-0.657	-0.928*	-0.738	-1.029*
	(-2.38)	(-2.73)	(-0.76)	(-2.14)	(-1.51)	(-1.87)	(-1.53)	(-1.87)
DEBT	-0.395	-0.331	0.055	0.069*	-0.320	-0.269	-0.422	-0.408
	(-1.60)	(-1.39)	(0.78)	(1.70)	(-1.00)	(-0.83)	(-1.01)	(-0.97)
PROFITS	0.018	0.017	-0.002	-0.002	-0.005**	-0.005**	-0.006**	-0.007**
	(0.72)	(0.65)	(-1.00)	(-1.07)	(-3.01)	(-2.54)	(-2.31)	(-2.65)
AGE	0.008	0.020	0.008	0.014	-0.010	-0.010	0.003	0.006
	(0.68)	(1.63)	(0.93)	(1.46)	(-0.67)	(-0.63)	(0.16)	(0.30)
FOREIGN	-0.558**	-0.432*	-0.428**	-0.311	1.573**	1.623**	-0.515*	-0.428
	(-2.46)	(-1.88)	(-2.13)	(-1.51)	(7.49)	(7.30)	(-1.67)	(-1.35)
MULTI	0.364**	0.292*	0.385**	0.367**	0.470**	0.384*	0.618**	0.615**
	(2.20)	(1.73)	(3.31)	(3.16)	(2.24)	(1.84)	(2.75)	(2.73)
EXPORT	-0.112	0.211	0.257**	0.447**	0.482**	0.475**	0.543**	0.580**
	(-0.68)	(1.15)	(2.19)	(3.23)	(2.20)	(2.02)	(2.29)	(2.33)

Notes: z-stat in parentheses. ** (*) indicates that the parameter estimate is statistically significant at the 5 (10) percent significance level

It is also remarkable that FOREIGN now has a very strong positive impact on the probability of cross-border M&As as we have expected. The negative impact of PROFITS is in line with the stated inefficient management hypothesis. The negative coefficient of FIXED in the intra-regional category in Table 4 seems to contradict the results that are reported in Table 3. This finding can, however, be interpreted as describing the fact that it is relatively easy to evaluate the value of the target who is located far away and in whose balance sheet fixed tangible assets have a big weight.

9. CONCLUSIONS

In this study – which applies a fairly new approach in the literature – we have estimated a multilogit model for the probabilities that a firm will acquire or become a target in different M&A categories, which are defined according to the location of an acquirer with respect to the location of a target. According to the central findings of this study the firm characteristics of an acquiring firm such as the high educational level of the staff, which can be regarded as an indication of a good monitoring capacity, increases the probability of M&As and, in particular, the probability of cross-border M&As. The high educational level can also be interpreted as signalling good ability to internalise the potential synergies of M&As. A firm's R&D intensity, which may be a sign of good monitoring ability also increases the probability of a cross-border M&A. This result can also indicate that the knowledge capital, whose proxy RDINT is, can be commonly utilized even if an acquirer is located far from a target.

As far as the probability that a firm becomes a target of an M&A is concerned, we discovered that R&D in the firm's possession also increases the probability that a firm is acquired. We think that this result reflects the fact that geographical limits do not restrict the common use of knowledge capital so easily or that it is possible to evaluate the value of knowledge capital from afar, too. The result which states that the high educational level (measured by EDU2) only increases the probability of close M&AS is interpreted to describe the difficulties in monitoring the quality of human capital which is located far away.

APPENDIX A

Table A1. Multinominal logit model for acquirers.

Model 1: Pseudo R^2 = 0.3016; Model 2: Pseudo R^2 = 0.3353
Number of observations = 235192. Base group is no-M&A.

	Intra-regional		*Inter-regional*		*Cross-border*	
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
TURNOVER	0.567**	0.602**	0.655**	0.700**	0.829**	0.948**
	(18.42)	(17.06)	(22.74)	(20.30)	(19.20)	(20.28)
NUMBER	0.464**	0.493**	-0.115**	-0.057	-0.040	0.079
	(10.41)	(10.39)	(-3.23)	(-1.50)	(-0.81)	(1.41)
EDU1	1.370**	-0.081	1.900**	-0.026	4.201**	2.104**
	(4.64)	(-0.20)	(5.62)	(-0.05)	(13.84)	(5.51)
EDU2	2.099**	1.030**	2.015**	0.985**	3.747**	2.294**
	(6.04)	(2.46)	(5.46)	(2.38)	(9.18)	(4.35)
PATENTS1	-0.027	-0.038	-0.034*	-0.037*	-0.008	-0.009
	(-0.47)	(-0.60)	(-1.69)	(-1.64)	(-0.88)	(-1.18)
PATENTS2	-0.193	-0.206	0.016	0.012	0.012	0.003
	(-0.93)	(-0.94)	(0.69)	(0.54)	(0.41)	(0.11)
FIXED	-0.067	-0.847**	-0.020	-1.014**	-2.238**	-3.048**
	(-0.23)	(-2.74)	(-0.07)	(-3.43)	(-4.74)	(-5.35)
DEBT	-0.948**	-0.738**	-0.504**	-0.142	-2.465**	-2.292**
	(-4.25)	(3.46)	(-2.70)	(-0.87)	(-7.95)	(-6.97)
PROFITS	-0.004**	-0.003**	-0.003**	-0.003**	-0.004**	-0.003**
	(-2.73)	(-2.36)	(-2.48)	(-2.32)	(-2.97)	(-2.36)
AGE	-0.016	-0.003	-0.039**	-0.029**	0.004	0.006
	(-1.61)	(-0.32)	(-4.39)	(-3.14)	(0.26)	(0.38)
FOREIGN	-0.311	-0.114	-0.140	0.052	-1.825**	-1.754**
	(-1.59)	(-0.58)	(-0.83)	(0.31)	(-5.78)	(-5.42)
MULTI	0.844**	0.799**	1.238**	1.162**	0.666**	0.529**
	(5.76)	(5.38)	(9.50)	(8.82)	(3.48)	(3.00)
EXPORT	0.360**	0.597**	0.631**	0.558**	1.976**	1.814**
	(2.60)	(4.03)	(5.29)	(3.63)	(11.97)	(8.90)
INDUSTRY	Not included	Included	Not included	Included	Not included	Included

Notes: z-stat in parentheses. ** (*) indicates that the parameter estimate is statistically significant at the 5 (10) percent significance level.

Table A2. Multinominal logit model for a target firm.

Model 1: Pseudo R^2 = 0.1752; Model 2: Pseudo R^2 = 0.2016
Number of observations = 235253. Base group is no-M&A.

	Intra-regional		*Inter-regional*		*Cross-border*		*Rearrangement*	
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
TURNOVER	0.481**	0.512**	0.474**	0.478**	0.497**	0.549**	0.607**	0.647**
	(16.20)	(14.92)	(18.86)	(17.04)	(10.68)	(10.74)	(14.86)	(13.90)
NUMBER	0.452**	0.469**	-0.167**	-0.126**	-0.087*	-0.010	-0.064	0.017
	(10.46)	(10.47)	(-6.47)	(-4.61)	(-1.76)	(-0.19)	(-1.29)	(0.32)
EDU1	1.465**	0.137	1.786**	0.465	2.280**	1.290**	2.349**	0.739
	(5.75)	(0.39)	(7.30)	(1.45)	(7.31)	(3.45)	(4.71)	(0.96)
EDU2	1.291**	0.215	0.902*	-0.181	0.766	-0.141	2.281**	1.258*
	(3.86)	(0.54)	(1.90)	(-0.32)	(0.97)	(-0.16)	(3.81)	(1.73)
PATENTS1	-0.013*	-0.015**	-0.017	-0.021	0.005	0.004	-0.014	-0.018
	(-1.83)	(-2.16)	(-1.22)	(-1.42)	(0.64)	(0.52)	(-1.21)	(-1.51)
PATENTS2	0.045**	0.038**	0.045	0.045	0.022	0.016	0.043	0.038
	(2.27)	(2.02)	(1.38)	(1.40)	(0.60)	(0.48)	(1.45)	(1.35)
FIXED	-0.648**	-1.484**	0.336*	-0.615**	-0.384	-1.092**	-0.665	-1.391**
	(-2.07)	(-4.49)	(1.66)	(-2.68)	(-1.09)	(-2.70)	(-1.51)	(-2.82)
DEBT	-0.415*	-0.208	-0.197	-0.006	-0.733**	-0.566**	-0.591*	-0.379
	(-1.92)	(-1.09)	(-1.43)	(-0.09)	(-2.98)	(-2.30)	(-1.74)	(-1.18)
PROFITS	-0.003**	-0.003**	-0.002*	-0.002*	-0.002	-0.001	-0.003**	-0.003**
	(-2.33)	(-1.98)	(-1.87)	(-1.85)	(-1.26)	(-0.96)	(-2.45)	(-2.34)
AGE	0.002	0.015*	0.002	0.012*	-0.017	-0.009	0.003	0.009
	(0.30)	(1.73)	(0.35)	(1.67)	(-1.56)	(-0.80)	(0.21)	(0.53)
FOREIGN	-0.425**	-0.226	-0.308*	-0.156	1.981**	2.056**	-0.573**	-0.419
	(-2.28)	(-1.21)	(-1.78)	(-0.89)	(9.96)	(10.18)	(-2.02)	(-1.46)
MULTI	0.277**	0.206	0.369**	0.369**	0.254	0.132	0.587**	0.590**
	(1.96)	(1.42)	(3.42)	(3.36)	(1.46)	(0.76)	(2.78)	(2.83)
EXPORT	0.328**	0.475**	0.713**	0.607**	0.792**	0.634**	1.053**	0.813**
	(2.54)	(3.20)	(7.11)	(4.81)	(4.50)	(3.23)	(5.38)	(3.51)

Notes: z-stat in parentheses. ** (*) indicates that the parameter estimate is statistically significant at the 5 (10) percent significance level.

Table A3. Statistics for acquirers, data set which includes RDINT.

Number of observations 50883.

	Mean	*Std. dev*	*Min*	*Max*
TURNOVER	14.84	1.75	5.12	23.35
NUMBER	6.69	1.75	2.77	9.15
EDU1	0.06	0.15	0	1
EDU2	0.02	0.07	0	1
RDINT	-0.79	1.57	-8.50	8.72
FIXED	0.29	0.22	0	1
DEBT	0.68	0.47	0	46.53
PROFITS	-0.02	4.77	-588.29	2.41
AGE	13.62	6.63	1	25
FOREIGN	0.07	0.25	0	1
MULTI	0.31	0.46	0	1
EXPORT	0.46	0.50	0	1

Table A4. Statistics for acquirers, data set which does not include RDINT.

Number of observations 235188.

	Mean	*Std. dev*	*Min*	*Max*
TURNOVER	13.58	1.54	5.12	23.35
NUMBER	6.78	1.63	2.71	9.15
EDU1	0.03	0.12	0	1
EDU2	0.02	0.09	0	1
PATENTS1	0.05	1.66	0	317
PATENTS2	0.01	0.53	0	90
FIXED	0.25	0.22	0	1.35
DEBT	0.77	0.91	-1.62	191.00
PROFITS	0.02	4.37	-951	20.33
AGE	11.78	7.04	1	25
FOREIGN	0.03	0.17	0	1
MULTI	0.15	0.35	0	1
EXPORT	0.17	0.37	0	1

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