Win, Place, or Show? How Foreign Investment Strategies Contribute to the Technological Growth of the Multinational Corporation

Katarina Blomkvist, Philip Kappen, Ivo Zander

Abstract

This paper investigates the sources of technological growth of the multinational corporation. We conceptualize and shed empirical light on whether foreign investment strategies based on advanced greenfield subsidiaries, acquired subsidiaries, or a combination of both increase the likelihood of entry into technologies that represent new additions to the MNC's technology portfolio. Repeated events analyses of the complete U.S. patenting activity in 226 foreign locations of 21 Swedish multinationals reveal a substantially higher likelihood of entry into new technologies among investment strategies based on foreign acquisitions, as opposed to investment strategies based on greenfield establishments only. To the extent that MNC managers seek to enhance technological and strategic renewal through the expansion of foreign operations, the findings suggest that foreign investment strategies that involve the use of acquisitions are and should be the preferred alternative.

Introduction

Compared to the extensive literature on decision-making at the point of entering foreign markets (e.g., Hill et al., 1990; Hennart & Park, 1993; Buckley & Casson, 1998; Sharma & Erramilli, 2004), developments and effects in the post-entry period have received more limited attention. Some studies have looked at the implications of entry strategies for survival and forms of divestment (Li, 1995; Mata & Portugal, 2000), subsequent investment patterns (Chang & Rosenzweig, 2001), or subsidiary growth (Tan, 2009), but by and large the longitudinal effects of different forms of foreign investment strategies have received comparatively limited conceptual and empirical attention. At the same time, post-entry developments are of significant strategic importance for the MNC, as in many cases foreign parts of operations come to account for significant shares of total revenues and new capability development.

In this paper, we examine how foreign investment strategies influence the MNC's long-term ability to develop new technological capabilities and enter into previously unexplored technologies; i.e., its technological growth. We particularly focus on the relative contributions from greenfield investments vs. foreign acquisitions and attempt to shed light on which of the two represents the most significant contributor of new technology to the MNC. The existing literature supports *a priori* expectations about differentiated contributions, as foreign acquisitions have been found to introduce more distinct revolutionary breaks in otherwise path-dependent patterns (Zander, 1999), and there is evidence to suggest they may be characterized by a relatively higher degree of strategic asset-seeking behavior among maturing MNCs (Granstrand et al., 1992; Dunning & Narula, 1995; Cantwell & Narula, 2001). Yet, these expectations are still to be placed on firmer conceptual and theoretical grounds and to be explored in a direct comparative setting.

To disentangle and assess the technological consequences of different foreign investment strategies, we draw upon literatures that from various angles speak to the long-term development

and expected contributions from foreign subsidiaries to the MNC's overall technological portfolio. We are particularly concerned with predicting and examining the effects of foreign subsidiaries that have entered the advanced stage of development, or the stage at which they have proven their capacity to make significant technological discoveries and recurrent contributions to the overall multinational group. Most of the subsidiaries can be expected to display the comparatively high complexity of activities and technological work that characterizes competence-creating subsidiaries (Cantwell & Mudambi, 2005; Cantwell & Mudambi, 2011). In the empirical approach, we consider a "horse race" between three types of MNC investment strategies in foreign locations, characterized by the MNC's deployment of either greenfield or acquired subsidiaries, or a combination of the two. The analysis of three hypotheses aims at uncovering which type of investment strategy has a particularly pronounced effect on the pace of entry into technologies that represent new additions to the MNC's overall technology portfolio.

For the empirical investigation, we draw on a data set containing the complete U.S. patenting by subsidiaries in 226 foreign locations of 21 Swedish multinationals in the 1893-2008 period. From this data, we estimate the hazard rates for successive entries into new technologies for each of the possible investment strategies, controlling for a set of additional variables internal and external to the MNC. The results show that there are substantially different probabilities of advanced subsidiaries' contribution to MNC technological growth. Specifically, investment strategies involving acquisitions are significantly more likely to contribute to the technological growth of the MNC than those depending only on greenfield subsidiaries.

The paper makes two main contributions to the literature on post-entry effects of foreign market investment strategies. We conceptually disentangle and predict the development of technological contributions from advanced subsidiaries of the MNC, and, in contrast to prior work which addresses only greenfield subsidiaries (Blomkvist et al., 2010) or the dynamics of competence-creating overlaps (Kappen, 2011), make a direct empirical comparison between

greenfields and acquisitions with regard to their ability to contribute to the technological growth of the entire multinational group. In addition to contributing new theoretical and empirical knowledge about post-entry developments in the internationalization of the MNC, the empirical findings offer some overall guidance for managers concerned with the growth and long-term strategy of the international firm. Specifically, if technological growth through operations in foreign locations is seen as desirable, the findings suggest that, in the choice between greenfield investments and acquisitions, investment strategies based on acquisitions should be the preferred and encouraged form of international expansion.

Three Investment Strategies in Foreign Locations

When the MNC enters and expands its technological activities in foreign locations, it may use three types of strategy: 1) Investment based only on greenfield subsidiaries; 2) investment based only on acquired subsidiaries; and 3) investment based on a combination of greenfield and acquired subsidiaries[1]. Consider these three possibilities and their implications for the MNC's technological growth and entry into new technologies *ad seriatim*.

Investment Strategies Based Only on Greenfield Subsidiaries. In this case, the MNC establishes operations in a foreign location through a greenfield investment, which in terms of advanced technological capabilities then remains the only mode of operating in that location.

In most cases, the initial investment decision is driven by the MNC's need to adapt products to local market needs, which sets the stage for the emergence of more sophisticated technological roles and responsibilities (Ronstadt, 1978; Pearce & Singh, 1992; Pearce, 1994; Taggart, 1996; Frost, 2001). Fundamentally, it is a process by which the foreign subsidiary

[1] The discussion is restricted to greenfield and acquired subsidiaries only, thus excluding from consideration other potential sources of MNC technological renewal such as joint ventures and strategic alliances. Hence, the study only captures a partial aspect of the broader internationalization and technological capabilities of the MNC.

gradually becomes more embedded in its local business environment (Jaffe et al., 1993; Almeida, 1996; Mudambi, 1998; Maskell & Malmberg, 1999; Frost, 2001; Andersson et al., 2001; Andersson et al., 2002). Enhanced degrees of local embeddedness allow for the identification of new business opportunities in the local environment (Rugman & Verbeke, 2001), over time expanding the subsidiary's technological activity into new and locally idiosyncratic areas.

Successful pursuit of the new opportunities may lead to the granting of a world product mandate and the formation of a "center of excellence" within the multinational group (Chiesa, 1995; Birkinshaw & Hood, 1998; Holm & Pedersen, 2000). It comes with formal recognition of the subsidiary's particular technological and strategic capabilities, along with enhanced levels of autonomy to develop operations within the selected field of activity. At this stage of development, the subsidiary is likely to have developed the more advanced and complex technological capabilities that are characteristic of a competence-creating subsidiary (Cantwell & Mudambi, 2005; Cantwell & Mudambi, 2011). As each local environment offers a unique set of technological and business opportunities (e.g., Pavitt, 1988a; Porter, 1990; Cantwell, 1991), foreign subsidiaries reaching this advanced stage will tend to enter and exploit technologies that represent new additions to the technological portfolio of the multinational group.

Formal recognition as a center of excellence puts the advanced subsidiary in a position from where it can accelerate its entry into new technologies, as the granting of a world product mandate may trigger virtuous cycles of technological and strategic initiatives (Delaney, 1998). Birkinshaw (1999) shows that the formation of distinctive subsidiary capabilities promotes subsidiary initiatives, and suggests that proven capabilities and initiatives increase headquarters responsiveness for further initiatives. Following a different line of argumentation, Andersson and Forsgren (1996) and Forsgren, Johanson and Sharma (2000) suggest that higher degrees of local embeddedness lower the possibility to execute corporate control and lead to higher degrees of subsidiary autonomy. Such autonomy has been associated with product mandates and centers of

excellence (Forsgren & Pedersen, 1998; Ensign et al., 2000) and enhanced levels of exploration of new fields of technology (Yamin, 2000).

Over time, the advanced greenfield subsidiary's ability to enter into new technologies is boosted further by the combinative capabilities offered by its broadening set of technological capabilities (Pavitt et al., 1989; Granstrand & Sjölander, 1990), and enhanced integration with the overall MNC may extend these combinative processes to the international level (Gerybadze & Reger, 1999; Pearce & Papanastassiou, 1999; Pearce, 1999; Cantwell & Piscitello, 2000; Johanson & Vahlne, 2003). Integration with other subsidiaries of the multinational network suggests an enhanced capability to draw upon and combine an increasingly diverse set of impulses and resources (Hedlund, 1986; Bartlett & Ghoshal, 1989; Hedlund & Ridderstråle, 1995), resulting in a multiplicative effect on the subsidiary's ability to introduce technologies that are new to the multinational group.

Overall, there are nevertheless reasons to believe that the advanced greenfield subsidiary's entry into new technologies is a relatively slowly evolving process. Greenfield subsidiaries to a large extent draw upon and expand already existing firm-specific advantages (Hennart & Park, 1993; Chang & Rosenzweig, 2001; Belderbos, 2003), and the path dependency created by technology transfer from the home country will initially keep them in the neighborhood of already established technological capabilities. Greenfield subsidiaries are also affected by liability of foreignness (Zaheer, 1995), which has proven an enduring barrier to the development of closer and embedded ties with local firms (Zaheer & Mosakowski, 1997). Recent empirical evidence indeed suggest a relatively slowly developing capacity among advanced greenfield subsidiaries to contribute new technologies the MNC's technological portfolio (Blomkvist et al., 2010).

Investment Strategies Based Only on Acquired Subsidiaries. In this investment strategy, which is expected to be most prevalent late in the MNC's internationalization process (Johanson & Vahlne, 1977), the acquisition of one or several local firms represents the only mode of developing operations in a certain foreign location.

In this case, and in contrast to the greenfield investment, there will be no gradually increasing embeddedness and scope of technological activity, but rather "instant and full embeddedness" through the acquisition of companies with a relatively long history in the local market (Forsgren, 1989; Andersson et al., 1997). As opposed to greenfield subsidiaries, whose technological activities tend to remain tainted by the initial ambition to exploit the technological advantages developed by home country units, the acquisition route thereby offers more or less immediate access to the unique technological capabilities and profile of the local unit and host location (Tan, 2009).

There is evidence that some foreign acquisitions are undertaken with the explicit aim of accessing new technology in foreign locations (Granstrand et al., 1992; Dunning & Narula, 1995; Cantwell & Narula, 2001). Although this form of asset-seeking behavior may not be the primary driver of the internationalization of MNC activity (e.g., Caves & Mehra, 1986; Hennart & Park, 1993; Norburn & Schoenberg, 1994; Hamill & Castledine, 1996), in individual cases it can have a significant broadening effect on the MNC's overall technology portfolio. In those instances where foreign units are acquired for the specific purpose of accessing new technological capabilities, these are likely to be the outcome of headquarter decisions, and retained and supported in the post-acquisition period (Cantwell & Mudambi, 2005).

The long-term development of technological activities of individual acquired subsidiaries is somewhat inconclusive, perhaps as a consequence of variations in age and motives among the acquiring firms (Hitt et al., 1996; Bergek & Berggren, 2004) or varying strengths of product mandates among the acquired units (Cantwell & Mudambi, 2005). Bertrand and Zuniga (2006)

conclude that cross-border acquisitions have a positive effect on the R&D intensity of the acquired unit, a result that becomes stronger the higher the R&D intensity of the industry. Mudambi and Navarra (2004) observe a slightly higher level of knowledge development among foreign subsidiaries established through acquisitions than among greenfield investments. While the results are not entirely conclusive, they support Cantwell and Mudambi's (2005) assertion that acquired subsidiaries are more likely to act in asset-seeking ways, thus developing more substantial technological capabilities and having a greater strategic impact on the overall MNC than greenfield establishments.

Investment Strategies Based on a Combination of Greenfield and Acquired Subsidiaries. In this strategy, for operating in a foreign location the MNC uses a combination of different investment strategies (Benito & Welch, 1994). In the typical case, the first establishment in the foreign location takes the form of a greenfield investment, which after some time is complemented by one or several acquisitions of local firms (some of which may be the result of local subsidiary initiatives; cf. Zander, 2002, Blomkvist et al., 2012).

The additional acquisition of local firms may be the result of several considerations with different effects on capability development (Birkinshaw & Lingblad, 2005), but enhanced speed in penetrating the local market would be one main underlying motive. Because of the entry barriers that typically surround local markets, acquisitions may be the only way to achieve more significant market shares within a short period of time. Alternatively, establishing an initial greenfield presence in the local market can heighten the MNC's awareness of local business opportunities, which includes the identification of new and what are perceived as promising acquisition candidates and technologies for future use. In this case, the addition of one or more acquisitions to an established greenfield subsidiary reflects the explicit ambition to gain access to new technological capabilities.

When acquisitions are added to already existing greenfield subsidiaries, they may speed up the MNC's entry into new technology, as in some cases the newly-acquired units will be engaged in locally idiosyncratic operations and associated technological capabilities (Cantwell, 1991; Serapio & Dalton, 1999; Puranam et al., 2006).

At the same time, an investment strategy based on a combination of greenfield and acquired subsidiaries will tend to create some degree of activity overlap in the location. The subsidiaries involved in such overlaps are likely to face pressures for cooperation as well as internal competition (Birkinshaw & Lingblad, 2005). For instance, the spatial proximity of the units should intensify the competition for limited headquarters' attention, resources, and network positions. At the headquarters level, the combined foreign market entry strategy could trigger location-specific consolidations of technology exploitation and exploration activities. Hitt et al. (1991) showed that acquisitions generally induced firm-wide reductions in research intensity, thus potentially lowering the likelihood for future entries into new technologies. Further, Kappen (2011) found an initial retrogressive effect on the likelihood of entry into new technologies by advanced greenfields when sharing location with acquired subsidiaries. In essence, while subsidiaries sharing locations also share a mandate for corporate technological and strategic renewal, involvement in the same immediate market may cause a crowding-out effect, potentially giving the competitive element of the relationship the upper hand. This would mirror Burt's (1987) notion that structurally equivalent units are substitutable and tend to be more competitive in nature.

Hypotheses

The preceding discussion gives rise to a set of hypotheses about the relative importance of the three types of investment strategies as sources of MNC technological growth and entry into technologies that are new to the entire multinational group.

To reiterate, while greenfield subsidiaries can be expected to gradually extend the firm-specific advantages and capabilities transferred from the MNC's country of origin, acquisitions of established foreign firms offer the MNC "instant and full embeddedness" in the local business environment. Foreign acquisitions thereby give comparatively rapid access to often full-fledged local operations and technologies that tend to differ from those that have been encountered and developed in the MNC's home environment. In some foreign acquisitions, access to new and distinct technological capabilities can indeed be endogenous to the foreign market entry decision. Hence, compared to investment strategies based on only greenfield subsidiaries, strategies focusing exclusively on acquired subsidiaries are expected to be associated with a higher likelihood of technological growth:

Hypothesis 1: Investment strategies based on greenfield subsidiaries are less likely to generate entry into new technologies than investment strategies based on only acquired subsidiaries.

As discussed above, investment strategies based on a combination of greenfield and acquired subsidiaries represent an in-between form, and mixed locations should be more likely to cause entry into new technologies than those based solely on greenfield subsidiaries. The difference between mixed locations and locations represented only by acquired subsidiaries is more indeterminate. Considering the typical sequence from greenfield to acquired subsidiaries in the mixed locations (Kappen, 2011), it may be expected that the greenfield unit for some time retains a dominant influence over technological activities and development, and that initial local acquisitions mainly focus on enhancing market shares in the local market (cf. Fritz & Karlsson, 2006; Blomkvist et al., 2012). Adding to this, competence-creating overlaps in individual locations may initiate a process of rationalization and technological consolidation among the

units involved. It is therefore expected that there is a ratchet effect with respect to the three main strategies for entering and developing operations in foreign locations:

Hypothesis 2: Investment strategies based on a combination of greenfield and acquired subsidiaries are more likely to generate entry into new technologies than are investment strategies represented only by greenfield subsidiaries.

Hypothesis 3: Investment strategies based on a combination of greenfield and acquired subsidiaries are less likely to generate entry into new technologies than are investment strategies represented only by acquired subsidiaries.

Method

Sample. The empirical analysis is based on the complete U.S. patenting activity by all technologically-active subsidiaries in foreign locations, represented by a sample of 21 Swedish multinationals in the 1893-2008 period. Out of the 226 locations identified in the sample, 151 were in Europe (most importantly Germany, 19, Switzerland, 17, Denmark, 14, United Kingdom, 14, Finland, 14, and Netherlands, 13), 20 in the United States, and 55 in other countries (most importantly Canada, 10, Australia, 7, and Japan, 6). The sample firms represent a relatively broad spectrum of industries including, for example, pulp and paper, motor vehicles, pharmaceuticals, and telecommunications equipment (Appendix A). Previous studies have shown that these companies account for a significant number of inventions and amount of R&D expenditure in Swedish industry (Wallmark & McQueen, 1986; Håkanson & Nobel, 1993).

In order to define the sample firms and their foreign subsidiaries in a way that allows for longitudinal comparisons, a historical examination of each individual firm was performed to identify any possible name changes as well as potential changes in ownership through mergers and acquisitions. The data consolidates any patenting associated with first-order, majority-owned

subsidiaries for the periods during which they belonged to the parent companies. These subsidiaries were identified through an extensive and systematic search into the history of each individual sample firm, using the publications Svenska Aktiebolag – Handbok för Affärsvärlden, Koncernregistret – KCR, Who Owns Whom – Continental Europe, and from 1991 and onward, information in annual reports and corporate trees offered by the Thomson Innovation database[2]. Complementary publications, such as publications on company histories, were also used in the consolidation process.

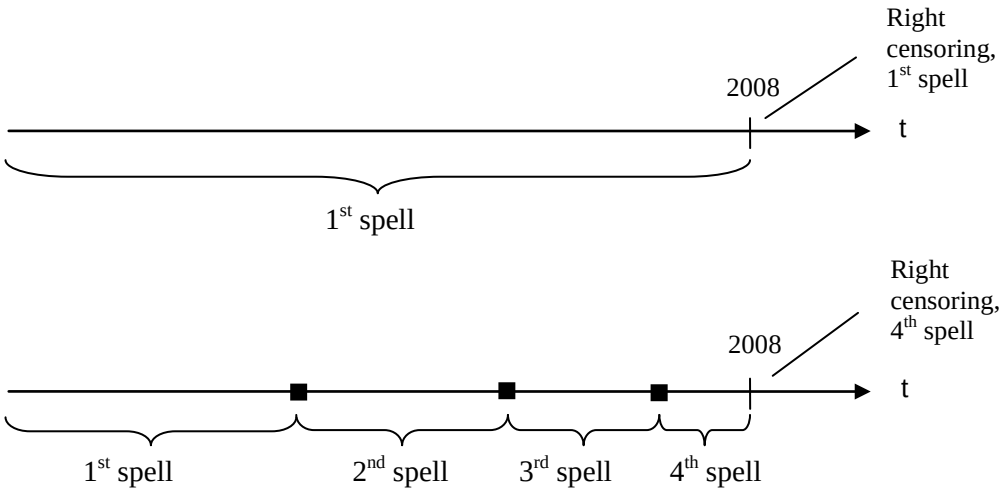
It should be emphasized that the data includes only advanced or competence-creating foreign subsidiaries with a proven capacity to contribute significantly to the technological and strategic development of the multinational group. Proof of this capacity is that the subsidiaries have been awarded at least one U.S. patent, which by definition requires that inventions be novel, non-obvious, and constitute useful additions to the existing stock of knowledge (additional methodological notes and comments are contained in Appendix B). Therefore, the insights from the current paper are limited to the MNC's growth in terms of relatively significant new additions to the technology portfolio, and the paper does not account for the potentially wide range of minor technological advancements and improvements that may have taken place in parallel in the multinational network.

Finally, it is notable that in some of the locations foreign subsidiaries may have been awarded one or several U.S. patents, but never accomplished entry into a technology that was new to the entire multinational group (just over 50 percent of the locations accounted for by the sample). Other locations are associated with single or multiple entries, but testing for patterns in the entry into new technologies requires the inclusion of both types in the empirical investigations. A stylized representation of the two types of location, which also illustrates the

[2] Swedish corporations are by law required to disclose their holdings of shares in domestic and international subsidiaries in their annual reports. Required information includes, but is not limited to, the name of the subsidiary, number of shares held by the corporation, and the nominal value of the shares.

different spells or time periods between entries into new technologies that are central to the statistical analyses, is provided in Figure 1.

Figure 1
Two hypothetical patterns of entry into new technologies



X marks the first recorded patent in a given location and ■ entry into a technology that is new to the entire multinational group (the first recorded patent sometimes coincides with entry into a technology that is new to the multinational group). The first example shows a location which has entered the risk set but has never generated entry into any new technologies. The second example, on the other hand, during the window of observation has experienced three documented entries into new technologies, but as the last entry occurred before the end of the observation period, it involves four spells, of which the last is right-censored.

Data and Data Collection

The study uses patents as an indicator of technological activity and firms' entry into new technologies. Patents are a frequently-used indicator of technological activity and the geographical location of technological capabilities (e.g., Jaffe, 1986; Archibugi & Pianta, 1992; Almeida & Phene, 2004; Feinberg & Gupta, 2004; Singh, 2007). They have a specific advantage in that they provide consistent and comparable information over extended periods of time. Patenting also correlates highly with alternative measures of technological activity and innovative performance, such as research and development expenditure and new product introductions. In a study comprising a large number of companies in four high-tech industries, Hagedoorn and Cloodt (2003, pp. 1375, 1365) found "no major systematic disparity amongst R&D inputs, patent counts, patent citations and new product announcements," and conclude that "future research might also consider using any of these indicators to measure the innovative performance of companies in high-tech industries."

The present study relies specifically on the firms' patenting in the United States. The completion of a U.S. patent application requires that the nationality of the inventor be recorded (rather than the nationality of the research unit). Under the assumption that the nationality of the inventor in the majority of cases coincides with the geographical location of invention, it will be possible to find out where the research and development underlying the invention was carried out. Thus, for every U.S. patent registered under the name of any of the sample firms and their subsidiaries, it is known if the patent *originated* in, for example, Germany, the United Kingdom, the United States, or any other country[3]. This is an important advantage because company-specific patenting policies (for example, involving the registration of patents under the name of

[3] A small proportion of all patents in the current data set were associated with several inventors of different nationalities. In those cases, the geographical location of invention was recorded as that of the first inventor.

the parent company rather than the inventing subsidiary) could otherwise conceal the correct geographical distribution of technological activity and invention.

One further advantage of using U.S. patenting data is that the general attractiveness of the large U.S. market encourages patenting of inventions that are believed to be of relatively high quality and commercial value. The use of U.S. patenting data thereby reduces the risk that accidental or insignificant inventions may contaminate the results. It has been found that Swedish firms' patenting in the United States does not differ significantly from patenting in other large markets, such as Germany or France (Archibugi & Pianta, 1992). One potential drawback of using U.S. patenting data is that it tends to inflate the technological activity in U.S. units (because they have a relatively higher propensity to patent in what is their home market). In the current sample, the United States as a location accounts for not more than 20 out of the 226 foreign locations comprised by the sample and should not have a disproportionate influence on the results.

Although information from patents must be treated with some caution (Schmookler, 1950; Pavitt, 1988b), no substantial biases are anticipated in the present study. Most of the sample firms are active in medium- to high-tech industries, where patenting is considered an important competitive device. While patenting propensity varies across the sample firms, causing variation in the number of patents associated with each firm, this does not in itself affect observed patterns in the timing of entry into new technologies.

Variables

Dependent Variable. The key event is when a greenfield or acquired subsidiary in a specific foreign location generates entry into a technology that is new to the multinational group. Entry occurs when the subsidiary is awarded a patent in a patent class in which the multinational group has not been previously active. Time to entry is measured as the number of years between either

the first recorded patenting in a location and the first recorded entry into a technology that is new to the multinational group, or the number of years between any two successive entries (for example, the number of years between the 1st and 2nd entry into a new technology, or between the 2nd and 3rd entry, etc.). Entry is a distinct event, but any particular location or subsidiary may have been involved in several such entries over time.

Entry into new technologies is measured at the level around 400 classes of technology as defined by the U.S. Patent Office[4]. For matters of convenience, these classes of technology are referred to as "technologies" throughout the paper. At this level of aggregation, it is possible to distinguish between relatively narrowly-defined technologies, such as resistors and electrical connectors. Other examples include paper-making and fiber preparation, chemistry carbon compounds, liquid purification and separation processes, and pulse or digital communications. For the purposes of this paper, the classification should strike a useful balance between more aggregate groups (the use of which would result in fewer identified entries into new technologies) and finer levels of aggregation.

Investment Strategies. As the main covariate, the analysis makes a distinction between three fundamental investment strategies: 1) Investment based only on greenfield subsidiaries; 2) investment based only on acquired subsidiaries; and 3) investment based on a combination of greenfield and acquired subsidiaries. These three groups are used in different combinations to test Hypotheses 1-3, excluding one category at a time for each test (which also leads to different numbers of annual observations per test).

[4] The U.S. Patent Office classification is primarily based on the nature and function of the inventions, not their primary adopters. The manual states that arts or instruments having like functions, producing like products, or achieving like effects, are classified together. The functions or effects that are chosen as a basis of classification must be proximate or essential, not remote or accidental. The categories of invention are product, process, apparatus, composition of matter, and certain varieties of plants. Accessories are generally classified with the instrument to which they are peculiar (Manual of Classification, Revision No. 1, June 1993, U.S. Department of Commerce, Patent and Trademark Office).

It should be pointed out that the observation that entry into new technologies in a particular location has been generated only by greenfield subsidiaries does not necessarily prevent additional acquisitions from being made in that location. It may simply be the case that these acquired firms were not technologically active and/or failed to produce any patents that would put them in the advanced category, and at risk for generating entry into new technologies. In a strict sense, the data and results therefore do not provide conclusive evidence on the mix of greenfield subsidiaries and acquisitions employed in each location, but they do reveal the extent to which any of the two types in their advanced form have contributed to the MNC's entry into new technologies.

Control Variables. Although the data ideally should have included several control variables—for example, variables measuring the munificence and other aspects of the local business environment or the overall degree of centralization of the MNC—the length of the time period under investigation in combination with unavailability of data at the subsidiary and location levels precluded their full inclusion in the statistical models.

We nevertheless included a control variable for tenure or age as a technologically advanced subsidiary, measured as the time elapsed from the subsidiary's first awarded patent to any identified entries into new technologies, continuing each year the unit was at risk of experiencing an event. We further included size of the local market as a general proxy for the munificence of the local technological and business environment, influencing the local subsidiary's ability to branch out into a potentially broader portfolio of technologies and businesses. The size of the local market was measured in annual GDP expressed in the log as millions of USD (constant 1990 terms), using data obtained from the GGDC Total Economy Database (2008). It is expected that large markets offer broader technological and business opportunities than small markets,

creating more opportunities to identify and combine diverse ideas and resources within the local context.

To control for differences in national culture and their possible effects on technological activity, reflecting both the ability and desirability to control the technological development of foreign subsidiaries and local technology strategies (Luo, 2002), we included a cultural distance measure using Kogut and Singh's (1988) index and the scores of Hofstede's (2001) cultural dimensions, with the exception of the Confucian dynamism dimension[5]. Further, a control variable capturing changes in general business conditions and management practices over time (e.g., Hedlund, 1986; Doz & Prahalad, 1991) was included as a positive linear function of time for each decade between 1893 and 2008.

Three industry dummy variables (coded 0 and 1) were introduced to control for industry-dependent effects on the timing of entry into new technologies. These dummy variables are expected to reflect different propensities to centralize R&D activities (Papanastassiou & Pearce, 1998) and to exchange knowledge across individual subsidiaries of the multinational network (Randoy & Li, 1998). The first dummy variable captured firms in the automotive industry (two firms); the second, firms in processing industries such as pulp and paper, and steel (four firms); and, the third, firms involved in pharmaceuticals and chemicals (four firms). This left a mixed group of sample firms mainly active in mechanical engineering industries, often with highly diversified product portfolios.

[5] With the progress of cultural distance measures, other indexes than Hofstede's have been developed and used (e.g., the Schwartz index, 1994, which has been found to at least partly overlap Hofstede's index; Drogendijk & Slangen, 2006). Although we did not test the Schwartz index, we did test a Euclidian distance index based on Hofstede (2001) (see e.g., Brouthers & Brouthers, 2001; Vermeulen & Barkema, 2001) as well as a clustering approach (Ronen & Shenkar, 1985) and found it to have no significant impact on the results.

Statistical Method

The statistical method is event history analysis. Since locations and foreign subsidiaries may be involved in a number of successive entries into new technologies, the specific method is repeated events with Prentice-Williams-Peterson (PWP) partial likelihood estimation, using the SAS 9.2 statistical package. Each spell between entries into new technologies represents a distinct observation (the 1^{st}, 2^{nd},…, K^{th} entry into a technology that is new to the multinational group in any location or foreign subsidiary). The first spell is between the first recorded patenting in a specific location and first entry into a new technology. In some cases there is no entry at all over the observed time period (resulting in a right-censored observation), and in yet other cases the first recorded patenting coincides with the entry into a new technology. The subsequent spells are between successive entries into new technologies. Since all observations end in 2008, the last spell of any sequence of entries into new technologies is typically right-censored.

With the development of repeated or recurrent event analysis, there are now several basic models in use (e.g., Therneau & Hamilton, 1997; Kelly & Lim, 2000; Box-Steffensmeier & Zorn, 2002; Ezell et al., 2003; Jiang et al., 2006). To test Hypotheses 1-3, we used the PWP model, which is suitable whenever events occur sequentially and the main interest is duration since the last event (Box-Steffensmeier & Zorn, 2002). The PWP model applies a restrictive risk set in that each observation at risk for event *k* must have experienced event *k*-1. Thus, separate baseline hazards are estimated, based on stratification by event number. The PWP model uses a gap-time formulation for estimating the times between events, which implies that the clock resets after each experienced event.

One limitation of repeated events approaches is that they do not account or correct for unobserved heterogeneity[6]. To a certain extent, the homogeneity of the sample firms in terms of

[6] A fixed-effects partial likelihood (FEPL) method as suggested by Allison (1996), which controls for all time-invariant unobserved heterogeneity, was not under consideration for the current study since it

geographical origin and organizational traits should have contributed to creating similar conditions across firms and individual subsidiaries. Also, a number of controls that account for possible effects produced by industry and region on the timing of entry into new technologies are employed. Finally, all subsidiaries in the sample have reached at least a stage with documented capabilities to contribute significantly to the technological and strategic renewal of the multinational group (through patented inventions, judged sufficiently important to be applied for in the United States). This would exclude a number of heterogeneous groups of subsidiaries from the analysis; for example, those consisting of only sales subsidiaries or subsidiaries involved in minor adaptations of products and services according to local market needs.

All variables that could potentially vary independently over time were included as time-varying covariates to obtain unbiased estimates (Aydemir et al., 1999). Nevertheless, the absence of a more extensive set of control variables and the potential existence of unobserved heterogeneity suggest caution when interpreting the results (Ezell et al., 2003). Accordingly, in our view, the findings reflect broad tendencies in the connection between investment strategies and their impact on technological growth of the MNC, thereby paving the way for further and more comprehensive empirical investigations.

Results

Of the 226 foreign locations covered by the sample firms, over the entire period of observation 162 were represented only by greenfield subsidiaries, 15 only by acquired subsidiaries, and 49 by a combination of greenfield and acquired subsidiaries. The combined category includes 21 locations that experienced single shifts from the greenfield to the combined investment strategy

---

requires that most observations have a least two events. Further, it discards observations with no events (i.e., those with only a single censored spell), and those with one uncensored spell and one censored spell, if the censored spell is shorter than the uncensored spell. An additional, and most important, reason for not applying the FEPL model is its restrictions concerning the use of time-invariant covariates, such as our investment strategy covariates.

(or, in six cases, the reverse), and six locations where shifts occurred from initially only acquired units to the combined strategy. In the remaining cases that involved a combination of greenfield and acquired subsidiaries, individual locations experienced multiple shifts between the categories, as acquisitions and divestments of acquired units occurred over time (Table 1).

Table 1
Locations and investment strategies[a]

Location	Greenfield only	Acquisition only	Combination of greenfield and acquired
United States	22	1	16
West Germany/Germany	21	1	7
Switzerland	16	1	3
Netherlands	13	1	1
United Kingdom	12	1	5
Denmark	11	2	3
Finland	11	2	3
France	10	2	5
Canada	9	1	-
Italy	8	3	4
Norway	7	2	1
Japan	7	2	-
Australia	6	1	1
Austria	6	1	1
Belgium	6	-	1
Hungary	4	-	-
Spain	4	-	-
New Zealand	4	1	-
Ireland	3	-	-
Mexico	3	-	-
South Africa	3	-	-
Brazil	2	1	-
India	2	-	-
Israel	2	-	-
Soviet Union/Russia	2	-	-
Czechoslovakia/Czech Republic	1	1	-
Other Africa	1	1	-
Argentina	1	-	-
China	1	-	-
Bulgaria	1	-	-
Greece	1	-	-
Luxemburg	1	-	-
Poland	1	-	-
Portugal	1	-	-
South Korea	1	-	-
Turkey	1	-	-
Yugoslavia	1	-	-
Other Asia	1	-	-
Other Europe	1	-	-
Other Middle East	1	-	-

[a] Figures refer to location observations. In a number of cases, subsidiaries experienced single or multiple shifts between the categories, which means that the number of location observations exceeds the 226 locations represented by the sample firms.

As can be seen from Table 1, there is a significant amount of overlap in the locations in which the three investment strategies are observed. In other words, in terms of the location of advanced technological capabilities, there is no obvious pattern to suggest that certain types of investment strategies are favored for certain types of countries. Strategies based on greenfield investment strategies clearly dominate, although numbers on types of strategy do not contain any information about the pace of entry into new fields of technology. In contrast, it is fairly uncommon that investment strategies depend on only acquired subsidiaries, whereas the combined strategy is used relatively frequently. The descriptive statistics include one additional baseline observation—across the categories the average time from first entering the risk set to any subsequent entry into a technology that is new to the entire multinational group is close to 17 years (median 11, including right-censored cases).

Table 2 shows the correlation coefficients for the covariates of interest in the study. The correlation matrix displays rather modest correlations, except, as expected, for the interaction between period and age, and also between cultural distance and GDP. The VIF scores were estimated to check for potential multicollinearity issues. With no scores above 2 in any model specifications (Hair et al., 1998), the risk of significant misinterpretations of the results due to multicollinearity appears limited.

Table 2
Correlation matrix and descriptive statistics [a]

	1.	2.	3.	4.	5.
1. Strategy [b]	1.000				
2. GDP	0.329/0.011/-0.227	1.000			
3. Period	0.063/0.186/0.444	0.075/0.121/-0.070	1.000		
4. Age	0.084/-0.143/-0.306	0.187/0.089/0.208	-0.605/-0.603/-0.405	1.000	
5. Cultural distance	0.078/0.052/0.089	0.471/0.492/0.508	0.050/0.073/0.067	-0.012/-0.040/-0.023	1.000
Model 1					
Mean	0.119	12.756	7.524	20.810	1.145
Standard deviation	0.324	1.532	2.378	17.953	0.747
VIF	1.212	1.598	1.729	1.678	1.350
Model 2					
Mean	0.033	12.578	7.595	19.268	1.132
Standard deviation	0.178	1.460	2.436	17.233	0.769
VIF	1.058	1.464	1.684	1.727	1.383
Model 3					
Mean	0.146	13.567	8.805	13.952	1.203
Standard deviation	0.353	1.634	1.164	10.871	0.684
VIF	1.304	1.743	1.451	1.563	1.392

[a] The correlation matrix shows three values for each variable since the estimations are based on three samples. The values are reported for the sample of Model 1, 2 and 3, respectively. [b] Mode coded 0=only greenfields, 1=both greenfields and acquisitions/0=only greenfields, 1=only acquisitions/0=both greenfields and acquisitions, 1=only acquisitions.

Model 1 of Table 3 tests the difference between greenfield subsidiaries and combined investment strategies with regard to the likelihood of generating entry into technologies that are new to the multinational group. Models 2 and 3 incorporate the same control variables but test for the difference between investment strategies of only greenfield or acquired subsidiaries, and the difference between investment strategies of acquired subsidiaries and combined modes respectively. Notably, the PWP model controls for the number of prior entries, as separate baseline hazards are estimated based on stratification by event number.

Model 1 shows that investment strategies based on a combination of greenfield and acquired subsidiaries have a significantly higher probability of introducing new technologies than investment strategies represented by only greenfield subsidiaries. The hazard ratio indicates that the likelihood of introducing a new technology is 1.426 ($e^{0.355}$), or about 43 percent higher for combined investment strategies compared to investment strategies with only greenfield subsidiaries. Model 2 shows similar and, in addition, significant results, indicating a hazard ratio of 1.608 ($e^{0.475}$), or over 60 percent greater risk that investment strategies based on only acquired subsidiaries will develop new technology compared to locations represented by only greenfield subsidiaries. The combined results of Models 1 and 2 provide evidence that investment strategies based on only greenfield subsidiaries are less likely to generate entry into technologies that are new to the entire multinational group than are investment strategies represented by either both greenfield subsidiaries and acquired subsidiaries, or only acquired subsidiaries. Hypotheses 1 and 2 are therefore supported.

Model 3 tests Hypothesis 3, which postulated that investment strategies based on a combination of greenfield and acquired subsidiaries are less likely to generate entry into technologies that are new to the entire multinational group than are investment strategies represented only by acquired subsidiaries. As these types of investment strategies are comparatively few, the number of observations is significantly reduced from previous models.

The covariate representing the different strategies was not significant at the 5 percent level with a hazard ratio of 1.048 ($e^{0.047}$). Hypothesis 3 is therefore not supported, but as expected the coefficient is positive and an overall ratchet effect across the three investment strategies thus indicated.

Regarding covariates that control for characteristics of the advanced subsidiaries and their environment, industry dummies in six out of nine cases turned out negative estimates, but the effect was found to be significantly negative only for firms in the pharmaceuticals and chemicals group in Model 1. GDP was significant, showing a positive hazard ratio, or, in other words, that large markets increase the risk of entry into new technologies. The covariates controlling for period effects and age displayed non-significant coefficients throughout all models. The variable capturing cultural distance showed directional support for our predictions, although it was only significant in one of the models. All four models have a satisfactory explanatory power, with highly significant Wald test scores ranging from 46.6 to 60.1.

Table 3
Repeated events PWP models [a]

	Model 1		Model 2		Model 3	
Main covariates						
Strategy [b] (greenfield vs. combined)	0.355*	(0.177)				
Strategy [c] (greenfield vs. acquired)			0.475*	(0.208)		
Strategy [d] (combined vs. acquired)					0.047	(0.256)
Control variables						
Age	-0.005	(0.006)	0.003	(0.006)	0.017	(0.019)
GDP	0.317**	(0.061)	0.328**	(0.068)	0.317**	(0.062)
Period	-0.063	(0.053)	-0.071	(0.040)	0.166	(0.094)
Cultural distance	-0.288*	(0.146)	-0.249	(0.154)	-0.265	(0.146)
Industry dummies included	YES		YES		YES	
Diagnostics						
Number of annual observations	5952		5436		1223	
Number of events	398		258		173	
Wald test (d.f.) [e]	60.106** (8)		46.556** (8)		46.457** (8)	

[a] Robust (sandwich) standard errors in brackets. [b] Investment strategy coded 0=only greenfields, 1=both greenfields and acquisitions. [c] Investment strategy coded 0=only greenfields, 1=only acquisitions. [d]

Investment strategy coded 0=both greenfields and acquisitions, 1=only acquisitions. Estimates significant at the 0.05 and 0.01 levels are indicated with * and ** respectively. All tests are two-tailed.

Discussion

Earlier studies have explored the choice between greenfield and acquisition investment strategies (e.g., Caves & Mehra, 1986; Kogut & Singh, 1988; Hennart & Park, 1993; Cho & Padmanabhan, 1995; Andersen, 1997; Harzing, 2002; Larimo, 2003), and there is a fair amount of agreement on which major factors influence market entry choice. However, less emphasis has been placed on post-entry effects and developments, and relatively little is known about how different investment strategies influence overall MNC technological growth. The results of the present paper provide evidence that choosing between alternative investment strategies has a significant effect on the long-term ability of MNCs to upgrade their technological portfolios and sustain their competitive advantage.

The overall pace of entry into new technologies is found to be quite modest. In the average foreign location it takes almost 17 years (median 11) before any entry into technologies that are new to the multinational group occurs. In general, the development of advanced technological and strategic capabilities in foreign locations may therefore be characterized as a slowly evolving process (Blomkvist et al., 2010).

Tests of the three hypotheses confirm systematic and significant differences in the technological contribution from different strategies for developing operations in foreign locations. Specifically, in terms of advanced technological capabilities exclusive reliance on greenfield establishments is found to be least likely to contribute to overall MNC technological growth, whereas significantly higher risks of entry into new technologies apply to strategies involving either acquisitions or a combination of greenfield and acquired subsidiaries. Although hazard rates start at a relatively low level, strategies based on foreign acquisitions, either singularly or in combination with greenfield establishments, are 1.4-1.6 times more likely to

generate entry into new technologies than are strategies represented by only greenfield investments.

The observation that technological renewal through greenfield subsidiaries is comparatively cumbersome lends further support for the view that large and established firms are not the most fertile ground for exploring new technological options (Block & MacMillan, 1993; Dougherty & Hardy, 1996). Instead, they have to rely upon buying their way into new technological fields, in the case of MNCs by exploring developments taking place in the organization's periphery or outside its organizational boundaries (Regnér, 2003). The results may be indicative of an internal division of labor within the MNC, where in general greenfield subsidiaries are locked into and used for exploitation purposes, while foreign acquisitions take on a more explorative role in the multinational network.

One of the three hypotheses, which predicted that investment strategies based on a combination of greenfield and acquired subsidiaries would be less likely to generate entry into new technologies than strategies represented by only acquired subsidiaries, was not confirmed. One explanation for this result could be that the dynamics of mixed strategies is one of initial and gradual learning about the market, which ultimately builds confidence to undertake relatively significant acquisitions (whether to increase market shares or to acquire companies with interesting new technologies) that to a large extent counteracts the consolidating effects of competence-creating overlaps. Such developments would typically take place in the larger markets, where stakes are high and MNCs would avoid making substantial investments when market uncertainty is still high. This interpretation seems to gains some support from the fact that, among the present sample firms, strategies that combine greenfield and acquired subsidiaries tend to correlate positively with market size.

While results for two of the three hypotheses are significant, size of the local market is consistently significant across the models, providing evidence that larger economies offer

broader technological and business opportunities for local subsidiaries. In other words, when advanced foreign subsidiaries contribute to the technological and strategic renewal of the MNC, they tend to be found in the large economies (cf. Blomkvist et al., 2012). Taking a closer look at the investment strategies and the locations in which they occur, we find no major distinctions in terms of locational presence. The more fine-sliced data presented in Table 1 essentially rules out the idea that observed differences in the pace of entry into new technologies are driven primarily by distinctive associations between investment strategies and locational choices. Indeed, the data suggest that different investment strategies are used in the same locations depending on the investing company's aim of international expansion.

In light of the observed differences in technological contribution from greenfield and acquired subsidiaries, and the relatively common investment path from greenfields to a combination of greenfield and acquired subsidiaries, there is some evidence that in their investment strategies firms frequently follow a logic of sequential and add-on investments. It is more difficult to say whether such add-on investment strategies are driven by market expansion ambitions (which add accidental new technologies) or asset-seeking behavior. In either case, however, the results reinforce the notion that more significant contributions from advanced foreign subsidiaries to the MNC's overall technological portfolio are the result of relatively long-term and cumulative processes.

Looking at the other control variables included in the models, results for age are somewhat surprising, as it was expected that old subsidiaries would find more extensive opportunities to become involved in a diverse set of new technologies. However, this expectation could only be partially confirmed. Additional analyses provided a potential explanation for the observed results, as it was found that those subsidiaries that were added to the multinational groups during more recent times displayed more rapid entry into first, second, and third new technologies. In other words, because young foreign subsidiaries were generally associated with faster entry into

new technologies, perhaps in reflection of their occurrence in times of more modern management practices in the MNC (Doz & Prahalad, 1991), this effect outweighed the more incremental influence from gradually increasing embeddedness in local business environments.

Neither the control variables capturing changes over time in the general business environment nor industry classifications come out as consistently significant. Results for the individual industry dummies show that entry rates among foreign subsidiaries of firms in the automotive, processing, pharmaceutical and chemical industries are generally lower (the only significantly negative influence is found for the pharmaceutical and chemical industry dummy in Model 3). Taken together, our findings suggest that investment strategies and market conditions rule, regardless of subsidiary age, time period and industry. Although there are differences across industries in terms of R&D intensity and patenting behavior, among those factors investigated in the present study acquisition activity together with local market opportunities represent the main and most consistent engines for foreign entry into new technologies within the MNC.

Managerial Implications

Turning to managerial implications, it must be emphasized that higher rates of entry into new technologies and a broadened scope of the MNC's technological portfolio may not necessarily be seen as universally desirable. To the extent that internationalization and the broadening of technological capabilities are incidental to the primary objective of gaining local market share (Håkanson & Nobel, 1993; Bergek & Berggren, 2004), enlarged and possibly overlapping technological activities can translate into loss of strategic focus and costly duplication of research and development efforts. A related point would be that international expansion must strike a balance between exploitation and exploration purposes, and it is difficult to tell whether unequal rates of technological renewal among greenfield and acquired subsidiaries reflect planned and globally-optimized behavior among the sample firms.

But, if for any reason enhanced technological and strategic renewal through foreign operations is seen as desirable and necessary (Hedlund, 1986; Bartlett & Ghoshal, 1989; Doz & Prahalad, 1991), the results from the present study provide clear guidance for MNC managers—i.e., in the choice between greenfield subsidiaries and acquisitions, focus on acquisitions as the preferred strategy for entering and developing operations in foreign markets. The associated new technologies should then be nurtured to generate further growth or become part of re-combinations across dispersed subsidiaries in the multinational network (Van Looy et al., 2005; Garcia-Vega, 2006). Despite all the complications that may be associated with post-acquisition integration processes (Haspeslagh & Jemison, 1991), managers should realize that it is among foreign acquisitions that the potential effect on the MNC's technological capabilities is most substantial.

The observed differences in the effects of alternative investment strategies of course also reflect the fact that some foreign acquisitions are made with the explicit aim of accessing new technological capabilities (Dunning & Narula, 1995; Cantwell & Narula, 2001). In this way, entry into new technologies becomes partly endogenous to MNC and subsidiary development. Yet, there is evidence that traditional market-driven considerations have continued to play a major role in the internationalization of the MNC (Norburn & Schoenberg, 1994; Hamill & Castledine, 1996); in that case, highlighting the need for continuous managerial attention to those technological capabilities that are "accidentally" added to the MNC's portfolio (Ronstadt, 1978). To maximize technological contributions, management should make sure these new and accidental capabilities are not neglected or destroyed in the post-acquisition integration process.

On a more speculative note, the empirical observations appear to challenge established notions that shared norms, values, and a common corporate culture permit the MNC to achieve maximum cross-unit interaction and innovation output throughout the multinational network (cf. Hedlund, 1986; Bartlett & Ghoshal, 1989). Arguably, it would be easier to introduce common

norms, values, and culture among greenfield establishment than among foreign acquisitions, as in the case of greenfields technology transfer, and the initial use of expatriates in the establishment process would allow for a certain amount of up-front alignment of headquarters and subsidiary perspectives. In contrast, among acquired units the introduction of a common frame of reference would be a comparatively difficult and drawn-out process. If these assumptions are correct, integrative measures apparently have not been able to significantly outweigh the liability of foreignness and incremental processes that are characteristic of the development of greenfield subsidiaries. Alternatively, there may have been only limited attempts at creating shared norms, values, and culture in the examined MNCs, and if that is the case it would appear that modern management practices and their positive effects on cross-unit interaction and innovation are still to be more forcefully introduced.

Limitations

While, in all probability, the main tendencies observed in the present study also apply to other MNCs, particularly those originating from small and open economies, words of caution concerning the extent to which the results can be generalized are in place. The current sample is confined to Swedish MNCs with potentially idiosyncratic paths of internationalization and targets for foreign acquisitions, and corroboration of the results and proposed managerial implications will require the analysis of broader datasets. It should also be emphasized that the current paper focuses on the historical development of by now well-established MNCs, many of which have maintained operations in foreign markets for more than a century. The paper does not account for the development of MNCs of more recent date, specifically those that have emerged in the past few decades and on account of their rapid and sometimes unconventional internationalization processes have been referred to as international new ventures or born globals (e.g., Oviatt & McDougall, 1994; Madsen & Servais 1997).

Also, using the first year of observed patenting in the United States for determining when individual units entered the risk set of advanced foreign subsidiaries represents an approximation of original entry times, especially among the greenfield subsidiaries. While this may have affected results in terms of the time-varying covariates, the observed timing of subsequent entries into new technologies should nevertheless remain unbiased. Information from annual reports further suggested that restructuring of operations was relatively common among the sample firms, and one suspicion is that over time a number of acquired units were formally merged with already existing greenfield units. While it is very difficult to gauge and control for this effect, it suggests that potential differences between locations represented by greenfield and/or acquired subsidiaries would be biased downward. This would then strengthen the conclusion that real differences in technological contributions are indeed present among the foreign units of the sample firms.

It should also be emphasized that results at the chosen level of aggregation may conceal foreign subsidiaries' involvement in a large number of technological niches that are particularly important in the local business and technological environments. Hence, subsidiaries in a foreign location may not be recorded for a high number of entries into technologies that are new to the multinational group, yet they may produce continuous entries within more narrowly-defined fields of technology. Because a study at the level of classes of technology as defined by the U.S. Patent Office does not capture more incremental technological development, the temporal patterns of such minor advancements remain unknown. Yet, for the purposes of the present paper, the applied aggregation of classes of technology should strike a reasonable and useful balance between finer categorizations and more aggregate groups. Arguably, the applied level of aggregation also corresponds to the type of innovation considered by the extant literature on the technological and strategic renewal of the MNC (Hedlund, 1986; Bartlett & Ghoshal, 1989; Doz & Prahalad, 1991).

Finally, it should be noted that the present study captures only partial aspects of all research and development activities carried out in the MNC. By focusing on patentable inventions that also represent entry into previously unexplored fields of technology, the empirical material cannot reveal developments and relative positions with regard to more incremental technological advancements. Also, while patents may draw upon accumulated technological knowledge from a variety of sources, the study only to a limited extent captures technological advancements associated with the sample firms' involvement in technology acquisition, strategic alliances, and joint ventures. The empirical data include the patentable inventions that are produced by majority-owned investments (which may be seen as a form of joint ventures; Swan & Ettlie, 1997), but do not allow for a systematic analysis of the relative technological contributions made by joint ventures. With these limitations and shortcomings in mind, the paper nevertheless captures main tendencies in significant technological renewal in two important strategies for foreign market entry and penetration.

Concluding Remarks

This paper has explored the issue of technological growth in the MNC framed as a "horse race" between the effects of three investment strategies in foreign markets. Specifically, we have attempted to conceptualize and shed empirical light on whether investment strategies based on greenfield subsidiaries, acquired subsidiaries, or a combination of both increase the likelihood of entry into technologies that represent new additions to the MNC's technology portfolio.

The findings suggest that winners in the race for technological contributions and growth are the acquired subsidiaries, which are found to be significantly more likely to contribute to the technological and strategic renewal of the MNC than greenfield subsidiaries. Among the sample MNCs, strategies based on acquired subsidiaries, either singularly or in combination with greenfield establishments, are between 1.4-1.6 times more likely to generate entry into new

technologies than strategies represented by only greenfield subsidiaries. This observation suggests that managers involved in the technological and strategic renewal of the MNC, whether concerned with finding new growth opportunities in foreign locations or controlling the expansion of the corporate technology portfolio, should focus most of their attention on the development of acquired subsidiaries. Greenfield subsidiaries, it seems, lead a more restricted life in terms of their potential contribution to the technological and strategic development of the multinational group.

Appendix A

The sample of consolidated Swedish MNCs

Firm[a]	Principal field of industrial activity	Total number of locations at risk[b]
AGA (1904)[c]	Industrial gases	8
Alfa Laval (1878)	Separators, agricultural equipment	13
ASEA (1883)	Power generation and distribution equipment	15
Astra (1913)	Pharmaceuticals	18
Atlas Copco (1873)	Pneumatic and hydraulic equipment	13
Electrolux (1910)	White goods, home appliances	19
Ericsson (1876)	Telecommunication equipment	25
ESAB (1904)	Welding equipment	4
Fagersta (1873)	Metals, rock drills	1
MoDo (1873)	Pulp and paper	4
Perstorp (1880)	Chemicals, conglomerate	9
Pharmacia (1911)	Pharmaceuticals	14
PLM (1919)	Packaging material	3
Saab-Scania (1891)	Automotive products, aircraft	3
Sandvik (1862)	Specialty steel and metals, hard materials	22
SCA (1925)	Pulp and paper	10
SKF (1905)	Ball and roller bearings	13
Stora (1888)	Pulp and paper	4
Tetra Pak (1946)	Liquid packaging machinery	10
Trelleborg (1905)	Rubber products, conglomerate	6
Volvo (1915)	Automotive products, food	12

[a] Years within parentheses indicate the year of establishment.

[b] Being at risk means that any type of foreign subsidiary has shown the capacity to contribute significantly to the technological and strategic development of the multinational group by means of patenting, but these subsidiaries may or may not have been responsible for subsequent entries into new technologies. One location may be represented by more than one subsidiary (greenfield and/or acquired).

[c] AGA was acquired by Linde in 2000 and observations truncated in that year. Other sample firms with truncated observations include ASEA (1988, merged with Swiss Brown Boveri et Cie.), Alfa Laval (1993, acquired by Tetra Pak), Astra (1999, merged with Zeneca Group), ESAB (1994, acquired by Charter), MoDo (2000, acquired by Metsä), Perstorp (2001, acquired by Sydsvenska Kemi), Pharmacia (1990, merged with Kabi Vitrum), PLM (1999, acquired by Rexam), Scania (1990, car division acquired by GM), Stora (1998, merged with Enso), Tetra Pak (1993, acquired Alfa Laval), Volvo (1999, car division acquired by Ford).

Appendix B
Methodological notes

Patents as proof of advanced technological capabilities: Using the number of granted U.S. patents as proof of a subsidiary's capacity to contribute significantly to the technological and strategic development of the multinational group runs the risk of including units in the sample which only display serendipitous technological discoveries. It has not been possible to estimate the relative proportion of these units in the current sample, but only a very small number of the identified subsidiaries were responsible for only one patent over the entire period.

Identification of foreign subsidiaries and their patenting activities: The empirical analysis is based on the assumption that, over time, the sample firms have maintained one greenfield subsidiary per country (an assumption supported by the historical accounts and information on the international operations of the sample firms in annual reports), although in some cases individual greenfield investments may have included several legally separate entities. Each location may include one or more acquired subsidiaries. In those cases where the parent firm has been awarded a U.S. patent that has its origin in a foreign country, and the patenting records do not with certainty reveal the organizational identity of the unit performing the actual research, it is assumed that the underlying research was carried out by a greenfield rather than acquired subsidiary. Because acquiring parents tend to tread carefully in post-acquisition integration processes, it is expected that few of the patents generated by acquired units because of corporate patenting policies would end up in the parent's patent portfolio.

It is possible that over time some of the patenting by major acquired subsidiaries has become registered under the name of the parent firm rather than that of the acquired organizational unit, which would mean that the data picks up some of the technological activity of acquired units under that of greenfield units. While it is not possible to know the extent to which this has occurred in the present sample, the patenting records provide ample evidence of extensive patenting by major acquired subsidiaries long after the point of acquisition (these units retain a separate organizational code in the records of the U.S. Patent Office).

Period of investigation: Although the data covers the period 1893-2008, the majority of entries into new technologies were recorded after 1950. It should be expected that the reliability of the data improved over the measured time period, especially as for most firms the United States may have been perceived as relatively distant in the early 20th century (and hence not prioritized as a country in which patents were sought). It is notable, however, that the firm which accounts for most of the observed U.S. patents before the Second World War – Alfa Laval – established large-scale operations in the United States already in the late 19th century.

Other considerations: A number of considerations, such as adjustments for what may have been potential re-entries into technologies after substantial periods of inactivity, had minor effects on the construction of the final data set. More importantly, as the search for acquired foreign subsidiaries drew upon different and probably increasingly accurate sources of information, this may have increased the probability of picking up new technology entries by this particular group towards the end of the examined time period.

References

Ahuja, G.; Katila, R., 2001. Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal 22,* 197-220.

Allison, P.D., 1995. Survival Analysis Using the SAS System: A Practical Guide. The SAS Institute, Cary, NC.

Allison, P.D., 1996. Fixed-Effects Partial Likelihood for Repeated Events. *Sociological Methods & Research 25(2),* 207-222.

Almeida, P., 1996. Knowledge Sourcing by Foreign Multinationals: Patent Citation Analysis in the U.S. Semiconductor Industry. *Strategic Management Journal 17,* 155-165.

Almeida, P.; Phene, A., 2004. Subsidiaries and knowledge creation: the influence of the MNC and host country on innovation. *Strategic Management Journal 25,* 847-864.

Andersen, O., 1997. Internationalization and Market Entry Mode: A Review of Theories and Conceptual Frameworks. *Management International Review Special Issue (2),* 27-42.

Andersen, P.; Gill, R., 1982. Cox's Regression Model for Counting Processes: A Large Sample Study. *Annals of Statistics 10(4),* 1100-1120.

Andersson, U.; Forsgren, M.; Holm, U., 2001. Subsidiary Embeddedness and Competence Development in MNCs: A Multi-level Analysis. *Organization Studies 22(6),* 1013-1034.

Andersson, U.; Forsgren, M.; Holm, U., 2002. The strategic impact of external networks: subsidiary performance and competence development in the multinational corporation. *Strategic Management Journal 23,* 979-996.

Andersson, U.; Johanson, J.; Vahlne, J.-E., 1997. Organic Acquisitions in the Internationalization Process of the Business Firm. *Management International Review 37(2),* 67-84.

Archibugi, D.; Pianta, M., 1992. Specialization and size of technological activities in industrial countries: The analysis of patenting data. *Research Policy 21(1),* 79-93.

Aydemir, U.; Aydemir, S.; Dirschedl, P., 1999. Analysis of time-dependent covariates in failure time data. *Statistics in Medicine 18(16),* 2123-2134.

Bartlett, C.A.; Ghoshal, S., 1989. Managing Across Borders: The Transnational Solution. Harvard Business School Press, Boston, MA.

Beck, N.; Katz, J.N.; Tucker, R., 1998. Taking Time Seriously: Time-Series—Cross-Section Analysis with a Binary Dependent Variable. *American Journal of Political Science 42(4),* 1260-1288.

Belderbos, R., 2003. Entry mode, organizational learning, and R&D in foreign affiliates: evidence from Japanese firms. *Strategic Management Journal 24,* 235–259.

Benito, G.; Welch, L.S., 1994. Foreign market servicing: beyond choice of entry mode. *Journal of International Marketing 2(2),* 7-27.

Bergek, A.; Berggren, C., 2004. Technological internationalisation in the electro-technical industry: a cross-company comparison of patenting patterns 1986-2000. *Research Policy 33,* 1285-1306.

Bergek, A.; Bruzelius, M., 2008. Patents with multiple inventors from different countries: exploring two methodological issues through a case study. *Mimeo,* Linköping University.

Bertrand, O.; Zuniga, P., 2006. R&D and M&A: are cross-border M&As different? An investigation on OECD countries. *International Journal of Industrial Organization 24(2),* 401-423.

Birkinshaw, J., 1999. The determinants and consequences of subsidiary initiative in multinational corporations. *Entrepreneurship Theory and Practice 24(1),* 9-36.

Birkinshaw, J.; Hood, N., 1998. Multinational subsidiary evolution: capability and charter change in foreign-owned subsidiary companies. *Academy of Management Review 23(4),* 773-795.

Birkinshaw, J.; Lingblad, M., 2005. Intrafirm Competition and Charter Evolution in the Multibusiness Firm. *Organization Science 16(6)*, 674-686.

Block, Z.; MacMillan, I.C., 1993. Corporate Venturing: Creating New Businesses within the Firm. Harvard Business School Press, Boston.

Blomkvist, K.; Kappen, P.; Zander, I., 2010. Quo vadis? The entry into new technologies in advanced foreign subsidiaries of the multinational enterprise. *Journal of International Business Studies 41(9)*, 1525-1549.

Blomkvist, K.; Kappen, P.; Zander, I., 2012. Superstar Subsidiaries of the Multinational Corporation: In Search of Origins and Drivers, in: Andersson, M.; Johansson, B.; Karlsson, C.; Lööf, H. (Eds.), *Innovation and Growth: From R&D Strategies of Innovating Firms to Economy-wide Technological Change*. Oxford University Press, Oxford.

Box-Steffensmeier, J.M.; Zorn, C., 2002. Duration Models for Repeated Events. *The Journal of Politics 64(4)*, 1069-1094.

Brouthers, K.; Brouthers, L., 2001. Explaining the National Cultural Distance Paradox. *Journal of International Business Studies 32(1)*, 177-189.

Buckley, P.; Casson, M., 1998. Analyzing Foreign Market Entry Strategies: Extending the Internalization Approach. *Journal of International Business Studies 29(3)*, 539-561.

Burgelman, R., 1986. Managing corporate entrepreneurship: New structures for implementing technological innovation, in: Horwitch, M. (Ed.), *Technology in the Modern Corporation,*. Pergamon Press, New York.

Burt, R.S., 1987. Social contagion and innovation: cohesion versus structural equivalence. *American Journal of Sociology 92*, 1287–1335.

Cantwell, J., 1989. Technological Innovation and Multinational Corporations. Basil Blackwell, Oxford.

Cantwell, J., 1991. The International Agglomeration of R&D, in: Casson, M. (Ed.), *Global Research Strategy and International Competitiveness*. Basil Blackwell, Oxford.

Cantwell, J.; Mudambi, R., 2005. MNE Competence-Creating Subsidiary Mandates: An Empirical Investigation. *Strategic Management Journal 26,* 1109-1128.

Cantwell, J.; Mudambi, R., 2011. Physical attraction and the geography of knowledge sourcing in multinational enterprises. *Global Strategy Journal 1(3-4),* 206-232.

Cantwell, J.; Narula, R., 2001. The Eclectic Paradigm in the Global Economy. *International Journal of the Economics of Business 8(2),* 155-172.

Chang, S-J., Rosenzweig, P.M., 2001. The choice of entry mode in sequential foreign direct investment. *Strategic Management Journal 22(8),* 747-776.

Caves, R.E.; Mehra, S.K., 1986. Entry of foreign multinationals into U.S. manufacturing industries, in: Porter, M.E. (Ed.), *Competition in Global Industries.* Harvard Business School Press, Boston.

Chiesa, V., 1995. Globalizing R&D around centres of excellence. *Long Range Planning 28(6),* 19-28.

Cho, K.R.; Padmanabhan, P., 1995. Acquisition versus new venture: The choice of foreign establishment mode by Japanese firms. *Journal of International Management 1(3),* 255-285.

Delaney, E., 1998. Strategic Development of Multinational Subsidiaries in Ireland, in: Birkinshaw, J.; Hood, N. (Eds.), *Multinational Corporate Evolution and Subsidiary Development,*. MacMillan Press Ltd, Houndmills.

Dosi, G., 1982. Technological paradigms and technological trajectories. *Research Policy 11,* 147-162.

Dougherty, D.; Hardy, C., 1996. Sustained Product Innovation in Large, Mature Organizations: Overcoming Innovation-to-Organization Problems. *Academy of Management Journal 39(5),* 1120-1153.

Doz, Y.; Prahalad, C.K., 1991. Managing DMNCs: A Search for a New Paradigm. *Strategic Management Journal 12*, 145-164.

Drogendijk, R.; Slangen, A., 2006. Hofstede, Schwartz, or managerial perceptions? The effects of different cultural distance measures on establishment mode choices by multinational enterprises. *International Business Review 15,* 361-368.

Dunning, J.H., 1994. Multinational enterprises and the globalization of innovatory capacity. *Research Policy 23,* 67-88.

Dunning, J.H.; Narula, R., 1995. The R&D Activities of Foreign Firms in the United States. *International Studies of Management and Organization 25(1-2),* 39-74.

Ezell, M.E.; Land, K.C.; Cohen, L.E., 2003. Modeling Multiple Failure Time Data: A Survey of Variance-Corrected Proportional Hazard Models with Empirical Applications to Arrest Data. *Sociological Methodology 33,* 111-167.

Feinberg, S.E.; Gupta, A.K., 2004. Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries. *Strategic Management Journal 25,* 823-845.

Fischer, W.A.; Behrman, J.N., 1979. The Coordination of Foreign R&D Activities by Transnational Corporations. *Journal of International Business Studies 19(3),* 34.

Forsgren, M., 1989. Managing the Internationalization Process: The Swedish Case. Routledge, London.

Forsgren, M.; Yamin, M., 2006. Hymer's analysis of the multinational organization: Power retention and the demise of the federative MNE. *International Business Review 15(2),* 166-179.

Fritz, M.; Karlsson, B., 2006. SKF—A Global Story: 1907-2007. Roos Tryckerier AB,

Sundbyberg.

Frost, T.S., 2001. The geographic sources of foreign subsidiaries' innovations. *Strategic Management Journal 22*, 101-123.

Frost, T.S.; Birkinshaw, J.; Ensign, P., 2002. Centers of excellence in multinational corporations. *Strategic Management Journal 23,* 997-1018.

Garcia-Vega, M., 2006. Does technological diversification promote innovation? An empirical analysis for European firms. *Research Policy 35,* 230-246.

Gerybadze, A.; Reger, G., 1999. Globalization of R&D: recent changes in the management of innovation in transnational corporations. *Research Policy 28,* 251-274.

GGDC—Groningen Growth and Development Centre and the Conference Board (2008). *Total Economy Database*. October 2011.

Granstrand, O.; Sjölander, S., 1990. Managing innovation in multi-technology corporations. *Research Policy 19,* 35-60.

Granstrand, O.; Bohlin, E.; Oskarsson, C.; Sjöberg, N., 1992. External technology acquisitions in large multi-technology corporations. *R&D Management 22(2),* 111-113.

Hagedoorn, J.; Cloodt, M., 2003. Measuring innovative performance: is there an advantage in using multiple indicators? *Research Policy 32,* 1365-1379.

Hair Jr, J.F.; Anderson, R.E.; Tatham, R.L.; Black, W.C., 1998. Multivariate Data Analysis (5th edition). Prentice-Hall, Upper Saddle River, N.J.

Håkanson, L.; Nobel, R., 1993. Foreign research and development in Swedish multinationals. *Research Policy 22,* 373-396.

Hamel, G.; Prahalad, C.K., 1994. Competing for the Future. Harvard Business School Press.

Hamill, J.; Castledine, P., 1996. Foreign Acquisitions in the U.K.: Impact and Policy, in: Burton, F.; Yamin, M.; Young, S. (Eds.), *International Business and Europe in Transition.* St. Martin's Press, New York.

Harzing, A.-W., 2002. Acquisitions versus greenfield investments: International strategy and management of entry modes. *Strategic Management Journal 23(3),* 211 – 227.

Haspeslagh, P.C.; Jemison, D.B., 1991. Managing Acquisitions: Creating Value Through Corporate Renewal. The Free Press.

Hedlund, G., 1986. The hypermodern MNC - A heterarchy? *Human Resource Management 25(1),* 9-35.

Hedlund, G.; Ridderstråle, J., 1995. International development projects: Key to competitiveness, impossible, or mismanaged? *International Studies of Management and Organization 25(1-2),* 121-157.

Hennart, J.F.; Park, Y.R., 1993. Greenfield vs. Acquisition: The Strategy of Japanese Investors in the United States. *Management Science 39(9),* 1054-1070.

Hill, C.W.; Hwang, P.; Kim, W.C., 1990. An eclectic theory of the choice of international entry mode. *Strategic Management Journal 11(2),* 117-128.

Hitt, M.; Hoskisson, R.; Ireland, R.; Harrison, J., 1991. Effects of Acquisitions on R&D Inputs and Outputs. *Academy of Management Journal 34,* 693–706.

Hitt, M.; Hoskisson, R.; Johnson, R.; Moesel, D., 1996. The Market for Corporate Control and Firm Innovation. *Academy of Management Journal 39,* 1084–1119.

Hofstede, G., 2001. Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations (2nd edition). Sage, Thousand Oaks, CA.

Holm, U.; Pedersen, T., 2000 (Eds.). The Emergence and Impact of MNC Centres of Excellence. Macmillan Press, London.

Jaffe, A.B., 1986. Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits, and Market Value. *American Economic Review 76,* 984-1001.

Jaffe, A.B.; Trajtenberg, M.; Henderson, R., 1993. Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *Quarterly Journal of Economics 108(3),* 577-598.

Jiang, S.-T.; Landers, T.L.; Rhoads, T.R., 2006. Assessment of repairable-system reliability using proportional intensity models: a review. *IEEE Transactions on Reliability 55(2),* 328-336.

Johanson, J.; Vahlne, J.-E., 1977. The Internationalization Process of the Firm – A Model of Knowledge Development and Increasing Foreign Market Commitments. *Journal of International Business Studies 8(1),* 23-32.

Johanson, J.; Vahlne, J.-E., 2003. Business Relationship Learning and Commitment in the Internationalization Process. *Journal of International Entrepreneurship 1,* 83-101.

Kappen, P., 2011. Competence-creating overlaps and subsidiary technological evolution in the multinational corporation. *Research Policy 40(5),* 673-686.

Kelly, P.J.; Lim, L.L.-Y., 2000. Survival analysis for recurrent event data: an application to childhood infectious diseases. *Statistics in Medicine 19,* 13-33.

Kogut, B.; Singh, H., 1988. The Effect of National Culture on the Choice of Entry Mode. *Journal of International Business Studies 19(3),* 411–432.

Kogut, B.; Zander, U., 1992. Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science 3(3),* 383-397.

Kuemmerle, W., 1997. Building Effective R&D Capabilities Abroad. *Harvard Business Review, March-April,* 61-70.

Larimo, J., 2003. Foreign direct investment form of investment by Nordic firms in world markets. *Journal of Business Research 56(10),* 791-803.

Li, J., 1995. Foreign entry and survival: effects of strategic choices on performance in international markets. *Strategic Management Journal 16(5),* 333-351.

Luo, Y., 2002. Capability Exploitation and Building in a Foreign Market: Implications for Multinational Enterprises. *Organization Science 13(1),* 48-63.

Madsen, T.K.; Servais, P., 1997. The internationalization of born globals. *International Business Review 6(6),* 561-583.

Maskell, P.; Malmberg, A., 1999. Localised Learning and Industrial Competitiveness. *Cambridge Journal of Economics 23,* 167-185.

Mata, J.; Portugal, P., 2000. Closure and Divestiture by Foreign Entrants: The Impact of Entry and Post-Entry Strategies. *Strategic Management Journal 21(5),* 549-562.

Mudambi, R., 1998. The Role of Duration in Multinational Investment Strategies. *Journal of International Business Studies 29(2),* 239-62.

Mudambi, R.; Navarra, P., 2004. Is Knowledge Power? Knowledge Flows, Subsidiary Power and Rent-Seeking Within MNCs. *Journal of International Business Studies 35(5),* 385-406.

Norburn, D.; Schoenberg, R., 1994. European Cross-Border Acquisitions: How Was It For You? *Long Range Planning 27(4),* 25-34.

Oviatt, B.M.; McDougall, P.P., 1994. Toward a theory of international new ventures. *Journal of International Business Studies 25(1),* 45-64.

Papanastassiou, M.; Pearce, R.D., 1998. Individualism and Interdependence in the Technological Development of MNEs: The Strategic Positioning of R&D in Overseas Subsidiaries, in: Birkinshaw, J.; Hood, N. (Eds.), *Multinational Corporate Evolution and Subsidiary Development*. MacMillan Press Ltd, Houndmills.

Patel, P., 1995. Localized production of technology for global markets. *Cambridge Journal of Economics 19,* 141-153.

Patel, P.; Pavitt, K., 1991. Large Firms in the Production of the World's Technology: An Important Case of Non-Globalization. *Journal of International Business Studies 22(1),* 1-21.

Patel, P.; Pavitt, K., 1995. The localized creation of global technological advantage, in: Molero, J. (Ed.), *Technological Innovation, Multinational Corporations and New International Competitiveness – The Case of Intermediate Countries*. Harwood Academic Publishers.

Pavitt, K., 1988a. International patterns of technological accumulation, in: Hood, N.; Vahlne, J-E. (Eds.), *Strategies in Global Competition.* Croom Helm, London.

Pavitt, K., 1988b. Uses and Abuses of Patent Statistics, in: Van Raan, A.F.J. (Ed.), *Handbook of Quantitative Studies of Science and Technology.* Elsevier Science, North-Holland.

Pavitt, K.; Robson, M.; Townsend, J., 1989. Technological accumulation, diversification and organisation in UK companies, 1945-1983. *Management Science 35(1),* 81-99.

Pearce, R.D., 1989. The Internationalisation of Research and Development by Multinational Enterprises. MacMillan.

Pearce, R.D., 1994. The internationalization of research and development by multinational enterprises and the transfer sciences. *Empirica 21,* 297-311.

Pearce, R.D., 1999. Decentralized R&D and strategic competitiveness: globalized approaches to generation and use of technology in multinational enterprises (MNEs). *Research Policy 28*, 157-178.

Pearce, R.D.; Papanastassiou, M., 1999. Overseas R&D and the strategic evolution of MNEs: evidence from laboratories in the UK. *Research Policy 28,* 23-41.

Pearce, R.D.; Singh, S., 1992. Internationalization of Research and Development Among the World's Leading Enterprises: Survey Analysis of Organisation and Motivation, in: Granstrand, O.; Håkanson, L.; Sjölander, S. (Eds.), *Technology Management and International Business - Internationalization of R&D and Technology*. John Wiley & Sons, Chichester.

Porter, M.E., 1990. The Competitive Advantage of Nations, 2nd edition, 1998. The Free Press (MacMillan Business).

Prentice, R.; Williams, B.; Peterson, A., 1981. On the regression analysis of multivariate failure time data. *Biometrika 68(2),* 373-379.

Puranam, P.; Singh, H.; Zollo, M., 2006. Organizing for Innovation: Managing the Coordination-Autonomy Dilemma in Technology Acquisitions. *Academy of Management Journal 49(2),* 263-280.

Randoy, T.; Li, J., 1998. Global Resource Flows and MNE Network Integration, in: Birkinshaw, J.M.; Hood, N. (Eds.), *Multinational Corporate Evolution and Subsidiary Development*. MacMillan Press Ltd, Houndmills.

Reger, G., 2002. Internationalisation of research and development in Western European, Japanese and North American multinationals. *International Journal of Entrepreneurship and Innovation Management 2(2/3),* 164-185.

Regnér, P., 2003. Strategy Creation in the Periphery: Inductive Versus Deductive Strategy Making. *Journal of Management Studies 40(1),* 57-82.

Ronen, S.; Shenkar, O., 1985. Clustering Countries on Attitudinal Dimensions: A Review and Synthesis. *Academy of Management Review 10,* 435-454.

Ronstadt, R.C., 1978. International R&D: The Establishment and Evolution of Research and Development Abroad by Seven U.S. Multinationals. *Journal of International Business Studies 9(1),* 7-24.

Rugman, A.; Verbeke, A., 2001. Subsidiary-specific advantages in multinational enterprises. *Strategic Management Journal 22,* 237-250.

Schmookler, J., 1950. The Interpretation of Patent Statistics. *Journal of the Patent Office Society 32(2),* 123-146.

Schwartz, S., 1994. Beyond Individualism/Collectivism: New Cultural Dimensions of Values, in: Kim, U.; Triandis, H.; Kagitcibasi, C.; Choi, S.; Yoon, G. (Eds.), *Individualism and Collectivism: Theory, Methods, and Applications*. Sage, Thousand Oaks, CA.

Serapio, M.; Dalton, D., 1999. Globalization of Industrial R&D: An Examination of FDI in R&D in the US. *Research Policy 28,* 303–316.

Sharma, V.M.; Erramilli, M.K., 2004. Resource-Based Explanation of Entry Mode Choice. *Journal of Marketing Theory and Practice 12(1),* 1-18.

Singh, J., 2007. Asymmetry of knowledge spillovers between MNCs and host country firms. *Journal of International Business Studies 38,* 764-786.

Swan, P.F.; Ettlie, J.E., 1997. U.S.-Japanese Manufacturing Equity Relationships. *Academy of Management Journal 40(2),* 462-479.

Taggart, J.H., 1996. Multinational manufacturing subsidiaries in Scotland: Strategic role and economic impact. *International Business Review 5(5),* 447-468.

Tan, D., 2009. Foreign market entry strategies and post-entry growth: acquisitions vs greenfield investments. *Journal of International Business Studies 40,* 1046-1061.

Therneau, T.M.; Hamilton, S.A., 1997. rhDNase as an example of recurrent event analysis. *Statistical Medicine 16,* 2029-2047.

UNCTAD, 2005. World Investment Report—Transnational Corporations and the Internationalization of R&D. United Nations, New York and Geneva.

Van Looy, B.; Martens, T.; Debackere, K., 2005. Organizing for Continuous Innovation: On the Sustainability of Ambidextrous Organizations. *Creativity and Innovation Management Journal 14(3),* 208-221.

Vermeulen, F.; Barkema, H., 2001. Learning Through Acquisitions. *Academy of Management Journal 44(3),* 457-476.

Wallmark, T.; McQueen, D., 1986. *100 viktiga innovationer under tiden 1945-1980* [100 important innovations in the period 1945-1980]. Studentlitteratur.

Zaheer, S., 1995. Overcoming the Liability of Foreignness. *Academy of Management Journal 38(2),* 341-363.

Zaheer, S.; Mosakowski, E., 1997. The Dynamics of the Liability of Foreignness: A Global Study of Survival in Financial Services. *Strategic Management Journal 18(6)*, 439-463.

Zander, I., 1999. Whereto the multinational? The evolution of technological capabilities in the multinational network. *International Business Review 8(3)*, 261-291.

Zander, I., 2002. The formation of international innovation networks in the multinational corporation – an evolutionary perspective. *Industrial and Corporate Change 11(2)*, 327-353.

Biographies

Katarina Blomkvist is an assistant professor of International Business at the Department of Business Studies, Uppsala University. Her main research interest is the development and transfer of knowledge and technology within MNEs, with a specific focus on the evolution of subsidiary technological capabilities and the drivers of innovation. Born in Stockholm and a Swedish citizen, she received her PhD from Uppsala University. E-mail: katarina.blomkvist@fek.uu.se

Philip Kappen is an associate professor of Strategic and International Management at the Department of Strategic Management and Globalization, Copenhagen Business School. His research focuses on subsidiary evolution and the role of headquarters in MNEs, as well as the management of innovation. Born in Uppsala and a Swedish citizen, he received his PhD from Uppsala University. E-mail: pk.smg@cbs.dk

Ivo Zander received his PhD from the Institute of International Business, Stockholm School of Economics. He currently holds the Anders Wall Chair of Entrepreneurship at the Department of Business Studies, Uppsala University. His research focuses on the technological evolution of foreign subsidiaries of the MNE, the entrepreneurial dynamics of internationalization, and corporate entrepreneurship. Born in Stockholm, he is a citizen of Sweden. E-mail: ivo.zander@fek.uu.se