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THE PERSISTENCE OF DISTANCE? THE IMPACT OF TECHNOLOGY ON MNE MOTIVATIONS FOR FOREIGN INVESTMENT

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Why do firms go abroad when technology makes it possible to do business at a distance? We argue that the cost of distance differentially affects investment motivations across industries. We find support for this hypothesis in a study of U.S. inward and outward FDI. Knowledge seeking and efficiency seeking are the two most important explanations for international activity in information-intensive industries, reinforcing the value of intangible resources in this sphere. In less information-intensive industries, market seeking and the search for low-cost export platforms are the dominant motivations for FDI. An important implication for the current debate on offshoring is that inward FDI flows into the United States occur in high- rather than low-paying industries, and are of the knowledge-seeking variety, while outward flows are driven by the search for efficiency and markets. Copyright © 2005 John Wiley & Sons, Ltd.

Distance, broadly defined to encompass geographic, cultural, economic, and administrative dimensions (Ghemawat, 2001), is fundamental in international business theory, and implicitly or explicitly occupies a central position in all its subfields. It is implicit in Hymer's discussion of the distinctive international aspect of the MNE (Hymer, 1960), as well as in Buckley and Casson's conceptualization of the MNE as a means to internalize markets across national boundaries (Buckley and Casson, 1976). It is also at the center of more recent conceptualizations of the MNE as a mechanism for the transfer of knowledge over distance (Kogut and Zander, 1993). In one way or another, these theories explain the existence of the MNE, and its distinctiveness as an organizational form (Ghoshal and Westney, 1993), with reference to the challenges and opportunities it faces as a result of distance.

Changes in the costs of distance are thus bound to have profound implications for the understanding of the MNE. Technology eliminates some of the challenges posed by distance and diminishes the costs of others. In this, technology frees firms from some of the constraints of distance, and enables them to access resources and customers remotely, without having local presence. Technology also opens up new opportunities to create value over distance (Zaheer and Manrakhan, 2001, Zaheer and Zaheer, 2001; Nachum, 2003). These changes may modify the entire rationale for investing overseas, and indeed for the existence of MNEs.

In this paper, we examine how variation in the costs of distance, caused by technological developments, affect one aspect of international activity: the rationale for foreign investment. We seek to

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explain why, when technology has made it possible to do business at a distance, firms continue to invest overseas. Even firms that produce and sell nothing physical locate activities overseas. Amazon.com, eBay, and AOL have declared that at the top of their agenda is international expansion and significantly increasing their overseas earnings (*Business Week*, 2000b; *Financial Times*, 2001). These firms have indeed established substantial physical presence abroad. For example, recently eBay acquired EachNet, the most popular online auction company in China, and Baazee.com, an online auctions firm in India (Amit, 2004). What is the rationale for such moves? And how do the lowered costs of distance, brought about by information technology, affect the motivations of firms to invest overseas?

Understanding *why* firms go overseas is critical because the rationale for foreign investment largely underlies the very nature of MNEs and their behavior. This question is not only important theoretically, but also has critical implications for practice. Different motivations for going abroad require different strategies, and are associated with different capabilities. They also necessitate corresponding organizational structures and processes and different managerial skills. An explicit understanding of the rationale for firms' foreign investments is necessary also to propose adequate policy responses (Farrell, Remes, and Schultz, 2004). Investment driven by different motivations is associated with different benefits and costs for the countries involved and requires different policy responses.

With motivations being of such critical importance, for both theory and practice, it is important to understand what may drive changes in them. If the low costs of distance have implications for investment motivations, there is a need to understand this effect and its direction. The use of information technology has been growing rapidly in all industries, and is altering the global configuration of value-added activities (Quinn, 1992; *Business Week*, 2004), and is likely also to affect investment motivations. The nature of this impact is the central issue we address in this paper.

We begin by discussing how the lowered costs of distance, brought about by information technology, might affect the motivations of firms to go overseas. In this discussion, we combine insights from international business theory on the rationale for foreign investment (Behrman, 1974; Flowers, 1976; Dunning, 1993; Graham, 1998; Chung and Alcacer, 2002; Wesson, 2004), with recent developments in theories of market transformation resulting from information technology (e.g., Garud and Kumaraswamy, 1993; Christensen, Suarez, and Utterback, 1998; Sampler, 1998; Brynjolfsson and Kahin, 1999; McKnight, 2002). We develop hypotheses that specify the impact of technology on investment motivations, and test them on U.S. inward and outward foreign direct investment (FDI) data from 1990 to 1998, contrasting a group of information-intensive industries with a group of less information-intensive industries. We find differences between the motivations of MNEs to invest overseas in high and low information-intensive industries, and between investment flowing into the United States and investment from the United States. These findings show that technology differently influences the strategic implications of distance across industries. Different investment motivations display varying sensitivity to the costs of distance. In particular, we find the knowledge-seeking motivation for foreign investment to be unaffected by lower costs of distance, while efficiency-seeking investment is highly sensitive to it. We stress the need to examine MNE motivations in order to understand their behavior, and suggest that motivations or intent might even be fundamental to the creation of ownership advantages. This study also brings the motivations of MNEs to the fore in a field that, in its focus on the possession of firm-specific advantages, has tended to pay less attention to strategic intent.

MOTIVATIONS FOR FDI IN INFORMATION-INTENSIVE INDUSTRIES: THEORY AND HYPOTHESES

FDI theorists have long recognized that firms invest overseas for different reasons (Farmer and Richman, 1966; Behrman, 1969). Traditional conceptualizations, essentially formulated with reference to firms producing and selling physical products, in a world in which the possession of tangible assets was a major source of value creation, focused on the need to access physical assets and markets, and to cut costs, as major drivers of foreign expansion (Behrman, 1974; Dunning, 1993).

In response to changes in the internal organization of MNEs (Nohria and Ghoshal, 1997) and the growing prevalence of global integration and vertical investments (Caves, 1996), interest in the field broadened to include efficiency-seeking investments (Kobrin, 1991). With the growing importance of knowledge as the fundamental rationale for the existence of MNEs (Kogut and Zander, 1993), the search for knowledge is now recognized as a major driver of FDI as well (Kuemmerle, 1999; Chung and Alcacer, 2002; Wesson, 2004). Other researchers have acknowledged that while these motivations are internal to MNEs, under certain circumstances investment decisions are driven by external competitive pressure (Knickerbocker, 1973; Flowers, 1976; Graham, 1998). Drawing on these bodies of theory, we confine our analysis to the following as the major investment motivations identified in the literature: market seeking; resource seeking; export seeking; efficiency seeking; knowledge seeking; and competitive strategic motivation.

Technological advances reduce the cost of distance (Cairncross, 1997; O'Brien, 1992), create new ways to create value, and may change the motivations of cross-border activities. Information technology reduces the costs of transaction and coordination over distance and thus opens up a range of new possibilities for interaction over distance, both between subunits of the same MNE, and between MNEs and the market (Roche and Blaine, 2000; Brynjolfsson and Kahin, 1999; Bakos, 1998). By enabling remote access to resources, employees, and customers, information technology weakens the link that has traditionally been assumed to exist between physical location and value creation (e.g., Dunning, 1993). This dissociation of physical location from value creation could affect many of the motivations for undertaking FDI, notably access to immobile resources or cost minimization (Zaheer and Manrakhan, 2001, Zaheer and Zaheer, 2001). Information technology may also introduce new ways by which firms can create and capture value across borders, such as increasing specialization, capitalizing on the advantages of different locations, or introducing new ways of interaction over distance with suppliers and customers. It may also open up new possibilities to capture value across traditional industry boundaries (Bresser, Heuskel, and Nixon, 2000).

These effects of information technology may create different drivers for foreign investment in information-intensive industries. In what follows we hypothesize the extent to which the major motivations identified in the literature are likely to drive FDI in high information-intensity industries, using low information-intensity industries as a control group.

Market seeking

Market-seeking investment is undertaken in order to serve particular markets by local production and distribution, rather than by exporting from the home country or from a third country. Several major reasons are recognized in the literature as driving this type of investment, all of them having to do with market failure of one kind or another. The first of these is the imposition by host governments of a variety of import barriers on foreign-made goods and services, which raise the costs of servicing a particular market via exports. Although governments increasingly attempt to regulate business activity in information-intensive industries, at least until now, they have been subject to fewer trade restrictions (Kobrin, 1998). Hence, there has been little market failure caused by government intervention in information-intensive industries.

Another factor driving market-seeking investment is the reduction of transaction costs, primarily those arising from transportation. Such an impetus applies to products that are costly to transport. The negligible cost of transfer over distance of information-intensive products excludes the need for foreign local presence for this reason.

Further, market-seeking investment is often driven by the need for proximity to actual and potential customers in order to be aware of and be able to better meet their specific tastes and needs. In many cases, if foreign firms do not familiarize themselves with the local language, business customs, legal requirements, and marketing procedures, they might find themselves at a disadvantage *vis-à-vis* local firms. By reducing the costs of communicating with and learning about customers, information technology could diminish the need for local presence and provide MNEs with alternative routes to developing customer knowledge, which do not require local presence. For example, dot.com firms are using the information gathered on their websites to gain better knowledge of their customers than perhaps even geographic proximity may provide (Zaheer and Manrakhan, 2001). Exploiting the technologies of data mining and

analysis, MNEs operating in information-intensive industries may be in a position to understand patterns of behavior and customer preferences without being locally present.

Information technology not only reduces the need for local presence, it might also increase the advantages of centralized service provision. For example, it enables MNEs to offer round-the-clock service, taking advantage of different time zones in different parts of the world (Roche and Blaine, 2000; Zaheer, 2000).

Apart from the technological possibility of accessing consumers remotely, which reduces the need for market seeking investment, there is some evidence that consumer preferences and needs are becoming similar, at least within certain geographic areas. For example, a survey of respondents from 12 Western European and North American countries found that similar site characteristics affect the online purchasing behavior of customers within these regions (Lynch and Beck, 2001). Furthermore, standards for many information-intensive products are increasingly being developed on a global, rather than a local, basis (Christensen *et al*., 1998; Katz and Shapiro, 1994), eliminating the need for local adaptation in order to serve particular customers effectively. These arguments lead us to suggest that:

Hypothesis 1: Market seeking is a weaker motivation for FDI in highly information-intensive industries.

Resource seeking

The resource-seeking motivation is driven by a need to access resources not available in the home countries of the investing firms, or available at higher costs than could be obtained in other locations. Cost minimization considerations and the need to secure sources of supply are the major drivers of this investment motivation. A fundamental assumption underlying the conceptualization of the resource-seeking motivation has been the immobility of the resources sought (Behrman, 1974; Dunning, 1993). If a resource can be transported over distance at low costs it might be more economic to import it than to establish foreign operations in order to access it. Hence, this motivation was influential primarily with reference to physical, tangible resources, which are immobile and costly to transport.

Such considerations are a lesser imperative for undertaking investment in information-intensive industries than in traditional ones. Hence we would expect that investment driven by the need to access resources would have limited, if any, impact on FDI in information-intensive industries. Formally:

Hypothesis 2: Resource seeking is a weaker motivation for FDI in highly information-intensive industries.

Export seeking

Export-seeking investment, that is, locating production overseas in order to serve a third market, is undertaken by firms seeking to lower production and transportation costs. It is essentially an investment driven by cost considerations. For several reasons, this cost-based rationale is less important in highly information-intensive industries. For one, the race to become the dominant standard and capture increasing returns to scale (Arthur, 1994) is a critical aspect of competition in such industries, and costs play a secondary role. Further, as a result of specific characteristics of these industries, such as network effects and high switching costs, there is perhaps a tendency for these industries to converge toward a monopolistic structure, which again leads to costs playing a limited role.

Third, a major factor influencing the cost-cutting intention underlying the export-seeking motivation is transportation costs (hence, firms seeking export platforms often locate in proximity to their markets). The low cost at which many information-intensive products can be transferred over distance reduces the need to engage in foreign activities for this reason. Formally:

Hypothesis 3: Export seeking is a weaker motivation for FDI in highly information-intensive industries.

Efficiency seeking

Efficiency-seeking investment is driven by the intention to spread value-adding activities geographically in order to take advantage of differences in the availability and cost of factor endowments in different countries. Essentially this is a decision by the MNE on how best to configure its activities internally, in line with the comparative advantage of different locations (Zaheer and

Manrakhan, 2001), in order to maximize efficiency and reduce costs. This decision is dependent on the balance between the advantages to be gained by spreading value-added activities in various locations and the cost of communication and coordination over distance, including transportation costs (Aarland *et al*., 2003). The spread of activity geographically involves a great deal of coordination and knowledge transfer, which for reasons of market failure of various kinds is better done internally than externally (Kogut and Zander, 1993).

By reducing the costs of distance and thereby reducing the costs of transactions between subunits of the same firm, information technology increases the potential for local specialization of value-adding activity (Zaheer and Manrakhan, 2001; Roche and Blaine, 2000). It enables MNEs in information-intensive industries to take advantage of differences in country costs and skills to a greater degree than firms in traditional industries can. Both inputs and outputs of information-intensive activities can be transferred rapidly and reliably at negligible cost between distant locations, enabling firms to coordinate and control their geographically dispersed activities more effectively. Affiliates located in different parts of the globe can thus collaborate to produce entire product lines economically (Maznevski and Chudoba, 2000).

By spurring the introduction of global technical standards, and by its tendency to merge into one dominant technology worldwide (Katz and Shapiro, 1994), information technology also increases the benefits of centralization of a single activity in one location, while capitalizing on the advantages of many locations at the same time. It thus increases the potential for exploiting scale economies resulting from the concentration of a particular economic activity in certain locations, and for exploiting scope economies resulting from coordination across concentrated activities in different countries. Hence:

> *Hypothesis 4: Efficiency seeking is a stronger motivation for FDI in highly information-intensive industries.*

Knowledge seeking

Knowledge-seeking investment is driven by firms' needs to access complementary resources, notably various kinds of knowledge, in order to upgrade their own capabilities (Kuemmerle, 1999; Chung and Alcacer, 2002; Wesson, 2004). While traditional investment motivations were based on the intention of firms to exploit their firm-specific advantages overseas (Hymer, 1960), knowledge-seeking investment is undertaken in order to develop new advantages and to upgrade existing ones.

In information-intensive industries, various kinds of knowledge, both tacit and codified, replace physical assets as the most critical resources. The tacit elements of this knowledge (Martin and Salomon, 2003) are often embedded in individuals or in teams, and in clusters of firms, which in their close interaction create local dynamics of collective learning and innovation (Scott, 1998), making these knowledge resources immobile and inaccessible from a distance.

Improvements in communication technology have not eliminated the need for geographic proximity to access these types of knowledge and expertise (Leamer and Storper, 2001). Substantial research suggests that these changes have not eradicated the need for geographic proximity, as a requisite for benefiting from knowledge spillovers and collective learning (e.g., Best, 2000; King, Silk, and Ketelhohn, 2003). The very tacitness of the knowledge creates conditions for market failure and increases the difficulties of arm's-length interactions. As these types of knowledge play more critical roles in the production of information-intensive products, we would expect them to drive the investment activities of information-intensive firms to a greater degree than those of their traditional counterparts. Hence:

> *Hypothesis 5: Knowledge seeking is a stronger motivation for FDI in highly information-intensive industries.*

Competitive strategic motivations (oligopolistic reaction)

In addition to the previous motivations, which were driven essentially by internal strategic considerations, firms often invest overseas on account of competitive pressures of various kinds, i.e., in reaction to competitors' actions, or as preemption to advance the firm's competitive position *vis-à-vis* its major competitors (Knickerbocker, 1973; Flowers, 1976; Graham, 1998).

Such competitive pressures are likely to influence firms in information-intensive industries more

than those operating in more traditional industries, because imitating competitors as a driver for international expansion is more likely in environments subject to rapid change and modification of the rules of the game (Martin, Swaminathan, and Mitchell, 1998). Indeed, the competitive reaction hypothesis as a driver of FDI was formulated with specific reference to highly innovative industries, where rapid technological changes introduce a high degree of uncertainty and risk (Knickerbocker, 1973; Flowers, 1976). Head, Mayer, and Ries (2002) show that uncertainty and risk aversion are major drivers of oligopolistic reaction, and that oligopolistic reactions are more likely in the presence of uncertainty. These market attributes are more apparent in rapidly changing information-intensive industries than in relatively stable and mature traditional industries.

These theoretical arguments are consistent with casual observations of the international expansion of firms operating in information-intensive industries. For example, major U.S. Internet firms have expanded overseas simultaneously, often investing in the same regions and countries (*Business Week*, 2000a). Formally:

> *Hypothesis 6a: Competitive pressure is a stronger motivation for FDI in highly information-intensive industries.*

It is likely that a non-linear relationship better describes the effect of competitive pressure on firms' international expansion (Martin *et al*., 1998; Haveman, 1993). Up to a point, the international moves of competitors indicate market attractiveness and provide legitimacy (Hannan and Carroll, 1992), but there is a constraint on the number of firms that can expect to imitate industry pioneers successfully. As the number of competitors that invest in a foreign country increases, the level of competition among these firms increases, causing the costs of international entry to rise and the gain from operating in a foreign location to decline (Mitchell, Shaver, and Yeung, 1994). A number of empirical studies have found that foreign entry by domestic competitors conforms to these theoretical arguments, with the number of new entrants first increasing and then decreasing as more domestic competitors expand (Yu and Ito, 1988; Martin *et al*., 1998).

The nature of many information-intensive markets is such that they have a natural tendency for highly concentrated industrial structures (Bakos, 1998). Under such circumstances, both the need to follow competitors' moves and the crowding effect that acts to decrease the attractiveness of markets as the number of competitors increases are likely to be stronger. Formally:

> *Hypothesis 6b: The inverted U relationship between competitive pressure and FDI will be stronger in highly information-intensive industries.*

DATA AND METHODS

To test the hypotheses, we used time-series, cross-sectional data on U.S. FDI, collected by the Bureau of Economic Analysis. The time range of the data is 1990–98. Significant FDI activity in many of the information-intensive industries had only started in the late 1980s and early 1990s, and therefore we start the analysis in this period. We use both inward FDI, that is, investment by non-U.S. firms in the United States, as well as outward FDI, i.e., investment by U.S. MNEs overseas. The application of the analysis to both inward and outward FDI increases its generalizability and the validity of the findings.

For reasons of data availability, majority-owned (i.e., more than 50% owned) non-bank affiliates of non-bank parents data are used for the analysis of outward FDI; non-bank affiliates data (that is, more than 10% foreign ownership) are used for the inward FDI analysis. Although this difference implies that the results are not fully comparable, the differences between the two categories are small. For example, in the 1997 Benchmark Survey, there were 2,690 parents of all non-bank foreign affiliates and 2,549 parents of majority-owned non-bank foreign affiliates. The combined number of observations (i.e., the final N) is 270 for inward and outward FDI, that is, 30 industries observed over 9 years.

Selection of industries

The selection of specific industries for the analysis, that is, the identification of information-intensive industries, and the distinction between high and low information-intensive industries is a difficult task for two major reasons. First, all industries have some level of information intensity, albeit to

different degrees, and it is difficult to split them neatly. Common industrial classifications further complicate this task as they often group traditional products with information-intensive products. For example, the category 'computer and office equipment' includes not only computers and peripherals, but also typewriters, cash registers, and simple accounting machines.

The second reason is associated with the difficulty of defining industries and drawing boundaries between them. By creating new forms of interactions between and across firms (McKnight, 2002), information technologies enable greater levels of specialization in skills that cut across traditional industrial boundaries (Bresser *et al*., 2000). Amazon.com's distribution of books, CDs, video cassettes, software and the like, items traditionally belonging to separate industries, is an example of the erosion of traditional industrial boundaries.

In order to distinguish between industries that are high and low on information intensity, we used the investment in information and communication technology (ICT) in an industry.[1] Rather than relying on commonly accepted classifications (such as 'high-tech' and 'low-tech'), which are often based on subjective judgment, our classification is thus based on an objective measure of technology intensity. Hence, the problems of defining industry boundaries discussed above are less of an issue in this study. The use of ICT as a classification criterion has support in extant research. For instance, it is regarded as the most appropriate criterion to draw a dividing line between more and less information-intensive industries by the OECD (OECD, 2000).

ICT intensity is measured as the cumulated volume of investment in ICT between 1990 and 1999. This approach has been used by Loveman (1994) and by Brynjolfsson and Hitt (1995), and is considered to provide an accurate picture of the current position since it is less sensitive to the bias of depreciation in the value of equipment. Because the results could potentially be sensitive to the assumed life of ICT equipment, we conducted the analysis while varying this assumption from 3 to 10 years, and found no significant differences in the final ranking of industries. To adjust for industry size, we expressed this measure as a share of the total accumulated investment in an industry over the same period.

As the analysis focuses on U.S. FDI, we rely on U.S. data (collected by the Bureau of Economic Analysis) for the level of ICT investment in industries. After excluding industries in which there is no FDI activity (e.g., personal services, Federal Reserve banks, housing, agriculture), we were left with 87 industries from which we selected the top and bottom 15 for a total of 30 industries. The 15 industries with the highest ratios of ICT investment to total investment were representative of highly information-intensive industries. The 15 industries with the lowest such values were selected as a control group. The Appendix lists the industries included in these two groups.

The choice of industry data for a study of this kind may require a few words of explanation. Investment motivations are essentially a firm-level decision and may call for a firm level of analysis. However, we feel that the lack of good firm-level data on this issue is not as major a concern in this study. While firm-level data clearly have some advantages if the research question involves intra-industry heterogeneity, there are advantages to industry-level data when the research question applies to industry-level variation. Industry data enable us to focus just on the characteristics of the technology at the industry level. Essentially, by using industry data we assume that the industry averages correspond to a 'representative' firm in the industry.

Measures of investment motivations: operation of the constructs

Market seeking (Hypothesis 1)

The cost of sales of affiliates as a share of total costs is used as an indicator of the extent of marketing and sales efforts directed to local markets. Another possible operationalization, which directly measures the magnitude of activity directed towards the local market, is the local sales of affiliates. Such data are not available for inward FDI and we select the cost-based operationalization to increase comparability between the inward and outward analyses. In the outward data, these two measures were highly correlated (0.91, $p < 0.01$), which suggests that the cost-based measure is a reasonable operationalization of the market-seeking motivation.

[1] ICT investment is defined by the source of our data as including mainframe and personal computers, storage devices, integrated systems, software, other office equipment, communication equipment, photocopy and related equipment, and instruments.

Resource seeking (Hypothesis 2)

Resource seeking is operationalized as local purchases by affiliates as a share of total costs. High shares of local purchases imply heavy reliance on the host economy for the acquisition of various resources.

Export seeking (Hypothesis 3)

Export seeking is operationalized as

$$\frac{\text{Total exports by affiliates} - (\text{Exports to parents} + \text{Exports to other affiliated bodies})}{\text{Total sales of affiliates}}$$

This is a measure of the export propensity of affiliates. It captures the exports of affiliates to unrelated bodies, and is thus distinguished from intra-firm transactions that were used to operationalize the efficiency-seeking motivation.

Efficiency seeking (Hypothesis 4)

The magnitude of intra-firm transactions is used to operationalize the efficiency-seeking motivation, as it indicates the intensity of internal linkages within the MNE (Kobrin, 1991). Large transfers indicate joint production by various parts of the MNE, which are spread geographically. We use a variation of Kobrin's index of integration (Kobrin, 1991), as follows:[2]

$$\frac{\text{Sales of affiliates to parents} + \text{Sales of affiliates to other affiliated bodies} + \text{Sales of parents to affiliates}}{\text{Total sales of affiliates}}$$

Intra-firm transaction data are biased on several grounds (see Kobrin, 1991 for a discussion), the most important of which is transfer pricing, a caveat that has to be borne in mind when interpreting the findings.

Knowledge seeking (Hypothesis 5)

Knowledge seeing is operationalized by two measures:

1. The level of compensation per employee. High pay levels indicate reliance on highly skilled employees. Wages paid by foreign affiliates have often been used as indications of the employment of skilled labor in foreign countries (e.g., Lall, 1980). We used the average compensation per employee across all countries.
2. R&D intensity, measured by R&D investment by affiliates as a share of sales. The R&D intensity of affiliates is often used as an operationalization of an MNE's search for sources of knowledge in foreign countries (e.g., Kuemmerle, 1999; Belderbos, 2003).

Competitive strategic motivation (oligopolistic reaction) (Hypothesis 6)

The number of foreign entrants in an industry is usually used as a measure of competitive pressure to expand overseas (e.g., Martin *et al*., 1998; Yu and Ito, 1988; Flowers, 1976). Following these studies, we use the number of new affiliates entering foreign markets each year, expressed as a share of the total number of affiliates in an industry. The higher the value, that is, the more rapid the growth of foreign activity, the greater is the need of an individual MNE to follow the trend in the industry and invest overseas. This measure is expressed in both linear and quadratic forms, to account for the hypothesized non-linear impact of the number of previous entrants on an MNE's international expansion.

Data availability introduces differences in the measurement of this motivation between inward and outward FDI. For outward FDI we use the growth in the number of U.S. affiliates overseas, and we thus operationalize the competitive pressure from home country competitors. An equivalent measure for inward FDI is not easily available and we use instead the growth in the number of all foreign affiliates entering the United States. In this case we actually measure global industry pressure.

The model

In order to test the hypotheses, we constructed a model connecting FDI as the explanatory variable with the set of investment motivations discussed above. The model is of the general form

$$\mathrm{FDI}_{it} = f(\beta^{*}\mathrm{M}_{it}; \beta^{*}\mathrm{X}_{it}) + \mathrm{E}_{it}$$

[2] Kobrin's index also includes in the denominator 'parents exports.' These data are not available for inward FDI and the ratio is estimated with affiliates' sales only to increase comparability between the inward and outward analyses.

where FDI is the total capital flow, including capital flow between parents and affiliates, intercompany loans, and reinvested earnings; M represents a vector of FDI motivations; X is a vector of control variables, including firm and industry attributes; i stands for industries, $i = 1 \ldots n$ ($n = 30$); t for time, $t = 1 \ldots m$ ($m = 9$); and E is the random error term.

The model is estimated based on inward and outward FDI data for the United States, as it is the only country that publishes the data needed for this analysis. We use the totals of the inward and outward data.

We add a number of control variables which account for the major factors identified in the literature to affect FDI intensity (Caves, 1996):

1. Intangible assets—the single most important factor influencing the propensity of firms to engage in foreign activities and explaining variation in the intensity of such activities among them (Hymer, 1960; Caves, 1996). Profitability is often used as a proxy for the possession of such advantages (Shaver and Flyer, 2000) and is used here.
2. Size and growth, as previous research provides strong support for their influence on FDI activity (Horst, 1972; Grubaugh, 1987). We measure size and growth by the number of employees in an industry and its annual growth. Employment level is often used as a measure of size (e.g., Martin *et al*., 1998).
3. The propensity for undertaking FDI, measured by FDI stocks, to control for variation in the extent to which FDI is considered as an important strategic alternative and growth route.
4. Market structure, because it affects the competitive pressure to expand overseas (Knickerbocker, 1973; Flowers, 1976). The total number of firms in an industry, an indicator of overall industry structure, is commonly used to operationalize the prevalence of oligopolistic reaction as a driver of FDI (e.g., Yu and Ito, 1988). We use the number of parent firms in an industry, and also include a quadratic term of this measure to account for a non-linear impact of the number of competitors on investment behavior. Such data are not available for inward FDI, and we control for the possible impact of market structure only in the outward analysis.

The Shapiro–Wilk test reveals that FDI stocks and size (number of employees) are not normally distributed. Hence we took the natural logarithm of these data.

Table 1 presents the explanatory variables included in the inward and outward analyses, their operationalizations, descriptive statistics and correlation coefficients. Most of the correlation coefficients are low, implying that for the most part there are no problems of correlation between the independent variables. The exceptions are the coefficients between variables and their quadratic terms. These tend to be high, but raise no statistical concern. Other high coefficients are those between variables with common denominators. Three of the independent variables are constructed as shares of sales, to control for the overall magnitude of activity. Their correlation coefficients are high (particularly in the outward data) and exceed the standard cut-off point of 0.5. To correct for this, we introduce these variables gradually, generate their residuals and use the residuals in the analyses that follow.[3]

Independent sample t-tests suggested that the missing value patterns are not random, and they were estimated from available observations, by testing a model based on all observations for which there were no missing values, and using it to estimate the missing values. This analysis was conducted separately for the inward and outward samples. This approach is based on the assumption that the missing values have a similar distribution to the non-missing values, an assumption commonly made when estimating missing values (e.g., Schafer and Olsen, 1998).

The nature of the dataset raises a concern regarding the possibility of unobserved heterogeneity, arising due to differences among industries in omitted variables that may affect both independent and dependent variables (as a common cause). For example, certain developments in particular industries may affect both the total investment in those industries, as well as the preference for

[3] The first variable was regressed along with other independent variables on the dependent variable; the residual from this regression was entered into regression, which included the second independent variable; once again, the residual from this second regression was introduced into the final regression, which included the third variable. The emerging coefficients were interpreted as representing the additional contribution of the independent variable in question to the dependent variable after it has been adjusted for the contribution of the other correlated independent variables (Trevor, Tibshirani, and Friedman, 2001).

Table 1. Descriptive statistics and correlation coefficients of the independent variables included in the model

Motivations	Operation measures[a]	Descriptive statistics Mean (SD) Inward	Outward	Correlation coefficients (Pearson correlations) (The outward sample in the upper right part of the table; the inward in the lower left part) 1	2	3	4	5	6	7
Investment motivations										
Market seeking	1. Costs of sales/total costs (H1)	0.948 (0.032)	0.927 (0.041)	**1**	0.054 (0.473)	0.028 (0.647)	−0.087 (0.187)	−0.033 (0.594)	0.113 (0.071)	−0.046 (0.450)
Resource seeking	2. Local purchases/total costs (H2)	0.707 (0.455)	0.699 (0.186)	0.138 (0.029)*	**1**	−0.025 (0.736)	−0.445 (0.000)**	−0.331 (0.000)**	−0.371 (0.000)**	−0.070 (0.354)
Export seeking	3. Exports to unrelated bodies/sales (H3)	0.039 (0.041)	0.087 (0.137)	−0.099 (0.132)	−0.019 (0.782)	**1**	0.164 (0.019)*	0.114 (0.079)	−0.083 (0.232)	−0.057 (0.362)
Efficiency seeking	4. Intra-firm transactions/sales (H4)	0.034 (0.036)	0.224 (0.239)	0.136 (0.038)*	−0.169 (0.011)*	0.697 (0.000)**	**1**	0.037 (0.577)	0.571 (0.000)**	−0.026 (0.679)
Knowledge seeking	5. Compensation per employee ($) (H5)	47.441 (20.990)	33.846 (13.997)	0.112 (0.072)	0.105 (0.097)	−0.125 (0.046)*	0.105 (0.112)	**1**	0.060 (0.335)	−0.054 (0.376)
	6. R&D investment/sales (H5)	0.021 (0.028)	0.010 (0.020)	−0.126 (0.057)	−0.159 (0.018)	0.595 (0.000)**	0.580 (0.000)**	0.151 (0.023)*	**1**	−0.076 (0.251)
Oligopolistic reaction	7. Growth foreign affiliates (H6a)	0.129 (1.343)	0.042 (0.130)	−0.127 (0.041)*	0.152 (0.016)*	−0.023 (0.713)	−0.052 (0.439)	−0.195 (0.003)**	0.051 (0.432)	**1**
	8. (Growth foreign affiliates)^2 (H6b)	0.377 (3.350)	0.018 (0.091)	0.047 (0.454)	−0.115 (0.070)	0.016 (0.794)	0.080 (0.226)	0.202 (0.002)**	−0.058 (0.369)	−0.897 (0.000)**
Industry-level control variables										
Profitability	9. Net income ($)	184.189 (14,160)	1831.883 (2712.71)	0.042 (0.500)	0.044 (0.488)	0.232 (0.000)**	0.025 (0.709)	−0.167 (0.011)*	0.081 (0.214)	−0.062 (0.315)
Size	10. # employees ('000)	125.906 (13.490)	131.322 (124.082)	0.153 (0.014)*	0.050 (0.431)	−0.326 (0.000)**	−0.133 (0.046)*	−0.231 (0.000)**	−0.126 (0.051)	0.081 (0.187)
Growth	11. Change # employees	0.263 (1.843)	0.003 (0.480)	−0.016 (0.797)	−0.012 (0.848)	0.016 (0.793)	0.043 (0.521)	0.030 (0.643)	0.059 (0.362)	0.053 (0.386)
FDI stocks	12. ($)	11,638 (11,696)	13,996 (30,756)	−0.008 (0.902)	0.094 (0.137)	0.431 (0.000)**	0.008 (0.907)	−0.116 (0.077)	0.092 (0.153)	0.020 (0.740)
# of parent firms	13. No.	—	51.383 (32.669)	—	—	—	—	—	—	—
(# of parent firms)^2	14. (No.)^2	—	3703 (4912)	—	—	—	—	—	—	—
N		270	270							

Table 1. (*Continued*)

Motivations	Operation measures[a]	Descriptive statistics Mean (SD) Inward	Outward	Correlation coefficients (Pearson correlations) (The outward sample in the upper right part of the table; the inward in the lower left part) 8	9	10	11	12	13	14
Investment motivations										
Market seeking	1. Costs of sales/total costs (H1)	0.948 (0.032)	0.927 (0.041)	−0.133 (0.029)*	−0.351 (0.000)**	0.018 (0.767)	−0.059 (0.334)	−0.051 (0.408)	0.138 (0.033)*	0.134 (0.038)*
Resource seeking	2. Local purchases/total costs (H2)	0.707 (0.455)	0.699 (0.186)	−0.045 (0.552)	0.241 (0.001)**	0.151 (0.044)*	0.309 (0.000)**	0.139 (0.063)	−0.045 (0.588)	−0.103 (0.210)
Export seeking	3. Exports to unrelated bodies/sales (H3)	0.039 (0.041)	0.087 (0.137)	−0.060 (0.336)	−0.129 (0.039)*	−0.024 (0.696)	−0.437 (0.000)**	−0.097 (0.121)	0.349 (0.000)**	0.410 (0.000)**
Efficiency seeking	4. Intra-firm transactions/sales (H4)	0.034 (0.036)	0.224 (0.239)	−0.087 (0.160)	0.117 (0.058)	0.011 (0.854)	−0.464 (0.000)**	0.048 (0.437)	0.359 (0.000)**	0.398 (0.000)**
Knowledge seeking	5. Compensation per employee ($) (H5)	47.441 (20.990)	33.846 (13.997)	−0.074 (0.227)	0.486 (0.000)**	−0.216 (0.000)**	−0.011 (0.863)	0.461 (0.000)**	0.057 (0.375)	0.014 (0.828)
	6. R&D investment/sales (H5)	0.021 (0.028)	0.010 (0.020)	−0.044 (0.503)	0.035 (0.598)	−0.035 (0.598)	−0.530 (0.000)**	−0.044 (0.510)	0.284 (0.000)**	0.352 (0.000)**
Oligopolistic reaction	7. Growth foreign affiliates (H6a)	0.129 (1.343)	0.042 (0.130)	0.445 (0.000)**	0.008 (0.896)	0.062 (0.307)	−0.015 (0.802)	−0.014 (0.813)	0.027 (0.677)	0.023 (0.725)
	8. (Growth foreign affiliates)^2 (H6b)	0.377 (3.350)	0.018 (0.091)	**1**	−0.048 (0.429)	0.013 (0.830)	−0.006 (0.925)	−0.035 (0.564)	−0.052 (0.420)	−0.026 (0.694)
Industry-level control variables										
Profitability	9. Net income ($)	184.189 (14,160)	1831.883 (2712.71)	0.006 (0.918)	**1**	0.240 (0.000)**	0.054 (0.376)	0.527 (0.000)**	0.143 (0.027)*	0.056 (0.392)
Size	10. # employees ('000)	125.906 (13.490)	131.322 (124.082)	−0.053 (0.392)	0.038 (0.544)	**1**	0.099 (0.105)	0.076 (0.215)	0.440 (0.000)**	0.351 (0.000)**
Growth	11. Change # employees	0.263 (1.843)	0.003 (0.480)	−0.140 (0.022)*	0.013 (0.834)	0.086 (0.161)	**1**	0.033 (0.586)	−0.181 (0.005)**	−0.244 (0.000)**
FDI stocks	12. ($)	11,638 (11,696)	13,996 (30,756)	0.018 (0.770)	0.630 (0.000)**	0.166 (0.007)**	0.043 (0.485)	**1**	0.067 (0.302)	0.018 (0.784)
# of parent firms	13. No.	—	51.383 (32.669)	—	—	—	—	—	**1**	0.862 (0.000)**
(# of parent firms)^2	14. (No.)^2	—	3703 (4912)	—	—	—	—	—	—	**1**
N		270	270							

** Correlation significant at the 0.01 level (2-tailed)
* Correlation significant at the 0.05 level (2-tailed)
[a] % unless otherwise stated.

certain motivations for investment. To eliminate any spurious effects due to unobserved differences among industries, we add fixed industry effects by entering dummy variables for each industry (minus one). This also takes care of possible selection bias (Heckman, 1979). None of these industry dummies were significant in any of the analyses that follow. Also, since we focus in our hypotheses testing only on the strength of association between FDI and MNE motivations across high and low information-intensive industries, we do not explicitly correct for endogeneity (by the normal method of introducing lagged variables).

The model was estimated by means of panel data analysis (Hsiao, 1999), using STATA software. Panel data techniques enable the introduction of different slopes to test for industry and time effects. The hypothesis that the time effects are the same was rejected for all models ($p < 0.1$, $F = 8.75$ for inward high information-intensive industries; $p < 0.01$, $F = 9.95$ for outward high information-intensive industries; $p < 0.1$, $F = 7.95$ for inward low information-intensity; and $p < 0.001$, $F = 12.67$ for outward low information-intensive industries). The hypothesis that the industry effects are the same was not rejected at the 0.01 levels ($F = 3.97$) for FDI in inward low information-intensive industries and at 0.1 for outward low information-intensive industries ($F = 2.33$). It was rejected for inward high information-intensive and for outward high information-intensive industries at the 0.1 levels ($F = 13.12$, $F = 11.10$ for FDI in inward information-intensive and outward information-intensive industries respectively). The models were estimated accordingly with time effects, industry effects, and both.

The time and industry effects can be introduced as fixed or random. A Hausman test was conducted to test which of these effects would be more suitable. The test was not significant (χ^2) for both the inward and outward industries ($F = 10.95$ and $F = 12.36$ respectively), implying no significant differences between fixed and random effects. The random-effects model is regarded as more suitable for a balanced panel (Hsiao, 1999), like the one analyzed here. The results of the White general test and Breusch–Pagan test did not enable us to exclude the possibility of heteroskedasticity and cross-section correlations ($\chi^2 = 5.6e{-}21$ and 0 in the inward data, and $\chi^2 = 2.3e{-}06$ and $1.1e{-}155$ in the outward data for the White general test and Breusch–Pagan test respectively). Therefore, we used the generalized least square (GLS) analysis, which is a modification of the random-effects model that is less restrictive. We also conducted a test of stability, using the Chow test, to see whether the parameters are the same in each of the years analyzed. The F value of 3.546 enables us to conclude that there are no structural changes in the variables over time (Hsiao, 1999).

The hypotheses were tested by estimating two regression equations, for the high and low information-intensive samples (Table 2), and then testing differences in the explanatory power of individual independent variables between them (Table 3). The analytical methodology wherein regression coefficients are compared across two models has been utilized extensively in prior research to compare between two groups of firms or industries (e.g., Dean, Brown, and Bamford, 1998; Mata and Portugal, 2002). Difference statistics were introduced by calculating interaction variables (Friedrich, 1982), constructed by multiplying each of the explanatory variables by a dummy variable that gets the value 1 for information-intensive industries, 0 otherwise (Table 3). A significant sign of the interaction term implies that the variable in question is a significant discriminator between information-intensive and non-information-intensive industries.

RESULTS AND DISCUSSION

Before discussing the results, a few caveats should be borne in mind. For one, the reliance on industry-level data, while it certainly has its merits, can obscure firm-level variation in terms of strategic objectives and resource availability. To truly establish that the two sets of industries are different, ideally one would need to know the distribution of firm characteristics within the industries and these data are not available to us. However, as mentioned earlier, industry-level data have their advantages in that they enable us to isolate the impact of the technology on motivations from firm-level idiosyncrasies, including firm-specific motivations. Another caveat of our data is that the different motivations for FDI may not be entirely independent. For example, the resource-seeking motivation might coexist with an export platform investment. An additional caveat is that the motivations we study cannot be said to exhaust the entire spectrum of possible motivations driving firms to invest

Table 2. Motivation for FDI in high and low information-intensive industries: inward and outward FDI

Constructs	Operation measures	Outward FDI Information intensity		Inward FDI Information intensity	
		High	Low	High	Low
Constant		−3044.73	0.128	−9195.67	−74648.54
		(−0.68)	(0.58)	(−1.81)	(−5.28)***
Investment motivations (Hypotheses)					
Market seeking	Costs of sales/total costs (H1)	−1480.74	3710.17	−1293.01	71011.01
		(−0.32)	(2.90)**	(−0.28)	(4.42)***
Resource seeking	Local purchases/total costs (H2)	−0.00	1749.89	−2297.07	1391.09
		(−0.03)	(2.22)**	(−0.89)	(6.06)***
Export seeking	Exports to unaffiliated bodies/sales (H3)	1244.38	0.87	4426.83	−9398.08
		(0.33)	(3.79)***	(1.69)*	(−2.04)**
Efficiency seeking	Intra-firms transactions/ sales (H4)	2560.72	0.17	8524.15	−766.83
		(3.33)***	(1.57)+	(6.94)***	(−1.06)
Knowledge seeking	Compensation of employees (H5)	20.17	0.00	34.25	−77.80
		(1.42)	(0.02)	(2.66)**	(−3.81)***
	R&D investment/sales (H5)	−20193.86	1.06	2448.38	3738.82
		(−1.29)	(0.82)	(0.36)	(0.13)
Oligopolistic reaction	Number of foreign affiliates (H6a)	1842.18	0.15	−4986.94	16,695.86
		(1.16)	(0.93)	(−1.23)	(1.06)
	(Number of foreign affiliates)^2 (H6b)	−174.11	0.15	−457.61	1882.77
		(−0.02)	(0.93)	(−0.92)	(4.69)***
Industry-level control variables					
Profitability	Net income ($)	0.46	0.007	0.35	0.16
		(3.43)***	(4.67)***	(3.45)***	(0.84)
Size	No. employees ('000)	−186.12	0.00	−728.55	−2306.67
		(−0.61)	(0.42)	(−1.49)+	(−5.17)***
Growth	Annual change no. employees	720.43	0.01	53.68	−1244.71
		(1.21)	(0.20)	(2.54)**	(−4.98)***
FDI stocks	($)	851.53	−0.04	1387.17	2550.43
		(2.60)**	(−2.51)**	(4.14)***	(6.11)***
# of parent firms	No.	0.175	0.00	—	—
		(1.45)	(0.74)		
(# of parent firms)^2	(No.)^2	−35.94	−0.00	—	—
		(−1.76)*	(−0.34)		
Wald χ^2		264.24	−389.94	798.52	380.15
Prob. $>\chi^2$		0.0000	0.0000	0.0000	0.0000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$

overseas. However, by incorporating the motivations identified in the literature, including both those driven by transaction cost considerations (Buckley and Casson, 1976; Rugman, 1981; Hennart, 1982; Dunning, 1993) and those resulting from strategic considerations (Flowers, 1976; Graham, 1998), we believe this problem is minimized.

With these caveats in mind, we go on to discuss the findings. *Hypothesis 1, that market seeking will be a weaker explanation for FDI in highly information-intensive industries received strong support in both the inward and outward analyses.* Both the coefficients and the level of statistical significance are much higher in the low information-intensity conditions. The market-seeking motivation has the expected strong positive relationship to both inward and outward FDI in low information-intensive industries. The analyses in Table 3 show that the differences between the information-intensive and non-information-intensive industries are significant in both the inward and outward analyses. These findings confirm the theoretical arguments regarding the diminishing need for physical presence in order to serve markets effectively in information-intensive industries.

Table 3. Test of difference between high and low information-intensive industries

	Outward	Inward
Constant	7270.35 (1.05)	−8590.82 (−0.34)
Investment motivations		
Market seeking	20,261.11 (2.53)**	−3595.42 (−0.14)
Resource seeking	−3710.16 (−1.45)	777.66 (0.07)
Export seeking	−32,339.13 (−1.30)	7662.53 (0.40)
Efficiency seeking	−9911.04 (−0.84)	3636.65 (0.06)
Knowledge seeking	−219.92 (−1.68)*	−33.56 (−0.24)
	66,452.61 (0.74)	13,950.14 (0.15)
Oligopolistic reaction	−784.81 (−0.11)	11,083.56 (1.80)*
	−17,367.38 (−0.43)	10,089.99 (1.12)
Control variables		
Profitability	0.29 (2.42)**	−0.09 (−0.21)
Size	−3062.448 (3.27)***	−217.08 (−0.09)
Growth	6928.33 (2.33)**	−983.84 (−2.82)**
FDI stocks	1276.11 (2.95)**	1424.41 (1.86)*
No. parents	−218.41 (−2.00)**	—
(No. parents)^2	1.31 (2.00)*	—
Interaction variables (Investment motivations × dummy variable: high/low information-intensity industries)		
Market seeking	−1806.91 (−2.09)*	−28,550.12 (−3.15)***
Resource seeking	1493.33 (0.41)	412.92 (0.04)
Export seeking	−49,164.65 (2.05)*	−17,662.53 (1.98)*
Efficiency seeking	4435.78 (2.39)**	4853.48 (2.54)**
Knowledge seeking	281.34 (1.93)*	60.91 (0.41)
	−61,261.03 (−0.67)	37,394.70 (0.40)
Oligopolistic reaction	4530.43 (0.60)	−13,936.70 (−1.78)
	14,388.82 (0.36)	−13,063.04 (−1.19)
Profitability	0.13 (0.81)	0.05 (0.07)
Size	11.89 (1.28)	−4.89 (−0.13)
Growth	−6255.57 (−2.09)**	1035.75 (2.64)**
FDI stocks	0.01 (0.96)	0.01 (0.26)
No. parents	223.96 (1.60)+	—
(No. parents)^2	−1.34 (−1.23)	—
Wald χ^2	195.05	160.15
Prob. $>\chi^2$	0.0000	0.0000

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$

Only partial support is found for Hypothesis 2, that the resource-seeking motivation for tangible resources would be weaker in information-intensive than in non-information-intensive industries. As hypothesized, this driver is a positive, significant motivation for FDI in low information-intensive industries, for both inward and outward FDI. This suggests that for these industries access to tangible factors of production continues to be a critical driver of FDI. The non-significance of this variable for the high information-intensity conditions suggests that the search for tangible resources is less important in such industries. However, the test of difference in Table 3 shows that these differences between the high and low information-intensive industries are not statistically significant.

Some explanation for this partial support might be suggested in that technology has affected access to resources in both high and low information-intensive industries, and to a certain degree has blurred the differences between them. Technological developments have eliminated the costs of transporting resources and increased their mobility over distance. In doing so, technology has reduced the need for physical presence in foreign countries in order to access some tangible resources such as raw materials and the like. Technology has also enabled companies to access resources remotely

without having local presence, so although the resources themselves remain immobile distance is less of a barrier in accessing them. Such developments enable firms to access labor remotely, as the current growth of outsourcing illustrates (Drezner, 2004; Dossani and Kenney, 2003).

Hypothesis 3, that the motivation to find low-cost export platforms would be a more significant driver of FDI in low information-intensive industries, is strongly supported. As expected, export seeking is statistically significant as an explanation of both inward and outward FDI in the low information-intensive industries, and is only weakly, if at all, related to FDI in information-intensive industries. However, there are some differences between the inward and outward analyses in terms of the strength of the association and the direction of causality. In the outward analysis the coefficients are highly significant and positive, in the direction hypothesized. In the inward analysis, the sign of the coefficient in the low information-intensity case is negative. These results are consistent with the expectation that export-seeking investment is a stronger driver of outward investment from the United States but perhaps much less so, if at all, for investment flowing into the United States. The United States is unlikely to be an attractive export platform to third countries in low information-intensity industries (e.g., in low-tech industries).

Hypothesis 4, that efficiency-seeking motivations will drive FDI more strongly in information-intensive industries, received strong support, in both the inward and outward FDI analyses. This reinforces the role played by reduced transportation and coordination costs in information-intensive industries, which contributes to the greater international dispersion of economic activities (Zaheer and Manrakhan, 2001).

Hypothesis 5, that knowledge seeking would be a stronger motivation in high information-intensive than in low information-intensive industries, was supported in the inward analysis, although the differences between the industries are not significant, but is not supported in the case of intangible assets embedded in human capital in the outward analysis (Table 3). These differences between the inward and outward analyses perhaps imply that investment to the United States is strongly driven by the search for knowledge resources, and this cuts across all industries, regardless of the nature of their technology. This is a less important driver for U.S. investment overseas. The strong positive association in high investment-intensive industries between compensation per employee and FDI into the United States speaks to the importance of the United States as a source of knowledge in high-technology industries. At the same time, the negative and significant relationship between these variables in the low information-intensity industries implies that investments in low information-intensity industries are not attracted to the United States when compensation levels are high. In a sense, low information-intensity industries behave like inferior goods where demand for employees is sensitive to the compensation levels, while high information-intensity industries act like Giffen goods whereby high levels of compensation attract more FDI. R&D investment is insignificant in all the analyses (Table 2).

Hypotheses 6a and 6b, that competitive pressure would be a stronger driver of FDI in the information-intensive world (in both its linear and quadratic forms), receives no support in either the outward or inward analysis. The linear measure is insignificant in both analyses and the quadratic term has weak explanatory power in the low information-intensity inward analysis (Table 2). Neither of the differences tested in Table 3 is significant.

A number of possible explanations for this finding might be proposed. One is that the argument that firms seek to imitate other firms in their international expansion, on which the competitive pressure hypothesis lies, is based on the assumption that firms regard these other firms as competitors, whose actions might be a threat. However, many activities in the information-intensive world are based on open systems, standard-based technologies, and network interconnections that reduce many of the isolating mechanisms that exist between firms in traditional competition (Garud and Kumaraswamy, 1993). Under such circumstances, competition coexists with cooperation and collaboration agreements (Katz and Shapiro, 1994). It might also be that the deconstruction of industry barriers (Bresser *et al*., 2000), discussed earlier, alters the competitive boundaries and is therefore not fully picked up in our measure of competitive pressure.

The differences between the inward and outward analyses (that is, investment flowing to the United States and the investment of U.S. MNEs overseas) are most telling. It will be recalled that, owing to data constraints, the operations of this investment

motivation are not identical in the two analyses. The operation in the outward analysis is a direct measure of the oligopolistic reaction motivation (Knickerbocker, 1973), as traditionally conceptualized, that is, as rooted in the structure of home markets, and as the product of domestic industry rivalry. The operation of the inward analysis is the number of all foreign affiliates entering the United States, and might be interpreted as the pressure of global competition. The non-significance of this measure in the outward analyses and its somewhat greater significance in the inward analyses may thus provide support to the views that the traditional oligopolistic reaction hypothesis is losing its power, as competition is taking place on a global rather than domestic basis, and a firm's most relevant competitors, whose actions it needs to watch and imitate, are not likely to be from its home country.

It might also be that the notion of home-based competition, which undermines the competitive pressure hypothesis, is weakening in highly information-intensive industries, where geography is arguably playing a less important role than in the traditional world. Firms are increasingly competing globally, not only with those competitors residing in the same territory. The emergence of global standards for many information-intensive products acts to enhance the global, rather than domestic, base of competition.

Throughout the previous discussion we have alluded to the differences between the inward and outward analyses. Given the unique attributes of the U.S. market, and the distinguishing characteristics of U.S. firms, these results are not surprising. These differences may suggest that investment motivations can only be analyzed meaningfully with reference to a specific context. Other things being equal, they would vary by the nationality of the investing firm, and the home and host countries involved. Certain markets are more suitable for achieving certain motives, and firms of particular nationality are more likely to be driven by certain motives.

We conducted a number of tests to examine the sensitivity of our findings to the classification of industries we adopted. We started by applying a stricter criterion for the selection of the information-intensive sample of industries to include only those industries in which both the inputs and outputs can be transferred electronically. These industries were business services, insurance, communication, information services and data processing, motion pictures, printing and publishing, and finance ($N = 63$). The results continue to hold, at similar significance levels. The stronger significance levels expected were not obtained, probably due to the smaller number of observations in these analyses. We also tested for the sensitivity of the findings for the inclusion of additional industries. We added the next five industries that exhibited the lowest and highest intensity of ICT investment to the non-information-intensive and information-intensive groups respectively.[4] We reached the same conclusions on these extended samples, but at a somewhat lower level of significance, as the differences between these two samples are naturally weaker. The results of these analyses are available upon request.

We conducted additional difference tests to see whether the differences between the entire models are significant between the information-intensive and non-information-intensive industries. F-tests on the residual sum of squares of the two models found that the null hypothesis that there are no differences between information-intensive and non-information-intensive industries in terms of the motivations for FDI is rejected for both inward and outward FDI ($F = 1.578$; $p < 0.05$; $F = 0.985$; $p < 0.001$ respectively).

CONCLUSION

In this paper we examined the impact of the lowered costs of distance, caused by information technology, on the motivations of firms to locate activities overseas. Our starting point was that with distance being fundamental to international business activity (Ghemawat, 2001), lower costs of distance are bound to have a profound impact on the rationale for foreign investment. We examined, theoretically and empirically, how these changes affect the prevalence of various investment motivations in different industries.

The key finding is that investments in industries with different levels of information intensity are

[4] The following industries were added to the digital sample: depository institutions, auto services, miscellaneous repair services, chemicals and allied products, and holding and investment offices. The group of industries added to the non-digital sample includes tobacco products, coal mining, leather and leather products, personal services and metal mining.

driven by different motivations. The quest for intangible assets in the form of highly paid human capital and the search for efficiency are the two most important explanations for international activity in information-intensive industries, reinforcing the value of intangible resources such as intellectual capital in this sphere. The low costs of distance do not seem to affect the need for knowledge-seeking foreign investment in these industries. In less information-intensive industries, market seeking and the search for low-cost export platforms are the dominant motivations for FDI.

These differences imply that the various investment motivations are affected differently by information technology (Venables, 1999). Technology does not reduce the need to locate overseas in order to access knowledge (Chung and Alcacer, 2002). Distance still carries costs for such investments, so that firms invest overseas in order to be close to the sources of knowledge and learning. At the same time, by reducing the costs of communication and coordination between different subunits of the same MNE, technology has accelerated the dispersion of economic activities worldwide (Zaheer and Manrakhan, 2001) and the prevalence of efficiency-seeking investments.

These findings thus suggest that the 'death of distance' (Cairncross, 1997) and the 'end of geography' (O'Brien, 1992), which are taken for granted in discussions of information technology and the global organization of work, do not apply to the same degree across different motivations for going abroad. Rather, technology has a mixed and complex effect on the costs of distance (Kolko, 1999), and hence on investment motivations. Technological advances appear to have a dramatic impact on some costs of distance, such as those related to market and export seeking, to such an extent that it modifies the association between location and value creation and eliminates some of the reasons for locating activities overseas. Other drivers of such moves, however, appear to remain almost unaffected. This suggests a need to rethink the role of distance in international business and to introduce a more nuanced view of distance (Friedland and Boden, 1994), as it affects the ways firms operate internationally.

The findings also show that motivations vary between investments flowing into and out of the United States, suggesting that motivations differ not only across industries but also across countries. Investment in the United States is motivated by the search for intangible assets, while investments of U.S. firms overseas are primarily driven by the search for efficiency and low costs. These differences imply that investment coming to the United States will have different implications for local resources, notably the local labor market, as well as local suppliers and competitors, than investment flowing from the United States. The recent debate in the United States regarding the consequences of movement of service jobs overseas for the local labor market, and the implications of these moves for employment in the recipient countries (e.g., Agrawal, Farrell, and Remes, 2003), vividly illustrate the implications of these differences for the home and host countries involved.

Our empirical work demonstrates that inward FDI flows into the United States (and therefore job creation in the United States) occur in high- rather than low-paying industries, and are of the knowledge-seeking variety. Outward FDI flows from the United States are driven by efficiency seeking and the search for markets. This has two major policy implications: (1) that the United States needs to continually invest in knowledge creation to keep its edge in attracting FDI and jobs; and (2) as outward FDI flows from the United States in information-intensive industries are being driven primarily by a search for efficiency and markets, it is good for U.S. firms, and in anything but the very short term, for U.S. jobs as well.

A point to note is that although our empirical test focuses on differences across industries at different levels of information intensity, there could be some dynamic implications for the evolution of motivations within industries over time, if we believe that the use of information technology in an industry may evolve over time. This reflects our assumption that, while in some ways the extent of information intensity is intrinsic to the type of industry involved, there could also be a strategic element of choice and innovation involving a movement toward greater use of information technology.

These findings have several important theoretical contributions. For one, they bring the issue of motivation to the forefront in discussing MNE and foreign investment. As strategic intent drives behavior (Hamel and Prahalad, 1989), an understanding of motivations is a first step towards understanding the behavior of MNEs, and can be used to predict their actions (Hitt *et al.*, 1995). The implicit assumption underlying the theory of the MNE is that the possession of ownership

advantages is what drives firms to invest overseas. But in fact the intention to invest—the motivation—precedes the actual possession of advantages, and may even be a necessary precondition for the creation of these advantages. For example, market-seeking investment rests on the ability to meet local demand and on marketing skills, while knowledge-seeking investment depends on learning capabilities and on the integration of this learning with the firm's own knowledge. Different motivations may also favor different organizational modes. For instance, market-seeking investment is perhaps more successfully implemented via acquisition of previously independent local companies, while knowledge-seeking investment, whereby the affiliates act as censoring posts for new knowledge, may favor greenfield entry, because such establishments are usually easier to integrate within the MNE existing structure (Nohria and Ghoshal, 1997).

A second contribution to theory is in the explicit acknowledgment that motivations are context specific, varying both across industries and across countries. By comparing the investment motivations of firms in high and low information-intensive industries we show that technology affects the global organization of activities in different ways in different industries. The differences found between the motivations for investment flowing into and out of the United States show the impact of both home and host country attributes on investment motivations. This research also provides a general framework to examine the relative importance of investment motivations under different circumstances. For example, much interest has been lately given to knowledge-seeking investment (e.g., Chung and Alcacer, 2002). By jointly analyzing the major investment motivations identified in the literature we provide some means to examine the prevalence of this investment motivation *vis-à-vis* other motivations in different industries and countries.

This paper opens up several avenues for future research. Our findings suggest a need for more research on the various dimensions of distance (Ghemawat, 2001) and its implications for international business strategy. Further, in information-intensive industries, entry and exit may take quite different meanings than in traditional product markets, as all one needs to enter international markets at a basic level is a website. Future research may need to examine the implications of this type of internationalization. There is also a need to re-examine the dichotomy between internalization and externalization, on which the internalization theory of the MNE rests (Buckley and Casson, 1976). For example, General Electric, building on technological advances, both internalizes and externalizes the market for very similar functions. This suggests that technology can facilitate global reach and allow for different organizational forms to be functionally equivalent. By reducing communication and coordination costs, information technology exerts pressures for both expansion and contraction of firms' boundaries (Mosakowski and Zaheer, 1999), calling for research that will examine the geographic scope of MNEs as a result of these contradictory forces.

In conclusion, in this paper we investigated the impact of the reduced costs of distance, brought about by information technology, on the motivation of firms to locate activities overseas. We find that this impact varies across industries and across investment motivations. Our findings stress the importance of industry-level heterogeneity in driving strategic international activity and imply a need to explicitly acknowledge the impact of distance when considering investment driven by different motivations. In particular, knowledge seeking requires a different approach to foreign investment, as there is less potential for arm's-length approaches relative to, for example, market seeking.

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APPENDIX: CLASSIFICATION OF INDUSTRIES BY ICT INTENSITY*

High information-intensive industries (highest ICT intensity)		Low information-intensive industries (lowest ICT intensity)	
Industries	ICT intensity	Industries	ICT intensity
Business services	0.895	Oil and gas extraction	0.260
Insurance	0.876	Hotels and other lodging places	0.259
Communication	0.846	Other transportation equipment	0.237
Information services and data processing	0.823	Industrial machinery and equipment n.e.c.	0.225
Drugs	0.778	Retail trade	0.189
Household audio and video, and communication equipment	0.757	Textile and apparel products	0.186
		Food and kindred products	0.182
Motion pictures, including TV tape and film	0.723	Paper and allied products	0.175
		Stone, clay and other non-metallic mineral products	0.165
Electric and electronic components and accessories	0.680		
		Rubber products	0.154
Electronic and electric components n.e.c.	0.629	Fabricated metal products	0.159
Printing and publishing	0.598	Petroleum and coal products	0.129
Finance (except depository institutions)	0.590	Lumber, wood, furniture and fixtures	0.079
Transportation	0.565	Primary metal industries	0.055
Computer and office equipment	0.481	Construction	0.017
Instruments and related products	0.458		
Industrial chemicals and synthetics	0.447		

* ICT intensity = ICT investment as share of total investment, calculated as accumulated investment during 1990–99.
Source: http://www.bea.doc.gov/bea/dn2/facd.htm