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Knowledge transfer capacity and its implications for the theory of the multinational corporation

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Abstract
This study updates and extends research on foreign entry modes by examining the impacts of knowledge transfer capacity and knowledge tacitness. Research on international corporate expansion has long emphasized that deploying intangible knowledge-based assets is required for successful international expansion. More recently, research from a 'knowledge-based' perspective has addressed the role of tacitness in constraining a firm's ability to transfer knowledge internationally. We combine these perspectives to describe how knowledge tacitness affects the relative suitability of four archetypal entry modes: exporting, licensing, establishing an alliance, and wholly owned entry. We then examine and develop conceptually a seldom-studied firm characteristic, knowledge transfer capacity. We offer predictions that describe the combined effects of knowledge tacitness and transfer capacity on entry mode choice. We distinguish between the transfer capacity of the organization that develops knowledge (source transfer capacity) and that of the organization that seeks to access that knowledge (recipient transfer capacity). The discussion addresses how our model generalizes to knowledge-seeking strategies and to the study of ongoing multinational networks. The study enriches and reconciles multiple theoretical perspectives on entry strategy. It brings together the study of knowledge characteristics and firm heterogeneity in the theory of the multinational corporation, and in international and strategic management more generally.
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Introduction

One of the basic premises of internalization research on multinational firms is that, in order to succeed internationally, a firm must possess some advantageous, intangible knowledge-based assets (Hymer, 1960; Buckley and Casson, 1976). Once this advantage is replicated throughout a firm's operations, it can compete successfully in multiple-country markets. Following this fundamental insight, researchers sought to identify what firms possess the right characteristics in the first place. The fruits of this research show that international expansion is value creating for firms with distinctive technological, marketing and managerial capabilities (for reviews see Dunning, 1993; Caves, 1996).

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However, possession of a knowledge-based advantage does not by itself guarantee that a firm will be able to exploit the sources of this advantage in foreign operations. Recent work in the 'knowledge-based' literature suggests that the tacitness of such knowledge places major constraints on the extent and manner in which it can be used to support corporate expansion. Describing the role of knowledge in defining strategies and firm boundaries, Grant (1996, 114) argued that 'if most of the knowledge relevant to production is tacit, then transfer of knowledge between organizational members is exceptionally difficult.' Similarly, Teece (1977) and Kogut and Zander (1993) have highlighted the particular relevance of tacitness for multinational corporations. Thus transferring knowledge-based assets abroad cannot be taken for granted. When the costs of transferring tacit knowledge across borders are taken into account, the adequate choice of entry strategy acquires renewed importance.

This paper explores the conditions under which tacit knowledge constrains entry mode selection. We examine how tacitness stands to affect the transmission of knowledge-based advantages to new locations, and how firms' abilities to transfer knowledge efficiently affect the relative suitability of various entry modes. We show how tacitness and firms' heterogeneous capacities in the transfer of tacit knowledge jointly affect the entry modes that firms should employ. This paper highlights how heterogeneity in the ability to transfer knowledge-based assets can make a substantial difference to a firm's prospects for international expansion.

Our analysis of entry strategy brings together two influential schools of thought on the boundary of the multinational corporation: internalization theory and the knowledge-based view. *Internalization theory* focuses on the economics of leveraging existing intangible assets deployed abroad. It predicts that, as a firm accumulates intangible knowledge-based assets, it is better suited to expand internationally (Buckley and Casson, 1976). Moreover, the internalization perspective highlights that closely held entry modes such as wholly owned subsidiaries (WOSs) should be used when transaction costs stand to be high subsequent to entry, such as when the firm's proprietary assets are at risk of misappropriation (Buckley and Casson, 1976; Anderson and Gatignon, 1986). Yet, as the *knowledge-based* approach emphasizes, the *ex ante* costs of transferring those assets abroad in the first place should not be overlooked (Kogut and Zander, 1992). Tacitness can impede the knowledge transfer required for foreign production in a manner that constrains the choice of entry mode. By incorporating knowledge transfer costs into the entry mode decision, our study helps reconcile these two views of multinational firm expansion, whose compatibility has been the subject of some debate (e.g., Kogut and Zander, 1995; Love, 1995; McFetridge, 1995).

The paper proceeds in several sections. First, we provide a brief review of the relevant concepts regarding international corporate expansion and entry strategy. Second, we discuss the determinants of the costs of knowledge transfer across national borders, with emphasis on tacitness. We describe how tacitness affects the relative suitability of four archetypal entry modes. Third, we introduce the concept of knowledge transfer capacity, which describes how firms differ in their relative abilities to transfer knowledge across borders. We describe how transfer capacity moderates the effects of tacitness on entry mode choice. We then discuss how the results inform broader research in international business and strategy. We extend the model to outline how these arguments inform the literatures on knowledge-seeking entry strategies and on mature multinationals with existing networks of subsidiaries. We also briefly discuss how the analysis applies given various features of a target location. Finally, we draw implications for future research and offer brief conclusions.

Knowledge-based assets and international entry modes

Since at least Hymer (1960), researchers have sought to understand what motivates some firms to expand internationally while others in the same industry do not. The answer, according to internalization theory (Buckley and Casson, 1976), revolves around proprietary intangible assets. In this influential theory, advantageous intangible assets are deployed both domestically and abroad, where their strength allows the firm to compete with local and other foreign rivals. Consistent with this insight, empirical research shows that firms that possess distinctive technologies are particularly likely both to tap foreign markets and to be successful in doing so (Pugel, 1978; Morck and Yeung, 1991, 1992; Dunning, 1993; Caves, 1996). Evidence is occasionally mixed and less complete regarding marketing and managerial intangibles, but some existing studies suggest that these too can

promote successful international expansion (Pugel, 1978; Morck and Yeung, 1991, 1992; Dunning, 1993; Caves, 1996).

The internalization view assumes that knowledge-based assets have a *public good* characteristic that allows firms to exploit the knowledge in various locations at little or no additional cost (Caves, 1971, 1996). Once the knowledge-based advantage is replicated abroad, a firm can compete successfully in multiple country-markets. However, possessing advantageous knowledge does not guarantee that a firm will be able to exploit this advantage abroad. Before the multinational corporation can thrive, it must be able to replicate its advantage in foreign locations. Recent research argues that the knowledge transfer process is more critical than the internalization view would suggest (Caves, 1971, 1996). It requires the transfer of whole routines and procedures – a costly and failure-prone undertaking (Teece, 1977; Galbraith, 1990). Thus knowledge transfer is often difficult and time consuming, and substantially affects the performance of foreign operations (Kenney and Florida, 1993; Martin *et al*., 1995).

Furthermore, possession of distinctive knowledge-based assets does not inherently oblige a firm to transfer them across borders. Under the right circumstances, a firm can export goods made in the domestic country using its home-grown knowledge advantage. This minimizes the need for cross-border knowledge transfer considerably, relative to other entry modes. In particular, if the knowledge advantage resides in a manufacturing process, exporting requires no substantial transfer of the process technology, whereas licensing and direct production investment would (Teece, 1977; Rugman, 1981; Kogut and Zander, 1993).

In many instances, however, incentives exist for locating production abroad. Previous research has identified a range of factors that influence this decision (for reviews see Dunning, 1993; Caves, 1996). What matters for our purpose is that production abroad requires the transfer of productive knowledge to a foreign location. Cross-border knowledge transfer may occur within any of three basic governance approaches: WOS; alliance, where two (or more) firms contribute ongoing resources and share in the management of the venture (we include equity joint ventures in this category); or licensing, whereby the transferee (or recipient firm) contracts to use the knowledge-based assets but otherwise remains independent of the source firm.

In total, then, we consider four basic entry modes: exporting, WOS, licensing, and alliance. A fifth strategy, forgoing international entry altogether, serves as a base case. For simplicity, we focus initially on *de novo* expansion – entry mode decisions made by a firm establishing an initial presence in the foreign location. We do so to remain consistent with the prevailing literature upon which we build (Coase, 1937; Caves, 1996; Kogut and Zander, 1992). We also examine the entry mode decision from the standpoint of the firm that initially develops the knowledge-based production asset (the source firm). This provides a logical antecedent to the study of knowledge-seeking entry, and multinationals with pre-established subsidiaries, issues that we revisit in the section 'Extending the model'.

Comparing entry modes

A model comparing the costs of exporting, licensing and a WOS (*foreign direct investment*) was initially proposed by Hirsch (1976) and revisited by Rugman (1981). We elaborate their model to explicate the tradeoffs among four entry modes. Following Rugman (1981), the notation is as follows:

- C Normal costs of producing the good in the initial (home) country.
- C^* Normal costs of producing the good in a foreign (host) country indicated by *.
- M^* Export marketing costs including insurance, transport and tariffs.
- A^* Costs specific to foreign firms operating in the host country, such as environmental, cultural and political information costs (also known as *liability of foreignness*).
- D^* Knowledge dissipation costs associated with the risk of compromising the firm-specific advantage to a local arm's length partner. This includes the costs associated with the appropriation of the knowledge once it has been transferred, including ongoing monitoring and control, potential renegotiation and litigation, and the costs associated with replacing the knowledge if the partner should misappropriate it. This recognizes that concerns about the appropriation of intangible knowledge determine whether a firm will be willing to transfer its knowledge-based assets to a partner, or will prefer to limit the transfer to subsidiaries that it controls closely.

To this list of factors we add a variable T^*, which reflects the costs of transferring knowledge-based assets to a foreign location:

T^* Transfer costs associated with reproducing productive assets in a foreign location.

For now, we take T^* to be constant across entry modes. We shall relax this assumption later in the study. For comparative purposes, all costs described above represent net present values (Hirsch, 1976; Agmon and Hirsch, 1979; Rugman, 1981). That is, they capture the expected present value of all current and future costs associated with a particular foreign market entry.[1] With this notation, the *ceteris paribus* costs relevant to the source firm's entry mode choice are:

Export: $C + M^*$,
License: $C^* + D^* + T^*$,
WOS: $C^* + A^* + T^*$,
Alliance: $C^* + \alpha A^* + \beta D^* + T^*$,

where α and β are weights assigned to costs A^* $(0<\alpha<1)$ and D^* $(0<\beta<1)$ to represent the fraction of these costs incurred in an alliance.[2]

The separate weights α and β reflect the fact that alliances exhibit characteristics that can differentiate them from simple linear combinations of contracts and WOSs. That is, β does not have to strictly equal $1-\alpha$. In order for an alliance to be preferable to licensing and to a WOS, there must exist a range of conditions where the alliance faces a liability of foreignness (A^*) lower than the foreign partner's share, and/or knowledge dissipation costs (D^*) lower than the local partner's share: that is, $\alpha+\beta<1$. This is consistent with an extensive literature on alliances (see Williamson, 1991; Hennart, 1993; Buckley and Casson, 1996). The notation also helps distinguish between alliance, WOS and licensing: α would be equal to 1 and β to 0 for a WOS, and α would be equal to 0 and β to 1 for licensing at arm's length.

With this extended notation, we can now generalize the decision rules proposed by Hirsch (1976) and Rugman (1981), while using the same comparative logic and assumptions. In this paper, then, we employ a cost minimization approach to the entry mode decision.[3] For tractability, this approach assumes that revenues are comparable across entry modes.[4] After eliminating common terms, the relevant costs are as given in Table 1.

Our purpose is to examine characteristics of knowledge-based assets that affect the tradeoffs between these entry modes. Accordingly, we can make several additional simplifications to the model just described. First, we assume that production costs are the same in the home (C) and host (C^*) countries, and these costs are held constant. That is, we set $C=C^*=$constant. Alternatively, without loss of generality, M^* can be redefined to include any difference between C and C^* (Rugman, 1981). We also assume that $M^*>A^*$; otherwise, with positive transfer costs and $C=C^*$, there would be no scope for a WOS. In practice, if $M^*\leqslant A^*$, then input cost differences such that $C>C^*$ would be necessary to warrant a WOS (Rugman, 1981). With these assumptions, we now turn to the effects of tacitness on entry strategy.

Table 1 Selection of entry modes based on comparative costs

Entry mode	*Conditions under which the entry mode is preferable to alternatives*
1. Export if	$C+M^*<C^*+A^*+T^*$ (exporting costs less than WOS) and $C+M^*<C^*+D^*+T^*$ (exporting costs less than licensing) and $C+M^*<C^*+\alpha A^*+\beta D^*+T^*$ (exporting costs less than alliance)
2. WOS if	$C^*+A^*+T^*<C+M^*$ (WOS costs less than exporting) and $A^*<D^*$ (WOS costs less than licensing) and $A^*<\alpha A^*+\beta D^*$ (WOS costs less than alliance)
3. License if	$C^*+D^*+T^*<C+M^*$ (licensing costs less than exporting) and $D^*<A^*$ (licensing costs less than WOS) and $D^*<\alpha A^*+\beta D^*$ (licensing costs less than alliance)
4. Ally if	$C^*+\alpha A^*+\beta D^*+T^*<C+M^*$ (alliance costs less than exporting) and $\alpha A^*+\beta D^*<A^*$ (alliance costs less than WOS) and $\alpha A^*+\beta D^*<D^*$ (alliance costs less than licensing)

How knowledge tacitness affects entry modes

Tacitness and the costs of international expansion

In a series of recent papers, Kogut and Zander (1992, 1993, 1995) emphasized a *knowledge-based* view whereby the suitable entry mode for international expansion depends on the knowledge being exploited, specifically its tacitness. The basic notion that tacitness is associated with international expansion has been long established (see in particular Teece, 1977, 1981). On a general level, knowledge-based arguments parallel the internali-

zation premise that the most distinctive knowledge also has the greatest potential to support international expansion.

Tacit knowledge deserves particular attention in the analysis of a firm's resources because it can be a potent source of distinctive competitive advantage (Teece, 1981; Reed and DeFillippi, 1990; Grant, 1996; Wright, 1997). Tacitness, as originally defined by Polanyi, is that feature of knowledge that requires 'the observance of a set of rules which are not known as such' to those following them (Polanyi, 1958, 49; see also Nelson and Winter, 1982). In the knowledge-based literature, factors associated with tacitness include non-codifiability, non-teachability and complexity (Kogut and Zander, 1993; Zander and Kogut, 1995). Narrower conceptualizations focus on non-codifiability and non-teachability, while recognizing that complexity and tacitness reinforce each other. For our purposes, broad and narrow definitions have similar implications.

Tacitness, it turns out, renders knowledge both particularly promising and problematic for transfer to foreign locations. Thus it can have a strong influence on entry mode selection. The upside of tacit knowledge is that non-codifiability serves as a shield against unintended imitation by rivals. Tacit knowledge is better protected because its properties in use are harder to assess from the outside (Nelson and Winter, 1982; Grant, 1996).[5] Thus, all else equal, knowledge that is more tacit possesses stronger potential to generate distinctive competitive positions. As a result, ignoring (for a moment) the cost of transferring knowledge to foreign facilities, tacitness is positively associated with the potential gains from exploiting knowledge abroad (Kogut and Zander, 1992).

While tacitness protects against unwanted imitation, it also has the disadvantage of raising some of the cost components described in Table 1. We do not expect tacitness to make a substantial difference to M^* or A^*. And while tacitness may affect production costs, it is a feature of knowledge rather than location; thus it should have the same effect (in whatever direction the relationship) on both C and C^*. Production cost differences can therefore be set aside for the remainder of the analysis, with M^* effectively incorporating other differences between countries (see also Rugman, 1981).

One area where tacitness is likely to make a substantial difference is to knowledge dissipation costs, D^*. The direction of this effect warrants discussion, as it may appear counter-intuitive at first glance. As mentioned earlier, tacitness can protect knowledge against unwanted imitation by non-partner firms – that is, those that cannot directly observe the knowledge in use. However, in licensing and alliance agreements, the formal knowledge transfer process between a willing source and an intentional recipient effectively removes this barrier (Teece, 1981). Meanwhile, all else equal, tacit knowledge is costlier and more time-consuming for the source firm to replace if an opportunistic partner misappropriates it (Teece, 1981; Nelson and Winter, 1982; Dierickx and Cool, 1989). Indeed, the harder assets are to replace, the more severe the dissipation costs (Anderson and Gatignon, 1986; Saviotti, 1998). Thus, presuming that the knowledge can be transferred abroad in the first place, we expect D^* to increase in tacitness.[6]

The foregoing yields these premises regarding the parameters in Table 1 (other than T^*):

$$\partial C/\partial\tau = \partial C^*/\partial\tau, \tag{1}$$

$$\partial M^*/\partial\tau = 0, \tag{2}$$

$$\partial A^*/\partial\tau = 0, \tag{3}$$

$$\partial D^*/\partial\tau > 0, \tag{4}$$

where τ is the tacitness of the knowledge.

We now turn to transfer costs, T^*. Extant literature emphasizes a critical link between tacitness and the costs of transferring knowledge. As tacitness increases, so do the costs of transferring knowledge to a remote location, especially across national borders (Teece, 1977, 1981; Galbraith, 1990). Specifically, transfer costs tend to increase more than proportionately with tacitness (e.g., Mansfield *et al.*, 1982; Nelson and Winter, 1982; Cowan and Foray, 1997). Thus the very characteristic that can make tacit knowledge useful once transferred abroad also creates an impediment to its transfer in the first place (Kogut and Zander, 1992; Kim and Hwang, 1992).

Previous empirical work provides substantial corroborating evidence for this tacitness–transfer cost relationship, both directly and indirectly. Teece (1977) established a direct positive relationship between the tacitness of a technology and the total cash-equivalent cost of transferring it to a foreign location. Galbraith (1990) argued that tacitness increases both the amount of time required to transfer a technology, and the time required after

initial transfer for the technology to become fully effective in the new location. Where the preceding studies examined technological know-how, Simonin (1999b) added evidence about marketing know-how. He showed a strong negative relationship between tacitness and anticipated ease of transfer. In fact, Simonin (1999b, 463) concluded: 'tacitness emerges as the most significant determinant of knowledge transferability.' Altogether, evidence of the effect of tacitness on the ease and cost of knowledge transfer is strong.

In line with the existing research, we expect transfer costs to increase more than proportionately with tacitness (Teece, 1977, 1981; Mansfield *et al*., 1982). We therefore add the following premises to complement the review of the costs from Table 1:

$$\partial T^*/\partial \tau > 0, \tag{5}$$

$$\partial^2 T^*/\partial \tau^2 > 0. \tag{6}$$

Tacitness and entry strategies

Having reviewed the impact of tacitness on the cost components of various entry modes, we can examine these premises and conditions to arrive at predictions about the relative suitability of these entry modes. We first examine the extreme cases where relatively straightforward predictions arise. We then examine the impact of tacitness in its intermediate range, where the most intricate implications arise.

The extremes of knowledge tacitness are likely to discourage modes of entry that require knowledge transfer. First, knowledge with extremely low tacitness is unlikely to be very distinctive. Furthermore, it is likely to be very rapidly imitated, barring exceptionally strong intellectual property protection (Mansfield *et al*., 1982). Thus the least tacit knowledge offers relatively poor short-term and long-term prospects to tap international markets. All else equal, we expect a firm with minimally tacit knowledge to forgo foreign entry altogether.

Second, consider the upper extreme of the tacitness range. While the prospects for tapping a foreign market exist, the obstacles to foreign production are also greatest. Transfer costs, T^*, rise rapidly. A WOS also incurs foreignness costs, A^*. The situation is likely to be even less favorable for licensing, as knowledge dissipation costs, D^*, rise with tacitness. Alliances also face an undesirable combination of A^* and increasing D^* costs. Instead, we expect exports from the home base to be the preferred solution given extremely high tacitness.

Table 2 Simplified selection among WOS, alliance and licensing

Entry mode	*Conditions under which the entry mode is preferable to alternatives*
1. WOS if	$A^* < D^*$ and $A^* < \alpha A^* + \beta D^*$
2. License if	$D^* < A^*$ and $D^* < \alpha A^* + \beta D^*$
3. Ally if	$\alpha A^* + \beta D^* < A^*$ and $\alpha A^* + \beta D^* < D^*$

This leaves the intermediate tacitness range as most plausible for the transfer of knowledge-based assets abroad. In this range, the knowledge can be sufficiently distinctive to support international expansion. Also, transfer costs can be sufficiently low that it is warranted to transfer the knowledge abroad to avoid exporting costs: that is, low T^* favors $A^* + T^* < M^*$ and $D^* + T^* < M^*$, rendering the export option comparatively inefficient. Thus the plausible entry modes are WOS, licensing and alliance. The choice among these depends on the relative value of the foreignness costs, A^*, and knowledge dissipation costs, D^*. Simplifying the rules from Table 1, the choice among WOS, alliance, and licensing becomes as shown in Table 2.

The relative shape of A^* and D^* with respect to tacitness becomes the relevant issue. As stated above, we expect D^* to increase continuously in tacitness, while A^* is constant. Furthermore, at the lower levels of tacitness, D^* will be very low and plausibly lower than A^*. That is because the knowledge is readily imitable by outsiders, so that the added risk of partnering is negligible. This allows a direct comparison of the licensing and WOS options as tacitness increases in its intermediate range. Of these two options, we expect licensing to be preferred at lower levels of tacitness and WOS at higher levels of tacitness. The reason is that at lower (intermediate) tacitness, licensing incurs relatively low D^* while avoiding A^* altogether, whereas a WOS incurs A^* but avoids the rising D^* at higher (intermediate) tacitness.

This leaves the case of alliances to be examined. As described above, alliances incur both partial foreignness costs, αA^* (because the transferor is a foreign entrant), and partial knowledge dissipations costs, βD^* (because the transferor employs a local partner). In order for an alliance strategy to dominate both licensing and a WOS, it is necessary that $\alpha + \beta < 1$ (with $0 < \alpha < 1$ and $0 < \beta < 1$). If α and β are both assumed to be very low, it is theoretically possible that an alliance will be preferred to WOS *and* licensing across the whole intermediate range of tacitness (Hennart, 1993). However, that is

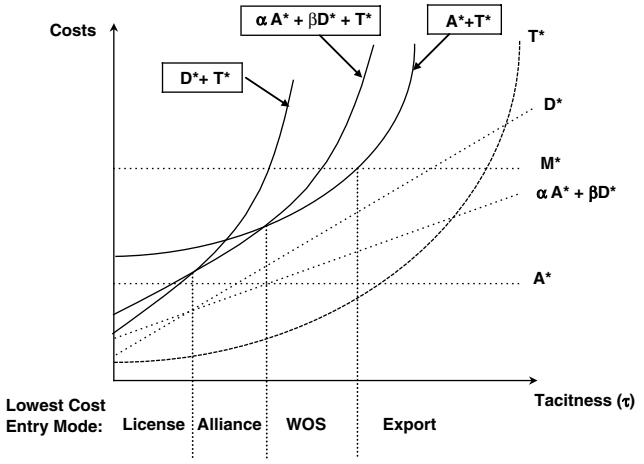

Figure 1 Effect of tacitness on costs of four entry modes.

unlikely in practice, as an alliance still incurs both some A^* and some D^* (see Buckley and Casson, 1996). Furthermore, since an alliance faces some weighted combination of A^* and D^* whereas WOS and licensing incur only one of these costs to its full extent, the range of tacitness at which an alliance is most likely to be optimal will lie between the ranges at which licensing and WOS dominate, respectively.[7]

Figure 1 illustrates the choice among entry modes graphically. At lower tacitness levels, the knowledge dissipation costs, D^*, are low, so that licensing is preferred to a WOS (and an alliance) incurring foreignness costs, A^*. Transfer costs, T^*, are also low, so licensing is preferred to exporting. As tacitness increases, D^* rises to exceed A^*. In the middle range, where D^* and A^* are approximately equal, an alliance stands to be superior to a WOS and to licensing alike because it incurs these two costs less than proportionately. As tacitness increases further and D^* grows much larger than A^*, a WOS is preferred to an alliance (and licensing). A WOS is also preferred to exporting, provided that transfer costs are not too high. Finally, as tacitness increases yet further, exporting becomes the lowest-cost solution.

In summary, we expect the most suitable among five strategies to vary as follows (as tacitness decreases): first, exporting, where extreme transfer costs preclude foreign production; second, WOS, which overcomes export barriers and ensures the greatest control over the know-how abroad but incurs a full liability of foreignness; third, an alliance, which incurs a lower liability of foreignness and provides partial protection against knowledge dissipation, and is most likely to be optimal when A^* and D^* costs are roughly equal; fourth, licensing, which avoids the disadvantages of foreignness provided the dissipation costs can be kept in check; and fifth, forgoing the foreign market (doing nothing), if knowledge-based assets are insufficiently distinctive and defensible. The corresponding propositions are:

Proposition 1a: All else equal, at the highest levels of knowledge tacitness, a firm is most likely to use exports to tap a foreign market (rather than adopt one of the other entry strategies).

Proposition 1b: All else equal, at higher-intermediate levels of knowledge tacitness, a firm is most likely to establish a WOS (rather than adopt one of the other entry strategies).

Proposition 1c: All else equal, at medium-intermediate levels of knowledge tacitness, a firm is most likely to establish an alliance with a local partner (rather than adopt one of the other entry strategies).

Proposition 1d: All else equal, at lower-intermediate levels of knowledge tacitness, a firm is most likely to license its knowledge to a partner based in the host country (rather than adopt one of the other entry strategies).

Proposition 1e: All else equal, at the lowest levels of knowledge tacitness, a firm is most likely to forgo any attempt at tapping a foreign market (rather than adopt one of the other entry strategies).

Incorporating firm heterogeneity: effects of knowledge transfer capacity

The above section shows how strongly knowledge tacitness can influence firms' international strategies. This is not to say, however, that all firms will respond similarly to a given level of tacitness. Relatively little attention has been paid to inter-firm heterogeneity in dealing with tacitness-related constraints on knowledge transfer (Galbraith, 1990; Subramaniam and Venkatraman, 2001). As a result, we know little about how the effects of tacitness may vary across firms (Kogut and Zander, 1995; Love, 1995; McFetridge, 1995). We turn to this issue next. We start by introducing the concept of *knowledge transfer capacity*. Given this, we relax the assumption that knowledge transfer costs (T^*) are the same regardless of entry mode. We then discuss how transfer capacity moderates the relationship between knowledge tacitness and the choice among entry strategies.

The concept of knowledge transfer capacity

A firm needs a range of organizational and technological skills to transfer its knowledge effectively. Nelson and Winter (1982) argued that firms develop idiosyncratic routines aimed at discovering introspectively what functions their technologies serve and articulating them for new users, and that these routines evolve into lasting firm differences. Galbraith (1990) asserted that technology transfer skills represent a substantial source of competitive heterogeneity. We argue that, while possession of knowledge-based assets endows a firm with the potential to benefit following their transfer abroad, a distinct ability to transfer tacit knowledge efficiently is required to make the expansion possible.

The distinction between the creation of tacit knowledge and the ability to transfer the knowledge (that is, efficiency in its transmission to a different user) is critical in this respect. Just as firms and their business units possess differing abilities to create knowledge, they also differ in their ability to transfer knowledge (Teece, 1981, 2000; Kogut and Zander, 1993; Szulanski, 1996). Some are strong at accumulating idiosyncratic knowledge, yet lack the ability to transfer it efficiently. Other firms have a weaker ability to create idiosyncratic knowledge but are quite adept at understanding, articulating, and transferring that knowledge. Conceptually then, knowledge creation and transfer are separate and orthogonal skill dimensions. Again, of course, some firms may be simultaneously strong at creating and transferring knowledge.

All knowledge transfer events involve both a source, or *transferor*, and a recipient, or *transferee* (Arrow, 1969; Szulanski, 1996; Gupta and Govindarajan, 2000). We refer to a transferor's ability to transfer knowledge effectively as *source transfer capacity*. We define source transfer capacity (STC) as the ability of a firm (or the relevant business unit within it) to articulate uses of its own knowledge, assess the needs and capabilities of the potential recipient thereof, and transmit knowledge so that it can be put to use in another location.

This definition highlights three related factors that contribute to a source firm's ability to transfer knowledge. First, a firm should be able to identify potential uses of its knowledge and the conditions under which it can be effectively used (Nelson and Winter, 1982). This does not entail articulating the knowledge itself, but rather being able to describe potential uses and conditions regarding what the knowledge can help a user accomplish. Second, a source firm should be able to determine how ready a recipient is to access knowledge and assess the recipient's strengths and weaknesses in the assimilation and use of the knowledge (Arrow, 1969; Leonard-Barton, 1988). This understanding of the recipient helps the source ascertain how the knowledge should be conveyed and what expectations can be set. Third, a source should be able to act as a proficient sender, transmitting the underlying information in proper form, duly arrayed and timed, and targeted to the proper recipient(s) within the transferee organization (Godkin, 1988; Winter, 1995). These three factors contribute to establishing a suitable match between the knowledge and the implementation environments of the source and recipient (Leonard-Barton and Sinha, 1993; Szulanski, 1996). Furthermore, the source and recipient have complementary roles in the transfer event (Szulanski, 1996; Argote, 1999).

Indeed, a competence related to but distinct from STC is *recipient transfer capacity* (RTC). We define RTC as a transferee's ability to assimilate and retain knowledge from a willing source. To assimilate knowledge requires that a firm be able to evaluate external knowledge, take in all its detail, and modify or create organizational procedures to accommodate the new knowledge (Arrow, 1969; Leonard-Barton, 1988). Retaining the knowledge is also critical, and entails spreading the knowledge within the recipient organization and motivating and monitoring its continued use (Szulanski, 1996; Argote, 1999).

RTC and STC differ in that STC pertains to the outward transmission of knowledge, whereas RTC applies to its inward transfer. RTC encompasses the ability of the recipient to decipher the message in a collaborative transfer event, whereas STC refers to the source's ability to convey the knowledge under the same circumstances. RTC also differs from the concept of *absorptive capacity* as described by Cohen and Levinthal (1990). RTC describes the ability to take in know-how from a specific willing and cooperative source, whereas absorptive capacity pertains to the ability to capture spillovers from unwilling sources in a diffuse competitive environment. Explaining knowledge transfer from a willing source is conceptually and practically different from explaining competitive spillovers from unwilling sources (Teece, 1981; Mansfield *et al*., 1982; Rivkin, 2001).

Entry modes and STC

The transfer of knowledge requires active involvement by both the source and the recipient. Thus the total transfer costs, T^*, are a function of the

amount of effort contributed by each partner in the transfer, and of their respective efficiency in transferring knowledge. Transfer costs will therefore vary with the efficiency of the source and recipient in transferring knowledge, as well as with the division of labor that determines how much each partner's efficiency gets factored into overall transfer costs. In this section we examine the effect of STC on transfer costs, and how that in turn affects the choice among entry modes.

In a knowledge transfer event, the costs associated with the source's efforts will vary inversely with the source's efficiency (STC), while the costs associated with the recipient's efforts will vary inversely with the recipient's RTC. Stronger STC lowers transfer costs because it reduces the costs associated with the source's effort. Transfer costs stand to be lower the more efficient the source firm is at identifying recipients, assessing the recipient's readiness to use the knowledge, organizing the underlying information, and transmitting that information accurately. Likewise, stronger RTC helps, holding STC constant. The costs resulting from the recipient's efforts will be lower if the recipient is better able to assess and assimilate new knowledge, and to spread and reinforce its use. Because we are interested in describing the transferor's strategy, and STC most directly describes transferor-side heterogeneity, we focus on STC at first. Thus, for now, we assume RTC to be fixed. The benefits of STC in terms of knowledge transfer costs are expressed as:

$$\partial T^*/\partial\sigma < 0, \tag{7}$$

where σ indicates STC.

Furthermore, STC will moderate the relationship between tacitness and entry strategy. STC, by itself, does not remove the low codifiability, low teachability and high complexity that characterize tacit knowledge. However, superior STC allows a source firm to anticipate transfer requirements, prepare personnel accordingly, and optimize the amount and pacing of information delivered to the recipient. Through such mechanisms, STC helps reduce the 'stickiness' associated with tacit knowledge (von Hippel, 1994; Szulanski, 1996). STC thus counteracts the positive impact of tacitness on transfer costs. Formally stated:

$$\partial^2 T^*/(\partial\sigma \cdot \partial\tau) < 0, \tag{8}$$

where T^* represents transfer costs, σ is STC, and τ is tacitness.

Given these relationships, we can now revisit the effects described in Propositions 1a–1e to incorporate firm heterogeneity in the form of STC. These propositions described multiple tradeoffs. The most relevant of these tradeoffs are between adjacent solutions in Figure 1: that is, (1) between export and WOS, (2) between WOS and alliance, (3) between alliance and licensing, and (4) between licensing and forgoing. As we discuss next, STC modifies each of these tradeoffs in a distinct way. Figure 2 illustrates this graphically.

The choice between exporting and WOS varies in a straightforward way with STC. We anticipate that this tradeoff will matter most when tacitness is high. Exporting minimizes knowledge transfer costs, but incurs export marketing costs, M^*. Stronger STC lowers the rate at which knowledge transfer costs increase with tacitness. Thus, as STC increases, the point at which transfer costs plus foreignness costs ($T^* + A^*$) exceed export marketing costs (M^*) shifts to a higher tacitness level. Therefore STC encourages WOS as a substitute for export, all else equal.

STC also stands to affect the tradeoffs between alliance and WOS, and between alliance and licensing. However, these relationships are more intricate, because each of these modes requires the transfer of knowledge abroad. All else equal, the stronger a firm's STC, the more advantageous it would be to substitute comparatively efficient source transfer effort for recipient transfer effort. Yet the extent to which STC can be leveraged in this way tends to vary across entry modes.

WOS and alliance are most likely to be preferred at intermediate to high levels of tacitness. In this range, higher tacitness encourages WOS relative to alliance. Furthermore, we expect the offsetting effect of STC to be stronger for a WOS than for an alliance. That is because the division of labor gives the source unit a more important role in a WOS than in an alliance, whether the WOS is a greenfield investment or an acquisition. In the greenfield case, a newly established subsidiary inherently lacks skills and recipient capacity independent of the parent. For acquisitions, the transfer tasks similarly accrue primarily to the source (Capron *et al.*, 1998). Conversely, in alliances the maintenance of a cooperative stance between legally separate parents prevents unilateral reliance on the source's skills but favors a balanced division of labor (Teece, 1981; Hennart, 1993). Thus, all else equal, a WOS will leverage STC so that stronger STC will encourage WOS over alliance by pushing the boundary between these two choices to a lower (albeit still relatively high) level of tacitness.

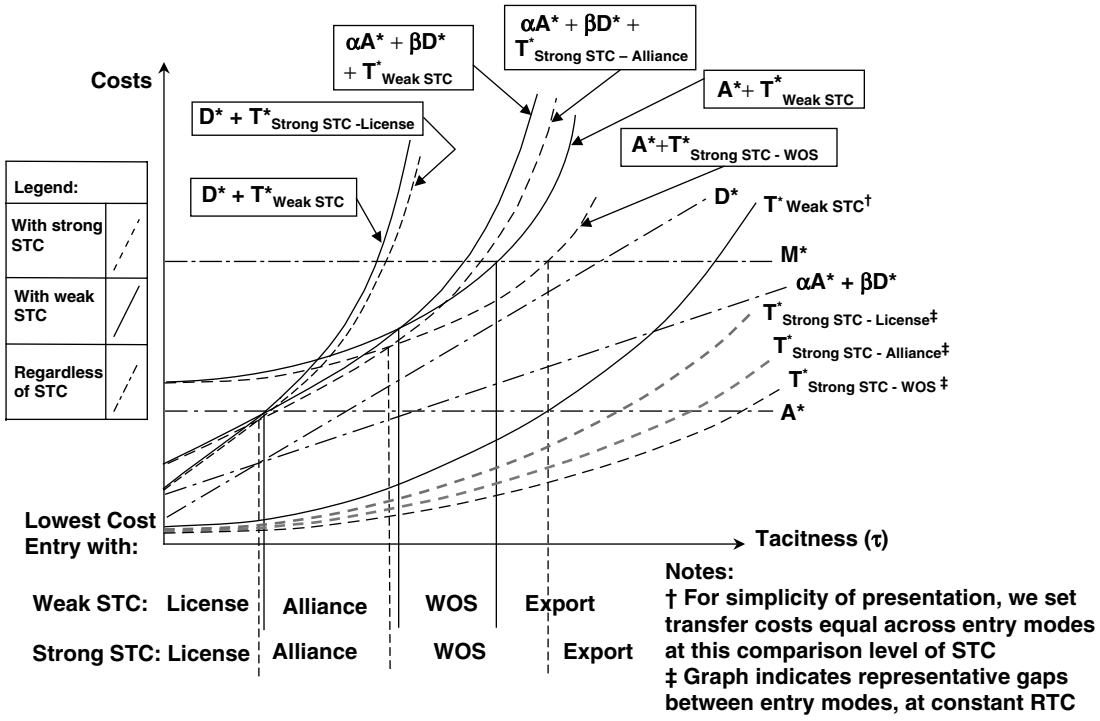

Figure 2 Effect of tacitness with moderating effect of STC.

The boundary between alliance and licensing occurs in the lower to intermediate range of tacitness, with higher tacitness encouraging alliance over licensing. In this instance, we expect an alliance to leverage STC more strongly than licensing. The purpose of licensing is to allow the recipient to master the knowledge so it can use it autonomously, without ongoing involvement by the source. This requires extensive involvement of the recipient in the knowledge transfer process (Godkin, 1988; Galbraith, 1990). Alliances favor comparatively greater source involvement (Teece, 1981; Hennart, 1993). Thus stronger STC should encourage alliance over licensing.

Finally, at lower levels of knowledge tacitness, STC affects the choice between licensing and forgoing the foreign market altogether. Stronger STC can marginally lower the transfer costs to a licensee at lower levels of tacitness. The benefits of stronger STC, meanwhile, are not exploited when a firm forgoes knowledge transfer altogether. Therefore higher STC may encourage licensing rather than forgoing the foreign market.

In addition to the above comparisons among entry modes, we expect the magnitude of the effect of STC to be greater, the more tacit the knowledge. This is for two reasons. First, because T^* increases more than proportionately with tacitness, the gains in transfer costs for each unit of STC stand to increase with tacitness. Second, among the three modes of entry that involve knowledge transfer, the division of labor increases the role of the source, and therefore of STC, as we move from licensing, to alliance, to WOS.

Altogether, we make four predictions about how STC (holding RTC constant) moderates the effect of knowledge tacitness. First, STC will strongly encourage WOS rather than exporting at higher-intermediate levels of tacitness. That is because STC's ability to reduce transfer costs is particularly relevant at relatively high tacitness levels, and a WOS promotes the greatest leverage of source capabilities. Second, stronger STC will encourage WOS rather than alliances at medium to high levels of tacitness. Third, STC will encourage alliances rather than licensing at low to medium levels of tacitness. The scope for STC to lower transfer costs is more limited in this case, because tacitness is moderate and the division of labor may be constrained. Finally, at lower-intermediate levels of tacitness, firms with stronger STC will be marginally more likely to prefer licensing rather than forgoing the market altogether. This yields the following:

Proposition 2a: Given knowledge of higher tacitness, the suitability of establishing a WOS rather

than exporting will increase with STC, all else equal.

Proposition 2b: Given knowledge of medium–high tacitness, the suitability of using a WOS rather than an alliance will increase with STC, all else equal. This increase will be stronger, the more tacit the knowledge.

Proposition 2c: Given knowledge of medium–low tacitness, the suitability of using an alliance rather than a license will increase with STC, all else equal. This increase will be stronger, the more tacit the knowledge.

Proposition 2d: Given knowledge of lower tacitness, the suitability of licensing knowledge rather than forgoing expansion altogether will increase with STC, all else equal. This increase will be stronger, the more tacit the knowledge.

Summary of entry mode predictions

So far we have examined the joint effect of two knowledge-related factors on the choice of entry strategy. First, tacitness raises the costs of transferring productive knowledge to foreign locations and thus hinders some international expansion mechanisms. Second, the ability of the source firm to transfer knowledge effectively (STC) moderates this effect to various extents. The two factors combine to shape the relative suitability of each of the entry strategies.

Figure 3 illustrates the combined effects of STC and tacitness over the entire range of entry strategies. Propensities to adopt a given strategy are indicated in full lines in the case of low STC, and with dashes in the case of high STC. The combined effect of the four propositions can be summarized as follows. First, the combination of Propositions 2a and 2b means that STC will widen the range of tacitness at which WOS will be the preferred entry mode. A firm with stronger STC will tend to use WOS in situations where a weaker-STC firm would resort to exporting (at higher tacitness) and, to a lesser extent, alliance (at medium–high tacitness).

Second, combining Propositions 2b and 2c, stronger STC shifts towards lower values the range of tacitness where alliance is preferred to licensing. A firm with stronger STC will tend to use an alliance where a weaker-STC firm may license (at medium–low tacitness). Likewise, a firm with strong STC will tend to license where it might otherwise forgo entry (at lower tacitness). Thus the tacitness ranges where various strategies prevail relative to others depend upon the strength of STC and the extent to which each entry mode leverages it. However, particularly with alliances and licenses, this also depends on the recipient's RTC.

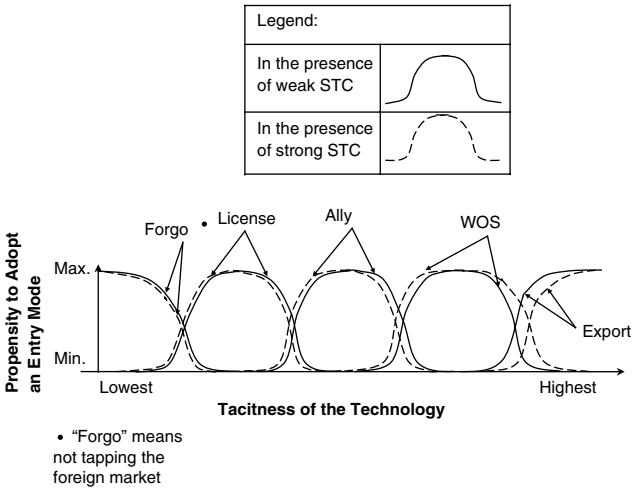

Figure 3 Combined effects of tacitness and STC on entry mode.

Revisiting the role of RTC

A notable implication of our discussion of tacitness and STC so far is that the overall scope for licenses and alliances appears to be reduced as STC increases. Holding RTC constant, we predict that stronger STC will encourage WOS over alliance, so the overall scope for alliance and licensing may be reduced. Yet the use of cooperative strategies is prevalent and if anything becoming more common (e.g., Contractor, 1990; Hennart, 1993; Martin *et al*., 1998). To understand why this may be, even in the presence of tacit knowledge, it is useful to consider the role of RTC. In so doing, our framework allows us to fruitfully revisit existing knowledge-based arguments about foreign market entry.

Ignoring STC and RTC, Kogut and Zander (1992) argued that transferring tacit technology would inherently be more expensive across firm boundaries than within a firm. They argued that firms exist because they are intrinsically more capable of transferring their own proprietary knowledge. As evidence, Kogut and Zander (1993) reported that, given that foreign transfer occurred, more tacit technologies were more likely to be transferred internally through a WOS. Our analysis conditions this argument by showing that, while this may often be true, this depends crucially on transfer capacities.

In the presence of strong STC, we indeed expect the costs of internal transfer to be lower than those of alliances or license contracts. Furthermore, Equation (8) implies that this differential will increase with tacitness. At weaker levels of STC, however, the gap in transfer costs declines. Furthermore, the RTC of potential licensees or alliance partners may act as a substitute for some elements of STC. Thus it is theoretically possible that an alliance or license agreement could lower aggregate transfer costs relative to a WOS. More specifically, this may occur where the source has relatively weak STC, and a potential licensee or alliance partner possesses superior RTC. This scenario adds a level of contingency to the pattern predicted by Kogut and Zander (1993). Under this scenario, the scope for alliances and licenses may increase substantially, as these entry modes leverage RTC best. The basic lessons of our analysis nevertheless remain true: namely, that tacitness still constrains the overall scope for international entry modes that require knowledge transfer. Furthermore, concerns about knowledge dissipation ultimately make a WOS preferable to collaborative entry modes (Anderson and Gatignon, 1986): thus Propositions 1a–1e still hold. Further, the logic underlying Propositions 2a–2d still applies as the relative strength of a source's STC and its potential partner's RTC helps explain the relative suitability of the various entry strategies.

Extending the model

Knowledge-seeking strategies and pre-existing foreign subsidiaries

Up to this point, the analysis has focused on foreign entry as a means of exploiting a firm's knowledge-based advantages. However, our results can also help reconcile arguments regarding knowledge-exploiting *vs* knowledge-seeking expansion. Recent research has emphasized that firms may expand with the primary intention of acquiring valuable knowledge that resides abroad. Firms may seek knowledge from various subsidiaries within the MNC (Ghoshal and Bartlett, 1990) or from independent firms located abroad. Some empirical results support this claim (Kogut and Chang, 1991; Almeida, 1996; Shan and Song, 1997).

Our analysis can be extended to encompass knowledge-seeking strategies. Knowledge seeking represents the mirror image of knowledge exploiting, with transfer roles reversed so that the focal firm becomes the recipient. The basic issues of knowledge transfer costs, tacitness, and transfer capacities still apply. Tacitness still places a premium on tight coordination between recipient and source, and beyond some point discourages knowledge transfer. In this case, the RTC of the recipient becomes the focal variable of interest. RTC helps the knowledge-seeking firm identify, assimilate and retain knowledge residing abroad. However, the foreign source's STC is also an important consideration. The relative costs of different entry strategies depend on the relative transfer capacities of the two parties, and on how much they can be leveraged under each entry mode. The conditions for each entry strategy to be optimal are thus consistent with those in knowledge-exploiting situations, albeit with transfer roles reversed.

Our analysis also informs the knowledge transfer strategies of firms that already possess established networks of foreign subsidiaries, with a straightforward adjustment in level of analysis from the firm to the business unit. Above, we focused on the single-country company that contemplates initial foreign entry. This focus on the nascent multinational corporation was consistent with the internalization and knowledge-based literatures upon which we build and allowed greater simplicity in presentation. However, mature multinationals have multiple subsidiaries in place, each of which may play the roles of source and recipient. Substantial research has addressed the issues inherent in managing widespread subsidiary networks. Much of this research emphasizes the relationships among existing subsidiaries that, by mandate or idiosyncratically, may differ in their accumulated knowledge at a given point in time (e.g., Bartlett and Ghoshal, 1989; Birkinshaw and Hood, 1998).

In the case of a nascent multinational that starts solely with home-country operations, the parent firm and sole initial unit represents the entire organization. Thus the whole firm is the relevant unit of analysis. For an established multinational with multiple subsidiaries, the business unit where knowledge initially resides can be thought of as the organization of reference. Again, tacitness affects the cost of knowledge transfer among subsidiaries, and the comparison among entry strategies remains valid. Furthermore, our model readily extends to allow each subsidiary to have its own distinct STC and its own distinct RTC. The division of labor for the knowledge transfer still stands to be salient. And again, the effects of the source unit's STC and recipient's RTC can be analyzed using our model. Thus our predictions generalize usefully to

existing multinational networks with internally differentiated knowledge bases, and the model adds richness in the analysis of transfer capacities.

Incorporating various means of protecting knowledge

As discussed above, one of the relevant features of tacitness is that it shields knowledge from unwanted imitation. Conceptually, there exist other means of protecting knowledge from imitation, including secrecy and intellectual property rights such as patents, copyrights and trademarks. These alternative knowledge protection mechanisms may also affect the choice of entry mode. Theoretically, such alternatives could reduce the impact of tacitness. For instance, perfect intellectual property rights would render a licensing option comparatively attractive (Buckley and Casson, 1976). We therefore consider next the practical and conceptual implications of the existence of alternative appropriability mechanisms.

In some cases, secrecy or strong intellectual property rights may allow firms to protect even highly explicit knowledge against unwanted imitation. However, as Levin *et al*. (1987) showed in their exhaustive survey, such protection is considered weak or ineffective in most US industries. This is especially the case for *process knowledge*, which is the form of knowledge of interest here. Levin *et al*. (1987, 796) wrote of the 'perceived ineffectiveness of patents in most industries'.

Teece (2000) examined the international dimensions of this issue. He pointed out that intellectual property rights remain weaker yet in most other countries. Teece (2000, 96) argued that:

> Despite recent efforts to strengthen the protection of intellectual property, strong appropriability is the exception rather than the rule…. Since strong appropriability is the exception rather than the rule, innovators must adopt clever market entry strategies if they are to keep imitators and other followers at bay.

Cohen *et al*. (2002) provide additional support for this view, showing that patents are of limited effectiveness in Japan as well.

Practically, our predictions about tacitness are most relevant for the many industries and countries where patents and secrecy are insufficient alternatives for protecting knowledge. In those relatively few industries where intellectual property rights are potent protection mechanisms, licensing and/or alliances may be more common. However, even then, tacitness still retains an important role as a complementary mechanism in appropriating returns from innovation (Nelson and Winter, 1982; Teece, 2000).

Conceptually, differences in appropriability regimes and/or the effectiveness of secrecy may be incorporated into the model as downward shifts in the intercept of D^*. The slope of D^* may also decrease, but it is unlikely to flatten altogether (Nelson and Winter, 1982; Teece, 2000). Under these conditions, our model remains relevant for questions pertaining to knowledge transfer costs and the division of labor between source and recipient. In assessing how to exploit its knowledge abroad, it is critical for a source firm to address obstacles to transferring knowledge and how tacitness may be partly overcome by STC and/or RTC.

Incorporating host location characteristics

For clarity, the discussion above has taken host location features as given. Although some differences between countries may make a difference of degree to the results stated above, we do not believe that they fundamentally change them. Still, it is worth considering the impact of location on entry strategy. We discuss how two types of country factors can fit in our model.

First, some country factors primarily affect the costs of operating in the host country (*vs* the source country). They affect the relative suitability of export *vs* the aggregate of the solutions that require knowledge transfer (WOS, alliance and licensing). The variable M^* can be defined to include any such differences. For instance, higher tariffs discourage exports (they raise M^*). For the purpose of comparing among the four entry modes, additional fixed costs associated with locating in a given foreign location (e.g., forced disclosure of technology) can likewise be modeled as a decrease in M^*.

A second set of country characteristics may make a further difference to the choice among the entry modes that involve production in the target country. These host location characteristics can differentially affect the costs of knowledge transfer for licensing, WOS and alliance. For example, even in those relatively few industries where patents may effectively protect process knowledge in a firm's home country, arm's length transfer will be problematic in foreign markets where intellectual property rights are improperly enforced. In this case, weak local institutions can be thought of as raising knowledge dissipation costs, D^*. Here, and more generally, we again do not expect country features to change the logic of the entry mode choice as

stated in our propositions. Features that raise dissipation costs promote WOSs over alliances and licensing (Anderson and Gatignon, 1986; Caves, 1996). Thus the combined scope for closely controlled solutions (WOSs or exporting) grows. Also, the knowledge-protecting feature of tacitness becomes all the more important as local institutions for intellectual property rights protection are weak, and imitation by non-partners cannot be legally prevented (Kogut and Zander, 1992; Teece, 2000). However, the relative ranking among entry strategies with respect to tacitness and STC remains unchanged. Thus while examining location factors is certainly relevant, particularly in studies with multiple host countries, such country effects do not change our predictions.

Discussion and conclusion

Implications for theories of entry mode

For competitive advantage, a firm must not simply create distinctive intangible assets; it must also exploit the knowledge efficiently (Nelson and Winter, 1982). Multinational firms seeking to exploit their intangibles must decide whether and how to transfer the underlying knowledge across borders. This study adds to our understanding of these issues in several ways.

First, we examine the impact of tacitness on entry strategy. In so doing we enhance recent knowledge-based arguments about the scope for various entry modes. We describe formally how tacitness will influence the costs associated with each mode of entry. Tacitness stands to raise dissipation and transfer costs. We predict that the preferred entry modes will vary as follows as tacitness decreases: exporting, WOS, alliance, and licensing.

This analysis extends Kogut and Zander's (1992, 1993) arguments about modes of entry. Kogut and Zander (1992) examined the choice between WOS and external transfer in a sample consisting solely of investments in foreign locations. Kogut and Zander (1993) found that, as tacitness increases, WOS becomes more likely relative to cooperative entry modes. Our propositions add precision to knowledge-based arguments by distinguishing between the conceptually separate modes of alliance and licensing, and by incorporating exporting and forgoing (non-entry) options.

Our entry mode analysis also extends the predictions arising from conventional internalization research. Internalization research has traditionally focused on the contrast between WOS and licensing (Buckley and Casson, 1976). Models incorporating a full range of entry modes are an important and timely addition (Buckley and Casson, 1996). This study contributes by generalizing internalization research across five entry options. In addition, it outlines points of agreement between internalization and the more recent knowledge-based view of the firm. We show under what conditions firms (or their business units) with weaker or stronger transfer capacity can use knowledge-based assets to support international expansion, given the challenges inherent in transferring tacit knowledge. This argument helps reconcile the internalization and knowledge-based views of multinational firm expansion whose convergence has been the subject of recent debate (Kogut and Zander, 1995; Love, 1995; McFetridge, 1995).

Second, we address the impact of heterogeneous knowledge transfer skills. We introduce the concept of STC and relate it to the distinct, but complementary, concept of RTC. STC and RTC represent the respective capacities of a source and recipient to effectively transfer knowledge-based assets. We describe how the combination of STC and tacitness influences a firm's choice of entry strategy, thus formally building firm heterogeneity into the extended knowledge-based model. When a firm possesses strong STC, the costs of transferring its knowledge will still increase with tacitness, but at a slower rate.

Transfer capabilities help explicate the conditions under which it becomes suitable to use various foreign entry modes. Holding RTC constant, STC shifts the costs of each entry mode in ways that increase the combined scope for alliance and WOS, but do not change the ranking of the modes with respect to tacitness. Transfer capacities also shed light on the use of collaborative entry modes. The costs of alliances and licensing increase in tacitness, but STC and RTC moderate these effects in complex and interesting ways. Importantly, the analysis also points to the importance of RTC as a criterion for assessing potential alliance partners or licensees.

Finally, we incorporate knowledge transfer costs, tacitness, and transfer capacity into an established model of entry mode selection first advanced by Hirsch (1976) and Rugman (1981). We extend their model to recognize that knowledge transfer is not costless, and can substantially constrain foreign entry. Moreover, we describe how firms may overcome some of these constraints. Although we adopt simplifying assumptions from previous models for greater theoretical tractability, an interesting exten-

sion would be to relax some of the assumptions to formally incorporate dynamics into the model. For example, future research could allow the tacitness of knowledge to vary over time and examine the subsequent influence on the cost components of the model. Likewise, future research could explicitly incorporate different revenue flows for different entry modes, as may be relevant if a firm's proprietary knowledge is subject to uncertain imitation or obsolescence.

Empirical operationalization

Another promising and highly relevant avenue for future research is the empirical examination of the effects we predict. In this respect, an important consideration is how to operationalize the explanatory variables outlined here, especially tacitness and knowledge transfer capacity.

The empirical literature contains examples of two different methods to measure tacitness. Some research has used a survey approach. Studies reporting tacitness items include Kim and Hwang (1992), Kogut and Zander (1993), and Simonin (1999a). These measures have the advantage of being applicable in multi-industry studies, with the usual caveats. An alternative approach uses variance among technologies employed in a single industry to infer tacitness levels. Instances include Arora and Fosfuri (2000) and Martin and Salomon (2003), which relate tacitness with the propensity to invest abroad (but do not explore the full range of entry modes). Studies using this approach can make use of archival sources and longitudinal data. Overall, the literature on the measurement of tacitness has become quite extensive. This progress is remarkable given that tacit knowledge is inherently harder to measure than other knowledge.

Although there has been less research on knowledge transfer capacity, we believe that it too can be reliably measured. Again, questionnaire-based measures hold promise. Szulanski (1996) describes a construct of the ability of a recipient to routinize and retain newly acquired knowledge, and associates it with the difficulty of transferring technology within firms. Using a similar approach, it would likewise be possible to develop a symmetric concept on the source side. Indeed Pedersen *et al.* (2003) offer a partial measure of source 'transfer capability' and relate it with participants' satisfaction with the knowledge transfer process. These precedents suggest that STC and RTC could be suitably measured via survey.

In addition, several correlates of an organization's STC or RTC are observable. For example, firms have more success in transferring their technology outward if they have a formal, dedicated 'knowledge and technology transfer unit' in place (Von Krogh *et al.*, 2000). Meanwhile, inward transfer works better when the recipient is organized to deploy flexible multidisciplinary teams (Godkin, 1988). Likewise, prior experience with successive projects may improve an organization's ability to transfer knowledge, though research has yet to determine the relative magnitude of these effects for sources and recipients (see Godkin, 1988; Kogut and Zander, 1992). In summary, past research suggests that the concepts of STC and RTC, like tacitness, are amenable to measurement and empirical testing.

Performance implications

Another interesting extension of this research pertains to performance implications. Multiple dimensions of performance are plausibly affected by the conditions we describe. In studies of knowledge transfer, researchers commonly measure the performance of the transfer event by using subjective measures of satisfaction with the process and/or outcome of transfer (e.g., Szulanski, 1996). It is also possible to obtain indicators of the costs and time requirements of transfer, and the objective performance of the knowledge in use (e.g., Teece, 1977; Mansfield *et al.*, 1982; Galbraith, 1990). Such indicators would be especially useful in comparing the performance of transfers using different entry modes. Combinations of quantitative and qualitative methods can be used when researching knowledge transfer performance (e.g., Almeida *et al.*, 2002).

Scholars in international business and strategy are also keen to understand organization-level performance, both before and after knowledge transfer (Kotabe *et al.*, 2003). Relevant indicators include firm-level productivity, profitability and risk, costs and revenues, innovativeness, and survival. Since we contemplate a full range of collaborative and single-firm strategies, one complication is that there may be up to three different entities whose performance can be measured. For instance, in licensing, the recipient is the licensee, but in a joint venture a third entity may be created and become the recipient relative to a source parent and a second, non-source parent. Fortunately, the split between source and recipient also presents opportunities for researchers by making it possible to disaggregate costs and benefits across parties. In particular, given that each transfer event involves a

mix of source and recipient tasks, it would also be interesting to examine how the risks and rewards of knowledge transfer are divided between source and recipient (see Contractor, 1985).

Given that our model proposes several contingencies for entry strategy, a particularly appropriate issue for analysis is that of fit and performance. Matching the medium of transfer with knowledge characteristics is an important task (Leonard-Barton, 1988; Pedersen *et al.*, 2003). We argue that firms should further fit their mode of entry to tacitness and transfer capacity conditions. Because our predictions are based on the set of costs and risks associated with each mode, we expect that firms whose choices of entry modes match the propositions will do best. Furthermore, the form and extent of the penalties associated with various deviations from the suggested optimum may vary. Further research into the extent and implications of various misfits would therefore be very worthwhile (Shaver, 1998).

Conclusion

This study analyzes tacitness and transfer capabilities to provide a more complete picture of how knowledge shapes entry mode selection. Previous studies of foreign entry mode show that tacitness can be a severe obstacle to entry. We argue that whether and how this obstacle can be overcome is a function of idiosyncratic firm capabilities in knowledge transfer. To characterize these we advance the concepts of STC and RTC. Previous research has tended to be piecemeal in its treatment of entry mode choice in the presence of tacit knowledge, even though a salient recent debate on the theory of the multinational corporation centers on this issue. Research has been particularly scarce regarding heterogeneous transfer capacities. We discuss how these contingencies can help reconcile and enrich internalization and knowledge-based views. Our enhanced framework characterizes the relative suitability of the complete range of entry options including domestic (export), foreign (WOS) and collaborative (alliance, licensing) solutions. This research yields insights into how firms choose what knowledge to exploit (or seek) abroad, and how to govern these strategic endeavors. Further conceptual and empirical research in this area is well warranted.

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Notes

[1]In order for firms to determine the net present value of the costs associated with particular entry modes, we must assume that they have access to the information necessary to assess those costs over time (Rugman, 1981).

[2]Although the licensing and alliance options generally involve the sharing of production costs between source and recipient, we include C^* among the costs relevant to the source firm in examining the license and alliance options. We do so because this facilitates comparisons with the export and WOS alternatives (see also Hirsch, 1976; Rugman, 1981). This is analytically convenient and duly recognizes that, if the productive knowledge is used abroad, then the source firm and/or its partner must incur production costs in the host location. Furthermore, these costs should be deducted from the project's revenues in arriving at the potential profits to the source firm. Our specification recognizes that C^* represents a deduction from revenues that, regardless of entry mode, will affect the net income available to the source firm. We thank two anonymous reviewers for helpful comments on these issues.

[3]The cost minimization approach is also consistent with the broader international business literature, including internalization arguments, and with many models that describe cost minimization as a means of studying profit-maximizing strategies (see Buckley and Casson, 1976; Williamson, 1991; Varian, 1992; Hennart, 1993; Caves, 1996). Two simple assumptions facilitate such a comparison among entry modes. First, the source firm is the only firm that possesses the knowledge-based assets at first (Hirsch, 1976; Dunning, 1993; Caves, 1996). Second, there exist several potential partners in the host location (Rugman, 1981). Such conditions allow the monopolist to extract the profits from any partnership (see also Buckley and Casson, 1998). Then, assuming that demand is independent of the mode of entry used by firms, cost minimization is strictly equivalent to profit maximization (Hirsch, 1976; Rugman, 1981; Williamson, 1991; Hennart, 1993).

[4]The basic model assumes that the net present value of gross revenues is equal across entry modes. However, should any systematic difference in revenues exist across modes, these could be accommodated in

the model as shifts of equivalent magnitude in the various cost components. For example, if we were to assume that a technology must be exploited extremely rapidly, and that licensing (partnering) inherently allows faster entry (notwithstanding knowledge transfer issues), then increases in A^*, and possibly M^*, could accommodate the opportunity cost of not licensing (partnering). Alternatively, D^* could be shifted downwards.

[5]In the section 'Extending the model', we discuss alternative potential means of shielding knowledge, including secrecy and intellectual property rights.

[6]The presumption that the knowledge can be transferred deserves further attention, because tacit knowledge may be inherently difficult to transfer. We return to this issue below.

[7]Although $\alpha + \beta < 1$ is a necessary condition for an alliance to be preferable to licensing and WOS, it is not a sufficient condition. If D^* sufficiently exceeds A^*, or *vice versa*, then the condition will not by itself allow an alliance to outperform both a WOS and a license. Conversely, the condition is sufficient to ensure that an alliance is the preferred mode in a range where A^* and D^* are approximately equal.

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