A theoretical perspective on the location of banking FDI

Abstract

The paper models location of banking FDI under volatile demand conditions. In the model, information arrives either through passage of time or though presence in the foreign market. The model is also extended to analyze strategic and simultaneous FDI to generate an integrated view of the location of production problem.

Key Results

The results show that market entry evolves from deferring FDI to partial FDI and only then to full FDI. The switch to partial FDI occurs faster when banks can gather information only through a presence in the foreign market. The switch to partial FDI does not occur when immediate full FDI enables more efficient production. The results are at odds with models developed for predictable demand conditions in which banks switch straight from deferring FDI to full FDI. The paper generates an integrated view of the location of banking FDI.

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Abbreviated Heading

Location of banking FDI

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1. Introduction

Internalization theory applied to the banking firm is concerned with why banks expand across borders and how they do so. The theory assumes that source country banks develop resources in the form of information, technology, capital or managerial expertise in the domestic market that can be used in the foreign market at a low marginal cost (Casson 1990, Esperanca and Gulamhussen 2001, Qian and Delios, 2008). High costs of transacting these ownership advantages inhibit the emergence of licensing, franchising and joint venture arrangements. Domestic banks thus appropriate greater rent by undertaking wholly-owned FDI rather than using the aforementioned entry modes (Tschoegl 1987). Banks may be attracted to specific foreign markets due to regulatory factors as well as the size of the local banking market measured, for example, as the presence of domestic and local customers (Gray and Gray 1981, Cho 1986, Nigh, Cho and Krishnan 1986, Sabi, 1988).

Banking activity is location-specific in the sense that presence in the foreign market is required for information production and signaling and to monitor domestic and local customers, reduce transaction costs and undertake portfolio optimization and asset transformation (Grubel 1977). For example, the need to monitor customers more closely than can be done from the headquarters provides an incentive to establish a direct overseas presence although these foreign offices will probably still face somewhat of a disadvantage relative to their local competitors in this area (Diamond 1984); banks with a diversified customer base will be able to reduce transaction costs by pooling customers with offsetting needs (Benston and Smith 1976); banks that excel in producing value-added products develop expertise in portfolio and asset transformation (Diamond and Dybvig 1983); banks that specialize in syndicated loans, foreign exchange, Eurobond issues and derivatives develop signaling related advantages (Campbell and Kracaw 1980).

The location of FDI involves a comparison between exporting to the host country (through correspondent banking) and market servicing from a production unit sited in the host country (an office in the foreign market) (Aliber 1976). Khoury (1979) formalizes this problem and shows that firms export when demand grows at a predictable rate as long as the marginal cost of

production and transport are less than the cost of undertaking FDI. The model developed in this paper shows that when demand is volatile banks exercise caution not only by exporting but also by undertaking partial FDI. The initial version of the model is based on the assumption that the bank has a monopoly over an investment opportunity and the product market is perfectly competitive, i.e. the impact on prices and market structure is minimal. This assumption is relaxed in subsequent sections. The bank produces under constant marginal costs but makes decisions prior to the revelation of demand.

The paper differs from earlier papers that analyze FDI under volatile supply conditions, i.e., it is not foreign demand that is volatile but the cost of producing in different locations (DeMeza and van der Ploeg 1987, Capel 1992, Kogut and Kulatilaka 1994, Mello, Parsons and Triantis 1995, Capel 1997). Unlike transitory volatility modeled here, papers based on supply assume that volatility relating to the cost of producing in different locations is persistent and firms make decisions after the revelation of cost conditions.

Sections 2-4 of this paper lay out the foreground for the development of a dynamic analysis of banking FDI. The specialist reader can skip these sections. Section 5 develops a simple model that addresses key issues involved in the location of FDI under volatile demand conditions. Sections 6-9 analyze the option effects in waiting and in undertaking partial, strategic and simultaneous FDI. The last section summarizes the main conclusions and suggests avenues for further research.

2. Internalization and the Flow of Information

Banks make extensive use of information in their role as financial intermediaries. Considering a simple debt contract, to start with, potential borrowers and lenders need to find a suitable partner to trade with. In such trade borrowers are typically better informed about the future prospects of their investments than lenders. This information gap is a source of market failure. If it is wide then lenders may not be willing to engage in trade with borrowers because of the potential costs associated with being cheated (Akerlof 1970). Although borrowers can reduce this gap by engaging in positive signaling activities, signaling is frequently not sufficient for markets to be established. Banks overcome this hurdle by participating in the process of screening borrowers. This activity reduces the information gap between lenders and borrowers who engage in trade via the intermediary (Chan 1983). Banks also help to overcome market failures by monitoring borrowers, reducing transaction costs, portfolio optimization and asset

transformation and information production and signaling. In their role as intermediaries, banks reduce several types of cost: search costs relating to bringing lenders and borrowers together; verification costs relating to the certification of the accuracy of information provided by borrowers; monitoring costs relating to the avoidance of adverse selection and moral hazard; and finally costs relating to enforcement in the event of breach of contract. Proximity to borrowers and markets facilitates the gathering of information required to establish markets (Heffernan, 1996).

Banking activity is location-specific in the sense that a local presence is required to establish markets. In distant markets, information can be produced and distributed by undertaking FDI. If banks undertake immediate full FDI, it becomes a risky action in the short-run because the results may prove to be too poor if the market turns out to be unfavorable. However, in the long-run this may be useful because full FDI may confer a cost advantage that will not be available to late entrants (see section 8 and 9). The alternative to undertaking immediate full FDI is to undertake partial FDI. With such an investment, banks can exercise the implicit options to expand if foreign demand is favorable or withdraw from the market if foreign demand is unfavorable (see section 6 and 7). An alternative to gathering information by undertaking FDI is to export or hire consultants. However, the quality of such information may not be appropriate enough to allow banks to make sound decisions. In this sense, undertaking FDI can be viewed as an experimental approach whereas the gathering of information (prior to undertaking FDI) through exporting or hiring consultants can be viewed as a more analytical approach (Casson, 1994).

Another way to deal with demand volatility is to act in the belief that it can be dispelled with the passage of time. This makes it advantageous to postpone FDI by exporting. Deferring FDI (or exporting) means that decisions are made after the arrival of information which implies that the risk of making a mistake is lower than when decisions are made to enter the foreign market at the outset (see section 5). However, deferring entry can lead competitors to pre-empt the market. Thus, there is a trade-off between waiting for the arrival of information and entering the foreign market at the outset. This is the thrust of the emerging literature on real options (Dixit, 1994).

In the formal international business literature, volatility is captured by discretizing the set of all possible states of the environment into subsets and then assigning subjective probabilities to the different subsets (Casson 1999). Volatility is assumed to be high when the subsets have approximately equal probabilities and it is low when one subset has a probability close to unity.

Managers face the problem of maximizing expected NPV. In the case where managers face a single source of volatility, the weighted average of the strategies in response to each possible state generates the expected value of deciding with information. This value is then compared with the expected value of deciding with no information. The value of information can then be measured in terms of the increase in the expected value of the strategies. If new information changes the decision, it is relevant and of value. New information increases the expected value of the decision because decisions based on more information are better than those made with no information. Information is most valuable to managers when they lack confidence about the true state and where the cost of making mistakes is high. Conversely, the value of information is least valuable to managers when they are confident about the true state and where the cost of making mistakes is low. The more confident the managers, the less they feel the need for more information and the more likely they are to take gambles instead. The less confident the managers, the more they feel the need for more information in order to avoid mistakes.

3. Adjustment Costs

In the existing literature on multinational banking, authors use cost-based analysis to determine whether banks should defer or undertake FDI (e.g. Aliber 1976). These contributions fail to recognize that the location decision is a dynamic problem because demand conditions are likely to change over time and, if switching between different modes involves costs, it may no longer be obvious what the bank's optimal serving mode is at each point in time (Buckley 2004). Switching between different market servicing modes is similar to an investment where the adjustment costs represent the initial investment outlay. Buckley and Casson (1981) addressed this issue explicitly. In their model, they assume that foreign demand grows at a predictable rate and switching involves costs that firms have to incur when undertaking FDI.

In this paper, banks face a similar decision but foreign demand is volatile. Thus, the paper addresses the impact of volatile demand and the optimal timing of switches between alternative market-servicing modes. If these switches were costless, then there would be no need for banks to plan more than one period at a time. In other words, banks could reverse decisions without incurring costs. It is the combination of volatility and adjustment costs that complicates matters.

When costs of adjustment are high, it is simply uneconomical to continually re-evaluate decisions in light of every minor change in the environment. Costless adjustment is a reasonable assumption when managers are just making buying and selling decisions in financial markets. It

is also a reasonable approximation to the situation in real markets where there is intense competition and the costs of switching between alternative trading partners are negligible. But it does not apply in the context of FDI.

Adjustment costs refer to the costs that are incurred when resources in the form of capital managerial or technical expertise are moved to another location. These costs fall into two categories: entry costs (e.g. costs of training employees or acquiring local reputation) and exit costs (e.g. redundancy payments and costs relating to early termination of lease contracts). Exit costs do not necessarily imply that banks make a net payment on withdrawal. They may still get a positive amount of money when selling computers and office furniture. Exit costs exist when entry costs are not fully recovered. Switching between alternative market servicing modes entails both entry and exit costs. For instance, a bank that switches from exporting to FDI has to build local capacity by buying or leasing new office space, office equipment, training employees and establishing local contacts. But this bank also evaluates the expected costs of closing this local capacity in the future.

4. Option Effects

Option theory is now called on to analyze FDI under volatile conditions (Buckley and Casson 1998, Rugman and Li 2005). There is a close analogy with option theory in this context as well, as a bank's switch from one market servicing mode to another market servicing mode can be viewed as the exercise of an option. The bank pays an exercise price (the adjustment cost) to build local capacity (the alternative market servicing mode) that has a positive value (expected increase in revenues). Whenever the bank switches, it gives up the potentially valuable opportunity to evaluate this switch at a later date when more information is available. However, there are important differences between the present model and the pure financial theory based model.

Financial option theory is based on very specific assumptions (Black and Scholes, 1973). The popular Black-Scholes pricing formula assumes a Brownian motion in the movement of the price of the underlying financial asset and the 'risk neutrality' of the asset-holder, a misleading term because it connotes a particular feature of the arbitrage process. These assumptions obscure the more general insights that emerge in the context of non-contractual real options that are relevant for the location of FDI.

The contemporary theory of financial options is also committed to continuous time models in the tradition of the French mathematician Louis Bachelier. Continuous time is a reasonable approximation to reality in stock and currency markets where trading is virtually instantaneous, but it is a poor approximation to non-contractual decisions relating to the deployment of real assets..

The key to the pricing financial options lies in the solution of specific partial differential equations. The Black-Scholes pricing formula derives a one-dimensional parabolic partial differential equation that describes the price of a European option. This is a special case because it can be solved analytically by transforming the problem into a standard heat equation. More complex options require approximation using finite-difference methods for example. These models can be interpreted as state-contingent models in discrete time. These models are both more realistic and more tractable than the continuous time models to which they approximate. These models are solved backwards using a dynamic recursive technique. The existence of a final period, with which the solution can begin, is crucial to this method. The decisions that can be made in the final period are a function of the decisions that have been made in the previous periods. Managers will have considered the consequences of constraining later decisions when they make earlier decisions. These constraints are particularly important under two conditions: when new information becomes available with the passage of time and when adjustment costs of switching market servicing modes are quite severe (see section 3). Mistakes in switching can occur because the information upon which the decisions are based is poor. The adjustment cost of switching strategies can be reduced by avoiding unnecessary switches.

Financial options involve a contractual agreement that creates the right to either buy or sell financial assets – equity, bond or currency – at a future time at a pre-specified price that is fixed or specified by a rule. The contractual right that stems from the agreement can be traded, as can the underlying financial assets. Real options are applied to different circumstances. The underlying asset to which the option relates is not a financial asset, but consists of FDI in the form of an office. It generates a non-contractual right to expand or contract FDI, conditional on the arrival of new information. This option exists because the bank can exercise it by retaining the ownership of the office and relocating it to an alternative use. Although the office can be sold to another bank, the option is not designed for sale, irrespective of the office to which it applies.

This reflects the non-tradable nature of the real option**.** Non-contractual options are particularly relevant for the location of FDI.

The simplest formalization of a decision involving non-contractual options can be viewed in the context of banking FDI. Consider a bank that owns two identical units of capital stock that can be used to produce services in a different location. The location of one unit is equivalent to undertaking partial FDI. The location of two is equivalent to undertaking full FDI. Instead of undertaking immediate full FDI, the bank can undertake partial FDI with one unit and use the information derived from this to decide whether full FDI will be necessary or not. This is a more flexible form of investment in that it is reversible. One way of expressing this result is to say that partial FDI confers a non-contractual right to expand or divest. The value of the option stems from the adjustment costs that are saved from avoiding the mistaken location of two units. Partial investment is however an interesting option when the firm has monopolistic access to an opportunity and its impact on the market structure is minimal. When there are other potential competitors, not undertaking immediate full FDI can result in competitors seizing the opportunity (see section 8 and 9).

5. The Model

Consider a bank that owns capital stock that can be used to set up an office in a foreign market. This capital is fixed and for convenience is normalized at 2 units. It can be split into two units of one. There are two markets: domestic (A) and foreign (B), and a time structure of three periods. Capital stock is initially located in the domestic market. The size of foreign market (B) can vary between zero and two units.

Demand is volatile because the size of the market is not known at the outset and is dispelled in period 1, after the period 1 decision is made but before the period 2 decision. The problem can be addressed graphically as depicted in Figure 1. It shows the distribution of capital stock at each point in the time structure according to the specifications of the model. Capital stock can follow three paths. One path is associated with exporting in period 1 and undertaking full FDI in period 2 after the size of the market is dispelled; the second path involves undertaking partial FDI in period 1, and once the size of the market is dispelled, the remaining capital stock will be redistributed back to the domestic market or foreign market; and the third path involves undertaking immediate full FDI in period 1 before the size of the market is dispelled. Transaction

costs inhibit the emergence of alternative contractual arrangements such as licensing, franchising or joint ventures.

The probability that the size of the foreign market will be two units is *p*. The probability that the size of foreign market will be zero units is (1-*p*). If the size of the foreign market is two units, the bank can obtain revenues of 30 monetary units; and if the size of foreign market is zero units, the bank can only obtain 10 units of revenue. The cost per unit of output is 5. Selling bank services from the domestic market (A) to the foreign market (B) involves export costs, and buying banking services from the foreign market (B) involves import costs. For simplicity transport and tariff costs are assumed to be 4 units for both directions.

Change in the level of distribution of capital stock from one period to another incurs adjustment costs. The cost of locating two units of the capital stock from the domestic market to the foreign market is 4 and the cost of locating the first unit is 3 while the cost of locating the second unit is 1. The cost of relocating two units of capital stock from the foreign market to the domestic market is 8. The cost of relocating the second unit from the foreign market to the domestic market is 6 and the cost of relocating the first unit from the foreign market to the domestic market is 2 units. Notice that the cost of relocating two units from the domestic market to the foreign market is higher than the cost of relocating the first unit ($4 > 3$). But the sum of the costs of relocating the two units at the outset and one unit at a time is the same ($4 = 3 + 1$). The cost of relocating two units from the foreign market to the domestic market at the outset is higher than the cost of relocating the second unit ($8 > 6$); however, the sum of the costs of relocating the second and the first unit from the foreign market to the domestic market is the same ($8 = 6 + 2$). The cost of relocating one unit from the foreign market to the domestic market is lower than the cost of locating the second unit from the domestic market to the foreign market ($2 > 1$) and the cost of relocating the second unit from the foreign market to the domestic market ($2 < 6$).

In this specification, adjusting the second unit to a given location is lower than the cost of adjusting the first unit: this implies that $1 < 2$ for investment in the foreign market; however, it implies that $2 < 6$ for divestment from the foreign market. This reflects the location-specificity of the banking activity observed in the form of factors such as proximity to sources of information, availability of a large pool of skilled labor, good communication infrastructure, size and structure of the foreign market, level of trade and presence of domestic customers. This asymmetry creates a complication because the initial conditions imposed on the model are liable to influence the

asymmetries specified. In addition, adjusting both units of capital in any given period is more expensive than adjusting only one: thus, the cost when investing in the foreign market is 4 > 2, 1; and when divesting from the foreign market to invest in the domestic market it is 8 > 6, 2. The rationale for this assumption is that the closure of banks offices carries higher loss of reputation where a full FDI is involved, e.g. because of search costs and problems of adverse selection that customers have to bear when trying to establish new relationships with other banks. The direction of the inequality reflects the initial condition that all the capital stock is located in the domestic market in period 0. If this initial condition is changed so that all capital stock is located in the foreign market, then it might well be appropriate to reverse it.

The discount rate is set to be zero. This does not cause convergence problems because of the model's finite time horizon property.

6. Deferring FDI

The model is solved diagrammatically and shown in Figure 2. Dynamic effects can be observed by analyzing the two traditional mistakes in probability theory, namely Type I which is to export when the foreign market size is two units, and Type II which is to undertake immediate full FDI when the size of the market is zero units (Marschak and Radner, 1972). The probability that exporting results in a mistake is p, namely the probability that the foreign market is size two; however, the probability that FDI results in a mistake is $(1-p)$, namely the probability that the foreign market size is zero. Thus, the expected cost of the Type I mistake increases and the expected cost of the Type II mistake decreases as p increases. In particular, it can be noticed that the cost of the exporting strategy increases with p and decreases with $(1-p)$ and conversely the cost of direct foreign investment decreases with p.

The figure plots the expected cost of each strategy vertically and the probability (0 to 1) horizontally. The expected cost of exporting is illustrated by the upward sloping schedule AA' on the right hand vertical axis. On the basis of the assumed parameter values, this equals $12p$. The expected cost of immediate full FDI is illustrated by the downward sloping schedule BB' on the left hand side of the vertical axis. Again, on the basis of the assumed parameters, this equals $4+16(1-p)$. The cost of partial FDI is illustrated by the horizontal schedule CC'. This equals $5p+6(1-p)+3$. At the critical probability $p^*=0.69$ (derived through the intersection of schedules AA' and CC'), the bank switches from exporting to partial FDI and at the critical probability $p^*=0.73$ (derived through the intersection of schedules BB' and CC') to immediate full FDI. The

latter critical probability reflects the relative magnitude of the two types of mistake: mistake Type II to mistake Type I. Notice that the intersection of AA' and BB' is never optimal.

Deferred FDI is an option in earlier models of location of FDI in the perfect knowledge of demand conditions. This is also the case of this model where deferred FDI is an option that banks can exercise under highly volatile demand conditions. But of particular interest is the possibility of undertaking partial FDI in period 1. The figure shows that the range of probability for which it pays to undertake partial FDI is very small. This is not merely a case of reducing the variance of the overall expected cost of setting up plants in both markets. The reason is that the partial FDI provides the options to either expand or withdraw from the market.

The cost of partial FDD from the foreign market (B), 6, does not figure at all in the profitability of operations in either period 1 or period 2. This is because it is never efficient to partially close an office in period 2; moreover, it is impossible to partially close in period 1 because the initial conditions do not permit it. However, it is important to emphasize that this only applies at the margin; if, for example, partial closure of full FDI were costless, whilst complete divestment were extremely costly, then partial divestment rather than complete divestment becomes the preferred option for period 2. Thus, the marginal influence of partial closure is denied by the fact that it is so expensive; its magnitude is still significant from an overall perspective.

The solution of the model shows that NPV can be maximized by deferring FDI until the arrival of information that is missing at the outset. This insight also emerges in models developed by Aliber (1976) and Khoury (1979). However, in their models, it is not volatility but the predictable growth of demand that governs FDI. In addition, the model with volatile demand shows that banks also undertake partial FDI. In this case, partial FDI replaces deferred FDI although for a very narrow range of probability values. The point that NPV can be maximized by exporting (deferring FDI) is also made by Buckley and Casson (1981) in a formalization of Vernon's (1966) classical location of production problem. In their model, licensing is relevant as an alternative to exporting and FDI because of its importance for the manufacturing firm.

7. Partial FDI

Deferring FDI is the most common response in the preceding context where information arrives through the passage of time although it pays to undertake partial FDI for a very narrow

range of probability values even if the foreign market is never of unit size. It is therefore important to consider the case where information is gathered through an intended consequence. In other words, information on foreign market size does not arise spontaneously during period 1, but only accrues to banks that have invested in the market at the beginning of period 1.

This modification can be accommodated in the example as solved diagrammatically in Figure 3. The range of probability values for which it pays to undertake partial FDI increases through a change in the schedule of the expected costs of mistake (Type I) to the left: the range of probability values for which it pays to make partial FDI is now $p^*=0.53$ and $p^*=0.73$; this is larger than where information arrived through the passage of time because of an increase in the expected cost of deferring FDI.

This picture of FDI is similar but not identical to the one described in the older Scandinavian literature on the internationalization process where costs of doing business abroad lead firms to expanding sequentially from one national market to another market (Johanson and Vahlne 1977). In this paper, it is volatility that leads banks to expand in any one market in steps that maximize the option-value. The model is therefore more applicable to the expansion of banks within one market and not across several markets as predicted in the older Scandinavian literature. Casson (1994) shows that option-value of sequential entry into successive foreign markets can be maximized by entering foreign markets in a sequence that maximizes the information externalities.

8. Strategic FDI

The preceding analysis is an accurate description of FDI in which early entry does not generate any advantage to the incumbent. However, the commitment of irreversible FDI can typically generate pre-emptive effects by conferring a future cost advantage *vis-à-vis* potential entrants (Dixit 1979). In other words, immediate full FDI can result in the acquisition of a 'capability' that allows banks to take better advantage of future growth opportunities. Specifically, an initial FDI in a growth opportunity can reduce the marginal cost of production so that growth can take place at a lower cost than for competitors. Examples of strategic FDI leading to comparative advantages are: research into building a technological advantage, an advertising campaign leading to identification and name recognition by customers and logistic planning leading to lower costs in building local infrastructure which is more applicable to banks. This may be a strategic advantage in states of high demand when profits per unit of output are higher,

but in states of low demand it can be viewed as a commitment to a more aggressive future strategy.

Consider that at time 0 the bank has the opportunity to undertake initial FDI of 2 units and that this enables more efficient (specifically lower cost) production. This view is fairly general and the results hold if the investment leads to greater quality or consumer appeal. The size of the market is not known until time 1, when the market opens. With no initial FDI, the bank will produce at a unit cost of 5. An initial full FDI reduces the future cost to 0.

This modification can be accommodated in the previous numerical example as diagrammatically solved in Figure 4. The range of probability for which it pays to defer FDI reduces to p^*=0.58 (earlier it was 0.69) because of the change in the schedule of the expected cost of Type I mistake. The lower marginal cost of production compared to no FDI induces the firm to commit fully to the market. This switch occurs faster in the case where only presence in the foreign market enables the bank to forecast demand. Figure 5 shows that this switch occurs at p^*=0.52. At this critical probability, the bank no longer undertakes partial FDI.

In previous sections, deferring FDI was more valuable in situations of higher volatility reflecting a lower risk exposure; however, volatility may be more favorable to FDI when cost reduction can be achieved through immediate full FDI. This is a surprising result in light of current practice which tends to view volatility as a strong disincentive to full FDI.

9. Simultaneous FDI

In the previous section, the prototype bank is the sole supplier in the market; this is of course a very restrictive assumption as other foreign banks can also enter a newly opened market at the same time (Vernon, 1979).

Consider the case of a foreign bank (L) entering a market in which the host country bank (F) can also enter. This is now a 2*x*2 duopoly game in which both players have the strategies of deferring/ immediate full FDI. In the investment-timing scenario in which one decides to defer FDI, it appropriates (5+8*p*). If both banks decide to defer, they share the value of deferring FDI in period 1 equally, resulting in a payoff of (2.5+4*p*, 2.5+4*p*).

When L enters at the outset, it gains a first-mover advantage in already having incurred sunk costs. In this scenario, F will only source the domestic market and L appropriates monopoly profits from immediate full FDI. Thus, L appropriates (-10+36*p*) for itself whereas F will appropriate (0), which results in a payoff of (-10+36*p*; 0). When both banks undertake immediate

full FDI, they share (-5+8*p*; -5+8*p*). These payoffs are presented in the normal form in Figure 6. The outcome depends on the magnitude of the volatility parameter *p*.

Consider first L's payoff from pursuing immediate full FDI (-10+36*p*) and deferring FDI (5+8*p*), regardless of which strategy F chooses. At the critical probability $p^* = 0.54$, it has a dominant strategy to undertake immediate full FDI regardless of the timing decision of F. Knowing that immediate full FDI yields (-10+36*p*) and after the critical probability $p^* = 0.39$, its payoff is higher than the deferral strategy (>2.5+4*p*); L would invest resulting in a symmetric equilibrium where both banks receive their worst payoff of (2.02*, 2.02*) - an application of the well-known prisoners' dilemma. The paradox, of course, is that this equilibrium outcome is worse than the situation where both defer FDI (4.06, 4.06). If the two banks could coordinate their investment strategy, they could share the flexibility benefits of deferring FDI and avoid the 'inferior' "panic equilibrium" where the two rush to FDI prematurely.

It can be observed that at a high level of volatility neither firm would invest, whereas at the critical probability $p^* = 0.39$ both rush to invest. Beyond the critical probability $p^* = 0.54$ (-10+36*p* > 5+8*p*), the structure of payoff changes, yielding another symmetric equilibrium where the payoff from deferring FDI is lower than the payoff from immediate FDI.

10. Summary and conclusions

Internalization theory applied to the banking firm deals with why and how banks go abroad. Aliber (1976) and Khoury (1979) model the standard location of banking FDI problem. In their models, when demand grows at a predictable rate, banks defer FDI to the point where it becomes profitable to undertake full FDI. This paper extends this line of inquiry by modeling banking FDI under volatile demand conditions in response to calls for such an analysis by Buckley and Casson (1998) and Rugman and Li (2005).

The model developed in this paper furthers this line of inquiry and shows that under volatile demand conditions, deferring FDI allows information to be revealed on the size of the foreign market, which is missing at the outset, before the resources are committed to the foreign market. This avoids mistaken FDI because investment is only undertaken if it is known that the market will be profitable. When immediate full FDI does not confer any significant cost advantage, the profit from deferring FDI is significant relative to the cost of immediate full FDI, i.e., an increase in volatility increases the value of deferring FDI. If FDI enables more efficient production due to lower production cost, the value of immediate full FDI increases with volatility. With imperfect

competition, simultaneous FDI generates the well known inferior equilibrium where banks rush to FDI but obtain a lower payoff compared with deferring FDI.

The model also shows partial FDI as an alternative to deferred and full FDI. Partial FDI confers the flexibility to expand or divest after clarification of foreign demand conditions. Banks switch to partial FDI under more volatile conditions when information on the foreign market is available only through presence in the foreign market, thereby reducing the value of deferring FDI. The switch to partial FDI occurs under less volatile conditions when information becomes available through the passage of time, thereby increasing the value of deferring FDI.

The main results of the paper may be surprising in light of current practice which tends to view volatility as a strong disincentive for FDI. This notion needs to be revisited. Volatility can in fact be seen as an opportunity for FDI: it can capture the upside potential with greater control over the downside risk in the case of deferred and partial FDI, and relatively lower control over the downside risk in the case of immediate full FDI. Whilst the role of partial FDI is known in the literature, its formal integration within the emerging literature on the influence of volatility on the location of FDI is not yet fully addressed.

The theoretical perspective developed in this paper brings a diverse and standalone analysis of location of banking FDI into a single integrated model and generates insights hitherto not captured. This perspective can be used to predict the cross-sectional variation in the size of banking FDI which is relevant for the location dimension of internalization theory. The particular application of the model is suitable for the banking industry where licensing and franchising arrangements are less frequently observed. The method used in this paper can be used to analyze the influence of volatility on the simultaneous choice of location and technique that also has significant relevance for the banking industry. In addition, the influence of volatility in supply is another fruitful area for future research. Furthermore, the method can be used to analyze the location of FDI in other sectors and option features that are relevant for the ownership dimension of internalization theory.

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Figure 1

The sequence of FDI under volatile demand conditions

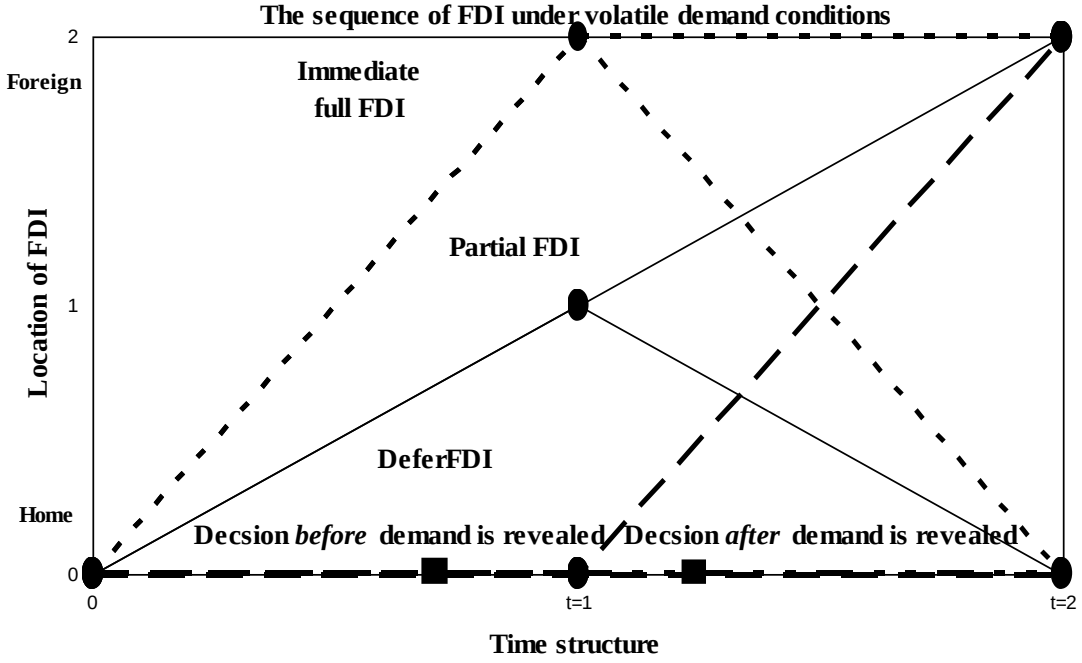
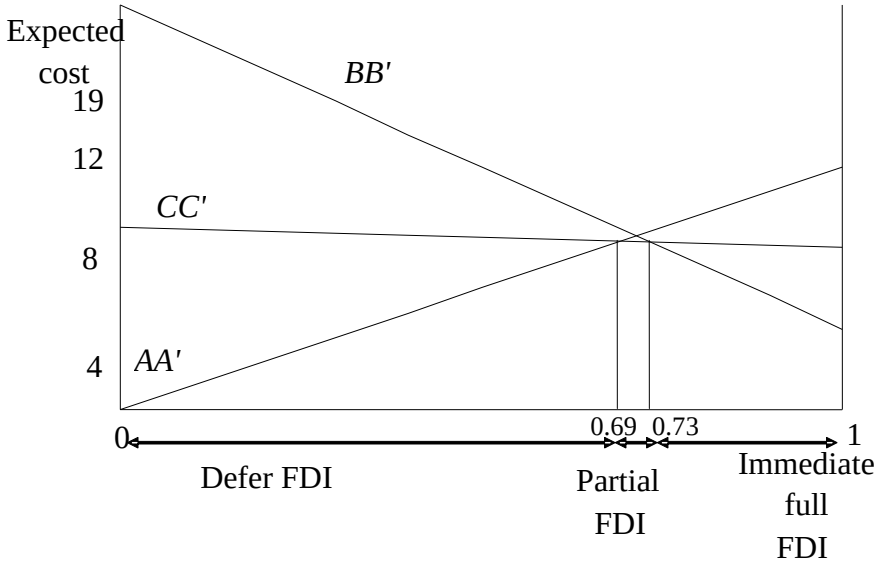


Figure 2
Determination of optimal foreign investment strategy through minimization of expected cost of servicing a foreign market over two periods



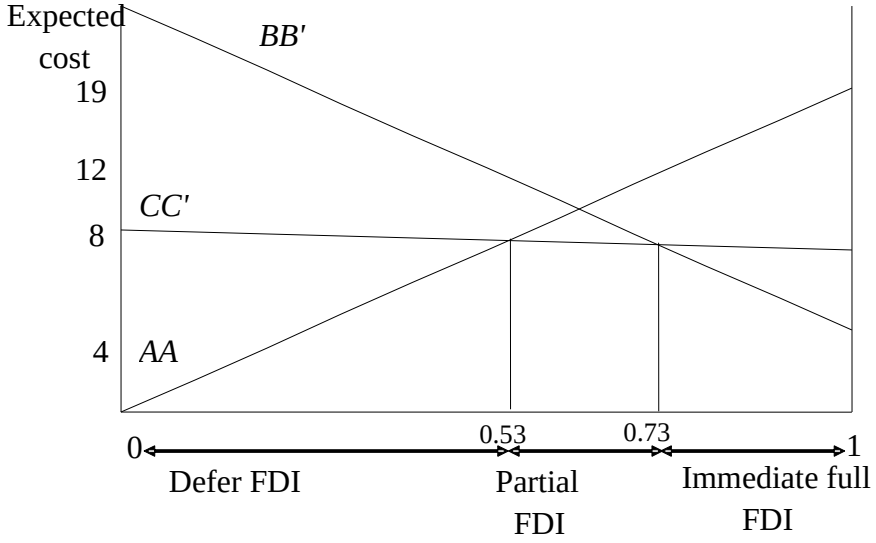
AA' – Exporting

BB' – Immediate full FDI

CC' – Partial FDI

Figure 3

Change in optimal foreign investment strategy when the information required to forecast the size of the foreign market is only obtainable through foreign investment

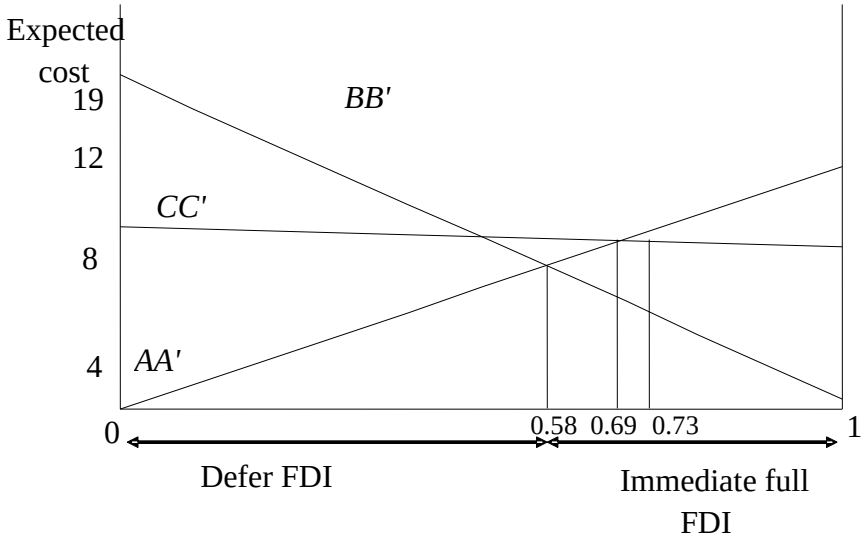


AA' – Exporting

BB' – Immediate full FDI

CC' – Partial FDI

Figure 4
Determination of optimal foreign investment strategy under competition through minimization of expected cost of servicing a foreign market over two periods



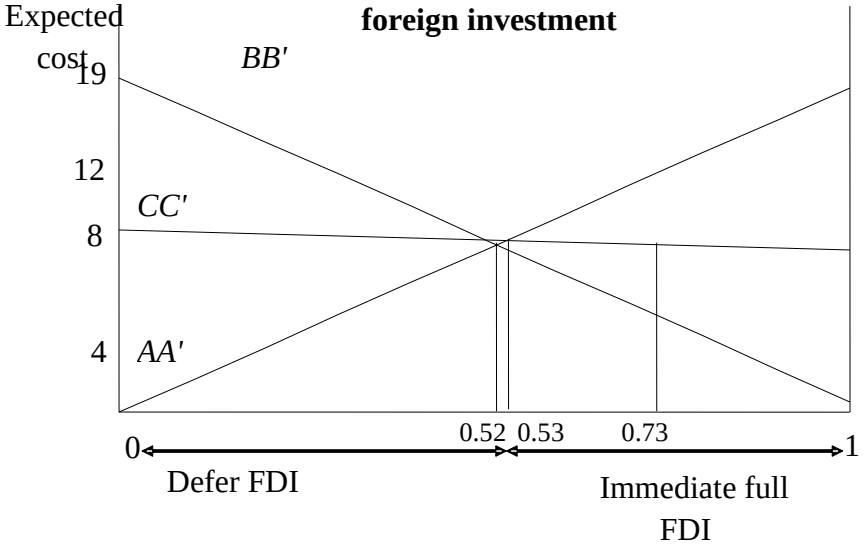
AA' – Exporting

BB' – Immediate full FDI

CC' – Partial FDI

Figure 5

Change in optimal foreign investment strategy under competition when the information required to forecast the size of the foreign market is only obtainable through foreign investment



AA’ – Exporting

BB’ – Immediate full FDI

CC’ – Partial FDI

Figure 6
2 x 2 Duopoly game in the normal form

	Defer FDI	**Immediate full FDI**
Defer FDI	L=2.5+4*p* F=2.5+4*p*	L= 0 F=-10+36*p*
Immediate full FDI	L= -10+36*p* F= 0	L= -5+8*p* F= -5+8*p*