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Formalizing internationalization in the eclectic paradigm

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Abstract
The paper presents a simple general equilibrium model that formalizes internationalization in the eclectic paradigm based on a reconfiguration of concepts taken from the new classical economics literature. The model enables us to address simultaneously the role of ownership, location and internalization advantages, and their interaction, in the emergence of the multinational enterprise (MNE) through a set of mathematical inequalities. Our model offers a bridge between the detached perceptions of the MNE often held by international trade economists and international business scholars, and makes specific aspects of the eclectic paradigm empirically testable.
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INTRODUCTION

Thirty years have passed since John Dunning first articulated the eclectic paradigm (Dunning, 1977). Dunning's approach to the complex phenomenon of the multinational enterprise (MNE) has proved robust and, over time, has become one of the most influential streams of thought in the international business literature. The eclectic paradigm explains the emergence of MNEs according to three types of competitive advantage: ownership advantage, location advantage and internalization advantage (Dunning, 1977, 1981, 1988, 1993, 1998). Despite its dominant position within the field of international business, the eclectic paradigm has not yet been formalized across all of its elements (ownership, location and internalization advantages) within a general equilibrium model. While some scholars have borrowed partial insights from the eclectic paradigm in their formal modeling of MNEs (e.g., Carr, Markusen, & Maskus, 2001; Ethier, 1986; Horstman & Markusen, 1987; Markusen, 1998), many others claim that the paradigm is too rich to be formalized, and that it is more of a "broad tent" rather than a model (Cantwell & Narula, 2001; Eden, 2003).

The purpose of the current paper is to offer a simple general equilibrium model that formalizes internationalization within the eclectic paradigm. The novelty of our approach lies in the formalization of all three constructs within the eclectic paradigm, rather than relating to one or two of them. The model is essentially based on a simple reconfiguration of concepts taken from recent

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new classical economics literature (e.g., Yang, 1994, 2001; Yang & Ng, 1995) to analyze the impact of labor and knowledge productivity on the utility of both entrepreneurs and workers.

In the next section we briefly survey the vast literature on firm internationalization and the emergence of MNEs. In the following section, we present the features of our model. The model is then used to compare the utilities of entrepreneurs and workers in various possible operation modes. The emergence of the MNE is explained endogenously within a unifying framework that compares domestic production for exports and local consumption, international licensing and foreign direct investment (FDI). We then incorporate knowledge-asset-seeking motivations for FDI into the model, and conclude by presenting the implications of the proposed model, suggesting how it could be empirically verified, and highlighting opportunities for future theoretical advances. It is evident that other areas of the paradigm could be similarly formalized, and this paper provides a generalizable means of so doing.

A BRIEF LITERATURE REVIEW

Over the last three decades, two major schools of thought have tried to explain the phenomenon of the MNE. Both schools' point of departure was orthodox economics, or more specifically the Heckscher–Ohlin–Samuelson theory of trade, but they have diverged quite substantially from each other and, by and large, have ignored each other (Markusen, 2001). One school of thought, dominated by international trade economists, remained in the domain of orthodox economics in the sense that it introduced general-equilibrium models with strict assumptions to explain the emergence of the MNE. While this stream of research has gradually moved away from assumptions of perfect competition and constant returns to models incorporating imperfect competition, economies of scale and differentiated products, its main focal point has remained the explanation of patterns of production, consumption and trade at the country level rather than the firm level. Some major contributions are Brainard (1997), Ethier (1986), Grossman and Helpman (2002), Helpman (1984), Helpman and Krugman (1985), Markusen (1984) and Markusen and Venables (1998, 2000).

The other school of thought, consisting of international business scholars, chose to move into heterodox economics and introduce partial equilibrium models based on more relaxed underlying assumptions. This line of research is mainly interested in explaining the firm's strategic motivation to choose FDI over other entry modes when internationalizing. Dunning's eclectic paradigm (Dunning, 1977, 1981, 1988, 1993, 1998) offers a straightforward articulation of the major insights of this school of thought by referring to the combined impact of ownership advantage, location advantage and internalization advantage on foreign entry mode selection by internationalizing firms.

Ownership advantage is a firm characteristic. It is manifested by firm-specific ownership of intangible assets such as technological or marketing knowledge, as well as by superior managerial capabilities (in comparison with those of indigenous competitors) to control and coordinate international transactions. The factors constituting ownership advantage are viewed as an "intra-firm public good", transferable between different units of an MNE around the world.

Location advantage is a country-specific characteristic. Conceptually it is similar to comparative advantage, familiar from international trade theory. Location advantage is represented by the comparative cost of country-specific inputs (e.g., materials, labor, natural resources) accessible by enterprises operating within that country's borders, or by the cost of trade barriers between countries, which may include transportation costs, tariffs and non-tariff barriers. The factors that constitute location advantage are country specific and are location bound – they are internationally immobile.

Internalization advantage is a transaction attribute. It stems from the fact that the factors constituting ownership advantage become a private good once transferred outside the boundaries of the firm. Internalization advantage applies to the case where the firm prefers to exploit its ownership advantage internally, rather than by licensing or any other collaborative mode, in order to minimize the transaction costs associated with the inter-firm transfer of proprietary knowledge and capabilities.[1]

In his earlier work, Dunning assumed that a firm's ownership advantage originates in its home country, where its motivation to internationalize is market seeking, or resource seeking, or efficiency seeking, or other global strategic considerations (Dunning, 1977, 1988, 1993). However, more recently Dunning and other scholars (e.g., Almeida, 1996; Cantwell, 1995; Dunning & Narula, 1995; Kogut & Chang, 1991) have given more attention to knowledge-asset-seeking motivations of internationalization. Knowledge asset seeking essentially implies that ownership advantage does not necessarily

originate in a firm's home country, but rather may be acquired and augmented abroad, and thus serves as a motivation for firm internationalization.

GENERAL PROPERTIES OF THE MODEL

Consider a world comprising two countries, A and B. A single good (g) can be produced in A and B, by using two intermediate goods: labor (l) and know-how (k). We assume that there are two types of "consumer-producer" individual in A and B: "entrepreneurs" and "workers". The entrepreneurs supply technological, marketing or managerial know-how, which is transformed by the workers into units of g. For simplicity we assume that there are n_A identical entrepreneurs in A and n_B identical entrepreneurs in B.

While g can be produced through either a firm or a non-firm production mode (Alchian & Demsetz, 1972), we assume that the firm production mode is more efficient than the non-firm production mode, as it enables transaction costs between individuals with different specializations to be minimized. We also assume that entrepreneurs use their know-how to become employers that offer contracts in which the workers get payment for their labor and the entrepreneur gets the residual returns from selling the workers' output (g) in the market (Milgrom & Roberts, 1988; Yang, 2001; Yang & Ng, 1995). We ignore the possibility whereby a worker employs entrepreneurs to produce g, and the possibility that an entrepreneur employs another entrepreneur.

The production function of g is assumed to be of a Cobb-Douglas type, in the following structure:

$$G = aK^{\alpha}L^{\beta} \qquad (1)$$

where G is the output volume of g, K is the required quantity of k to produce g, L is the quantity of l required to produce g, and α and β are productivity constants. The costs of producing a given quantity of K are assumed to be sunk costs, and L is subject to a per-unit cost of w_i (i=A, B). Constants a, α and β are positive, with $a>1, 0<\alpha<1$ and $0<\beta<1$. Know-how productivity (α) is assumed to be equal in A and in B, but labor productivity is assumed to be different: accordingly we shall refer to workers' productivity in A (β_A) and workers' productivity in B (β_B). This Ricardian view of differences in labor productivities represents another important component of location advantage, and its logic dates back to Solow (1957).[3]

Entrepreneurs are free to move between A and B, and their k can be sold across borders. Entrepreneurs may also supply know-how (k) to other entrepreneurs in the market. Since in each country entrepreneurs are assumed identical, the sale of k is relevant only between A and B. Thus k is an intangible tradable intermediate good, where entrepreneurs with higher K are said to have an ownership advantage. The quantity of k offered to the market in A (B) is denoted by K_i^s (i=A, B). The quantity of k purchased by an entrepreneur in the market in A (B) is denoted by K_i^d (i=A, B), which, allowing for transaction costs, is given by

$$K_i^d = te_{kij}K_i^s, 0<te_k<1, i, j = A, B, i \neq j \qquad (2)$$

where te_k is the transaction efficiency of the sale of know-how to the market. Thus, in the case where k is traded in the market, it is subject to a transaction cost coefficient of $1-te_k$. Intra-firm transaction costs are assumed to be zero (i.e., te_k=1), and hence reflect the internalization advantage.[4]

In addition, we assume that workers cannot move between A and B: thus l is a country-specific intermediate good representing an important component of location advantage. The overall quantities of labor available in A and B are denoted by L_A and L_B, respectively.

An additional major factor in the model is the efficiency of operating in a foreign country, denoted as $te_{f,AB}$. Thus $1-te_{f,AB}$ may be regarded as a fixed learning cost that stems from the "liability of foreignness" (Hymer, 1976; Zaheer, 1995). Entrepreneurs from A are foreigners in B (and vice versa), and thus have to pay a certain "cost premium" over indigenous entrepreneurs who are more familiar with the local business, legal and political environments. These costs may derive from the need to communicate in two or more languages, overcome cultural differences, and accommodate different legal and regulatory systems (Hofstede, 1980; Hymer, 1976; Kogut & Singh, 1988; Martin & Salomon, 2003; Zaheer, 1995).

The good (g) can be self-consumed, supplied to the workers in return for their l, or supplied to other entrepreneurs in return for their k. The self-consumed quantity of g in A (B) is denoted by G_i^c (i=A, B). The quantity of g supplied by entrepreneurs in A (B) to workers or other entrepreneurs, be they located domestically or internationally, is denoted by G_i^s (i=A, B, where i determines the location of the entrepreneur who supplies g). The quantity of g received by entrepreneurs and workers in A (B) from other entrepreneurs, be they located domestically or internationally, is denoted by G_i^d (i=A, B, where i determines the location of the workers or entrepreneurs receiving g).

The utility function (U_e) of an entrepreneur in A (B) is represented by the quantity of self-consumed g (G_i^c) and the quantity of g received from other entrepreneurs (G_i^d), as follows:

$$U_{ei} = G_i^c + G_i^d, \quad i = A, B \tag{3}$$

This utility function captures the value of "self-produced and self-consumed" goods in A or in B as well as of goods that are purchased from other entrepreneurs locally or internationally.

The utility function (U_w) of a worker in A (B) is represented by the wages compensation he or she receives for their work, as follows:

$$U_{wi} = w_i L_i', \quad i = A, B \tag{4}$$

where w_i represents the price of l in terms of g, and L_i' is the quantity of labor conducted by the worker (e.g., number of hours or a fraction of his or her overall working time).

Finally, each entrepreneur's supply of k and g to the market should equal his or her demand for k and g. Hence each entrepreneur in A (B) faces a budget constraint:

$$P_k K_i^d + G_i^d = P_k K_i^s + G_i^s, \quad i = A, B \tag{5}$$

where P_k represents the price of k in terms of g, and G_i^s is the quantity of supplied g.

UTILITY FROM DIFFERENT OPERATION MODES

Each entrepreneur decides how much to produce and how much to consume of the product g in order to maximize his OR her utility. A combination of transactions between individuals (entrepreneurs and/or workers) where l and k are exchanged for g is defined as an "operation mode". A feasible operation mode is composed of a set of transactions conducted by individuals so that the market-clearing conditions are met. Each operation mode has an equilibrium solution in which the market is cleared and the entrepreneurs and subsequently their workers maximize their utility (Yang & Ng, 1995). This equilibrium reflects the maximal quantity of g that is producible under the constraints of a given operation mode.

The entrepreneurs from A and B face five alternative operation modes: domestic production for exports and local consumption; international licensing from A to B; international licensing from B to A; FDI in A; and FDI in B. Since the focus of this paper is ON the emergence of the MNE, we ignore the domestic licensing alternative. This alternative has more to do with the question of the firm's boundaries (i.e., integration vs outsourcing) than with firms' internationalization and thus will be analyzed here only in the international context.

By applying marginal analysis to these alternatives we can obtain the entrepreneurs' utility (or real income) from each operation mode. The basic features of the five operation modes that we examine are as follows:

(1) *Domestic production for exports and local consumption*. Each entrepreneur in i (i=A, B) hires workers from i to transform k into g. An entrepreneur pays his or her workers' labor and collects the whole net revenues (total revenues minus workers' wages). Hence this operation mode involves the exchange of l for g, which is denoted as: L_i/G_i^s in both A and B.

(2) *International licensing from A to B*. In addition to engaging in domestic production in A as described above, each entrepreneur in A provides k to licensees, being entrepreneurs in B who produce g using the purchased k and workers from B. The produced amount of g is then exchanged by the entrepreneurs from B as wages compensation and in exchange for the supplied k. Two transactions are implied by international licensing from A to B: entrepreneurs from A trade k for g (denoted as K_A^s/G_B^s) and, on the basis of this know-how, entrepreneurs from B hire workers to produce g, thus exchanging l for g (denoted as: L_B/G_B^s).

(3) *International licensing from B to A*. Each entrepreneur in A obtains k from a licensor, being an entrepreneur from B, and then produces g using the purchased k and workers from A. The produced amount of g is then exchanged locally (as wages compensation) and internationally (in exchange for the supplied k). Two transactions are implied by international licensing from B to A: entrepreneurs from A trade k for g (denoted as K_B^s/G_A^s) and, on the basis of this know-how, hire workers to produce g, thus exchanging l for g (denoted as L_A/G_A^s). In addition, each entrepreneur in B engages in domestic production as described above.

(4) *FDI in B*. In addition to engaging in domestic production in A, each entrepreneur in A sets up a firm (subsidiary) in B. Then g is produced using local workers in B and know-how brought in from A. FDI in B implies the exchange of l for g, which is denoted by L_B/G_B^s. B's entrepreneurs remain unemployed in this operation mode.

(5) *FDI in A*. In addition to engaging in domestic production in B, each entrepreneur in B sets up a firm (subsidiary) in A. Thus g is produced using local workers in A and know-how brought in from B. FDI in A implies the exchange of l for g, which is denoted by L_A/G_A^s. A's entrepreneurs remain unemployed in this operation mode.

The possible five operation modes discussed above are summarized in Table 1.

It is noteworthy that our model ignores the costs of transferring goods between A and B. We refer only to alternative operation modes in which the aim is to maximize the overall quantity of produced g. The efficiency of transferring goods between A and B (denoted by $te_{g,ij}$, $0<te_g<1$, i,j=A, B, $i\neq j$) actually represents an inter-country "tax" that reduces the total utility obtained by any given operation mode. The quantity of g that is shipped between A and B is therefore reduced by an inter-country "transfer" cost. Since, in all five operation modes, production takes place in both A and B, the decision of entrepreneurs to ship some of the produced goods to another country (in exchange for a different good g') is essentially derived from comparative advantage of A (B) in producing g and g' and "transfer" costs considerations, as well as (to some extent) the relative sizes of A and B (Ohlin, 1933; Heckscher, 1949). Nevertheless, the decision on where to produce these products (in A and/or B) and under which operation mode would still be the outcome of the relative maximal utilities of the operation modes discussed.

Next, we calculate the utility of A's and B's entrepreneurs from each of the above operation modes.

Utility from Domestic Production for Exports and Local Consumption

In this operation mode each entrepreneur from i (i=A, B) uses a certain amount of g to pay workers (G_i^s), and consumes the remaining quantity of g (G_i^c). The decision problem of each entrepreneur is

$$\text{Max } U_{ei} = G_i^c (i = \text{A, B})$$

subject to

$$G = G_i^c + G_i^s = a\left(K_i'\right)^{\alpha}\left(\frac{L_i}{n_i}\right)^{\beta_i} \quad \text{(production function)}$$

$$G_i^s = w_i\left(\frac{L_i}{n_i}\right) \quad \text{(workers' wages constraint)}$$

where K_i' represents the quantity of k held by each entrepreneur in i; L_i/n_i is the quantity of labor required by each entrepreneur in i (where n_i represents the number of entrepreneurs in country i; i=A, B), assuming a uniform distribution of labor between all identical entrepreneurs; and w_i is the appropriate wage rate in terms of g, as noted earlier. G_i^s is the quantity of g paid to workers by the entrepreneur, G_i^c is the entrepreneur's residual return, and β_i is an indicator of the workers' productivity in i.

The entrepreneurs from i are always expected to utilize their maximal level of k in order to maximize utility: hence by differentiating U_{ei} with respect to L_i/n_i and setting the result equal to zero we can derive the maximal utility of each entrepreneur from domestic production for exports and local consumption in i:[5]

$$U_{ei,\text{domestic}-i} = a(1-\beta_i)\left(K_i'\right)^{\alpha}\left(\frac{L_i}{n_i}\right)^{\beta_i}, \quad i=\text{A, B} \quad (6a)$$

Table 1 Production characteristics in different operation modes

Operation mode	*Production characteristics in A*	*Production characteristics in B*	*Comments*
Domestic production for exports and local consumption	A's entrepreneurs use their k to produce g with L_A	B's entrepreneurs use their k to produce g with L_B	
International licensing from A to B	A's entrepreneurs use their k to produce g with L_A	B's entrepreneurs use k from A's entrepreneurs to produce g with L_B	
International licensing from A to B	A's entrepreneurs use k from B's entrepreneurs to produce g with L_A	B's entrepreneurs use their k to produce g with L_B	
FDI in B	A's entrepreneurs use their k to produce g with L_A	A's entrepreneurs use their k to produce g with L_B	B's entrepreneurs remain unemployed
FDI in A	B's entrepreneurs use their k to produce g with L_A	B's entrepreneurs use their k to produce g with L_B	A's entrepreneurs remain unemployed
Knowledge-asset-seeking FDI in B	A's entrepreneurs use their k to produce g with L_A	A's entrepreneurs employ B's entrepreneurs and use their k to produce g with L_B	

Since it is now straightforward to calculate the workers' utility from domestic production for exports and local consumption, we can also derive the total utility of this operation mode. The *total* utility of domestic production for exports and local consumption is represented by the utility of *all* entrepreneurs and workers in A and in B, and is given by

$$U_{\text{domestic}} = n_{\text{A}} a\left(K'_{\text{A}}\right)^{\alpha}\left(\frac{L_{\text{A}}}{n_{\text{A}}}\right)^{\beta_{\text{A}}} + n_{\text{B}} a\left(K'_{\text{B}}\right)^{\alpha}\left(\frac{L_{\text{B}}}{n_{\text{B}}}\right)^{\beta_{\text{B}}} \quad (6b)$$

Utility from International Licensing from A to B

In the case of international licensing of know-how from A to B, the individual decision problem of each entrepreneur in A in the exchange of $K^{\text{s}}_{\text{A}}/G^{\text{s}}_{\text{B}}$ is

$$\text{Max} U_{\text{eA}} = P_k K^{\text{s}}_{\text{A}}$$

The utility of each entrepreneur in A represents the amount of g that he or she receives in exchange for his or her k. Thus in this case the utility of each entrepreneur from A depends on the quantity of k that entrepreneurs from B are willing to purchase, and on the price these entrepreneurs are willing to pay. Since B's entrepreneurs also maximize their utility, the quantity and price of k will be determined so that the utility of the entrepreneurs from B is maximized. Thus the utility of each entrepreneur in A from being an international licensor is determined according to the maximization of the utility of the entrepreneurs from B who purchase k. We would therefore calculate maximal U_{eB} and then compute U_{eA} in order to derive the maximal utility of an A's entrepreneur from being an international licensor. The individual decision problem of B's entrepreneurs is

$$\text{Max} U_{\text{eB}} = G^{\text{c}}_{\text{B}}$$

subject to

$$G^{\text{c}}_{\text{B}} + G^{\text{s}}_{\text{B}} = a\left(te_{k,\text{AB}} K^{\text{s}}_{\text{A}}\right)^{\alpha}\left(\frac{L_{\text{B}}}{n_{\text{B}}}\right)^{\beta_{\text{B}}}$$

$$G^{\text{s}}_{\text{B}} = w_{\text{B}}\left(\frac{L_{\text{B}}}{n_{\text{B}}}\right) + P_k K^{\text{s}}_{\text{A}}$$

where $L_{\text{B}}/n_{\text{B}}$ is the quantity of labor required for each entrepreneur in B, and w_{B} is the wage rate in terms of g. The transaction efficiency coefficient for know-how transfer from A to B is denoted by $te_{k,\text{AB}}$: hence $1-te_{k,\text{AB}}$ represents the transaction costs for know-how transfer, that is, the dissipation of an A's entrepreneur's proprietary know-how when it is transferred to an independent foreign entrepreneur (Martin & Salomon, 2003; Rugman, 1981). The quantity of g sold by each entrepreneur in B in order to pay for K^{s}_{A} and L_{B} is G^{s}_{B}, and G^{c}_{B} is the residual return of each entrepreneur in B.

Differentiating U_{eB} with respect to $L_{\text{B}}/n_{\text{B}}$, differentiating U_{eB} with respect to K^{s}_{A}, and setting the differentiated terms equal to zero enables us to derive the maximal utility of a B's entrepreneur from being international licensee as per the two intermediate products he or she uses. Results show that this utility is maximized in the case where $K^{\text{s}}_{\text{A}}=\text{K}'_{\text{A}}$: that is, when an A's entrepreneur supplies all the knowledge he or she retains. Based on the computed U_{eB} we can derive U_{eA}, as follows:

$$U_{\text{eA,license-A to B}} = a\alpha\left(te_{k,\text{AB}}\right)^{\alpha}\left(K'_{\text{A}}\right)^{\alpha}\left(L_{\text{B}}/n_{\text{B}}\right)^{\beta_{\text{B}}} \quad (7a)$$

The total utility of this operation mode is represented by the utility of B's entrepreneurs, the utility of n_{B} A's entrepreneurs who sold their k to B's entrepreneurs,[6] the utility of A's entrepreneurs from domestic production, and the utility of the workers in A and B, as follows:

$$U_{\text{license-A to B}} = a\left(K'_{\text{A}}\right)^{\alpha} \times \left[\left(te_{k,\text{AB}}\right)^{\alpha}\left(L_{\text{B}}/n_{\text{B}}\right)^{\beta_{\text{B}}} n_{\text{B}} + n_{\text{A}}\left(L_{\text{A}}/n_{\text{A}}\right)^{\beta_{\text{A}}}\right] \quad (7b)$$

Utility from International Licensing from B to A

The case of international licensing of know-how from B to A is symmetric to the previous operation mode, where the maximal utility of an entrepreneur from A being an international licensee is

$$U_{\text{eA,license-BtoA}} = a\left(te_{k,\text{BA}}\right)^{\alpha}\left(K'_{\text{B}}\right)^{\alpha}\left(\frac{L_{\text{A}}}{n_{\text{A}}}\right)^{\beta_{\text{A}}} \times\left(1-\beta_{\text{A}}-\alpha\right) \quad (8a)$$

The total utility from this operation mode is

$$U_{\text{license-BtoA}} = a\left(K'_{\text{B}}\right)^{\alpha} \times \left[\left(te_{k,\text{BA}}\right)^{\alpha}\left(\frac{L_{\text{A}}}{n_{\text{A}}}\right)^{\beta_{\text{A}}} n_{\text{A}} + n_{\text{B}}\left(\frac{L_{\text{B}}}{n_{\text{B}}}\right)^{\beta_{\text{B}}}\right] \quad (8b)$$

Utility from FDI in B

In the case of FDI in B, the decision problem of each entrepreneur in A is

$$\text{Max} U_{\text{eA}} = G^{\text{c}}_{\text{B}}$$

subject to

$$G_B^c + G_B^s = a\left(te_{f,AB}K'_A\right)^{\alpha}\left(\frac{L_B}{n_A}\right)^{\beta_B}$$

$$G_B^s = w_B L_B$$

where $te_{f,AB}$ represents the efficiency of operating in a foreign country.

Differentiation of U_{eA} with respect to L_B/n_B and setting the result equal to zero yields the maximal utility of an A's entrepreneur from FDI in B:

$$U_{eA,FDI-B} = a(1-\beta_B)\left(te_{f,AB}\right)^{\alpha}\left(K'_A\right)^{\alpha}\left(\frac{L_B}{n_A}\right)^{\beta_B} \quad (9a)$$

In this operation mode B's entrepreneurs remain unemployed, and total utility is reflected by the utility of A's entrepreneurs from producing in A and B as well as the utility of the workers they employ, as follows:

$$U_{FDI-B} = n_A a\left(K'_A\right)^{\alpha}\left[\left(\frac{L_A}{n_A}\right)^{\beta_A} + \left(te_{f,AB}\right)^{\alpha}\left(\frac{L_B}{n_A}\right)^{\beta_B}\right] \quad (9b)$$

Utility from FDI in A

The case of FDI in A is symmetric to the previous operation mode where A's entrepreneurs remain unemployed and a B's entrepreneur utility is given by

$$U_{eB,FDI-A} = a(1-\beta_A)(te_{f,BA})^{\alpha}(K'_B)^{\alpha}\left(\frac{L_A}{n_B}\right)^{\beta_A} \quad (10a)$$

and the total utility of this operation mode is

$$U_{FDI-A} = n_B a\left(K'_B\right)^{\alpha}\left[\left(\frac{L_B}{n_B}\right)^{\beta_B} + \left(te_{f,BA}\right)^{\alpha}\left(\frac{L_A}{n_B}\right)^{\beta_A}\right] \quad (10b)$$

THE EMERGENCE OF THE MNE

By comparing the maximal total utility obtained from the different operation modes we can define the set of necessary and sufficient conditions for the emergence of the MNE. Entrepreneurs are expected to prefer the operation mode where they obtain the highest utility. Workers, on the other hand, are expected to prefer the operation mode that yields the highest wages for their level of productivity, and thus would prefer to work for the entrepreneur with the highest utility level.[7] Hence the operation mode that yields the highest total utility would be selected in equilibrium.

Let us consider, for instance, the conditions under which FDI in B emerges as the selected operation mode.[8] This will be the case if: $U_{FDI-B} > U_{domestic}$, $U_{FDI-B} > U_{license-AtoB}$, $U_{FDI-B} > U_{license-BtoA}$ and $U_{FDI-B} > U_{FDI-A}$. The set of necessary and sufficient conditions for FDI in B is specified by inequalities (11a)–(11d), which represent, respectively, the conditions under which the utility from FDI in B is greater than the utility in each of the above operation modes.

$$\frac{(K'_A)^{\alpha}\left[n_A^{1-\beta_A}(L_A)^{\beta_A} + n_A^{1-\beta_B}(te_{f,AB})^{\alpha}(L_B)^{\beta_B}\right]}{n_A^{1-\beta_A}(K'_A)^{\alpha}(L_A)^{\beta_A} + n_B^{1-\beta_B}(K'_B)^{\alpha}(L_B)^{\beta_B}} > 1 \quad (11a)$$

$$\frac{n_A^{1-\beta_A}(L_A)^{\beta_A} + n_A^{1-\beta_B}(te_{f,AB})^{\alpha}(L_B)^{\beta_B}}{n_B^{1-\beta_B}(te_{k,AB})^{\alpha}(L_B)^{\beta_B} + n_A^{1-\beta_A}(L_A)^{\beta_A}} > 1 \quad (11b)$$

$$\frac{(K'_A)^{\alpha}}{(K'_B)^{\alpha}} \cdot \frac{n_A^{1-\beta_A}(L_A)^{\beta_A} + n_A^{1-\beta_B}(te_{f,AB})^{\alpha}(L_B)^{\beta_B}}{n_A^{1-\beta_A}(te_{k,BA})^{\alpha}(L_A)^{\beta_A} + n_B^{1-\beta_B}(L_B)^{\beta_B}} > 1 \quad (11c)$$

$$\frac{(K'_A)^{\alpha}}{(K'_B)^{\alpha}} \cdot \frac{n_A^{1-\beta_A}(L_A)^{\beta_A} + n_A^{1-\beta_B}(te_{f,AB})^{\alpha}(L_B)^{\beta_B}}{n_B^{1-\beta_B}(L_B)^{\beta_B} + n_B^{1-\beta_A}te_{f,BA}(L_A)^{\beta_A}} > 1 \quad (11d)$$

It is straightforward to see how inequalities (11a)–(11d) represent the various parameters of the eclectic paradigm. Internalization advantage is represented by $te_{k,AB}$ and $te_{k,BA}$: the higher $te_{k,ij}$ (i, j=A, B), the lower the internalization advantage. The lower the transaction efficiency of the international markets for know-how, the greater the likelihood that an MNE will emerge. This view is consistent with mainstream literature on the emergence of MNEs, of both international trade economists and international business scholars.

Ownership advantage is represented by K'_A/K'_B. The higher the K'_A/K'_B ratio, the greater the likelihood that A's entrepreneurs will engage in FDI in B. Nevertheless, ownership advantage is also affected by the efficiency of operating in a foreign country, denoted by $te_{f,AB}$ and $te_{f,BA}$. The higher $te_{f,AB}$ is (for instance as a result of previous experience of A's entrepreneur in B's market), the higher the likelihood that A will maintain the ownership advantage that stems from a high K'_A/K'_B ratio, and thus the higher the likelihood that FDI in B will occur.

The role of location advantage is somewhat more complicated. While location advantage essentially refers to the $(L_B)^{\beta_B}/(L_A)^{\beta_A}$ ratio, the impact of this ratio on the likelihood of FDI in B is strongly

affected by the terms $te_{f,AB}$, $te_{f,BA}$, $te_{k,AB}$ and $te_{k,BA}$. The higher $te_{f,AB}$ and the lower $te_{k,AB}$ ($te_{k,BA}$) are, the higher the probability is for FDI in B to occur, rather than international licensing (inequalities (11b) and (11c)). The higher $te_{f,AB}$ and the lower $te_{f,BA}$ are, the higher the probability is for FDI in B to occur, rather than FDI in A (inequality (11d)). Moreover, according to inequality (11d) it is not comparative labor quantities or labor productivities that determine whether FDI in A or FDI in B will occur; rather it is the impact of the comparative liability of foreignness that determines which of the two operation modes will yield a higher total utility.

Deeper investigation of inequalities (11a)–(11d) clarifies the main factors affecting the attractiveness of FDI in B, compared with alternative operation modes. Inequality (11a) implies that the likelihood of FDI in B compared with domestic production for exports and local consumption in both A and B increases when $K'_A \times te_{f,AB} > K'_B$: that is, when A's k discounted by the liability of foreignness exceeds B's k. Inequality (11b) implies that the likelihood of FDI in B compared with international licensing of k from A to B increases when $te_{k,AB} < te_{f,AB}$: that is, when the inefficiency of the market for know-how has a stronger impact over k dissipation than the liability of foreignness. Inequality (11c) implies that the likelihood of FDI in B compared with international licensing of k from B to A increases when $te_{k,BA} < te_{f,AB}$: that is, when the efficiency of transferring k from B to A is lower than the liability of foreignness faced by A's entrepreneurs operating in B. While the feasibility of FDI in B in this case is by and large conditioned by the K'_A/K'_B ratio, the impact of the market for k and of the liability of foreignness may clearly revert this ratio, implying that, albeit having a lower k, FDI in B is still feasible for A's entrepreneurs in this case. Inequality (11d) implies that the likelihood of FDI in B compared with FDI in A increases when $te_{f,BA} < te_{f,AB}$: that is, when the foreignness faced by A's entrepreneurs operating in B is lower than that faced by B's entrepreneurs operating in A. It is noteworthy again that while the feasibility of FDI in B in this case is by and large conditioned by the K'_A/K'_B ratio, the impact of relative liabilities of foreignness may revert this ratio, implying once again that, albeit having a lower k, FDI in B is still feasible for A's entrepreneurs. As noted by Shenkar (2001), some of the major factors affecting the liability of foreignness, such as cultural distance, are not necessarily symmetric, implying that differences in bidirectional liabilities of foreignness are not unlikely.

Finally, it follows from inequalities (11a)–(11d) that the larger the number of entrepreneurs in A is relative to entrepreneurs in B, the higher the probability is for FDI in B to occur, rather than the respective alternative operation modes. This implies that, other things being equal, we should expect countries with a larger number of entrepreneurs to have a higher propensity for outgoing FDI.

Overall, inequalities (11a)–(11d) demonstrate how ownership advantage, location advantage and internalization advantage interact in determining the set of necessary and sufficient conditions for the emergence of MNEs (in this case FDI in B). As mentioned before, much of the strength of the eclectic paradigm lies in the perception that the interaction between ownership advantage, location advantage and internalization advantage determines the feasibility of the emergence of an MNE. Our formalization of the eclectic paradigm can further contribute to this strength of the original paradigm, since inequalities (11a)–(11d) enable us to specifically observe the relationships between the various elements of the eclectic paradigm. According to these inequalities, each of these elements (ownership, location and internalization advantages) may strengthen or counteract the impact of the others, depending on its relative magnitude. For instance, our discussion regarding the factors affecting location advantage implies that location advantage by itself is of little importance (note that in each of the inequalities (11a)–(11d) we get L_B and L_A in both the numerator and the denominator), and that the magnitude of the $(L_B)^{\beta_B}/(L_A)^{\beta_A}$ ratio is actually shaped by the efficiency of the market for know-how (i.e., the existence of an internalization advantage) and the extent of the liability of foreignness in A and B, which is related to firms' ability to exploit their ownership advantage. Likewise the emergence of FDI in B compared with international licensing of k, either from A to B or vice versa, is determined by the interaction between ownership advantage (represented by the K'_A/K'_B ratio discounted by the liability of foreignness) and internalization advantage (represented by the efficiency of the market for k).

Hence, while the eclectic paradigm does not specify the relations between its elements, our model explicitly addresses this issue. According to our model, the emergence of FDI in B should not be regarded as the product of binary values that

represent the existence or non-existence of ownership, location and internalization advantages (for example, 1=a specific advantage exists; 0=a specific advantage does not hold). This line of thinking would lead to the faulty conclusion that the non-existence of one of these advantages is sufficient to prevent FDI from taking place. Our model captures ownership, location and internalization advantages as the product of continuous (non-zero) variables, with the magnitude of each variable affecting the probability of the emergence of an MNE. Thus, even in cases where one advantage is low, other advantages that are exceptionally high can counterbalance this disadvantage, and FDI may still occur.

Finally, under the current model the functional relationship between ownership and advantages can be explicitly specified. Following Buckley and Casson (1976), Kogut and Zander (1993) and Martin and Salomon (2003), the greater ownership advantage is, the greater is internalization advantage, since complex firm-specific knowledge can be more efficiently transferred within firms than between firms. Following our specifications of ownership and internalization advantages, Eq. (12) is a possible formulation of this relationship:

$$1 - te_{kij} = \mu \frac{K'_{\mathrm{A}}}{K'_{\mathrm{B}}} te_{\mathrm{f}ij}, \qquad 0 < te_k < 1, 0 < te_{\mathrm{f}} < 1; \mu > 0, i, j = \mathrm{A}, \mathrm{B}, i \neq j \tag{12}$$

Insertion of Eq. (12) into Eqs. (11b) and (11c) enables us to compare the attractiveness of FDI in B with licensing. A simple mathematical manipulation indicates that in both cases the impact of $te_{\mathrm{f},ij}$ on the chosen operation mode diminishes, and that the probability of FDI occurring in B is higher, the higher the knowledge wedge is between A and B entrepreneurs (i.e., the higher $K'_{\mathrm{A}}/K'_{\mathrm{B}}$ is).

KNOWLEDGE-ASSET-SEEKING FDI

Relaxing our underlying assumptions to allow entrepreneurs to employ foreign entrepreneurs and use these entrepreneurs' know-how to produce g either in A or in B may enable us to relate to the phenomenon of knowledge asset seeking FDI (Almeida, 1996; Cantwell, 1995; Dunning & Narula, 1995; Kogut & Chang, 1991). Knowledge asset seeking essentially implies that ownership advantage (associated with having a superior k) should not necessarily originate in a firm's home country, but rather may be obtained by accessing more superior k abroad.

In the context of the current model knowledge asset seeking implies that, if $K'_{\mathrm{B}} > K'_{\mathrm{A}}$, an entrepreneur from A may employ an entrepreneur from B and pay for the latter's k with g units (as done with his or her workers), rather than purchasing the k of a B's entrepreneur in the market for know-how.[9] In this case the k of B entrepreneurs becomes an additional part of B's location advantage, which in turn becomes A's entrepreneurs' ownership advantage (Cantwell & Narula, 2001).

The utility of an entrepreneur from A represents the amount of g that he or she receives for K'_{B}, and his or her individual decision problem is

$$\mathrm{Max}\, U_{\mathrm{eA}} = g^{\mathrm{c}}_{\mathrm{A}}$$

subject to

$$G = G^{\mathrm{c}}_i + G^{\mathrm{s}}_{\mathrm{A}} = a(te_{\mathrm{f,A,B}} K'_{\mathrm{B}})^{\alpha} \left(\frac{L_{\mathrm{A}}}{n_{\mathrm{A}}}\right)^{\beta^{\mathrm{A}}} \quad \text{(production function)}$$

$$G^{\mathrm{s}}_{\mathrm{A}} = w_{\mathrm{A}} \left(\frac{L_{\mathrm{A}}}{n_{\mathrm{A}}}\right) + w'_{\mathrm{B}} K'_{\mathrm{B}} \quad \text{(wages constraint)}$$

Knowledge-asset-seeking FDI by A's entrepreneurs differs from FDI in B in the fact that K'_{B} is used to produce g rather than K'_{A}; however, it is noteworthy that using B entrepreneur's K'_{B} does not eliminate the liability of foreignness associated with operating in a foreign country, as discussed earlier.[10] Differentiation of U_{eA} with respect to $L_{\mathrm{A}}/n_{\mathrm{A}}$ and K'_{B}, setting the results equal to zero and then computing U_{eA} enables us to derive the maximal utility of A's entrepreneur from knowledge assets seeking FDI. This utility equals

$$U_{\mathrm{eA},k-\mathrm{seeking}} = a\alpha(te_{\mathrm{f,AB}} K'_{\mathrm{B}})^{\alpha} \left(\frac{L_{\mathrm{A}}}{n_{\mathrm{A}}}\right)^{\beta_{\mathrm{A}}} (1 - \beta_{\mathrm{A}} - \alpha) \tag{13a}$$

Hence the total utility of this operation mode is represented by the utility of the employing entrepreneurs, the utility of the n_{A} employed entrepreneurs from B,[11] and the utility of the workers in A and B employed by A's entrepreneurs (see Table 1), as follows:

$$U_{k\mathrm{seeking}} = a(te_{\mathrm{f,AB}} K'_{\mathrm{B}})^{\alpha} [n_{\mathrm{A}}^{-\beta_{\mathrm{B}}} \beta_{\mathrm{B}} L_{\mathrm{B}}^{\beta_{\mathrm{B}}} + n_A^{1-\beta_{\mathrm{A}}} L_{\mathrm{A}}^{\beta_{\mathrm{A}}}] \tag{13b}$$

Since we have argued earlier that the operation mode yielding the highest total utility is the one likely to emerge, it follows that knowledge asset seeking will be preferred over, for instance,

international licensing (arguably its natural alternative) from B to A when

$$\frac{a\left[(te_{f,AB})^{\alpha}n_A^{-\beta_B}\beta_B L_B^{\beta_B}+n_A^{1-\beta_A}L_A^{\beta_A}\right]}{n_A^{1-\beta_A}(te_{k,BA})^{\alpha}L_A^{\beta_A}+n_B^{1-\beta_B}L_B^{\beta_B}}>1 \qquad (14a)$$

which indicates that low efficiency of the market for know-how from B to A and high productivity of B's workers lead to knowledge-asset-seeking FDI rather than licensing *k* from B to A.

Likewise, knowledge asset seeking will be preferred over FDI in B when

$$\left(\frac{K'_B}{K'_A}\right)^{\alpha}\frac{a\left[(te_{f,AB})^{\alpha}n_A^{-\beta_B}\beta_B L_B^{\beta_B}+n_A^{1-\beta_A}L_A^{\beta_A}\right]}{n_A^{1-\beta_A}L_A^{\beta_A}+n_A^{1-\beta_B}(te_{f,AB})^{\alpha}L_B^{\beta_B}}>1 \quad (14b)$$

which implies that the higher the wedge is between K'_B and K'_A, the higher is the liability of foreignness for A's entrepreneurs operating in B, and the higher the productivity of B's workers is, the higher is the likelihood of knowledge-asset-seeking FDI in B.

Finally, we compare the utility of knowledge asset seeking in B by A's entrepreneurs with the alternative of B's entrepreneurs engaging in FDI in A. Here knowledge asset seeking is preferred when

$$\frac{(te_{f,AB})^{\alpha}n_A^{-\beta_B}\beta_B L_B^{\beta_B}+n_A^{1-\beta_A}L_A^{\beta_A}}{n_B^{1-\beta_A}(te_{f,BA})^{\alpha}L_A^{\beta_A}+n_B^{1-\beta_B}L_B^{\beta_B}}>1 \quad (14c)$$

which implies that the relative liabilities of foreignness of A and B entrepreneurs as well as the relative number of entrepreneurs from each country are the major determinants of the type of FDI that will emerge in equilibrium.

Overall, inequalities (14a)–(14c) exemplify once again how ownership, location and internalization advantages interact to yield the emergence of an optimal operation mode.

DISCUSSION AND CONCLUSION

This paper has constructed a simple general equilibrium model that formalizes the predictions of the eclectic paradigm regarding the emergence of MNEs. To the best of our knowledge it is the first attempt to formalize internationalization within the eclectic paradigm. Our model constitutes an intermediate route between the view of MNEs taken by international trade economists and that taken by international business scholars. It presents a formal decision-making model that simplifies reality while retaining relaxed underlying assumptions to explain simultaneously the location and control dilemmas of internationalizing firms. We incorporate the concepts of ownership, location and internalization advantages, familiar from international business literature, into a general equilibrium model, usually preferred by international economists. Our model endogenously explains FDI as the operation mode that maximizes the total utility of entrepreneurs and workers while clearing the markets for know-how and labor.

By examining comparative labor productivities, comparative firm-specific know-how levels, the transaction efficiency of the international market for know-how, and entrepreneurs' efficiency of operating in a host country, we are able to introduce a set of necessary and sufficient conditions for the emergence of the MNE, so that the total utility derived from FDI in a host country exceeds the utility from domestic production for exports and local consumption, international licensing and incoming FDI. Moreover, we are able to model the emergence of knowledge-asset-seeking FDI with the same modeling tools as used to model more conventional operation modes (e.g., international licensing and FDI).

Our model is able to explain the simultaneous existence of domestic production for exports and local production and FDI and the simultaneous existence of such domestic production and international licensing. It is explicit in its formulation of the structure of the firm's production function, and in the residual rights allocation between entrepreneurs and workers. As such, while remaining simple, it encompasses multiple combinations of alternative operation modes. More specifically, several insights may be gained from our formalization of the eclectic paradigm. The first insight is the observation that the impact of comparative labor quantities and labor productivities on the likelihood that an MNE will emerge is moderated by comparative liability of foreignness and the efficiency of the markets for know-how. As the market for know-how transfer (from B to A) becomes more efficient, and as the liability of foreignness decreases, labor cost and labor productivity considerations become less substantial in explaining the emergence of the MNE.[12] The second insight is the perception of ownership, location and internalization advantages as continuous, rather than dichotomous, variables, which may counteract or support each other. Here, we assert that even when one of these advantages is very low the other advantages may still compensate for it and justify

the emergence of an MNE. The interaction between the different types of advantage can be further manifested by referring to specific functional relationships between them. We have demonstrated the impact of a positive linear relationship between ownership and internalization advantages. Other functional relationships between ownership and internalization advantages or between other elements of the paradigm can obviously be further analyzed using our model. Finally, the impact of the relative number of entrepreneurs in A and B on the emergence of the MNE, as identified in our model, supports the notion that countries that are comparatively abundant with entrepreneurs are expected to have a positive FDI balance with less abundant countries.

A major benefit of our formalization of the eclectic paradigm is that it paves the way for testing the paradigm empirically, a need identified by many scholars (e.g., Casson, 2000). The variables specified in our model are either measurable or are variables for which reasonable proxies can be proposed. Data on domestic production volumes are obviously available, and data on production volumes of foreign affiliates within a host country have been used before (e.g., Carr et al., 2001; Markusen, 2001). Data on labor productivity in different countries are often published by international organizations such as the International Labor Organization, UNCTAD and the WTO. It is more difficult to measure firm-specific know-how; however, measures such as the ratio of a specific firm's R&D expenses to its overall costs of production, or the number of patents a firm holds (e.g., Cantwell, 1995), may be used as proxies for firm-specific know-how. Such data may be used at both the country and the sector levels to enable an analysis of both inter-country and inter-sector differences in the levels of FDI. Similarly, data on patents registered in various countries (sectors) and the enforceability of intellectual property rights in these countries could serve as a proxy for the efficiency of the market for know-how transfer. As for the excess costs of operating in a different country, measures of cultural distance between countries (Kogut & Singh, 1988; Ronen & Shenkar, 1985) or data on the differences between countries' income per capita (Linder, 1961) may be used as rough measures for the difficulty of doing business abroad. Other parameters that can be used in this respect are the indexes of the difficulty of investing in a host country published by the World Economic Forum (Carr et al., 2001; Markusen, 2001), or the costs attributed to institutional differences between countries (Henisz, 2005). Therefore we believe that future research should aim to quantify or proxy the variables suggested in this paper and subsequently test our model against the FDI patterns of different countries and sectors (as reported for instance in UNCTAD, 2005). This is essential in order to verify the robustness of the proposed model.

Our proposed model can be expanded in several directions. For instance, one may refer to non-identical entrepreneurs originating in A and B respectively. For such entrepreneurs one may, for instance, assume that $K'_A > K'_B$ for a specific subgroup of entrepreneurs in A, but that this relationship reverses for a different subgroup. This modification may enable us to relate to additional issues such as the labor allocation between different entrepreneurs according to their specific quantity of know-how, the coexistence of FDI in A and FDI in B, and so on. Other modifications may be to allow multiple stages of production and hence relate to vertically integrated MNEs (Brainard, 1997; Teece, 1981) rather than relating only to horizontally integrated ones, or to refer to the impact of increasing returns to scale (rather than the constant returns assumed in our model). Another route in which our model can be expanded is adding an additional product g' so that classic comparative advantage considerations are also taken into account. This should also enable us to specifically incorporate the efficiency of transferring goods between A and B (te_g) in the model. Finally, a further expansion route might be to specifically model the competition on talented employees between entrepreneurs from different countries (Lewin & Peeters, 2006). This requires specific modeling of the allocation of incentives offered by entrepreneurs to workers (in terms of the good g) in order to attract the most productive ones under conditions of worker scarcity. Such modifications complicate the mathematical formulation of the model considerably, and are beyond the scope of the current paper.

Dunning's original intention may have been to step out from orthodox economics modeling and present a heterodox paradigm that is richer and more realistic. At the time this was probably the best way to offer progress in our understanding of the complex phenomenon of the MNE. However, 30 years later it may be the time to offer models that formalize the basic notions of the eclectic paradigm. Such models should still preserve the richness of the original paradigm, but should also enable us to build refutable hypotheses. While such

lines of modeling may confine the paradigm to specific contexts (such as internationalization in the current case), it is essential to do so in order to make the paradigm more robust and to gain further insights from it. Our model provides a straightforward example that this task is feasible.

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NOTES

[1]A similar view is also taken by Buckley and Casson (1976, 1998), Hirsch (1976), Hennart (1982, 1993) and Rugman (1981, 1986).

[2]K can be thought of as the quantity of tacit and codified technological know-how, patents and designs obtained by entrepreneurs.

[3]Physical capital costs are assumed to converge around the globe, and hence are ignored in this model (Casson, 1985). Differences in production output are expected to be mainly a function of know-how level, labor volume and labor productivity.

[4]Strictly speaking we should refer to intra-firm and inter-firm transaction costs where the latter are expected to exceed the former (Buckley & Casson, 1976; Williamson, 1975, 1985). Ignoring intra-firm transaction costs is done for simplicity and does not change the results of our model.

[5]For simplicity we assume that the parameters a and α are identical for entrepreneurs in A and in B.

[6]Or alternatively the utility of n_B transactions in which K'_A was transferred by any number of A's entrepreneurs smaller than n_B.

[7]This is so because such entrepreneurs will always be able to offer them marginally higher wages in terms of g (i.e., $w_i + \varepsilon$, where $\varepsilon =$ incremental wage difference).

[8]The case where FDI in A is selected is perfectly symmetric.

[9]Since all entrepreneurs in B are identical, enrolling a single entrepreneur will suffice.

[10]We are in debt to an anonymous reviewer for this comment.

[11]Or alternatively the utility of n_A transactions in which K'_B was transferred by any number of B's entrepreneurs smaller than n_A.

[12]As they appear in both the numerators and the denominators of Eqs. (11a)–(11d).

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