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A global system view of firm boundaries

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Abstract
This paper applies the global system view to the location and control strategies of firms. This approach envisages the world as a grid of potential locations for value-adding activities, connected by flows of information and products. The simplified model provides a basis for testing new hypotheses on the number of firms that will exist in the global system, their locations, and their organisational boundaries. The paper provides a rigorous and formal exposition of the theories of internationalisation and the multinational enterprise.
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Introduction

The vast majority of scholars investigating the global *location* and *control* configurations of firms tend to base their analysis upon the point of view of a *single* firm. This point of view is common to most schools of internationalisation, ranging from the economic school (e.g. Buckley and Casson, 1976; Hirsch, 1976; Dunning, 1977, 1988; Rugman, 1986), to the stages model (Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1977, 1990; Welch and Luostarinen, 1988), the network approach (Johanson and Mattsson, 1992; Sharma, 1992; McNaughton and Bell, 1999), and the strategy-structure school (e.g. Bartlett and Ghoshal, 1989; Sundaram and Black, 1992; Birkinshaw, 1997). As noted by Casson (2000), few attempts have been employed to incorporate a *global system view* in the location configuration of firms (i.e. the location of various value-adding activities) and in their control configuration (i.e. the mode of control exerted for each value activity).

Applying a global system view to the theory of internationalisation means relating to the world as a grid of locations for various value-adding activities (e.g. R&D, production, marketing) that are interconnected through information and material/product flows. The basic notion of the global system view dates back to Robertson (1923) and to Coase's (1937) transaction cost theory. Essentially, each value-adding activity can be located in any location and coordinated by a variety of institutional arrangements (within a firm, through the market, by the state, or through institutional/social networks). The number of firms that would eventually exist, their location and their organisational boundaries (in terms of the value-adding activities) are expected to minimise both the overall cost of the system and the cost of each firm. Equilibrium will not be achieved as long as there is a profit opportunity somewhere in the system that enables actors within it to reduce costs. At one extreme there would be as many firms as the number of potential locations multiplied by the number of relevant value-adding activities (each firm performs one activity in one location). At the other extreme, a single multinational enterprise (MNE) would exist and would internalise the whole world. The implication of the above statement is that traditional internationalisation theories, which focus on the point of view of a single firm and ignore the different forces operating within a global system, constitute merely special cases of a wider theoretical platform, and may yield misleading outcomes. As Casson (2000, 65) notes:

> [As] the theory of internalization thus became divorced from the systems view of the economy… It is necessary to recognise the costs as well as the benefits of internalization, for it is the costs that account for the benefit of the external market system in which firms are embedded.

In fact, failing to do so would be somewhat similar to expounding microeconomics from the point of view only of a monopoly, while neglecting the potential existence of perfect or semi-perfect markets.

There is no doubt that applying the global system view to international business is complex, as the number of possibilities tends to 'combinatorically explode'. Nevertheless, as demonstrated by Casson (1990, 1995, 2000), several simplifying assumptions, which do not affect outcomes, enable the global system view to be employed.

The current paper borrows from Casson (2000) but extends his formal analysis of the global system in two major directions. First, the paper focuses on a global system that contains:

- a single large market;
- a small, innovative developed country that has a comparative advantage in R&D;
- a developing country that has a comparative advantage in production.

This system is claimed to be more representative of the variety of countries as reflected in the internationalisation literature (e.g. Buckley and Casson, 1976; Hirsch, 1976; Dunning, 1977, 1988, 1993; Johanson and Vahlne, 1977, 1990; Anderson and Gatignon, 1986; Welch and Luostarinen, 1988; Bartlett and Ghoshal, 1989; Benito and Gripsrud, 1992). Second, the paper introduces a formal solution for identifying optimal location and control configurations within that global system by specifying products' economies of scale (EOS), knowledge intensity and distance sensitivity. Basically three locations (the above-mentioned countries) and two control configurations (internalisation within a firm or externalisation to the market) are considered for each value-adding activity.

The purpose of the model

The model presented in this paper derives the optimal global system, which minimises the cost of operations and the flows within the system, from a small number of parsimonious assumptions. Given specific product attributes, the model predicts the number of firms in the system and their boundaries. Ways of testing the model empirically are suggested, and the global system view is shown to be the general case in which internationalisation theories and theories of the MNE emerge as special cases.

The following section outlines the formal definitions of the global system. Then a formal solution to the system's optimal location configurations and its control configurations is presented. We conclude with a discussion of the implications of the global system approach, and outline possible directions for further study.

Theoretical framework: a simplified global system

Consider an economic system that produces a single consumer good. The system consists of a market in the size of X of a large developed country (A), as well as a small-developed economy (B) and a developing country (C), both having a negligible home market. Following Buckley and Casson (1976) and Hirsch (1976) three types of value-adding activity are involved: R&D (R), production (P) and marketing (M). Skilled labour is assumed to be comparatively abundant in Country B: hence, according to the Hecksher–Ohlin–Samuelson (H–O–S) theory, it is expected to have a comparative advantage in R&D (in comparison with A and C). Less skilled (or production) labour is comparatively abundant in Country C, which therefore has a comparative advantage in production (in comparison with A and B). Labour is assumed to be immobile whereas capital is assumed to be internationally mobile and thus has little or no impact on comparative advantage. The value-adding activities are linked to one another by flows of products (denoted by T) and/or by flows of information or knowledge (denoted by I). Three main types of linkage are identified: $I_{R\text{–}P}$ flow of know-how between R&D and production; $I_{M\text{–}R}$ flow of

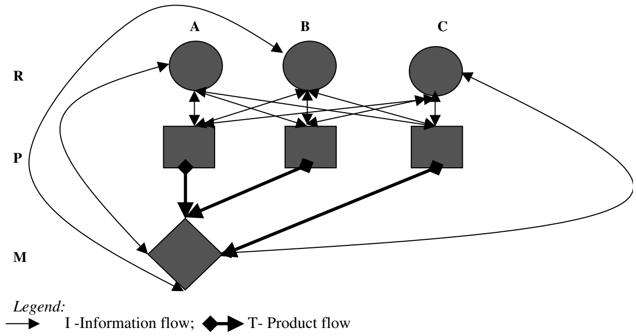

Figure 1 Location of value-adding activities.

information between marketing and R&D; and $T_{P\text{–}M}$, flow of goods from production to the customers via the marketing entity.

Product flow is one-way, but all information flows are two-way. This is because there is always feedback in information flows between different value-adding activities. There is no flow of knowledge between production and marketing, as it is assumed that the transmission of information between these two entities is entirely intermediated by R&D. This simplification is of little importance, as production and marketing are linked by product flows.

The system is portrayed in Figure 1. An R&D laboratory is denoted by a circle, a production plant by a square, and a marketing facility by a diamond. A product flow is denoted by a thick line and an information flow by a thin line, and the direction of flow is indicated by an arrow. It is clear that each value-adding activity might be located at one or more locations. For the sake of simplicity, we ignore the case of multiple R&D facilities, multiple production plants and multiple marketing entities within the same country. In our model R and P can be located at A or B or C. M can be located only in country A, near the product's market, for reasons to be detailed below. Following these assumptions there are $7 \times 7=49$ location options for the various value-adding activities. Hence the system may include a maximum of seven firms (assuming each value-adding activity is performed by an independent firm) and a minimum of one firm (assuming one MNE internalises all of the value-adding activities).

Costs of operation

R&D costs

The output of an R&D laboratory is a public good that can be transferred via $I_{R\text{–}P}$ to production sites around the globe. As international information flow costs are higher than local ones, there are cost advantages in locating the R&D laboratory in the same country as the production plant. Nevertheless the final location decision depends on the costs of operating the R&D laboratory (R_i; i=A, B, C) and the costs of production (P_i; i=A, B, C) as well. R&D activities are assumed to incur a fixed cost, and can be located in one or more countries. For the sake of simplicity we ignore the cost of information flow between R&D facilities in various countries. We also ignore the existence of EOS and scope in locating R&D in a single location and assume that, whenever there are multiple R&D laboratories, average overall R&D costs are the simple average of the single R&D laboratories' operation costs, as stated below:

$$R_{i,j} = \frac{R_i + R_j}{2} \quad (i,j = \mathrm{A, B, C};\, i \neq j) \tag{1a}$$

$$R_{i,j,k} = \frac{R_i + R_j + R_k}{3} \quad (i,j,k = \mathrm{A, B, C};\, i \neq j \neq k) \tag{1b}$$

As B has a comparative advantage in R&D (and C has a comparative advantage in production), according to the H–O–S theory we may expect that $R_\mathrm{B}/P_\mathrm{B} < R_\mathrm{A}/P_\mathrm{A} < R_\mathrm{C}/P_\mathrm{C}$. For the sake of simplicity we assume that

$$R_\mathrm{B} < R_\mathrm{A} < R_\mathrm{C} \tag{2}$$

We may also assume that the cost of R&D in country C is far too high to justify the establishment of an R&D facility there. This simplification is supported by the fact that it is extremely hard to locate R&D facilities in developing countries, as these countries lack the adequate labour and infrastructure to attract the establishment of R&D facilities (Ronstadt, 1978; Dunning and Narula, 1995; Pearce and Papanastassiou, 1996, 1999; Kumar, 2001).

Production costs

Production cost is composed of variable production cost, which is determined by the cost of labour required to produce one product unit (W_i, i=A, B, C) and fixed production cost, which is assumed to be the cost of capital (K). More specifically, one can determine that:

$$P_i = K + W_i x \ (i = \mathrm{A, B, C}, \ x = \text{number of produced units}) \tag{3a}$$

In the case of multiple production plants, we assume that production is uniformly distributed among the plants. Thus

$$P_{i,j} = 2K + (W_i + W_j)\,\frac{x}{2} \quad (i,j,k = \text{A,B,C}; i \neq j \neq k) \tag{3b}$$

$$P_{i,j,k} = 3K + (W_i + W_j + W_k)\frac{x}{3} \quad (i,j,k = \text{A,B,C}; i \neq j \neq k) \tag{3c}$$

Evidently, this cost structure implies that EOS in production are a major consideration.

Following the discussion regarding the comparative advantages of the three countries we simplify the analysis and assume that

$$P_{\mathrm{C}} < P_{\mathrm{A}} = P_{\mathrm{B}} \tag{4}$$

This simplification should not have a major impact on the results of our model.

Marketing costs

As mentioned earlier, the vast majority of the world market (X) is located in country A, whereas the market for the product is negligible both in B and in C. The cost of marketing is specifically defined as the costs of the interface between the marketing personnel and the customers as well as the cost of supplying after-sale services (including travelling costs and ongoing market research cost). The model assumes that all these costs are accounted for in the large country (A). The proximity of marketing activities to the firm's customers is extremely important once the firm has to serve a large mass of customers. The savings on transport costs of individuals (e.g. sale representatives, technicians), the savings on transportation of spare parts (which can be stored in country A), the quick response to customer needs, and the ability to collect data on the market trends in a much more efficient way are all parts of the explanation why M is located at A (Buckley and Casson, 1976; Hirsch, 1989).

Marketing costs are a function of fixed costs(D) and variable costs(E), as determined by the following expression:

$$M_{\mathrm{A}} = D + Ex \quad (x = \text{number of produced units}) \tag{5}$$

Costs of the flows

It is clear that both types of flows incur costs. Product flow is subject to *transfer costs*, that is, the cost of transportation, tariff barriers, and non-tariff barriers, as well as the cost of interaction with the most adequate local distribution channels to the product's customers (Casson, 2000, 67–70). These flows are between a plant (plants) and the customers in A and are assumed to be coordinated by the marketing entity located at A. Because of specifically international barriers, we may assume that international transfer costs are higher than local transfer costs. Hence, if a single plant (at A, B or C) is to serve the market at A, we may refer to local transfer costs per unit (α) and international transfer costs per unit (β), implying that total transfer costs of x units are

$$T_{\mathrm{A-A}} = \alpha x; T_{j-\mathrm{A}} = \beta x \quad (\beta > \alpha; j = \mathrm{B, C}) \tag{6a}$$

Following the same logic, if multiple plants are to serve the market at A, transfer costs may be calculated as an average of the local and international transfer costs, assuming uniform distribution of production among the various plants. If we define $T_{i,j,k\text{–A}}$ as the transfer costs from countries i, j, k to country A (i, j, k=A, B, C; $i \neq j \neq k$), we can determine that, in the case of two plants serving A's market, transfer costs are

$$T_{\mathrm{A},j-\mathrm{A}} = \frac{x(\alpha + \beta)}{2} \tag{6b}$$

$$T_{j,k-\mathrm{A}} = \beta x \tag{6c}$$

In the case of three plants serving that market, transfer costs are

$$T_{\mathrm{A},j,k-\mathrm{A}} = \frac{x(\alpha + 2\beta)}{3} \tag{6d}$$

Information flow costs include communication costs and transaction costs: thus they might be viewed as fixed costs that are higher across borders than locally (Teece, 1986; Casson, 2000, 67–70) because of cultural differences between countries (Hymer, 1976; Hofstede, 1980; Kogut and Singh, 1988; Contractor, 1990), geographic distance (Krugman, 1991; Hirsch and Hashai, 2000), and the greater complexity of control in an imperfect world (Buckley and Casson, 1976).

Hence, if we let $I_{R(i)-P(j)}$ denote the cost of information flow between R&D and production (i, j=A, B, C), one can determine that, for the case of information flow between a single plant and a single R&D laboratory:

$$I_{R(i)-P(i)} = \gamma; I_{R(i)-P(j)} = \delta(\gamma < \delta; i \neq j) \tag{7a}$$

As mentioned earlier, the global system may contain multiple R&D laboratories and plants, each located in a different country. In this case, we define information costs as an average of local (γ) and international (δ) flow costs, assuming uniform distribution of information flow among different value-adding activities. Thus, if we define $I_{R(i,j,k)-P(i,j,k)}$ as the information flow cost between R&D laboratories and plants in countries i, j, k (i, j, k=A, B, C; $i \neq j \neq k$), five additional typical cases exist:

(1) information flow between a single plant and two R&D laboratories –one local and the other international (e.g. $I_{R(A,B)-P(A)}$ or $I_{R(A,B)-P(B)}$), with a cost of

$$I_{R(i,j)-P(i)} = \frac{\gamma + \delta}{2} \quad (7b)$$

(2) information flow between two R&D laboratories and two plants located in the same location (e.g. $I_{R(A,B)-P(A,B)}$), where the costs are

$$I_{R(i,j)-P(i,j)} = \frac{\gamma + \delta}{2} \quad (7c)$$

(3) information flow between two R&D laboratories and a plant located in a third country (e.g. $I_{R(A,B)-P(C)}$) with a cost of

$$I_{R(i,j)-P(k)} = \delta \quad (7d)$$

(4) information flow between two R&D laboratories and two plants, one of them in the same country and one in another (e.g. $I_{R(A,B)-P(A,C)}$), where the cost is

$$I_{R(i,j)-P(i,k)} = \frac{\gamma + 3\delta}{4} \quad (7e)$$

(5) information flow between two R&D laboratories and three plants (e.g. $I_{R(A,B)-P(A,B,C)}$), where the costs are

$$I_{R(i,j)-P(i,j,k)} = \frac{\gamma + 2\delta}{3} \quad (7f)$$

For the case of information flow between marketing and R&D, we may apply the same logic to determine that, if $I_{M(A)-R(i,j,k)}$ denotes the information flow cost between the marketing entity at A and the R&D laboratories in countries i, j, k (i, j, k=A, B, C; $i \neq j \neq k$), then the following typical cases exist:

(1) information flow between a single R&D laboratory and the marketing entity, where its cost is

$$I_{M(A)-R(A)} = \gamma; I_{M(A)-R(j)} = \delta \quad (\gamma < \delta; j \neq A) \quad (8a)$$

(2) information flow between the marketing entity and two R&D laboratories, one at A and the other at either B or C (e.g. $I_{M(A)-R(A,B)}$), with a cost of

$$I_{M(A)-R(A,j)} = \frac{\gamma + \delta}{2} \quad (8b)$$

(3) information flow between the marketing entity and two R&D laboratories located at B and C, with a cost of

$$I_{M(A)-R(j,k)} = \delta \quad (8c)$$

Optimal location configurations

An optimal global system minimises the cost of operations and flows within it. This view corresponds with the 'economic school' view of internationalisation as a pattern of investment in foreign markets explained by rational economic analysis, according to which firms choose their optimal structure by evaluating the cost of economic transactions (e.g. Buckley and Casson, 1976; Hirsch, 1976; Dunning, 1977, 1988; Rugman, 1986; Morck and Yeung, 1992; Fina and Rugman, 1996), but extends it to a global system (Casson, 2000, 62–63).

According to the above definitions, the global system is now composed of 21 (3×7) alternative location configurations: see Table 1, which details the possible mathematical permutations for the global system and their cost. The total cost of each location configuration can be calculated by summing up the relevant costs of its operation (R, P and M) in countries A, B or C and the relevant information and product flows. As mentioned above, theory predicts that the configurations with the lowest cost are the optimal ones. Which configuration is chosen depends on the relative magnitude of the different variables that represent the costs of operations and flows. The easiest way to understand the general properties of the solution is first to eliminate the configurations that are clearly dominated by others and then to compare the remaining ones in terms of the major trade-offs involved and the magnitude of each variable according to specific product attributes.

Based on the assumptions made earlier on operation and flow costs, it is quite straightforward to see that the following configurations are dominated by others: configurations 2 and 9 (by configuration 3), configuration 7 (by configuration 1), configuration 10 (by configuration 8), configuration 13 (by configuration 6), and configuration

Table 1 Costs of alternative location configurations

No.	*R&D*	*Information flow, R&D–Production*	*Production*	*Transfer to customers*	*Marketing*	*Information flow, Marketing–R&D*
1	R_A	$I_{R(A)-P(A)}$	P_A	T_{A-A}	M_A	$I_{M(A)-R(A)}$
2	R_A	$I_{R(A)-P(B)}$	P_B	T_{B-A}	M_A	$I_{M(A)-R(A)}$
3	R_A	$I_{R(A)-P(C)}$	P_C	T_{C-A}	M_A	$I_{M(A)-R(A)}$
4	R_B	$I_{R(B)-P(A)}$	P_A	T_{A-A}	M_A	$I_{M(A)-R(B)}$
5	R_B	$I_{R(B)-P(B)}$	P_B	T_{B-A}	M_A	$I_{M(A)-R(B)}$
6	R_B	$I_{R(B)-P(C)}$	P_C	T_{C-A}	M_A	$I_{M(A)-R(B)}$
7	R_A	$I_{R(A)-P(A)}$, $I_{R(A)-P(B)}$	$P_{A, B}$	T_{A-A}, T_{B-A}	M_A	$I_{M(A)-R(A)}$
8	R_A	$I_{R(A)-P(A)}$, $I_{R(A)-P(C)}$	$P_{A, C}$	T_{A-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$
9	R_A	$I_{R(A)-P(B)}$, $I_{R(A)-P(C)}$	$P_{B, C}$	T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$
10	R_A	$I_{R(A)-P(A)}$, $I_{R(A)-P(B)}$, $I_{R(A)-P(C)}$	$P_{A, B, C}$	T_{A-A}, T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$
11	R_B	$I_{R(B)-P(A)}$, $I_{R(B)-P(B)}$	$P_{A, B}$	T_{A-A}, T_{B-A}	M_A	$I_{M(A)-R(B)}$
12	R_B	$I_{R(B)-P(A)}$, $I_{R(B)-P(C)}$	$P_{A, C}$	T_{A-A}, T_{C-A}	M_A	$I_{M(A)-R(B)}$
13	R_B	$I_{R(B)-P(B)}$, $I_{R(B)-P(C)}$	$P_{B, C}$	T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(B)}$
14	R_B	$I_{R(B)-P(A)}$, $I_{R(B)-P(B)}$, $I_{R(B)-P(C)}$	$P_{A, B, C}$	T_{A-A}, T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(B)}$
15	$R_{A, B}$	$I_{R(A)-P(A)}$, $I_{R(A)-P(A)}$	P_A	T_{A-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
16	$R_{A, B}$	$I_{R(A)-P(B)}$, $I_{R(B)-P(B)}$	P_B	T_{B-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
17	$R_{A, B}$	$I_{R(A)-P(C)}$, $I_{R(B)-P(C)}$	P_C	T_{C-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
18	$R_{A, B}$	$I_{R(A)-P(A)}$, $I_{R(A)-P(B)}$, $I_{R(B)-P(A)}$, $I_{R(B)-P(B)}$	$P_{A, B}$	T_{A-A}, T_{B-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
19	$R_{A, B}$	$I_{R(A)-P(A)}$, $I_{R(A)-P(C)}$, $I_{R(B)-P(A)}$, $I_{R(B)-P(B)}$	$P_{A, C}$	T_{A-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
20	$R_{A, B}$	$I_{R(A)-P(B)}$, $I_{R(A)-P(C)}$, $I_{R(B)-P(B)}$, $I_{R(A)-P(C)}$	$P_{B, C}$	T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$
21	$R_{A, B}$	$I_{R(A)-P(A)}$, $I_{R(A)-P(B)}$, $I_{R(A)-P(C)}$, $I_{R(B)-P(A)}$, $I_{R(B)-P(B)}$, $I_{R(B)-P(C)}$	$P_{A, B, C}$	T_{A-A}, T_{B-A}, T_{C-A}	M_A	$I_{M(A)-R(A)}$, $I_{M(A)-R(B)}$

18 (by configuration 15). Thus we are left with 15 configurations, the decision between which is dependent on the magnitude of the various cost variables.

Let us now refer to three major product attributes: capital intensity, which is expected to correspond to EOS; knowledge intensity, which can be determined by the ratio of R&D expenses to sales; and distance sensitivity, which is mainly a function of the ratio between the product cost and its transportation cost. Each of these attributes has a counter-attribute: some products enjoy EOS in production, but others are characterised by diseconomies of scale (e.g. supplying tailor-made products). Some products might be knowledge intensive (or Schumpeterian products) whereas others are universal know-how products (Schumpeter, 1934; Hirsch, 1989; Almor and Hirsch, 1995). Some products are distance sensitive whereas others are less so (Helpman and Krugman, 1985; Hirsch and Hashai, 2000).

Moreover, each of the above attributes relates to one or more of the above-mentioned cost variables: EOS is related to the number of plants (and to the product's capital intensity); knowledge intensity is related to the cost of R&D as well as to the cost of information flows, which are assumed to be more intensive and more expensive for knowledge-intensive products (Buckley and Casson, 1976; Hirsch, 1989); and distance sensitivity is related to transfer costs. Thus, by analysing the costs within each configuration, one can determine the applicability of each location configuration to specific product attributes.

Table 2 describes the fit between the cost advantages of each location configuration (i.e. having relatively low cost of specific flows and/or operations, according to the model's basic assumptions) and the various product attributes. Whenever a specific location configuration incurs transfer costs of α it has a transfer cost advantage (denoted by T'). Whenever a configuration incurs information flow costs of γ it has an information cost advantage (denoted by I'). If manufacturing is located in country C, the relevant configuration has a variable cost advantage (denoted by P'). If R&D is located in country B, there is an R&D cost advantage (denoted by R'), and if a configuration contains only one plant it can better exploit EOS because of savings on capital (denoted by K'). If a configuration is only partly

Table 2 Location configuration costs and product attributes

Location configuration no.	*Cost advantages*	*Product attributes*			*Alternative configuration*
		EOS	*Knowledge intensity*	*Distance sensitivity*	
1	T', I', K'	✓	✓	✓	4
3	P', I', K'	✓	✓	×	5 and 6
4	R', T', K'	✓	✓	✓	1
5	R', I', K'	✓	✓	×	3 and 6
6	R', P', K'	✓	✓	×	3 and 5
8	$I/'$, (P'), (T'), (K')	–	✓	–	11 and 12
11	R', (I'), (T'), (K')	–	✓	–	8 and 12
12	R', (P'), (T'), (K')	–	✓	–	8 and 11
14	R', (I'), (P'), (T')	✓	✓	–	
15	T', K', (R'), (I')	✓	–	✓	
16	K', (R'), (I')	✓	–	×	17
17	P', K', (R'), (I')	✓	–	×	16
19	(R'),(I'),(P'),(T'),(K')	–	–	–	
20	(R'), (I'), (P'), (K')	–	–	×	
21	(R'), (I'), (P'), (T')	×	–	–	

Costs: T', transfer cost; I', information cost; P', variable production cost; R', R&D cost; K', capital intensity; ( ), minor advantage.
Product attributes: ✓, attribute exists; –, indifference to attribute; ×, attribute does not exist.

composed of one (or more) of the above cost advantages (T', I', P', R' and K') its relevant cost advantage is regarded as minor (for example, if a configuration includes a plant in C and a plant in A, it will have a minor variable production cost advantage). In addition, when appropriate, alternative compatible configurations are noted for a set of product characteristics. For example, if a product is characterised by EOS in production, knowledge intensity and distance sensitivity, configurations 1 and 4 are expected to minimise its global system cost and thus are its optimal location configurations. The choice between these configurations would probably be the outcome of the magnitude of the cost minimisation of the various flow/operation costs (for example, if minimising R&D cost enables a greater cost saving than minimising information flow cost, configuration 4 is preferable to configuration 1). Similarly, in a product characterised by EOS, that has modest knowledge intensity and no distance sensitivity, the optimal configurations for the global system would be configurations 16 and 17. In this case, the importance of variable production cost advantage (P') enables us to choose between the two alternative configurations (that is, if variable production costs have a substantial impact on the overall operations and flows costs, configuration 17 would be superior).

Optimal control configurations

So far we have dealt with a definition of the boundaries of the global system. We have still not answered two major questions:

- How many firms should operate within such a system?
- What are the boundaries of each firm within the system?

In order to answer these questions we should define which of the value-adding activities would be internalised within a firm and which would be externalised through arm's length transactions with the market. This requires several additional assumptions regarding internalisation of flows (i.e. maintaining a flow between two internal value-adding activities) or their externalisation (i.e. maintaining a flow with at least one external value-adding activity involved).

We assume that local transfer costs (T) are lower if they are internalised, the reason being the superior ability of the firm to monitor the interface between production and marketing and to avoid transaction costs if it internalises both operations. Thus we assume that

$$T_{i-i(\mathrm{int})} < T_{i-i(\mathrm{ext})} \quad (i = \mathrm{A, B, C}, \; \mathrm{int} = \mathrm{internal}, \; \mathrm{ext} = \mathrm{external}) \tag{9a}$$

Nevertheless, global transfer costs are lower if they are externalised. This stems from the fact that global transfer costs capture not only transportation but also the need to cope with non-tariff barriers and the ability to target the right distribution channels in the host market. These activities are better performed by indigenous organisations in the host country that are more familiar with their local business and governmental environment and that have a deeper and better understanding of the market (Kogut and Singh, 1988; Contractor, 1990). Therefore we assume that

$$T_{i-j(\mathrm{int})} > T_{i-j(\mathrm{ext})} (i, j = \mathrm{A, B, C}; i \neq j) \tag{9b}$$

Our assumptions regarding information flow costs (I) depend on the knowledge intensity of the product. In knowledge-intensive products the comparative importance of R&D to the flow cost is higher than the importance of production and marketing. Thus, for both local and global information flows, internalisation is preferred. The reasons are the need to prevent leakage of highly valuable private information that is the core of sustainable competitive advantage, and the increased probability of being exposed to higher transaction costs in order to protect valuable know-how (Casson, 1994, 2000; Besanko *et al*, 2000: 132–135). Thus we assume that, for knowledge-intensive products,

$$I_{i-i(\mathrm{int})} < I_{i-i(\mathrm{ext})} (i = \mathrm{A, B, C}) \tag{10a}$$

and

$$I_{i-j(\mathrm{int})} < I_{i-j(\mathrm{ext})} (i, j = \mathrm{A, B, C}; i \neq j) \tag{10b}$$

On the other hand, for medium- and non-knowledge-intensive products the comparative importance of production and marketing to these products' information flow costs (I^*) increases. In this case local information flows might still be cheaper to internalise, for the reasons mentioned above. A firm is expected to have a superior ability to control internal activities, avoid disinformation that might occur in the process, and prevent dishonesty and opportunism costs, as long as it operates in its home country (Coase, 1937; Williamson, 1975, 1985). Once international information flows are involved, external entities that are more familiar with their local business and governmental environment and that are less exposed to cultural distance and to the liability of foreignness may decrease information flow costs (Hymer, 1976; Hofstede, 1980; Kogut and Singh, 1988). Thus we assume that, among medium- and non-knowledge-intensive products,

$$I^*_{i-i(\mathrm{int})} < I^*_{i-i(\mathrm{ext})} \quad (i = \mathrm{A, B, C}) \tag{11a}$$

and

$$I^*_{i-j(\mathrm{int})} > I^*_{i-j(\mathrm{ext})} (i, j = \mathrm{A, B, C}; i \neq j) \tag{11b}$$

Based on the above assumptions, Table 3 links each of the location configurations from Table 2 to preferred control configurations, by identifying the cost-minimising ones. Table 3 details the optimal control configurations and the number of firms that would exist in the global system as a function of the fit between a specific location configuration and products' knowledge intensity (as identified in Table 2). In some of the cases there is more than one cost-minimising configuration: thus the preferred configuration should be chosen according to specific comparison of relative information and product flow costs. In these cases we also face the triangle problem (Casson, 2000, 75–80), meaning there are contradicting criteria of internalisation and externalisation. For example, in location configuration 3 the cost minimisation criteria dictate internalisation of the information flows between R_A and P_C and between R_A and M_A, but externalisation of the product flow between P_C and M_A. This is an impossible control configuration because one criterion requires internalisation of P_C and the other requires its externalisation. In these cases we follow Casson (2000) and solve the triangle problem by changing only one of the flow's control modes in order to get a coherent control structure. Thus the triangle problem of location configuration 3 might be solved by internalizing T_{C-A} (indicating the existence of one firm within the system) or by externalizing either $I_{R(A)-P(C)}$ or $I_{M(A)-R(A)}$ (indicating the existence of two firms within the system). The choice between these alternative control configurations should be made according to specific product attributes. If it is less costly to externalise an international information flow rather than externalise an international product flow (implying it is less costly to externalise an international production facility), two firms would exist; otherwise only one firm would exist.

Tables 2 and 3 may be used to examine the geographic dispersion and the degree of control in various industrial branches. Take for example the aircraft industry, which is characterised by high EOS, knowledge intensity and distance sensitivity. Configuration 1 in our model may well suit to

Table 3 Optimal control configurations

Location configuration no.	*Product*			*Notes*
	Knowledge intensity	*Alternative control configurations*	*No. of firms*	
1	✓	$\{R_A, P_A, M_A\}$	1	
3	✓	$\{R_A, P_C, M_A\}$ $\{R_A, M_A\};\{P_C\}$ $\{R_A, P_C\};\{M_A\}$	1 or 2	Triangle problem
4	✓	$\{R_B, P_A, M_A\}$	1	
5	✓	$\{R_B, P_B, M_A\}$ $\{R_B, M_A\};\{P_B\}$ $\{R_B, P_B\};\{M_A\}$	1 or 2	Triangle problem
6	✓	$\{R_B, P_C, M_A\}$ $\{R_B, M_A\};\{P_C\}$ $\{R_B, P_C\};\{M_A\}$	1 or 2	Triangle problem
8	✓	(1) $\{R_A, P_A, P_C, M_A\}$ (2) $\{R_A, P_A, M_A\}$; $\{P_C\}$	1 or 2	Triangle problem
11	✓	(1) $\{R_B, P_A, P_B, M_A\}$ (2) $\{R_B, P_A, M_A\}$; $\{P_B\}$	1 or 2	Triangle problem
12	✓	(1) $\{R_B, P_A, P_C, M_A\}$ (2) $\{R_B, P_A, M_A\}$; $\{P_C\}$	1 or 2	Triangle problem
14	✓	(1) $\{R_B, P_A, P_B, M_A\}$ (2) $\{R_B, P_A, M_A\}$; $\{P_B\}$	1 or 2	Triangle problem
15	–	$\{R_A,P_A,M_A\};\{R_B,P_B\}$	2	
16	–	$\{R_A,P_A\};\{R_B,P_B\}$	2	
17	–	$\{R_A\};\{R_B\};\{P_C\};\{M_A\}$	4	
19	–	$\{R_A,P_A,M_A\};\{R_B\};\{P_C\}$	3	
20	–	$\{R_A,M_A\};\{R_B,P_B\};\{P_C\}$	3	
21	–	$\{R_A,P_A,M_A\};\{R_B,P_B\};\{P_C\}$	3	

✓, high knowledge intensity; –, medium knowledge intensity.

describe the global system of this industry, where it portrays a geographically and organisationally concentrated system. This is matched in reality, where two firms that rely on local operations (Boeing and Airbus) virtually control the world's airplane production. Another example is the semiconductors industry, which is characterised by high EOS and knowledge intensity, but low distance sensitivity, and hence is expected to be more geographically dispersed, albeit remaining quite organisationally concentrated. Configurations 3, 5 and 6 characterise this industry well when one large firm (Intel) and a couple of others dominate the world's market. On the other hand an industry such as textiles and clothing, which does not incur high EOS and is relatively not knowledge intensive or distance sensitive, is expected to be much more geographically and organisationally dispersed (configurations 19–21). This expectation is surely met in reality.

Generally speaking, Tables 2 and 3 indicate an interesting difference between knowledge-intensive and less knowledge-intensive products. Knowledge-intensive products tend to be less geographically dispersed and exhibit a higher degree of control mode (i.e. favour internalisation) than less knowledge-intensive products.

Discussion and conclusion

This paper extends the work of Mark Casson (1990, 1995, 2000) on the global system view of firm boundaries in two major directions. First, we present a more complex model of the global system. Rather than relating to two similar economies, this model includes a large developed economy, a small developed economy, and a small developing one. Not only do these locations represent a larger variety of world economies, but also the mathematical formulation and solution of such a model becomes more complicated. The model is further complicated by relaxing Casson's (2000) restrictions on multiple links between R&D laboratories and production plants, which again is assumed to be more representative of R&D–production know-how flows in reality. Second, and most importantly, we formally solve the model to identify the optimal location and control configurations of the global system. This is done by linking the cost advantages that stem from various location and control configurations to specific product attributes: EOS, knowledge intensity and distance sensitivity. Thus the model suggested in this paper captures the choice between alternative location and control configurations as a systematic comparison between the costs of worldwide operations and the cost of information and product flows between them, where the optimal configurations exhibit minimal costs.

The role of the global system view in international business research

One may wonder: What is the point of using the global system view in international business research? We assert that adopting a global system view enables us to offer a more rigorous and formal dimension to the theory of internationalisation and the theory of the MNE. Furthermore, we argue that the traditional competing theories of internationalisation and the MNE are all different *special cases* of a wider perspective encapsulated in the global system view.

The basic notion of the global system view is that the locational and organisational boundaries of firms are the outcome of equilibrium in two competitive markets: the market for capital and the market for managers (Coase, 1937; Casson, 2000). The success of entrepreneurs in bundling resources into firms will be determined by their success in raising funds. The capital market will allocate funds only to firms that are believed to have the 'right' boundaries. Thus entrepreneurs will have to widen or narrow the boundaries of their firms according to the capital market signals. Similarly, if managers' incentives are tied to profit maximisation, they will aim to maximise the profit of their firm by determining its optimal boundaries. Otherwise they may lose their jobs to managers who will do so. Hence the competition for funds and managers will eventually be the driving force that determines firms' locational and organisational boundaries, as noted by Coase (1937): 'In a competitive system there is an optimum amount of planning.' The *traditional theories* of internationalisation and the MNE only partially adopt this point of view. This makes them somewhat divorced from each other, rather than being viewed as complementary fractional explanations of the same phenomenon.

The economic school of internationalisation and FDI (e.g. Hirsch, 1976; Dunning, 1977, 1988; Rugman, 1986) focuses only on the firm's individual decisions on its operations location and internalisation, while ignoring the fact that such decisions are actually driven by powerful external sources – the discipline to the markers for capital and managers. Moreover, most commonly, scholars adhering to this school treat the firm as a 'black box' (and not as a grid of interconnected value-adding activities) and implicitly assume that firm-specific know-how is developed at a specific 'home country' and transferred abroad, while neglecting the existence of internal and external know-how flows that may origin in foreign countries. (For example, only in his later work has Dunning turned to concepts such as 'knowledge seeking' or 'strategic asset seeking' that take foreign-based know-how into account.) A simple example, relating to Dunning's well-known OLI paradigm, is perhaps best to demonstrate the weakness of taking a single firm's point of view.

Many technology-based start-ups from small developed economies (such as the Scandinavian countries, or Israel) possess an ownership advantage that is based on their core technology. These firms are usually disadvantaged in their location in terms of their distance from the world's largest markets for technological products (e.g. the USA or Japan). Hence they need to internationalise some of their operations. These firms' location disadvantage should dictate, according to the OLI paradigm terminology, two alternatives: either to externalise operations by selling core technology to indigenous firms that operate in these firms' target markets, or to internalise operations and focus on a small market niche where their size constraint makes them less disadvantaged compared with larger firms. However, it is well known that, in many cases, the strategy of these firms is completely different. They simply seek to be bought out by larger firms. This strategy (which is frequently the firm's declared strategy from the day of its inception) is driven by the capital market (either venture capital funds or stock exchanges), which rewards firms for such a strategy by enabling them to raise required funds. This strategy is further driven by the market for managers, which rewards mangers for being able to sell their company successfully (e.g. by bonuses or by the fact that the value of shares or options they hold will increase once their firm is sold out). Contrary to the OLI paradigm, adopting the global system view should reveal that the activities of such firms should be internalised within the operations of another firm.

The stages model (Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1977, 1990; Welch and Luostarinen, 1988) takes another partial view of the global system, whereby it essentially concerns the *process* of defining the geographic and organisational boundaries of a single firm. This model neglects the role of the markets for capital and managers in shaping this process, regards firm-specific knowledge as chiefly a 'home' country attribute, and ignores the role of external information and knowledge flows. In addition, the stages model is 'marketing oriented' and thus it ignores the cost pressures to locate R&D and production activities outside the host market. Moreover, in sharp contrast to the global system view, this model implicitly assumes that full internalisation will eventually occur (i.e. wholly owned production sites in the host market).

The network approach (e.g. Johanson and Mattsson, 1992; Sharma, 1992; McNaughton and Bell, 1999) takes a somewhat wider view whereby it actually refers to the role of external information flows between network members in promoting firms' internationalisation. In the terminology of the global system view these flows may be defined as an additional type of information flow that lies between 'internal' and 'external' flows, that is, an external flow that has the 'quality' of intra-firm information flow (Casson, 2000). Thus the network approach also becomes a special case within the global system view, and its focal point should be expanded in the directions suggested above.

The strategy-structure school (e.g. Bartlett and Ghoshal, 1989; Sundaram and Black, 1992; Birkinshaw, 1997) highlights the importance of exploiting bilateral knowledge flows between various subsidiaries of the MNE, and is also conscious about cost considerations in determining the location of such subsidiaries. Yet this school confines its point of view to intra-firm information and product flows while neglecting the firm's ability to leverage itself by using external operations and flows. Hence this school captures another fraction of the global system view and should also be expanded.

Evidently, each of the above-mentioned international business theories is focused on different sections of the global system view.

Alternative modifications of the model

The key exogenous variables in our model are the comparative costs of R&D and production in various countries and the comparative costs of local versus international as well as internal versus external product and information flows. Obviously some of the assumptions regarding the comparative magnitude of these exogenous variables are not applicable for all cases. Nevertheless, modifications of the proposed model enable it to be applied with different assumptions as well. One modification that comes to mind is to allow a more complex system that contains multiple countries of the above nature (i.e. several large markets, several small developed countries and several developing countries). These countries may differ in the distance between each other as well as in their ability to exploit EOS. This, of course, complicates the decision-making, as the number of alternative configurations increases dramatically. Incorporating operations research analysis tools makes this 'combinatorial explosion' problem manageable. If we think of the global system as a 'plant' with internal flows between 'production stages', basic operations research tools of analysis such as linear programming may be suitable to solve complex location and control problems of cost minimisation. Another possible modification to the model is to allow multiple stages of production, instead of relating to production as a 'black box'. Some simple changes in the basic model structure and a few more adaptations can enable a systematic analysis of the location and control configuration in this case as well.

Finally, it is noteworthy that the global system view is static in its nature, where a stable equilibrium emerges under specific cost considerations. The frequent changes in costs of transportation and communication indicate that the costs of information and product flows are also likely to change over time. This of course will result in changes in the locational and organisational boundaries of a given global system. Future research may aim to introduce dynamics into the global system view in order to predict more systematically how changes in various exogenous variables affect the boundaries of firms.

Testing the model

The above modifications outline a promising way to start to validate and test the model empirically.

Interestingly, Casson's (1990, 1995, 2000) original work on the global system view of the firm has not been empirically tested. We believe this is partly because of the combinatorial complexity associated with the global system view and partly because of the fact that in its original formulation the global system view seemed to many scholars to be too theoretical to be applied to real-life circumstances. Thus the current version of the global system view, which introduces the impact of various product attributes, may be the best way to start and validate the theory.

Various hypotheses may be derived from our model regarding the impact of our exogenous variables on location and control configurations in sectors with different product attributes. Based on an adequate linear programming model, which takes the costs of value-adding activities and flows in specific product sectors and locations as input, we may be able to compare the predictions of a synthesised model with reality, and use various sensitivity analyses to compare the results of the model with historical changes in firms' boundaries and – more importantly – to predict the impact that changes in such costs would have on the structure of the global system. This may require changing some of the assumptions of our model to better fit data on specific countries and product sectors, but the general methodology of solving the global system's configurations will essentially remain the same.

It seems quite straightforward to determine costs of various value-adding activities and product flows (through firms' financial reports or by interviewing senior managers). It is more problematic, however, to define information flow costs. Nevertheless, direct measurement of internal and external information flows' cost has been exercised before (e.g. Van den Bulte and Moenaert, 1998). Finally, the global system view and its predictions for different product sectors should be confronted with an analysis of the forces that affect the decisions of firms to expand geographically and organisationally. Sector-specific interviews with firm managers and venture capital funds, and a longitudinal analysis of the links between firm's shares performance and their declared geographic and organisational expansion strategies, may well yield vital information on the role of the markers for capital and managers on the internationalisation of firms.

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