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SYMPOSIUM

Power in the multinational corporation in industry equilibrium

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Abstract Recent theories of the multinational corporation introduce the property rights model of the firm and examine whether to integrate or outsource firm activities locally or to a foreign country. This paper focuses instead on the internal organization of the multinational corporation by examining the power allocation between headquarters and subsidiaries. We provide a framework to analyse the interaction between the decision to serve the local market by exporting or FDI, market access and the optimal mode of organization of the multinational corporation. We find that subsidiary managers are given decision power to run the firm at intermediate levels of host country competition. We then provide comparative statics on the optimal organization of the multinational corporation for changes in fixed FDI entry costs, trade costs, as well as changes in information technology.

Keywords Multinationals · Power · Incentives · Industry equilibrium

JEL Classification F12 · F23 · D23

1 Introduction

Recent theories of the multinational corporation open up the black box of the firm by incorporating theories of the firm in models of the multinational corporation. Antras (2003) and Antras and Helpman (2004) introduce the property rights model of the firm (Grossman and Hart 1986; Hart and Moore 1990) into a model of the multinational

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corporation. They examine questions of the boundaries of the multinational firm by analysing the decision whether to integrate or outsource firm activities locally or to a foreign country. This paper focuses instead on the internal organization of the multinational corporation. We introduce a variant of the Aghion and Tirole (AT) (1997) model of the firm into a monopolistic competition model of the multinational corporation. We provide a framework to analyse the interaction between delegating power to the manager in the foreign subsidiary, market access, and the decision whether to enter a foreign market via exporting or foreign direct investment (FDI).

The paper is related to previous work on the international organization of firms. Antras et al. (2006) and Grossman and Rossi-Hansberg (2006) focus also on the internal organization of the multinational corporation by examining the formation of international teams. Puga and Trefler (2005) uses also the Aghion and Tirole model to investigate whether to involve a local agent in incremental innovation in the South. Ottaviano and Turrini (2007) introduces incomplete outsourcing contracts in a standard choice between multinational activity and exporting. Marin (2006) and Nunn and Trefler (2008) expose the choice of the boundary of the multinational corporation to the data.

In previous work we have investigated how international trade affects the internal organization of national firms. In Marin and Verdier (2006, 2007) we introduce a variant of the Aghion and Tirole model into a Krugman (1980) cum Melitz and Ottaviano (2005) model of international trade to examine how international competition is affecting internal hierarchies of firms in similar countries (North-North trade). In Marin and Verdier (2003a,b) we incorporate AT in a Helpman and Krugman (1985) model of trade to analyse how international trade between countries which differ in factor endowments (North-South trade) is affecting the allocation of power inside firms. In Marin and Verdier (2008) we analyse how corporate organization is affecting firm performance and the nature of competition in international markets.

The paper is organized in the following sections. In Sect. 2, we consider the allocation of decision power inside a multinational firm between its headquarters and subsidiary management in the foreign country. We determine the multinational firm's optimal mode of organization in response to exogenous changes in the market environment in which the multinational subsidiary eventually operates. Section 3 brings this theory of allocation of power in the multinational corporation into a simple monopolistic industrial equilibrium model in which firms can serve a foreign market through exports or foreign direct investment. We characterize the equilibrium number of multinational subsidiaries serving that market and their equilibrium hierarchical organization. Section 4 then examines how changes in trade costs, fixed costs of FDI and information technologies affect the equilibrium mode of organization of FDI. In Sect. 5, we finally conclude.

2 Allocation of power in the multinational firm

We first start with a simple partial equilibrium model of the choice of firm organization of a multinational serving a foreign market through a subsidiary. This building block will be useful later when we analyze the interaction between the power dynamics

of FDI and the market structure in an industry equilibrium model of monopolistic competition.

We consider a multinational firm contemplating to invest in a foreign market. Production within a subsidiary means running a production project in the host economy. Following Aghion and Tirole (1997), we consider that the multinational has the simplest hierarchical structure consisting of the headquarters (the principal P) located in the country of residence of the multinational, a subsidiary manager (the agent A) hired to implement the production project in the subsidiary in the foreign country, and local labor to run the production plan. There are m potential and a priori identical projects (or ways to produce the good). Payoffs are ex ante unknown to both parties, headquarters and local management. Among the m projects, there are only two viable projects. Both leads to positive recurrent profits B for the firm. One of them though gives to the local manager the possibility to divert part of the firm's profits to himself. More precisely, when the first project is implemented, the firm's benefit is the entire profit B. On the other hand, when the second project is implemented the agent may divert a fraction λB of the benefits. The firm therefore gets only $B(1-\lambda)$ with $0 < \lambda < 1$. Out of the diverted part λB though, the agent receives an amount $\lambda\beta B$ with $0 < \beta < 1$. Hence parts of the transferred profits are assumed to be dissipated during the diversion process, implying an inefficiency cost of implementing this second type of project.

The values of B, λ and β are supposed to be known ex ante though the parties do not know ex ante which project yields such payoff. We assume also that, among the m projects, there are some with very high negative payoffs to both parties, implying that choosing randomly a project without being informed is not profitable to both agents who instead prefer to do nothing (project 0). This aspect, together with the fact that each uninformed party prefers to rubber-stamp the other informed's party suggestion to do nothing, implies that private information about payoffs gives decision control to the informed party. In this case, the informed party has "real authority" rather than "formal authority".

Parties may acquire information on the payoff structure in the following way. By paying an investment cost f, the headquarters of the multinational has access to a centralized information gathering technology which allows him to learn with a given probability E the payoff structure of all projects. It remains uninformed otherwise. Similarly, by dedicating some time effort inside the subsidiary, local management can acquire information on the payoff structure of all projects. More precisely, out of 1 unit of skilled labor time, the manager may dedicate a fraction $h \in [0, 1]$ of his time to work for the firm and the rest $1 - h$ to work outside at a wage rate q. In that case, he learns with probability

$$e(h) = \overline{e}h, \quad \text{with } 0 < \overline{e} < 1. \tag{1}$$

the structure of projects and remains uninformed with probability $1 - e(h)$.

In order to focus on the role of allocation of power in multinational firms, we assume that it is not possible to contract on profit levels B nor on the amount of effort h the manager devotes to produce useful information to the firm. Moreover, both the firm and the agent are risk neutral with respect to income. Given our incomplete contractability assumptions, the multinational cannot incentivize the local manager

with monetary rewards. After observing his opportunity cost to work elsewhere, the agent's incentives to gather information on projects will have to come from the power he gets on projects' decisions and therefore on his capacity to choose and implement his "best" project inside the multinational's subsidiary.

Decisions are taken in the following sequence. After paying the investment cost f, the multinational (the principal) chooses the organization between no-delegation (i.e. a P-multinational form) or delegation to the subsidiary manager (i.e. a A-multinational form). Then the subsidiary manager (the agent) is hired at a wage $\widetilde{q}$. Then both headquarters and the subsidiary manager collect information about projects' payoffs. The party who does not have decision power suggests a project (or nothing) to the other party. Finally, the party with power rubber stamps the other party's suggestion or selects an alternative project, or decides to do nothing. Hence, the party with formal authority, whenever informed, picks her preferred project. When she remains uninformed ex post, that party rubber-stamps the suggestion of the other party who, whenever informed, has real authority over the project choice and gets his preferred project implemented. When neither party has information on the payoff structure, no project is undertaken by the firm.

Consider first the equilibrium informational effort of the two parties under the two types of organizations.

2.1 P-multinational firm

We start with the case in which the multinational's headquarters keep formal power (a P-multinational firm). The principal's and the agent's expected payoffs are then

$$\Pi_P = EB + (1-E)e(h)B(1-\lambda) - \widetilde{q} - f$$
$$u_P = (1-E)e(h)\beta\lambda B + q(1-h) + \widetilde{q}$$

With probability E, the multinational's top management (the principal) becomes fully informed about her payoffs and picks her preferred project with payoff B. With probability $1-E$, the multinational headquarters remain uninformed about payoffs. The subsidiary manager decides how to allocate her time h (whether to work for the firm or to shirk and work for himself). She learns with probability $e(h)$ the payoff structure. In that case, she suggests to the uninformed headquarters her best project (which is accepted). Owners/headquarters receive then the payoff $B(1-\lambda)$ while the subsidiary manager gets her diverted benefit $\beta\lambda B$.

The first order conditions for the subsidiary manager are

$$h_P^* = 1 \quad \text{and} \quad e = \overline{e} \quad \text{if } q < \beta\lambda\overline{e}B(1-E)$$
$$h_P^* = 0 \quad \text{and} \quad e = 0 \quad \text{if } q > \beta\lambda\overline{e}B(1-E)$$
$$h_P^* \in [0,1] \quad \text{and} \quad e \in [0,\overline{e}] \quad \text{if } q = \beta\lambda\overline{e}B(1-E)$$

The conditions highlight the trade-off between the headquarter's control and the subsidiary manager's initiative. The better the headquarter's information technology

(larger E), the lower the incentive for the subsidiary manager to spend efforts to gather information on implementable projects. Control thus comes with the cost of loosing the agent's initiative. In turn, the larger the profits $\beta\lambda B$ the subsidiary manager can divert from a project and the lower her time opportunity costs q, the larger the effort of the local manager to gather information for the firm.

Given that the agent's reservation income is his opportunity cost of labor q, $\widetilde{q}$ should be fixed such that $u_P = q$. The firm's equilibrium payoff under a P organization is then given by:

$$\Pi_P^* = EB + (1-E)e(h_P^*)B(1-\lambda) + (1-E)e(h_P^*)\beta\lambda B - qh_P^* - f$$

or more explicitely, posing $K = 1-\lambda(1-\beta)$ and

$$B_P(E) = \frac{1}{\beta\lambda\overline{e}(1-E)}$$

$$\begin{aligned}\Pi_P^* &= EB + (1-E)\overline{e}BK - q - f \quad \text{if } B_P(E) < B/q \\ &= EB - f \quad \text{if } B_P(E) > B/q \\ &= EB + [(1-E)B\overline{e}K - q]\,h_P^* - f \quad \text{with } h_P^* \in [0,1] \text{ if } B_P(E) = B/q \end{aligned} \tag{2}$$

2.2 A-multinational firm

Consider now the case where the multinational has delegated decision control to the subsidiary manager and thus the agent has formal authority. Now, headquarters are prevented from overruling the agent's decision when both have acquired information. The two parties' expected payoffs are then

$$\begin{aligned}\Pi_A &= e(h)B(1-\lambda) + (1-e(h))EB - f - \widetilde{q} \\ u_A &= e(h)\beta\lambda B + q(1-h) + \widetilde{q}\end{aligned}$$

Now the agent chooses his preferred project when informed. When the principal is informed and the agent is uninformed, the principal suggests her preferred project, which is then implemented by the agent.

The analysis is similar to the one of the P-multinational. We get the following characterization of the equilibrium effort level of the local manager:

$$\begin{aligned}&h_A^* = 1 \quad \text{and} \quad e = \overline{e} \quad \text{if } q < \beta\lambda\overline{e}B \\ &h_A^* = 0 \quad \text{and} \quad e = 0 \quad \text{if } q > \beta\lambda\overline{e}B \\ &h_A^* \in [0,1] \quad \text{and} \quad e \in [0,\overline{e}] \quad \text{if } q = \beta\lambda\overline{e}B\end{aligned}$$

Again, given that the agent's reservation income is his opportunity cost of labor q, $\widetilde{q}$ should be fixed such that $u_A = q$ and the firm's equilibrium payoff under an A organization is immediately given by:

$$\begin{aligned}\Pi_A^* &= EB + (K-E)\bar{e}B - q - f \quad \text{if } B_A < B/q \\ &= EB - f \quad \text{if } B_A > B/q \\ &= EB + [(K-E)B\bar{e} - q]\,h_A^* - f \quad \text{with } h_A^* \in [0,1] \text{ if } B_A = B/q \end{aligned} \tag{3}$$

with

$$B_A = \frac{1}{\beta\lambda\bar{e}}$$

defining the profit threshold below which the local manager does not put any effort in the firm.

As $\frac{1}{\beta\lambda} < \frac{1}{\beta\lambda(1-E)}$, then $B_A < B_P(E)$ and $h_A^* \geq h_p^*$. The agent A's initiative is triggered at a lower profit level B/q under the A-organization than under the P-organization. The reason is that under the A-firm the agent has formal authority and therefore has better effort incentives than when the principal has formal authority. Hence, it requires a smaller stake to motivate the agent to undertake initiative under the A-firm than under the P-firm. Consequently, the threshold level of profits of the principal at which the agent's effort is stimulated is lower under the A-firm as compared to the P-firm.

Note finally that the multinational's payoff is the same under the two organizations when the agent does not provide any effort level (i.e. when $h = 0$). In that case the multinational's organization is equivalent to a subsidiary with a dummy local manager. Hence, we define this as a multinational O-organization (or a O-multinational form).

2.3 Optimal multinational organization

The derivation of the optimal organizational form of the firm can be obtained by comparing (2) to (3) at different profit levels of the multinational. Three cases can then be distinguished.

Case 1: $B/q \leq B_A$ (*low profits*)

The utility levels of headquarters (the principal) under the two forms of organization are simply $\Pi_P^* = \Pi_A^* = EB - f = \Pi_O^*$

Given that $h_A^* = h_P^* = 0$, the equilibrium organization is an O-multinational. At this profit level there is no trade-off between headquarters' control and the subsidiary manager's initiative. When B/q is low, the subsidiary manager's stakes to engage in the firm are so low that even when power is delegated to her (i.e. in an A-multinational), the agent has no incentive to put any effort into the firm. Both organizations give rise to an O-multinational.

Case 2: $B_A < B/q \leq B_P(E)$ (*intermediate profits*)

At this profit level, the P-multinational kills the agent's effort and $h_P^* = 0$, while he exerts maximal effort $h_A^* = 1$ under the A-multinational. Thus, the multinational's expected payoffs under the two organizations are given respectively by:

$$\Pi_P^* = \Pi_O^* = EB - f \quad \text{and} \quad \Pi_A^* = EB + (K-E)\bar{e}B - q - f$$

In such a case, $\Pi_O^* < \Pi_A^*$ if and only if

$$\frac{B}{q} > \frac{1}{(K-E)\overline{e}}$$

$\frac{1}{(K-E)\overline{e}}$ is the critical profit level at which headquarters are indifferent between centralization without initiative (a O-multinational) and the delegated A-multinational with full initiative. Above the profit level B/q the principal prefers to delegate power to the subsidiary manager at the cost of loosing control inside the multinational corporation.

The preceding discussion can be summarized in a more compact way. Denote

$$\overline{B}(E) = \text{Max}\left[\frac{1}{\lambda\beta\overline{e}}; \frac{1}{(K-E)\overline{e}}\right]$$

Then at intermediate profits the optimal firm organization switches in the following way: (i) at $B/q < \overline{B}(E)$ the principal prefers the O-multinational with no agent's effort to the A-multinational. (ii) at $B/q > \overline{B}(E)$ the A-multinational dominates.

Case 3: $B_P(E) < B/q$ (*high profits*)

In this case we have to compare

$$\Pi_P^* = EB + (1-E)\overline{e}BK - q - f \quad \text{to } \Pi_A^* = EB + (K-E)\overline{e}B - q - f$$

As $(1-E)\overline{e}BK > (K-E)\overline{e}B$ as $K = 1-\lambda(1-\beta) < 1$ and therefore $\Pi_P^* > \Pi_A^*$ the headquarter prefers the P-multinational organization. At this profit level there is again no trade-off between control and initiative. Both types of organizations P and A stimulate fully the agent's initiatives. Profits are so large that even when the agent has no power in the subsidiary his payoff is sufficiently large to empower his initiative. As the P-multinational gives control to the heaquarters, it is preferred by the multinational firm.

We summarize the preceding discussion in Proposition 2.1, stating the optimal organization of the multinational firm as a function of the multinational 's recurrent payoff B.

Proposition 1 *Let* $E_{\max} = (1-\lambda)/(1-\lambda\beta)$.

(i) *When* $E \geq E_{\max}$, *the delegated A-multinational is never optimal. For* $B/q < B_P(E)$ *the equilibrium organization is the O-multinational organization. For* $B/q > B_P(E)$, *the equilibrium organization is the P-multinational with full initiative* (*i.e. with* $h_P^* = 1$). *If* $B/q = B_P(E)$, *then the optimal organization is a P-multinational with some interior initiative* $h_P^* \in [0,1]$.

(ii) *When* $E \in]1-\lambda, E_{\max}[$, *the following organizational pattern emerges. (iia) For* $B/q < \overline{B}(E)$, *the equilibrium organization is the O-multinational. (iib) For* $B/q = \overline{B}(E)$, *the equilibrium organization is the O-multinational or the A-multinational with full initiative* $h_A^* = 1$. *(iic) For* $\overline{B}(E) < B/q < B_P(E)$, *the equilibrium organization is the A-multinational with full initiative* $h_A^* = 1$. *(iid) For* $B_P(E) = B/q$, *the equilibrium organization is the P-multinational*

with some interior initiative $h_P^* \in \left[\underline{h}_P, 1\right]$. *(iie) For* $B_P(E) < B/q$, *the equilibrium organization is the P-multinational with full initiative* $h_P^* = 1$.

(iii) *When* $E \leq 1 - \lambda$, *the following organizations are optimal. (iiia) For* $B/q < \overline{B}(E)$, *the equilibrium organization is the O-multinational. (iiib) For* $B/q = \overline{B}(E)$, *the equilibrium organization is an A-multinational with some interior initiative* $h_A^* \in [0, 1]$. *(iiic) For* $\overline{B}(E) < B/q < B_P(E)$, *the equilibrium organization is the A-multinational with full initiative* $h_A^* = 1$. *(iiid) For* $B_P(E) = B/q$, *the equilibrium organization is the P-multinational.with some interior initiative* $h_P^* \in \left[\underline{h}_P, 1\right]$. *(iiie) For* $B_P(E) < B/q$, *the equilibrium organization is the P-multinational with full initiative* $h_P^* = 1$.

The proposition is illustrated in Fig. 1a, b, and c plotting the shape of the principal's profit function as a function of B/q. The three curves $\Pi_O(B/q) = EB/q$; $\Pi_A(B/q) = EB/q + (K-E)\overline{e}B/q - 1$ and $\Pi_E(B/q) = EB/q + (1-E)\overline{e}KB/q - 1$ are depicted.

The three cases are illustrated in Fig. 1a, b, and c. The first case (i.e. Fig. 1a) corresponds to $B_P(E) < 1/(K-E)\overline{e}$ or equivalently $E \geq E_{\max}$. The profit function under the O-multinational organization $\Pi_O(B/q)$ crosses the profit function of the A-multinational organization $\Pi_A(B/q)$ at some point above $B_P(E)$. In that case, the A multinational is always dominated and we have the situation depicted by (i). Note that at $B/q = B_P(E)$, there is a upward jump of the profit function from $\Pi_O(B/q)$ to $\Pi_E(B/q)$. As the agent is indifferent at this point between doing nothing or investing in the organization, the vertical part then corresponds to interior values of initiatives of the agent $h_P^* \in \left[\underline{h}_P, 1\right]$ and is described by the segment PM in Fig. 1a.

The second case is represented in Fig. 1b and corresponds to $1/\lambda\beta\overline{e} < 1/(K-E)\overline{e} < B_P(E)$ with $\overline{B}(E) = 1/(K-E)\overline{e}$. This happens when $E \in]1-\lambda, E_{\max}[$. In such a case $\Pi_O(B/q)$ crosses $\Pi_A(B/q)$ at point $\overline{B}(E)$ and we have the situation depicted by ii). Note again that at $B_P(E) = B/q$, there is an upward discontinuous jump as the profit function under the P-multinational with full initiative with $\Pi_P(B/q)$ is above the profit function of the A-multinational with full initiative $\Pi_A(B/q)$. Now at $B_P(E) = B/q$, making the agent initiative h_P^* varying from 0 to 1, one can see that the profit level under the P-multinational moves from $\Pi_O(B_P(E)) < \Pi_A(B_P(E))$ (i.e. point X) to $\Pi_P(B_P(E)) > \Pi_A(B_P(E))$ (i.e. point Y). Thus, by continuity, there is a unique value $\underline{h}_P$ such that for $h_P^* \in \left[\underline{h}_P, 1\right]$, $EB/q + [(1-E)\overline{e}KB/q - 1]h_P^* > \Pi_A(B_P(E))$. Hence, a P-multinational with any partial initiative $h_P^* \in \left[\underline{h}_P, 1\right]$ will dominate the A-multinational with full initiative as can be seen from the segment PM in Fig. 1b.

Finally the last case is depicted in Fig. 1c where $1/(K-E)\overline{e} < 1/\lambda\beta\overline{e} < B_P(E)$. It corresponds to the situation $E \leq 1 - \lambda$ and $\overline{B}(E) = 1/\lambda\beta\overline{e}$. Now there is also an upward jump at point $B/q = \overline{B}(E)$, as the $\Pi_O(B/q)$ curve crosses $\Pi_A(B/q)$ at $1/(K-E)\overline{e} < 1/\lambda\beta\overline{e} = \overline{B}(E)$. Applying the same reasoning as before the vertical part at that point $B/q = \overline{B}(E)$ corresponds to a optimal A-multinational with partial agent's initiative $h_A^* \in [0, 1]$. (i.e. region AM in Fig. 1c).

We can also illustrate Proposition 1 in Fig. 2 in the plane $(B/q, E)$ of real profits in terms of managerial labor and the technology of information of the multinational headquarters. The curve B_P shows the threshold $B_P(E)$ below which the agent's

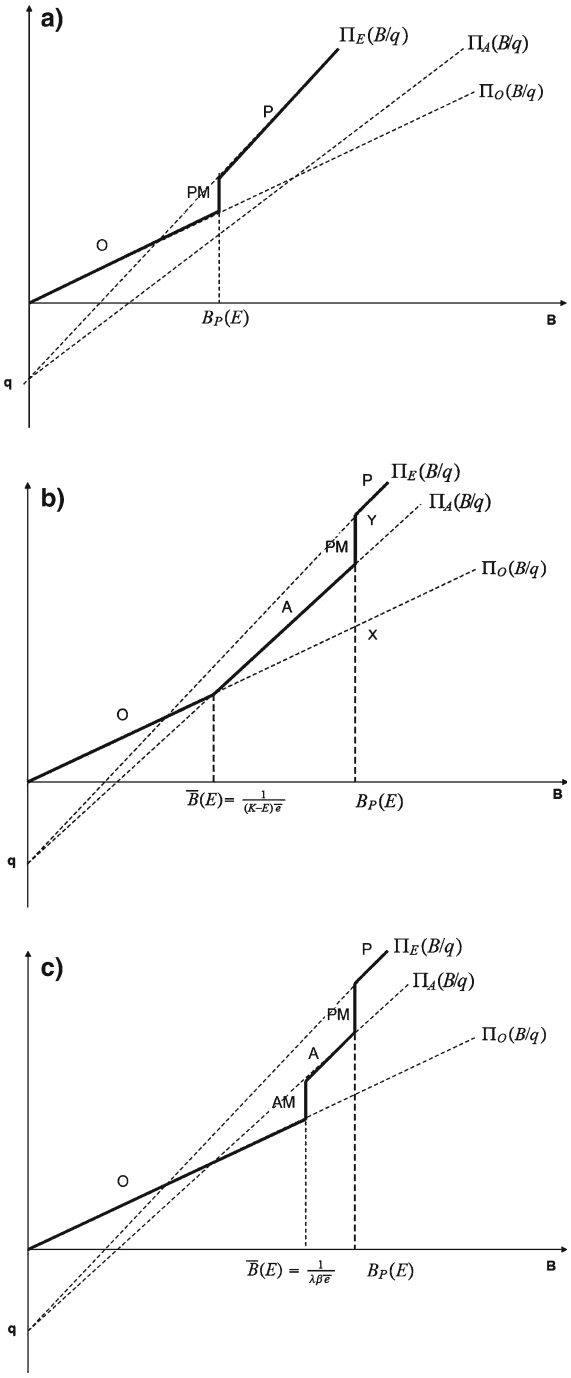

Fig. 1 **a** Optimal organization (no delegation). **b** Optimal organization with delegation. **c** Optimal organization with delegation

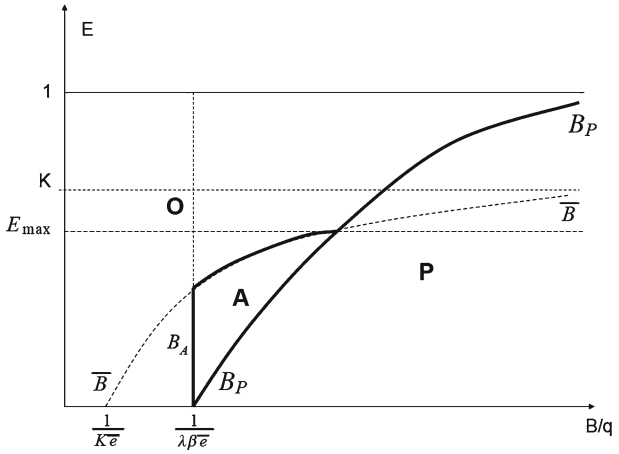

Fig. 2 Optimal organization

initiative inside a P-multinational organization is crowded out. It is an upward sloping curve as more information E, and therefore control by the headquarters, reduces the incentives of the agents to take intiative. The curve $\overline{B}$ reflects as well the function $\overline{B}(E)$. It is consists of a vertical part B_A and an upward sloping part $\overline{BB}$. The vertical part corresponds to the threshold of profits above which the agent starts to take initiative in the delegated structure (i.e. $B/q = 1/\lambda\beta\overline{e}$). The part $\overline{BB}$ defines the threshold value of profits at which the principal is indifferent between stimulating initiative inside the A-multinational and losing decision control in the O-multinational (i.e. $B/q = 1/(K - E)\overline{e}$). An increase in E tends to favor control at the expense of initiatives. In order to leave the principal indifferent between the two organizations, the agent's stakes (which are proportional to the firm's profit) have to increase to establish the balance between control and initiatives. Hence, the positive slope of $\overline{B}(E)$. The $\overline{BB}$ curve crosses B_P at point $E_{\max} < 1$. The different equilibrium organizations of the multinational firm are illustrated in Fig. 2.

When the information technology of the multinational headquarters is very efficient (i.e. $E \geq E_{\max}$), decision power is never delegated to subsidiary management. Under centralized control, the hierarchical P-multinational will matter only as long as the agent has enough stakes (i.e. B/q above the B_P curve) to undertake initiative inside that structure. Otherwise an O-multinational will prevail without subsidiary management initiative.

When headquarters do not have access to good quality information (i.e. $E < E_{\max}$), then delegation can prove to be optimal, though this will imply diversion of rents by subsidiary management. In that case, the multinational's organization matters for incentives inside the firm at intermediate levels of profits only. At low and high profit levels there is no trade-off between control and initiative. At low profit levels (i.e. for B/q below the $\overline{B}$curve), the subsidiary manager can divert only little and she cares little. Therefore, there is no agent's initiative in any organizational form and the O-multinational emerges naturally. At high profit levels (i.e. B/q above the B_P curve),

diverted profits for the subsidiary manager are sufficiently large that she undertakes effort even under the centralized P-multinational leading to maximum effort by the agent in both types of organizations (A and P). Since P has more control under the P-firm compared to the A-firm, the principal prefers the P-firm. At intermediate levels of profits there is a trade-off between control and initiative. When the profit level B keeps increasing in that intermediate range, the gain emanating from the agent initiative overcomes the loss of control of the principal and the delegated A-multinational is the optimal organization (i.e. in the region for B/q in between above the $\overline{B}$ curve and the B_P curve).

In the sequel, we will limit ourselves to the case where:

$$\text{Assumption A1: } E \in]1-\lambda, E_{\max} = (1-\lambda)/(1-\lambda\beta)[$$

that is the case described by (ii) in Proposition 1. At intermediate efficiency of the information technology of the multinational's headquarters delegation of power to the subsidiary manager (the A-multinational) with full initiative can emerge.

3 Industry equilibrium

In this section, we endogenize the multinational's profit B as well as the decision to access a local market by FDI or by exports, for a given international market structure of the industry. This will allow us to analyze the interaction between the organization of multinational firms, exports, trade frictions and market competition. In order to do this, we embed our model of power inside the firm of the previous section in an equilibrium framework with monopolistic competition. We consider a particular local market characterized by L consumers whose preferences are defined over a continuum of differentiated varieties indexed by $i \in [0, N]$ and an homogenous good 0 chosen as the numeraire.

$$U = x_0 + \left[\int_0^N x(i)^{\frac{\sigma-1}{\sigma}} \mathrm{d}i\right]^{\frac{\sigma}{\sigma-1}}$$

The numeraire good 0 is produced with constant returns to scale (one unit of good 0 requires one unit of unskilled labor) and under perfect competitive conditions. The unskilled labor wage w is therefore pinned down to 1. Each variety of the differentiated good is produced under monopolistically competitive conditions. There are two types of firms potentially operating in the sector: local firms n and foreign firms n^*. Foreign firms can access the local market either by exporting or opening a subsidiary (FDI). Local firms and (eventually) subsidiaries of foreign multinationals can produce a given variety i with constant marginal cost c, while exporters produce at the constant marginal cost c^* and are subjects to iceberg trade costs $\tau > 1$.

Exporting and FDI are assumed to have different informational requirements. We assume that exporters do not need to invest in information to get access to the foreign

country. They can use their available blueprint with marginal costs $c^*$and are, however, faced with trade friction τ when supplying the foreign country.

When opening a subsidiary in the foreign county, firms need to acquire information on how to implement local production. More precisely, the firm has to undertake a profitable production project which is a way to run the firm's production with a constant marginal cost technology. We embed then our previous model of power inside the firm by assuming that there are ex ante m alternative ways to produce the good. Thus, before starting to produce the firm needs to get informed about the cost parameters of the various local ways of producing. By paying a fixed cost f, headquarters have access to an information technology which discovers with probability E all local production projects' payoffs. The firm may also hire a local skilled agent (subsidiary manager) who can spend some time effort $h \in [0, 1]$ to get the relevant information with probability $e(h)$ as described in (1). As before we assume that out of all the possibilities, only two projects are worth doing from the point of view of the two parties. These two projects implement production with the local marginal production cost c. As before though, one of the projects gives to the local manager the possibility to divert part of the income for himself. More precisely, under that project, if the firm's entire recurrent benefit is B,the agent may divert a fraction of the benefits λB, and receives actually the smaller amount $\lambda\beta B$ with $0 < \beta < 1$. When no information is revealed, the firm does not open a subsidiary in the foreign market.

3.1 Monopolistic competition and product market

Given Dixit–Stiglitz (1977) preferences, the demand of each firm i is of the form

$$x(i) = \frac{L}{\int_0^N p(j)^{1-\sigma}\,\mathrm{d}j}\, p(i)^{-\sigma} \tag{4}$$

where $p(i)$ is the price of good i and N the total number of firms operating in the market

For a product with marginal cost of production $c(i)$, monopolistic profit maximization provides the standard mark-up relationship

$$p(i) = \frac{\sigma}{\sigma - 1} c(i) \tag{5}$$

and recurrent profit levels can be written as

$$\pi(i) = \frac{L}{\int_0^n p(j)^{1-\sigma}\,\mathrm{d}j} \left(\frac{\sigma}{\sigma - 1}\right)^{1-\sigma} \frac{[c(i)]^{1-\sigma}}{\sigma}$$

Given the symmetry of the problem, recurrent profits of a local firm and a multinational subsidiary are simply written as

$$\pi_I = \frac{L}{\sigma} \frac{c^{1-\sigma}}{(n + n_I)\, c^{1-\sigma} + n_X\, (c^*\tau)^{1-\sigma}}$$

while profits from exporting are

$$\pi_X = \frac{L}{\sigma} \frac{(c^*\tau)^{1-\sigma}}{(n+n_I)\,c^{1-\sigma} + n_X\,(c^*\tau)^{1-\sigma}}$$

where n_I is the number of subsidiaries and n_X is the number of exporters to the foreign country. Using the usual "freeness" of trade index $\varphi = (c/c^*\tau)^{\sigma-1}$ which is decreasing with trade friction τ and assumed to be less than 1 (i.e. $c \leq c^*$), we get the following profits

$$\pi_I = \frac{L}{\sigma} \frac{1}{n+n_I+n_X\varphi} \quad \text{and} \quad \pi_X = \frac{L}{\sigma} \frac{\varphi}{n+n_I+n_X\varphi}$$

Taking this into account we can rewrite the principal's profit when her or the agent's best project is implemented, respectively, as in the firm equilibrium framework of Sect. 2 with the profit level of the principal $B = \pi_I$.

3.2 Multinational equilibrium and the choice between exports and FDI

We characterize now the nature of the multinational equilibrium and the choice between serving the local market through exports or through the establishment of a foreign subsidiary. Generally, FDI will be preferred if and only if

$$\pi_X \leq W_I - f$$

where W_I is the optimal expected recurrent profit of a foreign subsidiary and f is the set-up cost of that subsidiary. Depending on the optimal allocation of power inside a multinational firm, different equilibrium regimes are possible. To analyze them we introduce some notations. Denote $v_O(E) = E$; $v_A(E) = E + (K - E)\overline{e}$ and $v_P(E) = E + (1-E)\overline{e}K$ and $Q_O(E) = E$; $Q_P(E) = Q_A(E) = E + (1-E)\overline{e}$, and $Q(E,h) = E + (1-E)\overline{e}h$ for $h \in [0,1]$.

(i) *P*-multinational equilibrium with full initiative
In that case,

$$W_I = v_P(E)\pi_I - q$$

Noting that $\pi_X = \varphi\pi_I$, the conditions for the emergence of multinationals with a P-organization in foreign country are

$$\frac{L}{\sigma} \frac{\varphi}{n+n_I+n_X\varphi} = \frac{L}{\sigma} \frac{v_P(E)}{n+n_I+n_X\varphi} - q - f \gtrsim 0$$

and

$$B = \frac{L}{\sigma} \frac{1}{n+n_I+n_X\varphi} > q\,B_P(E)$$

This can be rewritten as

$$\frac{L}{\sigma}\frac{v_P(E)-\varphi}{n+n_I+n_X\varphi}-q=f \quad \text{and} \quad n_I\geq 0$$

Denote n_I^0 the number of firms choosing to access the local market through FDI. Then, only a fraction $Q_P(E)$ will successfully implement a production project. Therefore, using the law of large numbers, we have the relationship

$$n_X+n_I^0=n^* \quad \text{and} \quad n_I=n_I^0 Q_P(E)$$

which provides the following conditions for this FDI regime

$$\frac{L}{\sigma}\frac{v_P(E)-\varphi}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E)})}-q=f \quad \text{and} \quad n_I\geq 0 \tag{6}$$

and

$$\frac{L}{\sigma}\frac{1}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E)})}>qB_P(E) \tag{7}$$

Rearranging (6) determines the equilibrium number of multinational P-firms

$$n_I^P=\frac{1}{1-\frac{\varphi}{Q_P(E)}}\left[\frac{v_P(E)-\varphi}{\left[1+\frac{f}{q}\right]}\frac{L}{\sigma q}-\left(n+n^*\varphi\right)\right]$$

Condition (7) is given as

$$\frac{1+f/q}{B_P(E)}>v_P(E)-\varphi \tag{8}$$

Also the condition for the emergence of multinationals with a P-organization is given as

$$n_I\geq 0\Leftrightarrow\varphi\leq\varphi_0^P\left(\frac{f}{q},E,n,n^*,L\right)=\frac{\frac{L}{\sigma q}v_P(E)-\left[1+\frac{f}{q}\right]n}{\frac{L}{\sigma q}+\left[1+\frac{f}{q}\right]n^*}<Q_P(E) \tag{9}$$

while condition (8) becomes

$$\varphi>\widetilde{\varphi}_P\left(E,\frac{f}{q}\right)=v_P(E)-\frac{\left[1+\frac{f}{q}\right]}{B_P(E)} \tag{10}$$

It is simple to see that the curve $\varphi_0^P(\frac{f}{q},E,n,n^*,L)$ is decreasing in f/q. The curve $\widetilde{\varphi}_P(E,\frac{f}{q})$ is linear decreasing in f/q as well and $\varphi_0^P(-1,E,n,n^*,L)=\widetilde{\varphi}_P(E,-1)$.

Therefore, a necessary and sufficient condition for the existence of such a regime is that there exists some φ and $\frac{f}{q} > 0$ such that

$$\widetilde{\varphi}_P\left(E, \frac{f}{q}\right) < \varphi < \varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right)$$

This condition defines a non empty set of values of φ when the horizontal intercept at the origin of the function $\varphi_0^P(\frac{f}{q}, E, n, n^*, L)$ (i.e. $\frac{L}{\sigma q n} v_P(E) - 1$) is larger than the horizontal intercept at the origin of the function $\widetilde{\varphi}_P(E, \frac{f}{q})$ (i.e. $v_P(E) B_P(E) - 1$) or the condition:[1]

$$n < \frac{L}{\sigma q B_P(E)}$$

We may then summarize the preceding discussion in the following proposition:

Proposition 2 (i) *When* $n < \frac{L}{\sigma q B_P(E)}$, *there exists a P-multinational equilibrium with full initiative if and only if*

$$\widetilde{\varphi}_P\left(E, \frac{f}{q}\right) < \varphi < \varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right)$$

and the equilibrium number of subsidiaries is given by

$$n_I^P = \frac{1}{1 - \frac{\varphi}{Q_P(E)}} \left[\frac{v_P(E) - \varphi}{\left[1 + \frac{f}{q}\right]} \frac{L}{\sigma q} - \left(n + n^* \varphi\right) \right] > 0 \tag{11}$$

(ii) *When* $n > \frac{L}{\sigma q B_P(E)}$, *there does not exist a P-multinational equilibrium with full initiative.*

(ii) *P*-multinational equilibrium with partial initiative $h_P^* \in [\underline{h}_P, 1[$.
In this regime, we have:

$$\frac{L}{\sigma} \frac{1}{n + n^* \varphi + n_I (1 - \frac{\varphi}{Q_P(E,h)})} = q B_P(E) \tag{12}$$

Denoting $v_P(E, h) = E + (1 - E) \bar{e} h K$ for $h \in [0, 1]$, the arbitrage condition between exports and FDI is given by

$$\frac{L}{\sigma} \frac{\varphi}{n + n^* \varphi + n_I (1 - \frac{\varphi}{Q_P(E,h)})} = \frac{L}{\sigma} \frac{v_P(E, h)}{n + n^* \varphi + n_I (1 - \frac{\varphi}{Q_P(E,h)})} - qh - f \tag{13}$$

[1] Given the convexity of the function $\varphi_0^P(\frac{f}{q}, E, n, n^*, L)$ in f/q, it is also easy to see that when $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E)$, then $\varphi_0^P(\frac{f}{q}, E, n, n^*, L) > \widetilde{\varphi}_P(E, \frac{f}{q})$ for all $\frac{f}{q}$.

The P-multinational firm with interior initiative dominates the A-multinational firm with full initiative. This translates into the following condition:

$$\frac{L}{\sigma}\frac{v_P(E,h)}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}-qh\geq\frac{L}{\sigma}\frac{v_A(E)}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}-q \quad (14)$$

The first two conditions (12) and (13) give the equilibrium value of h_P

$$B_P(E)\left[v_P(E,h_P)-\varphi\right]-h_P=\frac{f}{q}$$

It is shown in the Appendix that a necessary and sufficient condition for the existence of such a regime with positive FDI is that

$$n<\frac{1}{B_P(E)}\frac{L}{\sigma q}$$

and that

$$\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)<\varphi<\text{Min}\left[\widetilde{\varphi}_m^0(E);\widetilde{\varphi}_P\left(E,\frac{f}{q}\right)\right]$$

where

$$\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)=v_A(E)-\left[1+\frac{f}{q}\right]\frac{1}{B_P(E)}\quad\text{and}\quad\widetilde{\varphi}_m^0(E)=\frac{\frac{1}{B_P(E)}\frac{L}{\sigma q}-n}{n^*}$$

Moreover the equilibrium number of multinationals in that regime is then given by

$$n_I^m=\frac{1}{1-\frac{\varphi}{Q_P(E,h_P)}}\left[\frac{1}{B_P(E)}\frac{L}{\sigma q}-\left(n+n^*\varphi\right)\right]$$

We get then the following proposition:

Proposition 3 (i) *When* $n<\frac{L}{\sigma q B_P(E)}$, *there exists a P-multinational equilibrium with partial initiative* $h_P<1$ *if and only if*

$$\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)<\varphi<\text{Min}\left[\widetilde{\varphi}_m^0(E);\widetilde{\varphi}_P\left(E,\frac{f}{q}\right)\right]$$

and the equilibrium number of subsidiaries is given by

$$n_I^m=\frac{1}{1-\frac{\varphi}{Q_P(E,h_P)}}\left[\frac{1}{B_P(E)}\frac{L}{\sigma q}-\left(n+n^*\varphi\right)\right]>0 \quad (15)$$

(ii) *When* $n>\frac{L}{\sigma q B_P(E)}$, *there does not exist a P-multinational equilibrium with partial initiative.*

(iii) *A*-multinational equilibrium with full initiative

The conditions for such a regime are

$$n_I = \frac{1}{1-\frac{\varphi}{Q_A(E)}}\left[\frac{\nu_A(E)-\varphi}{\left[1+\frac{f}{q}\right]}\frac{L}{\sigma q} - \left(n+n^*\varphi\right)\right] > 0$$

and

$$q\overline{B}(E) < \frac{L}{\sigma}\,\frac{1}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_A(E)})} < qB_P(E)$$

which can be rearranged as

$$\varphi < \widetilde{\varphi}_m\left(E,\frac{f}{q}\right) = \nu_A(E) - \left[1+\frac{f}{q}\right]\frac{1}{B_P(E)}$$

and

$$\varphi > \widetilde{\varphi}_A\left(E,\frac{f}{q}\right) = \nu_A(E) - \left[1+\frac{f}{q}\right]\frac{1}{\overline{B}(E)}$$

Finally, the condition for positive FDI in such a regime is

$$n_I \geq 0 \Leftrightarrow \varphi \leq \varphi_0^A\left(\frac{f}{q},E,n,n^*,L\right) = \frac{\frac{L}{\sigma q}\nu_A(E) - \left[1+\frac{f}{q}\right]n}{\frac{L}{\sigma q}+\left[1+\frac{f}{q}\right]n^*} < Q_A(E)$$

Hence, the necessary and sufficient conditions for the existence of such a regime are that for some φ and $\frac{f}{q} > 0$

$$\widetilde{\varphi}_A\left(E,\frac{f}{q}\right) < \varphi < \text{Min}\left[\varphi_0^A\left(\frac{f}{q},E,n,n^*,L\right),\ \widetilde{\varphi}_m\left(E,\frac{f}{q}\right)\right]$$

Again, this condition defines a non empty set of values of φ when the horizontal intercept at the origin of the function $\varphi_0^A(\frac{f}{q},E,n,n^*,L)$ (i.e. $\frac{L}{\sigma qn}\nu_A(E)-1$) is larger than the horizontal intercept at the origin of the function $\widetilde{\varphi}_A(E,\frac{f}{q})$ (i.e. $\nu_A(E)\overline{B}(E)-1$) or the condition:[2]

$$\nu_A(E)\overline{B}(E) < \frac{L}{\sigma qn}\nu_A(E)$$

[2] It can be easily shown as well that the value of φ at which eventually $\varphi_0^A(\frac{f}{q},E,n,n^*,L)$ is equal to $\widetilde{\varphi}_m(E,\frac{f}{q})$ is also $\widetilde{\varphi}_m^0(E)$ and that the value φ at which eventually $\varphi_0^A(\frac{f}{q},E,n,n^*,L)$ is equal to $\widetilde{\varphi}_A(E,\frac{f}{q})$ is $\widetilde{\varphi}_O(E) = \frac{\frac{1}{\overline{B}(E)}\frac{L}{\sigma q}-n}{n^*}$.

which gives

$$n < \frac{L}{\sigma q \overline{B}(E)}$$

Hence the proposition

Proposition 4 (i) *When* $n < \frac{L}{\sigma q \overline{B}(E)}$, *there exists an A-multinational equilibrium with full initiative if and only if*

$$\widetilde{\varphi}_A\left(E, \frac{f}{q}\right) < \varphi < \text{Min}\left[\varphi_0^A\left(\frac{f}{q}, E, n, n^*, L\right), \widetilde{\varphi}_m\left(E, \frac{f}{q}\right)\right]$$

and the equilibrium number of subsidiaries is given by:

$$n_I^A = \frac{1}{1 - \frac{\varphi}{Q_A(E)}}\left[\frac{\nu_A(E) - \varphi}{\left[1 + \frac{f}{q}\right]}\frac{L}{\sigma q} - \left(n + n^*\varphi\right)\right] > 0 \tag{16}$$

(ii) *When* $n > \frac{L}{\sigma q \overline{B}(E)}$, *there cannot exist an A-multinational equilibrium with full initiative.*

(iv) *O*-multinational equilibrium

Finally, the conditions for existence of this regime are

$$n_I = \frac{1}{1 - \frac{\varphi}{Q_O(E)}}\left[\frac{\nu_O(E) - \varphi}{f}\frac{L}{\sigma} - \left(n + n^*\varphi\right)\right] > 0 \tag{17}$$

with

$$\frac{L}{\sigma}\frac{1}{n + n^*\varphi + n_I\left(1 - \frac{\varphi}{Q_O(E)}\right)} < q\overline{B}(E) \tag{18}$$

Substituting and rearranging (17) gives then the following conditions on the "freeness" of trade for positive FDI

$$\varphi \leq \varphi_0^O(f, E, n, n^*, L) = \frac{\frac{L}{\sigma}\nu_O(E) - fn}{\frac{L}{\sigma} + fn^*}$$

while condition (18) can be rewritten as:

$$\varphi < \nu_O(E) - \frac{f}{q}\frac{1}{\overline{B}(E)} = \nu_A(E) - \left[1 + \frac{f}{q}\right]\frac{1}{\overline{B}(E)} = \widetilde{\varphi}_A\left(E, \frac{f}{q}\right)$$

Thus the necessary and sufficient condition for this regime is[3]

$$\varphi < \text{Min}\left[\widetilde{\varphi}_A\left(E, \frac{f}{q}\right), \varphi_0^O(f, E, n, n^*, L)\right]$$

Proposition 5 *There exists an O-multinational equilibrium with no delegation if and only if*

$$\varphi < \text{Min}\left[\widetilde{\varphi}_A\left(E, \frac{f}{q}\right), \varphi_0^O(f, E, n, n^*, L)\right]$$

and the equilibrium number of subsidiaries is given by

$$n_I^O = \frac{1}{1 - \frac{\varphi}{Q_O(E)}}\left[\frac{v_O(E) - \varphi}{f}\frac{L}{\sigma} - \left(n + n^*\varphi\right)\right] \tag{19}$$

The series of Propositions (2), (3), (4) and (5) are illustrated in Fig. 3a–d where the different regions have been drawn in the plane $(\varphi, f/q)$ of trade freeness φ and real fixed costs f/q. They reflect the importance of the relationship between local competition, local market size and the different possible regimes as a function of trade costs and fixed cost of FDI.

We consider four cases. Case 1: little competition in the host country (i.e. $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E)$)[4]; case 2: intermediate competition in the host country $\frac{L}{\sigma q B_P(E)} - n^* v_P(E) < n < \frac{L}{\sigma q B_P(E)}$ that allows for the existence of P-multinationals; case 3: intense competition in the host country $\frac{L}{\sigma q B_P(E)} < n < \frac{L}{\sigma q \overline{B}(E)}$; case 4: very intense competition in the host country $\frac{L}{\sigma q \overline{B}(E)} < n$.

In case 1 all regimes are possible and the profitability constraint of access to the local market through FDI is never binding for the A and the O regimes (i.e. the constraint that $n_I > 0$ is only separating the P-multinational firm and exports as a strategy to enter the local market). In the intermediate competition case 2, P-multinationals are possible but the φ_0^P curve is not always above the $\widetilde{\varphi}_P$ curve. In case 3, however, P-multinationals are not possible (and potentially the range of parameters for A-multinationals is reduced). Finally, for case 4 A-multinationals are not an equilibrium and only the O-multinational firm is an alternative option to exporting to the host country.

[3] The value of φ at which eventually $\varphi_0^O(\frac{f}{q}, E, n, n^*, L)$ is equal to $\widetilde{\varphi}_A(E, \frac{f}{q})$ is given by $\widetilde{\varphi}_O(E) = \frac{\frac{1}{\overline{B}(E)}\frac{L}{\sigma q} - n}{n^*}$.

[4] Thus $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E) < \frac{L}{\sigma q \overline{B}(E)} - n^* v_A(E) < \frac{L}{\sigma q \overline{B}(E)} - n^* v_O(E)$. Therefore $\widetilde{\varphi}_A(E, \frac{f}{q}) < \varphi_0^O(f, E, n, n^*, L)$, $\widetilde{\varphi}_m(E, \frac{f}{q}) < \varphi_0^A(\frac{f}{q}, E, n, n^*, L)$ and $\widetilde{\varphi}_P(E, \frac{f}{q}) < \varphi_0^P(\frac{f}{q}, E, n, n^*, L)$ and $\widetilde{\varphi}_m^0(E) > \varphi_0^P(\frac{f}{q}, E, n, n^*, L)$ for all f/q.

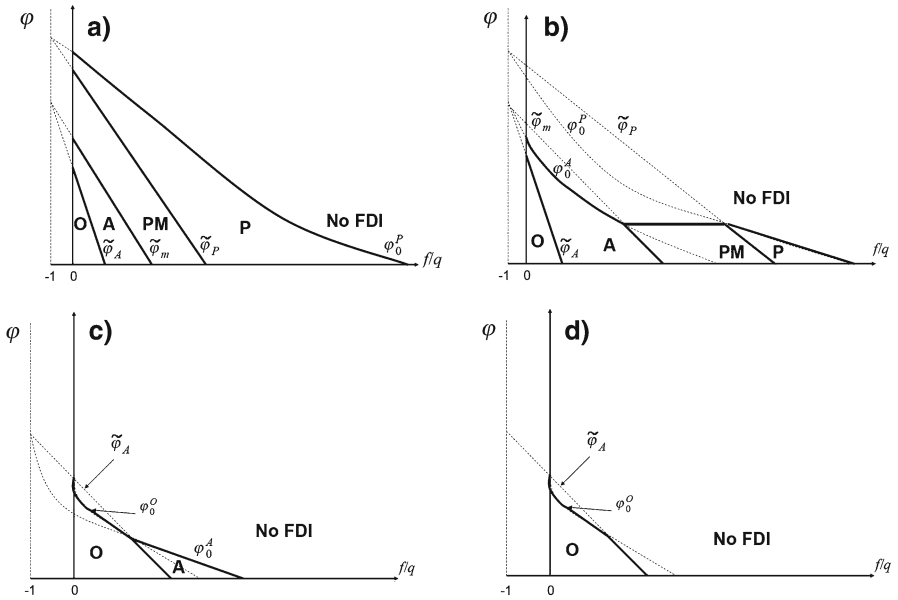

Fig. 3 **a** Low local competition: $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E)$. **b** Intermediate local competition: $\frac{L}{\sigma q B_P(E)} - n^* v_P(E) < n < \frac{L}{\sigma q B_P(E)}$. **c** Large local competition: $\frac{L}{\sigma q B_P(E)} < n < \frac{L}{\sigma q B(E)}$. **d** Very large local competition: $\frac{L}{\sigma q B(E)} < n$

4 Comparative statics

Our analysis allows us to discuss the impact of changes in various parameters of the model on the structure of delegating power inside the multinational corporation. Consider first the effect of trade costs and fixed costs of FDI on the allocation of power inside multinational firm. To illustrate this in the starkest way, it is useful to concentrate on the case depicted in Fig. 3a with $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E)$ and redrawn in Fig. 4. For sufficiently low trade costs (large values of φ) and sufficiently large fixed costs of FDI, exporting dominates the establishment of a foreign subsidiary. Hence, for values of φ and f/q above the curve $\varphi = \varphi_0^P(\frac{f}{q}, E, n, n^*, L)$, there is no FDI in the host country.

4.1 Trade costs

Figure 4 also shows how, the internal organization of the multinational subsidiary depends on trade frictions and the fixed costs of FDI. Typically for a given fixed cost f/q in a zone of profitable FDI, an increase in trade frictions (i.e. a reduction in φ) from a point like H to a point like L leads to different degrees of delegation of power inside the multinational firm.

More precisely, when trade costs are low, export profits are relatively high. In equilibrium, FDI needs to guarantee relatively high profits as well to be a viable

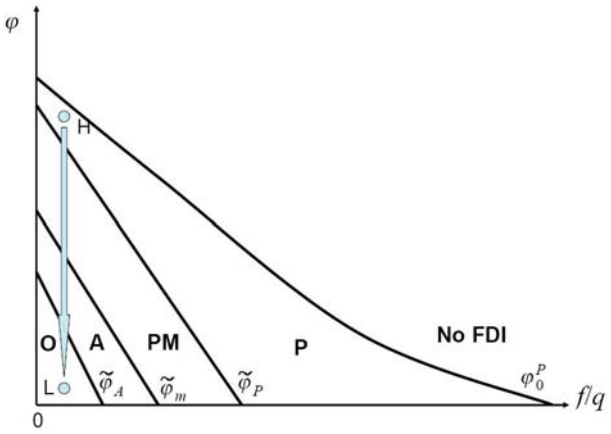

Fig. 4 Increase in trade costs

alternative to exports. Now, for high level of recurrent profits of the multinational firm, there is no trade-off between delegation and control inside the multinational firm. As Proposition 2.1 shows, in this case, subsidiary managers are induced to take sufficient initiatives under centralized control. Hence, a foreign subsidiary optimal mode of organization will be a P-multinational with full initiative when $\varphi > \widetilde{\varphi}_P(E, \frac{f}{q})$. Moreover, a P-multinational organization with less than full but sufficient high initiative will still be preferred in the region $\widetilde{\varphi}_m(E, \frac{f}{q}) < \varphi < \widetilde{\varphi}_P(E, \frac{f}{q})$.

With increasing trade costs (when φ keeps decreasing), however, equilibrium profits from exports are reduced, and with it the equilibrium profits from FDI as an alternative to exports. At this profit levels, the P-multinational is not able to sustain enough initiative of subsidiary management. It becomes then profitable to induce managerial initiative through delegation of power to the subsidiary and an A-multinational firm with full initiative emerges as the optimal mode of FDI. Delegating power to the subsidiary occurs indeed for intermediate values of φ in the region $\widetilde{\varphi}_A(E, \frac{f}{q}) < \varphi < \widetilde{\varphi}_m(E, \frac{f}{q})$.

Finally, when trade frictions become very high (i.e. $\varphi < \widetilde{\varphi}_A(E, \frac{f}{q})$), then equilibrium profits from exporting and FDI are low. Subsidiary managers subsidiaries cannot be induced to take any meaningful initiative even when power is delegated to them. There is again no trade-off between initiative and control. The optimal organization is the O-multinational firm with decision power fully centralized at the multinational headquarters' level.

4.2 Fixed costs

Alternatively, Figure 4 can be discussed in terms of comparative statics on fixed costs of establishing a foreign subsidiary, for a given value of φ. An increase in the fixed cost f/q makes the organizational mode move from a point like G to a point like I in Fig. 5. For low levels of fixed costs, many multinational firms enter the host country market. Therefore, local competition is tough and recurrent equilibrium profits of

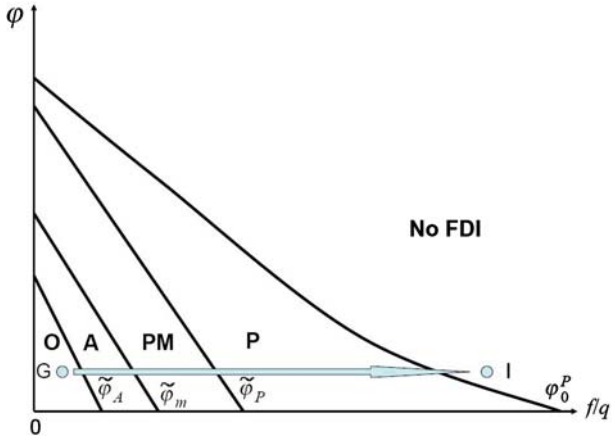

Fig. 5 Increase in fixed costs

foreign subsidiaries are low, leading to an O-multinational equilibrium. When fixed costs keep increasing, local competition becomes less intense leading to an increase in equilibrium profits of subsidiaries. As the stakes inside the multinational keep increasing, we have successively the different optimal organizational modes of power as described by Proposition 1. The A-multinational firm will emerge for intermediate values of f/q and the P-multinational corporation becomes optimal for larger values of f/q.

4.3 Information

In this model, collection of information on local production conditions is a central determinant whether firms undertake a foreign direct investment in the host country compared to exporting and whether they delegate power to the subsidiary in the foreign country. We investigate now how changes in the efficiency of the technology of information of headquarters E and of the subsidiary manager $\bar{e}$ will affect FDI and the organization of the subsidiary. Again to avoid cumbersome taxonomy, we focus on the case in which $n < \frac{L}{\sigma q B_P(E)} - n^* v_P(E)$.

(a) Headquarters' information technology

Consider then the effect of a change in E on the various relevant thresholds $\varphi_0^P(\frac{f}{q}, E, n, n^*, L)$, $\widetilde{\varphi}_P(E, \frac{f}{q})$, $\widetilde{\varphi}_m(E, \frac{f}{q})$, and $\widetilde{\varphi}_A(E, \frac{f}{q})$. We show in the Appendix that all the thresholds are increasing in E. Moreover,

$$\frac{\partial}{\partial E}\left[\varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right) - \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)\right] > 0$$

and

$$\frac{\partial}{\partial E}\left[\widetilde{\varphi}_P\left(E, \frac{f}{q}\right) - \widetilde{\varphi}_m\left(E, \frac{f}{q}\right)\right] > 0$$

while

$$\frac{\partial}{\partial E}\left[\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)-\widetilde{\varphi}_A\left(E,\frac{f}{q}\right)\right]<0$$

Hence, for a given value of trade costs, regions with P-multinationals (with full and partial initiative) as well as the region with O-multinationals expand, while the region with A-multinationals shrinks. Intuitively, more efficient information technologies available to multinational headquarters makes it more likely that the subsidiary manager is not given control over the organization.

(b) Subsidiary's information technology
Consider now an improvement in the information technology $\overline{e}$ of subsidiary management. We show in the Appendix that

$$\begin{aligned}
\frac{\partial}{\partial \overline{e}}\left[\varphi_0^P\left(\frac{f}{q},E,n,n^*,L\right)\right]&>0\\
\frac{\partial}{\partial \overline{e}}\left[\varphi_0^P\left(\frac{f}{q},E,n,n^*,L\right)-\widetilde{\varphi}_P\left(E,\frac{f}{q}\right)\right]&>0\\
\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_P\left(E,\frac{f}{q}\right)-\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)\right]&>0\\
\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_m\left(E,\frac{f}{q}\right)-\widetilde{\varphi}_A\left(E,\frac{f}{q}\right)\right]&>0
\end{aligned}$$

and

$$\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_A\left(E,\frac{f}{q}\right)\right]<0$$

Thus, the more efficient the information technology of the subsidiary manager, the more likely is a multinational organization that keeps the subsidiary manager's initiative alife (a P-multinational with full or partial initiative and an A-multinational) and the less likely are O-multinational firms.

We close this section by examining the role of information technology on the equilibrium number of multinationals in the host market. The effect is ambiguous. This can be seen from differentiating (11), (15), (16), or (19). On the one hand, better headquarters' or subsidiary management's information technology will improve the expected profitability to establish a productive subsidiary in the host county market as $\nu_P(E)$, $\nu_A(E)$ and $\nu_O(E)$ are all increasing in E and $\overline{e}$. On the other hand, as more subsidiaries are successfully producing, competition in the host country market becomes more intense and this tends to reduce profits and entry into the local market.

5 Conclusions

In this paper we examine how market competition, trade and entry costs as well as cost of information technology interact with firms' decision to serve a host country

market through exports or FDI and how these affect the optimal mode of multinational organization. Market competition changes managerial behavior and this in turn affects the allocation of power inside the multinational corporation. With more intense competition in the host country, the conflict of interests between headquarters and subsidiary management may become more costly to a multinational firm. More intense competition may reduce the rents that subsidiary managers can divert to themselves. This in turn may reduce the motivation of subsidiary managers to engage in the multinational firm. Under these circumstances, it is worthwhile for multinational headquarters to change the mode of organization of production of their subsidiaries and to delegate decision power to the subsidiary manager to stimulate her initiative. However, the empowerment of the subsidiary manager opens up the possibility for opportunism. The optimal allocation of power between headquarters and the multinational subsidiary involves a trade-off between initiative and control. We find that for intermediate levels of host country competition subsidiary managers are given decision power how to run the subsidiary. After characterizing the equilibrium organizational mode of multinational firms in a given host market, the paper investigated how changes in fixed costs of FDI entry, trade costs, and changes in information technology affect the power allocation in the multinational corporation. The paper predicts that delegation of power to local subsidiary management is most likely when these variables lead to intermediate values of competition in the host country.

Appendix 1: Existence conditions of a P-multinational equilibrium with partial initiative $h_P^* \in [\underline{h}_P, 1[$

In this regime, as mentioned in the main text, we should have:

$$\frac{L}{\sigma}\frac{1}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}=qB_P(E) \tag{20}$$

Denoting $v_P(E,h)=E+(1-E)\overline{e}hK$ for $h\in[0,1]$, the arbitrage condition between exports and FDI as a strategy to serve the local market writes as:

$$\frac{L}{\sigma}\frac{\varphi}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}=\frac{L}{\sigma}\frac{v_P(E,h)}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}-qh-f \tag{21}$$

Also the P-multinational with interior initiative should dominate the A-multinational with full initiative. This translates into the following condition:

$$\frac{L}{\sigma}\frac{v_P(E,h)}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}-qh\geq\frac{L}{\sigma}\frac{v_A(E)}{n+n^*\varphi+n_I(1-\frac{\varphi}{Q_P(E,h)})}-q \tag{22}$$

The first two conditions (20) and (21) give the necessary value of h_P in that regime as the solution of

$$B_P(E)\left[v_P(E,h_P)-\varphi\right]-h_P=\frac{f}{q} \tag{23}$$

Consider then the function $\Theta(h) = B_P(E)\,[\nu_P(E,h) - \varphi] - h$. Simple differentiation shows that $\Theta(h)$ is increasing in h. From this, a necessary solution for a interior solution $h_P < 1$ to (23) is that $\Theta(1) > f/q$ which can be rewitten as

$$\varphi > \nu_P(E) - \frac{\left[1 + \frac{f}{q}\right]}{B_P(E)} = \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)$$

As well substitution of (20) and (21) into (22) gives the following necessary condition for that regime:

$$\frac{f}{q} > B_P(E)\,[\nu_A(E) - \varphi] - 1$$

which can be rewritten as

$$\varphi > \widetilde{\varphi}_m\left(E, \frac{f}{q}\right) = \nu_A(E) - \left[1 + \frac{f}{q}\right]\frac{1}{B_P(E)}$$

Reciprocally assume that

$$\widetilde{\varphi}_m\left(E, \frac{f}{q}\right) < \varphi < \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)$$

holds. Then $\Theta(h) = f/q$ has a unique interior solution $h_P^* \in]0, 1[$. Indeed $\Theta(1) > f/q$. as $\varphi < \widetilde{\varphi}_P(E, \frac{f}{q})$, Also $\Theta(0) = B_P(E)\,[E - \varphi] < B_P(E)\,[\nu_A(E) - \varphi] - 1 < f/q$ when $\varphi > \widetilde{\varphi}_m(E, \frac{f}{q})$.

Now from (20), the equilibrium number of multinationals in this regime is given by:

$$n_I^m = \frac{1}{1 - \frac{\varphi}{Q_P(E,h_P)}}\left[\frac{1}{B_P(E)}\frac{L}{\sigma q} - \left(n + n^*\varphi\right)\right] > 0$$

which is positive when $\frac{1}{B_P(E)}\frac{L}{\sigma q} - (n + n^*\varphi) > 0$ or

$$\varphi < \widetilde{\varphi}_m^0(E) = \frac{\frac{1}{B_P(E)}\frac{L}{\sigma q} - n}{n^*}$$

Hence a necessary and sufficient condition for the existence of such a regime is

$$\widetilde{\varphi}_m\left(E, \frac{f}{q}\right) < \varphi < \text{Min}\left[\widetilde{\varphi}_m^0(E); \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)\right]$$

Clearly $\widetilde{\varphi}_m^0(E) > 0$ for such a condition to define a non empty set of values of φ. Hence the condition

$$n < \frac{1}{B_P(E)} \frac{L}{\sigma q}$$

as the condition for the existence of a P-multinational with interior initiatives. □

Note finally that the eventual value of φ such that $\varphi = \varphi_0^P(\frac{f}{q}, E, n, n^*, L) = \widetilde{\varphi}_P(E, \frac{f}{q})$ is determined by

$$\varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right) = \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)$$

or the value of f/q such that:

$$\frac{\frac{L}{\sigma q} \nu_P(E) - \left[1 + \frac{f}{q}\right] n}{\frac{L}{\sigma q} + \left[1 + \frac{f}{q}\right] n^*} = \nu_P(E) - \frac{\left[1 + \frac{f}{q}\right]}{B_P(E)}$$

which after manipulation gives:

$$\varphi = \frac{\frac{1}{B_P(E)} \frac{L}{\sigma q} - n}{n^*} = \widetilde{\varphi}_m^0(E)$$

Appendix 2: Changes in the information technology

For the information technology of a multinational headquarter, simple differentiation by E gives:

$$\begin{aligned}
&\frac{\partial}{\partial E}\left[\varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right) - \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)\right] \\
&= \left[\frac{\frac{L}{\sigma q}}{\frac{L}{\sigma q} - \left[1 + \frac{f}{q}\right] n^*} - 1\right](1 - \overline{e}K) + \left[1 + \frac{f}{q}\right]\beta\lambda\overline{e} \\
&= \frac{\left[1 + \frac{f}{q}\right] n^*}{\frac{L}{\sigma q} - \left[1 + \frac{f}{q}\right] n^*}(1 - \overline{e}K) + \left[1 + \frac{f}{q}\right]\beta\lambda\overline{e} > 0
\end{aligned}$$

and

$$\begin{aligned}
&\frac{\partial}{\partial E}\left[\widetilde{\varphi}_P\left(E, \frac{f}{q}\right) - \widetilde{\varphi}_m\left(E, \frac{f}{q}\right)\right] = (1 - \overline{e}K) - (1 - \overline{e}) = \overline{e}(1 - K) > 0 \\
&\frac{\partial}{\partial E}\left[\widetilde{\varphi}_m\left(E, \frac{f}{q}\right) - \widetilde{\varphi}_A\left(E, \frac{f}{q}\right)\right] = \left[1 + \frac{f}{q}\right][\beta\lambda\overline{e} - \overline{e}] < 0
\end{aligned}$$

For the information technology of a local management, simple differentiation by $\overline{e}$ gives:

$$\frac{\partial}{\partial \overline{e}}\left[\varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right)\right] = (1-E)K\frac{\frac{L}{\sigma q}}{\frac{L}{\sigma q} - \left[1+\frac{f}{q}\right]n^*} > 0$$

$$\frac{\partial}{\partial \overline{e}}\left[\varphi_0^P\left(\frac{f}{q}, E, n, n^*, L\right) - \widetilde{\varphi}_P\left(E, \frac{f}{q}\right)\right] = (1-E)K\left[\frac{\left[1+\frac{f}{q}\right]n^*}{\frac{L}{\sigma q} - \left[1+\frac{f}{q}\right]n^*}\right] + \left[1+\frac{f}{q}\right]\beta\lambda(1-E) > 0$$

$$\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_P\left(E, \frac{f}{q}\right) - \widetilde{\varphi}_m\left(E, \frac{f}{q}\right)\right] = (1-E)K - (K-E) = E(1-K) > 0$$

$$\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_m\left(E, \frac{f}{q}\right) - \widetilde{\varphi}_A\left(E, \frac{f}{q}\right)\right] = \left[1+\frac{f}{q}\right][-\beta\lambda(1-E) + (K-E)] = \left[1+\frac{f}{q}\right][1-\lambda-(1-\beta\lambda)E] > 0$$

$$\frac{\partial}{\partial \overline{e}}\left[\widetilde{\varphi}_A\left(E, \frac{f}{q}\right)\right] = (K-E) - \left[1+\frac{f}{q}\right](K-E) < 0$$

□

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