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## **A Model of Competition Between Multinational Firms**

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# A Model of Competition Between Multinational Firms\*

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## Abstract

This study focuses on the theory of how multinational firms choose their entry modes between alternative options (i.e., trade, greenfield investment, or acquisition). In a comprehensive model of strategic decision-making with more than one multinational firm, it delineates how a multinational firm's entry mode influences a rival multinational firm's market entry behavior and how exogenous factors (e.g., market size, firms' production cost, per-unit trade cost and fixed investment cost) affect the optimal entry modes. The main finding of the study is that competition among multinational firms substantially affects their optimal entry modes such that competition implies different entry modes compared to no competition.

Keywords: Market Entry; Foreign Direct Investment; Acquisition; Trade  
JEL Classification: D21; F23; L13

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# 1 Introduction

The last three decades have witnessed a proliferation of multinational firms, and a significant increase in the pace, scale as well as scope of internationalization of production and consumption of goods and services. In 1990, the number of multinational firms actively producing over borders was estimated at between 17,500 and 20,000. More recently, in 2007, this number was estimated to be about 79,000 (Dunning 1992; UNCTAD 2007, 2008). Furthermore, in 2007, the number of multinational firms' foreign affiliates was estimated at about 790,000 (UNCTAD 2007, 2008).

An important aspect of multinational firms' cross-border activities is that they take place mainly in developed countries' markets (Hirst *et al.* 2009; Markusen 1995; Navaretti and Venables 2004; Dunning and Lundan 2008). Since there is a substantial number of multinational firms focusing on investment opportunities in a small number of countries, competition between multinational firms—simultaneously or sequentially—entering the same market is inevitable.

Another important aspect of multinational firms' activities, since the late 1990s, is that they have been increasingly carried out through mergers and acquisitions. As reported by Dunning and Lundan (2008: 20) and UNCTAD (2006: 16), in the period 1999-2001 and since 2005, more than six thousand cross-border mergers and acquisitions were undertaken annually, and over a hundred deals annually had a value exceeding US\$ 1 billion. UNCTAD (2007: 29) also reports on a recent survey of CEOs on mergers and acquisition trends, which suggests that developed countries are the favoured destinations of such activities. According to the results of the survey, 43 per cent of CEOs prefer Western Europe for acquisitions, 31 per cent prefer Asia, and 25 per cent prefer North America. More importantly, the results indicate that the majority of CEOs target countries in their own region or traditional trading partners. Why do they target specific regions for their merger and acquisition activities? How do particular factors—market size, the fixed investment cost, the per-unit trade cost—affect their decision?

This study provides a comprehensive theoretical model of competition between multinational firms. In particular, I study the theory of how multinational firms choose their entry modes between alternative options. I consider two multinational firms willing to enter the same market. I allow the multinational firms to choose their entry modes between three alternative options. The first option is to produce at home and ship the goods to the market, which I refer to as *international trade*. If a firm wants to produce in the market, it has the option to set up its own subsidiary in the market,

which I refer to as a *greenfield investment*. Alternatively, a firm may acquire a local firm in the market, which I refer to as an *acquisition*.

In the late 1980s and early 1990s, many countries liberalized their economies so there were dramatic reductions in trade costs (Goodman and Pauly 1993; Hirst 1997). According to traditional models of trade, foreign direct investment should have been discouraged when trade costs fell. By contrast, over the same period, foreign direct investment grew much faster than trade. Given the fact that the majority of foreign direct investment, since the 1980s, has taken place through mergers and acquisitions, the limited explanatory power of the traditional theory is not surprising inasmuch as it does not distinguish between greenfield investment versus mergers and acquisitions. By distinguishing multinational firms' entry modes, this study shows that mergers and acquisitions are likely to increase when trade costs are reduced.<sup>1</sup>

In particular, a multinational firm prefers to produce at home and export if locating a subsidiary in a market is not as efficient (Hennart and Park 1993; Neary 2009). Similarly, a multinational firm may opt to acquire an existing local firm if entry by establishing its own subsidiary in the market is not as profitable. Görg (2000) finds that a foreign entrant favours acquiring a local firm over undertaking greenfield investment unless additional costs associated with greenfield investment (e.g., fixed costs of investment) are very low relative to costs associated with acquisition (e.g., product and process adaptation costs).

There are not many theoretical studies that discuss whether a multinational firm's entry mode choice is greenfield investment or acquisition. Furthermore, relatively few studies include international trade as an alternative option and identify why multinational firms prefer a particular entry mode. For example, Müller (2007) examines possible impacts of investment costs, technology differences—the difference between firms' marginal costs—market size, market structure and competition intensity on a multinational firm's entry mode choice in a model *à la* Hotelling where firms compete by prices. According to his finding, a higher cost of greenfield investment makes acquisition more attractive, whereas if the investment cost is too large, acquisition is not profitable and no entry is the optimal choice. The intuition is as follows. First, the relative cost of acquiring a firm decreases when the cost of greenfield investment increases. Second, if the investment cost sufficiently increases, greenfield investment is not profitable, so it is not a credible threat; since there is no alternative entry option except acquisition (e.g., Müller (2007) does not allow the multinational

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<sup>1</sup>See Bjorvatn (2004) and Neary (2009) for alternative approaches and explanations.

firm to export), the multinational firm either acquires a firm or stays out of the market. Consequently, the acquisition price increases and deters the multinational firm from entering the market. Müller (2007) also shows that the multinational firm is better off by undertaking greenfield investment if the technology difference is sufficiently large—if the rival is less efficient, and so greenfield investment yields more profits—or if the market is either very or not competitive, whereas, if competition is moderate, he finds that acquisition is the optimal entry mode.

By allowing for trade, Eicher and Kang (2005) discuss the impact of trade costs on the multinational firm's optimal entry mode. They show that the optimal entry mode is a function of fixed costs, trade costs and market size, provided that competition is sufficiently weak or product differentiation is strong. According to their finding, the multinational firm always acquires a local firm in a sufficiently large market when trade is free and transport costs are zero. The reason is that the multinational firm's acquisition profit increases with market size. If trade costs are low, a greenfield investment replaces trade for low fixed costs insofar as low fixed investment costs decrease the multinational firm's profit by less than the efficiency loss due to trade costs. Once fixed costs reach high levels, they show that a multinational firm chooses acquisition in a very large market, trade in a moderately large market and no entry in a small market.

Horn and Persson (2001) examine international versus national mergers by allowing more than one merger to take place at a time. They find that high trade costs may increase the profitability of national mergers relative to international mergers leading to reduced competition in the market. From this, Norbäck and Persson (2004) find that domestic firms can actually prevent foreign firms from becoming strong local competitors, so high greenfield investment costs and high trade costs do not necessarily induce foreign acquisitions. Moreover, by allowing local firms to react to a foreign entry by merging or exiting, Haller (2009) models the impact of acquisition and greenfield investment on domestic firms and shows that a multinational firm may favour greenfield investment over acquiring a local firm if local firms are relatively competitive or if local firms reduce competition by merging. In either case, the acquisition price increases, which decreases the acquisition profit.

Most of the studies in the literature concentrate on a single multinational firm's entry mode choice and ignore possible impacts of strategic interaction between multinational firms on their optimal market entry behavior. However, it is often observed that multinational firms compete against each other; hence it is crucial to capture competition among multinational firms. Furthermore, it is widely accepted that multinational

firms are quite responsive to each other's entry mode choice (Caves 1996). Javorcik and Saggi (2003) analyze two multinational firms' preferred entry modes when firms have different production cost. They allow the multinational firms to choose between greenfield investment and joint venture. Furthermore, they assume a single local firm, which is not able to produce alone. According to their finding, the efficient multinational firm is less likely to choose joint venture, inasmuch as it earns more if it undertakes greenfield investment and competes against the less efficient firm, and more likely to undertake greenfield investment compared to the inefficient multinational firm.

In a different context, Bjorvatn (2004) examines two multinational firms' entry mode choice. He allows the multinational firms to choose their entry modes between trade, greenfield investment and acquisition. He focuses on the relationship between economic integration—reduction in trade costs and/or fixed investment costs—and the profitability of acquisitions. He predicts that reduced trade costs and/or reduced investment costs may trigger acquisitions. In a more recent study, Norbäck and Persson (2008) allow for competition among many multinational firms and study multinational firms' entry mode selection between greenfield investment and acquisition. They argue that there may be fierce bidding competition over acquiring a local firm's assets if entry by acquisition provides a large market share. Consequently, the acquisition price substantially increases and the acquirer's *ex post* profit may be less than the greenfield profit.

This study is akin to Bjorvatn's (2004) study in the sense that I focus on two multinational firms' choices of their entry modes and consider the same inclusive set of entry options, i.e., trade, greenfield investment and acquisition. Unlike Bjorvatn (2004), I do not confine myself to a single parameter space. I provide a comprehensive model of strategic decision-making with more than one multinational firm. I delineate how a multinational firm's entry mode influences a rival multinational firm's market entry behavior and how exogenous factors (e.g., market size, firms' production cost, per-unit trade cost and fixed investment cost) affect multinational firms' optimal entry modes. The main finding of this study is that competition among multinational firms substantially affects their optimal entry modes such that competition will imply different entry modes compared to no competition. I show that if the ratio between market size and the local firm's marginal cost is sufficiently small, then a multinational firm prefers acquisition to both trade and greenfield investment, irrespective of its rival's entry mode as well as the per-unit trade cost and fixed investment cost. A multinational firm prefers greenfield investment to trade if the per-unit trade cost reduces its profit by more than the fixed greenfield cost. If the per-unit trade cost and fixed greenfield cost are both prohibitively large, and if acquisition is not allowed in

the market, a multinational firm prefers to stay out of the market because, in such a situation, neither trade nor greenfield investment yields *non-negative* profits.

I identify two main incentives leading a multinational firm to acquire a local firm: a *market-structure* effect, that is the change in the multinational firm's operating profit when it acquires the local firm rather than entering the market via the alternative entry mode, and a *cost-saving* effect, that is the change in the cost of market entry when the multinational firm enters the market via acquisition rather than its alternative entry mode. The *market-structure* effect decreases with the local firm's marginal cost of production, while the *cost-saving* effect increases. A multinational firm gains more when it acquires a strong rival—when the local firm's marginal cost is small—whereas the cost of acquiring a strong rival is high. The *market-structure* effect increases with market size, while the *cost-saving* effect decreases. The reason is that multinational firms' profits increase with market size; however, in larger markets, acquisition—reduction in competition—increases profits by more than alternative entry modes. Similarly, the local firm's profit increases with market size, and so does the acquisition price, which represents the cost of acquiring the local firm. Finally, I show that the impact of the per-unit trade cost on the *cost-saving* effect is *non-positive*, whereas the *market-structure* effect may increase or decrease with the per-unit trade cost.

The remainder of this paper is structured as follows: the model is introduced in *Section 2*. In *Section 3*, I solve the model for the optimal entry modes of multinational firms and determine the prospective equilibrium entry modes. *Section 4* scrutinizes the factors determining the optimal entry modes and explores the entry modes in equilibrium. Finally, *Section 5* concludes. For convenience, I have relegated the proofs and technical details to the *Appendix*.

## 2 The model

I consider a market which is served by one local firm, labeled 1. The local firm has paid a fixed cost which allowed market entry in the past. The fixed cost cannot be recovered by market exit. Let  $c$  denote the local firm's marginal cost of production, where  $c \in [0, 1]$ .

Consumers in this market have quasi-linear preferences which give rise to the inverse demand function,  $p = a - Q$ , where  $p$  denotes the equilibrium price and  $Q$  is the aggregate supply. If entry to this market is not allowed, the local firm will

maintain its monopoly power and produce at the output level of  $(a - c) / 2$  and earn the monopoly profit of  $(a - c)^2 / 4$ .<sup>2</sup>

Let a foreign investor/multinational firm (MNF)—namely,  $MNF_1$ —be willing to enter this market, and entry is allowed. I normalize  $MNF_1$ 's production cost to zero. Hence, the foreign firm is technologically superior.<sup>3</sup>

The foreign firm can choose its entry mode from three different options: *acquisition*, *greenfield investment* or *trade*.<sup>4</sup> I model the acquisition similar to Salant *et al.* (1983) such that the investor pays an acquisition price, denoted by  $\Omega$ , to the local firm and the local firm vanishes.<sup>5</sup> I assume that there is no efficiency loss when the investor acquires the local firm. Consequently,  $MNF_1$  employs its more efficient technology (Barros 1998; Borek *et al.* 2004).

The foreign firm may prefer to produce at home and ship the goods to this market. In this situation, the foreign firm will have to pay additional costs (e.g., transport costs and tariffs), which I refer to as trade costs. Let  $t$  denote the *per-unit trade cost*. If the foreign investor produces at home and ships the goods to this market, its marginal cost of production will increase to  $t$ .

The foreign investor can save the per-unit trade cost by undertaking greenfield investment. However, this investment requires a fixed cost of setting up a subsidiary in the market. Let  $f$  denote the *fixed cost* of undertaking greenfield investment. If the fixed investment cost is small such that  $f < 4t(a + c - t) / 9$ , the foreign investor prefers greenfield investment to trade because, in such a situation, the fixed greenfield cost reduces  $MNF_1$ 's profit by less than the efficiency loss due to trade.<sup>6,7</sup>

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<sup>2</sup>Firm 1 maximizes its profit,  $(a - q_1 - c)q_1$ , where  $q_1$  is firm 1's output. The first-order condition,  $a - 2q_1 - c = 0$ , immediately specifies firm 1's monopoly output in equilibrium such that  $q_1 = (a - c) / 2$ . By substituting this optimal monopoly output into firm 1's profit function, one can compute firm 1's monopoly profit, in equilibrium, which is  $(a - c)^2 / 4$ .

<sup>3</sup>Müller (2007: 95) reports that it is the common observation that local firms in many markets in Central and Eastern Europe generally possess a less efficient production technology compared to multinational firms entering those markets.

<sup>4</sup>If none of the entry modes yields *non-negative* profits in equilibrium,  $MNF_1$  will prefer to stay out of the market.

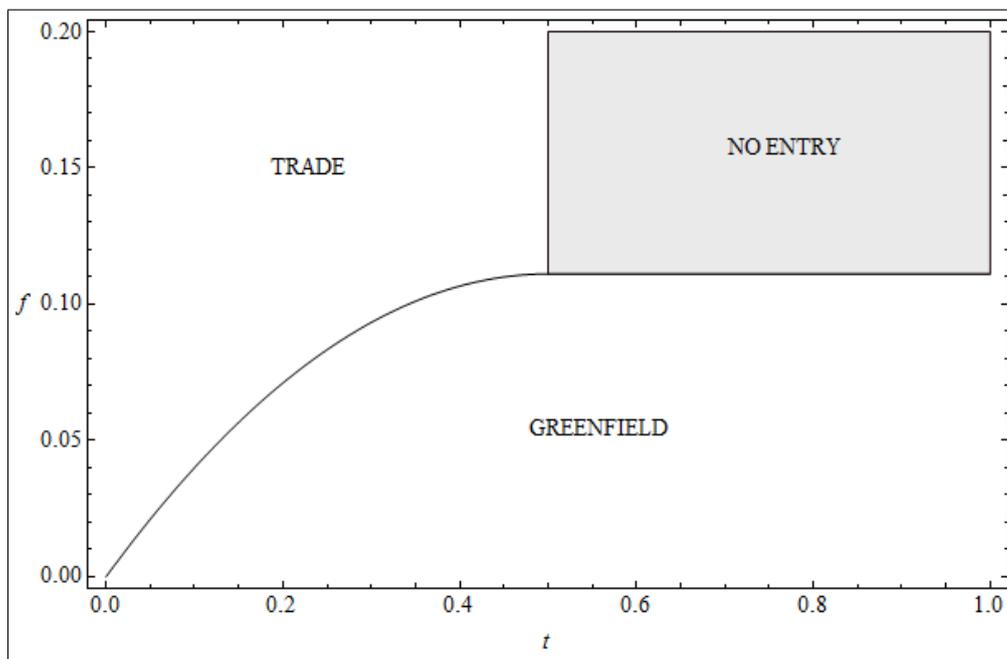
<sup>5</sup>I assume that there is no additional cost of acquiring a local firm. The acquisition price constitutes the sole cost of acquiring the local firm.

<sup>6</sup> $MNF_1$  prefers greenfield investment to trade if its greenfield profit,  $(a + c)^2 / 9 - f$ , is more than its trade profit,  $(a + c - 2t)^2 / 9$ . Provided that both entry modes yield positive profits, in equilibrium, that is the case when  $f < 4t(a + c - t) / 9$ . See *Appendix A.1* for details.

<sup>7</sup>The extension to the  $n$ -firm case is straightforward. See *Appendix A.1* for details.

Furthermore, if the market is not large enough to accommodate two firms (i.e.,  $a < 2c$ ),  $MNF_1$ 's greenfield entry will push the local firm out of this market. If the fixed greenfield cost is large such that  $f > 4t(a + c - t)/9$ ,  $MNF_1$  prefers trade to greenfield investment so long as trade yields *positive* profits. If the per-unit trade cost is sufficiently high such that  $t > (a + c)/2$ ,  $MNF_1$ 's trade profit will be *negative*. In this situation,  $MNF_1$  prefers to stay out of this market unless the fixed greenfield cost allows for a *positive* greenfield profit. Note that  $MNF_1$ 's greenfield profit is positive if (and only if) the fixed greenfield cost is less than the investor's operating profit, such that  $f < (a + c)^2/9$  (see *Appendix A.1* for details).

Let the local firm and  $MNF_1$  have the same production technology, such that  $c = 0$ . I first consider the case where acquisition is not allowed. *Figure 1* shows  $MNF_1$ 's optimal entry modes in equilibrium, for the fixed greenfield cost,  $f$ , and the per-unit trade cost,  $t$ , between zero and one (given market size,  $a = 1$ ).



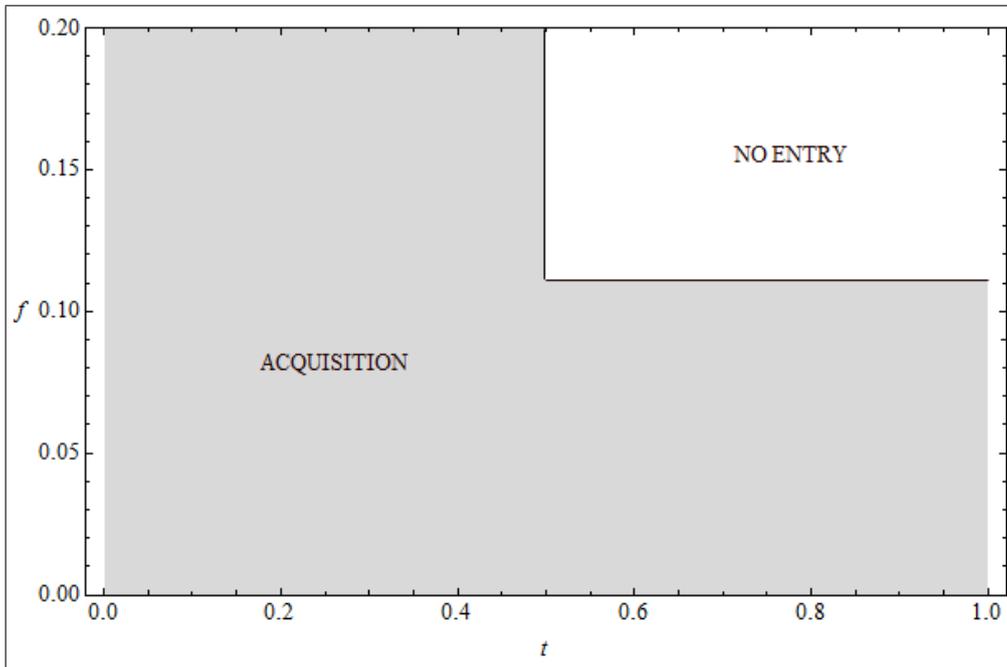
**Figure 1** Trade vs Greenfield Investment (Duopoly).

In this particular illustration, the market is large enough to accommodate two firms (i.e.,  $a > 2c$ ) so the local firm stays in the market, irrespective of  $MNF_1$ 's entry mode. As mentioned before, it is optimal for  $MNF_1$  to undertake greenfield investment if  $f < 4t(a + c - t)/9$ —to the right and below the curve in *Figure 1*—or export if otherwise. Furthermore,  $MNF_1$  will not enter this market if the per-unit trade cost and fixed greenfield cost are both large such that  $t > 1/2$  and  $f > 1/9$ , respectively, insofar as  $MNF_1$  will not be able to make *non-negative* profits in such a situation. Clearly, reducing the per-unit trade cost encourages  $MNF_1$  to export so long as the

fixed greenfield cost is not sufficiently low such that it permits greenfield investment as a solution. The smaller is the fixed cost of investment,  $f$ , the lower the per-unit trade cost would need to be to lead  $\text{MNF}_1$  to export.

However, by allowing the multinational firm to acquire the local firm, one can show that reduction in per-unit trade cost does not lead to trade nor does it lead to greenfield investment. In particular, irrespective of the per-unit trade cost,  $t$ , and the fixed greenfield cost,  $f$ , the MNF prefers acquisition to both trade and greenfield investment as its acquisition profit,  $a^2/4 - \Omega$ , is more than both its trade profit,  $(a - 2t + c)^2/9$ , and its greenfield profit,  $[(a + c)^2/9] - f$ .

The multinational firm makes a take-it-or-leave-it offer to the local firm, and the multinational firm's offer—if it is accepted by the local firm—will be the acquisition price,  $\Omega$ . As discussed in *Section 3.2*, the acquisition price,  $\Omega$ , is equal to the local firm's outside profit—the local firm's profit if it rejects the offer—such that  $\Omega = (a - 2c)^2/9$  if  $f < 4t(a + c - t)/9$  (because  $\text{MNF}_1$  will enter the market by undertaking greenfield investment if not by acquiring the local firm), and that  $\Omega = (a - 2c + t)^2/9$  if  $f > 4t(a + c - t)/9$  (because  $\text{MNF}_1$  will enter the market by exporting if not by acquiring the local firm). If  $\text{MNF}_1$ 's optimal outside option is to stay out of the market—if both  $t > (a + c)/2$  and  $f > (a + c)^2/9$ —the local firm will not accept any offer less than its monopoly profit  $(a - c)^2/4$ .



**Figure 2** Acquisition (Monopoly).

As illustrated in *Figure 2* where  $a = 1$  and  $c = 0$ ,  $\text{MNF}_1$  prefers to buy out its rival and earn a monopoly profit so long as  $t < 1/2$  and/or  $f < 1/9$ . Note that  $\text{MNF}_1$ 's

greenfield profit is *negative* if  $f > 1/9$ , and so is its trade profit if  $t > 1/2$ . If both  $f > 1/9$  and  $t > 1/2$ ,  $MNF_1$  may still want to acquire the local firm but acquisition in such a situation yields zero profit as both firms' monopoly profits are the same—both the local firm and the MNF produce with zero marginal cost. The local firm may be less efficient than the foreign firm, such that  $c > 0$ . In this situation,  $MNF_1$ 's monopoly profit will be larger than the local firm's monopoly profit (i.e.,  $a^2/4 > (a - c)^2/4$ ). Consequently, the foreign firm can acquire the local firm instead of staying out—when greenfield entry and trade are both not profitable—as the MNF is able to afford to pay the local firm's monopoly profit to acquire this firm and yet earn positive profits after the acquisition.

The analysis above rules out important implications associated with competition between  $MNF_1$  and any other firm willing to enter the same market. There may exist another foreign firm observing  $MNF_1$ 's entry and intending to enter the same market.<sup>8</sup> The presence of another firm willing to enter the same market will influence  $MNF_1$ 's optimal entry mode. Therefore, I will modify the above model and I will assume two multinational firms—namely,  $MNF_1$  and  $MNF_2$ —sequentially entering the same market. For simplicity, I will assume that  $MNF_1$  and  $MNF_2$  are *ex ante* symmetric in their marginal cost of production such that they both possess a similar production technology, and that they both produce the homogeneous good with the same marginal cost, which is normalized to zero.<sup>9</sup> When all three firms are active in the market, the aggregate supply,  $Q$ , comprises the MNFs' outputs  $q_{m1}$  and  $q_{m2}$ , and the local firm's output  $q_1$ .

As noted by Brainard (1993) and Markusen (1995), most foreign direct investment (FDI) is *horizontal*. Therefore, I focus on the horizontal motives for FDI in the sense that the multinational firms enter this particular market to serve local consumers.<sup>10</sup> The interaction between firms takes place such that  $MNF_1$  decides on its

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<sup>8</sup>I can also consider some domestic entrepreneurs observing profitable investment opportunities in this market. However, I will implicitly assume, for simplicity, that multinational firms hold intellectual property (e.g., technology ownership through patents) which is necessary to create a new firm in this market. See Mukherjee and Sengupta (2001).

<sup>9</sup>Given the fact that most FDI originates from developed countries, and that the majority of FDI goes to developed countries as well, I expect that some multinational firms—especially those producing homogenous goods—have access to and possess a similar production technology. By contrast, it is important to incorporate a less efficient incumbent firm, because, as noted by Navaretti and Venables (2004), it is often the case that multinational firms are, on average, more productive than local firms.

<sup>10</sup>It is *market-seeking* FDI that is under consideration. In this type of investment, investors sell their products where they invest. Large and growing markets provide investors with such opportunities. Furthermore, due to trade costs and fixed costs of market entry, it will not be optimal for investors to produce a homogenous good in a host country's market and re-export to their home countries.

entry mode first.  $MNF_2$  takes this decision as given, and, subsequent to  $MNF_1$ 's decision, decides on its entry mode. Particularly,  $MNF_1$  makes an acquisition offer to the local firm in the first stage of the game. It is a take-it-or-leave-it offer. If the local firm accepts  $MNF_1$ 's acquisition offer,  $MNF_1$  acquires the local firm.  $MNF_2$  observes the acquisition and, subsequently, chooses its entry mode between trade and greenfield investment. Then, both multinational firms compete against each other in the *Cournot* duopoly game. If  $MNF_1$  does not acquire the local firm in the first stage, both multinational firms sequentially choose their entry modes between trade and greenfield investment. Consequently, there will be three firms competing *à la Cournot* (i.e., the market will consist of two multinational firms and one incumbent firm), provided that all firms choose to produce in equilibrium. Moreover, a multinational firm does not enter the market if neither entry mode yields a *non-negative* profit. The game is solved backwards for the *subgame perfect Nash equilibria*.

### 3 Optimal entry modes

#### 3.1 Trade versus greenfield investment

In this section, I delineate how the multinational firms choose between trade and greenfield investment. Consequently, I will focus on the situation where acquisition is not profitable.

Let  $\pi_{m1}^{t(t)}$  and  $\pi_{m2}^{t(t)}$  denote  $MNF_1$ 's and  $MNF_2$ 's profit, respectively, in the case that both multinational firms choose trade as their entry modes.  $\pi_{m1}^{t(t)}$  and  $\pi_{m2}^{t(t)}$  are given by equation (1) (see *Appendix A.1* for details):

$$\pi_{m1}^{t(t)} = \pi_{m2}^{t(t)} = \left( \frac{a + c - 2t}{4} \right)^2. \quad (1)$$

Note that the superscript  $t$  refers to trade and that the superscript in brackets represents the rival firm's entry mode. In equation (1), both multinational firms' profits decrease with the per-unit trade cost,  $t$ . The per-unit trade cost represents the efficiency loss due to trade. The higher the per-unit trade cost—the larger the efficiency loss—the lower is the multinational firms' trade profit and the less is the competitive pressure on the incumbent firm.

Let  $\pi_{m1}^{t(g)}$  and  $\pi_{m2}^{g(t)}$  denote  $MNF_1$ 's and  $MNF_2$ 's profit, respectively, in the case that  $MNF_1$  chooses trade and  $MNF_2$  chooses greenfield investment. Note that the superscript  $g$  refers to greenfield investment. Similarly, let  $\pi_{m1}^{g(t)}$  and  $\pi_{m2}^{t(g)}$  denote  $MNF_1$ 's

and  $\text{MNF}_2$ 's profit, respectively, in the case that  $\text{MNF}_1$  chooses greenfield investment and  $\text{MNF}_2$  chooses trade. Equations (2) and (3) give the multinational firms' profits,  $(\pi_{m1}^{t(g)}, \pi_{m2}^{t(g)})$  and  $(\pi_{m1}^{g(t)}, \pi_{m2}^{g(t)})$ , respectively (see *Appendix A.1* for details):

$$\pi_{m1}^{t(g)} = \pi_{m2}^{t(g)} = \left( \frac{a + c - 3t}{4} \right)^2, \quad (2)$$

$$\pi_{m1}^{g(t)} = \pi_{m2}^{g(t)} = \left( \frac{a + c + t}{4} \right)^2 - f. \quad (3)$$

It is clear in equations (2) and (3) that if an MNF chooses trade when the rival MNF undertakes greenfield investment, the profit of the MNF choosing trade decreases with the per-unit trade cost,  $t$ , whereas the other MNF's profit increases with  $t$ . The intuition is that both firms have downward-sloping reaction curves as they compete by quantities. Therefore, when one firm reduces its output, the other firm will increase it. In equations (2) and (3), the firm opting for trade reduces its output as it loses its competitive position due to the efficiency loss—its profit decreases—so the other firm increases its output—its profit increases—insofar as, in this situation, the *non-exporting* firm has a competitive advantage over the *exporting* firm. The higher is the per-unit trade cost, the larger is the competitive advantage that the non-exporting firm has over the exporting firm, so the higher is the non-exporting firm's profit.

Alternatively, both multinational firms may undertake greenfield investment. In this situation, let  $\pi_{m1}^{g(g)}$  and  $\pi_{m2}^{g(g)}$  denote  $\text{MNF}_1$ 's and  $\text{MNF}_2$ 's profit, respectively, which are given by equation (4) (see *Appendix A.1* for details):

$$\pi_{m1}^{g(g)} = \pi_{m2}^{g(g)} = \left( \frac{a + c}{4} \right)^2 - f. \quad (4)$$

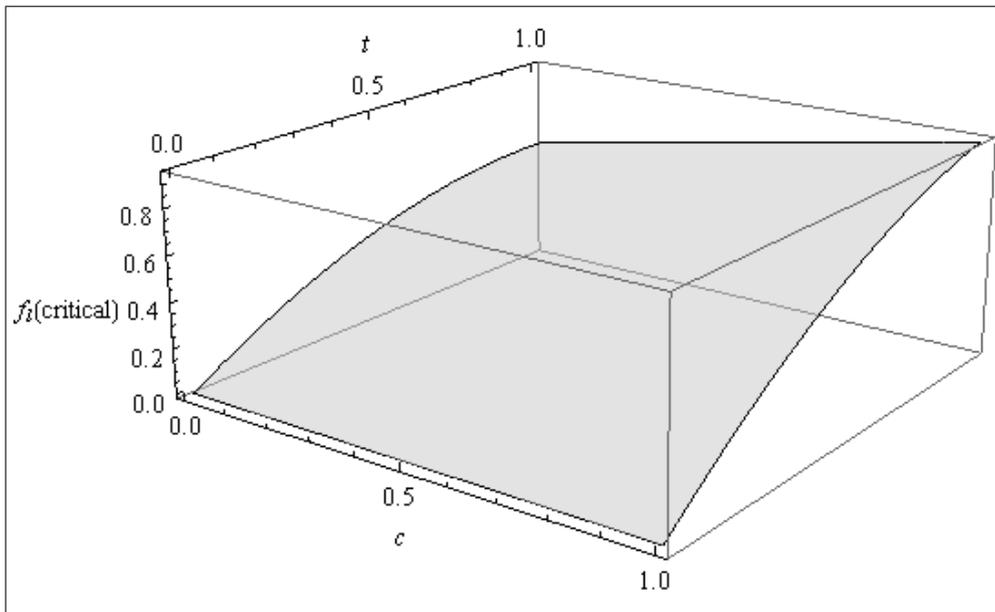
As is clear in equation (4), both multinational firms in this situation have the same competitive position—they both produce the homogenous good with zero marginal cost—and make the same profits, which decrease with the fixed greenfield cost.

Suppose that acquisition is not profitable. In such a situation, acquisition does not take place. The multinational firms sequentially choose their entry modes between trade and greenfield investment.  $\text{MNF}_1$  chooses greenfield investment, irrespective of  $\text{MNF}_2$ 's choice, if (and only if)  $\pi_{m1}^{g(t)} > \pi_{m1}^{t(t)}$  and  $\pi_{m1}^{g(g)} > \pi_{m1}^{t(g)}$ . Subsequent to  $\text{MNF}_1$ 's entry mode choice,  $\text{MNF}_2$  decides on its entry mode between greenfield investment and trade.  $\text{MNF}_2$  also chooses greenfield investment, irrespective of  $\text{MNF}_1$ 's choice, if (and only if)  $\pi_{m2}^{g(t)} > \pi_{m2}^{t(t)}$  and  $\pi_{m2}^{g(g)} > \pi_{m2}^{t(g)}$ . This leads to *Proposition 1*.

**Proposition 1** *If acquisition is not profitable, greenfield investment is both firms' dominant strategy if (and only if)  $f < f_l$ , where  $f_l = 3t(2a + 2c - 3t)/16$ . Market structure is characterized by one local firm and two multinational firms both entering the same market by undertaking greenfield investment.*

**Proof.** See Appendix A.2. ■

Figure 3 shows the critical value of the fixed greenfield cost,  $f_l$ , for the local firm's productivity,  $c$ , and the per-unit trade cost,  $t$ , between zero and one (given market size such that  $a = 3$ ).



**Figure 3** The Critical Value of the Fixed Greenfield Cost— $f_l$ .

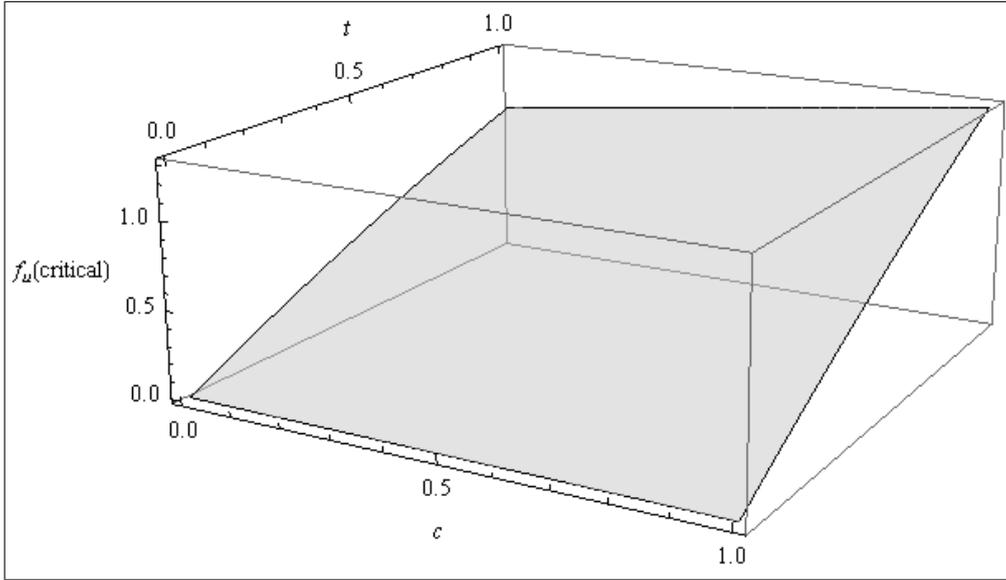
It is clear from *Figure 3* that if there is no efficiency loss due to trade, such that  $t = 0$ , it is never a dominant strategy to serve the market through greenfield investment, provided that the multinational firms have to incur positive fixed cost of investment if they undertake greenfield investment. But as the cost of serving the market through trade rises, so the maximum value of the fixed cost of investment that permits greenfield investment as a solution increases. And the less efficient is the domestic firm—the higher is  $c$ —the more likely it is that greenfield investment is a dominant strategy.

Trade can also be both multinational firms' dominant strategy. Both  $MNF_1$  and  $MNF_2$  opt for trade if (and only if)  $\pi_{m2}^{t(t)} (= \pi_{m1}^{t(t)}) > \pi_{m2}^{g(t)} (= \pi_{m1}^{g(t)})$  and  $\pi_{m2}^{t(g)} (= \pi_{m1}^{t(g)}) > \pi_{m2}^{g(g)} (= \pi_{m1}^{g(g)})$ , which leads to *Proposition 2*.

**Proposition 2** *If acquisition is not profitable, trade is both firms' dominant strategy if (and only if)  $f > f_u$ , where  $f_u = 3t(2a+2c-t)/16$ . Market structure is characterized by one local firm and two multinational firms both entering the same market by exporting.*

**Proof.** See Appendix A.2. ■

As in Figure 3, Figure 4 shows the critical value of the fixed greenfield cost,  $f_u$ , for the local firm's productivity,  $c$ , and the per-unit trade cost,  $t$ , between zero and one (given market size such that  $a = 3$ ).



**Figure 4** The Critical Value of the Fixed Greenfield Cost— $f_u$ .

Clearly, if the cost of serving the market through trade is zero, it is always a dominant strategy to serve the market through trade, provided that the fixed greenfield cost is positive. But as the cost of serving the market through trade rises, so the minimum value of the fixed cost of investment that permits trade as a solution increases. And the less efficient is the domestic firm—the higher is  $c$ —the larger is the minimum value of the fixed cost of investment that permits trade as a dominant strategy.

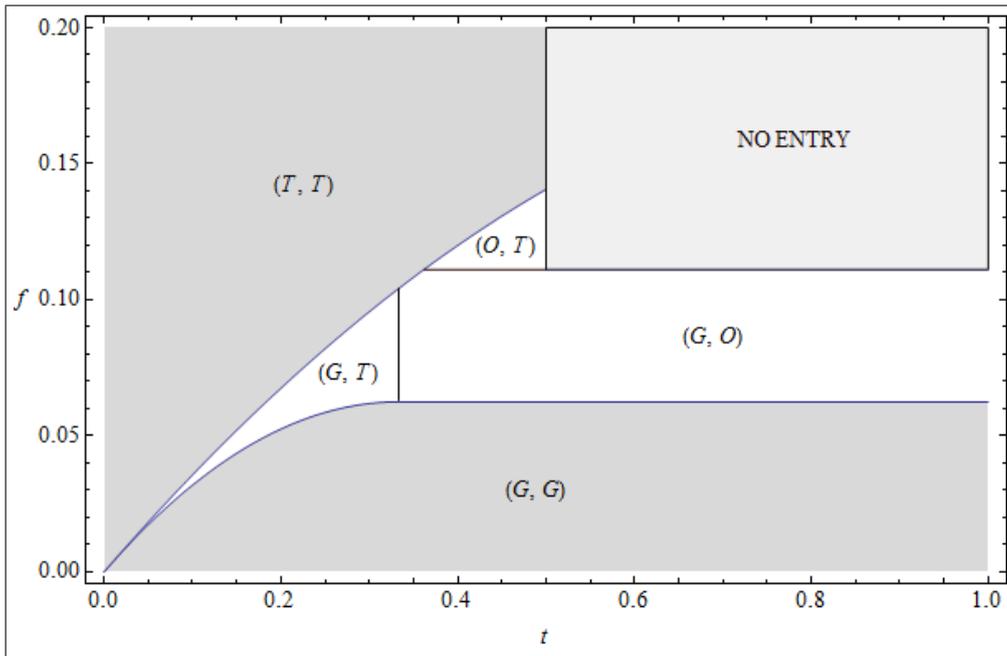
It is also possible that  $MNF_2$  exports, when  $MNF_1$  undertakes greenfield investment in equilibrium, which is the case if  $\pi_{m2}^{g(t)} > \pi_{m2}^{t(t)}$ ,  $\pi_{m2}^{g(g)} < \pi_{m2}^{t(g)}$  and  $\pi_{m1}^{g(t)} > \pi_{m1}^{t(g)}$ . This leads to *Proposition 3*.

**Proposition 3** *If acquisition is not profitable,  $MNF_1$  undertakes greenfield investment and  $MNF_2$  exports in equilibrium if (and only if)  $f_l < f < f_u$ , where  $f_l$  and  $f_u$  are given by Propositions 1 and 2, respectively. Market structure is characterized by one local firm and two multinational firms with two different types of entry.*

**Proof.** See Appendix A.2. ■

Note that in *Propositions 1, 2* and *3*, the per-unit trade cost is given, such that  $t < (a + c)/3$ , so both multinational firms prefer to enter the market and produce in equilibrium.<sup>11</sup> Furthermore, the market is large enough to accommodate three firms producing in equilibrium (i.e.,  $a > 3c$ ). If  $a < 3c$ , the local firm will not be able to make *non-negative* profits especially when the two multinational firms enter the market by undertaking greenfield investment. The reason is simple. There will be high competitive pressure on the local firm if both multinational firms enter this market by undertaking greenfield investment, and, if the market is not large enough, due to the high level of competition, it will not be profitable for the competitively disadvantaged local firm to compete against the two multinational firms.

Let the local firm produce with zero marginal cost, such that  $c = 0$ . *Figure 5* illustrates each firm's optimal entry modes in equilibrium, for the fixed greenfield cost,  $f$ , and the per-unit trade cost,  $t$ , between zero and one (given market size,  $a = 1$ ).



**Figure 5** Trade vs Greenfield Investment.

In *Figure 5*, greenfield investment, trade and staying out are represented by the letters  $G$ ,  $T$ , and  $O$ , respectively. *No entry* refers to both multinational firms staying out of this market. As in *Figure 1*, which illustrates the case where there is only one multinational firm entering the market, a high trade cost and a high fixed greenfield cost (i.e.,  $t > 1/2$  and  $f > 1/9$ , respectively) deter both firms from entering this market. If only the per-unit trade cost is sufficiently high,  $t > 1/2$ , but the fixed greenfield cost is reduced

<sup>11</sup>Depending on parameter values, further equilibria are possible, in which one multinational firm stays out of the market. For details, see *Appendix A.3*.

such that  $1/16 < f < 1/9$ , it is optimal for only one firm—namely,  $MNF_1$ , because the game is played sequentially—to enter the market. In this situation,  $MNF_2$  stays out of the market. Consequently,  $MNF_1$  prefers greenfield investment to trade as it is not profitable to export when the per-unit trade cost is so large. Moreover, given that  $t > 1/2$ ,  $MNF_2$  enters the market and undertakes greenfield investment if (and only if) the fixed greenfield cost is  $1/16$  or less.<sup>12</sup>

Once the per-unit trade cost is reduced such that  $t < 1/2$ , if the fixed greenfield cost is prohibitive, such that  $f > f_u$ , trade will be the optimal entry mode for both firms inasmuch as it will be the only entry mode yielding *positive* profits (see equations (1), (2), (3) and *Appendix A.1*). Given the fixed greenfield cost such that  $1/9 < f < f_u$ , if the per-unit trade cost is in the high range, such that  $t \in [11/30, 1/2]$ ,  $MNF_1$  stays out of the market but  $MNF_2$  opts for trade. The reason is as follows: if  $MNF_1$  chooses trade, it will be optimal for  $MNF_2$  to undertake greenfield investment, which will intensify competition in the market and will affect  $MNF_1$ 's profit negatively; since the per-unit trade cost,  $t$ , is relatively high,  $MNF_1$ 's market entry via trade—which leads  $MNF_2$  to undertake greenfield investment—will yield *negative* profits so it is dominated by the strategy of staying out. Similarly, if  $MNF_1$  undertakes greenfield investment, it will be optimal for  $MNF_2$  to stay out of the market. However, given the fixed investment cost such that  $1/9 < f < f_u$ , greenfield entry will not yield *non-negative* profits unless the rival multinational firm enters the market by exporting. Consequently,  $MNF_1$  will opt to stay out which will lead  $MNF_2$  to enter the market by exporting so as to make *positive* profits. Clearly, the first-moving firm is in a disadvantageous position in such a situation.

As illustrated by *Figure 5*, if I do not distinguish between greenfield investment and acquisition—as in traditional models of trade—I would have expected reductions in per-unit trade cost to lead multinational firms to export, given that the fixed investment cost is high (i.e.,  $f > 1/9$ ). But, I cannot neglect the fact that the establishment of a foreign subsidiary may also take place as an acquisition of an existing firm, especially given the fact that most FDI takes place through mergers and acquisitions rather than greenfield investment. Therefore, in the following sections I incorporate acquisition into the analysis.

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<sup>12</sup>More generally, let  $n$  denote the total number of firms having already entered this market by undertaking greenfield investment. Therefore, there are in total  $(n + 1)$  firms in the market (i.e., one incumbent firm and  $n$  foreign firms, where  $n = 1, \dots, N$ ). In this situation, the  $(N + 1)^{th}$  firm's greenfield entry yields *positive* profits if (and only if)  $f < (a + c)^2 / (n + 3)^2$ . Otherwise, it yields *non-positive* profits.

## 3.2 Acquisition

In this section, I scrutinize the situation in which acquisition is profitable and  $MNF_1$  acquires the local firm. When  $MNF_1$  acquires the local firm, the market structure will change as there will be only two multinational firms competing *à la* Cournot in the market. Let  $\pi_{m2}^{t(a)}$  and  $\pi_{m2}^{g(a)}$  denote  $MNF_2$ 's profit when it enters the market by exporting and by undertaking greenfield investment, respectively, given that  $MNF_1$  has acquired the local firm. Equations (5) and (6) give  $\pi_{m2}^{t(a)}$  and  $\pi_{m2}^{g(a)}$ , respectively (see *Appendix A.1* for details):

$$\pi_{m2}^{t(a)} = \left( \frac{a - 2t}{3} \right)^2, \quad (5)$$

$$\pi_{m2}^{g(a)} = \left( \frac{a}{3} \right)^2 - f. \quad (6)$$

Greenfield entry is  $MNF_2$ 's best response if (and only if)  $\pi_{m2}^{g(a)} > \pi_{m2}^{t(a)}$ . Otherwise,  $MNF_2$  opts for trade. This leads to *Proposition 4*.

**Proposition 4** *When acquisition is profitable and  $MNF_1$  acquires the local firm,  $MNF_2$  undertakes greenfield investment if (and only if)  $f < \tilde{f}$  where  $\tilde{f} = 4t(a - t)/9$ . Otherwise, it exports.*

**Proof.** See *Appendix A.2*. ■

*Proposition 4* assumes that both trade and greenfield investment yield *positive* profits, so  $MNF_2$  decides on the entry mode which yields the highest profit. However, if the per-unit trade cost is sufficiently high, such that  $t > a/2$ , trade will not yield *non-negative* profits; consequently,  $MNF_2$  will enter the market only if it can earn *non-negative* profits by undertaking greenfield investment (i.e.,  $f < a^2/9$ ; see equations (5) and (6)). If neither entry mode yields *non-negative* profits—if the per-unit trade cost and the fixed greenfield cost are both sufficiently high such that  $t > a/2$  and  $f > a^2/9$ , respectively— $MNF_2$  will stay out of the market.

I now turn to the first stage of the game where  $MNF_1$  offers an acquisition price to the local firm. Let  $\pi_{m1}^{a(g)}$  and  $\pi_{m1}^{a(t)}$  denote  $MNF_1$ 's profit when it acquires the local firm and when the rival multinational firm undertakes greenfield investment or exports, respectively. Equations (7) and (8) give  $\pi_{m1}^{a(g)}$  and  $\pi_{m1}^{a(t)}$ , respectively (see *Appendix A.1* for details):

$$\pi_{m1}^{a(g)} = \left( \frac{a}{3} \right)^2 - \Omega, \quad (7)$$

$$\pi_{m1}^{a(t)} = \left( \frac{a+t}{3} \right)^2 - \Omega. \quad (8)$$

Clearly, acquisition is profitable if (and only if) the acquisition price,  $\Omega$ , is less than  $\text{MNF}_1$ 's operating profits, which are given by equations (7) and (8). Furthermore, the operating profit given by equation (7) is less than the operating profit given by equation (8). The reason is that the market will be more competitive if  $\text{MNF}_2$  undertakes greenfield investment subsequent to  $\text{MNF}_1$  acquiring the local firm. Given that  $\text{MNF}_1$  acquires the local firm, if  $\text{MNF}_2$ , however, prefers trade to greenfield investment,  $\text{MNF}_1$  will have a competitive advantage over  $\text{MNF}_2$  due to  $\text{MNF}_2$ 's efficiency loss. In particular, acquisition will allow  $\text{MNF}_1$  to produce with zero marginal cost, whereas  $\text{MNF}_2$ 's marginal cost of production will increase by the per-unit trade cost.

In equilibrium,  $\text{MNF}_1$  offers an acquisition price that makes the local firm indifferent between acceptance and rejection. The local firm will be indifferent between acceptance and rejection of  $\text{MNF}_1$ 's acquisition offer when the acquisition price,  $\Omega$ —the local firm's profit if it accepts the offer—is equal to its profit if it rejects the offer, that is the local firm's profit in the case that no acquisition takes place. Note that the local firm's profit given rejection is determined by the two multinational firms' optimal entry modes when no acquisition takes place. Let all firms produce in equilibrium, and  $\pi_1^{g/g}$ ,  $\pi_1^{g/t}$  and  $\pi_1^{t/t}$  denote the local firm's profits when no acquisition takes place, that is,  $\pi_1^{g/g}$  when both multinational firms undertake greenfield investment, in equilibrium,  $\pi_1^{g/t}$  when one multinational firm undertakes greenfield investment and the other multinational firm exports, in equilibrium, and  $\pi_1^{t/t}$  when both multinational firms export in equilibrium. The local firm's profits,  $\pi_1^{g/g}$ ,  $\pi_1^{g/t}$  and  $\pi_1^{t/t}$  are given by equations (9), (10) and (11), respectively (see *Appendix A.1* for details):

$$\pi_1^{g/g} = \left( \frac{a-3c}{4} \right)^2, \quad (9)$$

$$\pi_1^{g/t} = \left( \frac{a-3c+t}{4} \right)^2, \quad (10)$$

$$\pi_1^{t/t} = \left( \frac{a-3c+2t}{4} \right)^2. \quad (11)$$

Note that if the market is sufficiently large, such that  $a > 3c$ , the local firm will earn *non-negative* profits in the case that no acquisition takes place (see equations (9), (10) and (11)). Consequently, the local firm will not accept any acquisition offer less than its rejection profits given by equations (9), (10) and (11).

There is an indirect relationship between the fixed greenfield cost,  $f$ , and the cost of acquiring the local firm,  $\Omega$ . If  $f$  is sufficiently low, such that  $f < f_l$ , there will be fierce competition in the market—provided that no acquisition takes place—as both multinational firms will undertake greenfield investment in equilibrium. Under such a high level of competitive pressure, the local firm’s profitability—rejection profit—will be low, and so will the acquisition price,  $\Omega$  (see equation (9)). Similarly, if  $f$  is sufficiently high, such that  $f > f_u$ , the level of competitive pressure will be low—provided that no acquisition takes place—as both multinational firms will export in equilibrium. The higher the per-unit trade cost—the larger the multinational firms’ efficiency loss—the lower the level of competitive pressure on the local firm and the higher the local firm’s profitability. In this situation, the acquisition price will be higher (see equation (11)). Furthermore, given the fixed cost of investment,  $f$ , the acquisition price,  $\Omega$ , increases with market size,  $a$ , and decreases with the local firm’s marginal cost of production,  $c$  (see equations (9), (10) and (11)). The larger is the market and the more efficient is the local firm—the more profitable is the local firm—the higher is the local firm’s reservation acquisition price.

## 4 Equilibrium market structures

An MNF’s *post-entry* profit depends on its entry mode choice as well as on the entry mode chosen by the other firm entering the same market. There are basically two effects leading multinational firms to their optimal entry modes: a *market-structure* effect and a *cost-saving* effect. In the following sections, I first delineate the *market-structure* effect and *cost-saving* effect, and then scrutinize the multinational firms’ entry modes in equilibrium.

### 4.1 The market-structure effect

The *market-structure* effect is the ensuing level of competition in the market subsequent to both MNFs’ choice of their entry modes. In particular, I define the *market-structure* effect as follows:

**Definition 1** *The market-structure effect is the change in the multinational firm’s operating profit when it acquires the local firm instead of undertaking greenfield investment, provided that greenfield investment is the multinational firm’s optimal entry mode when acquisition does not take place, or instead of exporting, provided that trade is the multinational firm’s optimal entry mode when acquisition does not take place.*

Let  $\Delta_{ms}$  denote the *market-structure* effect, the change in  $\text{MNF}_1$ 's operating profit. If  $\text{MNF}_1$  acquires the local firm, its operating profit will be  $a^2/9$ , given the fixed greenfield cost such that  $f < \tilde{f}$ , or  $(a+t)^2/9$ , given the fixed greenfield cost such that  $f > \tilde{f}$ .<sup>13</sup> Furthermore, in the case that acquisition does not take place, both multinational firms will undertake greenfield investment if  $f < f_l$  (see *Proposition 1*), so  $\text{MNF}_1$ 's operating profit will be  $(a+c)^2/16$  (see equation (4));  $\text{MNF}_1$  will undertake greenfield investment, but  $\text{MNF}_2$  will export if  $f_l < f < f_u$  (see *Proposition 3*), so  $\text{MNF}_1$ 's operating profit will be  $(a+c+t)^2/16$  (see equation (3)); or, both multinational firms will export if  $f > f_u$  (see *Proposition 2*), so  $\text{MNF}_1$ 's operating profit will be  $(a+c-2t)^2/16$  (see equation (1)). *Table 1* summarizes the *market-structure* effect in equilibrium for all possible cases.

In *Table 1*, the market is sufficiently large such that  $a > 3c$  so the local firm will produce, in equilibrium, irrespective of the multinational firms' entry modes.<sup>14</sup> Furthermore, in *Table 1*, the per-unit trade cost is given such that  $t < (a+c)/3$ , which guarantees that neither multinational firm can deter its rival from entering the market (see *Appendix A.3* for details).

In *Table 1*, the *market-structure* effect,  $\Delta_{ms}$ , is positive for all cases, except for the third case, where  $\Delta_{ms}$  is positive if the market is larger such that  $a > 3(c+t)$ , or negative if otherwise. The intuition is as follows. In the third case,  $\text{MNF}_1$ 's and  $\text{MNF}_2$ 's outside options are greenfield investment and trade, respectively, so  $\text{MNF}_1$  will have a competitive advantage over  $\text{MNF}_2$  if it does not acquire the local firm. However, if  $\text{MNF}_1$  acquires the local firm and reduces competition in the market,  $\text{MNF}_2$  will undertake greenfield investment and, consequently,  $\text{MNF}_1$  will have no competitive advantage over  $\text{MNF}_2$ . Therefore,  $\text{MNF}_1$ 's acquisition (operating) profit will be more than the greenfield (operating) profit if (and only if) market size,  $a$ , is large enough to compensate for forgone competitive advantage.

In all cases presented in *Table 1*, the *market-structure* effect,  $\Delta_{ms}$ , increases with market size,  $a$  (see *Table 6* in *Appendix A.4*). The reason is that a multinational firm's

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<sup>13</sup>When  $\text{MNF}_1$  acquires the local firm,  $\text{MNF}_2$ 's best response is to undertake greenfield investment, in equilibrium, given the fixed greenfield cost such that  $f < \tilde{f}$  (see *Proposition 4*). In this situation,  $\text{MNF}_1$ 's operating profit will be  $a^2/9$  (see equation (7)). Furthermore, given the fixed greenfield cost such that  $f > \tilde{f}$ , it is optimal for  $\text{MNF}_2$  to export in equilibrium (see *Proposition 4*). In such a situation,  $\text{MNF}_1$ 's operating profit will be  $(a+t)^2/9$  (see equation (8)).

<sup>14</sup>As discussed in *Section 3.1*, if the market is not sufficiently large, such that  $a < 3c$ , the local firm may have to exit the market when the multinational firms enter via their alternative entry modes. In such a situation, the acquisition price will be zero and the result will be trivial, such that  $\text{MNF}_1$  will prefer to acquire the local firm for free. Consequently, the arguments in this section will be pointless.

**Table 1** The Market-Structure Effect in Equilibrium,  $\Delta_{ms}$

$f$	:	$\Delta_{ms}$
$f < \tilde{f}$ and $f < f_l < f_u$	:	$= \frac{a^2}{9} - \frac{(a+c)^2}{16} = \frac{(a-3c)(7a+3c)}{144}$
$f > \tilde{f}$ and $f < f_l < f_u$	:	$= \frac{(a+t)^2}{9} - \frac{(a+c)^2}{16} = \frac{(a-3c+4t)(7a+3c+4t)}{144}$
$f < \tilde{f}$ and $f_l < f < f_u$	:	$= \frac{a^2}{9} - \frac{(a+c+t)^2}{16} = \frac{(a-3c-3t)(7a+3c+3t)}{144}$
$f > \tilde{f}$ and $f_l < f < f_u$	:	$= \frac{(a+t)^2}{9} - \frac{(a+c+t)^2}{16} = \frac{(a-3c+t)(7a+3c+7t)}{144}$
$f < \tilde{f}$ and $f_l < f_u < f$	:	$= \frac{a^2}{9} - \frac{(a+c-2t)^2}{16} = \frac{(a-3c+6t)(7a+3c-6t)}{144}$
$f > \tilde{f}$ and $f_l < f_u < f$	:	$= \frac{(a+t)^2}{9} - \frac{(a+c-2t)^2}{16} = \frac{(a-3c+10t)(7a+3c-2t)}{144}$

operating profit, when there is reduction in competition, increases with market size,  $a$ , by more than the increase in its operating profit when there is no reduction in competition. Furthermore, the *market-structure* effect,  $\Delta_{ms}$ , decreases with the local firm's production cost,  $c$  (see *Table 5* in *Appendix A.4*). The less efficient is the local firm—the higher is  $c$ —the larger is the multinational firm's profitability when the multinational firm does not acquire the local firm but enters via its alternative entry mode, trade or greenfield investment. The intuition is that the multinational firm will have a large competitive advantage over the local firm if the local firm is less efficient, so the multinational firm's profit will be larger if it competes against the less efficient local firm.

The impact of the per-unit trade cost,  $t$ , on the *market-structure* effect,  $\Delta_{ms}$ , varies across the cases presented in *Table 1*. In particular, the per-unit trade cost,  $t$ , will have a *non-negative* impact on the *market-structure* effect,  $\Delta_{ms}$ , if the fixed greenfield cost,  $f$ , is sufficiently low, such that  $f < f_l < f_u$ , or sufficiently high, such that  $f_l < f_u < f$  (see *Table 7* in *Appendix A.4*). If the fixed greenfield cost is, however, such that  $f_l < f < f_u$ , the *market-structure* effect,  $\Delta_{ms}$ , may increase or decrease.

More specifically, the per-unit trade cost,  $t$ , will have a zero impact on the *market-structure* effect,  $\Delta_{ms}$ , if the fixed greenfield cost,  $f$ , is such that MNF<sub>2</sub> undertakes greenfield investment when MNF<sub>1</sub> acquires the local firm (i.e.,  $f < \tilde{f}$ ), and that both multinational firms undertake greenfield investment when acquisition does not take place (i.e.,  $f < f_l < f_u$ ). Clearly, in such a situation, trade is not the best response of either multinational firm, at any stage; therefore, the per-unit trade cost,  $t$ , does not pertain to either multinational firm's optimal behavior in equilibrium (see the first case in *Table 1*). If, however, the fixed greenfield cost,  $f$  leads MNF<sub>2</sub> to export subsequent to MNF<sub>1</sub> acquiring the local firm (i.e.,  $f > \tilde{f}$ ), then MNF<sub>1</sub> will have a competitive advantage over MNF<sub>2</sub>, so MNF<sub>1</sub>'s acquisition (operating) profit will increase with the per-unit trade cost (see equation (8)). Given the fixed greenfield cost such that  $f < f_l < f_u$ , the higher is the per-unit trade cost—the larger is MNF<sub>1</sub>'s acquisition (operating) profit, and no change in the profitability of its alternative entry mode—the larger is the *market-structure* effect,  $\Delta_{ms}$  (see the second case in *Table 1*).

Similarly, if the fixed greenfield cost,  $f$ , is sufficiently high, such that  $f_l < f_u < f$ , the *market-structure* effect,  $\Delta_{ms}$ , will increase with the per-unit trade cost,  $t$ . The intuition is as follows: first, in this situation, trade is both multinational firms' dominant strategy when acquisition does not take place (see *Proposition 2*); second, both multinational firms' trade profit decreases with the per-unit trade cost,  $t$  (see equation (1)); and, third, MNF<sub>1</sub> can prevent the efficiency loss by acquiring the local firm, so the

relative profitability of acquisition increases. Furthermore, if trade is MNF<sub>2</sub>'s best response when MNF<sub>1</sub> acquires the local firm (i.e.,  $f > \tilde{f}$ ), then the change in MNF<sub>1</sub>'s operating profit,  $\Delta_{ms}$ , will be even higher. The higher is the per-unit trade cost—the larger is the efficiency loss—the larger is MNF<sub>1</sub>'s benefit from preferring acquisition to trade.

By contrast, given the fixed greenfield cost such that  $f_l < f < f_u$  (i.e., MNF<sub>1</sub> will undertake greenfield investment and MNF<sub>2</sub> will export in the case that acquisition does not take place), then the *market-structure* effect,  $\Delta_{ms}$ , decreases with the per-unit trade cost,  $t$ , if acquisition leads MNF<sub>2</sub> to undertake greenfield investment (i.e.,  $f < \tilde{f}$ ), or increases with  $t$  if export is still MNF<sub>2</sub>'s optimal entry mode subsequent to MNF<sub>1</sub> acquiring the local firm (i.e.,  $f > \tilde{f}$ ). The reason is that, in the former case, the per-unit trade cost,  $t$ , will have a zero impact on MNF<sub>1</sub>'s acquisition (operating) profit, insofar as MNF<sub>2</sub> will prefer greenfield investment to trade when MNF<sub>1</sub> acquires the local firm, but MNF<sub>1</sub>'s profitability with its alternative entry mode, *greenfield investment*, increases with  $t$ , so the relative profitability of acquisition,  $\Delta_{ms}$ , will decrease with  $t$ . However, in the latter case, MNF<sub>1</sub>'s acquisition (operating) and greenfield (operating) profits will both increase with  $t$ , but the former will increase by more than the latter due to the reduction in competition. Therefore, the *market-structure* effect,  $\Delta_{ms}$ , will increase with  $t$ .

## 4.2 The cost-saving effect

A multinational firm can save the cost of a particular entry mode—the cost which does not influence the multinational firm's operating profit, but reduces the overall profitability of the entry mode—by choosing an alternative entry mode. Therefore, the *cost-saving* effect is determined by the cost of an entry mode relative to the cost of other available entry modes. In particular, I define the *cost-saving* effect as follows:

**Definition 2** *The cost-saving effect is the change in the market entry cost when the multinational firm acquires the local firm instead of undertaking greenfield investment, provided that greenfield investment is the multinational firm's optimal entry mode when acquisition does not take place, or instead of exporting, provided that trade is the multinational firm's optimal entry mode when acquisition does not take place.*

Let  $\Delta_{cs}$  denote the *cost-saving* effect, the change in MNF<sub>1</sub>'s market entry cost. If MNF<sub>1</sub> acquires the local firm, it has to pay an acquisition price,  $\Omega$ , which constitutes the sole cost of acquisition. Given the fixed greenfield cost,  $f$ , such that  $f < f_u$ , greenfield investment is MNF<sub>1</sub>'s outside option (see *Propositions 1* and *3*). In such a

situation,  $MNF_1$  can save the fixed greenfield cost,  $f$ , by acquiring the local firm. If  $MNF_1$  acquires the local firm instead of undertaking greenfield investment, the *cost-saving* effect,  $\Delta_{cs}$ , will be the difference between the fixed greenfield cost,  $f$ , and the acquisition price,  $\Omega$ , (i.e.,  $\Delta_{cs} = f - \Omega$ ).

Given the fixed investment cost such that  $f < f_u$ ,  $\Delta_{cs}$  is positive—an incentive to acquire the local firm—if greenfield investment requires a fixed investment cost larger than the acquisition price in equilibrium (i.e.,  $\Delta_{cs} > 0 \iff f > \Omega$ ), or negative—a disincentive to acquire the local firm—if otherwise. Note that  $\Omega$  is equal to  $(a - 3c)^2 / 16$  if  $f < f_l$ , or  $(a - 3c + t)^2 / 16$  if  $f_l < f < f_u$  (see *Section 3.2*, and equations (9) and (10), respectively).

If the fixed investment cost,  $f$ , is sufficiently high, such that  $f > f_u$ , then  $MNF_1$ 's outside option will be trade. In this situation, there will be no fixed market entry cost to save; therefore, the *cost-saving* effect,  $\Delta_{cs}$ , will eventually be negative, and hence a disincentive to acquire the local firm. Moreover, the larger is the per-unit trade cost—the bigger is the efficiency loss—the larger is the cost of acquiring the local firm,  $\Omega$  (see *Section 3.2* and equation (11)). I shall note that, in such a situation, the per-unit trade cost (the efficiency loss due to exporting) is an incentive for  $MNF_1$  to acquire the local firm, but this incentive has already been discussed as it is embedded in the *market-structure* effect. *Table 2* summarizes the *cost-saving* effect,  $\Delta_{cs}$ , in equilibrium.

**Table 2** The Cost-Saving Effect in Equilibrium,  $\Delta_{cs}$

$f$	:	$\Delta_{cs}$
$f < f_l < f_u$	:	$f - (a - 3c)^2 / 16$
$f_l < f < f_u$	:	$f - (a - 3c + t)^2 / 16$
$f_l < f_u < f$	:	$0 - (a - 3c + 2t)^2 / 16$

In *Table 2*, the *cost-saving* effect,  $\Delta_{cs}$ , decreases with market size,  $a$ , and increases with the local firm's marginal cost of production,  $c$ . The reason is simple: in larger markets, the local firm's profit will be high, and even higher if its marginal cost of production is low, therefore, its reservation acquisition price will be high.

### 4.3 Entry modes in equilibrium

In the previous sections, I first demonstrated how multinational firms choose between trade and greenfield investment, provided that acquisition is not profitable. Then, I delineated the case where acquisition is profitable, and  $MNF_1$  acquires the local firm

in the first stage. However, I have not yet determined whether  $MNF_1$ , indeed, acquires the local firm in the first stage. Hence, in this section I turn to the first stage of the game where  $MNF_1$  decides whether acquisition is more profitable than the alternative entry modes, trade or greenfield investment.

The *market-structure* effect and the *cost-saving* effect together, denoted by  $\Delta$ , constitute the *overall* gain from preferring acquisition to an alternative entry mode (i.e.,  $\Delta = \Delta_{ms} + \Delta_{cs}$ ). Table 3 follows from Tables 1 and 2, and presents the *overall* gain. If the *overall* gain,  $\Delta$ , is *positive*,  $MNF_1$  prefers to acquire the local firm, but if it is *negative*,  $MNF_1$  opts for the alternative entry mode. As in Tables 1 and 2, in Table 3, the per-unit trade cost is such that  $t < (a + c)/3$ ; therefore, all firms produce in equilibrium.

**Table 3** The Overall Gain,  $\Delta$

$f$	:	$\Delta$
$f < \tilde{f}$ and $f < f_l < f_u$	:	$f - (a - 15c)(a - 3c)/72$
$f > \tilde{f}$ and $f < f_l < f_u$	:	$f - [(a - 15c)(a - 3c) + 8t(2a + t)]/72$
$f < \tilde{f}$ and $f_l < f < f_u$	:	$f - [(a - 15c)(a - 3c) + 9t(2a - 2c + t)]/72$
$f > \tilde{f}$ and $f_l < f < f_u$	:	$f - (a - 15c + t)(a - 3c + t)/72$
$f < \tilde{f}$ and $f_l < f_u < f$	:	$0 - [(a - 15c)(a - 3c) - 36t(2c - t)]/72$
$f > \tilde{f}$ and $f_l < f_u < f$	:	$0 - [(a - 15c)(a - 3c) - 4t(4a + 18c - 7t)]/72$

Table 3 indicates that any pair of entry modes, which are specified by Propositions (1)-(4) may exist in equilibrium, and that the multinational firms select their optimal entry modes in equilibrium depending on the fixed cost of investment,  $f$ , the per-unit trade cost,  $t$ , market size,  $a$ , and the local firm's marginal cost,  $c$ .<sup>15</sup>

<sup>15</sup>Given the per-unit trade cost,  $t$ , such that  $t < (a + c)/3$ , if the *overall* gain,  $\Delta$ , is positive,  $MNF_1$  acquires the local firm, followed by  $MNF_2$  choosing between trade and greenfield investment.  $MNF_2$ 's choice depends on the fixed greenfield cost as well as the maximum value of the fixed investment cost,  $\tilde{f}$ —which is a function of market size,  $a$ , and the per-unit trade cost,  $t$ —that permits greenfield entry as  $MNF_2$ 's best response (see Proposition 4). Consequently, either (*acquisition, trade*) or (*acquisition, greenfield*) will be the pair of equilibrium entry modes. However, if  $\Delta$  is negative,  $MNF_1$  does not acquire the local firm, but chooses between trade and greenfield investment. Given the fixed greenfield cost,  $f$ , the maximum (minimum) value of the fixed cost of investment—which is a function of market size,  $a$ , the local firm's marginal cost,  $c$ , and the per-unit trade cost,  $t$ —that permits greenfield investment (trade) as a solution will determine the multinational firms' equilibrium entry modes; (*greenfield, greenfield*), (*greenfield, trade*) or (*trade, trade*) (see Propositions (1)-(3)).

For instance, if the ratio between market size,  $a$ , and the local firm's marginal cost,  $c$ , is such that  $a/c < 5$ , irrespective of the fixed greenfield cost,  $f$ ,  $MNF_1$  always acquires the local firm, provided that  $a > 3c$  and  $t < (a + c)/3$ .<sup>16</sup> The intuition is that, in such a situation, it is less costly to acquire the local firm and reduce competition, whereas it is more costly to increase competition in the market. More importantly, the gain from reducing competition is sufficient to compensate for its relative cost.

How do the multinational firms behave if the market is larger, or if the local firm is stronger, such that  $a > 5c$ ? Or, even  $a > 15c$  (see *Table 3*)? To illustrate these situations, let the local firm produce with zero marginal cost (i.e.,  $c = 0$ ), and let market size,  $a = 1$ .<sup>17</sup> *Table 4* presents the *market-structure* effect, the *cost-saving* effect and  $MNF_1$ 's *overall* gain from preferring acquisition to an alternative entry mode—for this particular parameter space—for all possible cases.

Note that *Table 4* assumes that all firms produce in equilibrium (i.e.,  $t < 1/3$ ). Therefore, I first focus on *Table 4* so as to delineate this situation, then, I move on to scrutinize the implications of higher per-unit trade costs (i.e.,  $t > 1/3$ ) so as to complete the analysis. According to *Table 4*, in the first case, where  $f < \tilde{f}$  and  $f < f_l < f_u$ , the *overall* gain,  $\Delta$ , is *negative* if the fixed greenfield cost is sufficiently low (i.e.,  $f < 1/72$ ); therefore,  $MNF_1$  does not acquire the local firm, but undertakes greenfield investment, followed by  $MNF_2$  undertaking greenfield investment in equilibrium (see *Proposition 1*). However,  $\Delta$  is *positive* if  $f > 1/72$ , which leads  $MNF_1$  to acquire the local firm, and  $MNF_2$  to undertake greenfield investment (see *Proposition 4*). The intuition is as follows. First,  $MNF_2$  undertakes greenfield investment, irrespective of  $MNF_1$ 's entry mode choice, so both multinational firms will eventually have the same competitive position. Second, acquisition is more costly than greenfield investment, so the *cost-saving* effect is *negative*. Third, if the fixed investment cost is sufficiently low such that  $f < 1/72$ —the relative cost of acquiring the local firm is sufficiently high—then  $MNF_1$ 's loss will be more than its benefit from competing against one less firm.

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<sup>16</sup>In particular,  $a < 5c$  is not a necessary but is a sufficient condition that leads  $MNF_1$  to acquire the local firm, irrespective of the fixed cost of investment and per-unit trade cost (see *Table 3*). Consequently, in equilibrium,  $MNF_1$  acquires the local firm and  $MNF_2$  undertakes greenfield investment if  $f < \tilde{f}$ , or exports if otherwise (see *Proposition 4*).

<sup>17</sup>This case is of particular interest as it simplifies the analysis and provides clearer results. It provides useful insights as it indicates how the multinational firms behave even in the worst case scenario in which the local rival is as competitive as the multinational firms. I have already noted that the weaker is the local firm—the higher is  $c$ —the more likely it is that the multinational firms move towards acquiring the local firm.

**Table 4** The Overall Gain,  $\Delta$ : An Illustration for  $a = 1, c = 0$

$f$	:	$\Delta_{ms}$	+	$\Delta_{cs}$	=	$\Delta$
$f < \tilde{f}$ and $f < f_i < f_u$	:	$\frac{7}{144}$	+	$f$	=	$f - \frac{1}{16}$
$f > \tilde{f}$ and $f < f_i < f_u^*$	:	$\frac{(1+4t)(7+4t)}{144}$	+	$f$	=	$f - \frac{(1-8t)(2+t)}{72}$
$f < \tilde{f}$ and $f_i < f < f_u$	:	$\frac{(1-3t)(7+3t)}{144}$	+	$f$	=	$f - \frac{(1+t)^2}{16}$
$f > \tilde{f}$ and $f_i < f < f_u$	:	$\frac{(1+t)(7+7t)}{144}$	+	$f$	=	$f - \frac{(1+t)^2}{16}$
$f < \tilde{f}$ and $f_i < f_u < f$	:	$\frac{(1+6t)(7-6t)}{144}$	+	$0$	=	$0 - \frac{(1+2t)^2}{16}$
$f > \tilde{f}$ and $f_i < f_u < f$	:	$\frac{(1+10t)(7-2t)}{144}$	+	$0$	=	$0 - \frac{(1+t)^2(1-14t)}{16}$

\* Given  $a = 1$  and  $c = 0$ , the case  $\tilde{f} < f < f_i$  is not possible as  $\tilde{f} = \frac{4}{9}(1-t)t > f_i = \frac{2}{16}(2-3t)t$  for any  $t$ . Consequently, we can disregard this case for the current parameter space.

In the third case, where  $f < \tilde{f}$  and  $f_l < f < f_u$ , the *overall* gain,  $\Delta$ , is negative so MNF<sub>1</sub> undertakes greenfield investment and MNF<sub>2</sub> exports in equilibrium (see *Proposition 3*).<sup>18</sup> However, in the fourth case, where  $f > \tilde{f}$  and  $f_l < f < f_u$ , the *overall* gain is *positive* so MNF<sub>1</sub> acquires the local firm, and MNF<sub>2</sub> exports in equilibrium (see *Proposition 4*).<sup>19</sup> The only distinction between the third and fourth case is the rival multinational firm's behavior. In the third case, MNF<sub>2</sub> exports if MNF<sub>1</sub> undertakes greenfield investment, but it undertakes greenfield investment if MNF<sub>1</sub> acquires the local firm, as acquisition reduces competition in the market. Therefore, MNF<sub>1</sub> will lose its competitive advantage over MNF<sub>2</sub> if it acquires the local firm in this case. However, in the fourth case, MNF<sub>2</sub> exports, irrespective of MNF<sub>1</sub>'s entry mode choice, so MNF<sub>1</sub> retains its competitive advantage even if it acquires the local firm.

If the fixed greenfield cost is such that  $f < \tilde{f}$  and  $f_l < f_u < f$ , then acquisition does not take place as the *overall* gain is obviously *negative* (see the fifth case in *Table 4*). Consequently, both multinational firms export in equilibrium (see *Proposition 2*). However, if the fixed greenfield cost is such that  $f > \tilde{f}$  and  $f_l < f_u < f$ , which is the last case in *Table 4*, then the *overall* gain is clearly *negative* for sufficiently low levels of the per-unit trade cost such that  $t < 1/14$ , so both multinational firms export in equilibrium, whereas the *overall* gain is *positive* for  $t > 1/14$ , which leads MNF<sub>1</sub> to acquire the local firm and MNF<sub>2</sub> to export in equilibrium.

*Figure 6* illustrates the equilibrium entry modes, for the fixed greenfield cost,  $f$ , and the per-unit trade cost,  $t$ , between zero and one (given market size  $a = 1$  and the local firm's marginal cost  $c = 0$ ). In *Figure 6*—as in *Figure 5*— $T$ ,  $G$  and  $O$  represent trade, greenfield investment and staying out, respectively. Furthermore,  $A$  represents acquisition, and *No Entry* means that both multinational firms stay out of the market.

*Figure 6* indicates that a sufficiently high per-unit trade cost (i.e.,  $t > 1/2$ ) and fixed investment cost (i.e.,  $f > 1/9$ ) deter both multinational firms from entering the market. In particular, when the per-unit trade cost is sufficiently high, such that  $t > 1/2$ , trade yields *negative* profits, and so it is dominated by the strategy of staying out. Similarly, if the fixed investment cost is sufficiently high as well, such that  $f > 1/9$ , greenfield investment yields *negative* profits as well, unless the rival exports, but

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<sup>18</sup>In this case, it is straightforward to show that  $f_u < \tilde{f}$  for  $t \leq 10/37$ , and that  $f_u > \tilde{f}$  for  $t > 10/37$ . In either situation, the *overall* gain is *negative* because  $f_u$  is the upper limit of the fixed greenfield cost,  $f$ , if  $t \leq 10/37$ , where  $f < f_u < (1 + 9t(2 + t))/72$ , or  $\tilde{f}$  is the upper limit of the fixed greenfield cost,  $f$ , if  $t > 10/37$ , where  $f < \tilde{f} < (1 + 9t(2 + t))/72$ .

<sup>19</sup>In this case, the per-unit trade cost  $t > 10/37$  as  $\tilde{f} < f < f_u$  (i.e.,  $\tilde{f} < f_u \iff t > 10/37$ ). It is straightforward to show that the lower limit of the fixed greenfield cost  $\tilde{f} > (1 + t)^2/72$  for  $t > 10/37$ .

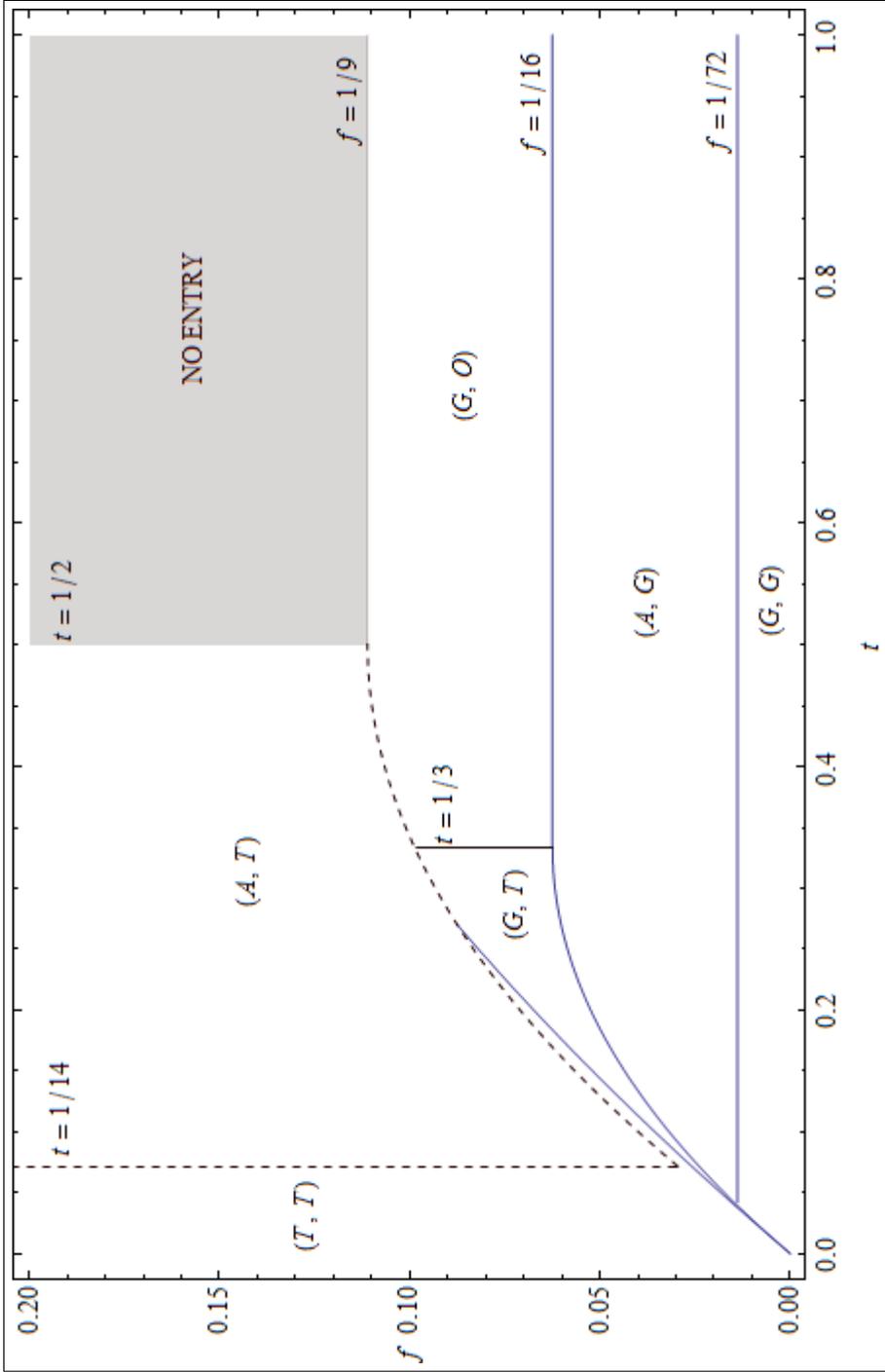


Figure 6 Equilibrium entry modes.

the rival does not export as trade is dominated by staying out. Therefore, greenfield investment is also dominated by staying out. There is only one option left, which is acquiring the local firm. Only one firm,  $MNF_1$ , can enter the market by acquiring the local firm—the other firm,  $MNF_2$ , will eventually stay out—as there is only one local firm in the market, so the local firm does not accept any offer below its monopoly profit, which is in fact the multinational firms' monopoly profit, given that all firms produce with zero marginal cost. Consequently, acquisition yields zero profit which is exactly what a multinational firm can get by staying out of the market. Nonetheless, a multinational firm may still want to acquire the local firm and make zero profit in such a situation.

By contrast, if the local firm is less efficient than the foreign firm, such that  $c > 0$ ,  $MNF_1$ 's monopoly profit will be larger than the local firm's monopoly profit (i.e.,  $a^2/4 > (a - c)^2/4$ ). Therefore, the foreign firm can make *positive* profits by acquiring the local firm—when greenfield entry and trade are both not profitable—as, in such a situation,  $MNF_1$  is able to afford to pay the local firm's monopoly profit because of the foreign firm's higher monopoly profit.

Moreover, in the case that neither multinational firm enters the market (i.e.,  $t > 1/2$  and  $f > 1/9$ ), reducing the per-unit trade cost will lead  $MNF_1$  to acquire the local firm. If the per-unit trade cost is sufficiently high, such that  $t > 1/2$ , but the fixed greenfield cost is reduced, such that  $1/16 < f < 1/9$ , then  $MNF_1$  undertakes greenfield investment in equilibrium, because, in this situation, greenfield investment is the only entry mode yielding *positive* profits, and deterring the rival from entering the market.  $MNF_2$  stays out of the market insofar as trade is not profitable and the fixed investment cost does not permit another multinational firm to undertake greenfield investment. However, if the fixed investment cost is reduced further (i.e.,  $1/72 < f < 1/16$ ),  $MNF_1$  acquires the local firm and  $MNF_2$  undertakes greenfield investment. By contrast, if the fixed investment cost is sufficiently low, such that  $f < 1/72$ , both multinational firms undertake greenfield investment, because the relative cost of acquisition in this situation offsets the gain from reducing competition.

## 5 Concluding remarks

In this study, I have developed a theoretical model of competition between multinational firms and have delineated the influence of the presence of a rival multinational firm on the entry mode choice of another multinational firm. Despite statistical evidence indicating that competition is inevitable among multinational firms, the most

common approach in the literature is to assume a single multinational firm, which ignores important implications of competition between multinational firms on their market entry behavior. I have shown that competition among multinational firms substantially affects their optimal entry modes, such that competition implies different entry modes compared to no competition.

This study can be extended in several ways. For example, instead of considering ex ante *symmetric* multinational firms, one can assume that multinational firms are ex ante *asymmetric* in cost structure. In such a situation, one multinational firm has a competitive advantage over the other multinational firm. To some extent, this study has captured such a situation in the sense that if only one multinational firm exports in equilibrium, then the other multinational firm will have a competitive advantage, and the higher is the per-unit trade cost, the larger is the competitive advantage. Nonetheless, it might still be worth examining how the results extend if multinational firms are heterogeneous from the outset.

Another possible extension of this study would be to allow both multinational firms to acquire the same local firm so as to form a joint venture, or to employ a bidding contest for the acquisition of the local firm. Obviously, the problem would be more complex if the rival multinational firm had the option to acquire the local firm if the first multinational firm were to forego the acquisition option in the first stage of the game. Nonetheless, this extension might produce some interesting results: for example, in some cases, one multinational firm might deliberately forego the acquisition option if it knows that its rival would acquire the local firm and reduce competition.

# Appendix A

## A.1 Solution to the Cournot competition

### One MNF and one local firm

(1) *The MNF exports:* Firms' maximization problems give the *first-order conditions* (FOCs),  $q_1(q_{m1}) = (a - q_{m1} - c)/2$  and  $q_{m1}(q_1) = (a - q_1 - t)/2$ , which lead to the equilibrium output levels,  $q_1^* = (a - 2c + t)/3$  and  $q_{m1}^* = (a + c - 2t)/3$ . Firms' equilibrium profits are  $(a - 2c + t)^2/9$  for firm 1, and  $(a + c - 2t)^2/9$  for the MNF, respectively. The MNF's trade profit is positive if (and only if) the per-unit trade cost is sufficiently low, such that  $t < (a + c)/2$ .

(2) *The MNF undertakes greenfield investment:* Firms' maximization problems give the FOCs,  $q_1(q_{m1}) = (a - q_{m1} - c)/2$  and  $q_{m1}(q_1) = (a - q_1)/2$ , which lead to the equilibrium output levels,  $q_1^* = (a - 2c)/3$  and  $q_{m1}^* = (a + c)/3$ . Firms' equilibrium profits are  $(a - 2c)^2/9$  for firm 1, and  $(a + c)^2/9 - f$  for the MNF, respectively. The MNF's greenfield profit is positive if (and only if) the fixed greenfield cost is less than the MNF's operating profit, such that  $f < (a + c)^2/9$ . Note that the MNF's greenfield profit,  $(a + c)^2/9 - f$ , is more than its trade profit,  $(a + c - 2t)^2/9$  (i.e.,  $(a + c)^2/9 - f > (a + c - 2t)^2/9$ ) when  $f < 4t(a + c - t)/9$  for  $t \in [0, (a + c)/2]$ . If  $t > (a + c)/2$ , the MNF will not be able to make positive profits by exporting. In this situation, any *non-negative* greenfield profit (i.e.,  $(a + c)^2/9 - f > 0 \iff f < (a + c)^2/9$ ) will be preferred to *negative* trade profit. ■

### Extension to $n$ -firm case (no competition)

Let  $f_{\max}$  denote the maximum value of the fixed cost of investment that permits greenfield investment as a solution. In the 2-firm case,  $f_{\max} = 4t(a + c - t)/9$ . One can generalize the critical value of the fixed investment cost,  $f_{\max}$ , to an  $n$ -firm case.

Let there be  $k$  periods and only one multinational firm entering the market in every single period. In the first period,  $\text{MNF}_1$  first enters the market and undertakes greenfield investment so long as  $f < 4t(a + c - t)/9$ . Note that, in the first period, there will be only one local firm and one multinational firm competing against each other. Suppose that  $(k - 2)$  periods have passed and  $(n - 2)$  multinational firms have successfully entered the market by undertaking greenfield investment, where  $k = n > 2$ . In the  $(k - 1)^{\text{th}}$  period,  $\text{MNF}_{n-1}$  chooses its entry mode between greenfield investment and trade, and competes against the other  $(n - 1)$  firms (i.e., one local firm and  $(n - 2)$  multinational firms). If  $\text{MNF}_{n-1}$  undertakes greenfield investment, it will make a profit of  $[(a + c)^2/(n + 1)^2 - f]$ , where  $c$  and  $n$  represent the local firm's marginal cost and the total number of active firms competing by quantities in the  $(k - 1)^{\text{th}}$  period, respectively. If  $\text{MNF}_{n-1}$  opts for trade, it will make a profit of  $(a - nt + c)^2/(n + 1)^2$ . Consequently,  $\text{MNF}_{n-1}$  prefers greenfield investment to trade— $\text{MNF}_{n-1}$ 's greenfield profit is more than its trade profit—if (and only if)  $f < nt(2a + 2c - nt)/(n + 1)^2$ .

Moreover,  $MNF_{n-1}$ 's trade profit will be negative if  $t > (a + c)/n$ . In such a situation,  $MNF_{n-1}$  will undertake greenfield investment as long as its operating profit under greenfield investment is larger than the fixed greenfield cost such that  $f < (a + c)^2 / (n + 1)^2$ . Note that  $f_{\max}$  is maximized at  $t = (a + c)/n$ , and that  $f_{\max} = nt(2a + 2c - nt) / (n + 1)^2 = (a + c)^2 / (n + 1)^2$  for  $t = (a + c)/n$ . Furthermore,  $f_{\max}$  decreases with the number of total firms in the market (i.e.,  $\partial f_{\max} / \partial n < 0$  for  $n > 1$ ). The larger is the number of firms in the market, the less likely it is that an MNF prefers greenfield investment to trade. Finally, the local firm—the competitively disadvantaged firm—will stay in the market and produce in equilibrium as long as  $a > nc$ , provided that it competes against  $(n - 1)$  multinational firms that have entered the market by undertaking greenfield investment. ■

### Two MNF and one local firm: greenfield versus trade

(1) *Both MNFs export:* Firms' maximization problems give the FOCs,  $q_1(q_{m1}, q_{m2}) = (a - (q_{m1} + q_{m2}) - c) / 2$ ,  $q_{m1}(q_1, q_{m2}) = (a - (q_1 + q_{m2}) - t) / 2$  and  $q_{m2}(q_1, q_{m1}) = (a - (q_1 + q_{m1}) - t) / 2$ , which lead to the equilibrium output levels,  $q_1^* = (a - 3c + 2t) / 4$ ,  $q_{m1}^* = (a + c - 2t) / 4$  and  $q_{m2}^* = (a + c - 2t) / 4$ . Firms' equilibrium profits are  $(a - 3c + 2t)^2 / 16$  for firm 1, and  $(a + c - 2t)^2 / 16$  and  $(a + c - 2t)^2 / 16$  for  $MNF_1$  and  $MNF_2$ , respectively.

(2)  *$MNF_1$  exports, whereas  $MNF_2$  makes a greenfield investment:* Firms' maximization problems give the FOCs,  $q_1(q_{m1}, q_{m2}) = (a - (q_{m1} + q_{m2}) - c) / 2$ ,  $q_{m1}(q_1, q_{m2}) = (a - (q_1 + q_{m2}) - t) / 2$  and  $q_{m2}(q_1, q_{m1}) = (a - (q_1 + q_{m1})) / 2$ , which lead to the equilibrium output levels,  $q_1^* = (a - 3c + t) / 4$ ,  $q_{m1}^* = (a + c - 3t) / 4$  and  $q_{m2}^* = (a + c + t) / 4$ . Firms' equilibrium profits are  $(a - 3c + t)^2 / 16$  for firm 1, and  $(a + c - 3t)^2 / 16$  and  $[(a + c + t)^2 / 16 - f]$  for  $MNF_1$  and  $MNF_2$ , respectively. As the game is symmetric, if  $MNF_1$  makes a greenfield investment and  $MNF_2$  exports, the equilibrium profits will be  $[(a + c + t)^2 / 16 - f]$  and  $(a + c - 3t)^2 / 16$  for  $MNF_1$  and  $MNF_2$ , respectively.

(3) *Both MNFs make a greenfield investment:* Firms' maximization problems give the FOCs,  $q_1(q_{m1}, q_{m2}) = (a - (q_{m1} + q_{m2}) - c) / 2$ ,  $q_{m1}(q_1, q_{m2}) = (a - (q_1 + q_{m2})) / 2$  and  $q_{m2}(q_1, q_{m1}) = (a - (q_1 + q_{m1})) / 2$ , which lead to the equilibrium output levels,  $q_1^* = (a - 3c) / 4$ ,  $q_{m1}^* = (a + c) / 4$  and  $q_{m2}^* = (a + c) / 4$ . Firms' equilibrium profits are  $(a - 3c)^2 / 16$  for firm 1, and  $[(a + c)^2 / 16 - f]$  and  $[(a + c)^2 / 16 - f]$  for  $MNF_1$  and  $MNF_2$ , respectively. ■

### Two MNFs and one local firm: acquisition

(4)  *$MNF_1$  acquires firm 1, whereas  $MNF_2$  exports:* Firms' maximization problems give the FOCs,  $q_{m1}(q_{m2}) = (a - q_{m2}) / 2$  and  $q_{m2}(q_{m1}) = (a - q_{m1} - t) / 2$ , which lead to the equilibrium output levels,  $q_{m1}^* = (a + t) / 3$  and  $q_{m2}^* = (a - 2t) / 3$ . Firms' equilibrium profits are  $\Omega$  for firm 1, and  $[(a + t)^2 / 9 - \Omega]$  and  $(a - 2t)^2 / 9$  for  $MNF_1$  and  $MNF_2$ , respectively.

(5)  *$MNF_1$  acquires firm 1, whereas  $MNF_2$  makes a greenfield investment:* Firms'

maximization problems give the FOCs,  $q_{m1}(q_{m2}) = (a - q_{m2})/2$  and  $q_{m2}(q_{m1}) = (a - q_{m1})/2$ , which lead to the equilibrium output levels,  $q_{m1}^* = a/3$  and  $q_{m2}^* = a/3$ . Firms' equilibrium profits are  $\Omega$  for firm 1, and  $[a^2/9 - \Omega]$  and  $[a^2/9 - f]$  for MNF<sub>1</sub> and MNF<sub>2</sub>, respectively. ■

## A.2 Proof of Propositions

### Proof of Proposition 1

MNF<sub>1</sub> prefers greenfield investment, irrespective of MNF<sub>2</sub>'s choice, if and only if  $\pi_{m1}^{g(t)} \geq \pi_{m1}^{t(t)}$  and  $\pi_{m1}^{g(g)} \geq \pi_{m1}^{t(g)}$ . Solving  $\pi_{m1}^{g(t)} \geq \pi_{m1}^{t(t)} \iff [(a + c + t)^2/16 - f] \geq (a + c - 2t)^2/16$  and  $\pi_{m1}^{g(g)} \geq \pi_{m1}^{t(g)} \iff [(a + c)^2/16 - f] \geq (a + c - 3t)^2/16$  for  $f$  gives two different conditions:  $f \leq 3t(2a + 2c - t)/16$  and  $f \leq 3t(2a + 2c - 3t)/16$ , respectively. The necessary and sufficient conditions can be reduced to only one condition, that is,  $f \leq 3t(2a + 2c - 3t)/16$  as it is obvious that  $f \leq 3t(2a + 2c - 3t)/16 \leq 3t(2a + 2c - t)/16$ . Similarly, MNF<sub>2</sub> prefers greenfield investment, irrespective of its rival's choice, if and only if  $\pi_{m2}^{g(t)} \geq \pi_{m2}^{t(t)}$  and  $\pi_{m2}^{g(g)} \geq \pi_{m2}^{t(g)}$ . This condition should also apply to MNF<sub>2</sub>, because  $\pi_{m1}^{g(t)} = \pi_{m2}^{g(t)}$ ,  $\pi_{m1}^{t(t)} = \pi_{m2}^{t(t)}$ ,  $\pi_{m1}^{g(g)} = \pi_{m2}^{g(g)}$ , and  $\pi_{m1}^{t(g)} = \pi_{m2}^{t(g)}$  (see *Appendix A.1*). ■

### Proof of Proposition 2

MNF<sub>1</sub> prefers trade, irrespective of MNF<sub>2</sub>'s choice, if and only if  $\pi_{m1}^{g(t)} \leq \pi_{m1}^{t(t)}$  and  $\pi_{m1}^{g(g)} \leq \pi_{m1}^{t(g)}$ . Solving  $\pi_{m1}^{g(t)} \leq \pi_{m1}^{t(t)} \iff (a + c + t)^2/16 - f \leq (a + c - 2t)^2/16$  and  $\pi_{m1}^{g(g)} \leq \pi_{m1}^{t(g)} \iff (a + c)^2/16 - f \leq (a + c - 3t)^2/16$  for  $f$  gives two different conditions:  $f \geq 3t(2a + 2c - t)/16$  and  $f \geq 3t(2a + 2c - 3t)/16$ , respectively. The necessary and sufficient conditions can be reduced to the condition  $f \geq 3t(2a + 2c - t)/16$  as it is obvious that  $f \geq 3t(2a + 2c - t)/16 \geq 3t(2a + 2c - 3t)/16$ . Similarly, MNF<sub>2</sub> prefers greenfield investment, irrespective of its rival's choice, if and only if  $\pi_{m2}^{g(t)} \leq \pi_{m2}^{t(t)}$  and  $\pi_{m2}^{g(g)} \leq \pi_{m2}^{t(g)}$ . This condition should also apply to MNF<sub>2</sub>, because  $\pi_{m1}^{g(t)} = \pi_{m2}^{g(t)}$ ,  $\pi_{m1}^{t(t)} = \pi_{m2}^{t(t)}$ ,  $\pi_{m1}^{g(g)} = \pi_{m2}^{g(g)}$ , and  $\pi_{m1}^{t(g)} = \pi_{m2}^{t(g)}$  (see *Appendix A.1*). ■

### Proof of Proposition 3

MNF<sub>2</sub> prefers greenfield investment when MNF<sub>1</sub> opts for trade if  $\pi_{m2}^{g(t)} \geq \pi_{m2}^{t(t)}$ . Similarly, MNF<sub>2</sub> prefers trade when MNF<sub>1</sub> opts for greenfield investment if  $\pi_{m2}^{g(g)} \leq \pi_{m2}^{t(g)}$ . I have already shown that  $\pi_{m2}^{g(t)} \geq \pi_{m2}^{t(t)} \implies f \leq 3t(2a + 2c - t)/16$  and  $\pi_{m2}^{g(g)} \leq \pi_{m2}^{t(g)} \implies f \geq 3t(2a + 2c - 3t)/16$ , respectively. When  $3t(2a + 2c - 3t)/16 \leq f \leq 3t(2a + 2c - t)/16$ , MNF<sub>1</sub> makes a greenfield investment if  $\pi_{m1}^{g(t)} \geq \pi_{m1}^{t(t)} \implies f \leq t(a + c - t)/2$ , which always holds for any  $f \in [3t(2a + 2c - 3t)/16, 3t(2a + 2c - t)/16]$  as  $3t(2a + 2c - t)/16 \leq t(a + c - t)/2$ . ■

## Proof of Proposition 4

MNF<sub>2</sub> prefers greenfield investment when MNF<sub>1</sub> acquires firm 1 if  $\pi_{m2}^{g(a)} \geq \pi_{m2}^{t(a)}$ . Solving  $\pi_{m2}^{g(a)} \geq \pi_{m2}^{t(a)} \iff a^2/9 - f \geq (a - 2t)^2/9$  for  $f$  gives the condition  $f \leq 4t(a - t)/9$ . ■

## A.3 Entry deterrence

A higher per-unit trade cost may deter one or both multinational firms from entering the market. For instance, given the per-unit trade cost, such that  $t \in ](a + c)/3, (a + c)/2[$ , one multinational firm stays out of the market unless the fixed greenfield cost is either sufficiently low, such that  $f < (a + c)^2/16$  or sufficiently high, such that  $f > f_u$ . Note that given the per-unit trade cost, such that  $t \in ](a + c)/3, (a + c)/2[$ , trade will yield *positive* profits so long as the rival multinational firm prefers either trade or staying out to greenfield investment (see equations (1), (2), (3) and *Appendix A.1*). If the fixed greenfield cost is sufficiently high, such that  $f > f_u$ , trade will be the only entry mode allowing both multinational firms to make *positive* profits. Consequently, both multinational firms will enter the market by exporting.

By contrast, if the fixed greenfield cost is sufficiently low, such that  $f < (a + c)^2/16$ , greenfield entry will be MNF<sub>2</sub>'s dominant strategy. In such a situation, MNF<sub>1</sub> will be able to make *positive* profits if (and only if) it undertakes greenfield investment as well (see equation (4)). The reason is that the per-unit trade cost is not sufficiently low, allowing MNF<sub>1</sub> to compete against MNF<sub>2</sub>, which will undertake greenfield investment, irrespective of MNF<sub>1</sub>'s entry mode choice.

Moreover, if the fixed greenfield cost is neither sufficiently low nor sufficiently high (i.e.,  $(a + c)^2/16 < f < f_u$ ), one multinational firm will not be able to enter the market. It is MNF<sub>2</sub>, which stays out, if the fixed cost of investment is such that  $(a + c)^2/16 < f < (a + c)^2/9$ , or MNF<sub>1</sub> if the fixed cost of investment is such that  $(a + c)^2/9 < f < f_u$ . The intuition is as follows: (i) given the fixed greenfield cost such that  $(a + c)^2/16 < f < (a + c)^2/9$ , MNF<sub>1</sub> can deter MNF<sub>2</sub> from entering the market by undertaking greenfield investment as the fixed investment cost does not permit two multinational firms to enter the same market by undertaking greenfield investment and as the per-unit trade cost does not allow for a *positive* profit when the rival is undertaking greenfield investment; and (ii) given the fixed greenfield cost such that  $(a + c)^2/9 < f < f_u$ , greenfield entry will not bring *positive* profits to either multinational firm unless the rival multinational firm opts for trade. However, neither multinational firm makes *non-negative* profits by exporting unless the rival stays out of the market. Consequently, MNF<sub>1</sub> will stay out of the market and make zero profit, and MNF<sub>2</sub> will export as it will be the single firm entering the market. ■

## A.4 Changes in the market-structure effect and the cost-saving effect

**Table 5** Impact of the local firm's marginal cost,  $c$ , on  $\Delta_{ms}$  and  $\Delta_{cs}$

$f$	:	$\partial\Delta_{ms}/\partial c < 0$	$\partial\Delta_{cs}/\partial c > 0$
$f < \tilde{f}$ and $f < f_l < f_u$	:	$-(a+c)/8 < 0$	$3(a-3c)/8 > 0$
$f > \tilde{f}$ and $f < f_l < f_u$	:	$-(a+c)/8 < 0$	$3(a-3c)/8 > 0$
$f < \tilde{f}$ and $f_l < f < f_u$	:	$-(a+c+t)/8 < 0$	$3(a-3c+t)/8 > 0$
$f > \tilde{f}$ and $f_l < f < f_u$	:	$-(a+c+t)/8 < 0$	$3(a-3c+t)/8 > 0$
$f < \tilde{f}$ and $f_l < f_u < f$	:	$-(a+c-2t)/8 < 0$	$3(a-3c+2t)/8 > 0$
$f > \tilde{f}$ and $f_l < f_u < f$	:	$-(a+c-2t)/8 < 0$	$3(a-3c+2t)/8 > 0$

**Table 6** Impact of the market size,  $a$ , on  $\Delta_{ms}$  and  $\Delta_{cs}$

$f$	:	$\partial\Delta_{ms}/\partial a > 0$	$\partial\Delta_{cs}/\partial a < 0$
$f < \tilde{f}$ and $f < f_l < f_u$	:	$(7a-9c)/72 > 0$	$-(a-3c)/8 < 0$
$f > \tilde{f}$ and $f < f_l < f_u$	:	$(7a-9c+16t)/72 > 0$	$-(a-3c)/8 < 0$
$f < \tilde{f}$ and $f_l < f < f_u$	:	$(7a-9c-9t)/72 > 0$	$-(a-3c+t)/8 < 0$
$f > \tilde{f}$ and $f_l < f < f_u$	:	$(7a-9c+7t)/72 > 0$	$-(a-3c+t)/8 < 0$
$f < \tilde{f}$ and $f_l < f_u < f$	:	$(7a-9c+18t)/72 > 0$	$-(a-3c+2t)/8 < 0$
$f > \tilde{f}$ and $f_l < f_u < f$	:	$(7a-9c+34t)/72 > 0$	$-(a-3c+2t)/8 < 0$

**Table 7** Impact of the per-unit trade cost,  $t$ , on  $\Delta_{ms}$  and  $\Delta_{cs}$

$f$	:	$\partial\Delta_{ms}/\partial t \begin{matrix} \leq \\ \geq \end{matrix} 0$	$\partial\Delta_{cs}/\partial t \leq 0$
$f < \tilde{f}$ and $f < f_l < f_u$	:	0	0
$f > \tilde{f}$ and $f < f_l < f_u$	:	$2(a+t)/9 > 0$	0
$f < \tilde{f}$ and $f_l < f < f_u$	:	$-(a+c+t)/8 < 0$	$-(a-3c+t)/8 < 0$
$f > \tilde{f}$ and $f_l < f < f_u$	:	$(7a-9c+7t)/72 > 0$	$-(a-3c+t)/8 < 0$
$f < \tilde{f}$ and $f_l < f_u < f$	:	$(a+c-2t)/4 > 0$	$-(a-3c+2t)/4 < 0$
$f > \tilde{f}$ and $f_l < f_u < f$	:	$(17a+9c-10t)/36 > 0$	$-(a-3c+2t)/4 < 0$

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