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# Multinational Entry and Host-Country Effects

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*Thesis submitted for assessment with a view to obtaining  
the degree of Doctor of the European University Institute*

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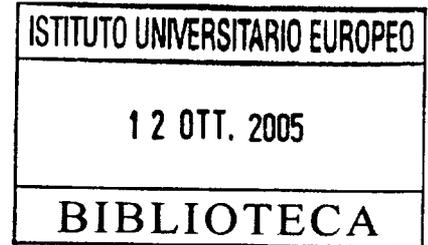
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**Department of Economics**



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Stefanie Alexandra Haller

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September 29, 2005

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# Introduction

While trade in commodities has for a long time been the traditional form of exchange between nations, at least since the 1980s an increasing number of firms have become multinational players by establishing subsidiaries abroad. As a result, world-wide foreign direct investment (FDI) has grown much faster than international trade and industrial production. According to the World Investment Report (2004) foreign direct investments measured as inward stocks have grown on average at a rate of about 13% per year between 1982 and 2003, this is almost twice as fast as world exports with an average annual growth rate of roughly 8% over the same period. For comparison, world GDP grew at an average annual rate of 5.5% in the period from 1982 to 2003 (UNCTAD (2004, p. 9)).

It is, thus, not surprising that foreign direct investment and its carriers, the multinational enterprises (MNEs), have received a considerable amount of attention in the economic literature as well as in the policy debate. Since the 1980s, the economic literature has come a long way in examining these issues. Initially, the main challenge was to explain why some firms prefer to engage abroad directly instead of trading at arms-length. More recently the focus has shifted towards the characteristics of multinational enterprises and which firms are more likely to become active abroad. A related, and still very much unresolved, question is why firms select different modes of entering a foreign market such as greenfield investments (i.e. setting up a new plant abroad) or cross-border mergers or acquisitions. In the light of many governments offering generous subsidies to attract investment from abroad, much of the literature has focused on the implications which the presence of foreign firm has on companies, employment, investment, and productivity growth in the host country.

In three essays, this thesis contributes to the literature by examining a multinational firm's mode of serving a foreign market in different contexts. In doing so, it also looks at host country effects of foreign entry such as competition, changes in market structure and productivity. The first chapter examines to what extent policy measures aimed at reducing trade and investment barriers can induce firms to increase their trade and foreign direct investments inside an integrat-

ing region. In the second chapter, the question is how a multinational's mode of entry affects the decisions of firms in the host country industry and what implications this interaction has for market structure, investments and welfare in the host-country. While the first two chapters attempt to rationalise empirical observations in theoretical models, the third chapter is an empirical analysis. It examines whether foreign and domestic firms differ in their contributions to productivity growth. It also explores whether greenfield entry and entry via acquisition have a different impact on the productivity of host-country firms. The remainder of this introduction provides a non-technical summary of the three essays and their main contributions.

Chapter 1 is motivated by the observation that during the implementation of the Single Market Programme (SMP) in the European Union (EU) the share of foreign direct investments remaining within the EU has almost doubled. Similar developments have been observed in other regions that have taken measures towards economic integration, for example in NAFTA and ASEAN. The Single Market Programme was implemented in 1986 in order to eliminate remaining trade and investment barriers. At the time, the main impediments in the EU were customs and tax controls at borders, technical barriers, restrictive practices in government procurement, but also a variety of technical and product standards or complicated bureaucratic procedures for establishing new plants. On these grounds the question is, to what extent these policy measures can account for the substantial increase in intra-EU direct investments and the smaller increase in intra-EU trade.

In the integrating region there are groups of countries that are closer to each other than others. Even in a region where economic integration has been under way for some time, geographic distance may not be negligible. However, some countries may be closer to each other in terms of cultural distance such as a common language or traditionally strong business relationships. In the model there is a multinational enterprise located at a distance from one such group of countries contemplating how to serve these countries. It can do so by exporting from its home country in the 'periphery' or by setting up its own plant(s) in one or more of these 'core' countries and possibly export to the other countries from there. Investment is associated with a fixed cost of setting up a new plant; these fixed costs can be affected by policy measures. Exporting, in turn, involves a variable trade cost of which one part is due to any remaining trade barriers ('tariff'); the other part is given by the distance of the exporter to its destination market, i.e. this distance cost is larger from the periphery to the core than within the core.

This setting is analysed under two scenarios that differ in the way firms compete. In the first scenario the MNE is the sole supplier of a certain good to the core. In the second scenario, the MNE faces competition from local incumbents - one in each core country - which can also

export to the other core countries. Regardless of the way firms compete, lowering barriers to investment which affect the fixed cost of setting up a new plant makes investment in one or more core countries more attractive. Under the first scenario, lowering barriers to trade makes exporting from the MNE's home country in the periphery or consolidation of investment in fewer core countries more profitable as long as the periphery and the core are not too distant. The second possibility is suggestive for the large share of cross-border mergers and acquisition in FDI. However, this is only the case as long as the periphery and the core are not too distant. If the MNE is located at a greater distance to the core, a lower tariff will induce it to set up a plant in the largest core country and export to the other core countries from there (so-called 'export platform investment'). This is a likely outcome also for intermediate levels of periphery-core to within-core distance cost, the more and the larger the countries that can be served from the export platform in the core.

When the multinational firm faces competition the model gets a strategic dimension. As the local competitors also benefit from lower trade costs, competition reduces the multinational's profits from investing in, as well as from exporting to, the core compared to the situation without competition. Hence, multinational activity in the core is less likely. Trade barriers have to be low for the MNE to export to the core, while core firms still find it profitable to trade within the core for intermediate levels of trade cost. If it is, however, profitable for the MNE to invest and trade costs are not too low, a duopoly between the MNE and the local incumbent arises in the core country where the MNE established its plant and exports from core country competitors are deterred.

Hence, the greenfield investment associated with the Single Market Programme can be attributed to the decline in barriers to investment, but also to lower trade barriers where they made export-platform investment attractive, possibly by deterring competition. In turn, if the multinational had subsidiaries in several core countries before the SMP lower trade cost may have induced consolidation of these plants to one or two export platforms. This is indicative for the increase in cross-border mergers and acquisitions during the SMP but also for the increase in exports. Overall, the model is thus able to capture some of the main features of the Single Market Programme. Its main contribution is to take the traditional trade-off between the fixed cost of establishing a new plant and the variable cost of exporting inside the realm of an integrating region.

While in the first chapter the distinction between different modes of foreign direct investment is only implicitly touched upon, Chapter 2 explicitly distinguishes between greenfield investment and cross-border mergers and acquisitions. Varying slightly by source and the countries under

consideration, the evidence suggests that about one half to four-fifths of foreign direct investment takes the form of cross-border mergers and acquisitions (M&A) rather than greenfield FDI. The chapter looks in particular at the impact of these two different modes of multinational entry on the choices of the domestic firms in the industry and discusses the implications of this interaction for market structure, investments and host-country welfare.

The centre of attention in this chapter is a host-country industry which consists of two firms that differ in size and production technology. A foreign multinational is considering entering this industry; it can do so either by setting up a plant of its own (greenfield investment) or by acquiring one of the domestic firms. The domestic firms can react to this choice; this determines the market structure outcome. In the next step, then, all firms that are active in the market decide on how much to invest in a cost-reducing technology.

The multinational is assumed to be more efficient than either of the domestic firms. Moreover, it can also avail of its superior technology in the host country immediately and without additional cost. Thus, irrespective of its mode of entry, it will always capture the largest share of the market. As a result a domestic firm that is very inefficient compared to its competitors may stop serving the market. This can occur under either entry strategy of the MNE. In the case of greenfield investment, a merger among the domestic firms may also help them to improve their competitive stance against the strong position of the MNE. Looking at the incentives to invest in a cost-reducing technology in such a setting, it can be shown that the presence of a more efficient foreign firm in the domestic market will increase the overall level of investment in the industry. However, this comes at the cost of crowding out domestic investment when compared to a situation with domestic firms only. This result is very much in line with findings in the empirical literature. Regarding welfare, there are two opposing effects. The increase in efficiency reduces prices and increases consumer surplus. On the other hand, producer surplus decreases due to full profit repatriation on the part of the foreign firm. In most cases, the second effect outweighs the first, so that domestic welfare will typically be lower after foreign entry. As the focus of the model is on competition, this result should, however, be regarded as a lower bound to domestic welfare after foreign entry. It does not take into account possible benefits for the host country from foreign presence, such as re-invested earnings, local tax payments, training of workers or technology spillovers.

Two main conclusions arise that have not been recognised in the literature before: first the impact of foreign entry on the host country industry is not independent of possible reactions by the local incumbents. In turn, these can also affect the multinational's choice of the mode of entry. Namely, the MNE's technological advantage only favours greenfield investment over an

acquisition when either the domestic firms are sufficiently competitive or when they are induced to eliminate competition among themselves by merging. Second, a concentrated market structure may result even if the multinational decides to set up its own plant when the domestic firms merge or exit the market as a consequence. This rationalises the observation that along with the surge in cross-border M&As as a share of FDI concentration ratios have also risen in industries where horizontal FDI is prevalent.

Chapter 3 is a joint work with Ragnhild Balsvik from the Norwegian School of Economics and Business Administration in Bergen. Like Chapter 2 it looks at the different implications of greenfield and acquisition FDI for the host country. In contrast to Chapter 2, however, it uses empirical methods on a panel of Norwegian manufacturing plants from 1987-2001. The chapter investigates whether domestic and foreign firms differ in their contributions to productivity growth which is the central force for economic welfare. It further asks whether foreign entry affects the productivity of domestic firms and whether the mode of foreign entry matters.

To answer the first question, productivity growth broken down into the contributions of entering, surviving and exiting plants. The analysis further distinguishes between domestic and foreign-owned plants and considers plants that change ownership from domestic to foreign or vice versa as a separate group. As the results of this productivity decomposition are subject to cyclical fluctuations, two periods that are at similar points of the business cycles in the 1980s and in the 1990s are compared. Similar to studies for other countries the results indicate that the largest share of productivity growth is generated within surviving plants. The contribution to productivity growth from foreign plants has increased substantially from the period in the 80s to that in the 90s. To a certain extent, this reflects the fact that activity of foreign firms picked up noticeably after 1990. Foreign entrants are much more productive than their domestic counterparts. In the period in the 1990s, surviving foreign plants as well as plants acquired by foreign owners contribute a substantially larger share to productivity growth than their market shares would suggest.

To examine whether, in addition to its contribution to productivity growth, entry of foreign firms also affects the productivity of domestic firms, production functions are estimated. Using a traditional measure of overall foreign presence and entry suggests that the foreign plants in the Norwegian market exert a negative impact on the productivity of Norwegian-owned plants. Much of this negative effect seems to be accounted for by foreign entrants setting up new plants. Moreover, greenfield entry is associated with a competition effect. This finding is attributed to a market-stealing effect which forces the domestic plants up their average cost curves and consequently decreases their productivity. However, as the negative impact on domestic plant

productivity is persistent when controlling for changes in market structure and competition, it might also be due to a different kind of stealing effect. It is conceivable that foreign firms attract highly qualified or highly motivated workers from domestic plants, leaving only the less productive resources behind. Foreign acquisitions, in turn, have a positive impact on the productivity of domestic plants and are not associated with competition effects. Existing local plants with foreign interests are likely to have established linkages with other plants in the host economy which may serve as a basis for possible knowledge or technology spillovers.

To summarise, this chapter demonstrates that there are a few highly productive greenfield entrants have a remarkable impact on the productivity of domestic plants. Part of this effect can be attributed to increased competition as a result of foreign entry and to foreign plants entering mainly in expanding sectors. In turn, plants that are acquired by foreign owners are not, on average, more productive than domestic plants. Nonetheless, they contribute substantially to overall productivity growth. In so doing, they generate positive externalities on the domestic plants. These plants may, in fact, serve as a channel for knowledge spillovers as they are well-integrated in the Norwegian market. The main contribution from this chapter is the distinction between greenfield and acquisition FDI as two different modes of foreign entry which allows us to draw the lines between spillover and competition effects more clearly.

# Chapter 1

## Does Economic Integration Increase Intra-Region Direct Investment?

### Modelling the Experience of the EU's Single Market

#### Abstract

We apply the fixed versus variable cost trade-off associated with a multinational firm's choice between investing abroad and exporting to a setting where the multinational is located inside an economically integrating region. We find that reducing obstacles to investment unambiguously favours setting up plants. When trade barriers decrease typically there will be consolidation of investment or a switch to exports. If, however, distance to destination markets matters for the multinational, export platform investment in one country will be induced. This is indicative of some of the developments in trade and direct investment during the EU's Single Market Programme.

## 1.1 Introduction

Multilateral trade liberalisation after World War II had a remarkable impact on growth rates of exports and imports worldwide. The subsequent increases in industrial production and foreign direct investment (FDI) from the 1980s onwards were even greater. By taking additional measures towards trade and investment liberalisation, regional trading and integrating agreements have benefited from these developments more than proportionally. Taking Europe as an example, positive effects from integration on trade as well as on direct investment were already observable during the formative years of the European Community (see Balassa (1975) and Yannopoulos (1990)). More striking, however, is the doubling of the share of intra-region direct investment in total direct investment of the European Union (EU) along with the implementation of the Single Market Programme (see Figure 1.1).<sup>1</sup>

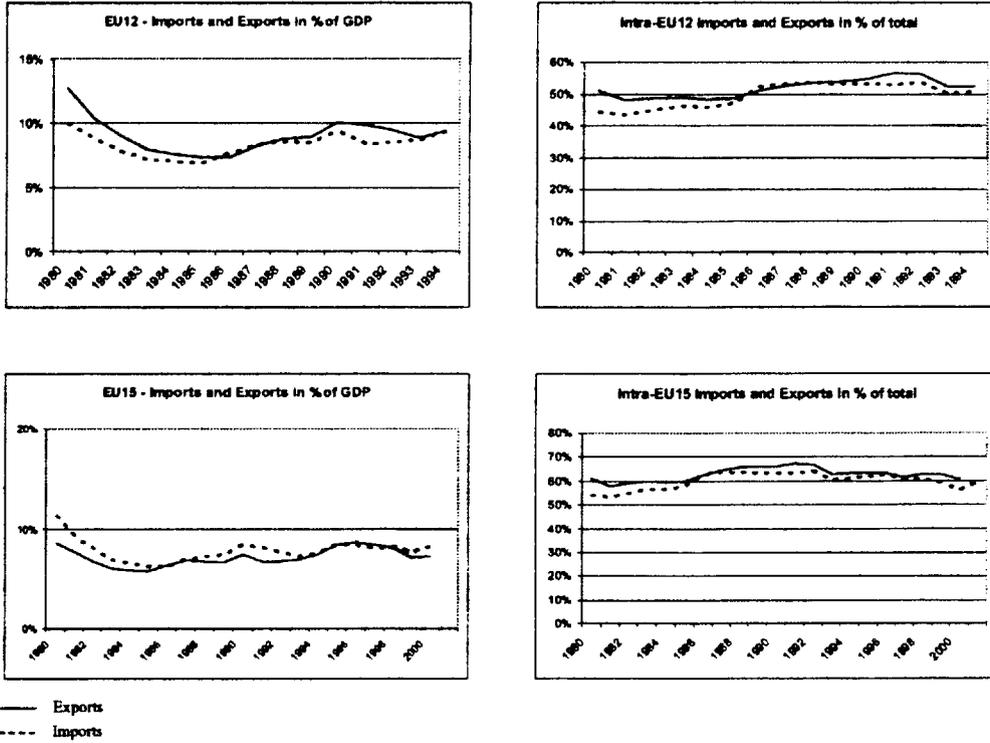
The Single Market Programme (SMP) was put in place in the mid-1980s in order to spur European integration beyond the early elimination of internal tariffs. Its aim was to achieve broad-scale harmonisation in a number of areas by 1992. Regarding trade and direct investment, the remaining impediments were customs and tax controls at borders, technical barriers, and restrictive practices in government procurement, but also a variety of technical and product standards or complicated bureaucratic procedures for establishing new plants (Monti (1996)). To what extent these policy measures can account for the strong reaction by firms regarding trade and investment decisions during the SMP is the question addressed in this chapter. We examine, in particular, the role of declining barriers to trade and to direct investment in a multinational firm's decision whether to export to or to invest in its member countries in an integrating region.

Figure 1.1 shows the evolution of trade and direct investment in the EU at the time. Intra-EU12 trade as a share of total EU12 trade increased by 5 percentage points between 1986 and 1992 to a level of roughly 55%, whereas intra-EU direct investment inflows and outflows doubled their share in total EU12 FDI flows from about 20% in the mid-1980s to more than 40% in 1993. Similar developments are visible for EU15. Intra-EU trade accounts for approximately 60% of total EU trade and intra-EU direct investment flows remained at a level of about 50% in total EU15 FDI after 1993. The increase in direct investment flows to the EU during the implementation of the SMP was accompanied by an increase in direct investment stocks, in particular those of EU and Japanese firms (Dunning (1997a), EC (1998a)). A large share of FDI results from mergers and acquisitions (M&A). According to Sleuwaegen (1998), they account

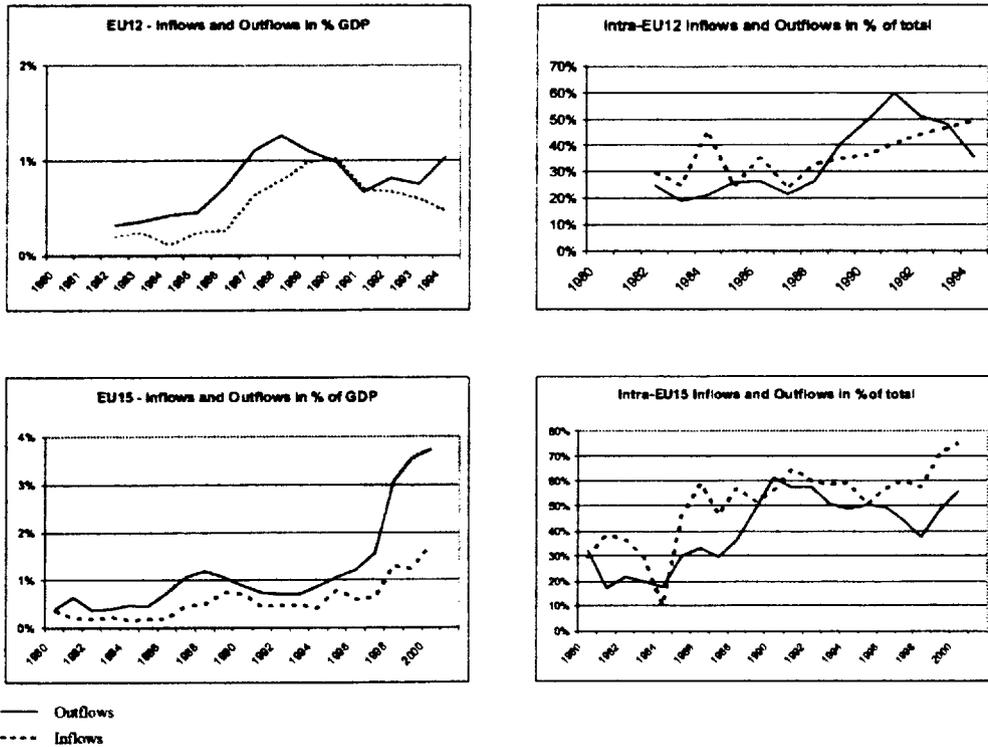
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<sup>1</sup> Similar increases of intra-region FDI can be observed for NAFTA (see e.g. various articles in Rugman (1994)) and ASEAN (Bende-Nabende (2000)).

Figure 1.1: Evolution of trade flows in EU12 (1980-1994) and EU15 (1980-2000)



Evolution of direct investment flows in EU12 (1982-1994) and EU15 (1980-2000)



Source: Author's compilation from OECD data.

for between 46% and 63% in the period from 1986 to 1994 in total EU12 inward FDI. Looking at M&As within the EU only, the number of mergers between firms located in the same member state doubled between 1987 and 1989 and diminished continuously thereafter. Cross-border mergers within the EU quadrupled after 1988 but fell back substantially after 1990, however the number of deals in 1994 (913) remains close to three times the level in 1987 (Sleuwaegen (1998) and European Economy (1999)).

Dunning (1997b) summarises the existing econometric work on direct investment associated with the Single Market in the EU. Among the few studies concerned with its impact on intra-EU direct investment, van Aarle (1996) finds that the EU12 countries trade and invest relatively more with and in each other, and, moreover, that the SMP has had a positive effect on inward and outward FDI and trade within the EU. Pain (1997) and Pain and Lansbury (1997) look at the stock of direct investment in the UK and Germany, respectively. They conclude that the SMP had a significant positive impact on the aggregate level of intra-EU direct investment by British as well as by German corporations in both industrial and services sectors.

In the theoretical literature, the decision between exporting and producing abroad is modelled as a trade-off between the fixed and the variable cost associated with these two possibilities.<sup>2</sup> Within this framework, models addressing the consequences of regional economic integration on multinational activity have been developed by Norman and Motta (1993) and Motta and Norman (1996). In their 1993 model they show that both market growth and improved accessibility due to economic integration will induce external firms to switch from exporting to FDI. In the second paper, they consider the impact of integration on the supply decision of an external firm and of two firms located inside an integrating region. For the external firm the above result continues to apply, while for the intra-region firms they obtain consolidation of intra-region investment to exporting. Taking the SMP as an example, Neary (2002) looks at the supply strategy of an MNE located outside an integrating region. He obtains tariff-jumping FDI to all union countries when the external tariff is high and the fixed cost of a new plant is relatively low. As internal tariff barriers go down, the MNE is likely to switch to export platform investment. When allowing for competition from domestic firms, one possible outcome is that the profits from investing or exporting are diluted to such an extent that the foreign firm decides not to supply the region at all ('fortress Europe outcome'). It may, however, also happen that the foreign firm is able to prevent intra-region firms from supplying a country by setting up a plant there.

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<sup>2</sup>See Markusen (2002) for a textbook treatment.

While these papers direct attention mainly at the impact of integration on the changes in supply strategies of firms located *outside* the integrating region, no attempt has been made to model the trade and direct investment decisions of intra-region firms. Our task in this chapter is, therefore, to rationalise the near-doubling of intra-region direct investment and the increase in trade during the Single Market Programme by examining how decreasing internal barriers to trade and investment affect the supply decision of a multinational firm when both the multinational and its target markets are located *inside* the integrating region. The specification of the model is similar to the structure in Neary (2002), this is then re-interpreted and amended to capture the intra-region focus. Geographically, the setting is such that the multinational is located in a country in an integrating region from where it has to overcome a greater distance to the markets it wants to serve than the firms based in these markets have to bridge to serve each other. The idea is that even in a region where economic integration has been underway for some time there will be groups of countries that are closer to each other than to the rest of the union countries. This may simply be in terms of geographic distance, but it can also be in terms of cultural proximity, like, for example, a common language or a similar way of doing business.<sup>3</sup>

We find that reducing obstacles to investment unambiguously favours setting up plants. When it comes to lowering trade barriers, the MNE's supply decision depends on its location relative to the market(s) it wants to serve in the integrating region. If the MNE is in a rather remote location, lower trade barriers will induce it to set up a plant in the largest destination country and export to the adjacent markets from there. Both of these findings capture some of the greenfield investment associated with the Single Market Programme. In turn, if the MNE is located close to its destination market(s) in the integrating region, lowering trade barriers will induce consolidation of investment or exports. This is indicative of the increase in cross-border mergers and acquisitions together with the SMP and the increase in exports. These predictions are derived in a setting where the MNE can act as a monopolist in its destination markets, which may serve as an approximation when the MNE has a strong technological or organisational advantage. When the MNE faces competition from a local incumbent and from exporters from the adjacent destination market(s) instead, trade barriers need to be lower for the MNE to serve these markets at all. If it is profitable to do so, however, it will be mainly in the form of investment. In fact, for low but not too low trade barriers, investment by the MNE will deter the incumbents in the adjacent countries from exporting. Hence, this case is again indicative for greenfield investment

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<sup>3</sup>The evidence on border effects and home bias suggests that regions that are close to each other do not extend beyond national borders. Nitsch (2002) finds that even after the Single Market Programme, EU countries trade on average ten times more within national borders than with other EU countries; Head and Mayer (2000) obtain a similar result at the industry level.

or consolidation of investment for very low levels of trade cost. The model thus generates a set of predictions consistent with some of the observed developments in trade and investment during the Single Market Programme.

This chapter is structured as follows: In Section 1.2 the model setup is presented. The MNE's supply decision is analysed when it is able to act as a monopolist in 1.3, and when it faces competition from a local incumbent in its destination markets in Section 1.4. Section 1.5 summarises and concludes.

## 1.2 The Model

Following the tradition in the literature on foreign direct investment, we model the multinational's supply decision as a trade-off between the variable cost of exporting (such as trade and distance cost) and the fixed cost of setting up a new plant. Moreover, the analysis accounts for empirical results from gravity equations, where market size and distance capture much of the variation (see e.g. Clegg (1998) for the EU).

As outlined above, the object of analysis is a multinational firm located in a country which is a member of an economically integrating region (union). The countries in this region are supposed to have reduced internal trade barriers, but there are still obstacles to trade and also to investment.<sup>4</sup> These obstacles translate into costs for firms when trading with or investing in the union member countries. In other words, in the region under consideration, economic integration is under way, but far from complete. Markets are therefore regarded as segmented.<sup>5</sup>

We look at firms in a single industry that are producing a homogeneous good, i.e. the model is one of partial equilibrium. In particular, consider a potential multinational enterprise located in a peripheral country when deciding to supply some or all of  $n$  ( $n \geq 2$ ) core countries that differ in market size  $s_i$ , but are symmetric with respect to the other parameters. The indirect demand

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<sup>4</sup>For the EU, the extent of such barriers before the SMP can be gauged from the Eurostat Business Survey (EC 1998c), which questioned some 13,500 enterprises during the first half of 1995. Regarding trade barriers, the effect of the SMP on the elimination of customs documentation, on the deregulation of freight transport, and on the elimination of delays at frontiers was reported positive by, respectively, 60%, 43% and 56% of the enterprises. Concerning potential barriers to investment, 31% of the firms questioned felt a positive impact from the harmonisation of technical regulations and/or standards, 32% from the mutual recognition of technical regulations and/or standards, 23% from the conformity of assessment procedures, and 13% from simplified patenting procedures.

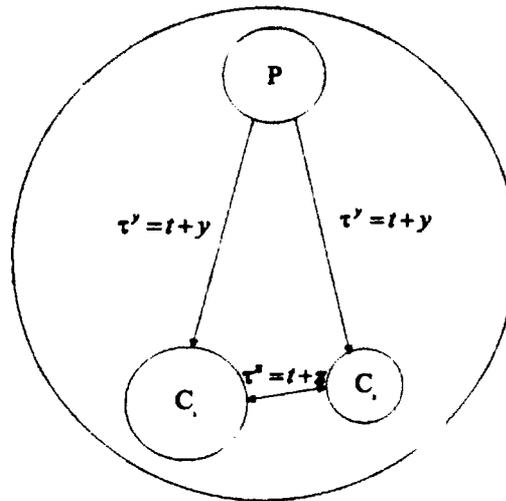
See also Brenton and Vancauteran (2001) for more recent empirical evidence.

<sup>5</sup>Venables (1990) compares the implications of a reduction in trade costs in a model of international trade under oligopoly when markets are segmented (i.e. when prices are set separately for each market) and when markets are integrated (i.e. when one price applies to all markets).

function  $p(x, s_i)$  is such that  $\frac{\partial p}{\partial s_i} > 0$  and  $\frac{\partial^2 p}{\partial s_i^2} \leq 0$ . Assume that countries are ordered according to market size:  $1 \geq s_1 \geq \dots \geq s_n > 0$ . The MNE produces at constant marginal cost  $c$ , that is, for simplicity, set equal to zero. If it decides to engage in foreign activity, this does not affect output and profits in its home country.

The main concern of the model is to see how changes in a multinational's cost of trading and investing affect its mode of supply. Trade and investment are associated with different costs: Setting up a plant in another country entails a fixed setup cost  $f$ , which depends on barriers to investment. Exporting, in turn, is subject to a per-unit trade cost  $\tau$  ( $0 \leq \tau \leq 1$ ). This trade cost is composed of two parts, a tariff  $t$  and a distance cost  $d$ :  $\tau^d = t + d$ . The underlying notion is that trade cost can be split up in a part that is given by a country's location ( $d$ ) and a part that can be influenced by policy ( $t$ ). The tariff  $t$  ( $0 \leq t \leq 1$ ) is given this name for expositional purposes; it is meant to be representative of any (non-)tariff trade barriers. It is assumed to be the same for all trade within the union. The distance cost  $d$  ( $0 \leq d \leq 1$ ) depends on the location of the country from where the exports take place:  $d \in \{z, y\}$  takes the value  $y$  if the MNE exports from its home country in the periphery to the core, it takes the value  $z$  if exports take place within the core. The distance cost can be interpreted as transport cost: consider, for example, the way commodities have to travel from the Nordic countries to the central or Southern members of the EU. Another way to look at it is that some countries are more similar to each other than others; for example, in terms of culture or the way of doing business. In this case the costs of doing business differ between groups of countries.

Thus, when serving the core the MNE's alternatives are associated with different costs. First, if it exports from its home country in the periphery it faces a per unit trade cost  $\tau^y = t + y$ . Second, it can set up a plant in one of the core countries and serve the other core countries with exports from there. Establishing a plant in a core country, on the one hand, saves the MNE the tariff and the distance costs to this country, but, on the other hand, involves the fixed cost  $f$  of setting up a plant. The core countries are closer to each other, therefore, exporting within the core is less costly than exporting from the periphery, per unit costs are  $\tau^z = t + z$ . Third, the MNE can decide to establish plants in more than one of the core countries, in which case FDI buys it preferential access to all of these markets at the cost of setting up. Not to engage in any core country at all remains, of course, also an option for the MNE. The figure below is a simple illustration of the trade cost between the MNE's home country P and two core countries  $C_1$  and  $C_2$ , where  $C_1$  is larger than  $C_2$ .



In the following section, we first analyse the MNE's supply decision treating it as a monopolist. In the following section, we then analyse the situation where the MNE faces competition from one incumbent firm in each core country. In this setting, the MNE's supply decision can have a strategic component. The analysis is set out in a general form. To illustrate ideas each section is accompanied by an example with linear demands of the form  $p(x, s_i) = \left(1 - \frac{x}{s_i}\right)$  with  $0 \leq x \leq s_i \leq 1$  for well-defined prices.<sup>6</sup>

### 1.3 The Supply Decision of the MNE as a Monopolist

First, the decision of a potential multinational located in a peripheral country is modelled under the assumption that it is the only supplier in this industry. The multinational can, thus, act as a monopolist under any supply regime. There are no other firms that might enter the market. This setting may well be a good approximation for a firm with a technological or organisational advantage, making it more likely to start production abroad. This applies in particular, whenever this firm manages to advance into a market where competitors have yet to establish themselves.

<sup>6</sup>Defining the indirect demand function in a more general way as  $p(x) = a - bx$  ( $a > 0$ ,  $b > 0$ ,  $\frac{a}{b} \leq x \leq a$ ) and assuming that the marginal cost of production  $c$  is non-zero, gives  $\frac{a-c}{b}$  as an alternative measure for market size (see Rowthorn (1992) for a more detailed discussion).

The MNE's profits from exporting to a core country  $i$  are given by  $\pi_i(s_i, \tau^d) = \pi_i(s_i, t + d)$ .<sup>7</sup> Quite naturally, they are increasing in the size of the market  $s_i$  and decreasing in trade cost  $\tau^d$ . If the tariff and the distance cost are at a sufficiently high level, it will not be profitable to export to any of the  $n$  core countries. In general, the prohibitive level of  $t$  given  $s_i$  and  $d$  is defined implicitly by  $\pi(\tilde{t}, \bar{s}_i, \bar{d}) = 0$ . The prohibitive tariff  $\tilde{t}$  is smaller, the smaller the market size of country  $i$  and the larger the distance cost  $d$ . If the MNE decides to serve all  $n$  core countries via exports from its home country in the periphery ( $X_P$ ) at distance cost  $y$ , its profits are given by

$$\Pi^{X_P} = \sum_{i=1}^n \pi_i(s_i, \tau^y) = \sum_{i=1}^n \pi_i(s_i, t + y). \tag{1.1}$$

Alternatively, the multinational can set up a plant in one of the core countries and supply the remaining core countries with exports. If it sets up a plant in a core country the MNE becomes a monopolist in that country, facing the fixed cost of setting up a plant  $f$ , but no other supply cost ( $\pi_i(s_i, 0) \equiv \pi_i(s_i)$ ). Exporting to the other core countries ( $X_C$ ) entails the tariff and the within-core distance cost  $z$ . Other things being equal, as profits are increasing in market size, the MNE will invest first in the core country with the largest market (1,1), earning

$$\Pi^{I,1+X_C} = \pi_1(s_1) - f + \sum_{i=2}^n \pi_i(s_i, \tau^z) = \pi_1(s_1) - f + \sum_{i=2}^n \pi_i(s_i, t + z). \tag{1.2}$$

Comparing exports from the MNE's home country to investing in one country and exporting from there, investing in core country 1 is profitable if

$$\begin{aligned} & \Pi^{I,1+X_C} - \Pi^{X_P} \\ &= \underbrace{\pi_1(s_1) - f - \pi_1(s_1, t + y)}_{\substack{\gamma_y(s_1, t + y, f) \\ + \quad + \quad -}} + \underbrace{\sum_{i=2}^n (\pi_i(s_i, t + z) - \pi_i(s_i, t + y))}_{\substack{\chi((n-1), s_i, t + z, t + y) \\ + \quad + \quad - \quad +}} \end{aligned} \tag{1.3}$$

<sup>7</sup>For the given specification of variable cost, profits can be shown to be convex in the trade barrier and distance cost, irrespective of the functional form of the demand function. The result of maximising operating profits ( $\max_x \pi(\cdot) = \max_x [p(x, s_i) - c - \tau]x$ ) by the choice of sales in country  $i$  can be written as  $\pi^* = \pi(p(x^*, s_i), x^*, \tau)$ . By the envelope theorem  $\frac{\partial \pi^*}{\partial \tau} = \frac{\partial \pi}{\partial \tau} = -x^*$ , and, thus  $\frac{\partial^2 \pi^*}{\partial \tau^2} = -\frac{dx^*}{d\tau}$ . From the first-order condition one can see that  $x^*$  is decreasing in  $\tau$ , and hence  $\pi^*$  is convex in  $\tau$ .

is positive. The first term,  $\gamma_y(s_1, t + y, f)$ , measures the difference in profits between investing in country 1 ( $\pi_1(s_1) - f$ ), and exporting to this country from where the MNE is located ( $\pi_1(s_1, t + y)$ ), i.e. it is the net gain from avoiding the tariff and the distance cost by investing. If this expression is positive, it is always profitable to establish a plant abroad. As can be seen from the profit function,  $\gamma_y(s_1, t + y, f)$  is increasing in the trade cost from the periphery  $t + y$ , and decreasing in fixed cost  $f$ . By the definition of the indirect demand function, it is increasing in market size  $s_i$ .

The second term  $\chi((n - 1), s_i, t + z, t + y)$  sums the differences in profits between exporting within the core and exporting from the periphery over all countries that the MNE can access at the lower distance cost by investing in country 1. In other words, country 1 can be viewed as an “export platform” to the other core countries. This export platform gain is always positive, since  $y > z$  and profits  $\pi_i(s_i, t + z)$  and  $\pi_i(s_i, t + y)$  are decreasing in trade cost. That is, this term can render investing in one core country profitable even if the trade cost avoiding gain (the first term in equation (1.3)) is negative.  $\chi((n - 1), s_i, t + z, t + y)$  is decreasing in the within-core trade cost  $t + z$  but increasing in the core-periphery trade cost  $t + y$ . By the convexity of profits in  $\tau^d$ , the export platform gain is decreasing in  $t$ , i.e.  $\pi_i(s_i, t + z)$  decreases by more than  $\pi_i(s_i, t + y)$  when  $t$  increases. Moreover,  $\chi((n - 1), s_i, t + z, t + y)$  is increasing in the number of countries  $(n - 1)$  close to country 1 and in their market size  $s_i$ . This means that investing in country 1 is more attractive the more countries can be served at a low distance and the larger their size.

Setting up plants in  $m$  ( $m \leq n$ ) core countries instead earns the MNE profits of

$$\begin{aligned} \Pi^{I,m+Xc} &= \sum_{i=1}^m [\pi_i(s_i) - f] + \sum_{i=m+1}^n \pi_i(s_i, t + z) \\ &= \Pi^{I,m-1+Xc} + \gamma_z(s_m, t + z, f) \end{aligned} \quad (1.4)$$

$$\text{where } \gamma_z(s_m, t + z, f) = \pi_m(s_m) - f - \pi_m(s_m, t + z).$$

The profits from investing in  $m$  countries can be expressed as a function of the profits from investing in  $m - 1$  countries plus the term  $\gamma_z(s_m, t + z, f)$ . It is profitable to invest in an additional core country as long as this trade cost avoiding gain is positive.  $\gamma_z(s_m, t + z, f)$  depends on trade and fixed cost as well as on market size in the same way as  $\gamma_y(s_m, t + y, f)$ . However, here instead of  $y$  the lower within-core distance cost  $z$  enters, implying that the additional gain from investing in a further core country will always be lower than the profit from the investment in country 1. In addition,  $\gamma_z(s_m, t + z, f)$  depends on the market size of country  $m$  and not on that of the larger country 1. Thus, the lower within-core distance cost and the smaller market size

can make it less profitable to invest in many or all core countries. If setting up in all countries is profitable ( $\gamma_z(s_m, t + z, f) > 0$  for  $m = 1, \dots, n$ ), total profits amount to

$$\Pi^{I,n} = \sum_{i=1}^n [\pi_i(s_i) - f],$$

implying that fixed cost cannot exceed  $f = \pi_i(s_i)$  in each country  $i$ , respectively; i.e. the upper bound for investment  $\bar{f}_{s_i}$  increases with the size of the market.

To summarise the impact of the different parameters, the incentive to invest in core country 1 stems from the difference in distance cost. In the absence of distance costs the MNE's decision would be driven only by the tariff and by market size.<sup>8</sup> The decision between exporting and investing in the core in this case would simply be a trade-off between the tariff and the fixed cost. Without distance costs, equation (1.3) does not produce the export platform term, but only the term that arises from trade cost jumping

$$\begin{array}{cccc} \gamma & (s_1, & t, & f) & = & \pi_1(s_1) & - & f & - & \pi_1(s_1, t). \\ & + & + & - & & & & & & \end{array} \quad (1.5)$$

This extends to investing in  $m \leq n$  countries in the same way as in equation (1.4), and therefore, as long as  $\gamma(s_m, t, f)$  is positive it pays to invest in more than one core country in order to avoid the tariff. If, in addition, all core countries had the same market size, without distance cost the MNE would either invest in all core countries or export to all of them or not serve them at all depending on the levels of the tariff and the fixed cost.

In the presence of different within-core and periphery-core distance costs, however, a high trade cost from the periphery favours investment in more than one country via its positive impact on the trade cost avoiding gain. The first plant in the largest core country in any case gives the highest trade cost avoiding gain, because this saves the tariff and the periphery-core distance cost. Investing in any further core country will still save the MNE the tariff; it will, however, no longer save it the periphery-core distance cost but only the lower within-core distance cost. In addition the smaller market size of these core countries makes investment there relatively less attractive.

<sup>8</sup>Note that such a situation can be interpreted in two ways here: either all countries inside the union can be served at the same cost, or alternatively that the MNE is located amidst its destination markets in the core.

Thus, regarding the SMP's attack on border formalities as *a reduction in variable trade cost*, a lower trade barrier  $t$  implies that the gain from avoiding the trade cost will be smaller, but the export platform gain will be larger. The relative levels of  $t + z$  and  $t + y$  determine which of the two effects dominates. That is, if the trade cost from the periphery is high relative to the trade cost within the core, lowering the tariff will increase the profitability of export platform investment relative to exporting. This is also a possible outcome if periphery-core and within-core distance cost differ less, but there are many core countries that can be served from the export platform. Finally, if the trade cost from the periphery is close to the trade cost within the core, lowering  $t$  will render trade cost jumping less attractive and, thus, exporting from the periphery will be preferred to export platform investment.

Going back to the empirical evidence, SMP measures aimed at barriers to trade have certainly eroded the trade cost avoiding motive further and, hence, facilitated exports. In turn, the outcome of the model where a lower tariff makes export platform investment more attractive reflects the surge in mergers and acquisitions across community borders. Empirically, very few studies find trade and direct investment to be substitutes for each other. Specifically for the case of the EU, Fontagné (1999) provides evidence more in favour of a complementary relationship. However, noting that intra-EU one-way trade decreased considerably during the implementation of the SMP, while at the same time intra-industry trade in differentiated products (trade in intermediate goods), which is generally associated with multinational activity, increased<sup>9</sup>, suggests that there has nonetheless been trade-replacing FDI. The lowering of non-tariff trade barriers is likely to be among the drivers of this development.

Concerning the cost of setting up, a high fixed cost makes exporting - even from the periphery - more attractive. However, even for intermediate values of fixed cost, setting up a plant in one core country from which the core is served with exports can be profitable. Due to SMP measures such as harmonisation of technical and product standards or improved business relations across countries one can argue that *the fixed cost of setting up a plant has decreased*. Therefore, investment in general has become more attractive. In particular, investing in a core country will be more attractive the more countries are accessible from this export platform. This captures mainly so-called 'greenfield investment'. Moreover, it is representative of the fact that between 1986 and 1994 in mergers and acquisitions the most actively targeted sectors were distribution and wholesale (Sleuwaegen (1998)). The example below will illustrate both channels further.

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<sup>9</sup>Two-way trade in vertically differentiated products went up from roughly 35% to 42% from 1986 to 1994, whereas the share of one-way trade in intra-EU12 trade decreased from about 47% to 38% over the same period (EC (1998b), ch. 4).

**Example with linear demands and quantities as the strategic variable**

Taking the indirect demand function to be  $p(s_i, x) = \left(1 - \frac{x}{s_i}\right)$ , output is given in the upper half of Table 1.1. Plugging these values into equation (1.3) the threshold between exporting from the periphery with investing in country 1 and exporting from there can be obtained as

$$f^{X_P \Leftrightarrow I, 1+X_C} = s_1 \left(\frac{1}{2}\right)^2 - s_1 \left(\frac{1-t-y}{2}\right)^2 + \sum_{i=2}^n s_i \left[ \left(\frac{1-t-z}{2}\right)^2 - \left(\frac{1-t-y}{2}\right)^2 \right]. \quad (1.6)$$

Comparing investment in  $m$  with investment in  $m-1$  core countries, the equivalent to equation (1.4) is

$$f^{I, m \Leftrightarrow I, m-1} = s_m \left(\frac{1}{2}\right)^2 - s_m \left(\frac{1-t-z}{2}\right)^2. \quad (1.7)$$

The graphs in Figure 1.2 plot equations (1.6) and (1.7) for two core countries with market size  $s_1 = 1$  and  $s_2 = 0.8$  in the  $f, t$  - space for given values of  $z$  and  $y$  ( $z = 0.1, y = 0.2$  (top) and  $y = 0.7$  (bottom)).

Looking at the impact of fixed cost, first fix  $t$  at a low level (below the prohibitive tariff for exports from the periphery  $\tilde{t}_{MNEP}$ ). For high fixed cost, the MNE will be exporting from the periphery ( $X_P$ ). When fixed costs decrease, at some point export platform investment in one core country ( $I, 1 + X_C$ ) becomes profitable and for low levels of fixed cost establishing a plant in both core countries ( $I, 2$ ) will be worthwhile. Next fix  $t$  at a level above  $\tilde{t}_{MNEP}$ . In this case the MNE will not find it profitable to supply the core ( $\emptyset$ ) for high values of fixed cost. As fixed costs decrease, again, export platform investment in the largest core country becomes profitable ( $I, 1 + X_C$ ). (Even if  $t$  is above the prohibitive level for exports within the core  $\tilde{t}_{MNEC}$ , there will still be investment in core country 1 ( $I, 1$ .) Finally, for low levels of fixed cost the MNE will invest in both core countries ( $I, 2$ ).

As for the tariff, given a high level of fixed cost, the MNE will not supply the core ( $\emptyset$ ) if the tariff is prohibitive, otherwise it will export from the periphery ( $X_P$ ). For intermediate values of fixed cost the effect of lowering  $t$  depends on the level of periphery-core to within-core distance cost. If periphery-core distance cost is not much higher than within-core distance cost, a lower tariff barrier will induce a shift from export platform investment in one core country ( $I, 1 + X_C$ ) to exports from the periphery ( $X_P$ ), as in the upper panel of Figure 1.2. If, instead, periphery-core distance cost are high relative to within-core distance cost the opposite will be the case: a lower tariff can induce a shift from exporting from the periphery ( $X_P$ ) to export platform investment in core country 1 ( $I, 1 + X_C$ ) as in the lower panel of Figure 1.2. Given the remaining parameters

Table 1.1: Sales of different firms under alternative supply strategies

The MNE as a monopolist			
supply strategy	sales in country $i$ by the		
	MNE 0: $x_{0,i}$	Home Firm $i$ : $x_{i,i}$	Core Firm $j$ : $x_{j,i}$
$X_P$	$s_i \frac{1-t-y}{2}$	-	-
$I, i + X_{C,j}$	$s_i \frac{1}{2}$	-	-
$I, n$	$s_i \frac{1}{2}$	-	-
supply strategy	sales in country $j$ ( $j \neq i$ ) by the		
	MNE 0: $x_{0,j}$	Home Firm $i$ : $x_{i,j}$	Core Firm $j$ : $x_{j,j}$
$X_P$	$s_j \frac{1-t-y}{2}$	-	-
$I, i + X_{C,j}$	$s_j \frac{1-t-z}{2}$	-	-
$I, n$	$s_j \frac{1}{2}$	-	-
The MNE facing competition from $n$ core firms			
supply strategy	sales in country $i$ by the		
	MNE 0: $x_{0,i}$	Home Firm $i$ : $x_{i,i}$	Core Firm $j$ : $x_{j,i}$
$X_P$	$s_i \frac{1-2t-(n+1)y+(n-1)z}{n+2}$	$s_i \frac{1+nt+y+(n-1)z}{n+2}$	$s_i \frac{1-2t+y-3z}{n+2}$
$I, i + X_{C,j}$	$s_i \frac{1-(n-1)t+(n-1)z}{n+2}$	$s_i \frac{1-(n-1)t+(n-1)z}{n+2}$	$s_i \frac{1-3t-3z}{n+2}$
$I, n$	$s_i \frac{1-(n-1)t+(n-1)z}{n+2}$	$s_i \frac{1-(n-1)t+(n-1)z}{n+2}$	$s_i \frac{1-3t-3z}{n+2}$
supply strategy	sales in country $j$ ( $j \neq i$ ) by the		
	MNE 0: $x_{0,j}$	Home Firm $i$ : $x_{i,j}$	Core Firm $j$ : $x_{j,j}$
$X_P$	$s_j \frac{1-2t-(n+1)y+(n-1)z}{n+2}$	$s_j \frac{1-2t+y-3z}{n+2}$	$s_j \frac{1+nt+y+(n-1)z}{n+2}$
$I, i + X_{C,j}$	$s_j \frac{1-2t-2z}{n+2}$	$s_j \frac{1-2t-2z}{n+2}$	$s_j \frac{1+nt+nz}{n+2}$
$I, n$	$s_j \frac{1-(n-1)t+(n-1)z}{n+2}$	$s_j \frac{1-3t-3z}{n+2}$	$s_j \frac{1-(n-1)t+(n-1)z}{n+2}$

where  $1 \leq i \leq m$  and  $m < j \leq n$

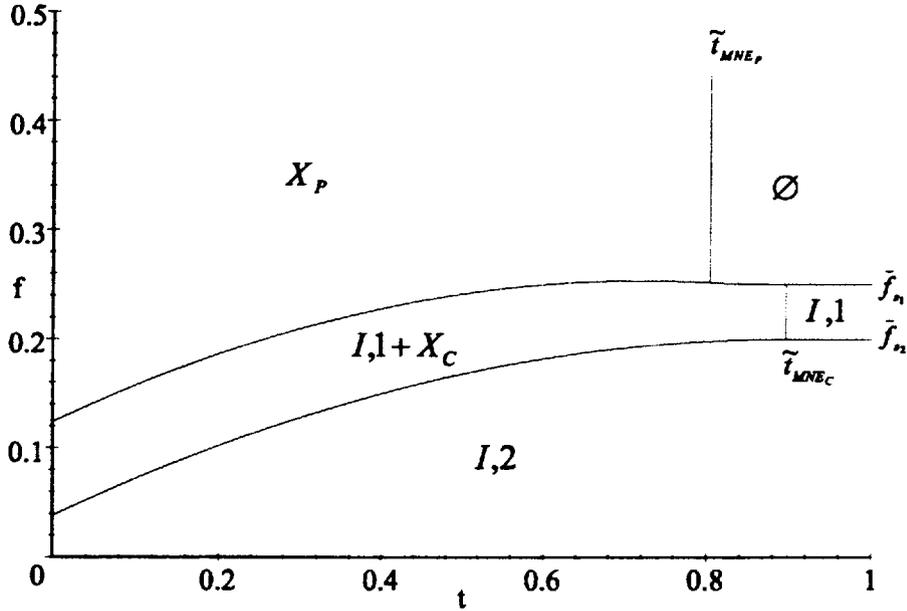
$X_P$ : Exports from the periphery P

$I, i + X_{C,j}$ : Investment in country  $i$  and exports within the core C to country  $j$

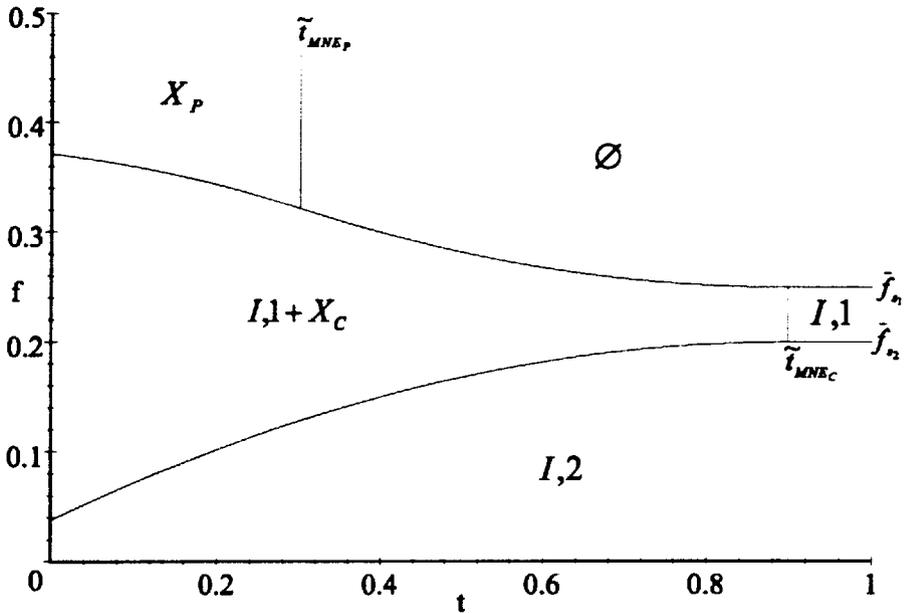
$I, n$ : Investment in  $n$  (all) core countries

Figure 1.2: The monopoly case for two core countries

Periphery-core distance cost small relative to within-core distance cost ( $y = 0.2$ )



Periphery-core distance cost large relative to within-core distance cost ( $y = 0.7$ )



- $X_{P/C}$ : Exports from the periphery (P) or the core (C)
- $I, n$ : Investment in  $n$  countries
- $\emptyset$ : no supply
- $\tilde{t}_{MNE_{P/C}}$ : prohibitive tariff for the MNE for exports from the periphery (P)/within the core (C)
- $\bar{f}_{s_i}$ : maximum level of fixed cost covered by market size  $s$  of country  $i$
- parameters:  $s_1 = 1, s_2 = 0.8, z = 0.1$

in this example, equation 1.6 will be concave as in the lower panel of Figure 1.2 for values of  $y > 0.6 - 0.5t$ . Finally, for low levels of fixed cost, a lowering of tariff barriers unambiguously induces consolidation of investment ( $I, 2$  to  $I, 1 + X_C$ ).

Figure 1.3 repeats the analysis for three core countries where the third core country is assumed to have market size  $s_3 = 0.5$ . As there are now more markets that can be served from country 1, the region where we observe export platform investment in the largest core country ( $I, 1 + X_C$ ) is larger than before. This can be seen by noticing that the periphery-core distance cost here only need to be larger than  $y > 0.4913 - 0.43478t$  for equation 1.6 to be concave. The region where there was investment in two core countries in Figure 1.2, in turn, is split into a region with export platform investment in the two larger core countries plus exports to the smallest core country from there ( $I, 2 + X_C$ ) and a region with investment in all three core countries ( $I, 3$ ). The reasoning for lower fixed cost or a lower tariff barrier is qualitatively the same as in the two core country case above.

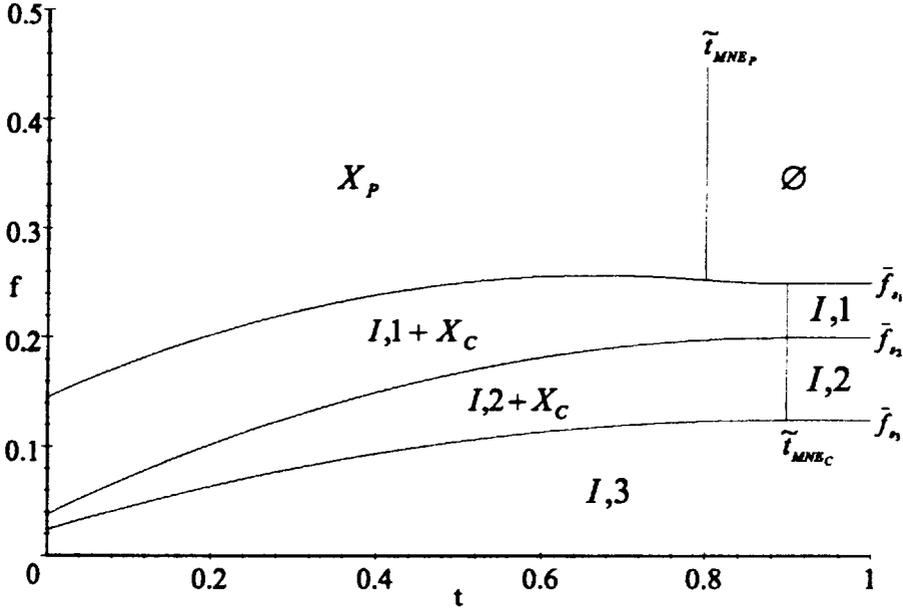
## 1.4 The Supply Decision when the Multinational Faces Competition

The analysis conducted for the multinational as a monopolist can be regarded as a good approximation in the most innovative industries; however, it is likely that the MNE will face some sort of competition. The amount of competition introduced here is restricted to local incumbent firms in the core countries. These firms always supply their home market, and if profitable they export to the other core countries. To keep things tractable they do not have the possibility to invest abroad. All firms still treat markets as segmented. There is no entry of firms other than those mentioned so far. That is, in each market there are between two (if the tariff is such that it is profitable for the MNE to invest, but too high for the other core firms to export), and  $n + 1$  firms operating.<sup>10</sup> Demands are linear with intercept and slope normalised to 1, and firms compete in quantities. This results in a Cournot-Nash equilibrium.

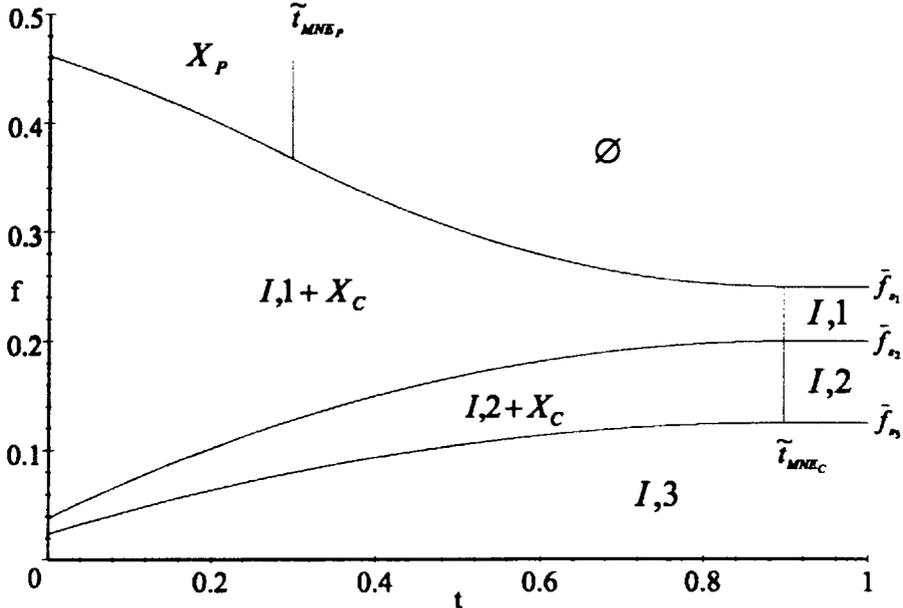
<sup>10</sup>Considering only cases where it is profitable for the MNE to serve the core at all.

Figure 1.3: The monopoly case for three core countries

Periphery-core distance cost small relative to within-core distance cost ( $y = 0.2$ )



Periphery-core distance cost large relative to within-core distance cost ( $y = 0.7$ )



- $X_{P/C}$ : Exports from the periphery (P) or the core (C)
- $I, n$ : Investment in  $n$  countries
- $\emptyset$ : no supply
- $\tilde{t}_{MNE_{P/C}}$ : prohibitive tariff for the MNE for exports from the periphery (P)/ within the core (C)
- $\bar{f}_{s_i}$ : maximum level of fixed cost covered by market size  $s$  of country  $i$
- parameters:  $s_1 = 1, s_2 = 0.8, s_3 = 0.5, z = 0.1$

Denote by  $\bar{x}_i = \sum_{k=1}^{n+1} x_{k,i}$  the total amount of sales of all  $k$  firms in market  $i$ . With total sales divided by market size  $s_i$ , the profits of firm  $k$  in any market  $i$  are

$$\pi_{k,i} = \left(1 - \tau_k^d - \frac{\bar{x}_i}{s_i}\right)x_{k,i} = \left(1 - t_k - d_k - \frac{\bar{x}_i}{s_i}\right)x_{k,i}, \quad (1.8)$$

where trade cost  $\tau_k^d$  are again composed of the tariff  $t_k$  and the distance cost  $d_k$ . The tariff is  $t_k = t$  for all firms that export to this market, and  $t_k = 0$  for the domestic firm and for the MNE if it decides to invest in country  $i$ . The distance cost  $d_k$  is equal to  $y$  for the multinational if it decides to export to a core country from its home country, it is equal to  $z$  for the exports of any firm located in the core and equal to zero for any firm with a plant in this market. The MNE is labelled  $k = 0$ , the local firm in market  $i$  is  $k = i$ , and  $0 < k \neq i$  is left for the incumbents in the other core countries. When profits of the multinational are referred to, the firm subscript  $k$  will be suppressed in the following. From (1.8) the first order condition for output of firm  $k$  in market  $i$  is given by

$$x_{k,i} = s_i \left(1 - \tau_k^d - \frac{\bar{x}_i}{s_i}\right), \quad (1.9)$$

i.e. equilibrium profits are given by  $\pi_{k,i} = s_i \left(1 - \tau_k^d - \frac{\bar{x}_i}{s_i}\right)^2$ . When it is profitable for all firms to be active in market  $i$ , total sales in this market can be obtained as

$$\bar{x}_i = s_i \frac{1 + n - \bar{\tau}^d}{n + 2}, \quad (1.10)$$

where  $\bar{\tau}^d = \sum \tau_k^d$ . Plugging this back into (1.9) output of each firm is

$$x_{k,i} = s_i \frac{1 - (n + 1)\tau_k^d + \bar{\tau}_{-k}^d}{n + 2}, \quad (1.11)$$

where  $\bar{\tau}_{-k}^d$  denotes the trade cost (i.e. the sum of the tariff and the distance cost) of all firms other than firm  $k$  operating in this market. The output of the MNE, the domestic firm and a core country firm are calculated explicitly in Table 1.1 for the case of  $n + 1$  firms (lower half).

From equation (1.11) one can see that a firm's sales and hence its profits in a market are decreasing in its own access cost (trade cost) and increasing in its competitors' access costs to this market<sup>11</sup>:

$$\pi_{k,i} = \pi \left( s_i, \tau_k^d, \bar{\tau}_{-k}^d \right) \quad (1.12)$$

+      -      +

By assumption, profits are increasing in market size. If trade costs change simultaneously for firm  $k$  and its  $n - 1$  competitors, one obtains

$$d\bar{\tau}_{-k}^d = (n - 1)d\tau_k^d \Rightarrow \frac{dx_{k,i}}{d\tau_k^d} = \frac{\partial x_{k,i}}{\partial \tau_k^d} + (n - 1) \frac{\partial x_{k,i}}{\partial \bar{\tau}_{-k}^d} < 0. \quad (1.13)$$

From equation (1.11) one can see that the direct effect dominates. Thus, as either component of the trade cost increases, output, and therefore profits, fall.

The analysis of the different supply strategies proceeds much the same way as above. Consider first the multinational's profits from exporting to all core countries

$$\Pi^{XP} = \sum_{i=1}^n \pi_i [s_i, \tau_y; (n - 1)\tau_z] = \sum_{i=1}^n \pi_i [s_i, t + y; (n - 1)(t + z)]. \quad (1.14)$$

The properties of the profit function in one market (equation (1.12)) continue to hold; total profits are also increasing in market size  $s_i$ , decreasing in own trade cost  $t + y$  and increasing in the competitors' trade cost  $t + z$ . The negative effect of own trade cost dominates (see (1.13)), implying that total exports are decreasing in  $t$ . From the expressions in Table 1.1, note that the prohibitive tariffs differ according to the location of firms. For the multinational the prohibitive tariff for exports from its home country to market  $i$  given distance cost is

$$\tilde{t}_{MNEP} = \frac{1 - (n + 1)\bar{y} + (n - 1)\bar{z}}{2}. \quad (1.15)$$

If the MNE exports from the periphery the prohibitive tariff for exports of a core country firm to market  $i$  given distance cost is

$$\tilde{t}_{CFX} = \frac{1 - 3\bar{z} + \bar{y}}{2}. \quad (1.16)$$

<sup>11</sup>Neary (2002) proves that this result also applies to different specifications of demand functions. In his Appendix he shows that the properties in (1.12) hold for Bertrand as well as for Cournot competition with linear demands and differentiated products. They also hold under Cournot competition with general demands except when demands are highly convex and the firm in question has a relatively small market share.



impact on profits due to increased competition may easily outweigh the positive own effect. In the case of the demand function employed in (1.8), equation (1.18) becomes

$$\frac{d\Pi^{I,1+X_C}}{dt} = -\frac{2}{(n+2)^2} \left\{ 2 \sum_{i=2}^n s_i - s_1(n-1) - (t+z) \left[ s_1(n-1)^2 + 4 \sum_{i=2}^n s_i \right] \right\}. \quad (1.19)$$

Normalising  $s_1$  to 1, this says that for values of  $t+z \geq \frac{1-n+2\sum_{i=2}^n s_i}{(n-1)^2+4\sum_{i=2}^n s_i}$  the impact from competition dominates. If all core country markets were of equal size ( $s_1 = s_i = 1$ ), this would be equal to  $t+z \geq \frac{1}{n+3}$ .<sup>14</sup> This threshold is decreasing in the number of countries that are to be served from country 1. If, in addition, these countries have small market sizes, the threshold for the own effect to dominate is further reduced. Taken together this implies that under competition, a lowering of trade cost is unlikely to induce a switch to export platform investment.

Comparing profits from investing in one core country with the profits from exporting to all core countries from the periphery, yields a decomposition similar to the monopoly case:

$$\begin{aligned} \Pi^{I,1+X_C} - \Pi^{X_P} &= \gamma_y^C(s_1, t+z, t+y, f) \\ &\quad + \quad + \quad + \quad - \\ &+ \chi^C(s_i, t+z, t+y, (n-1)), \\ &\quad + \quad - \quad + \quad + \end{aligned} \quad (1.20)$$

where  $\gamma_y^C(s_1, t+z, t+y, f)$   
 $= \pi_1[s_1; (n-1)(t+z)] - f - \pi_1[s_1, t+y; (n-1)(t+z)]$   
 and  $\chi^C((n-1), s_i, t+z, t+y)$   
 $= \sum_{i=2}^n \{ \pi_i[s_i, t+z; (n-1)(t+z)] - \pi_i[s_i, t+y; (n-1)(t+z)] \}.$

The trade and distance cost avoiding gain  $\gamma_y^C(s_1, t+z, t+y, f)$  is increasing in  $s_1$ , the market size of country 1 and decreasing in the fixed setup cost  $f$ . It is increasing in the core-periphery trade cost  $t+y$  as well as in the within-core trade cost  $t+z$ . The export platform gain  $\chi^C(s_i, t+z, t+y, (n-1))$  is increasing in the number of countries close to country 1, in the market size of these countries, and in the periphery-core trade cost  $t+y$ . It is decreasing in within-core trade cost  $t+z$ . Thus, while it becomes unlikely that a lower tariff induces export platform investment, the remaining parameters work in the same direction as in the monopoly case. This also holds for setting up plants in more than one core country. The profits from investing in  $m$  core countries

<sup>14</sup>A similar result is obtained by Neary (2002), p. 305.

in the order of their market size can be written as

$$\begin{aligned} \Pi^{I,m} &= \sum_{i=1}^m \{ \pi_i [s_i; (n-1)(t+z)] - f \} + \sum_{i=m+1}^n \pi_i [s_i, t+z; (n-1)(t+z)] \quad (1.21) \\ &= \Pi^{I,m-1} + \gamma_z^C (s_m, t+z, f). \\ &\quad \quad \quad + \quad \quad - \end{aligned}$$

In this case, too, as long as  $\gamma_z^C(s_m, t+z, f)$  is positive, it is profitable to establish plants in further core countries.

In the range of parameters where investment by the MNE gives rise to a duopoly by deterring exports from the core country incumbents, the trade cost avoiding gain in equation (1.20) becomes  $\gamma_y^D(s_1, t+y, t+z, f) = \pi_1^D(s_1) - f - \pi_1 [s_1, t+y; (n-1)(t+z)]$ . This expression now depends negatively on the within-core trade cost  $t+z$ . However, from (1.13) note that the direct effect of the periphery-core distance cost  $y$  in  $\pi_1 [s_1, t+y; (n-1)(t+z)]$  dominates.

In the presence of competition the overall picture remains similar to that of the monopoly case. On the one hand, lower trade and investment barriers favour competition between the MNE and core firms. This makes it less attractive for the MNE to engage in the core at all. On the other hand, if fixed costs are such that investing in at least one core country is profitable and within-core distance cost are not too low, investment by the MNE can even deter competition from the other core country firms. Thus, this case can be held representative for some of the greenfield investment. It is also representative for the increase in exports at the time of the SMP, in particular the increase in intra-industry trade in industries with high non-tariff barriers (EC (1998b), p. 115).

### Example with linear demands and Cournot competition

Output for the different firms under alternative supply strategies of the MNE (in the parameter range where all firms are active) are calculated in the lower part of Table 1.1. The threshold between investing in core country 1 and exporting from the periphery (equation (1.20)) is, thus, given by

$$\begin{aligned} f^{X_P \Leftrightarrow I,1+X_C} &= s_1 \left( \frac{1+(n-1)(t+z)}{n+2} \right)^2 \\ &\quad + \sum_{i=2}^n s_i \left( \frac{1-2(t+z)}{n+2} \right)^2 - \sum_{i=1}^n s_i \left( \frac{1-2t-(n+1)y+(n-1)z}{n+2} \right)^2. \end{aligned} \quad (1.22)$$

This holds for tariffs up to the prohibitive level for the MNE  $\tilde{t}_{MNEP} = \frac{1-(n+1)y+(n-1)z}{2}$ . Above that export platform investment in core country 1 by the MNE has to be compared to not supplying the core. Note that here, the higher the periphery-core distance cost  $y$ , the less likely it is that the MNE exports to the core at all from the periphery. Core country firms, on the other hand, will only stop exporting within the core for  $\tilde{t}_{CFX} > \frac{1-3z+y}{2}$ . If, however, fixed costs are such that the MNE invests, then core firms will already stop exporting above  $\tilde{t}_{CFI} = \frac{1-3z}{3}$ . For trade barriers higher than this, the MNE shares the market in country 1 only with the local incumbent. In this case, the first-term in equation (1.22) has to be replaced by the Cournot duopoly profits of  $s_1 \left(\frac{1}{3}\right)^2$ ; the other terms remain unchanged.

For investment in additional countries the threshold between investing in  $m$  and  $m - 1$  core countries (equation (1.21)) is given by

$$f^{I,m \Leftrightarrow I,m-1} = s_m \left( \frac{1 + (n-1)(t+z)}{n+2} \right)^2 - s_m \left( \frac{1 - 2(t+z)}{n+2} \right)^2. \quad (1.23)$$

In this equation too, for tariffs above  $\tilde{t}_{CFI}$ , the first term has to be replaced by the Cournot duopoly profits of  $s_m \left(\frac{1}{3}\right)^2$ .

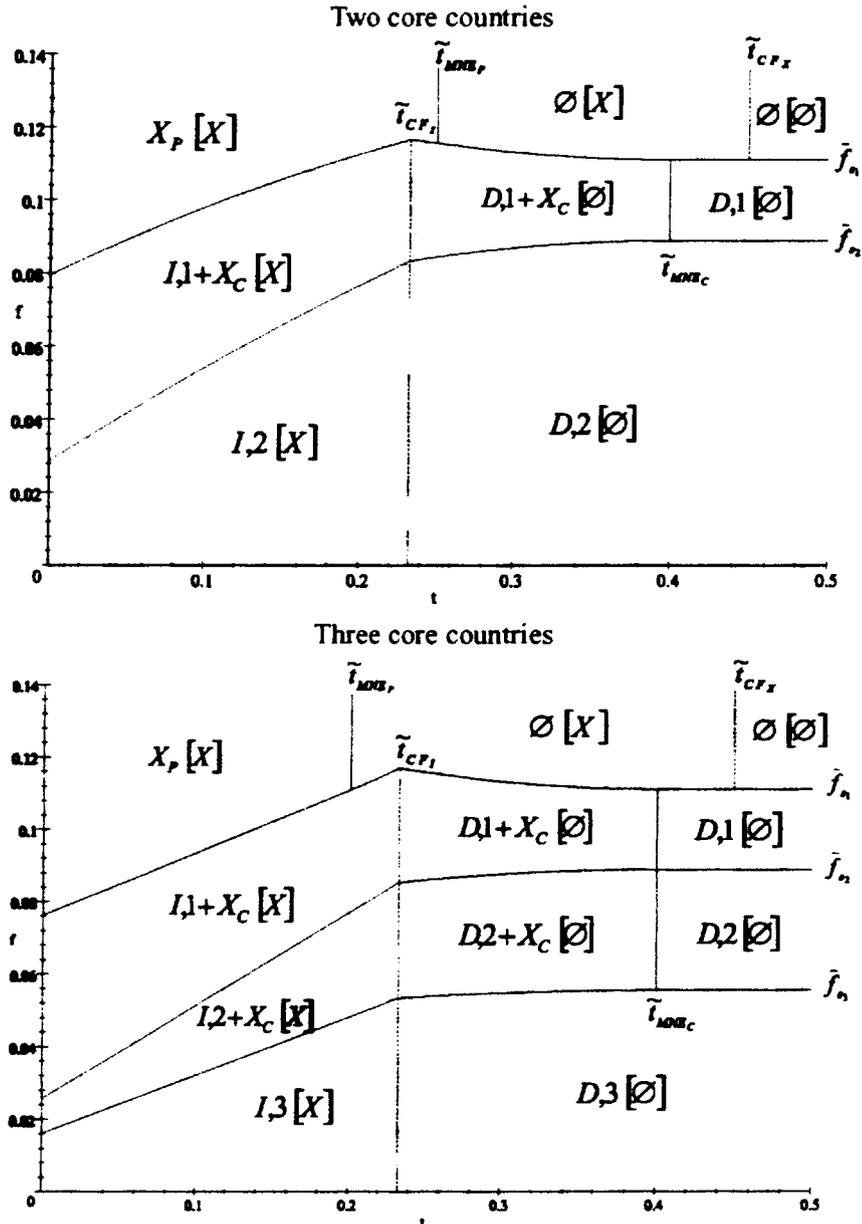
Thus, as can be seen from Figure 1.4, strategic interaction increases the number of possible outcomes of the MNE's supply decision. The two graphs depict the same situation as in the upper panels of Figures 1.2 and 1.3 for the case with competition (2 and 3 countries,  $s_1 = 1$ ,  $s_2 = 0.8$ ,  $s_3 = 0.5$ ,  $z = 0.1$ ,  $y = 0.2$ ).<sup>15</sup> In square brackets are the supply strategies for the core country firms (exports  $[X]$  or no supply  $[\emptyset]$ ).

Looking at fixed cost first, if the tariff is held fixed at a level below the prohibitive level for exports ( $\tilde{t}_{MNEP}$ ), the MNE will export from the periphery ( $X_P$ ). For lower values of fixed cost there will be export platform investment ( $I, i + X_C$ ) or investment in all core countries ( $I, 2$  or  $I, 3$ ) as before. When the trade barrier is above the prohibitive level for exports by the MNE and fixed costs are high, the MNE will not supply the core at all, while core country firms may still find it profitable to export within the core ( $\emptyset [X]$ ). For lower values of fixed cost, investment in one core country by the MNE may make it unprofitable for the core firms to export to this market. In this case, the MNE and the local incumbent earn duopoly profits in this country. Such investment serves as an export platform ( $D, i + X_C$ ) up to the prohibitive tariff for exports by the MNE within the core  $\tilde{t}_{MNEC}$ , above which the MNE keeps its plant, but stops exporting ( $D, i$ ).

<sup>15</sup>If  $y = 0.7$  as in the lower panels of Figures 1.2 and 1.3, the region where the MNE exports from the periphery disappears from the picture. In turn, export platform investment in country 1 will be profitable up to slightly higher values of  $f$ , the slope of this threshold will remain smaller than 1 though.

# Does Economic Integration Increase Intra-Region Direct Investment?

Figure 1.4: The competition case



- $X_{P/C}$ : exports by the MNE from the periphery (P) or the core (C)
- $I, n/D, n$ : investment/duopoly outcome in  $n$  countries
- $\emptyset$ : no supply
- $\tilde{t}_{MNEP/C}$ : prohibitive tariff for the MNE for exports from the periphery (P) within the core (C)
- $\tilde{t}_{CFX/I}$ : prohibitive tariff for the core firms if the MNE exports from the periphery (X) or invests (I)
- $\tilde{f}_{s_i}$ : maximum level of fixed cost covered by market size  $s$  of country  $i$
- [supply mode of core country firms]: [X] - exports, [ $\emptyset$ ] - no supply
- parameters:  $s_1 = 1, s_2 = 0.8, s_3 = 0.5, z = 0.1, y = 0.2$

Taking for given a high level of fixed cost, lower tariff barriers will induce the MNE to export from the periphery ( $\emptyset$  to  $X_P$ ). At low levels of fixed cost a decrease in tariff barriers first allows the MNE to export from the country where it has established a plant to the other core countries ( $D, i$  to  $D, i + X_C$ ) without having to fear competition from other core country firms. When tariff barriers decrease below  $\bar{t}_{CF}$ , the MNE's profits from investing will be diluted as core firms find it profitable to export as well.

Summarising, due to the competition, trade and investment barriers need to fall by more than in the monopoly case for the MNE to engage in the core. If it is profitable for the MNE to invest, however, it may be able to deter competition from exporters with its investment.

## 1.5 Concluding Remarks

This chapter analyses the decision of a multinational enterprise located inside an integrating region whether to supply a group of other countries in this region by investing there or via exports. Investing involves a fixed cost to establish production facilities. Exports, in turn, are subject to a trade cost of which one part is due to remaining trade barriers ('tariff') and the other part depends on the distance of the multinational's production facilities to its destination markets. The destination countries ('core') are assumed to be close to each other, either in terms of geographical distance or in terms of cultural linkages.

Within this setting the impact of a lowering of (non-)tariff barriers to trade and barriers to investment as suggested by measures associated with the Single Market Programme in the EU is examined. If the MNE is able to act as a monopolist, lowering barriers to trade, such as abolishing border formalities, makes exporting from the MNE's home country in the 'periphery' or consolidation of investment in fewer core countries more profitable. This accounts for the surge in cross-border mergers and acquisitions within the EU from 1988 to 1990.<sup>16</sup> If, however, trade costs (tariff plus distance costs) from the periphery to the core are much higher than within the core a lower tariff will make export platform investment more attractive than exports. This will also be the more likely outcome for intermediate levels of periphery-core to within-core distance cost, the more and the larger the countries that can be served from the export platform in the core. This situation accounts for some of the greenfield investment associated with the Single Market.

<sup>16</sup>Falvey (1998) and Horn and Persson (2001) examine incentives for mergers brought about by trade policy in two-country models.

Arguing that the SMP has affected the fixed cost of setting up a plant, the model predicts that rather than exporting or not supplying the core at all the multinational will invest first in the largest of the core countries. For low values of fixed cost, investment in more than one core country is also a possible outcome. This is another explanation for some of the greenfield investment the SMP has brought about.

If the multinational faces competition from core country incumbents that are able to export to the other core countries, the model gets a strategic dimension. As the local competitors also benefit from lower trade costs, competition reduces the multinational's profits from investing in as well as from exporting to the core compared to the monopoly case. Hence, MNE activity in the core is less likely. Trade barriers have to be low for the MNE to export to the core, while core firms still find it profitable to trade within the core for intermediate levels of trade cost. If parameters are such that investment is profitable and trade costs (or within-core distance costs) are not too low, a duopoly between the MNE and the local incumbent will arise in the core country where the MNE established its plant and exports from core country competitors are deterred.

MNE activity in the model is motivated by market-seeking motives throughout. It does not account for factor cost considerations, for example, which may well have been at the root of the increase in FDI flows going from the core (the founding members of the EU plus the UK) to the periphery between 1980 and 1992 (see Morsink (1998), p. 69). The model also neglects the impressive amounts of intra-EU FDI small countries such as Belgium and, in particular, Ireland have been able to attract. Next to these considerations, future research should develop the analysis further by allowing for competition from other potential multinationals and possibly for reciprocal investment.

## **Chapter 2**

# **The Impact of Multinational Entry on Domestic Market Structure and R&D**

### **Abstract**

We model the impact of different modes of multinational entry on the choices of domestic firms. Focusing on the competitive effects of foreign presence in the host country, we demonstrate that greenfield investment will increase competition only if it is not countered by anti-competitive reactions on the part of the domestic firms. Considering also cross-border mergers and acquisitions the model, thus, provides two alternative explanations for the increase in concentration ratios in industries with mostly horizontal foreign direct investment. Moreover, foreign presence is shown to raise total investment in the local industry at the cost of crowding out domestic R&D.

## 2.1 Introduction

Worldwide foreign direct investment (FDI) has grown impressively in the past 30 years. According to the latest World Investment Report 2004 (UNCTAD (2004)) FDI inward stock has grown on average at 13,1% per year between 1986 and 2003. Since the late 1980s FDI has increasingly taken the form of cross-border mergers and acquisitions (M&A) rather than greenfield investment (UNCTAD (2000)). At the same time concentration ratios in industries with strong horizontal FDI activity such as automobiles, pharmaceuticals and banking have risen (UNCTAD (1999)). Taken together this suggests that multinational enterprises (MNE) are increasing in size, if not also in efficiency.<sup>1</sup> The impact of these multinational players is likely to be felt strongest in the markets they enter. Previous work has mainly examined this in the light of technology spillovers from the foreign to the domestic firms. However, entry by a foreign multinational enterprise constitutes first of all a major change in the market structure of the host country industry. This may induce a reaction by the domestic firms that can take the form of investment in technology, exit, or a domestic merger. The aim of this chapter is to emphasise this latter aspect by examining the interaction between different modes of multinational entry and the induced moves of the domestic firms regarding changes in market structure, R&D investment and welfare.

From the perspective of an individual multinational firm, the choice between a cross-border merger or acquisition and greenfield entry is ascribed to different firm characteristics (see UNCTAD (2000, p. 145) and Kang and Johansson (2000)). Good organisational and managerial skills, high advertising intensity, and the prospect of a speedy market entry are more conducive to M&A. Whereas a technological advantage works in favour of greenfield investment. Host country governments, in turn, tend to have different concerns when it comes to choose between these two alternatives. Often they favour greenfield investment as it is said to increase competition by adding new production capacity to the market. M&As, in contrast, are associated with a decrease in competition or at best with no change in market structure. However, this perception disregards that firms acquired by foreign investors may initiate competition with incumbents in the host country, for example with the help of superior technological skills from parent companies. Furthermore, if inefficient target firms which otherwise may be forced to exit are acquired and restructured by foreign investors, M&As may enhance competition in the host country. By the same token, it is possible that an initial increase in competition through greenfield entry may trigger domestic firms to exit or to merge. While documentation of these issues is scarce, exit is

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<sup>1</sup> A number of empirical studies confirm that MNEs are, in most cases, the largest and most efficient firms in an industry. See Barba Navaretti and Venables (2004, ch. 7.3) for an overview.

shown to be a relevant strategy for domestic firms by De Backer and Sleuwaegen (2003). They find that import competition as well as FDI discourage entry and stimulate exit of domestic entrepreneurs in a sample of Belgian manufacturing firms. Accentuating the importance of research and development (R&D) in their analysis of Irish manufacturing, Görg and Strobl (2003) show that the presence of foreign firms can also have a life-enhancing effect on domestic firms, but this is the case only in high-tech sectors.

Next to its original intentions the empirical literature on technology spillovers renders a closer look at the impact of foreign entry on changes in market structure and competition in the host country an interesting exercise. A difficulty with many of these papers is that the available data does very often not allow to divorce spillover effects from pro-competitive effects of multinational presence. Görg and Strobl (2003) ascribe their above mentioned finding of a life-enhancing effect on Irish firms to technology spillovers from the foreign firms in the market. However, the majority of the empirical studies examining horizontal spillovers finds a negative impact of foreign presence on domestic firms or industries (see Görg and Greenaway (2004) for a survey). This suggests that the pro-competitive effects from foreign entry outweigh potential spillover effects at least in the short run. Sembenelli and Siotis (2005) confirm this in their study of Spanish manufacturing firms where they make an attempt to disentangle the pro-competitive and the spillover effects. They find that especially in non-R&D intensive sectors the entry of MNEs dampens the profit margins of local firms in the short run, to give way to efficiency-enhancing effects in the longer run. Overall, this suggests that the pro-competitive effects from foreign entry on the host country are strong and that domestic firms are more likely to be able to put up with them in high-tech sectors.

The theoretical literature has long treated foreign direct investment as a homogenous phenomenon, where cross-border mergers and acquisitions and greenfield investment are observationally equivalent. The focus of recent papers breaking with this tradition is mostly on the multinational firms' motives for choosing one mode of entry over another accounting for host country characteristics, e.g. Horn and Persson (2001), Bjorvatn (2004), Eicher and Kang (2004), Nocke and Yeaple (2004). In the model presented here we look at i) how the MNE's mode of entry choice is affected when the firms in the host country are allowed to react; ii) how this interaction affects market structure and iii) its impact on the level of R&D investments and welfare in the host country. To this end, we build a four-stage game where the MNE chooses between entry via acquisition of a domestic firm and greenfield investment in the first stage of the game. The domestic firms can react to this choice in the second stage. In the last two stages of the game all active firms first invest in process R&D before engaging in Cournot competition in the

product market. Two of the issues in this chapter have been addressed before in settings with one incumbent in the host country. Veugelers and Vanden Houte (1990) study the impact of foreign competition on the innovative efforts of a domestic firm. Mukherjee (2004) looks at the welfare implications of greenfield versus acquisition entry in a model of foreign entry and R&D competition.

The assumption of an asymmetric duopoly as the initial market structure in the host country allows us to demonstrate that the impact of foreign entry on the host country is not independent of possible reactions by the local incumbents. In particular, we show that a concentrated market structure may result even in the case of greenfield entry when the domestic firms merge or exit the market as a consequence. In this way, the chapter provides an explanation for the increase in concentration ratios in industries where horizontal FDI is prevalent that is complementary to the surge in cross-border M&A as a share of FDI. Moreover, we show that a technological advantage of the multinational firm only favours greenfield investment over an acquisition when either the domestic firms are sufficiently competitive or when they are induced to eliminate competition among themselves by merging. Looking at the incentives to engage in cost-reducing R&D investment in such a setting, we obtain a result that is very much in line with the empirical evidence: The presence of a more efficient foreign firm in the domestic market will increase total R&D investment in the industry. However, this comes at the cost of crowding out domestic R&D when compared to a situation with domestic firms only. This is in contrast to Veugelers and Vanden Houte (1990). In their model the less differentiated products, the less likely a negative impact of multinational presence on local innovative efforts. Finally, while consumer surplus increases, full profit repatriation on the part of the foreign firm reduces producer surplus by so much that domestic welfare will typically be lower after foreign entry. As the focus in this chapter is on competition, this should be regarded as a lower bound to domestic welfare after foreign entry.

The remainder of the chapter is structured as follows: Section 2.2 presents the components of the model. In Section 2.3 the model itself is addressed. First, the properties of the model are presented in the benchmark equilibrium without foreign entry (2.3.1); then the game with foreign entry is analysed (2.3.2). Section 2.4 illustrates the equilibrium market structure. Section 2.5 compares the associated R&D (2.5.1) and welfare levels (2.5.2) to the benchmark situation without foreign presence. Section 2.6 concludes.

## 2.2 The Setup

As the focus here is on the impact of the mode of foreign entry on changes in domestic market structure, all action will take place in one country. We look at one particular industry in this country. There are two domestic firms in this industry,  $H1$  and  $H2$ . They differ in their level of marginal cost,  $H1$  is more efficient than  $H2$ :  $c_{H1} \leq c_{H2}$ . The potential multinational entrant  $M$  is assumed to be more efficient than the domestic firms, its marginal cost is given by  $c_M$ , where  $c_M \leq c_{H1} \leq c_{H2}$ .

All firms in the market can make investments to reduce marginal cost by an amount  $x_i$ . Accordingly the kind of investment considered is process R&D.<sup>2</sup> Investment is associated with a cost of  $\gamma x_i^2$  for all firms, where  $\gamma$  measures the degree of convexity of the cost function. Convexity of investment cost is ensured by  $\gamma > \frac{3}{4}$ .<sup>3</sup>

Firms are producing a homogenous good. Hence, demand is the same for all firms with the indirect demand function given by  $p = a - Q$ , where  $a$  represents the size of the market and  $Q = \sum_{i=1}^n q_i$  is the sum over all firms' sales. For firms to produce positive levels of output, we need  $a > c_{H2} \geq c_{H1} \geq c_M > 0$ . The multinational's and the domestic firms' profits are then given by, respectively

$$\Pi_i(q_i, x_i) = (p - (c_i - x_i))q_i - \gamma x_i^2, \text{ where } i = M, H1, H2. \quad (2.1)$$

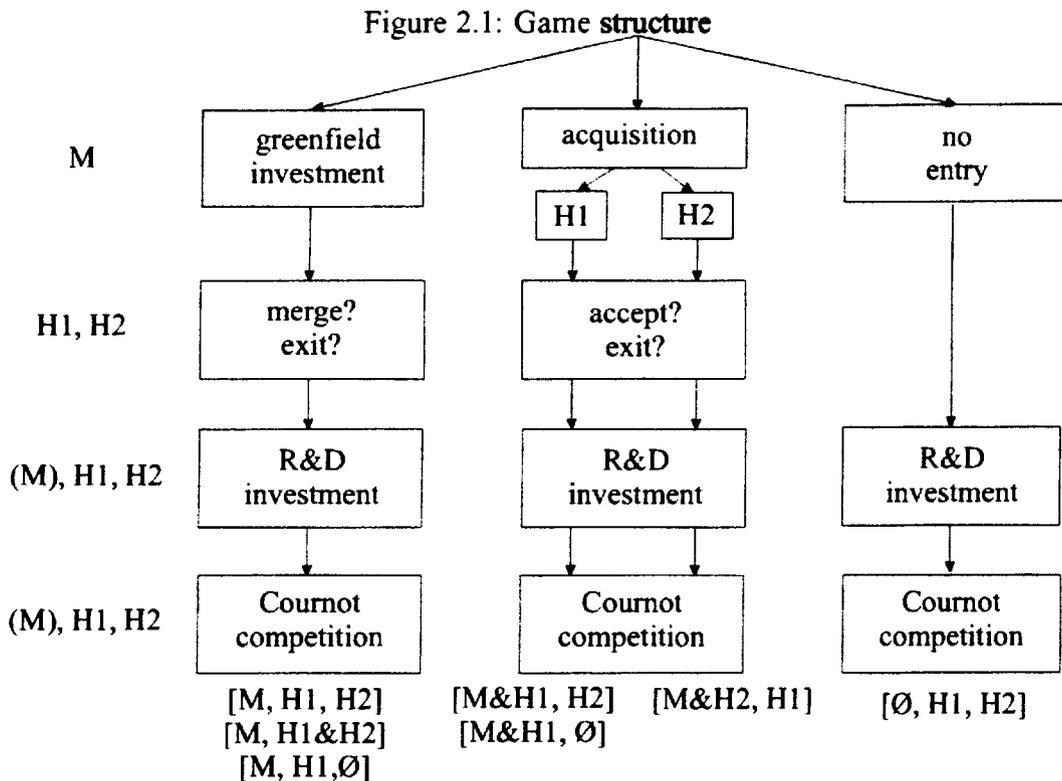
The structure of the game is outlined in Figure 2.1. In the first stage the multinational firm decides whether and if so how to enter the domestic market. It can either acquire one of the domestic firms or set up its own plant (i.e. greenfield investment).<sup>4</sup> If the MNE decides to enter via an acquisition, it will make a take-it-or-leave-it offer to one of the domestic firms. Mergers and acquisitions are modelled here as was first done by Salant, Switzer and Reynolds (1983), that is the target firm is compensated for being taken over and then vanishes.<sup>5</sup> Greenfield investment by the MNE is associated with a fixed cost of setting up production facilities  $f$ .

<sup>2</sup>This way of modelling R&D goes back to Brander and Spencer (1983). Investments that increase demand can be modelled in a similar way (see e.g. Veugelers and Vanden Houte (1990)).

<sup>3</sup>Note that this condition is stronger than the second order condition on investment. It is sufficient for the denominator of profits to be positive in a situation with three (or less) active firms in the market.

<sup>4</sup>This choice of alternatives for a firm to serve a market abroad is not exhaustive, especially exports are disregarded for simplicity. See e.g. Bjorvatn (2004) on the latter and Buckley and Casson (1998) for a fairly comprehensive treatment of possible supply modes from abroad.

<sup>5</sup>Note, however, that the assumption of different marginal cost does not imply the Salant, Switzer and Reynolds (1983) result that mergers will only be profitable if they involve at least 80% of the firms in an industry.



In the second stage the domestic firms can react to the MNE's decision. In the case of greenfield investment, entry by the MNE may induce exit or a merger among the domestic firms. In the case of entry via acquisition, the domestic firms can accept or reject the take-it-or-leave-it offer. Similarly an acquisition also has the potential to force the non-acquired firm out of the market.

In the third stage of the game, all active old and new entities of firms decide how much to invest in a cost reducing technology before engaging in Cournot competition in the last stage of the game. The game consists of these last two stages for the domestic firms only if the multinational firm decides not to enter the market. As will be detailed further in the next section, the notation in square brackets at the bottom of Figure 2.1 describes the resulting market structure outcomes. For example  $[\emptyset, H1, H2]$  states that only the two domestic firms are present in the market.

To understand the structure of the game and in particular the possibility of mergers and acquisitions, note that we assume a competition authority in the background that follows a simple rule: namely to prohibit mergers or acquisitions that lead to monopoly. A final assumption is

that whenever two firms form a new entity, they will be able to use the technology of the more efficient firm without additional cost, i.e. technology transfer is costless.<sup>6</sup>

## 2.3 The Model

### 2.3.1 Benchmark without Foreign Entry

The situation without foreign entry, i.e. the right hand arm of Figure 2.1, is considered to be the initial market structure and also the benchmark. We are, hence, looking at the solution to a two-stage game, where the two domestic firms decide about investments in technology in the first stage and engage in Cournot competition in the second stage. The game is solved by backward induction. Equilibrium profits are given in the top part of Table 2.1 (see  $[\emptyset, H1, H2]$ ). For  $H2$  to produce positive quantities in equilibrium, the following condition needs to be satisfied:

$$c_{H2}^{Dexit} \leq \frac{3\gamma(a + c_{H1}) - 2a}{2(3\gamma - 1)}. \quad (2.2)$$

Above this threshold,  $H2$  will exit the market. This condition also implies that both firms have positive levels of investment in equilibrium.

Sales are increasing in market size  $a$ , decreasing in own initial marginal cost  $c_i$ , increasing in the marginal cost of the competitor(s)  $c_{-i}$ , decreasing in the technology parameter  $\gamma$ , and decreasing in the number of active firms in the market. With the exception of  $c_{-i}$ , the same is true for investment. Whether a firm's investment level is increasing or decreasing in the marginal cost of its competitor(s) depends on its efficiency relative to the average efficiency (marginal cost) in the market. As shown in Boone (2000), firms that are far ahead or far behind their competitors have the least incentives to reduce marginal cost.

### 2.3.2 The Model with Foreign Entry

Now the game where the MNE actually enters the host country market can be addressed. Again, solving by backward induction the equilibrium profits under the different entry modes of the MNE can be obtained as given in Table 2.1. The different market structure outcomes are explained in detail below.

<sup>6</sup> Authors who consider technology transfer explicitly include, for example, Wang and Blomström (1992), Glass and Saggi (2002) and Mattoo, Olarreaga and Saggi (2004).

Table 2.1: Net profits

Domestic Firms only (Benchmark)	
[ $\emptyset, H1, H2$ ]	
H1	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a - 2c_{H1} + c_{H2}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
H2	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_{H1} - 2c_{H2}) - 2(a - c_{H2})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
Greenfield Investment	
[ $M, H1, H2$ ]	
M	$\gamma(16\gamma - 9) \left( \frac{4\gamma(a - 3c_M + c_{H1} + c_{H2}) - 3(a - c_M)}{(16\gamma - 3)(4\gamma - 3)} \right)^2 - f$
H1	$\gamma(16\gamma - 9) \left( \frac{4\gamma(a + c_M - 3c_{H1} + c_{H2}) - 3(a - c_{H1})}{(16\gamma - 3)(4\gamma - 3)} \right)^2$
H2	$\gamma(16\gamma - 9) \left( \frac{4\gamma(a + c_M + c_{H1} - 3c_{H2}) - 3(a - c_{H2})}{(16\gamma - 3)(4\gamma - 3)} \right)^2$
[ $M, H1 \& H2$ ]	
M	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a - 2c_M + c_{H1}) - 2(a - c_M)}{(9\gamma - 2)(3\gamma - 2)} \right)^2 - f$
H1&H2	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
[ $M, H1, \emptyset$ ]	
M	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a - 2c_M + c_{H1}) - 2(a - c_M)}{(9\gamma - 2)(3\gamma - 2)} \right)^2 - f$
H1	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
H2	0
Acquisition of H2	
[ $M \& H2, H1$ ]	
M	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a - 2c_M + c_{H1}) - 2(a - c_M)}{(9\gamma - 2)(3\gamma - 2)} \right)^2 - v_2$
H1	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
H2	$v_2 = \max \left[ 0; \gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H2}) - 2(a - c_{H2})}{(9\gamma - 2)(3\gamma - 2)} \right)^2 \right]$
Acquisition of H1	
[ $M \& H1, H2$ ]	
M	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a - 2c_M + c_{H2}) - 2(a - c_M)}{(9\gamma - 2)(3\gamma - 2)} \right)^2 - v_1$
H1	$v_1 \geq \gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
H2	$\gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H2}) - 2(a - c_{H2})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
[ $M \& H1, \emptyset$ ]	
M	$\gamma \frac{(a - c_M)^2}{4\gamma - 1} - v_1$
H1	$v_1 \geq \gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2$
H2	0

When the foreign firm acquires home firm  $H1$  for the takeover price  $v_1$ , there are two possible market structure outcomes. One in which the new joint entity of  $M\&H1$  shares the market with the less efficient home firm  $[M\&H1,H2]$ , and another one where the acquisition of  $H1$  by the MNE induces  $H2$  to exit  $[M\&H1,\emptyset]$ . We assume that the competition authorities cannot fully observe the firms' cost parameters and, thus, will only block mergers or acquisitions that lead to monopoly directly (i.e. when there are initially only two firms in the market), but not when a monopoly arises due to the exit of the less efficient firm after a takeover. When, instead, the MNE decides to acquire  $H2$  for the takeover price  $v_2$ , the market consists of the new entity  $M\&H2$  and the more efficient domestic firm  $[M\&H2,H1]$ . As will be shown later, exit of  $H1$  due to the takeover is a theoretical possibility but will not occur in equilibrium.

If the MNE engages in greenfield investment and establishes its own plant in the host country market there are three possible market structure outcomes. One possibility is that all three firms are active  $[M,H1,H2]$ . The other two possibilities are that the two domestic firms merge  $[M,H1\&H2]$  or that the less efficient domestic firm is driven out of the market  $[M,H1,\emptyset]$ .

We will now analyse each of the multinational's alternatives separately, in order to then determine the equilibrium outcomes depending on parameter values. Consider first the case of multinational entry by acquisition.

### 2.3.2.1 Acquisition decision

If the MNE decides to enter the domestic market by acquisition, its choice among the domestic firms will depend on the cost of the target firm and on the profits under the resulting market structure.

#### Acquisition of the more efficient domestic firm $H1$

When the more efficient domestic firm  $H1$  gets a take-it-or-leave-it-offer from the MNE, it will accept the offer for any quote  $v_1$  that gives it at least the profits it would earn if the MNE had decided to take over the other domestic firm  $H2$ , that is

$$v_1 \geq \gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H1}) - 2(a - c_{H1})}{(9\gamma - 2)(3\gamma - 2)} \right)^2. \quad (2.3)$$

If  $H1$  accepts, this leaves the MNE with net profits of  $\Pi_M^{M\&H1,H2} - v_1$ . It is straightforward to show that under the assumed ranking of marginal cost  $c_{H2} \geq c_{H1} \geq c_M$  an acquisition of  $H1$  is always profitable (see also Appendix 2.A.1.1).

When the MNE decides to buy  $H1$ , the condition for the less efficient domestic firm  $H2$  to leave the market becomes more stringent as compared to the situation without foreign presence (equation (2.2)):

$$c_{H2}^{A_{exit}} > \frac{3\gamma(a + c_M) - 2a}{2(3\gamma - 1)} \quad (2.4)$$

Thus, above this threshold the newly merged entity of  $M\&H1$  will earn monopoly profits after compensating  $H1$  for the takeover. These are always positive as  $a > c_M$  by assumption.

In this range of parameter values the MNE could instead obtain  $H2$  for free ( $v_2 = 0$ ). It turns out, however, that the monopoly outcome is more attractive for the MNE even though it has to compensate  $H1$  for the takeover. In other words, the MNE prefers to pay a price to have the market to itself, than to share it with a competitor for free. (Proof: see Appendix 2.A.1.2.)

### Acquisition of the less efficient domestic firm $H2$

If, instead, the MNE makes a take-it-or-leave-it-offer to the less efficient domestic firm,  $H2$  will accept for any price that is at least as large as the profits it would earn if the MNE took over  $H1$  :

$$v_2 = \max \left[ 0; \gamma(9\gamma - 4) \left( \frac{3\gamma(a + c_M - 2c_{H2}) - 2(a - c_{H2})}{(9\gamma - 2)(3\gamma - 2)} \right)^2 \right]. \quad (2.5)$$

As long as  $v_2$  is non-zero, the MNE's profits after the takeover  $\Pi_M^{M\&H2,H1} - v_2$  are positive for  $c_{H2} \geq c_{H1} \geq c_M$  and  $c_{H2} \leq \frac{3\gamma(2a - c_M + c_{H1}) - 2(2a - c_M)}{2(3\gamma - 1)}$  (see also Appendix 2.A.1.3).

Note that an acquisition of  $H2$  by the MNE will not induce the more efficient domestic firm  $H1$  to leave the market. As is demonstrated in Appendix 2.A.1.4 the hypothetical threshold for  $H1$  to exit in this case lies in the region where the MNE will prefer to acquire  $H1$ . Therefore,  $H1$  will always be in the market when the MNE acquires  $H2$ .

### Acquisition of $H1$ versus acquisition of $H2$

Comparing the payoffs for the MNE under both scenarios gives the threshold above which the MNE will prefer to acquire  $H1$  rather than  $H2$ :

$$c_{H2}^{A_{H2vsH1}} > \frac{9\gamma^2(2a + 8c_M - 5c_{H1}) - 24\gamma(a + c_M - c_{H1}) + 4a(2a - c_{H1})}{45\gamma^2 - 24\gamma + 4} \quad (2.6)$$

This result states that for small values of  $c_{H2}$  relative to  $c_{H1}$  the MNE will acquire the less efficient domestic firm  $H2$ . When  $H2$  is rather inefficient compared to  $H1$  the MNE will acquire the more efficient domestic firm  $H1$ . The intuition for this result can be obtained by looking at the profits after the takeover and acquisition prices. Holding everything else constant in the

case of the acquisition of  $H1$ , the profits for the MNE after the takeover depend positively on  $c_{H2}$  while the price of  $H1$  ( $v_1$ ) is independent of  $c_{H2}$ . In the case of the acquisition of  $H2$ , in contrast, the profits after the takeover for the MNE do not depend on  $c_{H2}$ , the takeover price  $v_2$  is, however, decreasing in  $c_{H2}$ :

$$\begin{aligned} \Pi_M^{M\&H1,H2}(\cdot, c_{H2}) &= v_1(\cdot) \\ &+ \\ \Pi_M^{M\&H2,H1}(\cdot) &= v_2(\cdot, c_{H2}) \\ &- \end{aligned}$$

The MNE's net profits from a takeover of either of the domestic firms are increasing in  $c_{H2}$  over the relevant range of parameter values. As the profits from an acquisition of  $H1$  ( $\Pi_M^{M\&H1,H2}$ ) and the takeover price for  $H2$  ( $v_2 = \Pi_{H2}^{M\&H1,H2}$ ) are the profits of two firms in the same market, it is sufficient to look at the direct effect of a change in  $c_{H2}$ . Taking derivatives it is not difficult to show that this direct effect is stronger on the MNE's profits after a takeover of  $H1$  than on  $v_2$ . *Ceteris paribus* the larger  $c_{H2}$  - that is the less efficient  $H2$  relative to  $H1$  - the more likely that the MNE buys  $H1$ . Put simply, in order to eliminate as much competition as possible the MNE would always like to acquire  $H1$ , however, there are instances when it can only afford  $H2$ .<sup>7</sup>

As the upper bound on the profitability of a takeover of  $H2$  is larger than the threshold obtained in equation (2.6), a takeover of  $H2$  will always be profitable for the MNE up to the threshold above which it prefers to acquire  $H1$ . Note from above that we need not worry about the profitability of a takeover of  $H1$  as this is profitable over the whole range of parameter values.

### 2.3.2.2 Greenfield decision

With greenfield entry by the MNE the number of firms in the market increases and so the condition for the less efficient domestic firm to stay in the market is more stringent than in the acquisition case (cf. equation (2.4)).  $H2$  will exit the market above

$$c_{H2}^{G\text{-}exit} > \frac{4\gamma(a + c_M + c_{H1}) - 3a}{3(4\gamma - 1)}. \quad (2.7)$$

Under greenfield entry, a merger among the domestic firms may become possible. While the competition authority would have blocked a merger to monopoly in a situation with the two

<sup>7</sup>Note that the threshold implied by equation (2.6) is not necessarily larger than  $c_{H1}$ . Thus when  $c_M$  is large relative to  $c_{H1}$ , the MNE may be able to afford  $H1$  over the whole range of parameter values.

domestic firms only, entry by the MNE may now induce the authorities to look at such a merger more favourably. A merger among the domestic firms  $H1$  and  $H2$  will be profitable if their joint profits after the merger are larger than the sum of their individual profits in the absence of a merger:  $\Pi_{H1\&H2}^{M,H1\&H2} \geq \Pi_{H1}^{M,H1,H2} + \Pi_{H2}^{M,H1,H2}$ . The implied threshold for a domestic merger to be profitable  $c_{H2}^{D,merger}$  is given in Appendix 2.A.1.5 as it is very long and does not provide any intuition.

### 2.3.2.3 Greenfield versus Acquisition

For the comparison between greenfield investment and a foreign acquisition, the dimension considered so far, namely the marginal cost of the 'pivotal' firm  $H2$  is not sufficient. While acquisitions by the MNE and the reactions of the domestic firms depend on marginal cost only, for greenfield investment the fixed cost of setting up a plant  $f$  also plays a role. The MNE's profits net of takeover prices or fixed cost as given in Table 2.1 need to be compared to obtain a full characterisation of market structure outcomes. The thresholds for  $c_{H2}$  computed above determine which of the respective greenfield and acquisition alternatives have to be compared. The next section presents graphical illustrations of the equilibrium structures under different parameter combinations.

## 2.4 Equilibrium

In order to separate the market structure outcome of the game from the additional effect of cost reducing R&D, we first assume that R&D investment is infinitely costly, that is  $\gamma = \infty$ . This amounts to analysing the game in Figure 2.1 without R&D investment in the third stage.<sup>8</sup> Fixing  $a = 4$ ,  $c_M = 1$ ,  $c_{H1} = 1.2$  (and  $\gamma = \infty$ ) the equilibrium outcomes can be represented in  $f, c_{H2}$ -space as given in Figure 2.2. The choice of parameter values allows for a rich set of market structure outcomes, as market size is relatively large compared to the firms' marginal costs.

The domestic firm  $H2$  is by assumption less efficient than  $H1$  ( $c_{H2} \geq c_{H1}$ ), therefore, attention can be constrained to values of  $c_{H2}$  larger than  $c_{H1} = 1.2$ . The upper bound for the field of action is given by the condition for  $H2$  to be in the market when the domestic firms are in the market alone (equation (2.2)), that is here equal to  $c_{H2}^{D,exit} = 2.6$ . The vertical loci in the Figure represent the thresholds for  $c_{H2}$  computed above. The non-vertical lines are obtained by

<sup>8</sup>Note that this reduces the equilibrium profits given in Table 2.1 to those of a Cournot game with two or three asymmetric firms.

comparing profits of the relevant greenfield and acquisition alternatives as given in Table 2.1 and solving for the fixed cost of greenfield investment  $f$ .

Assuming the fixed cost of greenfield investment  $f$  to be equal to zero, we move along the horizontal  $c_{H2}$  – axis from left to right. Close to the origin, that is, when  $H2$  is almost as efficient as  $H1$ , we observe an area where the MNE engages in greenfield investment and the two domestic firms stay in the market independently. For values of  $c_{H2}$  above  $c_{H2}^{D\_merger}$ , the less efficient domestic firm  $H2$  would only capture a small share of the market. By merging the two domestic firms are able to increase their profit as one firm with marginal cost  $c_{H1}$  above the sum of their individual profits. For values of  $c_{H2}$  to the right of  $c_{H2}^{G\_exit}$  greenfield investment by the MNE will induce  $H2$  to exit the market.

For values of  $c_{H2}$  up to where the diagonal line meets the horizontal axis, the MNE will engage in greenfield investment; for values of  $c_{H2}$  above that, it will prefer to acquire  $H1$ . In this range,  $H2$  is such an inefficient competitor that the MNE can afford to buy out the more efficient domestic firm  $H1$  and still earn higher profits than if it were sharing the market with  $H1$ , as would be the case under greenfield investment. In a situation where  $H2$  is very inefficient even the acquisition of  $H1$  will induce it to exit the market and create a monopoly for the MNE. This is the case for values of  $c_{H2}$  larger than  $c_{H2}^{A\_exit}$ .

Next consider a move along the vertical axis, that is a situation when both domestic firms have identical marginal cost ( $c_{H2} = c_{H1}$ ). For low values of fixed setup cost  $f$  we observe greenfield investment with both domestic firms in the market while, for larger values of  $f$ , acquiring  $H2$  is more profitable. The diagonal locus compares the MNE's profits under greenfield investment with both domestic firms in the market to those under an acquisition of  $H2$ . Below this threshold the MNE shares the profits with two other firms in the market and has to cover the fixed setup cost, whereas above it, it has to pay the takeover price to acquire  $H2$ , but then only shares the market with  $H1$ . Greenfield investment is profitable up to higher values of fixed setup cost when it induces the domestic firms to merge (to the right of  $c_{H2}^{D\_merger}$ ). In fact, when comparing the MNE's profits under an acquisition of  $H2$  to those under greenfield investment with only one efficient domestic firm in the market along the curved locus  $f$  is exactly equal to the takeover price for  $H2$ .

We now turn to investigate the situation with R&D investment. Figure 2.3 depicts the equilibrium market structure for the same parameters as in Figure 2.2 but now  $\gamma = 3$  rather than infinity. First note that the field of action contracts, that is  $c_{H2}^{D\_exit}$  is lower than above. The same observation is also true for all other thresholds; the R&D stage introduces fiercer competition to the game. Given the way R&D investment is modelled, the multinational, as the most efficient



firm, also benefits the most from investing to reduce its marginal cost. This distorts the market structure in favour of the MNE. For example  $H2$  can be more efficient than above and the MNE will still be able to afford  $H1$ . In fact, greenfield investment in this case is no longer profitable up to the level of  $c_{H2}$ , where the less efficient domestic firm would choose to exit the market.

Summarising the insights of these figures one obtains the following: First, the threshold for the less efficient domestic firm to exit is lower under either form of foreign presence than in its absence. This reflects a finding by De Backer and Sleuwaegen (2003) who show that the inflow of FDI increases domestic exit rates in a sample of Belgian manufacturing firms.

Second, while it is often held that greenfield investment is more likely when the MNE has a technological advantage, this is not the case per se in this setting. A technological advantage alone is not sufficient. Greenfield investment here is an attractive choice for the MNE in two cases. One is when the domestic firms are both rather competitive relative to the MNE. The reason for this is that when all three firms have similar levels of marginal cost, their profits are close to those in an equilibrium with symmetric firms, and hence an acquisition of either of the domestic firms becomes very expensive for the MNE.<sup>9</sup> In the other case, that is when the domestic firms react by merging, greenfield entry is attractive because the reduction in competition is without cost for the MNE; it only has to incur the cost of setting up a plant.

The third result concerns the MNE's choice of takeover target. In principle, the MNE would always like to acquire the more efficient domestic firm  $H1$  in order to eliminate the stronger competitor. However, as long as the MNE's and the domestic firms' marginal costs are not too different, it will only be able to afford the weaker domestic firm  $H2$ .<sup>10</sup> Empirically, at least the first observation is in line with Harris and Robinson (2002), who using a sample of UK manufacturing plants, demonstrate that foreign acquirers have higher productivity levels (as measured by total factor productivity) and that they buy the most productive domestic plants.

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<sup>9</sup>Applying a differentiated products interpretation to a Hotelling model, Eicher and Kang (2004) obtain a different result. They show that high degrees of competition (i.e. little product differentiation) reduce the likelihood that the MNE coexists with the local firm, as entry by the more efficient MNE drives the domestic firm out of the market.

<sup>10</sup>These results have to be compared to recent models of cross-border mergers and acquisitions in a general equilibrium context. In Neary (2004) trade liberalisation may lead to cross-border merger waves with low-cost home (foreign) firms buying up high-cost foreign (home) firms.

In Nocke and Yeaple (2004) cross-border M&A involve either the most or the least efficient active firms depending on whether firms differ in their mobile or non-mobile capabilities. In an industry where firms differ in mobile factors (i.e. technology), the most efficient firms engage in cross-border M&A, less efficient firms engage in greenfield FDI, while the least efficient active firms export. In an industry where firms differ in immobile capabilities the ranking of choices for the most efficient to least efficient firms is greenfield FDI, exports, cross-border M&A.

Finally, with R&D in the model, the pressure on the domestic firms is stronger. It permits the MNE, as the most efficient firm, to achieve a position in the market where it faces relatively little competition over a wider range of parameter values than in the situation without R&D.

## 2.5 R&D Investment and Welfare

Having analysed the impact of R&D on the equilibrium market structure, we now turn to comparing investment levels and welfare in a situation with the MNE in the market to the benchmark situation with domestic firms only.

### 2.5.1 R&D Investment

Table 2.2 provides the R&D levels associated with the different market structures for each firm individually and at the industry level. The right column of Table 2.2 compares the investment under the benchmark situation with domestic firms only to that under the different market structures. One can see that the presence of a more efficient foreign firm in the market results in a higher total level of investment targeted at the domestic market for all market structures other than the monopoly case. Not surprisingly, a monopolist has little incentive to invest.

Note, however, that entry of the more efficient multinational firm in most cases leads to the extinction of at least one of the domestic firms. As firms' investment levels are decreasing in own marginal cost and increasing in their competitors' marginal cost, a more efficient firm in the market reduces their R&D spending. This can also be seen from Table 2.2, where we see that R&D investment of the domestic firms is higher in the benchmark case than under any of the market structures where the MNE is in the market. Hence, investment by the MNE crowds out R&D investment by the domestic firm(s).

These results are in line with empirical findings by various authors: Lipsey (2002) in a survey of home country effects of FDI concludes that overall productivity is improved by the presence of foreign-owned operations. Concerning the innovative efforts of domestic firms, Veugelers and Vanden Houte (1990) find them to be reduced by foreign presence in a sample of Belgian manufacturing firms, - especially when products are not so differentiated as is the case here. For small Venezuelan enterprises, Aitken and Harrison (1999) show that foreign equity participation is positively correlated with plant productivity, whereas foreign investment negatively affects the productivity of domestically owned firms. Finally, Driffield (2001), in a sample of UK manufacturing firms, estimates inward investment to stimulate productivity growth in the domestic

2.5 R&D Investment and Welfare

Table 2.2: Investment levels

	Investment	Comparison to Benchmark*
Domestic Firms only (Benchmark)		
	$[\emptyset, H1, H2]$	
H1	$2 \frac{3\gamma(a-2c_{H1}+c_{H2})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)}$	-
H2	$2 \frac{3\gamma(a+c_{H1}-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)}$	-
total	$2 \frac{2a-c_{H1}-c_{H2}}{9\gamma-2}$	-
Greenfield Investment		
	$[M, H1, H2]$	
M	$\frac{4\gamma(a-3c_M+c_{H1}+c_{H2})-3(a-c_M)}{(16\gamma-3)(4\gamma-3)}$	-
H1	$\frac{4\gamma(a+c_M-3c_{H1}+c_{H2})-3(a-c_{H1})}{(16\gamma-3)(4\gamma-3)}$	$\frac{(60\gamma^2-85\gamma+30)a+(-324\gamma^2+288\gamma-48)c_M}{\gamma^{-1}(16\gamma-3)(4\gamma-3)(9\gamma-2)(3\gamma-2)} + \frac{(204\gamma^2-131\gamma+12)c_{H1}+(60\gamma^2-72\gamma+6)c_{H2}}{\gamma^{-1}(16\gamma-3)(4\gamma-3)(9\gamma-2)(3\gamma-2)} > 0$
H2	$\frac{4\gamma(a+c_M+c_{H1}-3c_{H2})-3(a-c_{H2})}{(16\gamma-3)(4\gamma-3)}$	$\frac{(60\gamma^2-85\gamma+30)a+(-324\gamma^2+288\gamma-48)c_M}{(16\gamma-3)(4\gamma-3)(9\gamma-2)(3\gamma-2)} + \frac{(60\gamma^2-72\gamma+6)c_{H1}+(204\gamma^2-131\gamma+12)c_{H2}}{(16\gamma-3)(4\gamma-3)(9\gamma-2)(3\gamma-2)} > 0$
total	$3 \frac{3a-c_M-c_{H1}-c_{H2}}{16\gamma-3}$	$-\frac{(17a-27c_M+5c_{H1}+5c_{H2})\gamma-6(a-c_M)}{(16\gamma-3)(9\gamma-2)} < 0$
	$[M, H1\&H2]$ or $[M, H1, \emptyset]$	
M	$\frac{3\gamma(a-2c_M+c_{H1})-2(a-c_M)}{(9\gamma-2)(3\gamma-2)}$	-
H1(&H2)	$\frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)}$	$\frac{c_{H2}-c_M}{(9\gamma-2)(3\gamma-2)} > 0$
total	$2 \frac{2a-c_M-c_{H1}}{9\gamma-2}$	$c_M - c_{H2} < 0$
Acquisition of H2		
	$[M\&H2, H1]$	
M	$\frac{3\gamma(a-2c_M+c_{H1})-2(a-c_M)}{(9\gamma-2)(3\gamma-2)}$	-
H1	$\frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)}$	$\frac{c_{H2}-c_M}{(9\gamma-2)(3\gamma-2)} > 0$
H2	0	$2 \frac{3\gamma(a+c_{H1}-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} > 0$
total	$2 \frac{2a-c_M-c_{H1}}{9\gamma-2}$	$c_M - c_{H2} < 0$
Acquisition of H1		
	$[M\&H1, H2]$	
M	$\frac{3\gamma(a-2c_M+c_{H2})-2(a-c_M)}{(9\gamma-2)(3\gamma-2)}$	-
H1	0	$2 \frac{3\gamma(a-2c_{H1}+c_{H2})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} > 0$
H2	$\frac{3\gamma(a+c_M-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)}$	$\frac{c_{H1}-c_M}{(9\gamma-2)(3\gamma-2)} > 0$
total	$2 \frac{2a-c_M-c_{H2}}{9\gamma-2}$	$c_M - c_{H1} < 0$
	$[M\&H1, \emptyset]$	
M	$\frac{a-c_M}{4\gamma-1}$	-
H1, H2	0	$2 \frac{2a-c_{H1}-c_{H2}}{9\gamma-2} > 0$
total	$\frac{a-c_M}{4\gamma-1}$	$\frac{\gamma(7a+9c_M-8c_{H1}-8c_{H2})-2(a+c_M-c_{H1}-c_{H2})}{(4\gamma-1)(9\gamma-2)} > 0$

\*  $x_i^{\emptyset, H1, H2} - x_i^{\text{[market structure]}}$ , where  $i = H1, H2, \text{total}$

sector by around 0.75% per annum. He argues that this is a result of the productivity advantage exhibited by foreign firms and that it cannot be attributed to investment or output spillovers. Moreover, he finds that foreign R&D appears to crowd out domestic R&D with a negligible effect on domestic productivity.

## 2.5.2 Welfare

The welfare levels associated with the different market structure outcomes are given in Table 2.3. Comparing the situation with two domestic firms only to any situation with foreign presence, welfare in the host country is higher without the MNE in the market (see Appendix 2.A.3). While there are efficiency gains due to foreign entry that result in higher consumer surplus, the MNE is able to fully convert its superior efficiency into profits and extract them to the detriment of the host country under any possible market structure outcome.

This result should not be used to demonise any form of foreign direct investment, rather it can be considered as a lower bound to host country welfare. Very often, host countries are able to benefit substantially from the presence of multinationals. Most easily this will be the case if the MNE does not fully repatriate its profits, but reinvests some of the earnings in the host country. Host countries may further benefit from MNEs under their jurisdiction through taxation, training of local workers, technology spillovers, and creation of employment.

From Table 2.3 it is also straightforward to see that the host country would not necessarily make itself better off by banning foreign entry by acquisition: welfare under an acquisition of  $H2$  [M&H2,H1] is higher than welfare under greenfield entry with the domestic firms merging [M,H1&H2].<sup>11</sup>

## 2.6 Concluding Remarks

This chapter analyses the impact of entry mode and presence of a foreign firm on the firms in a host country. While the prevailing literature is concentrated on technology or productivity spillovers, we focus on the effects stemming from foreign competition. In particular, we examine changes in market structure when the domestic firms do not stay idle after foreign entry. We also investigate how the interaction between a multinational entrant and the domestic firms affects R&D investments and welfare.

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<sup>11</sup> Mukherjee (2004) obtains a similar result in a setting with one local incumbent only.

Table 2.3: Welfare in the host country

	Producer Surplus	Consumer Surplus	Acquisition Price
$[\emptyset, H1, H2]$	$9\gamma^2 \frac{(2a-c_{H1}-c_{H2})^2}{2(9\gamma-2)^2}$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a-2c_{H1}+c_{H2})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$ $+ \gamma(9\gamma-4) \left( \frac{3\gamma(a+c_{H1}-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} \right)^2$	
$[M, H1, H2]$	$8\gamma^2 \frac{(3a-c_M-c_{H1}-c_{H2})^2}{(16\gamma-3)^2}$	$\gamma(16\gamma-9) \left( \frac{4\gamma(a+c_M-3c_{H1}+c_{H2})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$ $+ \gamma(16\gamma-9) \left( \frac{4\gamma(a+c_M+c_{H1}-3c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} \right)^2$	
$[M, H1\&H2]$	$9\gamma^2 \frac{(2a-c_M-c_{H1})^2}{2(9\gamma-2)^2}$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$	
$[M, H1, \emptyset]$			
$[M\&H2, H1]$	$9\gamma^2 \frac{(2a-c_M-c_{H1})^2}{2(9\gamma-2)^2}$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} \right)^2$
$[M\&H1, H2]$	$9\gamma^2 \frac{(2a-c_M-c_{H2})^2}{2(9\gamma-2)^2}$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} \right)^2$	$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$
$[M\&H1, \emptyset]$	$2\gamma^2 \frac{(a-c_M)^2}{(4\gamma-1)^2}$		$\gamma(9\gamma-4) \left( \frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2$

While much of the increase in concentration ratios in industries where horizontal FDI is prevalent can certainly be ascribed to the surge in cross-border mergers and acquisitions over the last decade or more, this chapter offers a complementary explanation. We argue that this can also be due to domestic firms merging or exiting the market as a reaction to foreign entry. Moreover, with the chosen setup it is possible to demonstrate that foreign entry may in fact make it desirable and feasible for domestic incumbents to merge. In turn, anticipating this kind of anti-competitive reaction a multinational considering to enter the market may prefer to set up its own plant (greenfield investment) to an acquisition of a local firm. When this sort of strategic interaction is combined with cost-reducing R&D investments by all active firms, a technological advantage of the MNE translates into higher R&D investment at the industry level. However, this comes at the cost of crowding out R&D investment by the domestic firm(s).

Regarding welfare, the model allows us to derive a lower bound to host country welfare after foreign entry. Entry of a more efficient foreign firm enhances consumer surplus. However, even if both domestic firms are present in the market after multinational entry, their profits are greatly reduced. This is due to the focus on competition which does not account for the possibilities of host countries to extract rents from multinational firms. A possible extension of the model is to compare the welfare outcomes of different policies towards MNEs and domestic firms in detail.

These results provide an intuitive explanation for a recurrent finding in the empirical literature on spillover effects, namely that foreign presence has a negative impact on the productivity of domestic firms. As suggested by Sembenelli and Siotis (2005) these pro-competitive effects are likely to be short-run phenomena, while technology spillovers and efficiency gains through multinationals take longer to materialise. Along somewhat different lines, Markusen and Venables (1999) emphasise the potential of backward and forward linkages created by multinationals to offset the possibility of foreign firms substituting for domestic production.

## 2.A Appendix

### 2.A.1 Takeover Profitability and Related Thresholds

#### 2.A.1.1 Profitability of a takeover of $H1$ :

Solving  $\Pi_M^{M\&H1,H2} - v_1 \geq 0$  yields  $c_{H2} \leq \frac{-3\gamma(2a-c_M-2c_{H1})+2(2a-c_M-c_{H1})}{3\gamma}$  and  $c_{H2} \geq \frac{3\gamma(3c_M-2c_{H1})-2(c_M-c_{H1})}{3\gamma}$ . Both of these potential thresholds are dominated by the assumed structure of marginal cost  $c_{H2} \geq c_{H1} \geq c_M$ , as

$$c_{H2} \leq \frac{-3\gamma(2a-c_M-2c_{H1})+2(2a-c_M-c_{H1})}{3\gamma} - c_{H1} = -\frac{9\gamma-2}{3\gamma} (c_{H1} - c_M) < 0$$

and

$$c_{H2} \geq \frac{3\gamma(3c_M-2c_{H1})-2(c_M-c_{H1})}{3\gamma} - c_{H1} = -\frac{3\gamma-2}{3\gamma} (2a - c_M - c_{H1}) < 0$$

#### 2.A.1.2 Acquiring $H1$ when it is optimal for $H2$ not to supply the market versus incorporating $H2$ for free

To compare the profits of the MNE when it becomes a monopolist after the acquisition of  $H1$  as  $H2$  exits to incorporating  $H2$  for free, we can write

$$\begin{aligned} & \Pi_M^{M\&H1,\emptyset} - v_1 - \left( \Pi_M^{M\&H2,H1} - 0 \right) \\ &= \frac{(a-c_M)^2}{4\gamma-1} - \gamma(9\gamma-4) \left[ \left( \frac{3\gamma(a+c_M-2c_{H1})-2(a-c_{H1})}{(9\gamma-2)(3\gamma-2)} \right)^2 + \left( \frac{3\gamma(a-2c_M+c_{H1})-2(a+c_M)}{(9\gamma-2)(3\gamma-2)} \right)^2 \right]. \end{aligned} \quad (2.8)$$

Taking the derivative w.r.t.  $c_{H1}$

$$\begin{aligned} & \frac{\partial}{\partial c_{H1}} \left( \Pi_M^{M\&H1,\emptyset} - v_1 - \left( \Pi_M^{M\&H2,H1} - 0 \right) \right) \\ &= \frac{\gamma(a(162\gamma^3-288\gamma^2+168\gamma-32)+c_M(648\gamma^3-504\gamma^2+96\gamma)+c_{H2}(-810\gamma^3+792\gamma^2-264\gamma+32))}{729\gamma^4-1296\gamma^3+792\gamma^2-192\gamma+16} < 0. \end{aligned}$$

The coefficients on  $a$  and  $c_{H2}$  sum to the negative of the coefficient on  $c_{H1}$ , hence this expression is decreasing in  $c_{H1}$ . When  $c_{H1}$  approaches its upper bound  $a^{12}$ , we have:

$$\Pi_M^{M\&H1,\emptyset} - v_1 - \left( \Pi_M^{M\&H2,H1} - v_2^{\min} \right) = \frac{891\gamma^3 - 693\gamma^2 + 132\gamma - 4}{(9\gamma-2)^2(3\gamma-2)^2(4\gamma-1)} \gamma^2 (a - c_M)^2 > 0.$$

<sup>12</sup>Note that 2.8 does not depend on  $c_{H2}$ .

Therefore, it is never profitable for the MNE to incorporate  $H2$  for free, when it can become a monopolist by acquiring  $H1$ .

### 2.A.1.3 Profitability of a costly takeover of $H2$

Solving  $\Pi_M^{M\&H2.H1} - v_2 \geq 0$ , where  $v_2 = \gamma(9\gamma - 4) \left( \frac{3\gamma(a+c_M-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)(3\gamma-2)} \right)^2$  yields

$$\frac{3\gamma(3c_M - 2c_{H1}) - 2c_{H1}}{2(3\gamma - 1)} \leq c_{H2} \leq \frac{3\gamma(2a - c_M + c_{H1}) - 2(2a - c_1)}{2(3\gamma - 1)}.$$

The lower bound is less stringent than the assumed structure of marginal cost  $c_{H2} \geq c_{H1} \geq c_M$ :

$$\frac{3\gamma(3c_M - 2c_{H1}) - 2c_{H1}}{2(3\gamma - 1)} - c_{H1} = -\frac{9\gamma - 2}{2(3\gamma - 1)}(c_{H1} - c_M) < 0.$$

Therefore, acquiring  $H2$  will be profitable for any value of  $c_{H2}$  between  $c_{H2} \geq c_{H1} \geq c_M$  and  $c_{H2} \leq \frac{3\gamma(2a - c_M + c_{H1}) - 2(2a - c_M)}{2(3\gamma - 1)}$ .

Note that this upper bound is larger than the threshold for a takeover of  $H1$  to be more profitable than a takeover of  $H2$  ( $c_{H2}^{A.H1vsH2}$ ):

$$\begin{aligned} & \frac{3\gamma(2a - c_M + c_{H1}) - 2(2a - c_M)}{2(3\gamma - 1)} - \frac{9\gamma^2(2a + 8c_M - 5c_{H1}) - 24\gamma(a + c_M - c_{H1}) + 4a(2a - c_{H1})}{45\gamma^2 - 24\gamma + 4} \\ &= \frac{9\gamma - 2}{2(3\gamma - 1)(45\gamma^2 - 24\gamma + 4)} [(18\gamma^2 - 12\gamma)a - (36\gamma^2 - 36\gamma + 4)c_M + (45\gamma^2 - 24\gamma + 4)c_{H1}]. \end{aligned}$$

The coefficients on  $a$  and  $c_{H2}$  add up to the coefficient to  $c_M$ . Hence, given that we have assumed  $a > c_{H2} \geq c_M$  this term is always larger than zero.

### 2.A.1.4 A takeover of $H2$ will never induce $H1$ to leave the market

The threshold for  $H1$  to exit the market when  $H2$  is taken over is  $c_{H1}^{A.exit} > \frac{3\gamma(a+c_M)-2a}{2(3\gamma-1)}$ . Solving solving equation (2.6) for  $c_{H1}$  instead of  $c_{H2}$  yields

$$c_{H1}^{A.H1vsH2} = \frac{9\gamma^2(2a + 8c_M - 5c_{H2}) - 24\gamma(a + c_M + c_{H2}) - 4(2a - c_{H2})}{(3\gamma - 1)(45\gamma^2 - 24\gamma + 4)}.$$

Comparing the two

$$\begin{aligned} & c_{H1}^{A.exit} - c_{H1}^{A.H1vsH2} \\ &= \frac{(27\gamma^3 + 18\gamma^2 - 36\gamma + 8)a - (279\gamma^3 + 216\gamma^2 + 36\gamma)c_M + (270\gamma^3 - 234\gamma^2 + 72\gamma - 8)c_{H2}}{2(3\gamma - 1)(45\gamma^2 - 24\gamma + 4)} > 0. \end{aligned}$$

Under given assumptions this term is always larger than zero, as the coefficients on  $a$  and  $c_{H2}$  add up to the coefficient on  $c_M$ .  $H1$  will, therefore, always be in the market when the MNE acquires  $H2$ .

**2.A.1.5 Threshold for a merger among the domestic firms in the case of greenfield investment by the MNE**

$$\frac{D_{merger}}{c_{H2}} = \frac{32\gamma^2(a+c_M+3c_{H1})-12\gamma(3a+c_M+2c_{H1})+9a}{160\gamma^2-72\gamma+9} + \frac{(16\gamma-3)}{(16\gamma-9)(9\gamma-2)(3\gamma-2)(160\gamma^2-72\gamma+9)} \sqrt{\gamma(16\gamma-9)} z,$$

where

$$\begin{aligned} z = & 20736\gamma^6 (a + c_M - 2c_{H1})^2 - 144\gamma^5 (391a + 415c_M - 806c_{H1}) (a + c_M - 2c_{H1}) \\ & + 24\gamma^4 (a(2195a + 5171c_M - 9561c_{H1}) + 2442c_M^2 - 10055c_Mc_{H1} + 9808c_{H1}^2) \\ & - \gamma^3 (17a(839a + 3840c_M - 5518c_{H1}) + 26016c_M^2 - 117312c_Mc_{H1} + 105559c_{H1}^2) \\ & - \gamma^2 (a(6511a - 19330c_M + 6308c_{H1}) - 5921c_M^2 - 31172c_Mc_{H1} + 18740c_{H1}^2) \\ & + 12\gamma (11a(34a - 29c_M - 39c_{H1}) - 51c_M^2 + 421c_Mc_{H1} + 4c_{H1}^2) \\ & - 36 (a - c_{H1}) (19a - 12c_M - 7c_{H1}) \end{aligned} \tag{2.9}$$

**2.A.2 Derivatives of Net Acquisition Profits**

$$\begin{aligned} \frac{\partial}{\partial c_{H2}} \left[ \Pi_M^{M\&H1,H2} \right] &= 6\gamma^2 (9\gamma - 4) \frac{(3\gamma-2)(a-c_M)+3\gamma(c_{H2}-c_M)}{(9\gamma-2)^2(3\gamma-2)^2} > 0 \\ \frac{\partial}{\partial c_{H2}} \left[ v_2 = \Pi_{H2}^{M\&H2,H1} \right] &= 4\gamma (9\gamma - 4) (3\gamma - 1) \frac{3\gamma(a+c_M-2c_{H2})-2(a-c_{H2})}{(9\gamma-2)^2(3\gamma-2)^2} \\ &\geq 0 \text{ for } c_{H2} \geq c_{H2}^{A\_exit} = \frac{3\gamma(a+c_M)-2a}{2(3\gamma-1)} \\ &< 0 \text{ for } c_{H2} < c_{H2}^{A\_exit} = \frac{3\gamma(a+c_M)-2a}{2(3\gamma-1)} \end{aligned}$$

$$\frac{\partial}{\partial c_{H2}} \left[ \Pi_M^{M\&H1,H2} \right] - \frac{\partial}{\partial c_{H2}} [v_2] = 2\gamma \frac{9\gamma - 4}{27\gamma^2 - 24\gamma + 4} (a - c_{H2}) > 0$$

### 2.A.3 Welfare

Having a close look at Table 2.3 allows us to rank unambiguously two market structures according to the associated welfare levels for all parameters right away:

$$\begin{aligned} W^{M\&H2,H1} &> W^{M,H1\&H2} \\ W^{M\&H2,H1} &\geq W^{M\&H1,H2} \end{aligned}$$

Welfare when the MNE buys  $H2$  is larger than when it engages in greenfield investment with one domestic firm in the market and it is also larger than welfare under an acquisition of  $H1$  when  $H2$  remains in the market.

We use the dominated welfare level of greenfield investment with one domestic firm and compare it to the monopoly outcome. It is sufficient to base the comparison on consumer surplus as producer surplus in the case of  $W^{M,H1\&H2}$  cancels with the acquisition price under  $W^{M\&H1,\emptyset}$ :

$$\begin{aligned} &CS^{M,H1\&H2} - CS^{M\&H1,\emptyset} \\ &= 9\gamma^2 \frac{(2a - c_M - c_{H1})^2}{2(9\gamma - 2)^2} - 2\gamma^2 \frac{(a - c_{H1})^2}{(4\gamma - 1)^2} \\ &= \frac{(6\gamma(7a - 5c_M - 2c_{H1}) - 10a + 7c_M + 3c_{H1})(6\gamma(a + c_M - 2c_{H1}) - 2a - c_M + 3c_{H1})}{2(9\gamma - 2)^2(4\gamma - 1)^2}. \end{aligned}$$

This expression is equal to or larger than zero for  $c_{H1} \leq \frac{2a(3\gamma - 1) + c_M(6\gamma - 1)}{4\gamma - 1}$ . By definition the largest value  $c_{H1}$  can take is  $c_{H2}$ . If both domestic firms have identical marginal cost, the exit threshold in a situation with domestic firms only applies to both firms equally and becomes  $c_{H2}^{D,exit} = c_{H1}^{D,exit} = a$ . The condition on  $c_{H1}$  ( $= c_{H2}$ ) derived above is larger than  $a$ :

$$\begin{aligned} &\frac{2a(3\gamma - 1) + c_M(6\gamma - 1)}{4\gamma - 1} - c_{H1}^{D,exit} \\ &= \frac{2a(3\gamma - 1) + c_M(6\gamma - 1)}{4\gamma - 1} - a = \frac{a(2\gamma - 1) + c_M(6\gamma - 1)}{4\gamma - 1} > 0. \end{aligned}$$

Hence, welfare under greenfield investment with one domestic firm in the market is larger than under the monopoly outcome over the whole range of parameter values.

It remains to establish that welfare in a purely domestic setting is larger than the two undominated results with foreign presence, namely  $W^{M,H1,H2}$  and  $W^{M\&H2,H1}$ . The comparison between  $W^{\emptyset,H1,H2}$  and  $W^{M,H1,H2}$  can be simplified.<sup>13</sup> It is sufficient to consider a situation with symmetric firms and without investment. Welfare in a situation without foreign presence is given

<sup>13</sup>Note that the sum of total sales in a market (and, therefore, also profits) with  $n$  asymmetric firms ordered according to marginal cost  $c_1 \leq \dots \leq c_i \leq \dots \leq c_n$  will never be larger than the sum of total sales in a market with  $n$  symmetric firms with marginal cost  $c_1$ :  $\sum_{i=1}^n q_i = \frac{na - \sum_{i=1}^n c_i}{n+1} \leq \sum_{i=1}^n q_i = \frac{na - nc_1}{n+1}$ .

by

$$\begin{aligned} W^{|\emptyset, H1, H2]} &= CS + PS \\ &= \frac{2}{9}(a-c)^2 + \frac{1}{9}(a-c)^2 + \frac{1}{9}(a-c)^2 = \frac{4}{9}(a-c)^2. \end{aligned}$$

Welfare under greenfield with the two domestic firms in the market is given by

$$\begin{aligned} W^{[M, H1, H2]} &= CS + PS \\ &= \frac{9}{32}(a-c)^2 + \frac{1}{16}(a-c)^2 + \frac{1}{16}(a-c)^2 = \frac{13}{32}(a-c)^2. \end{aligned}$$

As  $\frac{4}{9} > \frac{13}{32}$  we have shown that  $W^{\emptyset, H1, H2} > W^{M, H1, H2}$ .

The crucial parameter for the comparison between  $W^{\emptyset, H1, H2}$  and  $W^{M\&H2, H1}$  is  $c_{H1}$ . When  $c_{H1}$  is largest ( $c_M$ ) welfare will be highest under both scenarios, whereas the opposite is true at its minimum  $c_{H2}$ . Hence, we need to show that  $W^{\emptyset, H1, H2} - W^{M\&H2, H1} \geq 0$  within these boundaries. At  $c_{H1} = c_M$

$$\begin{aligned} &W^{\emptyset, H1, H2} - W^{M\&H2, H1} \\ &= \frac{3\gamma^2(c_{H2}-c_M)(81\gamma^2(c_{H2}-c_M)+12\gamma(2a+3c_M-5c_{H2})-4(4a-c_M-3c_{H2}))}{2(9\gamma-2)^2(3\gamma-2)^2}. \end{aligned}$$

This expression is nonnegative for  $c_{H2} \geq c_M$ . At  $c_{H1} = c_{H2}$

$$\begin{aligned} &W^{\emptyset, H1, H2} - W^{M\&H2, H1} \\ &= \frac{3\gamma^2(c_{H2}-c_M)(3\gamma(4a+5c_M-9c_{H2})-2(4a-3c_M+7c_{H2}))}{2(3\gamma-2)^2(9\gamma-2)}. \end{aligned}$$

This expression is nonnegative between  $c_M \leq c_{H2} \leq \frac{3\gamma(4a+5c_M)-2(4a+3c_M)}{27\gamma-14}$ . This upper bound is smaller than the upper bound for a takeover of  $H2$  ( $c_{H2}^{A, H1 vs H2}$ ) solved at  $c_{H1} = c_{H2}$ :

$$\begin{aligned} &\frac{3\gamma(4a+5c_M)-2(4a+3c_M)}{27\gamma-14} - c_{H2}^{A, H1 vs H2} \Big|_{c_{H1}=c_{H2}} \\ &= \frac{3\gamma(4a+5c_M)-2(4a+3c_M)}{27\gamma-14} - \frac{9\gamma^2(a+4c_M)-12\gamma(a+c_M)+4a}{45\gamma^2-24\gamma+4} \\ &= 3(a-c_M) \frac{(33\gamma^2-4)(3\gamma-2)}{(45\gamma^2-24\gamma+4)(27\gamma-14)} > 0. \end{aligned}$$

Therefore, welfare in a situation with two domestic firms in the market is larger than welfare in a situation where the MNE buys  $H2$  and shares the market with  $H1$  within the range of parameter values where a takeover of  $H2$  is profitable for the MNE.

With the above rankings for welfare levels we have also established that welfare will always be highest without foreign presence.

## Chapter 3

# Foreign Firms and Host-Country Productivity: Does the Mode of Foreign Entry Matter?

- joint with Ragnhild Balsvik\*

### Abstract

We examine the contributions of foreign entrants to productivity growth as well as their impact on the productivity of domestic plants in a panel of Norwegian manufacturing firms. A large share of overall productivity growth is generated by foreign plants. This includes, in particular, contributions from foreign acquisitions.

In contrast, the impact of foreign presence on the productivity of domestic plants is negative. We investigate this further by distinguishing between foreign greenfield entry and foreign entry by acquisition. We find that foreign acquisitions have a positive effect on the productivity of domestic plants, while the impact of greenfield entry is negative.

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## 3.1 Introduction

Multinational enterprises (MNEs) have come to play an important role in global production. Empirical evidence confirms that foreign-owned firms typically are larger, more productive, more capital- and research-intensive and pay higher wages than their domestically owned counterparts.<sup>1</sup> Foreign ownership of firms in a host economy can come about by greenfield entry or by foreign acquisition of assets in existing domestic firms. Greenfield entry, by adding new production capacity, may increase competition in the host market, while foreign acquisitions of host country firms are more likely to leave the degree of competition unchanged in the short run (UNCTAD (2000)). In addition, foreign firms are often viewed as a source of externalities for domestic firms, with the channels ranging from knowledge externalities over pecuniary externalities to competition effects. To the extent that domestic firms acquired by foreign owners are more integrated in the host country economy than new start-ups, the amount of such spillovers might also depend on the mode of entry.

Multinationals affect firm-level performance in the host country through two main routes (Barba Navaretti and Venables (2004)). The first route is a compositional effect; if MNEs are different from domestic firms in one or more dimensions, a higher share of foreign firms will change aggregate performance in the host economy along those dimensions. Secondly, as indicated above, foreign firms may also affect the performance of domestic firms by changing their behaviour (spillover or competition effect). Using total factor productivity (TFP) as a measure of firm performance, the aim of this chapter is to investigate aspects of both the compositional effect and the spillover effect in Norwegian manufacturing. Our focus is in particular on the entry of foreign firms, considering separately the effects of greenfield entry and foreign acquisitions.

To examine these two effects we draw on two different strands of the literature. We study the compositional effect by adapting an approach that has focused on the impact of entry and exit on productivity growth by changing the composition of firms in an industry, in most cases irrespective of their ownership. Such productivity decompositions calculate the contributions of entering, exiting and surviving firms to productivity growth in a country. Somewhat different methods have been proposed by Griliches and Regev (1995), Baily et al. (1992), Olley and Pakes (1996) and Haltiwanger (1997) and applied to mainly US data. In a recent cross-country analysis, Bartelsman et al. (2004) also summarise the evidence from earlier country-specific studies. Two earlier essays examine the contributions from foreign and domestic firms to productivity growth,

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<sup>1</sup>Most of the existing evidence is from manufacturing. See Barba Navaretti and Venables (2004) for a survey of empirical evidence.

namely Okamoto and Sjøholm (1999) for Indonesia and De Backer and Sleuwaegen (2003) for Belgium.

More or less explicitly, the productivity decomposition studies suggest that much of the productivity growth in surviving plants might be due to the entry of new and efficient firms that increase competitive pressure (see Bartelsman et al. (2004)). Olley and Pakes (1996), Disney et al. (2003) and Nickell (1996) examine this further, but do not take into account the role of foreign entry. Aghion et al. (2004) look at the impact of foreign entry on productivity growth in UK manufacturing, though they do not distinguish between different modes of foreign entry.

The literature that looks at the effects of foreign presence on host country firms has not considered newly entering foreign firms, but rather measures of overall foreign presence. This spillover literature is surveyed in Görg and Greenaway (2004) and Görg and Strobl (2001). The evidence on spillovers is mixed; recent contributions that uncover positive productivity spillovers are by Keller and Yeaple (2003) for the US and by Haskel et al. (2002) for the UK. Earlier work by Aitken and Harrison (1999) and Konings (2001) provides evidence of a negative spillover effect for Indonesia and Poland, Bulgaria and Romania, respectively. This negative impact is attributed to a market stealing or competition effect.

We contribute to both the decomposition studies and the spillover literature by introducing the distinction between foreign acquisitions and greenfield investment as two different modes of foreign entry. While De Backer and Sleuwaegen (2003), as well as Okamoto and Sjøholm (1999), distinguish between foreign and domestic firms in their productivity decompositions, we introduce a further distinction, namely that of foreign acquisitions. Our results show that along with the increase in foreign ownership in Norway, the contribution to productivity growth generated by foreign plants has also increased substantially. Most of the productivity growth in the manufacturing sector is generated within surviving plants, both domestic and foreign. By the 1990s, a substantial contribution comes from plants acquired by foreign owners, even though these plants do not have above average productivity at the time of acquisition. Greenfield entrants, in turn, are more productive upon entry but too few in number to contribute to productivity growth more than proportionally.

While the spillover literature has considered foreign direct investment (FDI) as a homogenous phenomenon, using measures such as the share of output or employment in foreign-owned firms, we focus on foreign entrants, differentiating between greenfield and acquisition FDI. Using an augmented production function approach similar to the spillover literature, our analysis suggests that the negative overall effect of foreign presence in Norway is mostly due to foreign entry, while acquisitions seem to enhance the productivity of domestic plants. Moreover, greenfield

entry is associated with competition effects which are not discernible for foreign acquisitions. These results are robust to a number of different specifications.

The remainder of this chapter is structured as follows. In Section 3.2 we describe data sources and define entry, exit and foreign ownership. The Section also gives an overview of the development of foreign ownership and foreign entry in Norwegian manufacturing. We illustrate our TFP measure in Section 3.3. Section 3.4 presents the decomposition of total factor productivity growth into the contributions from foreign and domestic entrants, survivors and exitors. In Section 3.5 we analyse the direct impact from greenfield entry and entry by acquisition on the productivity of the domestic firms. Section 3.6 briefly concludes.

## 3.2 Data Sources and Exposition

### 3.2.1 The Norwegian Manufacturing Statistics

Our main data is the annual census of all manufacturing plants in Norway collected by Statistics Norway. The Norwegian Manufacturing Statistics are collected at the plant level, where the plant is defined as a functional unit at a single physical location, engaged mainly in activities within a specific activity group. The plant-level variables include, among other things, detailed information on production, input use, investment, location, and industry classification.<sup>2</sup> We use the ISIC Rev. 2 classification in our analysis.<sup>3</sup>

We drop plants defined as small all their life, plants with less than 8 employees all their life, and observations of plants not in ordinary production (service units or plants under construction). The resulting large plant sample contains 150 000 observations and 10 400 plants for the period 1978-2001. In terms of employment and output, the large plant sample still contains more than 90% of total manufacturing output and employment.

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<sup>2</sup>The information for small plants (defined as having less than 5 or 10 employees) comes mainly from administrative registers and is therefore less extensive than for large plants. In particular, there is no investment information for small plants, which means that we are unable to construct TFP measures for this group.

<sup>3</sup>For more detailed descriptions of the Manufacturing Statistics, see the documentation in Halvorsen et al. (1991), and the annual publications from Statistics Norway (Manufacturing Statistics), where the aggregate results from the census are published.

### 3.2.2 The SIFON Register

Information about foreign ownership for the period 1990-2001 is obtained from the SIFON-register, which is a record of foreign ownership of equity in Norwegian firms. The SIFON-register contains information about the value and share of equity held by the largest foreign owner of the firm, the total share of equity held by foreign owners and the country of the largest owner.<sup>4</sup> It was initiated in 1972, and recorded only direct foreign ownership before 1990, while from 1990 indirect foreign ownership has also been included in the register.<sup>5</sup>

Before 1990, our information about foreign ownership is from the Manufacturing Statistics where plants are classified into three ownership classes: plants that are part of firms where less than 20%, 20-50%, or more than 50% of equity is foreign-owned. Since this information is obtained from the SIFON register, it means that only direct foreign ownership is included. We have chosen to treat indirect and direct foreign ownership equally after 1990, which means that we classify plants as foreign-owned when either the direct or the indirect foreign ownership of equity is above the 20% threshold.<sup>6</sup>

It is not unlikely that registration of indirect foreign ownership in 1990 was particularly low as this was the first year this type of foreign ownership was recorded. Figure 3.1 illustrates the development of foreign ownership among large plants in Norwegian manufacturing from 1978 to 2001. Indirect and direct foreign ownership is combined after 1990, and hence, in 1991 the curve for the share of plants that are foreign-owned shifts upwards by 3.5 percentage points. The comparable curves for employment and output shift upwards by 13.5 and 17 percentage points respectively through the inclusion of indirect foreign ownership. This indicates that indirectly foreign-owned plants are even larger than directly foreign-owned plants. The rate of increase in the number of indirectly foreign-owned plants during the 1990s was higher than that of directly foreign-owned plants, and by 2001 the number of indirectly foreign-owned plants exceeded the number of plants with direct foreign ownership interests. Global trends in corporate ownership structures may partly explain this shift towards indirect foreign ownership, but it is unlikely that indirect foreign ownership in Norwegian manufacturing was non-existent during the 1980s. Thus, our sample is likely to underestimate the extent of foreign ownership before 1991.

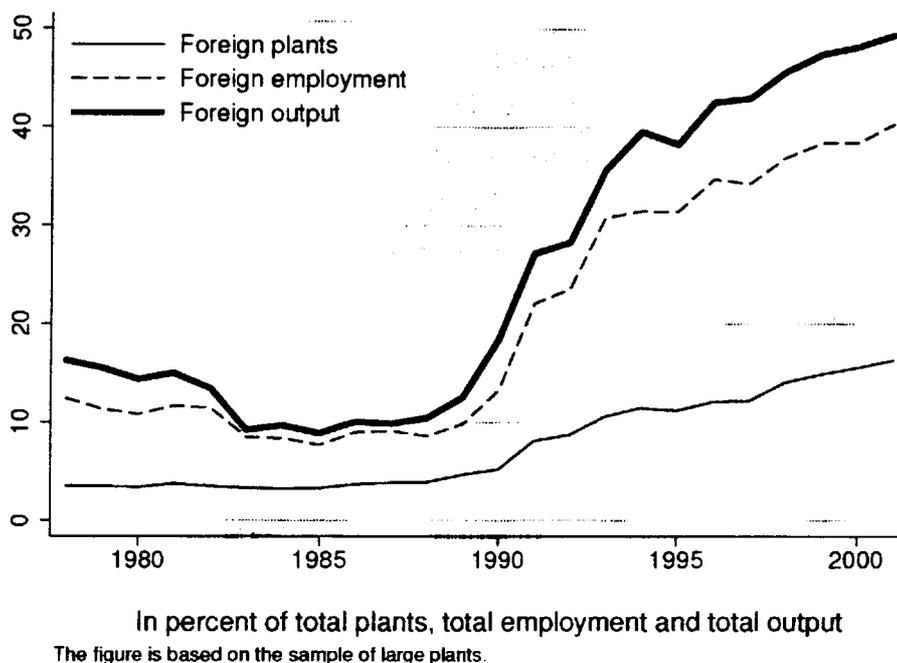
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<sup>4</sup>See Simpson (1994) for more details about the SIFON register.

<sup>5</sup>A firm has direct foreign ownership interests if foreigners own part of the equity of the firm. Firms that are owned 50% or more by another Norwegian-based firm (mother), with foreign equity stakes in the mother, are classified as indirectly foreign-owned.

<sup>6</sup>We report how this affects our results in the robustness analysis of Section 3.5.

Figure 3.1: Foreign presence in Norwegian manufacturing



Compared to neighbouring Sweden and Finland, the extent of foreign ownership in Norway seems to be larger in terms of the percentage of total manufacturing employment accounted for by foreign firms. In Swedish manufacturing, the share of employment in foreign-owned firms increased from 17% in 1990 to 27% in 2000 (Karpathy (2004)), while Finland had an increase from 6% to 22% in the same period (Huttunen (2005)). It is not clear whether the definitions of foreign ownership in these studies include indirect foreign ownership.

### 3.2.3 Entry, Exit and Foreign Acquisitions

In the Norwegian Manufacturing Statistics, each plant is assigned an identification number which it keeps throughout its life. A plant will even keep its previous identification number when it re-enters the panel after a time of inactivity as long as production restarts in the same geographic location. Mergers or buyouts at the firm-level do not affect the plant identification code. Since our data is from a census, we avoid the problem of possible false entries and exits due to plants not being sampled. Apart from data errors, false entries and exits may occur in our data set if

plants move location by closing down in one location just to reopen in another location. In such cases, the plant will get a new identification number and will be counted as an entrant.<sup>7</sup>

Our main concern when defining entry and exit is the treatment of plants that are present in the panel for one or more years and then absent for some years before they reappear in the panel again. Although the logic of the census would imply that all missing years in the time series for a single plant is due to the plant not being in operation that year, we assume that one or two consecutive years out of the sample is due to lack of registration rather than a temporary closure. When plants disappear for three or more consecutive years before they reappear again, we regard them as temporarily closed and thus count an extra exit and entry for that plant. We also define as temporarily closed those plants that are missing for two consecutive years, but reappear with a new owner (a new firm identification number). Thus, we define a plant as entering in year  $t$  if it appears for the first time in year  $t$ , or reappears in year  $t$  after a temporary closure. Similarly we define an exit in year  $t$  if the plant is present in year  $t$  and temporarily closed in  $t + 1$ , or absent all subsequent years.<sup>8</sup>

We follow Dunne et al. (1988) in their definition of entry and exit rates in year  $t$ :

$E_t$  : Number of plants present in year  $t$ , but not in year  $t - k$ .

$X_{t-k}$  : Number of plants present in year  $t - k$ , but not in year  $t$ .

$P_t$  : Total number of plants present in year  $t$ .

$AF_t$  : Number of plants where foreign ownership increased above 20% from year  $t - k$  to year  $t$ .

Entry and exit rates are then:

$$ER_t = E_t / P_{t-k}$$

$$XR_t = X_{t-k} / P_{t-k},$$

and the net entry rate is the difference between the two. The foreign acquisition rate is defined as

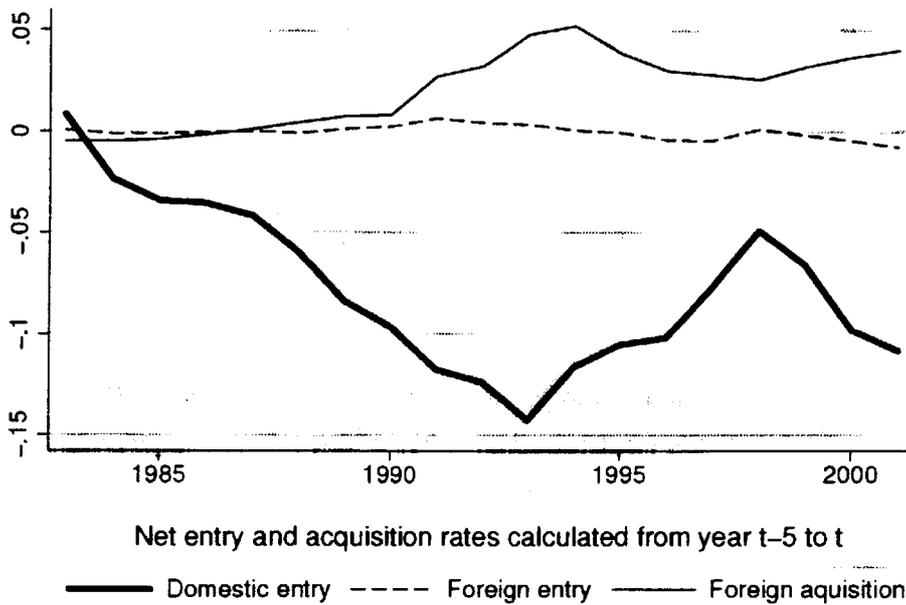
$$AFR_t = AF_t / P_{t-k},$$

while foreign divestures are those plants with a decrease in foreign ownership from  $t - k$  to  $t$ .

<sup>7</sup>Counting the number of firms that close and open plants of roughly the same size in the same sector in the same or the subsequent year indicates that this might be a problem for less than 1.5% of the total number of entries and exits in the sample. Most of these cases seem to be restructuring by multiplant firms that close one or more plants and move production to new plants. As one aim of this chapter is to decompose productivity growth into contributions from growth within existing plants and growth caused by entry and exit, we prefer to treat the exit and entry of plants by the same firm in the same sector and year (or consecutive year) as entries and exits.

<sup>8</sup>Only 2.5% of the plants in the sample have what we defined as temporary closures.

Figure 3.2: Net foreign and domestic entry rates



The net foreign acq. rate is defined as the foreign acq. rate minus the rate of foreign divestures.  
 The figure is based on the sample of large plants.

Figure 3.2 shows net foreign and domestic entry rates, and the net foreign acquisition rate calculated for overlapping 5-year periods. The foreign net entry rate is very small for the whole period, while the domestic net entry rate is negative, with a peak of exits during the recession in the early 1990s. The negative net entry rate reflects the overall trend in the economy of moving resources out of manufacturing into the services sector. During the period of analysis, the number of observations in the large plant sample decreased from 6 990 plants in 1978 to 4 850 plants in 2001. During the same period total employment declined by 33% to 220 000 in 2001.<sup>9</sup> By comparing the development in foreign acquisitions with the foreign and domestic net entry rates in Figure 3.2, we can conclude that the increase in foreign presence in Norwegian manufacturing over the last 25 years is due mainly to net exit of domestic plants and foreign acquisitions of domestic plants.<sup>10</sup>

<sup>9</sup>Haskel et al. (2002) report a similar trend for UK manufacturing employment: a decline of 36% between 1980 to 1992.

<sup>10</sup>That foreign entry by acquisition is more frequent than greenfield entry is also found for instance for the UK, see Griffith et al. (2004).

### 3.3 Total Factor Productivity of Survivors, Entrants and Exitors

To obtain a usable dataset, we clean the data with respect to missing observations and outliers. First, we drop plants with missing information for 80% or more of their life on the variables central for TFP calculation. We then define outliers as observations with TFP in the 1st and 99th percentile of TFP in the same 5-digit sector/year.<sup>11</sup> All plants with more than one outlier observation are dropped, while we keep plants with one outlier observation, dropping only that observation. This procedure gives a sample of 129 700 observations and 8 770 plants. This constitutes 86% of the initial large plant sample from 1978-2001. Dropping outliers did not change the 2-digit ISIC distribution of the sample much; average plant size is almost the same (from 42.9 to 45.4 employees), and the share of foreign plants falls from 7.1% to 6.5%. The number of plants per year in our sample is 6 090 in 1978, down to 4 000 in 2001.

To measure total factor productivity (TFP) we use an index calculated at the plant level as

$$\ln TFP_{it} = \ln \tilde{Y}_{it} - \alpha_t^K \ln \tilde{K}_{it} - \alpha_t^H \ln \tilde{H}_{it} - \alpha_t^M \ln \tilde{M}_{it}, \quad (3.1)$$

where  $\tilde{Y}_{it}$  is deflated plant output and  $\tilde{K}_{it}$ ,  $\tilde{H}_{it}$ , and  $\tilde{M}_{it}$  are inputs of capital, labour (measured in hours) and materials, respectively, and the  $\alpha_t$ 's are the average 5-digit industry cost shares.<sup>12</sup> The variable definitions rely in large part on previous work with this data.<sup>13</sup>

We construct an estimate of capital services using the following aggregation:

$$K_{it} = R_{it} + (0.07 + \delta^m)V_{it}^m + (0.07 + \delta^b)V_{it}^b,$$

where  $R_{it}$  is the cost of rented capital in the plant,  $V_{it}^m$  and  $V_{it}^b$  are the estimated values of machinery and buildings at the beginning of the year,  $\delta^m = 0.06$  and  $\delta^b = 0.02$  are the depreciation rates that we use. We take the rate of return to capital to be 0.07.<sup>14</sup>

<sup>11</sup>We have experimented with two different cleaning procedures (outliers defined as observations outside two standard deviations from the mean, or outside the range of three times the difference between the 25th and the 75th percentile from mean). All outlier measures drop plants evenly distributed across 2-digit sectors and domestic versus foreign plants. All procedures drop more observations after 1995. The main results in Sections 3.3 and 3.4 are the same for all three cleaning procedures.

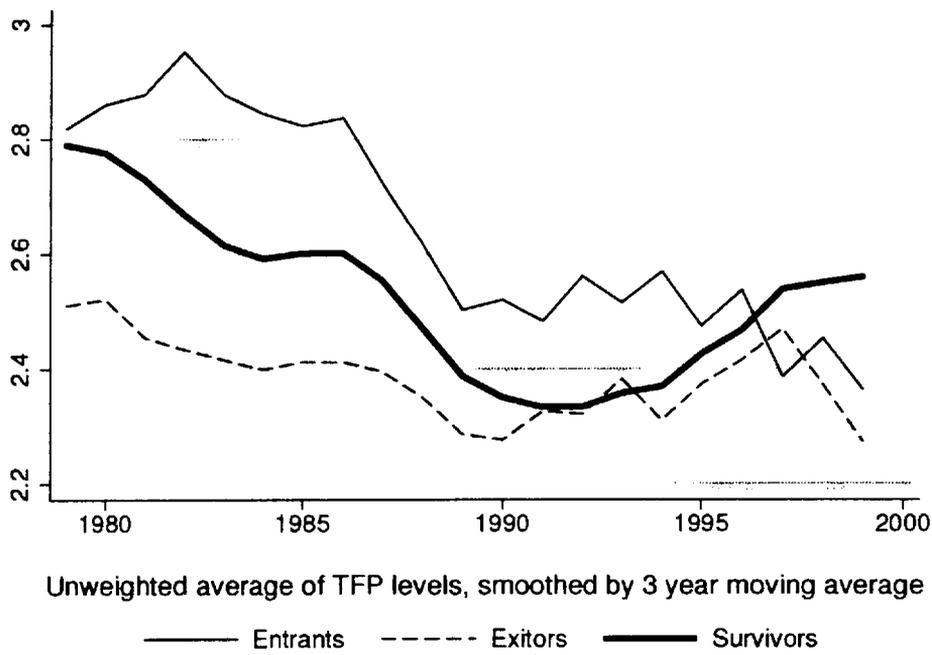
<sup>12</sup>This TFP measure is also used in the productivity decompositions by Foster et al. (1998), Disney et al. (2003), and Møen (1998).

<sup>13</sup>E.g. Griliches and Ringstad (1971), Klette (1994), Simpson (1994) and Møen (1998). See the Appendix for further details of the variable definitions.

<sup>14</sup>This is close to the ones used by Griliches and Ringstad (1971). For further details of the capital estimate, see the variable descriptions in the Appendix.

If the reallocation process of the market is "efficient", we should observe that plants that exit have lower productivity than continuing plants, while new plants should have higher productivity. Overall, the reallocation process seems to be efficient when looking at Figure 3.3, which shows smoothed annual average productivity of entrants, exitors and survivors for all manufacturing. The average productivity of entrants is above that of survivors most of the period, while the productivity of exiting plants is below that of survivors. Around 1997 the average productivity of entrants shows a marked decline. This is probably linked to measurement problems for capital, as the disappearance of fire insurance values from the Manufacturing Statistics in 1996 affects entrants disproportionately.

Figure 3.3: Average TFP of entrants, exitors and survivors



To investigate the pattern evident in Figure 3.3 further, we split the entrants, exitors and survivors by ownership and calculate average TFP for each group. The averages for the periods 1979-1989 and 1990-2000 relative to the average TFP of domestic survivors are shown in Table 3.1. From the table we observe that both foreign and domestic entrants have on average higher TFP than domestic survivors, while domestic exitors have lower TFP than survivors. Foreign exitors are not very different from domestic survivors in terms of productivity during the 1990s. Contrary to the common perception that foreign-owned plants are more productive than domestic

Table 3.1: Average TFP relative to domestic survivors

	1979-1989		1990-2000	
	TFP	N	TFP	N
Dom-entrants	*107.16	1554	*104.55	989
For-entrants	104.20	41	108.72	97
Dom-exitors	*92.86	2382	*96.43	2090
For-exitors	94.07	75	99.91	203
Dom-survivors	100	59501	100	43857
For-survivors	*97.09	1946	*93.46	4356
For-divestures	*90.85	176	*88.02	291
For-acquisitions	101.45	244	*93.86	745

For each group of plants we compute unweighted average TFP each year relative to the average TFP of domestic survivors. We then average over years.

plants, in our sample foreign survivors have lower productivity than domestic survivors. To check the significance of the results in Table 3.1, we estimated the following regression

$$\ln TFP_{it} - \overline{\ln TFP}_t = \alpha + \beta D_{it}^j, \quad (3.2)$$

where  $\overline{\ln TFP}_t$  is the average TFP of domestic survivors in year  $t$ , and  $\ln TFP_{it}$  is plant-level TFP, while  $D_{it}$  is a dummy equal to 1 for each of the 7 other groups of plants: domestic and foreign entrants and exitors, foreign acquisitions and divestures, and foreign survivors. We have marked with \* the results in Table 3.1 that are significantly different from the average TFP of domestic survivors at the 90% confidence level. Due to the low numbers of foreign entrants and exitors, the average TFP of these groups are measured rather imprecisely. It is worth noting that Table 3.1 does not suggest that foreign owners target high-productivity plants for acquisitions since the average TFP of plants with an increase in foreign ownership is not significantly above that of domestic survivors, while it does seem that foreign owners sell their interests in low-productivity plants.

## 3.4 Productivity Decompositions and Restructuring

### 3.4.1 Measurement

Decompositions of productivity have become a common method to analyse the sources of aggregate productivity growth at the industry level. Such decompositions can indicate the relative importance of what has been called internal versus external restructuring (Disney et al. (2003), Criscuolo et al. (2004)). Internal restructuring is the contribution to productivity growth coming from productivity improvements in existing plants, while external restructuring is the contribution coming from market-share effects: more productive plants gaining market share, less productive plants losing market share or even exiting the market, and new and more productive plants entering the market.

Different methods to decompose productivity growth have been proposed in the literature. We use the decomposition proposed by Haltiwanger (1997). This approach tracks changes in productivity relative to a reference point (i.e. to industry averages) and is therefore straightforward to interpret.<sup>15</sup> The decomposition starts from an index of industry level productivity

$$P_t = \theta_{it} p_{it},$$

where  $P_t$  is the index of aggregate industry productivity in year  $t$ ,  $\theta_{it}$  quantifies the market share of plant  $i$  in the industry and  $p_{it}$  is the plant's productivity measure. In our case  $p_{it}$  is the TFP measure introduced in equation (3.1), with the cost shares  $\alpha_t^j$  replaced by the average of year  $t$  and  $t - k$ . Our measure of market share is output. The change in industry productivity between period  $t$  and  $t - k$  can then be decomposed in the following way:

$$\begin{aligned} \Delta P_t = & \sum_{i \in S} \theta_{i,t-k} \Delta p_{it} + \sum_{i \in S} \Delta \theta_{it} (p_{i,t-k} - P_{t-k}) + \sum_{i \in S} \Delta \theta_{it} \Delta p_{it} \\ & + \sum_{i \in E} \theta_{it} (p_{it} - P_{t-k}) - \sum_{i \in X} \theta_{i,t-k} (p_{i,t-k} - P_{t-k}), \end{aligned} \quad (3.3)$$

where  $S$ ,  $N$  and  $X$  denote those plants that survive, enter and exit between  $t$  and  $t - k$ , respectively. We take  $k$  to be 5 in the following decompositions. The first term in equation (3.3) shows the contribution to productivity growth from TFP changes within surviving plants, the 'within'

<sup>15</sup>A full discussion of how this method compares to alternative decompositions such as those suggested by Baily et al. (1992) and Griliches and Regev (1995) is provided in Foster et al. (1998) and in Disney et al. (2004).

effect. The second term is the ‘between’ effect, which is positive if those plants that initially had above average TFP are the ones that gain market share. The third term is a ‘covariance’ term that will be positive when market share increases (falls) for plants with positive (negative) productivity growth. The last two terms represent the contribution to productivity growth accounted for by entry and exit. The sum of the entry and exit effect is referred to as net entry, or turnover effect. These terms are positive when there is entry (exit) of plants with above- (below-)average productivity.

Many studies have used equation (3.3) for decompositions of aggregate TFP growth to study the relative role of internal versus external restructuring. Our analysis is most closely related to two previous studies that explicitly investigate the role of foreign firms in such decompositions: Okamoto and Sjøholm (1999) and De Backer and Sleuwaegen (2003). Thus, we make a distinction between domestic and foreign-owned plants, but in contrast to the above mentioned studies we split the surviving plants into 4 groups; plants that are domestic all years between  $t - k$  and  $t$ , plants that are foreign all years between  $t - k$  and  $t$ , plants that change ownership and end up as foreign in year  $t$  (foreign acquisitions), and plants that change ownership and end up as domestic in year  $t$  (foreign divestures).<sup>16</sup>

### 3.4.2 Decomposition results

Figure 3.4 shows aggregate TFP growth calculated for overlapping 5-year periods from 1978 until 2001. Aggregate manufacturing productivity growth was obtained by weighting the TFP growth of each 3-digit industry with that industry’s share of total manufacturing output.<sup>17</sup> The Norwegian business cycle is strongly evident in the figure; with two major booms (peaking in 1987 and 1998) and a recession in between.<sup>18</sup> On a separate scale, Figure 3.4 also shows the contribution from the turnover of domestic and foreign plants. It is evident that the contribution from net entry closely follows the business cycle.

For further results from the productivity decomposition, we have selected two periods at similar points in these two booms, that is, the 5-year periods 1982-1987 and 1993-1998 ending at the peaks. This also makes it easier to compare the role of foreign-owned plants in the 1990s to that in the 1980s. Table 3.2 shows some of the components of the decomposition. From the table

<sup>16</sup>Okamoto and Sjøholm (1999) drop plants that change ownership during the period for which they calculate TFP growth.

<sup>17</sup>The output share of each industry is the average of output share in  $t$  and  $t - k$ .

<sup>18</sup>The cycle in the TFP growth curve corresponds closely to the 5-year growth rates of GDP and aggregate consumption in Norway.

### 3.4 Productivity Decompositions and Restructuring

Figure 3.4: Aggregate TFP growth and contribution from net entry

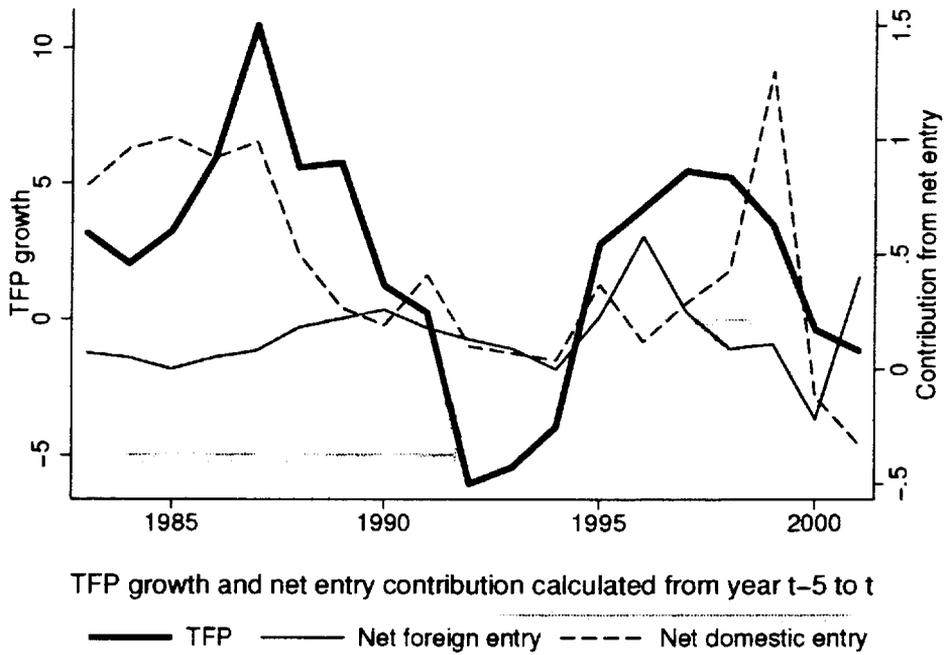


Table 3.2: Components of the TFP decomposition

	Plants		Market share		TFP		TFP growth	
	82-87	93-98	82-87	93-98	82-87	93-98	82-87	93-98
Dom-survivors	4781	3370	0.74	0.46	0.00	-0.00	0.04	0.02
For-survivors	114	273	0.06	0.27	-0.00	-0.04	0.11	0.05
For-divestures	70	135	0.07	0.05	0.07	-0.05	0.14	0.01
For-acquis.	75	268	0.02	0.13	-0.02	-0.01	-0.03	0.06
Dom-entrants	772	322	0.05	0.04	0.08	0.05		
For-entrants	25	58	0.01	0.02	0.23	0.09		
Dom-exitors	1004	776	0.10	0.07	-0.05	-0.02		
For-exitors	29	76	0.00	0.02	-0.06	-0.04		

Market shares are aggregated from 3-digit level using 3-digit output shares. Entrants' market share is calculated in year  $t$ , survivors' and exitors' in  $t-5$ .

TFP columns show average deviations from aggregate 3-digit TFP. For entrants it is the deviation of plant-level TFP in year  $t$  with aggregate TFP in  $t-5$ , for exitors and survivors we compute the deviation in  $t-5$ .

The TFP growth columns show unweighted average TFP growth from  $t-5$  to  $t$ .

we see that the market shares of both, entrants and exitors have not changed much from the first to the second boom. Entrants and exitors have market shares of less than 10% in both periods. The big change from the boom during the 1980s to the boom during the 1990s is the increase in market share of foreign plants. Taking foreign survivors and foreign acquisitions together, their market share increased from 8% in 1982 to 40% in 1993. The TFP of entrants is above average TFP and that of exitors is below average. Those plants experiencing foreign acquisitions have initially TFP below average. Even though foreign survivors have below average TFP, their TFP growth is larger than in the surviving domestic plants.

Table 3.3: Decomposition of TFP growth for 1982-1987 and 1993-1998

Period	Domestic		Foreign	
	1982-1987		1993-1998	
Survivors-within	4.24	0.36	-0.32	0.85
Acquisitions-within	1.85	0.09	0.18	1.24
Survivors-between	-0.46	-0.16	-0.28	-0.11
Acquisitions-between	-0.02	0.01	0.03	0.26
Survivors-cov	3.25	0.29	1.64	0.68
Acquisitions-cov	0.28	0.04	0.14	0.42
Entrants	0.85	0.08	0.60	0.10
Exitors	0.14	0.00	-0.16	-0.01
Total TFP growth	10.83		5.25	

What is labelled domestic acquisitions here, is usually referred to as foreign divestures.

Table 3.3 shows the results of the decomposition of aggregate TFP growth according to equation (3.3). As in most TFP decompositions, the within effect is the dominant driver of aggregate TFP growth. The total within effect accounted for 60% of aggregate TFP growth in the 1982-1987 period, while its contribution is reduced to 40% in the 1993-1998 period. Foreign plants played a negligible role in the within effect during the first period, but in the second period all of the positive within effect is accounted for by foreign survivors and foreign acquisitions. The between effect for surviving plants is negative in both periods for domestic and foreign plants, indicating that surviving plants with above-average productivity in the base year lose market shares over the 5-year periods under consideration. The covariance effect is positive; which indicates that plants with positive productivity growth increase their market share. The contribution from

net entry equals the sum of the entry and exit effect.<sup>19</sup> Net entry accounts for about 10% of TFP growth in both periods.

## 3.5 Mode of Foreign Entry and Domestic Productivity

### 3.5.1 Methods and Variables

From the above analysis it is apparent that at least since the 1990s, foreign firms have become major players in the Norwegian economy. Every year a small number of highly productive greenfield entrants penetrates the Norwegian market. Foreign owners entering the market by acquiring an established domestic plant manage to produce an impressive contribution to overall TFP growth in these plants. Recent research on a number of countries by Bartelsman et al. (2004) indicates that an ongoing entry and exit process promotes also the productivity growth of incumbent firms. In this section, we therefore examine whether entry of foreign firms has a direct impact on established firms in the market that cannot be read from the productivity decompositions. We focus, in particular, on how the mode of foreign entry affects the productivity of domestic firms, defined as those plants that have Norwegian owners throughout their presence in our panel.

To do so, we estimate production functions of the following form

$$\ln Y_{it} = \alpha \ln INPUTS_{it} + \sum_{k=0}^T \beta^k FOR_{I,t-k} + \gamma Z_{it} + v_i + v_t + \varepsilon_{it}. \quad (3.4)$$

Equation (3.4) states that output  $Y$  depends on the inputs  $K$  (capital),  $M$  (material) and  $H$  (hours), a plant specific effect  $v_i$ , a time specific effect  $v_t$  and an error term  $\varepsilon_{it}$ . In contrast to  $\ln TFP$  used above, we do not constrain the output elasticities of the inputs to be the factor shares, but estimate them.<sup>20</sup> In equation (3.4),  $FOR_{I,t-k}$  is our measure of foreign entry, it usually contains the employment-weighted entry rate of new foreign plants  $ENTRY_{It}$  and the employment-weighted rate of foreign acquisitions  $ACQUIS_{It}$  and their lags  $k$ . It seems important to include lags of the foreign entry and foreign presence variables as there is evidence from the literature on productivity spillovers that the effects from foreign presence may take time to materialise (e.g. Mansfield and Romeo (1980) and Sembenelli and Siotis (2005)). Where ap-

<sup>19</sup>In Table 3.3 an exit effect larger than zero indicates that exit increases aggregate productivity growth; i.e. it is plants with below-average productivity that exit the industry.

<sup>20</sup>The results using our constructed TFP measure point in the same direction and are reported in the robustness analysis at the end of this section.

appropriate we also include a set of competition variables ( $Z$ ).<sup>21</sup> That is we want to capture the effect foreign entry has on domestic productivity over and above potential competition effects. Looking at industry-specific variables we will only capture horizontal effects from foreign entry and acquisitions.<sup>22</sup>

The spillover literature on the impact of foreign presence on local productivity has produced rather mixed results (Görg and Greenaway (2004)). Görg and Strobl (2001) emphasize that the results in these studies are sensitive to the way foreign presence is measured. In fact, any measure of foreign presence will capture some combination of competition effects and potential spillovers from foreign to domestic firms.<sup>23</sup> In traditional measures such as the share of employment or the share of output in foreign-owned firms, newly entering foreign firms will be mixed with established foreign firms and even with foreign-owned plants exiting the market. To make our analysis comparable to the spillover studies we report results using a traditional foreign presence variable ( $FORPRES_{It}$ ) for  $FOR_{I,t-k}$  which measures foreign presence as the share of industry employment in foreign-owned plants.

The strongest impact from foreign-owned firms is yet to be expected when they bring in new capital and even more when a new foreign-owned subsidiary is established (greenfield investment). In particular, greenfield entry and foreign acquisitions are likely to have a different impact on the market structure in the industry.<sup>24</sup> While greenfield entry increases production capacity and therefore also competition, acquisitions do not necessarily have an immediate impact on market structure. Moreover, competition or efficiency-enhancing effects may take longer to materialise if an acquisition involves substantial restructuring in the acquired plant. Changes in market structure through foreign entry may affect the effort and therefore the productivity of local firms. Apart from these competition effects, the presence of foreign firms may have an impact on the productivity of domestic firms if they generate technology or knowledge spillovers. As these effects work in opposite directions, it is not immediately obvious what sign we should expect on the entry and acquisition rates.

<sup>21</sup>In similar approaches production functions have been 'augmented' with variables capturing, for example, product market competition (Nickell (1996); Disney et al. (2004)), trade liberalisation measures (Pavcnik (1999)), or measures of foreign presence (some recent contributions are e.g. Haskel et al. (2002), Keller and Yeaple (2003), Damijan et al. (2003)).

<sup>22</sup>A recent strand of literature looking at backward and forward linkages between industries has been initiated by Smarzynska Javorcik (2004).

<sup>23</sup>Sembenelli and Siotis (2005) attempt to disentangle the two effects.

<sup>24</sup>See e.g. UNCTAD (2000, p.145) for an informal description and Chapter 2 for a more formal exposition.

To get an idea of the size of the competition effect in the overall impact of foreign entry on domestic productivity, we use a set of variables that was first suggested in Nickell (1996). These variables are industry concentration ( $CONC_{it}$ ), market share ( $MS_{it}$ ), profit margins ( $PM_{it}$ ) and industry import penetration ( $IMP_{it}$ ).<sup>25</sup> Technological differences across industries imply very different requirements in terms of size and scale for firms to be able to operate in their respective environments (Sutton (1996)), thus high market shares need not indicate a lack of competition. However, changes in market structure over time are still going to be a reasonably good measure of changes in competition. The profit margins measure ( $PM_{it}$ ) is thought to capture possible rents that may be available to shareholders and workers in the form of higher pay and lower effort. As higher efficiency would raise both profit margins and market shares, these variables are potentially endogenous, which could result in a positive coefficient. We address this problem by lagging both measures by two years and note that endogeneity would bias the coefficients towards zero. All of these measures are constructed at the 5-digit ISIC level. As we do not have plant-level trade data, we compute import penetration  $IMP_{it}$  at the 3-digit ISIC level. If foreign entry and acquisitions are more concentrated in industries that are doing well or have good growth prospects, the domestic plants might be able to maintain their market shares even after foreign entry. What is more, leaving out variables that could be proxies for this may give rise to a spurious correlation between the entry variables and productivity. We try to control for this by using 5-digit industry output growth  $INDGR_{it}$  as a proxy for how well an industry is doing.

To eliminate plant and industry fixed effects we estimate equation (3.4) in first differences. If there are important unobservable variables that differ both across firms and over time (e.g. managerial ability), the error term will not be white noise. Olley and Pakes (1996) propose a structural approach that addresses this issue by assuming that such shocks can be reflected in investment behaviour as it is not correlated with current output. However, this approach relies on the assumption of perfectly competitive markets, which seems inappropriate when looking at competition effects.<sup>26</sup> A further issue is that our sample of firms will consist only of firms that are active in the market but not of those firms that exit, i.e. our estimations are likely to be biased by selection. To address this issue we also estimate the model using the Heckman selection model using two different specifications for the selection equation.

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<sup>25</sup>For the construction of these, see the variable definitions in the Appendix.

<sup>26</sup>For a discussion see Griliches and Mairesse (1998).

Taking first differences of (3.4), our estimation equation is:

$$\begin{aligned} \Delta \ln Y_{it} = & \alpha_1 \Delta \ln K_{it} + \alpha_2 \Delta \ln M_{it} + \alpha_3 \Delta \ln H_{it} \\ & + \sum_{k=0}^T \beta_1^k \Delta FOR_{I,t-k} \\ & + \gamma_1 \Delta MS_{i,t-2} + \gamma_2 \Delta PM_{i,t-2} + \gamma_3 \Delta CONC_{It} \\ & + \gamma_4 \Delta IMP_{I,t-2} + \gamma_5 \Delta INDGR_{It} + v_t + \xi_{it}. \end{aligned} \quad (3.5)$$

This equation includes our variables for inputs, the different measures of foreign entry and foreign presence, and if appropriate also the competition variables. We estimate equation (3.5) on the sample of firms that are Norwegian-owned throughout their presence in our panel. Summary statistics of the variables used in the regressions are presented in Table 3.7 in the Appendix. As a first step we compare a more widely used measure of foreign presence to our measures of foreign entry. We then present our main results for the two different modes of foreign entry, controlling also for selection. A number of robustness checks using different specifications and control variables are reported at the end of this section.

### 3.5.2 Results

Table 3.4 compares the results using the foreign presence variable and the two measures of foreign entry with and without controlling for competition and industry growth. We first estimate equation (3.5) without the foreign entry variables (column 1). All inputs are highly significant, the variables capturing product market competition are negatively signed with the exception of import penetration and industry growth. That is to say that decreases in market shares and profit margins are conducive to the productivity of established plants, although the coefficient on market share is not significant. Higher concentration implies lower productivity. Foreign competition, in the form of import penetration, seems to enhance the productivity of local firms, but not significantly so. In addition, industry output growth is positively correlated with plant productivity.

In column 2, the results for overall foreign presence measured by the share of employment in foreign-owned firms  $FORPRES_{It}$  are reported. While all of the individual lags are negatively signed, not all of them are significant.<sup>27</sup> However, the overall effect of foreign presence  $\sum \Delta FOR_I$  is negative and significant as indicated by the p-value in square brackets. Controlling

<sup>27</sup>Higher lags than  $k = 4$  for  $FORPRES_{It}$  and  $ENTRY_{It}$ , and  $k = 3$  for  $ACQUIS_{It}$  were not significant.

Table 3.4: Foreign presence, foreign entry, competition and domestic productivity

Dependent variable $\Delta \ln Y_{it}$	<i>FOR</i> =						
	-	<i>FORPRES</i>		<i>ENTRY</i>		<i>ACQUIS</i>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \ln K_{it}$	.072** (.002)	.072** (.002)	.072** (.002)	.072** (.002)	.072** (.002)	.072** (.002)	.072** (.002)
$\Delta \ln M_{it}$	.516** (.002)	.517** (.002)	.517** (.002)	.517** (.002)	.516** (.002)	.517** (.002)	.517** (.005)
$\Delta \ln H_{it}$	.283** (.003)	.282** (.003)	.283** (.003)	.283** (.003)	.283** (.003)	.282** (.003)	.283** (.003)
$\Delta MS_{i,t-2}$	-.050 (.057)		-.051 (.057)		-.048 (.057)		-.049 (.057)
$\Delta PM_{i,t-2}$	-.061** (.008)		-.060** (.008)		-.061** (.008)		-.060** (.008)
$\Delta CONC_{It}$	-.035* (.016)		-.034* (.016)		-.035* (.016)		-.034* (.016)
$\Delta IMP_{I,t-2}$	.024 (.021)		.022 (.021)		.025 (.021)		.024 (.021)
$\Delta INDGR_{It}$	.021** (.003)		.022** (.003)		.021** (.003)		.023** (.003)
$\Delta FOR_I$		-.006 (.011)	.005 (.011)			.036** (.012)	.035** (.012)
$\Delta FOR_{I,t-1}$		-.044** (.011)	-.042** (.011)	-.123** (.027)	-.109** (.027)	.025 (.016)	.026 (.016)
$\Delta FOR_{I,t-2}$		-.001 (.011)	-.001 (.011)	-.065 (.035)	-.054 (.035)	.053** (.017)	.054** (.017)
$\Delta FOR_{I,t-3}$		-.028* (.012)	-.029** (.037)	-.095** (.038)	-.083* (.037)	.041** (.014)	.039** (.014)
$\Delta FOR_{I,t-4}$		-.037** (.012)	-.035** (.012)	-.097** (.034)	-.082* (.030)		
$\sum \Delta FOR_I$ [p]		-.116 [.000]	-.112 [.000]	-.381 [.000]	-.328 [.002]	.155 [.001]	.154 [.001]
$R^2$	.76	.76	.76	.76	.76	.76	.76
<i>N</i>	66,144	66,144	66,144	66,144	66,144	66,144	66,144
<i>Plants</i>	6,254	6,254	6,254	6,254	6,254	6,254	6,254

\*\* , \* indicate significance at 1% and 5% respectively.

Robust standard errors in round parentheses.

for product market competition as done in column 3, the effect of foreign presence decreases by very little and the coefficients on the inputs and competition variables are almost unaffected.

In columns 4-7 we look at the foreign entry variables. Columns 4 and 5 show the results for the greenfield entry rate of foreign firms  $ENTRY_{It}$ . The coefficients on the lags of foreign entry are all negative and mostly significant. The overall effect on foreign entry is negative and significant and larger than that of  $FORPRES_{It}$ . When we control for competition and industry growth rates, the effect of the  $ENTRY_{It}$  variables decreases, as can be seen by the smaller long-run effect in column 5. Note that it is the inclusion of the industry growth rate that is responsible for most of the decrease in the long-run coefficient, excluding  $INDGR_{It}$  from column 5 results in a long-run effect on foreign entry of  $-.377[.000]$ . Looking at the impact of the foreign acquisition rate on domestic productivity (columns 6 and 7), all the coefficients on  $ACQUIS_{It}$  and its lags have positive signs. Their joint effect is significantly positive, and is virtually unaffected by including the competition and industry growth variables in column 7.

In Table 3.5 foreign entry and foreign acquisitions are included together. As the input coefficients hardly vary across specifications they are not reported here for brevity. The results in the first two columns of Table 3.5 confirm those of columns 4-7 of Table 3.4. An increase in foreign entry has a negative and significant impact on the productivity of the domestic plants, while the effect from foreign acquisitions is positive. In absolute terms the negative effect from foreign entry outweighs the positive effect from foreign acquisitions even though there are much fewer foreign greenfield entrants than foreign acquisitions. When controlling for competition (column 2) the long-run effect of foreign entry becomes smaller, while the long-run effect of foreign acquisitions is unaffected. As in columns 4 and 5 of Table 3.4, most of the difference in the long-run coefficients between the specifications in columns 1 and 2 is due to greenfield entrants targeting expanding industries. Excluding  $INDGR_{It}$  from the specification in column 2, the long-run coefficients on  $\sum ACQUIS_t$  and  $\sum ENTRY_t$  are  $-.389[.000]$  and  $.154[.001]$ , respectively.

The last two columns of Table 3.5 estimate equation (3.5) using a Heckman selection model. By virtue of observability, our sample consists of only those firms that survive, hence if foreign entry or foreign acquisitions affect the probability of survival, our earlier estimates may be biased. Therefore column  $S(HAZ)$  conditions survival on a probit of so-called hazard variables that have been found to determine exit (see e.g. Bernard and Jensen (2002)): plant age, age squared, plant size - measured as the number of employees, productivity - measured by our TFP measure from above and a multiplant dummy that takes value one if the plant is part of a multiplant firm. We also include the first differences of our foreign entry and acquisition variables.

Table 3.5: Modes of foreign entry, competition and domestic productivity

Dependent variable $\Delta \ln Y_{it}$				
	(1)	(2)	$S(HAZ)$	$S(OP)$
$\Delta MS_{i,t-2}$		-.047 (.057)	-.028 (.057)	-.029 (.057)
$\Delta PM_{i,t-2}$		-.060** (.008)	-.059** (.008)	-.058** (.008)
$\Delta CONC_{It}$		-.034* (.016)	-.025 (.018)	-.025 (.018)
$\Delta IMP_{I,t-2}$		.024 (.021)	.032 (.019)	.032 (.019)
$\Delta INDGR_{It}$		.021** (.003)	.021** (.004)	.021** (.004)
$\Delta ENTRY_{I,t-1}$	-.134** (.027)	-.119** (.028)	-.126** (.034)	-.126** (.034)
$\Delta ENTRY_{I,t-2}$	-.074* (.035)	-.063 (.035)	-.082 (.049)	-.082 (.049)
$\Delta ENTRY_{I,t-3}$	-.090* (.038)	-.078* (.035)	-.106** (.041)	-.105** (.041)
$\Delta ENTRY_{I,t-4}$	-.095* (.034)	-.078* (.034)	-.095* (.043)	-.094* (.043)
$\Delta ACQUIS_{It}$	.033** (.012)	.033** (.012)	.028* (.014)	.028** (.014)
$\Delta ACQUIS_{I,t-1}$	.024 (.016)	.025 (.016)	.013 (.015)	.013 (.015)
$\Delta ACQUIS_{I,t-2}$	.059** (.017)	.058** (.017)	.051** (.019)	.051** (.019)
$\Delta ACQUIS_{I,t-3}$	.042** (.014)	.040** (.014)	.035* (.015)	.035* (.015)
$\sum \Delta ENTRY_I$ [p]	-.394 [.000]	-.339 [.002]	-.409 [.003]	-.408 [.003]
$\sum \Delta ACQUIS_I$ [p]	.159 [.001]	.157 [.001]	.127 [.007]	.128 [.006]
$R^2$	.76	.76	-	-
$\chi^2(1)$ $\rho(SE)$	-	-	13.04 -.048(.013)	20.38 -.046(.010)
$N$	66,144	66,144	67,370	67,475
$Plants$	6,254	6,254	7,349	7,373

\*\* , \* indicate significance at 1% and 5% respectively.

Robust standard errors in round parentheses.

In turn, in the last column  $S(OP)$  we condition survival on investment and capital to capture the Olley and Pakes (1996) idea that investment which is observable but not correlated with current output can pick up unobservable shocks to productivity. In this equation, selection is determined by plant's investment shares and their capital in logs from levels up to their 4th powers.<sup>28</sup> Both selection equations yield similar results. The variables in the selection probits are jointly significant, as indicated by the  $\chi^2$  values. The selection terms  $\rho$  are also significant. The standard errors on almost all coefficients including inputs increase slightly. The overall negative impact of foreign entry is larger compared to column 2, whereas the overall impact of foreign acquisitions is somewhat smaller.<sup>29</sup>

To summarise, the overall effect of foreign presence on the productivity of the domestic plants is negative and robust to controlling for competition and industry growth. Considering only the foreign entry variables, much of this negative effect of foreign presence appears to be generated by newly established foreign plants. The addition of these new efficient foreign-owned plants to the market increases product market competition, which is confirmed when measuring foreign entry based on a plant count. In this case the negative effect from foreign entry is even stronger, while using the domestic entry rate does not yield a significant effect.<sup>30</sup> The negative impact on domestic productivity is usually attributed to a market stealing effect by the new foreign firms which forces the established firms up their average cost curve and, hence, decreases their productivity (Aitken and Harrison (1999)). As foreign plants enter mainly in expanding industries, the negative impact from foreign entry is smaller when controlling for industry growth.<sup>31</sup> After controlling for competition and industry growth we are still left with a significant negative impact of foreign entry on domestic productivity. A possible explanation for this might be that the new foreign entrants attract highly qualified workers from existing plants. If the affected plants have difficulties in replacing these workers adequately, this will have a detrimental impact on their productivity. Foreign acquisitions do not only target expanding industries and they are not associated with increased product market competition. In fact, they have a positive impact on domestic productivity. It is plausible that foreign acquisitions leave the existing firms in the market time to adapt to whatever externalities the change in ownership

<sup>28</sup> As zeros in investment are meaningful observations (see Nilsen and Schiantarelli (2003) for Norway) we prefer to scale investment by dividing through annual averages instead of taking logs.

<sup>29</sup> We also estimated all the specifications reported in Table 3.4 correcting for the two selection terms reported here with very similar results.

<sup>30</sup> These results are not reported here, but are available from the authors on request.

<sup>31</sup> The correlation coefficient between  $ENTRY_{It}$  and  $INDGR_{It}$  at the aggregate level is positive (.0825) and significant at 1%. At the industry level, the foreign entry rate and industry growth are mostly positively correlated as well. However, at more disaggregated industry levels, the number of industries where the correlation is negative is higher.

might bring about, possibly because they are themselves handicapped by substantial in-house restructuring after a takeover. Moreover, possible channels for spillovers are more likely to exist for these plants. As they have been present in the market before becoming foreign-owned, they may have well-established ties with other firms in the market through which technology or knowledge diffusion can occur.

### 3.5.3 Robustness Analysis

To check the robustness of our results we re-estimated the specification in column 2 and the selection equations excluding one 2-digit ISIC industry at the time. In each of these regressions the results go very much in the same direction as in the whole manufacturing sector. Taking out larger sectors that see the bulk of foreign entry or acquisitions obviously decreases the long-run effects and their significance.

In Table 3.6, we report the results for a number of robustness checks. They are all variations of equation (3.5). In column 1, we report the results from our constructed TFP measure used for the productivity decompositions in Section 3.4. The coefficients on foreign entry and acquisitions are 3-5 times larger than in the original specification and significant. Part of the reason for this might be that this TFP measure is based on average cost shares that include all plants and not only the domestic plants in our estimation panel. In sectors with many capital-intensive foreign firms the measured TFP of the domestic firms may then be biased downward.

Table 3.6: Robustness

Dependent variable $\Delta \ln Y_{it}$					
	(1)	(2)	(3)	(4)	(5)
	TFP from decompos.	direct ownership	full sample	ind. specific input coeff.s	GMM
$\sum_{ p } \Delta ENTRY_{it}$	-1.682 [.000]	-.559 [.313]	-.286 [.003]	-.270 [.013]	-.362 [.016]
$\sum_{ p } \Delta ACQUIS_{it}$	.666 [.000]	.154 [.001]	.156 [.001]	.143 [.002]	.055 [.606]
$R^2$	.03	.77	.75	.78	-
$N$	66, 144	66, 144	79, 252	66, 144	66, 136
$Plants$	6, 254	6, 254	7, 297	6, 254	6, 254

As noted in Section 3.2, from 1990 onwards our definition of foreign ownership includes both directly and indirectly foreign-owned plants. In column 2 of Table 3.6, we re-estimate the specification from above with our foreign entry and acquisition variables based on direct foreign ownership only. Foreign acquisitions are significant with almost the same coefficient size as in column 2 of Table 3.5. This indicates that the positive effect of acquisitions in Table 3.5 comes mainly from acquisitions of plants that are directly foreign-owned. As in most of our specifications, the long-run coefficient on entry is negative also when we only consider entry of directly foreign-owned plants. However, the long-run effect is insignificant because one of the four individual coefficients on  $\Delta ENTRY_{I,t-k}$  is positive and significant at the 10% level. Instead, the remaining three negative lags (two of which are significant) suggest a much stronger negative impact from direct foreign entry than indicated by the long-run coefficient in column 2. By comparing the results on the foreign entry variables in Table 3.5 and column 2 of Table 3.6, we can infer that the coefficients on the entry of indirectly foreign-owned plants are negative as well. Thus, combining direct and indirect foreign ownership helps us to get the number of observations sufficient to get significant results.

In column 3 we estimate equation (3.5) on the full sample used in the decomposition results. That is, this sample also includes foreign-owned plants and plants that change ownership in the period under consideration. The long-run coefficient on  $ENTRY_{I,t}$  is lower in absolute value than in column 2 of Table 3.5. Hence, the negative effect of foreign entry is more pronounced for domestic firms than for other foreign firms present in the market. A similar result has been obtained by Djankov and Hoekman (2000) for the Czech Republic. They find that the productivity of foreign affiliates and domestic plants that are part of joint ventures benefit from foreign ownership while the effect is negative for plants without foreign engagement.

Column 4 reports results for a more general specification of equation (3.5) in which we allow the  $\alpha$  coefficients on inputs to vary across 2-digit industries by interacting the inputs with industry dummies. Our base specification constrains the input elasticities to be the same for all manufacturing industries. This might ignore important differences between industries and thus bias our estimates of the effect of foreign entry. The overall effects of foreign entry and acquisitions are somewhat smaller, but the individual as well as the long-run effects remain significant. Similar results are obtained when varying the input coefficients across 3-digit industries or the industry classification used by Statistics Norway which is somewhere between the 2- and 3-digit ISIC level and corresponds to the level at which our deflators are defined (not reported).

The absence of feasible instruments for endogenous variables in particular inputs when estimating production functions may seriously bias the input coefficients. Since the inputs in our

model are likely to be correlated with the idiosyncratic component of the error term  $\varepsilon_{it}$ , our above results might be affected by this. While we are not interested in the input coefficients *per se*, we nonetheless re-estimate our results using the Generalised Method of Moments estimator suggested by Arellano and Bond (1991). The idea is that as long as the idiosyncratic component is white noise, twice or more lagged variables in levels are legitimate instruments for the first differenced right-hand side variables. Treating inputs and both foreign entry variables as endogenous we obtain a coefficient on greenfield entry that is of similar size to the one in column 2 in Table 3.5, while the coefficient on foreign acquisitions is smaller in size and insignificant. The p-value for the test of no MA(1) error in the residuals is zero, rejecting the null of no autocorrelation, which is to be expected since first differencing should induce MA(1) residual autocorrelation. However, the p-value for the test of no MA(2) error in the residuals is only 0.010, which is too small to confidently reject the null of no autocorrelation. It is nonetheless comforting that the results of this dynamic specification do at least point in the same direction.

### 3.6 Conclusions

In this chapter we examine the contributions of foreign-owned plants to productivity growth in a panel of Norwegian manufacturing plants, as well as their impact on the productivity of domestic establishments. While the largest part of productivity growth is generated within surviving plants - both domestic and foreign, the contribution of external restructuring via entry and exit of plants is not negligible. Our results show that foreign greenfield entrants have higher productivity compared to an average domestic firm and also compared to their domestic counterparts. The productivity decomposition further reveals that during the 1990s at least, foreign acquired plants are important contributors to productivity growth.

To examine the impact of the mode of foreign entry on changes in the productivity of native plants we estimate production functions. Overall foreign presence exerts a negative impact on the productivity of domestic plants. When considering, in particular, the effect from foreign entry, it appears that the effect of greenfield entry is very different from the effect of foreign entry via acquisition. Greenfield entry has a negative impact on the productivity of domestic plants. This effect is reduced when controlling for industry output growth as foreign owners set up new plants mainly in expanding industries. A smaller part of this negative impact can be attributed to the increase in competition associated with the entry of highly efficient foreign plants. Hence, there is a market-stealing effect from foreign greenfield entrants which forces the domestic plants up their average cost curves and decreases their productivity as a result. After controlling for

industry growth and competition effects, the negative impact from foreign entry on domestic plants is smaller, but still significant. It could be due to foreign firms attracting highly qualified or highly motivated workers from domestic plants resulting in productivity losses in these plants. The effect of foreign acquisitions is unaffected when controlling for competition and industry output growth. While their impact is smaller in size than that of greenfield entry, they generate a positive effect on the productivity of domestic plants. As these plants were already present in the market before being acquired by a foreign owner, they are likely to have established linkages with other plants in the host economy which may serve as a basis for knowledge, technology or human capital spillovers.

## 3.A Appendix

### Data and Variable Definitions

*ACQUIS<sub>It</sub>* Employment in plants that were acquired by a foreign owner between years  $t$  and  $t - k$  as a share of 5-digit industry employment in year  $t - k$ .

*CONC<sub>It</sub>* Joint market share of the 5 largest firms in terms of output. 5-digit industry level.

*ENTRY<sub>It</sub>* Employment in foreign-owned plants present in year  $t$  but not in year  $t - k$  as a share of 5-digit industry employment in year  $t - k$ .

*H<sub>it</sub>* Number of person hours in the plant. Since only blue-collar hours are reported prior to 1983, and only total hours from 1983, we estimate total hours before 1983 by using information on the blue-collar share of the total wage bill. Rented labour hours are calculated from the costs of rented labour using the calculated average wage for own employees.

*IMP<sub>It</sub>* Rate of imports over domestic consumption ( $IMP_{It} = M_{It}/(Y_{It} + M_{It} - X_{It})$ ). Import and export data are taken from the OECD ITCS International Trade Data SITC Rev. 2 and have been converted to 3-digit ISIC Rev. 2 codes using a conversion table provided by Maskus (1989). The data are converted into NOK using the annual average exchange rate provided in the International Financial Statistics. The output measure is constructed from the full census of manufacturing.

*INDGR<sub>It</sub>* Industry output growth between years  $t$  and  $t - k$  at the 5-digit level.

*K<sub>it</sub>* Our estimate of capital services use the following aggregation:

$$K_{it} = R_{it} + (0.07 + \delta^m)V_{it}^m + (0.07 + \delta^b)V_{it}^b,$$

where  $R_{it}$  is the cost of rented capital in the plant,  $V_{it}^m$  and  $V_{it}^b$  are the estimated values of machinery and buildings at the beginning of the year,  $\delta^m = 0.06$  and  $\delta^b = 0.02$  are the depreciation rates that we use. The estimated values of buildings and machinery are obtained from information on fire insurance values. To reduce noise and avoid discarding too many observations with missing fire insurance values, we smooth these values using the perpetual inventory method. Fire insurance values are not recorded after 1995, thus from 1996 we estimate capital values by adding investments and taking account of depreciation. We also used, where possible, estimates of firm-level capital values (assigned to

the plant level according to employment shares) as start values for plants with entry after 1995. These capital values were obtained from recent work to improve on capital estimates in Norwegian manufacturing (see Raknerud et al. (2003)). We use separate price deflators for inputs and output and for investment in buildings and machinery, obtained from Statistics Norway. The aggregation level for the price deflators is according to the sector classification used in the National Accounts, and is somewhere between the 2- and 3-digit ISIC level.

$M_{it}$  Total cost of materials used. Since this variable in the data includes rented labour and capital, we subtract these and allocate them to the labour and capital measures, respectively.

*multiplant* Dummy equal to 1 if the plant is part of a multi-plant firm.

$MS_{it}$  Plant output as a share of 5-digit industry output.

$PM_{it}$  Net output less material and wage costs divided by 5-digit industry output. We dropped observations with profit margins smaller than  $-1$ .

$Y_{it}$  Gross production value, net of sales taxes and subsidies.

Table 3.7: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
<b>Levels</b>					
$\ln Y_{it}$	9.524	1.261	4.085	14.462	66144
$\ln K_{it}$	7.102	1.278	0.593	12.301	66144
$\ln M_{it}$	8.704	1.46	1.384	14.165	66144
$\ln H_{it}$	3.308	1.097	0	8.154	66144
$MS_{it}$	0.016	0.045	0	1	66144
$PM_{it}$	0.081	0.126	-1	0.982	66144
$CONC_{It}$	0.365	0.218	0.091	1	66144
$IMP_{It}$	0.358	0.269	-0.325	1.322	66144
$ENTRY_{It}$	0.002	0.021	0	1.229	66144
$ACQUIS_{It}$	0.017	0.053	0	0.950	66144
$FORPRES_{It}$	0.112	0.154	0	0.978	66144
<b>Differences</b>					
$\Delta \ln Y_{it}$	-0.004	0.339	-5.464	5.952	66144
$\Delta \ln K_{it}$	0.057	0.321	-5.2	4.297	66144
$\Delta \ln M_{it}$	0.014	0.449	-7.014	7.142	66144
$\Delta \ln H_{it}$	-0.029	0.378	-5.043	5.44	66144
$\Delta MS_{it}$	0	0.012	-0.719	0.688	66144
$\Delta PM_{it}$	-0.006	0.127	-1.246	1.349	66144
$\Delta CONC_{It}$	0.003	0.045	-0.765	0.887	66144
$\Delta IMP_{It}$	0.004	0.035	-1.138	0.795	66144
$\Delta ENTRY_{It}$	0	0.029	-1.229	1.229	66144
$\Delta ACQUIS_{It}$	0	0.073	-0.950	0.950	66144
$\Delta FORPRES_{It}$	0.009	0.068	-0.985	0.958	66144
<b>Selection Variables</b>					
$age_{it}$	16.592	5.84	5	28	66144
$size_{it}$	28.862	57.229	1	2284	66144
$TFP_{it}$	3.939	1.323	-2.258	9.994	66144
$multiplant_{it}$	0.12	0.324	0	1	66144
$investment_{it}$	0	0	-0.009	0.018	66144

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