Foreign Direct Investment and Host-Country Effects

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Acknowledgements

To accept a PhD-scholarship mainly due to fear of unemployment, is perhaps not the best way to embark on such a long-term project. Adding to that a six year old memory of being a previous PhD drop-out did not contribute much to my excitement about research at the outset of this project in 2002. The impossible thought of adding yet another drop-out to my CV has certainly helped me complete this time, but more importantly I want to thank a number of people who in different ways have encouraged and supported me during the process.

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Introduction

General introduction

One of the most important features of globalization during the last 20 years is the increased fragmentation of production and the growth of foreign direct investment (FDI). Since the early 1980s direct investment by multinational firms has grown almost twice as fast as trade flows (UNCTAD, 2004). As a result, multinational firms have become major players in the global economy. They organize their production on a global scale in a number of different ways, and an increasing share of world trade is now so-called intra-firm trade conducted within multinationals. In the economic literature, these global trends have generated a considerable interest in multinationals and their effects on host countries. In addition, many countries have put favorable policies in place to attract inward FDI.

So, why do multinationals emerge? Dunning (1981) argues that three conditions need to be present in order for firms to undertake FDI. Dunning's framework has become known as the OLI-framework: Ownership, Location and Internalization. The ownership advantage could be a product or some knowledge that other firms do not have access to. This ownership advantage gives the firm some market power or cost advantage that is sufficient to overcome the extra costs of operating abroad. The location advantage is needed to ensure that it is profitable to establish foreign production rather than to export to the foreign market. Finally, the internalization advantage ensures that the ownership advantage is most profitably exploited within the firm in a subsidiary, rather than through a market process as, for example, through licensing. Recent theories of international trade also predict that it is the more efficient firms that engage in international activities, be it exporting or FDI (Antràs, 2003; Antràs and Helpman, 2004).[1] These models generate predictions about both the location of activities and the degree of internalization or control

[1] Antràs and Helpman (2004) combine the heterogeneous firm framework developed by Melitz (2003) with organizational theories of the firm as in Grossman and Hart (1986).

of the different stages of production of firms.

Given the advantage of multinationals predicted by the frameworks above, there is a possibility that some of this advantage can be picked up by local firms in the host country through knowledge spillovers. Knowledge spillovers can occur through two main channels; local firms may be able to directly copy or imitate the products or processes of multinationals, or they may hire labour previously employed in multinationals. In addition, FDI may increase product market competition and thus induce local firms to perform better in order to survive. The competition effect could in principle come about even if the multinational has no productivity advantage over local firms.

Faced with the possibility of knowledge spillovers that may erode the firm-specific advantage of the multinational after entry into a host country, the multinationals may be reluctant to transfer technology to their subsidiaries, or they may make attempts to limit knowledge spillovers. Spillovers can be limited for instance by paying higher wages in order to reduce labour mobility, as in Fosfuri et al. (2001) and Glass and Saggi (2002). Alternatively, firms may prefer to export to new markets rather than to produce locally by establishing subsidiaries. The trade-off between FDI and exports is considered in theoretical models by Markusen (2001), Petit and Sanna-Randaccio (2000), and Siotis (1999).[2] In all these models, the multinational produces one product, and spillovers from a subsidiary can erode the market power of the multinational. Hence, these models abstract from a vertical production structure and assume only horizontal spillovers. Though multinationals may want to limit horizontal spillovers to potential competitors, the issue may be rather different when considering also intermediate inputs used in the production of a final good. As multinationals may benefit from more productive local suppliers, the incentives for limiting vertical spillovers to suppliers may not be present, see Moran (2001) and Smarzynska-Javorcik (2004).

In the first chapter of the thesis, I depart from the assumption of horizontal spillovers and consider how strategic behaviour generated by vertical spillovers may affect a multinational's mode of entry into a new market. The model includes elements from recent work on outsourcing versus internal production of intermediate inputs by Grossman and Helpman (2002), but retains a partial equilibrium framework in order to consider spillovers and strategic interaction. I find that upstream spillovers affect the strategic interaction between the downstream multinational and the local upstream firm very differently depending on the type of outsourcing relationship; where the outsourcing relationships considered are

[2]See Markusen (1995) for a discussion of the licensing versus FDI trade-off

incomplete outsourcing contracts and successive monopoly. It turns out that threat of upstream entry will not benefit the MNE in the case of incomplete outsourcing contracts, while the result is the opposite in the case of successive monopoly.

While the first chapter in this thesis, along with most theoretical papers on FDI-spillovers, takes the presence of spillovers in the form of a pure externality for granted, there is a large literature searching for empirical evidence of spillovers. In the empirical literature the concept of spillovers is used as a general term to capture both knowledge diffusion and possible competition effects. As it is difficult to measure knowledge flows, the preferred measure for such spillovers is to look for its effect on the productivity of firms. The standard study of FDI-spillovers is conducted within a production function framework by regressing a measure of total factor productivity or labour productivity on input use and one or more variables to represent foreign presence in the industry, while controlling for firm and industry characteristics. If the coefficient on foreign presence is positive and significant, this is interpreted as evidence of positive spillovers from FDI. The first statistical studies of spillovers used cross-sectional aggregate industry level data, and they generally concluded that FDI is associated with positive spillovers.[3]

The major drawback of cross-sectional studies is the simultaneity problem. If a positive correlation between FDI and the productivity of local firms is found, is this due to spillovers or a tendency of foreign firms to locate in the most productive sectors? The simultaneity problem can be eliminated with plant level panel data. Such data were first used in the spillover-studies by Haddad and Harrison (1993) and Aitken and Harrison (1999), with data from Morocco and Venezuela, respectively. A large number of other studies have followed, and the verdict on the results of these studies seems to be that there is no clear evidence of positive spillovers from foreign-owned to host country firms in the same industry, see the recent survey by Görg and Greenaway (2004). Results seem to depend, among other things, on which host countries and time periods are studied, the methods used and the definition of foreign presence, see the meta-analysis in Görg and Strobl (2001).[4]

One argument put forward to explain the conflicting results on horizontal or intra-industry spillovers is that foreign-owned firms, at least in the short run, may steal market

[3]Among the first studies of FDI-spillovers are the papers by Caves (1974), Globerman (1979), and Blomström and Persson (1983), using industry level data from Australia, Canada and Mexico, respectively.

[4]As argued by Smarzynska-Javorcik (2004), spillovers within industries may be less likely than spillovers across industries. Using data from Lithuania, she finds evidence of spillovers from multinationals to domestic firms in sectors that provide intermediate inputs for the multinationals. See also Kugler (2006) for similar arguments and results from Columbia.

shares from domestic firms and, thereby, force them up their average cost curves. This implies that the measured productivity of domestic firms will be lower and we will observe a negative effect from FDI (Aitken and Harrison, 1999). This contrasts with the general view that increased competition induces more effort in local firms and therefore raises their productivity. It is not possible to distinguish any competition effects from knowledge diffusion in productivity regressions that only include variables to represent the extent of foreign presence in the industry. By introducing proxies for competition in the spillover regressions, the coefficient on foreign presence ideally captures only the effect of knowledge diffusion, while the competition effect of FDI is captured by the competition variable, see Haskel et al. (2002). Sembenelli and Siotis (2005) use a different approach to disentangle the competition and knowledge diffusion effects of FDI on the profitability of Spanish manufacturing firms. Their main argument is that the competition effect is likely to become effective quickly after ownership change, while knowledge diffusion may take time to materialise. Thus they identify short-term effects as competition effects, while long-term effects are interpreted as spillovers.

The second chapter of the thesis, coauthored with Stefanie A. Haller, deals with the competition versus knowledge diffusion effects of FDI on host country firms. We depart from Haskel et al. (2002) and Sembenelli and Siotis (2005) by arguing that the use of a single measure of overall foreign presence in a sector may hide different effects of new foreign entrants and foreign firms that have been in the market for a while. In particular, an increase in competitive pressure from foreign presence should be more prevalent from new foreign entrants. Among the new entrants, the effect of greenfield entrants and foreign acquisitions may also differ, as greenfield entry adds new production capacity in the sector while acquisition initially leaves production capacity unchanged. We use Norwegian manufacturing data to investigate how the productivity of domestic firms is affected by recent foreign entrants, separated by mode of entry, and long established foreign-owned firms. Our main finding is that greenfield entry is associated with a negative effect on the productivity growth of domestic plants, while foreign acquisitions have the opposite effect.

Another reason for the unclear results in the spillover-literature could be that the empirical studies treat the channels through which spillovers may occur as a black box. The third chapter of the thesis investigates empirically the common claim that labour mobility is an important channel for spillovers from multinationals to host country firms. To the best of my knowledge this is the first paper using extensive linked employer-employee data to investigate this issue. In the existing spillover-literature the use of a measure of foreign presence at the industry level cannot capture the fact that firms within the same industry have different degrees of contact with foreign firms. Domestic firms with explicit contacts with foreign firms may be the most likely to benefit from knowledge diffusion.[5] With the Norwegian linked employer-employee data I am able to construct plant-specific measures representing the share of workers in domestic firms with experience from multinationals located in Norway. I find that these workers contribute 20-25% more to the productivity of their domestic plants than the workers without multinational experience. The result is consistent with labour mobility being a channel for knowledge diffusion. In addition, when comparing the contribution to plant level productivity from workers with experience from multinationals to the wage-reward to multinational experience that these workers get, I conclude that the evidence of knowledge diffusion is also consistent with elements of a pure knowledge externality.

The empirical literature on host country effects of FDI has mainly been interested in the indirect effects through productivity spillovers, while other effects of FDI in host countries are less studied. As multinationals tend to be larger, do more research and development, use more advanced technology and pay higher wages than purely domestic firms, an increase in the share of foreign-owned firms in a host country may have a substantial compositional effect, even without any spillovers taking place. For instance, an increase in the share of highly productive foreign-owned firms will raise aggregate productivity in the host country. The final chapter of the thesis (coauthored with Stefanie A. Haller) calculates the contribution of foreign-owned firms to productivity growth and employment creation in Norwegian manufacturing.

[5]Examples of contacts between foreign and domestic firms in addition to labour mobility, could be technology licensing, cooperation in research and development, and exchange of intermediate inputs. Unfortunately, information at the firm or plant level on such links between foreign and domestic firms is rarely available.

Summary

The thesis consists of four self-contained chapters; one theoretical and three empirical. The common topic for all four chapters is foreign direct investment and spillovers or other host country effects. The three empirical chapters use panel data to investigate different aspects of the effect of foreign direct investment into Norwegian manufacturing. The following contains a short summary of each of the four chapters.

Multinationals' mode of entry with presence of upstream spillovers

Multinationals' mode of entry into a new market may depend on whether or not they expect spillovers to generate new competition. Existing theoretical models where the mode of entry is affected by spillovers, consider spillovers in the same market as the multinational sells its final product (horizontal spillovers). By contrast, I model the effects spillovers of intermediate input technology (upstream spillovers) have on a multinational's mode of entry. In the model a multinational (MNE) controls the technology for producing both the final good and a specialized intermediate input used in the assembly of the final good. The MNE establishes an assembly plant in a new market where it has monopoly power for the final good, and the organizational choice concerns how to get intermediate inputs to its new assembly plant. The MNE can import the specialized inputs from its home plant, or it can save on input trade costs by getting the inputs locally; either by vertically integrated production, or by outsourcing to a local supplier. Vertically integrated production of the intermediate input gives higher unit costs than specialized production in a local supplier, while outsourcing suffers from inefficiencies generated by the interaction between the supplier and the buyer. In addition, outsourcing to a local supplier gives rise to spillovers and threat of entry of a new supplier.

I show how the possibility of upstream spillovers affects the strategic interaction between the downstream MNE and the local upstream firm differently depending on the outsourcing contract, and how this affects the trade-offs between the various organizational choices of the MNE. I consider two types of outsourcing contracts, incomplete outsourcing contracts, and a contract where the MNE gives the supplier the right to set the price of the intermediate input as in a successive monopoly. With incomplete outsourcing contracts, threat of upstream entry has the effect of improving the outside option of the MNE in the negotiations with the incumbent supplier. It turns out that in most cases the MNE is

unable to use the threat of upstream entry to its own benefit. With successive monopoly, the incumbent supplier reacts to the threat of entry by reducing its price in order to keep the potential entrant out of the market, and this clearly benefits the MNE. If upstream spillovers are expected to occur, the MNE may let the supplier set the price of inputs as a monopolist in order to take advantage of the competition effect from future spillovers.

Foreign firms and host-country productivity: Does the mode of entry matter?

With Stefanie A. Haller, Economic and Social Research Institute, Dublin.

A large empirical literature has examined whether foreign presence in an industry gives rise to productivity spillovers to local firms in the same industry, without coming up with a clear-cut conclusion. Foreign firms are both potential sources of knowledge diffusion and sources of competition. Though the competition effect may well be positive, it has been argued that in the short run foreign firms are equally likely to steal market shares from domestic firms and, thereby give rise to a negative effect on the measured productivity of domestic firms. We argue that a change in competitive pressure due to foreign presence should primarily come from new foreign entrants, and not from long established foreign-owned firms. Among the new foreign entrants, greenfield entry increases production capacity and therefore also competition, while acquisitions do not necessarily have an immediate impact on market structure. In turn, if knowledge externalities take time to materialise, spillovers are more likely to originate from foreign firms that have been in the market for a while. Thus, the estimated effects of overall foreign presence on domestic productivity could conceal very different effects from new foreign entrants and existing foreign firms.

To investigate this, we split the measure of foreign presence commonly used in the literature into three terms representing greenfield entry, acquisition entry and existing foreign-owned firms in a sector. Using 24 years of comprehensive panel data for Norwegian Manufacturing, we find that greenfield entry has a negative impact on the productivity growth of domestic plants. The effect seems to be caused by domestic plants not adjusting their use of inputs (in particular labour) when reducing their output due to market share losses. Thus, greenfield entry can be associated with a negative competition effect. In contrast, we find a positive and significant effect of foreign acquisitions in low-concentration sectors. This suggests that existing linkages between the acquired plant and other domestic plants may facilitate knowledge spillovers.

Is mobility of labour a channel for spillovers from multinationals to local domestic firms?

In this chapter I use matched employer-employee data to investigate the frequent claim in the spillover-literature that labour mobility is a channel for knowledge spillovers from MNEs to non-MNEs. As a first exercise to assess the potential for spillovers, I estimate individual wage equations for manufacturing workers, where I control for plant and individual characteristics and include dummies for foreign and domestic MNEs. I find that foreign MNEs in Norwegian manufacturing pay a wage premium of 2.5 percent relative to non-MNEs, while Norwegian MNEs seem to give a wage premium only to workers with high education. Second, I document the extent of labour mobility from MNEs to non-MNEs in Norwegian manufacturing during the 1990s. I find that each year on average only around 1 percent of workers in MNEs leave to join a non-MNE. However, this translates into a growing percentage of workers in non-MNEs with previous experience from MNEs. In the year 2000, 45 percent of non-MNEs employed one or more workers with recent MNE experience.

Third, I find that domestic plants that hire workers with previous experience from MNEs benefit in terms of increased productivity. Workers with MNE experience contribute 20-25 percent more to total factor productivity than workers without experience from MNEs. This result is consistent with the idea that labour mobility from MNEs to non-MNEs is a channel for spillovers. Finally, I find that movers from MNEs to non-MNEs with more than 3 years of experience from MNEs receive a wage premium of almost 5 percent compared to their new colleagues, thus experience from MNEs is clearly valued by non-MNEs. For movers in the other direction; from non-MNEs to MNEs, there is no such wage premium. The difference between the private returns to mobility for movers from MNEs to non-MNEs and the productivity effect at the plant level, suggests that the hiring non-MNEs do not fully pay for the value of these workers. Thus, labour mobility from MNEs to non-MNEs seems to be a source of knowledge externality in Norwegian manufacturing.

The contribution of foreign entrants to employment and productivity growth

With Stefanie A. Haller, Economic and Social Research Institute, Dublin.

While it is recognized that the presence of foreign firms in a host country may affect the performance of domestic firms indirectly through knowledge spillovers, the direct effect foreign entry has by changing the composition of firms in the host country is less studied. As foreign firms tend to be larger and more productive than domestic firms, a rise in the share of foreign firms in a host country may increase aggregate productivity even without any spillovers taking place. Foreign firms usually source labour locally, and this may increase demand for labour in the case of greenfield entry. Foreign acquisitions, however, are often associated with fears of job losses as the new foreign owners are expected to restructure the acquired plant to increase efficiency. Moreover, job security may decrease as it may be easier for multinationals than for purely domestic firms to shift production between locations in different countries.

We compare employment and productivity dynamics in foreign and domestic entrants, exitors, survivors and acquisitions in Norwegian manufacturing from 1979 to 2000. We calculate job creation and job destruction rates, and examine productivity levels and contributions to productivity growth for the different groups of plants. We find that all types of foreign plants are on average more productive than their domestic counterparts, while there is more job reallocation in domestic than in foreign plants. Foreign owners do not seem to target highly productive plants for acquisition. Rather, they tend to reverse a negative trend in productivity and employment in the acquired plant. During the boom from 1992 to 1997 foreign acquisitions were major contributors to employment generation and productivity growth, and foreign plants taken together, with a market share of 38%, accounted for 61% of productivity growth.

Chapter 1

Multinationals' mode of entry with presence of upstream spillovers

Abstract

Multinationals' mode of foreign expansion may depend on whether or not they expect technological externalities or spillovers to generate new competition. I consider a monopoly firm with a vertical production structure and three possible modes of entry, one of which includes outsourcing of intermediate input production to a host country firm. Technological spillovers generate threat of entry of a new intermediate input producer. The ability of the downstream multinational to benefit from such upstream spillovers, depends on the nature of the outsourcing relationship. When outsourcing contracts are incomplete and the two firms bargain over how to share the potential surplus, upstream spillovers do not benefit the multinational downstream. If the multinational instead allows the supplier to set the price of intermediates (successive monopoly) the multinational clearly benefits from upstream spillovers.

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1.1 Introduction

Multinationals' mode of entry into a new market may depend on whether or not they expect technological externalities or spillovers to generate new competition. Existing models where the mode of entry is affected by spillovers, consider spillovers in the same market as the multinational sells its final product (horizontal spillovers). Typically, when the multinational expects that spillovers may generate new competition after establishing a subsidiary, it may choose to enter the new market through exports rather than through foreign direct investment (FDI).[1] By contrast, this chapter focuses on the impact spillovers of intermediate input technology (called upstream spillovers) have on a downstream multinational's mode of foreign expansion.

There is a large empirical literature looking for horizontal (or intra-industry) spillovers from FDI in the form of productivity effects in local firms, see Görg and Greenaway (2004) for a survey. Results are ambiguous, and Smarzynska-Javorcik (2004) argues that since multinationals have incentives to limit spillovers of their final good technology, while they may benefit from more productive local suppliers, knowledge spillovers to suppliers may be more likely than horizontal spillovers (see also Moran, 2001; Blalock and Gertler, 2005; Kugler, 2006). Despite the documented increase in vertical fragmentation of production (Hummels et al., 2001), theoretical work on vertical technology transfer and spillovers in the upstream market hardly exists. One exception is Pack and Saggi (2001), who discuss vertical technology transfer through outsourcing. They focus on how spillovers that generate threat of both upstream and downstream entry affect profits. Building on their model, Goh (2005) endogenizes the vertical technology transfer decision and studies how spillovers affect the incentives to transfer knowledge to a supplier.

Rather than taking the outsourcing decision as given, I focus on how upstream spillovers affect a multinational's preferred mode of entry, where outsourcing is one of three possibilities. The setting of the model is one where a multinational (MNE) controls the technology for producing both the final good and a specialized intermediate input used in the assembly of the final good. The MNE is going to establish a subsidiary (an assembly plant) in a new market where it has monopoly power for the downstream product. The three organizational choices differ with respect to how the MNE gets intermediate inputs to its new assembly plant.

[1] The export versus FDI trade-off with horizontal spillovers is modelled in Fosfuri et al. (2001), Glass and Saggi (2002), Markusen (2001), Petit and Sanna-Randaccio (2000) and Siotis (1999). See Markusen (1995) for a discussion of the licensing versus FDI trade-off.

One alternative is to import the intermediate input to the new assembly plant from the home plant of the MNE. Alternatively, the MNE can save on input trade costs by getting the intermediate input locally; either by vertically integrated production within the new subsidiary, or by outsourcing to a local supplier. In this 'make or buy' decision, we follow Grossmann and Helpman (2002) in assuming that a firm specialized in manufacturing intermediates has lower unit costs than a vertically integrated firm due to the benefits of specialization. Outsourcing, on the other hand, suffers from inefficiencies generated by the interaction between the supplier and the buyer. We consider two types of outsourcing contracts, incomplete outsourcing contracts as used in Grossman and Helpman (2002), Ottaviano and Turrini (2003), and Antràs and Helpman (2004), and a contract where the MNE gives the supplier the right to set the price of the intermediate input in a successive monopoly as in Pack and Saggi (2001).[2]

Though the two types of outsourcing contracts give the MNE different profit levels, the main point of this chapter is to show how the possibility of upstream spillovers affects the strategic interaction between the downstream and upstream firm in very different ways depending on the outsourcing contract. In turn, this affects the trade-offs between the various organizational choices of the MNE. Upstream spillovers imply that the knowledge of how to produce the specialized intermediate input may spread to another local firm, which gives the MNE potential access to a new supplier. With incomplete outsourcing contracts, threat of upstream entry has the effect of improving the outside option of the MNE in the negotiations with the incumbent supplier. It turns out that in most cases the MNE is unable to use the threat of upstream entry to its own benefit. With successive monopoly, the incumbent supplier reacts to the threat of entry by reducing its price in order to keep the potential entrant out of the market, and this clearly benefits the MNE.

The main trade-offs in the model are described in Section 1.2, while profits from the different entry modes without spillovers are calculated in Section 1.3 and the resulting mode of entry choice follows in Section 1.4. Section 1.5 contains the mode of entry discussion with spillovers in the upstream market and Section 1.6 briefly concludes.

[2] Lin and Saggi (2006) also construct a model where the focus is on different types of contractual relationships between a multinational and its local suppliers. They take the outsourcing decision as given, and analyze the choice between anonymous market interaction between the downstream multinational and its local suppliers, or contracts that do or do not constrain the supplier to only sell inputs to the multinational (exclusivity or non-exclusivity contracts). In their setting there are no spillovers.

1.2 Trade-offs between different modes of entry

Our firm enters the new market by establishing an assembly plant for its downstream, monopoly product. The inverse market demand function is

$$p = \sqrt{A/y}, \tag{1.1}$$

where A is a measure of market size and y is the amount of final goods sold in the market. Production of the final good requires one unit of intermediate input per unit of final output, otherwise the assembly process is costless. Since all organizational choices considered here involve the establishment of the same assembly plant, we can ignore the fixed costs of assembly. The intermediate input needed is specific for the final good and the firm controls the technology for both stages of production. The MNE has three different ways of getting intermediate inputs to its new plant: 1) import the intermediate inputs from the home plant, 2) vertically integrated production of the intermediate, and 3) outsourcing of the intermediate input to a local supplier.[3]

Imports are subject to iceberg trade costs: when importing x units of the intermediate input at a unit price normalized to 1, only $\tau_I\ x$ units arrive to be used in the assembly of the downstream product, $\tau_I \in (0,1)$. When τ_I is close to one, trade costs are very low, while as τ_I approaches zero, trade costs become prohibitive (subscript I denotes the importing mode of entry).[4]

The two other ways of getting intermediate inputs are either by vertically integrated production in the new plant (V) or by outsourcing of intermediate input production to a local firm (O). Both require technology transfer from the home base of the MNE. Technology transfer should be thought of mainly as transfer of the knowledge needed to produce the specific intermediate, and as training costs to reduce the unit cost of production. Technology transfer costs are assumed to be convex, thus to transfer the amount of technology

[3] I consider only the mode of entry choice for the upstream production stage and assume that the MNE locates the downstream stage in the new market. In previous versions I also included a fourth mode of entry; exports of the final good from the home plant. Introducing this additional mode of entry has no effect on how the possibility of upstream spillovers affect the mode of entry choice. Thus, in order to simplify the model, the possibility of exporting the final good is ignored.

[4] An alternative interpretation of this organizational choice is that instead of importing the intermediate from its home plant, the MNE purchases a generic input from the spot market (Spencer 2005). Since the generic input is not customized for the downstream product of the MNE, the production process for the final good is less efficient when using a generic input than when using a specialized input. When using x units of the generic input the MNE can only produce $\tau_I\ x$ units of the final good.

T, transfer costs are T^2, and this results in unit costs of intermediate input production of $1/T$.

As in Grossman and Helpman (2002), intermediate input production for a given level of technology transfer is less costly for the specialized supplier than for the vertically integrated firm. This could be due to benefits of specialization for the outsourcing partner, or extra monitoring costs in the vertically integrated firm. To capture this cost difference, for a given level of technology transfer T, the outsourcing partner has unit cost $1/T$ while the subsidiary of the MNE has unit cost $1/(T\tau_V)$, where $\tau_V \in (0,1)$ represents the cost disadvantage of vertical integration ($\tau_V = 1$ implies no cost disadvantage). An alternative argument for a cost disadvantage of internal production of the intermediate input can be based on a wage premium being paid by the MNE, as in Fosfuri et al. (2001) and Glass and Saggi (2002). The model here simplifies the production process for the final good since the focus of the paper is the upstream market, but this does not preclude the possibility that the assembly process can be both costly and complex. Imagine that the main advantage of the multinational (and thus the main reason for its multinationality) stems from a technological advantage in the assembly process; for instance through a superior ability to manage a complex process of turning intermediates into the final product. In the case of internal intermediate input production, the workers producing the intermediate in question may also acquire some of the knowledge that gives the MNE its advantage in the downstream market. Thus, in order to avoid labour mobility that might give rise to diffusion of what the MNE considers as its essential technological advantage, it pays higher wages to its workers; also to those producing the intermediate input focused on here.[5]

The extra cost of vertically integrated production of intermediates must be compared to the efficiency problems generated by the two types of outsourcing contracts considered here; incomplete contracts and successive monopoly. The basic justification for incomplete contracts is that the quality of intermediate inputs, though observable by the parties to the contract, cannot be verified by a third party. Nonverifiable quality implies non-contractible quality, which again implies that an ex-ante contract specifying a price and a quantity of the input is impossible. The MNE will not sign such a contract, since it gives the supplier incentives to cut costs by reducing quality. Thus, the quality must be approved by the downstream firm before any exchange can take place. One possible response to the incomplete contracting environment is that the MNE and the supplier resort to bargaining

[5] A second alternative argument for an inefficiency of internal production of intermediates is to assume incomplete contracts also within the firm as in Baker et al. (2002) and Antràs and Helpman (2004).

over how to share the sales revenue from the final good after the intermediates are produced (Grossman and Helpman, 2002; Ottaviano and Turrini, 2003). Since the MNE will not accept low quality intermediates at this stage, the supplier will produce the right quality. With no alternative buyer of the intermediates, the supplier faces a potential hold-up from the final good producer. The result is that the supplier has insufficient incentives to produce the optimal quantity of intermediates. As the MNE expects suboptimal production of intermediates, its incentives for technology transfer are also reduced, resulting in a double hold-up problem. But, whereas the supplier has no alternative buyer and thus has no outside option in the negotiations, the MNE can import intermediate inputs to its subsidiary from the home plant.

The second type of contract considered here is the successive monopoly setting used in Pack and Saggi (2001). In this case the MNE renounces on its bargaining power and lets the supplier act as a monopolist when setting the price of the intermediates. Since the demand for intermediates is derived from the demand in the downstream market where the MNE is a monopolist, the successive monopoly setting gives rise to the well-known double marginalization problem. Thus, both types of outsourcing contracts suffer from inefficiency problems. The organizational choice of the MNE must balance the results of imperfect contracting against the costs of less specialized internal production, and the trade costs of importing the intermediate inputs.

1.3 Profits under different modes of entry

1.3.1 Imports of intermediate inputs

The MNE decides the amount of inputs to ship to its new plant. Due to transport costs, when importing x units of input at a unit price normalized to 1, only $\tau_I x$ units of the input arrive at the assembly plant and can be transformed into the final good. The profit maximization problem is

$$\max_x \ \Pi_I = p\tau_I x - x, \tag{1.2}$$

where p is given by equation (1.1). The result is that the MNE imports $x = \frac{1}{4}A\tau_I$ units of the intermediate, and gets a total profit of

$$\Pi_I = \frac{1}{4}A\tau_I. \tag{1.3}$$

1.3.2 Vertical integration

After establishing the assembly plant, the MNE must decide on the level of technology transfer for intermediate input production. Given the level of technology, the MNE makes its production decision. The maximization problem is solved by backwards induction. First, for a given technology level T_V, maximize profits with respect to quantity produced:

$$\underset{y}{Max}\ \Pi_V = py - \frac{1}{\tau_V T_V} y - T_V^2. \tag{1.4}$$

The resulting quantity is $y = \frac{1}{4} A T_H^2 \tau_H^2$, and depends on the technology level and the cost disadvantage of internal production.

Second, find the optimal level of technology transfer by solving

$$\underset{T_V}{Max}\ \Pi_V = py - \frac{1}{\tau_V T_V} y - T_V^2, \tag{1.5}$$

taking y as given. The resulting level of technology transfer is $T_V = \frac{1}{8} A \tau_V$, thus technology transfer under vertical integration increases when internal production becomes more efficient (τ_V increases). Total profit is

$$\Pi_V = \frac{1}{64} A^2 \tau_V^2. \tag{1.6}$$

1.3.3 Outsourcing

After establishing the assembly plant, the MNE transfers technology to a local supplier, and conducts only the assembly of the final good in its subsidiary. The profit from outsourcing depends on the assumptions we make about the outsourcing relationship.

Incomplete contracts

If the outsourcing contract is incomplete, the two firms bargain over how to share the surplus from exchange of the intermediate inputs after technology transfer and intermediate input production have taken place. The surplus they can share is the revenue generated from sale of the final good. Given the market demand in (1.1), surplus is

$$S = \sqrt{Ay}. \tag{1.7}$$

At the time of bargaining the supplier has no alternative buyer if the two firms cannot agree, thus its fall-back in the negotiation is zero. The MNE can import intermediates from its home plant, so its fall-back corresponds to the profit from importing inputs in equation (1.3); $\frac{1}{4}A\tau_I$. The Nash bargaining solution to the negotiation is (with equal bargaining weights)

$$S^S = \frac{1}{2}(S - \frac{1}{4}A\tau_I) \tag{1.8}$$

$$S^{MNE} = \frac{1}{2}(S + \frac{1}{4}A\tau_I), \tag{1.9}$$

where S^S is the supplier's share of the surplus.

Anticipating the bargaining outcome, the supplier decides the quantity of inputs to produce given the technology transfer it has received from the MNE:

$$\underset{x}{Max}\ \Pi^S = \frac{1}{2}(\sqrt{Ax} - \frac{1}{4}A\tau_I) - \frac{1}{T_O}x. \tag{1.10}$$

The resulting intermediate input production is

$$x = \frac{1}{16}AT_O^2. \tag{1.11}$$

Moving backwards to the first stage in the sequence of decisions, the decision problem of the MNE is how much technology to transfer to its outsourcing partner, given what it expects the supplier to produce (1.11), and how they will share the resulting surplus (1.9):

$$\underset{T_O}{Max}\ \Pi_O^{MNE} = \frac{1}{2}(\sqrt{Ax} + \frac{1}{4}A\tau_I) - T_O^2. \tag{1.12}$$

The profit maximizing level of technology transfer is

$$T_O = \frac{1}{16}A, \tag{1.13}$$

and the resulting profit levels are

$$\Pi_O^{MNE} = \frac{1}{256}A^2 + \frac{1}{8}A\tau_I \tag{1.14}$$

$$\Pi^S = \frac{1}{256}A^2 - \frac{1}{8}A\tau_I. \tag{1.15}$$

Successive monopoly

Following Pack and Saggi (2001), suppose that the MNE gives the supplier the right to sell the intermediate inputs as a monopolist. The supplier sets the price of intermediates, given the expected demand from the MNE. Using backwards induction we first find the MNE's demand for inputs when it takes the input price (p_I) as given. The MNE's maximization problem results in the following input demand

$$x = \frac{1}{4}\frac{A}{p_I^2}. \tag{1.16}$$

Given the demand in (1.16) the supplier sets the price $p_I = \frac{2}{T}$. Moving forwards to the technology transfer decision of the MNE, the optimal level of transfer is $T = \frac{1}{16}A$ which is the same as under outsourcing, while the profit levels are

$$\Pi^{MNE} = \frac{1}{256}A^2 \tag{1.17}$$

$$\Pi^{S} = \frac{1}{256}A^2. \tag{1.18}$$

Comparing equations (1.17) and (1.14) we see that the MNE has lower profit with successive monopoly than with incomplete contracts, while the supplier is better off when it can set the intermediate input price as a monopolist (compare equations 1.18 and 1.15). While the incomplete outsourcing contract generates a double hold-up problem, outsourcing under successive monopoly suffers from the so-called double mark-up problem. Since the total profits with the two outsourcing contracts are equal, the double hold-up and the double mark-up generate the same degree of inefficiency with our choice of demand and cost functions.

1.4 Mode of entry choice without spillovers

The MNE makes its organizational choice by comparing profit levels from different modes of entry. This choice is affected by the value of the following parameters: market size (A), input trade costs (τ_I), and the cost disadvantage of internal production (τ_V). In the following, we will see how mode of entry varies with market size and costs of trading intermediate inputs, for a given value of the internal cost disadvantage, τ_V. This is done by calculating iso-profit curves and combining them in figures with market size (A) on the vertical axis and input trade costs (τ_I) on the horizontal axis.

1.4.1 Mode of entry with incomplete outsourcing contracts

The iso-profit curves are found by pairwise comparing profit levels from each mode of entry in equations (1.3), (1.6), and (1.14). Comparing (1.14) and (1.3), we find that outsourcing is preferred to importing inputs when

$$A > 32\tau_I. \tag{1.19}$$

From (1.14) and (1.6), we find that vertical integration is preferred to outsourcing when

$$A > 8\frac{\tau_I}{\tau_V^2 - \frac{1}{4}}, \tag{1.20}$$

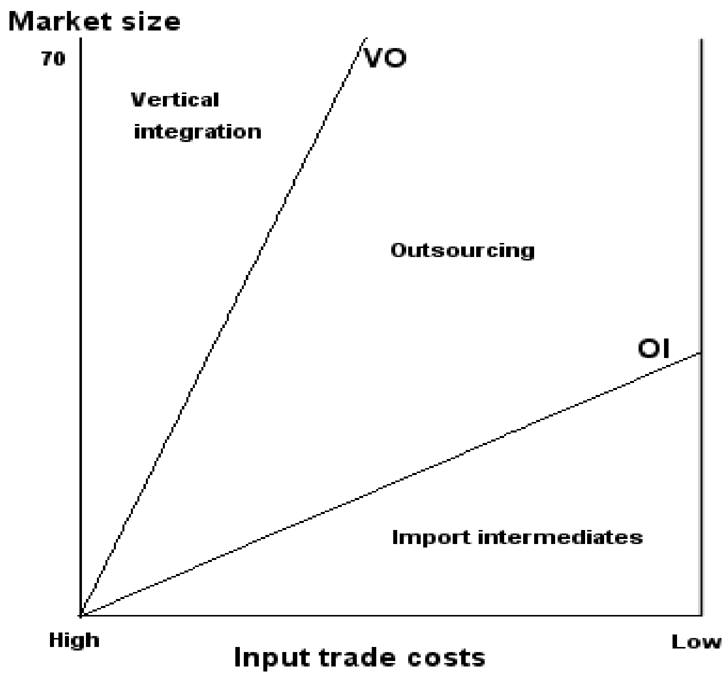
as long as the internal cost disadvantage is not too large ($\tau_V > \frac{1}{2}$). If $\tau_V < \frac{1}{2}$ outsourcing dominates vertical integration for all market sizes and input trade costs. For a given value of the internal cost disadvantage, both equations (1.19) and (1.20) are straight lines from the origin. Combining the two equations we see that both outsourcing and vertical integration are possible choices for the MNE only if the iso-profit curve in (1.20) has a steeper slope than the iso-profit curve in (1.19):

$$8\frac{\tau_I}{\tau_V^2 - \frac{1}{4}} > 32\tau_I. \tag{1.21}$$

The resulting constraint on τ_V is $\tau_V \in (\frac{1}{2}, \frac{1}{2}\sqrt{2})$. If $\tau_V < \frac{1}{2}$ outsourcing dominates vertical integration for all market sizes and input trade costs, because the internal cost disadvantage is too large to make vertical integration attractive for the MNE. If $\tau_V > \frac{1}{2}\sqrt{2}$ vertical integration dominates outsourcing because the efficiency loss generated by the internal cost disadvantage is smaller than the efficiency loss generated by the hold-up problem under incomplete contracts.

It is also important to check whether the supplier would want to produce for the MNE under the conditions of the incomplete outsourcing contract. We assume that the supplier declines an outsourcing contract if it expects negative profits. From equation (1.15) we find that the supplier accepts whenever the MNE prefers outsourcing to vertical FDI; i.e. when equation (1.19) holds.

Figure 1.1: Mode of entry with incomplete outsourcing contracts



The third iso-profit curve is derived from equations (1.3) and (1.6), and we find that vertical integration is preferred to imports of intermediates when

$$A > 16\frac{\tau_I}{\tau_V^2}. \tag{1.22}$$

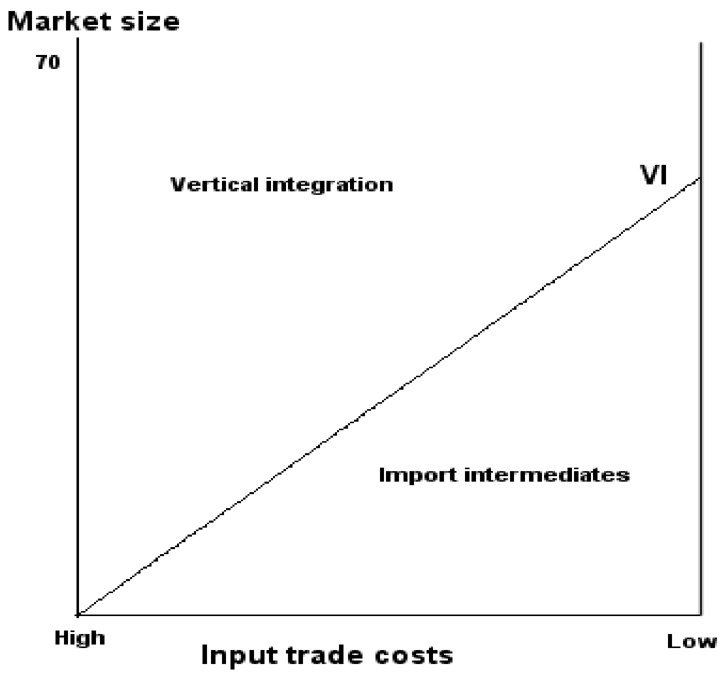
The initial choice of τ_V is made such that all three modes of entry are chosen in different areas of the $(A - \tau_I)$ -plane when outsourcing contracts are incomplete ($\tau_V = 0.55$). The relevant iso-profit curves are drawn in the $(A - \tau_I)$-plane. In Figure 1.1, and all following figures, the iso-profit curves are named with two letters corresponding to the two modes of entry being compared. As an example, the VO-curve shows the combinations of market size and input trade costs that equate profit from outsourcing to profit from vertical integration. The first letter corresponds to the mode of entry that is preferred above the curve.

The MNE's mode of entry choice when outsourcing contracts are incomplete is shown in Figure 1.1. From the figure we see that the MNE prefers to import intermediates when the market is too small to sustain the costs of technology transfer and trade costs are low. As market size increases the expected sales will be large enough to sustain also the costs of technology transfer, and outsourcing will be the preferred mode of entry. The reason for outsourcing to be preferred to vertical integration in the area of the figure where input trade costs are low is simply that low input trade costs give the MNE a better fall-back in the outsourcing negotiations with the supplier, and thus a large share of the surplus from the outsourcing relationship. When input trade costs are high (close to the vertical axis of the figure) the MNE's fall-back in the negotiations with the supplier is so low that it prefers vertical integration to outsourcing. The iso-profit curve in (1.22) is not drawn in the figure since it is dominated by the other two iso-profit curves.

1.4.2 Mode of entry with successive monopoly

The iso-profit curves for outsourcing under successive monopoly versus the other modes of entry are now found by comparing equation (1.17) with equations (1.3) and (1.6). From (1.6) and (1.17) we find that the MNE has higher profit from vertical integration than from outsourcing as long as $\tau_V > \frac{1}{2}$. So with our choice of parameter values ($\tau_V = 0.55$), the MNE will never choose outsourcing if the supplier can set the price of intermediate inputs. This means that the only relevant iso-profit curve is the curve comparing profits from vertical integration and imports of intermediates (1.22). This is shown in Figure 1.2.

Figure 1.2: Mode of entry with successive monopoly



1.5 Mode of entry choice with upstream spillovers

Consider what happens if spillovers from local production of the intermediate input in the new market generate threat of entry by a new intermediate input producer. This could happen under both vertical integration and outsourcing. First, consider the case where the MNE initially had chosen vertical integration and produces the intermediate inputs in-house. During the manufacturing of the inputs, knowledge of how to make the specialized input spreads to a potential new supplier. But at this point the costs of producing the intermediates are already sunk, and thus the MNE is not able to benefit from the upstream spillovers. Therefore we only need to consider the effect of spillovers in the upstream market under outsourcing.

1.5.1 Outsourcing with incomplete contracts

If the knowledge of how to produce the intermediates needed by the MNE spreads to another local firm, the MNE can turn to the new supplier if the negotiation with the incumbent breaks down. A potential new supplier improves the MNE's fall-back in its negotiation with the incumbent supplier. The new supplier has a unit cost of $1/\gamma T_O$ where $\gamma \in (0,1)$ is the spillover parameter and T_O is the level of training and technology transfer that the incumbent supplier has received. With perfect spillovers ($\gamma = 1$) the potential entrant has the same unit cost as the incumbent supplier.

To find the new fall-back in the negotiation with the incumbent, we must consider what would happen if the MNE were to break with the incumbent and rather bargain with the entrant. The entrant would have zero fall-back (no alternative buyer of inputs) while the MNE's fall-back would still be to import the inputs. Since the negotiation with the entrant has the same structure as the negotiation with the incumbent when no spillovers occur (Section 1.3.3), the new supplier faces the same trade-off as the incumbent supplier did. Thus the entrant will produce $x^E = \frac{1}{16} A T_o^2 \gamma^2$ units of the input, and the sales revenue or surplus that could be generated from interaction with the potential entrant is $S^E = \frac{1}{4}\gamma A T_O$. The resulting share for the MNE will be given by (1.9) with S^E replacing S. This potential share from bargaining with the entrant now defines the fall-back for the MNE when bargaining with the incumbent supplier:

$$F^{MNE} = \frac{1}{8}\gamma A T_o + \frac{1}{8} A \tau_I. \tag{1.23}$$

The incumbent supplier faces the same tradeoff as without threat of entry of a new supplier, and will produce the same as without spillovers, given in equation (1.11), for a given level of technology transfer from the MNE.

Since the technology transfer decision affects the unit cost of both the incumbent and the new supplier, the MNE faces a new tradeoff when making its technology transfer decision. The MNE decides on how much technology to transfer given its knowledge about what the outsourcing supplier will produce and how technology transfer affects its fall-back through spillovers. The profit maximization problem of the MNE is

$$\underset{T_O}{Max}\ \Pi_O^{MNE} = \frac{1}{2}(S + F^{MNE}) - T_O^2, \tag{1.24}$$

with first order condition

$$\frac{1}{2}(\frac{\partial S}{\partial T_O} + \frac{\partial F^{MNE}}{\partial T_O}) = 2T_O. \tag{1.25}$$

Use equations (1.7), (1.23) in the first order condition to solve for the optimal level of technology transfer:

$$T_O = \frac{1}{32}A(2+\gamma). \tag{1.26}$$

Comparing equations (1.13) and (1.26) we see that technology transfer is higher with spillovers than without. The reason is that transferring better technology to the outsourcing partner also lowers the unit cost in the firm that benefits from spillovers. A lower unit cost for the potential entrant improves the MNE's fall-back in its negotiation with the incumbent, and gives the MNE a larger share of the surplus. The profit levels with spillovers are

$$\Pi_O^{MNE} = \left(\frac{1}{32}A(2+\gamma)\right)^2 + \frac{1}{16}A\tau_I \tag{1.27}$$

$$\Pi^S = \frac{1}{16}\left(\frac{1}{32}A^2(2+\gamma)(1-\gamma) - A\tau_I\right) \tag{1.28}$$

Equations (1.27) and (1.28) only apply if the threat of entry of a new supplier is credible. If not, the MNE is unable to use the threat of going to a new supplier in its negotiations with the incumbent, and we are back to the situation without spillovers where the relevant profit levels are given in equations (1.14) and (1.15).

The first condition for credible entry is of course that the entrant expects positive profits if it contracts with the MNE. The entrant's profit is $\Pi^E = \frac{1}{8}\gamma AT_O - \frac{1}{8}A\tau_I - \frac{1}{\gamma T_O}x^E$, where the level of technology transfer is given in equation (1.26) and $x^E = \frac{1}{16}AT_O^2\gamma^2$. The resulting participation constraint for the entrant is

$$A \geq \frac{32}{\gamma} \frac{\tau_I}{\frac{1}{2}\gamma + 1}. \tag{1.29}$$

The second condition is that the MNE would actually prefer an outsourcing contract with the entrant to the other modes of entry if it breaks with the incumbent. The profit the MNE would get if it bargained with the entrant is

$$\Pi_{OE}^{MNE} = \frac{1}{8}\gamma A T_O + \frac{1}{8} A \tau_I - (T_O)^2 \,. \tag{1.30}$$

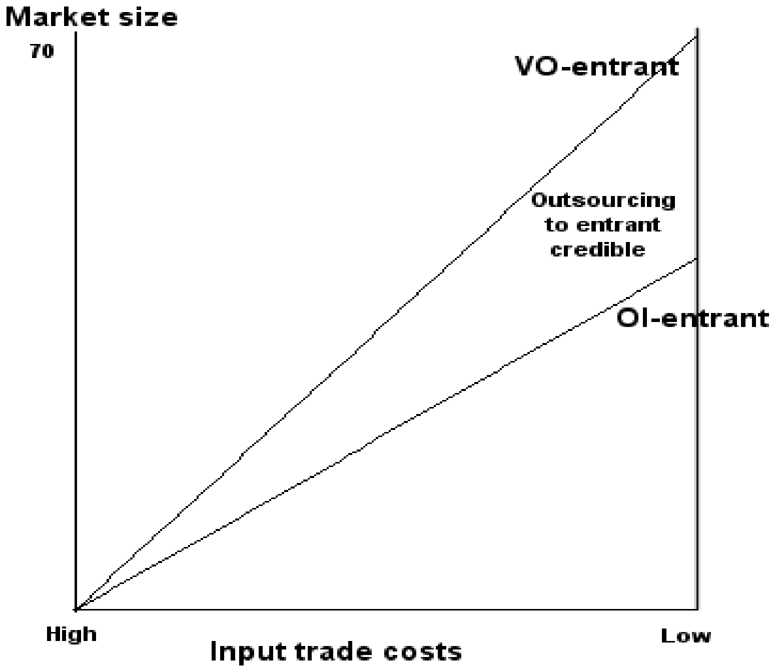
The MNE's threat of going to the new supplier is only credible if the iso-profit curves for outsourcing with the entrant (1.30) versus imports of intermediates (1.3), and vertical integration (1.6), give rise to an area in $A - \tau_I$ -space where outsourcing with the entrant would be chosen. If spillovers are perfect ($\gamma = 1$), these isoprofit curves give the outsourcing area illustrated in Figure 1.3. The entrant's participation constraint in (1.29) is not binding in this area and is therefore not drawn in the figure. It is only within the outsourcing area in Figure 1.3 that the profit levels in equations (1.27) and (1.28) are relevant. Outside this area, both the MNE and the incumbent supplier know that the MNE is unable to use the threat of entry in the negotiations with the incumbent. The result is that the decisions of, and the result for, the MNE would be the same as if no spillovers are expected.

The two iso-profit curves that are drawn in Figure 1.3 correspond to the two iso-profit curves that delimit the outsourcing area in Figure 1.1. The difference is that in Figure 1.3 the MNE's outsourcing profits come from bargaining with the entrant, while in Figure 1.1 the MNE bargains with the incumbent that received technology transfer. Since Figure 1.3 is drawn for perfect spillovers, it seems surprising that the outsourcing area is smaller than in the corresponding Figure 1.1 without spillovers.[6] The reason is simply that the expectations of spillovers and consequent potential entry have induced the MNE to transfer more technology in order to improve its bargaining position against the incumbent supplier. These extra transfer costs are larger than the extra surplus that could be shared due to the entrant's incentives to produce more with better technology.

The outsourcing area in Figure 1.3 is reduced as spillovers decrease (the slope of the VO–entrant curve decreases while the slope of the OI-entrant curve increases), and when

[6]Note that the other iso-profit curves are left out of Figure 1.3 in order to focus on the area where the threat of entry is credible. All iso-profit curves relevant for this case are repeated in Figure 1.4.

Figure 1.3: When is threat of entry credible?



$\gamma \approx 0.94$, the MNE's threat of bargaining with the new supplier is never credible because the MNE would choose vertical integration rather than an outsourcing contract with the entrant.[7]

Even if spillovers are large enough for the threat of entry to be credible, from the profit expression for the incumbent supplier (1.28) we get the participation constraint

$$A \geq 32 \frac{\tau_I}{(2+\gamma)(1-\gamma)}. \tag{1.31}$$

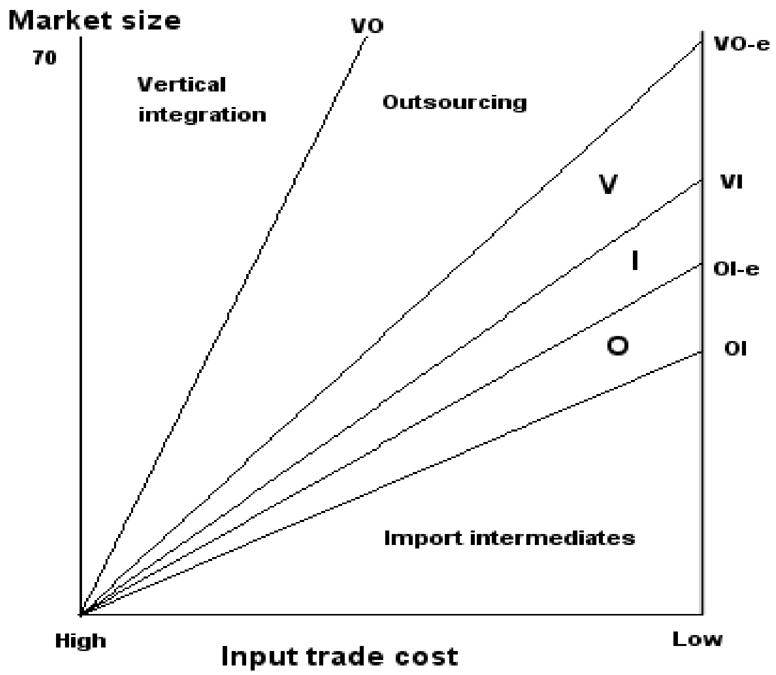
If the supplier expects perfect spillovers, we clearly see that the incomplete outsourcing contract will be rejected. In general, it will be the case that the incumbent supplier will not accept an outsourcing contract if it expects spillovers to be large enough to make the threat of entry of a new supplier credible. Thus the conclusion is that when the threat

[7] In equation (1.29) it is assumed that there are no entry costs for the firm that benefits from spillovers. With such entry costs, the entrant's participation constraint will be tighter and the area where the threat of entry is credible will be smaller or completely disappear, even with perfect spillovers.

of entry is credible, the MNE is unable to find a supplier that will accept an incomplete outsourcing contract. The result is that the MNE is worse off compared to a situation without spillovers because it cannot find an outsourcing partner that is willing to accept the contract unless the MNE can commit itself not to exploit the increased competition generated by spillovers.

Figure 1.4 shows the mode of entry picture if spillovers are perfect. The figure is a combination of Figure 1.1 and Figure 1.3. Within the area in Figure 1.3 where the threat of bargaining with the new supplier is credible, the incumbent supplier rejects the incomplete outsourcing contract and the MNE's mode of entry is either imports of intermediates (I) or vertical integration (V).

Figure 1.4: Mode of entry with incomplete contracts and spillovers



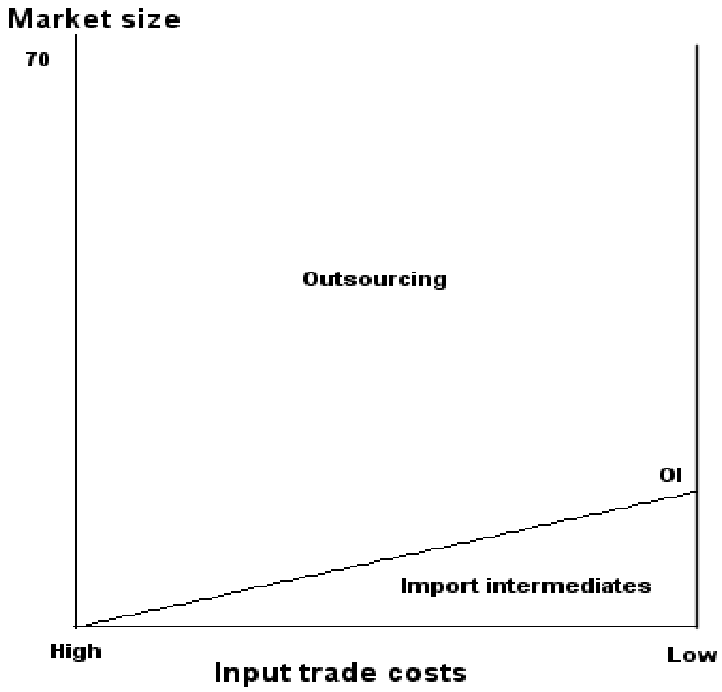
1.5.2 Outsourcing with successive monopoly

If the MNE gives the local supplier the power to set the price of the intermediate inputs, the effects of upstream spillovers and threat of upstream entry are very different from the case with incomplete outsourcing contracts. As in Pack and Saggi (2001), I assume Bertrand competition, i.e. the incumbent supplier reduces the price it charges for the input in order to keep the potential entrant out of the market. When the potential entrant has unit cost $\frac{1}{\gamma T}$, threat of entry is only credible if the unit cost is lower than the price the incumbent charges without spillovers, ie: $\frac{1}{\gamma T} < \frac{2}{T} \Leftrightarrow \gamma > \frac{1}{2}$. With threat of entry, the incumbent sets its price to $\frac{1}{\gamma T}$. Expecting this lower price, the MNE has incentives for a larger technology transfer $T = \frac{1}{8}\gamma A$, and the resulting profit levels of the MNE and the supplier are

$$\Pi^{MNE} = \frac{1}{64}A^2\gamma^2 \tag{1.32}$$

$$\Pi^S = \frac{1}{32} A^2 \gamma^2 (1-\gamma). \tag{1.33}$$

Figure 1.5: Mode of entry with successive monopoly and spillovers



As long as entry is credible, the MNE is better off and the supplier worse off than without spillovers. It is also the case that the profit of the MNE in (1.32) is larger than outsourcing profits with incomplete contracts (1.14). Comparing profits from outsourcing (1.32) with profits from vertical integration (1.6) we see that outsourcing is preferred as long as $\gamma > \tau_I$. Thus the mode of entry picture for the MNE changes completely with spillovers. Comparing Figure 1.5 with the corresponding Figure 1.2 for the case without spillovers, we see that the MNE prefers outsourcing if it expects spillovers from the supplier to other firms, while if it does not expect such spillovers, it prefers vertical integration.

1.6 Conclusions

When multinationals consider how to enter a foreign market, their decision might be affected by how their technology may spill over to other firms under different modes of entry. The mode of entry trade-off has typically been considered in models of horizontal FDI where competitors (new or existing) of the MNE acquire the knowledge of how to produce the MNE's product. The possibility of such ex-post competition may induce the MNE to export its product, rather than to establish a subsidiary in the foreign market. This chapter departs from the horizontal spillover-assumption and considers how mode of entry is affected by spillovers of intermediate input technology.

In the model presented here the MNE chooses between three different modes of entry. Two of the entry-modes involve production of the intermediate inputs in the local market, either by in-house production (vertical integration) or outsourcing. With local production of intermediate inputs, spillovers may enable a new firm to produce the inputs required by the MNE. Intuitively, this should be beneficial for the MNE. The results presented here show that upstream spillovers may not benefit the MNE in a setting of incomplete outsourcing contracts, while they are clearly beneficial in a successive monopoly setting.

Since both the supplier and the MNE make relation-specific investments (specialized input production and technology transfer, respectively), outsourcing with incomplete contracts suffers from a double hold-up problem. Threat of upstream entry works as an improvement of the bargaining position of the MNE in the outsourcing negotiations with the incumbent supplier. If knowledge of how to produce the input spreads to another firm, the MNE can threaten the incumbent supplier with getting inputs from the potential entrant, and thus get a larger share in the negotiations with the incumbent. Unfortunately for the MNE, this threat is not credible in most cases.

In addition, it turns out that when the threat of going to the entrant would be credible, the MNE is unable to outsource in the first place because a potential outsourcing partner expects negative profits with spillovers. Unless the MNE can commit itself not to exploit an increase in competition upstream, potential outsourcing partners will decline an incomplete outsourcing contract.

Upstream spillovers are much more beneficial for the MNE if the outsourcing relationship is a successive monopoly where the supplier sets the price of the inputs. A threat of entry of a new supplier forces the incumbent supplier to reduce its price in order to keep the competitor out of the market, and this benefits the downstream MNE. The effect on the mode of entry choice is that the MNE increases its outsourcing activities if it expects spillovers, while with incomplete outsourcing contracts, spillovers have no, or possibly a negative, effect on the extent of outsourcing.

In cases where for instance the quality of the intermediate input is observable for the MNE, but not easily verifiable by a third party, an incomplete contracting framework is thought to be relevant (Grossmann and Helpman, 2002). An empirical implication of the model is that in such cases multinationals may, after having transferred technology to an outsourcing partner, choose to let the supplier set the price of inputs, instead of bargaining over how to share the surplus. This choice of contract will be preferred for input technologies where spillovers are expected to occur, while if the MNE expects no or insignificant spillovers, incomplete outsourcing contracts are more likely to prevail.

An interesting topic for further analysis is to investigate how the interaction of upstream and downstream spillovers affects the choice of outsourcing when contracts are incomplete.

Chapter 2

Foreign firms and host-country productivity: Does the mode of entry matter?

- joint with Stefanie A. Haller*

Abstract

Foreign direct investment is often considered an important source of knowledge spillovers. However, results from the empirical literature relating overall foreign presence to host country productivity are ambiguous. We argue that this may be because different modes of entry may have different effects on productivity. Using 24 years of comprehensive panel data for Norwegian Manufacturing, we find that greenfield entry has a negative impact on the productivity growth of domestic plants, while entry via acquisition affects local productivity positively. The net effect is a small positive effect of an overall change in foreign presence on local productivity growth.

Acknowledgements

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2.1 Introduction

A large empirical literature has examined whether foreign presence in an industry gives rise to productivity spillovers to local firms in the same industry. A recent survey by Görg and Greenaway (2004) suggests that the literature on so-called intra-industry spillovers has not come up with a clear-cut answer.[1] A reason put forward is that multinational enterprises (MNEs), in addition to being potential sources of knowledge spillovers, are potential sources of competition. It is argued that in the short run at least, foreign firms are likely to steal market shares from domestic firms and, thereby, force them up their average cost curves. This implies that the measured productivity of domestic firms will be lower and we will observe a negative effect from foreign entry (Aitken and Harrison, 1999). A positive effect of foreign presence on host country firms is usually interpreted as evidence of knowledge diffusion or technology transfer, though competition could also be at work when a positive spillover effect is observed. Entry of new and efficient firms that increase product market competition, may enhance productivity in domestic firms by forcing them to reduce x-inefficiencies or to adopt new technologies faster than they otherwise would. Bartelsman et al. (2004) provide evidence of this Schumpeterian argument for a number of developed and developing countries; they find a positive correlation between turnover rates and productivity growth of incumbents. More directly, Aghion et al. (2005) demonstrate that foreign entry in the UK increases the incentives of firms to innovate in order to survive the increased competition. Of course, such a positive impact of foreign competition on host country firms may take time to materialise, see Sembenelli and Siotis (2005) for evidence from Spain.

Traditionally, the spillover-literature has measured foreign presence as the share of industry employment in foreign-owned firms, which represents the accumulated foreign direct investments (FDI) in the sector. This measure combines new foreign entrants with foreign-owned firms that have been in the market for some time. We argue that a change in competitive pressure due to foreign presence should primarily come from new foreign entrants, and not from foreign-owned firms that have already established their position in a sector. In turn, if knowledge externalities take time to materialise, spillovers are more likely to originate from foreign firms that have been in the market for a while. Our argument

[1] Among more recent studies, Aitken and Harrison (1999) find a negative effect for Venezuela, as does Konings (2001) for Poland, Bulgaria and Romania, and Djankov and Hoeckman (2000) for the Czech republic. On the other hand Haskel et al. (2002) and Keller and Yeaple (2003) find evidence of positive spillovers for the UK and the US, respectively.

implies that the estimated effects of overall foreign presence on domestic productivity could conceal very different effects from new foreign entrants and existing foreign firms. To investigate this, we decompose the usual measure of foreign presence into one term representing the existing foreign-owned firms in a sector and another term representing the new foreign entrants. Once we focus explicitly on the recent foreign entrants, we are also able to take account of the fact that foreign ownership can come about either by greenfield entry or by foreign acquisition of assets in existing domestic firms.

There are several reasons to suggest that the competition effect of foreign entry and the potential for spillovers from foreign entry may differ according to the mode of entry. We address differences in the potential for spillovers first. On the one hand, domestic firms acquired by foreign owners are likely to be more integrated in the host country economy than greenfield entrants; hence, the existing linkages with other local firms may serve as a channel for spillovers. On the other hand, if the most efficient foreign investors are more likely to choose greenfield entry[2], the new knowledge stock that forms the basis for potential spillovers may be larger with greenfield entry than with foreign acquisitions. Regarding possible competition effects, the likely differences between greenfield and acquisition entry derive from the way these two alternatives affect industry market structure.[3] 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.

Our aim in this chapter is to investigate whether the mode of foreign entry matters for the effects FDI has on host country firms. The approach is in the spirit of the spillover literature, where there have not been studies distinguishing between the recent foreign entrants and the existing foreign firms or between different modes of entry. There have, however, been previous efforts to refine the spillover question by splitting FDI into different subgroups. One example is studies examining whether the degree of ownership matters for the extent of spillovers from FDI (e.g. Blomström and Sjöholm (1999), Dimelis and Louri (2002) and Smarzynska Javorcik and Spatareanu (2003)). Another example are efforts to distinguish between technology sourcing and technology exploitation as motives for FDI (Driffield and Love (2002), Driffield et al. (2005)).[4] And finally, Castellani and Zanfei

[2]See Smarzynska-Javorcik and Saggi (2004) for a theoretical argument and empirical evidence.

[3]See e.g. UNCTAD (2000, p.145) for an informal description and Haller (2005) for a more formal exposition.

[4]The argument that the motivation for FDI may matter for spillovers goes back to Fosfuri and Motta

(2005) look into the importance of firm heterogeneity in terms of the markets they serve for generating and absorbing spillovers.

We use a large panel data set of Norwegian manufacturing industries for the period 1978-2001. Our results from estimating an augmented production function suggest that a change in foreign presence measured as the change in the share of overall employment in foreign-owned plants relative to total employment in a sector, has a significant but small positive effect on the productivity growth of domestic firms in low-concentration sectors. When we specifically account for the change in foreign presence due to both greenfield entry and foreign acquisitions, we find opposite effects of the two modes of entry. The impact of greenfield entry on domestic productivity growth is negative and seems to be caused by domestic plants not adjusting their use of inputs (in particular labour) when reducing their output due to market share losses. Thus, greenfield entry can be associated with a negative competition effect. In contrast, we find a positive and significant effect of foreign acquisitions in low-concentration sectors. This suggests that existing linkages between the acquired plant and other domestic plants may facilitate knowledge spillovers. There seems to be no effect of recent foreign entry on the productivity growth of domestic plants in high-concentration sectors. Our results are robust to a number of different specifications.

The remainder of this chapter is structured as follows. In Section 2.2 we discuss our strategy for estimating the impact from greenfield entry and entry by acquisition on the productivity of domestic firms. In Section 2.3 we describe the data sources and give an overview of the development of foreign ownership and foreign entry in Norwegian manufacturing. We present our results in Section 2.4, and examine their robustness in Section 2.5. Section 2.6 briefly concludes.

2.2 Empirical specification

In order to examine the impact of foreign presence and different modes of foreign entry on the productivity of domestic firms, we use an approach commonly adopted in the spillover

(1999), who demonstrate in a theoretical model that MNEs without firm specific advantages may have technology sourcing motives for FDI. If technology sourcing is the motive for FDI, one should not expect spillovers.

literature and start with an augmented production function of the following form

$$\ln Y_{it} = \beta_K \ln K_{it} + \beta_M \ln M_{it} + \beta_H \ln H_{it} + \sum_{k=0}^{T} \beta^k FP_{I,t-k} + \gamma \mathbf{Z}_{it} + \upsilon_i + \upsilon_t + \varepsilon_{it}. \tag{2.1}$$

In equation (2.1) $\ln Y$, $\ln K$, $\ln M$, and $\ln H$ are the natural logs of output, capital, hours and materials in plant i, year t.[5] $FP_{I,t-k}$ captures foreign presence at the 5-digit industry level and $\mathbf{Z}$ includes a set of competition variables. υ_i and υ_t are plant and time specific effects.

We employ a set of variables similar to those first proposed by Nickell (1996) to control for competition. These include industry concentration ($CR5_{It}$), market share (MS_{it}), profit margin (PM_{it}) and a measure of openness ($OPEN_{It}$). As our concentration measure we use the sum of market shares of the five largest plants defined at the 5-digit industry level.[6] 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, see Sutton (1996). High market shares, therefore, need not indicate a lack of competition. However, as argued by Nickell (1996), changes in market structure over time are still going to be reasonably good measures of changes in competition. The profit margin 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. The expected signs on the concentration measure, market share and profit margin are negative: higher profit margins allow scope for lower effort and thus lower productivity, and higher market shares or concentration ratios are associated with lower effort and productivity levels. As higher efficiency would raise both profit margins and market shares, these variables are potentially endogenous, which could result in positive coefficients. We follow Haskel et al. (2002) and Disney et al. (2003) and address this problem by lagging both measures. We use one-period lags and note that endogeneity gives rise to an upward bias in the estimated coefficients. The variable $OPEN_{It}$ is defined as imports over the sum of exports and imports, and the idea is that increased import competition acts as a disciplining force that has a positive effect on productivity.[7]

[5] The definitions of input and output rely to a large extent on previous work with this data, e.g. Griliches and Ringstad (1971), Simpson (1994), Møen (1998) and Klette (1999). For the construction of all variables, see the variable definitions in the Appendix.

[6] We have 132 5-digit sectors in our estimations.

[7] Due to data limitations, $OPEN_{It}$ is defined at the 3-digit industry level. We also experimented with the import penetration ratio (imports divided by domestic consumption) as an alternative measure, and our results are not sensitive to which measure of import competition we use. We feel more comfortable

Bartelsman et al. (2004) find a positive correlation between turnover rates and productivity growth of incumbents, which suggests that industries with a high turnover of firms are characterised by higher productivity. Thus, as an additional control variable we use the sum of entry and exit rates as a measure of gross turnover in the industry ($Turnover_{It}$). We also lag this variable by one period due to possible endogeneity. Turnover is also likely to be a good measure of industry-specific business cycles since entry and exit are closely correlated with the business cycle.

In equation (2.1), FP_{It} is the variable of main interest. In line with the previous spillover literature, in our first specification we take the variable to represent the overall stock of foreign presence measured as the share of industry employment in foreign-owned plants at the 5-digit ISIC level:

$$FP_{It} = \frac{\sum\limits_{i \in FO_{It}} (Empl)_{it}}{(Total\ empl)_{It}}, \tag{2.2}$$

where FO_{It} is the set of all foreign-owned plants in sector I, year t. As the effects from foreign presence may take time to materialise, we include 2 lags of foreign presence in our estimations. We experimented with different lag structures; more than two lags were not significant in any of our regressions.

To eliminate plant and industry specific effects we estimate equation (2.1) in first differences[8], thus our regression equation is

$$\begin{aligned}
\Delta \ln Y_{it} = {} & \alpha_K \Delta \ln K_{it} + \alpha_M \Delta \ln M_{it} + \alpha_H \Delta \ln H_{it} \\
& + \sum_{k=0}^{2} \beta_1^k \Delta FP_{I,t-k} + \gamma_1 \Delta MS_{i,t-1} + \gamma_2 \Delta PM_{i,t-1} \\
& + \gamma_3 \Delta CR5_{I,t} + \gamma_4 \Delta OPEN_{I,t} + \gamma_5 Turnover_{I,t-1} \\
& + \upsilon_t + \xi_{it.}
\end{aligned} \tag{2.3}$$

using $OPEN_{It}$ as we do not need to combine different data sources for its construction.

[8]An alternative method to eliminate unobserved plant specific effects is to use fixed effects estimation (within-transformation). The choice between these estimation strategies hinges on the properties of the idiosyncratic error term in equation (2.1). Fixed effects is efficient if the idiosyncratic error terms are not serially correlated, which implies that the within-transformed error terms should be negatively correlated. The residuals (excluding the plant specific effect) from a fixed effects estimation of (2.1) exhibit positive autocorrelation with an estimated ρ of 0.37. First differencing is efficient if the first-differenced error terms are not serially correlated. In our case, the residuals from the first-differenced equation (2.3) exhibit weak negative serial correlation with an estimated ρ of -0.17. These properties of the residuals support the choice of using first differences as our method of eliminating plant specific effects.

We estimate equation (2.3) on the sample of firms that are Norwegian owned throughout their presence in our panel. In all our regressions, we include year dummies to control for common year specific shocks to all manufacturing plants, and industry dummies (3-digit level) to account for industry specific linear time trends in the levels of the dependent variable.

ΔFP_{It} represents the change in foreign presence in the industry from $t-1$ to t given as

$$\Delta FP_{It} = \frac{\sum\limits_{i \in FO_{It}} (Empl)_{it}}{(Total\ empl)_{It}} - \frac{\sum\limits_{i \in FO_{I,t-1}} (Empl)_{i,t-1}}{(Total\ empl)_{I,t-1}}, \tag{2.4}$$

where FO_{It} is the set of foreign-owned plants in industry I at time t. A change in foreign presence can come about by greenfield entry of foreign plants, foreign acquisitions, employment expansion or contraction in existing foreign-owned firms, and also by withdrawal of foreign-owned firms through divestures or plant closures. To the extent that the effect of recent entrants is different from that of long established foreign-owned firms, empirical studies of spillovers from FDI which use the overall foreign presence measure may generate ambiguous results because the measure is a combination of these different causes of change in foreign presence. In particular, when discussing the possible competition effects of FDI, we argue that one should pay attention to the recent foreign entrants. Sembenelli and Siotis (2005), in their analysis of the effect of FDI on the price cost margins of Spanish firms, interpret the negative short-term effects of foreign presence as a competition effect and longer-term positive effects as spillovers. As their measure of foreign presence captures the stock of FDI in the sector, they are not able to explicitly identify the impact of the recent foreign entrants. The same caveat applies to Aghion et al. (2004): in their study of entry and productivity growth in the UK, they associate foreign entry with the first difference of overall foreign presence.

Thus, in our second specification we proceed to isolate the impact of the recent foreign entrants on the productivity of domestic plants. Although the overall change in foreign presence ΔFP_{It} could be caused by many factors, we focus here on greenfield and acquisition entry, and group the remaining possible changes into one term. The set of foreign-owned firms FO_{It} at time t can be split into the sets of greenfield entrants (GE_{It}), acquisition entrants (AE_{It}), and the set of remaining foreign-owned plants that have been present in the sector for at least one year ($FO1_{It}$), thus $FO_{It} = GE_{It} \cup AE_{It} \cup FO1_{It}$. Using these definitions of the different groups of foreign plants in year t, we can rewrite equation (2.4) in the following way

$$\begin{aligned}\Delta FP_{It} = & \frac{\sum\limits_{i \in GE_{It}} (Empl)_{it}}{(Total\ empl)_{It}} + \frac{\sum\limits_{i \in AE_{It}} (Empl)_{it}}{(Total\ empl)_{It}} \\ & + \left(\frac{\sum\limits_{i \in FO1_{It}} (Empl)_{it}}{(Total\ empl)_{It}} - \frac{\sum\limits_{i \in FO_{I,t-1}} (Empl)_{i,t-1}}{(Total\ empl)_{I,t-1}} \right) \\ & \equiv G_{It} + A_{It} + \Delta F_{It}. \end{aligned} \tag{2.5}$$

The first term G_{It} in equation (2.5) represents the change in foreign presence between $t-1$ and t that is attributable to greenfield entry. It is the employment-weighted greenfield entry rate; i.e. the sum of employment in those plants in industry I that are greenfield entrants in year t expressed as a share of total employment in the industry that year. Similarly, A_{It} represents the change in foreign presence due to foreign acquisitions; i.e. the employment share of plants in industry I that are acquired by foreign owners between $t-1$ and t. G_{It} and A_{It} represent the flow of new FDI into the sector differentiated by the mode of entry. The last term ΔF_{It} equals the two terms in brackets, and represents the remaining change in foreign presence between $t-1$ and t. ΔF_{It} captures employment expansion or contraction of existing foreign-owned firms relative to total industry employment, and also withdrawal of foreign firms through divestures or plant closures.

As the variables of main interest are foreign presence and foreign entry, we should take into account that the estimated relationship between these variables and productivity could be biased by selection on survival. Suppose for example, that foreign greenfield entry occurs primarily in sectors with good market growth prospects. In such sectors, even low productivity firms may survive, creating a negative correlation between foreign entry and productivity among surviving firms. Conversely, if foreign entry increases competitive pressure such that only the best firms survive, there will be a positive correlation between foreign entry and productivity among surviving firms. Thus, the selection bias could work in both directions and the overall bias is not known. To address this potential problem we use a Heckman selection model as one of our specifications when estimating equation (2.3) with both (2.4) or (2.5) representing the change in foreign presence.

The effect of a change in foreign presence on productivity growth may depend on the market structure of the industry. On the one hand, it could be argued that information about new technologies may spread more easily in a small and transparent market. This would imply that spillovers may be larger in concentrated industries. On the other hand, greenfield entry in a concentrated industry may have a larger impact on the competitive pressure in the industry than greenfield entry in a less concentrated industry. At least in the short run, this could lead to reduced domestic market shares or even a reduction in output prices. A similar effect might be generated if a foreign acquisition in a concentrated industry puts an end to collusive behaviour in that industry. To take account of the possibility that the effect of foreign entry may depend on the market structure of an industry, one of our specifications includes interaction terms and lagged interaction terms between the change-in-foreign-presence variable(s) under consideration and the 5-firm concentration measure.

2.3 Data

Our main data source is the annual census of all Norwegian manufacturing plants 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 detailed information on production, input use, investment, location, and industry classification. We use the ISIC Rev. 2 industry classification in our analysis.[9]

We drop plants with less than 8 employees throughout their lives, and observations of plants not in ordinary production (service units or plants under construction).[10] The resulting sample contains 150,000 observations from 10,400 plants for the period 1978-2001, with an average plant size of 43 employees. In terms of employment and output, the sample contains more than 90% of total manufacturing output and employment.

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 origin of the largest owner.[11] The register was initiated in 1972, and while only

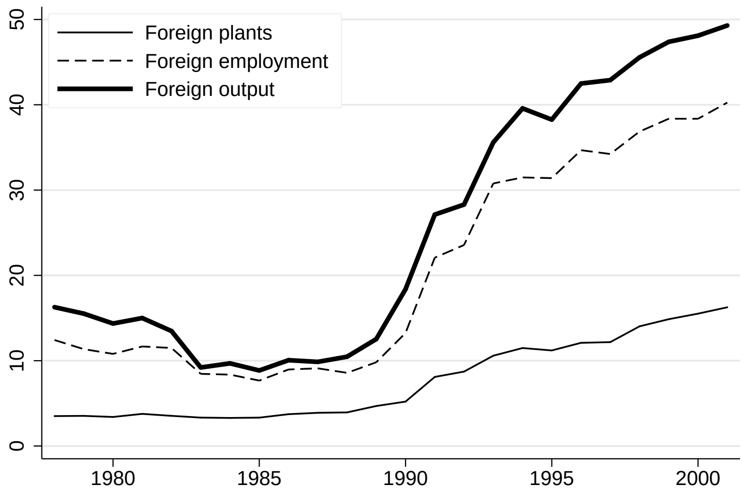
[9]For more detailed descriptions of the Manufacturing Statistics, see the documentation in Halvorsen et al. (1991) and Møen (2004).

[10]In addition, we drop plants that in the Norwegian Manufacturing Statistics are classified as "small" (defined as having less than 5 or 10 employees) throughout their life. The information for these plants comes mainly from administrative registers and is therefore less extensive than for large plants. In particular, there is no investment information, which means that we are unable to construct capital measures for this group.

[11]See Simpson (1994) for more details about the SIFON-register.

direct foreign ownership was recorded before 1990, from 1990 onwards also indirect foreign ownership is documented.[12] Before 1990, the Manufacturing Statistics contains a variable where plants are classified into three ownership classes; plants that are part of firms where less than 20%, between 20-50%, or more than 50% of the equity is directly foreign owned. This information is obtained from earlier versions of the SIFON-register. 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.[13]

Figure 2.1: Foreign presence in Norwegian manufacturing



In percent of total plants, total employment and total output

It is likely that registration of indirect foreign ownership in 1990 was somewhat incomplete as this was the first year when this type of foreign ownership was recorded. It is also likely that the degree of underreporting of indirect foreign ownership declined during the early 1990s. Figure 2.1 illustrates the development of foreign ownership in our sample, and shows a dramatic increase in foreign presence during the 1990s. This increase in foreign presence is a combination of a trend increase in foreign ownership as well as a result of the extended definition and recording of foreign ownership. The rate of increase

[12]A firm has direct foreign ownership interests if foreigners own part of the equity of the firm. Firms of which 50% or more is owned by another firm based in Norway (mother), and where the foreign equity stakes are in the mother, are classified as indirectly foreign owned.

[13]We report how this affects our results in the robustness analysis in section 2.5.

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 nonexistent during the 1980s. Thus, our sample is likely to underestimate the extent of foreign ownership before the early 1990s.

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 buy-outs at the firm level do not affect the plant identification code. Since our data are from a census, we avoid the problem of possible false entries and exits due to plants not being sampled.

Table 2.1: Annual number of foreign and domestic plants and foreign entrants

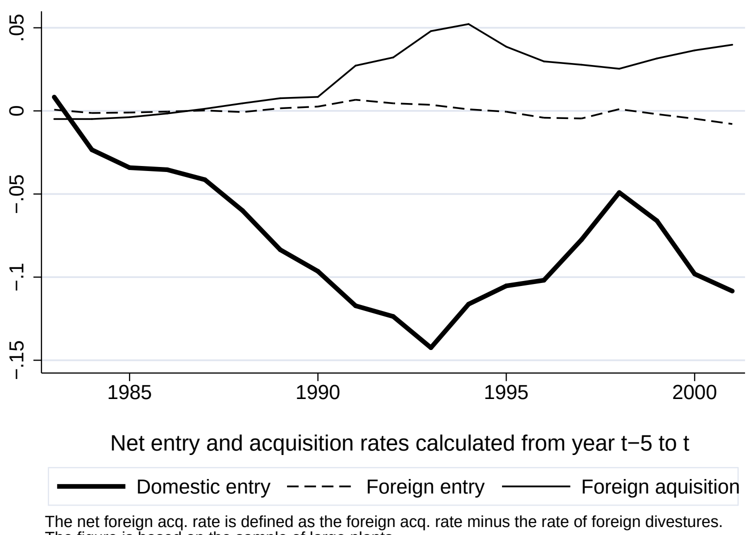
	Domestic plants	Foreign plants	Greenfield entry	Acquisition entry
1980-84	6,914	225	5	24
1985-89	6,492	223	8	35
1990-94	5,445	400	14	103
1995-99	4,775	590	24	91

Note: Averages over 5-year periods.

When defining entry and exit our main concern 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 a plant is not in operation if it is not observed in the census, we assume that when a plant is missing from the census for one or two consecutive years, this is due to lack of registration rather than a temporary closure. When a plant disappears for three or more consecutive years before it reappears in the census, we regard it 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 an entrant in year t if it appears for the first time in year t, or reappears in that year 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.[14]

In Table 2.1 we show the average annual number of foreign and domestic plants per 5 year period during the 1980s and 1990s, as well as the average yearly greenfield entry and acquisition numbers. Figure 2.2 then displays the 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 in exits during the recession in the early 1990s. This creates a trough in the net entry rate. The negative net entry rate reflects the overall trend in the economy of moving resources out of manufacturing into the services sectors. During the period of analysis the number of observations in our sample decreased from 6,990 in 1978 to 4,850 in 2001. During the same period total manufacturing employment declined by 33% from 330,000 in 1978 to 220,000 in 2001.[15] By comparing the development in foreign acquisitions with the foreign and domestic net entry rates in Figure 2.2, we can conclude that the increase in foreign presence in Norwegian manufacturing over the last 25 years is mainly due to net exit of domestic plants and foreign acquisitions of domestic plants.

Figure 2.2: 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.

[14]Less than 2.5% of the plants in the sample have what we define as temporary closures.

[15]Haskel et al. (2002) report a similar trend for UK manufacturing employment, a decline of 36% from 1980 to 1992.

For the econometric analysis we clean the data with respect to missing observations and outliers.[16] First, we drop plants with missing information on inputs or output for 80% or more of their life. We then drop observations with negative profit margins and negative value added. We also exclude sector 342, "Printing, publishing and allied industries" from our sample. Klette (1999), in his estimations of markups and scale parameters using the same data, concluded that the results from this sector were implausible and should be ignored. The printing sector has experienced a dramatic technological change over the period: it went from manual typesetting to computerized printing. Thus, the changes in this sector may be so large that results are not representative. Alternatively, there may be particular data problems affecting productivity estimates for the printing and publishing sector. When we include this sector, the results - except for the foreign presence (FP) variable - go in the same direction as our main results in Section 2.4, but the coefficients are 2-3 times as large. By excluding the printing sector (ISIC 342), we are thus making it more difficult for ourselves to obtain significant results.

Our cleaned sample contains 112,000 observations from 9,110 plants. This constitutes 75% of our initial sample from 1978-2001. Average plant size is almost the same (it increases from 43.0 to 43.9 employees), and the share of foreign plants is virtually unaffected. The number of plants per year in our cleaned sample is 5,410 in 1978, down to 3,630 in 2001.

2.4 Results

We estimate the first-differenced equation (2.3) on those plants that are Norwegian owned throughout their presence in our sample. Summary statistics of the regression variables for the domestic plants sample are presented in Table 2.6 in the Appendix. The results of estimating equation (2.3) using the overall change in foreign presence as defined in equation (2.4) are presented in the first column of Table 2.2. All inputs are significant. The coefficients on market share, concentration, and profit margin have the expected negative sign. This indicates that reduced competitive pressure has a negative effect on productivity, although the concentration index is only significant at the 10% level. The measure of

[16]We experimented with several cleaning procedures. In one alternative we define multiple outliers on plant level changes in output, materials use and hours from one year to the next according to the method by Hadi (1994), and defined as outliers all observations in the 1st and 99th percentile. In another alternative, we defined as outliers all observations with cost shares of capital, materials, or labour in the 1st and 99th percentile of observations for each year and 3-digit industry. All cleaning procedures drop observations evenly across 2-digit industries, and drop more observations after 1995. The main conclusions in section 2.4 hold for all cleaning procedures.

openness has a positive coefficient, hence higher imports enhance domestic productivity, while the turnover rate is not significant. The change in overall foreign presence is entered with its current value and two lags. Only the coefficient on the current change in foreign presence is significantly different from zero and has a positive sign, but the effect is small. In the row with $\sum \Delta FP$ we sum the three coefficients on the change in foreign presence: their accumulated effect is positive, but not significant. This is in line with previous results for Norway reported by Grünfeld (2002).

As argued in section 2.2, the effect of a change in foreign presence on productivity growth may depend on the market structure of the industry. Thus, in column 2 we include interaction terms between the 5-firm concentration measure and the change in foreign presence. This gives an indication of whether a change in foreign presence in concentrated sectors has a different effect from a change in foreign presence in less concentrated sectors. Including the interaction terms results in a significant and positive accumulated effect. The signs of the interaction terms go in opposite directions. In order to investigate these effects further, we split our sample at the median concentration level and run the regression of column 1 in Table 2.2 on these two samples separately. These results show a positive effect of foreign presence in low-concentration sectors, and no significant effect of foreign presence in high-concentration sectors.[17]

By virtue of observability, our sample consists only of those plants that survive. Hence, if foreign presence affects the probability of survival, our earlier estimates may be biased. In the last column of Table 2.2 we re-estimate column 2 using the 2-step Heckman selection procedure where survival is conditioned on investment and capital, see e.g. Haskel et al. (2002). This is to capture the idea that investment which is observable but not correlated with current output can pick up unobservable shocks to productivity. It can be considered a "reduced" form of the more structural approach to the exit decision taken in Olley and Pakes (1996). In this equation, selection is determined by the plants' investment shares[18] and capital in logs, each from levels up to their 4th powers. The results are very similar to those in column 2 without the selection correction. The variables in the selection probit are jointly significant, as indicated by the χ^2 value. The selection term ρ is also significant. We also tried to condition survival on a probit of so-called hazard variables that have been

[17] The sum of the three coefficients on the change in foreign presence is 0.108 with p-value 0.009 in the low-concentration sectors (sectors with $CR5_{It} < 0.25$) and in high-concentration sectors the effect is 0.009 with p-value 0.628. Using the Herfindahl-Hirschman index as an alternative concentration measure in the regressions of Table 2.2 gives very much the same results.

[18] As zeros in investment are meaningful observations (see Nilsen and Schiantarelli (2003) for Norway), we prefer to scale investment by dividing by annual averages instead of taking logs.

Table 2.2: Foreign Presence and Domestic Productivity

Dependent variable $\Delta \ln Y_{it}$			
	(1)	(2)	(selection)
$\Delta \ln K_{it}$	.058 (.003)**	.058 (.003)**	.055 (.003)**
$\Delta \ln M_{it}$	.520 (.005)**	.520 (.005)**	.528 (.005)**
$\Delta \ln H_{it}$	.290 (.007)**	.290 (.007)**	.281 (.006)**
$\Delta MS_{i,t-1}$	$-$.332 (.065)**	$-$.332 (.065)**	$-$.298 (.064)**
$\Delta PM_{i,t-1}$	$-$.375 (.009)**	$-$.375 (.009)**	$-$.378 (.009)**
$\Delta CR5_{I,t}$	$-$.025 (.014)$^{(*)}$	$-$.026 (.014)$^{(*)}$	$-$.021 (.014)
$\Delta OPEN_{I,t}$	.074 (.018)**	.074 (.018)**	.070 (.018)**
$Turnover_{I,t-1}$	.015 (.013)	.015 (.013)	.025 (.013)*
$\Delta FP_{I,t}$	.021 (.009)*	.036 (.024)	.034 (.023)
$\Delta FP_{I,t-1}$	$-$.001 (.010)	$-$.006 (.027)	.013 (.028)
$\Delta FP_{I,t-2}$	.005 (.009)	.056 (.026)*	.048 (.026)*
$(\Delta FP * CR5)_{I,t}$		$-$.024 (.035)	$-$.021 (.035)
$(\Delta FP * CR5)_{I,t-1}$		.008 (.041)	$-$.025 (.041)
$(\Delta FP * CR5)_{I,t-2}$		$-$.086 (.038)*	$-$.062 (.040)
$\sum \Delta FP_I$ [$p-value$]	.026 [.125]	.086 [.044]	.094 [.025]
R^2	.79	.79	–
χ^2 (1) $\rho(SE)$	–	–	11.54 $-$.049(.014)
N	61,929	61,929	63,623
$Plants$	6,558	6,558	6,558

Notes: **,*,$^{(*)}$ indicate significance at 1%, 5%, and 10% respectively. Year and 3-digit industry dummies included in all regressions. Robust standard errors adjusted for clustering at the plant level in round parentheses.

found to determine exit, see e.g. Bernard and Jensen (2002). The hazard variables are plant age, age squared, plant size (measured as the number of employees), labour productivity, a multiplant dummy that takes value one if the plant is part of a multiplant firm, and foreign presence. This selection equation yields similar results.

As argued earlier, the measure of foreign presence used combines the effects from recent foreign entrants and employment changes in longer-term foreign firms. In addition, the measure is not able to distinguish between different modes of foreign entry. Thus, we proceed by splitting the overall change in foreign presence according to equation (2.5). Results are presented in Table 2.3. The estimated coefficients on the input and competition variables do not change much when we split the change in foreign presence variable, thus the coefficients on inputs and competition variables are not reported.

In column 1 of Table 2.3 the coefficients on greenfield entry are negative, with the first lag of greenfield entry being significant. Their accumulated effect is negative and significant at the 5% level. Regarding acquisitions, only the current foreign acquisition rate is significant with a positive sign. The accumulated effect of foreign acquisitions is positive and significant at the 10% level, but it is small in economic terms. The effect of the remaining change in foreign presence ΔF_I is close to zero and insignificant.

In column 2, we add the interaction terms between the components of change in foreign presence and concentration in order to investigate whether the effects of foreign entry on productivity growth differ according to the level of industry concentration. The coefficients on current greenfield entry and its first lag are negative and significant; and their accumulated effect is substantially larger in absolute terms than in column 1. The interaction terms between greenfield entry (and lagged greenfield entry) and the concentration measure are positive and significant. This suggests that the negative effect of foreign entry is particularly strong in less concentrated industries. Industries with high levels of concentration are hardly affected at all, indicating that plants in these sectors are better able to face the increase in competition from foreign greenfield entry.

In the case of foreign acquisitions, the coefficients on the acquisition rate are positive in column 2 but, as in column 1, only the coefficient on the current acquisition rate is significant. The positive accumulated effect of acquisitions is significant at the 1% level, and as in the case of greenfield entry, the effect is substantially larger in absolute terms than in column 1. The interactions between the acquisition terms and the concentration index are negative, suggesting that in highly concentrated industries acquisitions have a negative impact on the productivity of domestic firms. Regarding the remaining change

Table 2.3: Modes of Foreign Entry and Domestic Productivity

Dependent variable $\Delta \ln Y_{it}$	(1)	(2)	(selection)
$G_{I,t}$	$-.040$ (.061)	$-.399$ (.196)*	$-.508$ (.202)**
$G_{I,t-1}$	$-.100$ (.050)*	$-.687$ (.195)**	$-.666$ (.204)**
$G_{I,t-2}$	$-.043$ (.054)	.007 (.223)	$-.167$ (.223)
$A_{I,t}$	.032 (.012)**	.082 (.031)**	.079 (.031)**
$A_{I,t-1}$	.002 (.013)	.052 (.034)	.048 (.034)
$A_{I,t-2}$	.002 (.014)	.055 (.035)	.063 (.036)$^{(*)}$
$\Delta F_{I,t}$	.013 (.017)	$-.008$ (.042)	$-.011$ (.041)
$\Delta F_{I,t-1}$	.007 (.017)	$-.039$ (.047)	.022 (.047)
$\Delta F_{I,t-2}$	.005 (.015)	.051 (.043)	.013 (.044)
$(G * CR5)_{I,t}$		.497 (.260)$^{(*)}$	.653 (.269)**
$(G * CR5)_{I,t-1}$		.812 (.243)**	.785 (.253)**
$(G * CR5)_{I,t-2}$		$-.064$ (.285)	.161 (.289)
$(A * CR5)_{I,t}$		$-.083$ (.046)$^{(*)}$	$-.081$ (.045)$^{(*)}$
$(A * CR5)_{I,t-1}$		$-.084$ (.051)$^{(*)}$	$-.081$ (.051)
$(A * CR5)_{I,t-2}$		$-.092$ (.053)$^{(*)}$	$-.100$ (.053)$^{(*)}$
$(\Delta F * CR5)_{I,t}$		.040 (.064)	.048 (.062)
$(\Delta F * CR5)_{I,t-1}$		.082 (.073)	$-.013$ (.072)
$(\Delta F * CR5)_{I,t-2}$		$-.072$ (.066)	.007 (.068)
$\sum G_I$ [$p-value$]	$-.183$ [.054]	-1.079 [.000]	-1.341 [.000]
$\sum A_I$ [$p-value$]	.036 [.065]	.190 [.000]	.190 [.000]
$\sum \Delta F_I$ [$p-value$]	.025 [.311]	.003 [.961]	.024 [.716]
R^2	.79	.79	–
χ^2 (1) $\rho(SE)$	–	–	11.16 $-.049(.015)$
N	61,929	61,929	63,623
$Plants$	6,558	6,558	6,558

Notes: **,*,$^{(*)}$ indicate significance at 1%, 5%, and 10% respectively. Input coefficients not reported. Year and 3-digit industry dummies included in all regressions. Robust standard errors adjusted for clustering at the plant level in round parentheses.

in foreign presence, ΔF_{It}, introducing the interaction terms does not give a clearer picture of any effect of these changes in foreign presence on the productivity growth of domestic plants. Also with the interaction terms included, the accumulated effect of the ΔF-terms remains insignificant.

In the third column of Table 2.3 we re-estimate column 2 using the Heckman selection model described above. The individual coefficients have mostly the same sign and significance level as in column 2. The result for the accumulated effect of greenfield entry is stronger, i.e. more negative, while the results on foreign acquisitions and the remaining change in foreign presence are not affected. Again conditioning selection on hazard variables and the G_{It}, A_{It} and ΔF_{It} measures gives similar results.

As in the case of an overall change in foreign presence, we split the sample into low- and high-concentration sectors and estimate the regression of column 1 in Table 2.3 on these two samples separately.[19] The results for the low-concentration sectors are presented in the first column of Table 2.4. The effect of greenfield entry is negative, while foreign acquisitions have a positive effect on the productivity growth of domestic plants. As an example, the coefficient on the first lag of greenfield entry implies that a one percentage point increase in last year's greenfield entry rate is associated with a decrease in current productivity growth of 0.52 percent. From the second column of Table 2.4 we find no significant effect of greenfield foreign entrants on productivity growth in high-concentration sectors. The effect from foreign acquisitions in high-concentration sectors is ambiguous. The current acquisition rate is positive and significant, whereas the second lag is negative and significant which results in an insignificant accumulated effect. The remaining change in foreign presence (ΔF) has a positive effect, suggesting a small spillover effect from the foreign plants that are not recent entrants into the sector. In small and transparent industries, the domestic firms may be in a better position to appropriate knowledge from foreign firms and thus benefit from spillovers. We obtain similar results as in Table 2.4 if we use the Herfindahl index as an alternative measure of concentration and split the sample at its median.

[19] Note that when splitting the sample at the median of $CR5 = 0.25$, the low-concentration sample contains 18 of 132 5-digit sectors (7 of these are in the food sector and 5 in the metal industry).

Table 2.4: Modes of Foreign Entry and Domestic Productivity in Low- and High-Concentration Sectors

Dependent variable $\Delta \ln Y_{it}$		
	(low conc)	(high conc)
$G_{I,t}$	$-.107$ (.164)	$-.002$ (.068)
$G_{I,t-1}$	$-.524$ (.167)**	.004 (.047)
$G_{I,t-2}$	.050 (.192)	$-.024$ (.057)
$A_{I,t}$	.046 (.034)	.027 (.014)*
$A_{I,t-1}$	.074 (.032)*	$-.015$ (.014)
$A_{I,t-2}$	.124 (.033)**	$-.034$ (.015)*
$\Delta F_{I,t}$	.040 (.042)	.012 (.019)
$\Delta F_{I,t-1}$	$-.017$ (.046)	.015 (.018)
$\Delta F_{I,t-2}$	$-.067$ (.038)$^{(*)}$	.032 (.017)$^{(*)}$
$\sum G_I$	$-.581$	$-.022$
[$p-value$]	[.020]	[.819]
$\sum A_I$	.244	$-.022$
[$p-value$]	[.000]	[.316]
$\sum \Delta F_I$	$-.044$	.060
[$p-value$]	[.447]	[.034]
R^2	.80	.79
N	34,576	27,353
$Plants$	3,789	3,028

Notes: **,*,$^{(*)}$ indicate significance at 1%, 5%, and 10% respectively. Coefficients on inputs and competition variables not reported. Year and 3-digit industry dummies included in all regressions.Robust standard errors adjusted for clustering at the plant level in round parentheses.

To summarise, we find a significant and positive effect of an overall change in foreign presence on the productivity growth of domestic plants in low-concentration sectors. However, when focusing explicitly on foreign entrants, we find that this is the result of two opposing effects from the recent foreign entrants. Greenfield entry has a negative impact on the productivity growth of domestic plants in less concentrated industries. Entry via acquisition affects domestic productivity growth positively. The effect of greenfield entry is stronger in absolute terms than that of acquisitions, but since foreign acquisition is the most frequent mode of entry, the acquisition effect dominates in the effect of an overall change in foreign presence (cf. Table 2.2).

For the low-concentration industries, the negative effect of greenfield entry on productivity could be due to a market stealing effect as argued by Aitken and Harrison (1999). In order to investigate this possibility further, we do a number of additional regressions. When repeating the regression of column 1 in Table 2.4 without controlling for the use of inputs, we find that the accumulated effect of greenfield entry in the low-concentration sectors is stronger on output (−1.549 [.001]) than on productivity (−0.581 [.020] from column 1 of Table 2.4). Given that our data do not contain information about prices, we do not know whether this is primarily a price or a quantity effect. Using profit margins as the left-hand side variable instead of output, with the remaining competition variables as right-hand side controls, yields no strong evidence of a price effect: two of the coefficients on G_I are positive while one is negative and the accumulated coefficient for the G_{It} variables is not significant (.122 [.350]). We also looked at how greenfield entry affects the use of materials and labour by using the change in these inputs as our dependent variable while controlling for competition in addition to the foreign entry variables on the right-hand side. These regressions give accumulated coefficients on $\sum G_{It}$ equal to (−1.706 [.021]) for material inputs and (−.802 [.134]) for hours, and none of the individual coefficients on the G_I-terms were significant. Thus it seems that plants in low-concentration sectors are able to reduce their use of materials as their output falls due to greenfield entry, but the negative effect on labour use is not significant. All in all, we take these results as suggesting that the transitory decline in productivity growth that seems to follow greenfield entry in sectors with low concentration rates is primarily caused by the domestic firms not sufficiently adjusting their use of labour in the short run.

Turning to the effect of foreign entry by acquisition, our results show that acquisitions are associated with higher productivity growth for domestic plants in low-concentration sectors, with the largest effect 2 years after entry. Given that we did not expect any (immediate) changes in market structure in the acquisition case, it is plausible that we do not find a negative competition effect. In fact, foreign acquisitions appear to give the existing firms in the market time to adapt, possibly because they are themselves handicapped by substantial in-house restructuring after a takeover. In addition, established links from the acquired plant to other domestic plants may serve as a channel for knowledge spillovers.

2.5 Robustness analysis

In Table 2.5, we report the results for a number of robustness checks. The regressions in the upper panel of Table 2.5 are all variations of equation (2.3) as reported in column 2 of Table 2.3. In the lower panel of the table we report the same variations of equation (2.3) on the sample of low-concentration sectors, thus the results in the lower panel are comparable to column 1 of Table 2.4. We only report the sum of coefficients on G_I, A_I and ΔF_I.

In columns 1 and 7 of Table 2.5, we report the results of a more general specification of equation (2.3) in which we allow the coefficients on inputs to vary across 3-digit industries by interacting the inputs with industry dummies. Our specifications in Tables 2.3 and 2.4 constrain the input elasticities to be the same for all manufacturing industries. This might disregard important differences between industries and thus bias our estimates of the effects of foreign entry. However, the overall effects of foreign entry and acquisitions are very similar to the results reported in column 2 of Table 2.3 and column 1 of Table 2.4.

Production function estimation has been shown to yield poor results when important unobservables that vary both across plants and over time, such as productivity shocks, are omitted. This suggests that differencing and controlling for plant fixed effects may yield poor estimates of input use and, moreover, it may not be sufficient to render the error term ε_{it} in equation (2.1) white noise. Olley and Pakes (1996) show that such unobservable shocks can be proxied for by investment behavior, on the assumption that these shocks influence current investment, but - since investment takes time - not current output. Their approach requires that plants do not undertake zero investment, which is not the case for about 25% of the observations in our sample. Instead, Levinsohn and Petrin (2003) propose using intermediate inputs rather than investment to address the underlying simultaneity problem. To make sure that our results are not affected by this problem, we estimate total factor productivity (TFP) as the residuals of a Cobb-Douglas production function at the

Table 2.5: Robustness

Dep. var.	$\Delta \ln Y_{it}$	$\Delta \ln \text{TFP}_{it}$	$\Delta\ \text{TFP}_{it}$	$\Delta \ln \text{LP}_{it}$	$\Delta \ln Y_{it}$	$\Delta \ln Y_{it}$
Check	3-digit inp. coeff.	levpet residuals	translog index	labour prod.	Direct foreign	Majority foreign
Full sample with concentration interactions (cf. Table 2.3 col (2))						
	(1)	(2)	(3)	(4)	(5)	(6)
$\sum G_I$	-1.066	-1.107	-1.324	-1.551	-1.438	-2.342
[$p-value$]	[.000]	[.000]	[.000]	[.001]	[.041]	[.001]
$\sum A_I$	.199	.206	.206	.124	.242	.207
[$p-value$]	[.000]	[.000]	[.000]	[.174]	[.003]	[.001]
$\sum \Delta F_I$	$-.016$	.086	.032	$-.109$	$-.021$	$-.091$
[$p-value$]	[.810]	[.214]	[.617]	[.430]	[.809]	[.373]
R^2	.81	.06	.07	.03	.79	.79
N	61,929	61,922	61,924	61,929	61,929	61,929
$Plants$	6,558	6,558	6,558	6,558	6,558	6,558
Low-concentration sectors only (cf. Table 2.4 col (low conc))						
	(7)	(8)	(9)	(10)	(11)	(12)
$\sum G_I$	$-.698$	$-.574$	-1.062	$-.747$	$-.494$	-1.641
[$p-value$]	[.003]	[.025]	[.000]	[.112]	[.308]	[.002]
$\sum A_I$	.264	.272	.247	$-.063$	.353	.160
[$p-value$]	[.000]	[.000]	[.000]	[.478]	[.001]	[.006]
$\sum \Delta F_I$	$-.066$	.008	$-.049$	$-.092$	$-.150$	$-.238$
[$p-value$]	[.244]	[.896]	[.368]	[.444]	[.123]	[.012]
R^2	.81	.07	.08	.03	.80	.80
N	34,576	34,574	34,576	34,576	34,576	34,576
$Plants$	3,789	3,789	3,789	3,789	3,789	3,789

2-digit level according to the Levinsohn-Petrin method.[20] In columns 2 and 8 of Table 2.5 we report the results of using this measure as our dependent variable in estimating equation (2.3) omitting the inputs on the right hand side. The results are similar to our original specifications.

In columns 3 and 9 we use as our measure of productivity growth a superlative index of total factor productivity growth used by Aghion et al. (2005), which is derived from a flexible translog specification of the production technology, see Caves et al. (1982a, 1982b).[21] The results from using this measure are very similar to those of the specification in Table 2.3. The accumulated effect of greenfield entry is stronger in absolute terms. In column 4 and 10 of Table 2.5 we report results for labour productivity. Labour productivity will not be affected by potentially poor measurement or poor estimation of the capital stock variable. Also here, the results for greenfield entry point in the same direction as our previous results; but the effect of acquisitions is not significant.

As noted in Section 2.3, from 1990 onwards our definition of foreign ownership includes both directly and indirectly foreign-owned plants. We re-estimate our original specifications with our foreign entry and acquisition variables based on, respectively, direct foreign ownership at the 20% threshold in columns 5 and 11 of Table 2.5, and on majority foreign ownership (direct + indirect) in columns 6 and 12. In both cases the coefficients on greenfield entry in the upper panel (columns 5 and 6) are negative and stronger than in the reference equation, and this also holds for majority foreign greenfield entry in the low-concentration sectors (column 12). This is in line with earlier results suggesting that the effects from majority foreign-owned enterprises are largest (e.g. Smarzynska-Javorcik and Spatareanu (2003)). Overall, we conclude that our results are not sensitive to how foreign ownership is defined or to the measure of total factor productivity used.

2.6 Conclusions

Our aim in this chapter was to bring new insights into the spillover debate by distinguishing between new and existing foreign firms, and furthermore between different modes of foreign entry. In our data, an overall change in foreign presence has a small positive impact on productivity growth of domestic plants in low-concentration sectors, and no effect in more

[20]In the absence of an appropriate deflator we use the share of energy in material use to proxy for unobserved productivity shocks.

[21]Details on the construction of this index are presented in the Appendix.

concentrated sectors. The effect in low-concentration sectors is generated by the recent foreign entrants, with opposite effects from greenfield entrants and foreign acquisitions. The impact of greenfield entry on domestic productivity growth is negative in low-concentration sectors. The negative effect of greenfield entry on the productivity growth of domestic plants in low-concentration sectors seems to be primarily due to these plants not adjusting their use of inputs (in particular labour) in the short run. The negative competition effect associated with greenfield entry in low-concentration sectors is not found for acquisitions. We find a positive effect of foreign acquisitions on the productivity growth of domestic plants in these industries, with the largest effect 2 years after entry. This suggests that established links from the acquired plant to other domestic plants may serve as a channel for knowledge spillovers. In highly concentrated sectors we find no significant effect of either of the recent entrants on domestic productivity growth.

2.A Appendix

Table 2.6: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Levels					
$\ln Y_{it}$	9.522	1.230	4.304	14.521	61,929
$\ln K_{it}$	7.257	1.253	1.792	12.300	61,929
$\ln M_{it}$	8.694	1.440	0.417	14.402	61,929
$\ln H_{it}$	3.368	1.070	-3.937	8.593	61,929
MS_{it}	0.017	0.047	0	1	61,929
PM_{it}	0.140	0.094	0	0.918	61,929
investment	0	0	-0.007	0.020	61,929
$CR5_{It}$	0.674	0.260	0.091	1	2,581
HHI_{It}	0.193	0.173	0.007	1	2,581
$OPEN_{It}$	0.645	0.192	0.034	0.956	2,581
$turnover_{It}$	0.069	0.080	0	1	2,581
FP_{It}	0.203	0.257	0	0.987	2,581
G_{It}	0.002	0.020	0	0.734	2,581
A_{It}	0.024	0.091	0	0.951	2,581
F_{It}	0.177	0.243	0	0.987	2,581
Differences					
$\Delta \ln Y_{it}$	0.012	0.313	-6.203	4.246	61,929
$\Delta \ln K_{it}$	0.034	0.319	-4.395	3.517	61,929
$\Delta \ln M_{it}$	0.025	0.428	-7.014	6.110	61,929
$\Delta \ln H_{it}$	-0.012	0.342	-7.336	7.293	61,929
ΔMS_{it}	0	0.012	-0.684	0.688	61,929
ΔPM_{it}	-0.003	0.085	-0.857	0.831	61,929

Note: Summary statistics for industry level variables are reported for 5-digit industry-year cells.

Data and variable definitions

A_{It} Employment in plants that were acquired by a foreign owner between years t and $t-1$ as a share of 5-digit industry employment in year t.

$CR5_{It}$ Joint market share of the 5 largest plants in a 5-digit industry in terms of output relative to industry output.

F_{It} Employment in foreign-owned plants present in year t and in year $t-1$ as a share of 5-digit industry employment in year t.

FP_{It} Employment in foreign-owned plants as a share of 5-digit industry employment in year t.

G_{It} Employment in foreign-owned plants present in year t but not in year $t-1$ as a share of 5-digit industry employment in year t.

H_{it} 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.

HHI_{It} Herfindahl-Hirschman index defined as the sum over the squares of each plant's market share in its 5-digit industry.

K_{it} Our estimate of capital services uses 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. The values for depreciation rates and the rate of return to capital are also used by Salvanes and Førre (2003) using the same data. 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. Where possible, we also use estimates of firm level capital values (distributed to the plant level according to employment shares) as starting values for plants with entry after 1995. These capital values are 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, which is somewhere in between the 2- and 3-digit ISIC level.

LP_{it} Labour productivity defined as output per hour.

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.

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

$OPEN_{It}$ Rate of imports over imports plus exports ($OPEN_{It} = M_{It}/(M_{It}+X_{It})$). 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.

PM_{it} Net output less material and wage costs divided by 5-digit industry output.

$Turnover_{It}$ (Total number of plants entering in year t + total number of plants exiting in year t)/(Total number of plants in year t)

ΔTFP_{it} The measure of TFP growth is derived from a flexible translog specification of the production technology.

$$\Delta TFP_{it} = \Delta \ln Y_{it} - \sum_{z=M,K,H} \widetilde{\alpha_{it}^{z}} \Delta \ln x_{it}^{z}, \tag{2.6}$$

where x_{it}^{z} is the quantity used of factor z in plant i at time t. The Divisia share $\widetilde{\alpha_{it}^{z}}$ is defined as $\widetilde{\alpha_{it}^{z}} = (\alpha_{it}^{z} + \alpha_{it-1}^{z})/2$ where α_{it}^{z} is the cost share of factor z relative to total output value Y in plant i at time t. We impose constant returns to scale. Since there could be substantial noise in the observed factor shares α_{it}^{z}, we apply a smoothing procedure proposed by Harrigan (1997). Assuming a translog production technology, constant returns to scale (CRS), and standard market-clearing conditions, α_{it}^{z} can be expressed as follows:

$$\alpha_{it}^{z} = \psi_i + \varphi_{It} + \sum_{z=M,H} \omega_{It} \ln(\frac{x_{it}^{z}}{x_{it}^{K}}) \tag{2.7}$$

where ψ_i is a plant-specific constant, φ_{It} an industry-time-specific constant and where we normalize relative to capital use to impose CRS. If the observed factor shares deviate from the left-hand side of this equation by an i.i.d. measurement error term, then the parameters can be estimated by running separate fixed effects panel data regressions for each industry I. We estimate equation (2.7) separately for each 3-digit ISIC industry, and use the fitted values from (2.7) as the factor shares in the calculation of (2.6).

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

Chapter 3

Is mobility of labour a channel for spillovers from multinationals to local domestic firms?

Abstract

This chapter documents the extent of labour mobility from multinationals (MNEs) to non-MNEs in Norwegian manufacturing during the 1990s. On average, each year around one percent of workers in MNEs move to non-MNEs. By the year 2000, 45 percent of the non-MNEs employed workers with experience from MNEs. These workers earned a wage premium of more than 3 percent compared to their new colleagues in the non-MNEs. I estimate a Cobb-Douglas production function for non-MNEs and include the share of workers with recent MNE experience. Consistent with mobility being a channel for knowledge diffusion, I find that these workers contribute 20-25 percent more to productivity than workers without experience from MNEs. The difference between the private returns to mobility and the productivity effect at the plant level suggests that labour mobility from MNEs to non-MNEs represents a true knowledge externality.

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3.1 Introduction

The empirical literature on knowledge spillovers from foreign direct investment to host country firms, treats the channels through which such spillovers may occur as a black box. The labour mobility channel for spillovers has been highlighted both in theoretical models (Fosfuri et al., 2001; Glass and Saggi, 2002), and in the empirical literature (for recent surveys of the empirical spillover literature, see Saggi, 2002 and Görg and Greenaway, 2004). The general approach of the empirical spillover literature is to regress a measure of domestic plant productivity on a measure of foreign presence at the industry level. When measuring foreign presence at the industry level it is not possible to capture the fact that domestic firms may have different links with foreign-owned firms. The more contact domestic firms have with foreign-owned firms, the more likely they are to benefit from spillovers. One type of contact with foreign-owned firms is to hire workers from these firms. I use linked employer-employee data to construct plant-specific measures for the share of workers in domestic plants with recent experience from multinationals. By using this measure of an explicit link between domestic and multinational firms in a productivity regression, I am able to go beyond the 'black box'-treatment of spillovers in the existing empirical literature. To the best of my knowledge, this is the first paper to use extensive linked employer-employee data to estimate the productivity effect of labour mobility from foreign to domestic firms in a host country.

In order for labour mobility to be a channel for spillovers from foreign to domestic firms, we would expect to observe the following: First, foreign-owned firms should have a firm-specific advantage that could be the basis for spillovers. A firm-specific advantage would give rise to extra profits in these firms. If firms share rents with their workers, observing a wage premium for workers in foreign-owned firms would be consistent with a potential for spillovers. Second, we should be able to document a nontrivial magnitude of foreign to domestic labour mobility. Third, domestic plants that hire workers with previous experience from foreign firms should benefit in terms of increased productivity. Fourth, the foreign to domestic movers should benefit from mobility in terms of their own wages, and their experience from foreign-owned firms should be valued by their new firms. In this chapter, I use linked employer-employee data to assess the evidence on all four points for Norwegian manufacturing during the 1990s.

The existence of a firm-specific advantage combined with evidence of actual mobility can only suggest that a potential for spillovers through labour mobility does exist, while a productivity benefit at the plant level due to mobility is consistent with labour mobility actually working as a channel for spillovers. To what extent such spillovers can be regarded as an externality, and not only as knowledge diffusion through market transactions, cannot be determined from a positive productivity effect alone.[1] An assessment of the size of the productivity benefit together with information about the wage increase obtained by the mobile workers may indicate to what extent a possible spillover is an externality. If the productivity benefit at the plant level is larger than the wage premium granted to workers with experience from MNEs, the evidence is consistent with a knowledge externality.

Foreign-owned firms are thought to be a relevant source of spillovers because they are part of MNEs with firm-specific assets that can be transferred across borders within the firm (Dunning, 1981; Markusen, 1995). It has recently been argued that the firm-specific advantage hypothesis, which is thought to be a reason for firms becoming multinational, should apply equally to domestic multinationals of the host country (Doms and Jensen, 1998; Bellak, 2004). The argument implies that the potential for spillovers should primarily go from multinationals to purely local firms, regardless of whether a multinational is foreign or domestically owned. The empirical analysis here will distinguish mainly between multinationals and local domestic plants, hereafter called MNEs and non-MNEs respectively.

As a first exercise to assess the potential for knowledge spillovers from MNEs to non-MNEs in Norwegian manufacturing, I look for evidence of a multinational advantage by estimating individual wage equations for manufacturing workers. I find a foreign MNE premium of 2,5% relative to non-MNEs, while Norwegian MNEs seem to give a wage premium only to workers with high education. The results are consistent with a potential for spillovers from MNEs to non-MNEs.

Little is known about the extent and pattern of labour mobility between foreign and domestic firms in a developed country, despite the frequent claim that it is a potential channel for spillovers.[2] Martins (2006) is the first to provide such evidence for a developed country, using a large panel of linked employer-employee data that covers virtually all firms and their employees in Portugal from 1986 to 2000. He finds relatively small labour flows between foreign and domestic firms. In this chapter I focus only on labour mobility within manufacturing. Partly because labour mobility between manufacturing and other sectors of

[1] Møen (2005) argues that if the hiring firm pays wages according to the marginal productivity of the new employee, a productivity benefit in the hiring firms is not an externality.

[2] Some case study evidence of foreign to domestic mobility in developing countries exists, see references in Saggi (2002) and Görg and Strobl (2005a).

the economy is likely to be lower than mobility within the manufacturing sector, and partly because knowledge acquired in other sectors may be of limited relevance in manufacturing. I find that on average, each year around 1% of workers in MNEs leave to join a non-MNE. However, this translates into a growing percentage of workers in non-MNEs with experience from MNEs. In the year 2000 15% of workers in non-MNEs had experience from MNEs, while 45% of non-MNEs in 2000 employed one or more workers with MNE experience, up from 18% in 1995. Thus, from the perspective of non-MNEs, labour mobility from MNEs seems to be large enough to play a role as a channel for spillovers in Norway, at least during the second half of the 1990s.

Given the extent of mobility from MNEs to non-MNEs, I proceed to estimate the effect of this mobility on the productivity of non-MNEs. Previously, this has only been examined empirically by Görg and Strobl (2005a), who use firm level data for a sample of manufacturing plants in Ghana. They find that firms whose entrepreneurs worked in multinationals in the same industry prior to joining or setting up their own firm are more productive than other firms, while experience from multinationals in a different industry has no effect on firm productivity. In contrast to the data from Ghana, I can determine the recent work history of all workers in non-MNEs. I include annual plant level measures of the share of workers with recent MNE experience in a Cobb-Douglas production function. Based on an interpretation provided by Griliches (1967, 1986), I find that workers with MNE experience contribute 20-25% more to total factor productivity than workers without experience from MNEs. This result is consistent with the idea that labour mobility from MNEs to non-MNEs is a channel for spillovers.

When looking at the wages of movers compared to colleagues with similar characteristics in their new plant, I find that movers from MNEs to non-MNEs with more than 3 years' experience from MNEs receive a wage premium of almost 5% compared to stayers in non-MNEs. Thus experience from MNEs is clearly valued in non-MNEs. For movers in the other direction there is no such wage premium. These results are consistent with mobility from MNEs to non-MNEs being a potential channel for spillovers. The difference in the private returns to mobility for movers from MNEs to non-MNEs and the productivity effect these movers have at the plant level, suggest that the hiring non-MNEs do not fully pay for the value of these workers to the firm. Hence, labour mobility from MNEs to non-MNEs seems to be a source of knowledge externality in Norwegian manufacturing.

The remainder of this chapter is structured as follows. Section 3.2 presents the data sources, followed by the empirical results regarding multinational wage premia in Section

3.3. Section 3.4 contains descriptive evidence of labour mobility from MNEs to non-MNEs in Norwegian manufacturing and Section 3.5 investigates whether non-MNEs that hire workers with MNE experience benefit in terms of productivity. Section 3.6 asks whether movers benefit from mobility in terms of wages, while Section 3.7 concludes.

3.2 Data

I use four different annual data bases for the years 1990-2000, all of which are censuses that can be linked to each other by firm or plant identifiers. All the data sources are administered by Statistics Norway. The starting point is the Norwegian Manufacturing Statistics, which is collected at the plant level. From the Manufacturing Statistics, I use information about production, input use, investment and industry classification (ISIC Rev. 2). As the main aim is to include measures of labour mobility into a plant level productivity framework, plants with insufficient information to calculate a measure of total factor productivity are excluded from the analysis. After this cleaning the remaining data still contains around 90% of manufacturing output and employment.[3]

In order to classify plants as MNEs or non-MNEs, I combine information obtained from the record of foreign ownership of equity in Norwegian firms (the so-called SIFON-register), and information from the register of outgoing foreign direct investment (FDI) from Norway. Both registers can be linked to the Manufacturing Statistics with firm identifiers. The SIFON-register contains information about the value and shares of equity owned by foreign interests, as well as the nationality of the largest owners.[4] The register of outward FDI contains information about shares and votes in operations abroad controlled by Norwegian firms, country of operation and a number of financial transactions between the owner in Norway and the operation abroad.[5] For the purpose of classifying plants as MNEs or non-MNEs, I use the information on the shares of equity in Norwegian firms owned by foreigners from the SIFON-register, and the shares of equity in firms abroad owned by firms in Norway. I define a Norwegian MNE as a firm that is not itself majority owned from abroad, while it has direct ownership shares of more than 20% in operations abroad. A foreign MNE is more than 20% foreign owned and at the same time not classified

[3]For more detailed descriptions of the Norwegian Manufacturing Statistics, see Halvorsen et al. (1991) and Møen (2004).

[4]See Simpson (1994) for more details about the SIFON-register.

[5]The register of outgoing FDI has hardly been used for research so far. Grünfeld (2005) uses this database to give an overview of foreign activities of firms based in Norway.

as a Norwegian MNE.

Finally, I link the administrative files containing the whole population of residents aged 16-74 to the plant level data. The administrative files contain, among other things, information on age, gender, identification of the current employer, weekly work-hours, annual earnings, start and end dates for the current employment spell and detailed education codes.[6] Weekly work-hours are recorded as a categorical variable in 4 groups, with the longest work-hours being 30 hours or more per week. I use only workers that are recorded as working 30 hours or more per week, and call these workers full-time workers (more than 90% of workers are full-time workers). As a proxy for wages, I use the recorded earnings variable in the data, where earnings are measured as annual taxable labour income.[7]

Table 3.1: Foreign and domestic plants and workers

	Number of plants			Mean empl.			Full-time workers		
	1	2	3	1	2	3	1	2	3
1990	5,211	249	216	27	83	179	141,435	20,634	38,719
1991	4,849	362	218	26	97	163	124,921	35,038	35,607
1992	4,739	390	240	25	96	161	119,181	37,474	38,677
1993	4,411	435	240	23	102	165	102,155	44,439	39,600
1994	4,455	497	219	24	92	177	106,481	45,742	38,815
1995	4,389	482	220	24	102	160	107,243	49,248	35,108
1996	4,296	512	203	24	103	151	101,375	52,715	30,651
1997	4,353	531	179	26	104	156	111,495	55,465	27,958
1998	4,282	639	159	26	94	179	111,109	60,254	28,384
1999	4,156	681	177	26	92	166	107,958	62,407	29,428
2000	3,923	689	215	26	88	128	100,231	60,615	27,421

Notes: 1=Non-MNE; 2=Foreign MNE; 3=Domestic MNE

Table 3.1 shows the total number of matched plants and full-time workers by type of plant. The total number of manufacturing plants decreased from 5 200 in 1990 to 3 900 in 2000, and the total number of full-time workers went down from around 200 000 in 1990 to below 190 000 in 2000. While the number of Norwegian MNEs and non-MNEs and

[6]See Salvanes and Førre (2003) for a general description of the Norwegian linked employer–employee data sets, see also Møen et al. (2004) for documentation.

[7]For the analysis of wages in Sections 3 and 6 I drop 135 000 individual observations (6% of the sample), where the recorded earnings are considered too low for a regular full time earning. I set this threshold to be below 12 000 NOK per month in 2001 prices. Dropping these low-wage observations does not affect the results.

the number of workers in these plants declined from 1990 to 2000, the number of foreign MNEs and the number of workers in foreign MNEs tripled during the same period. Plants of Norwegian MNEs are substantially larger in terms of the average number of workers than plants of foreign MNEs.

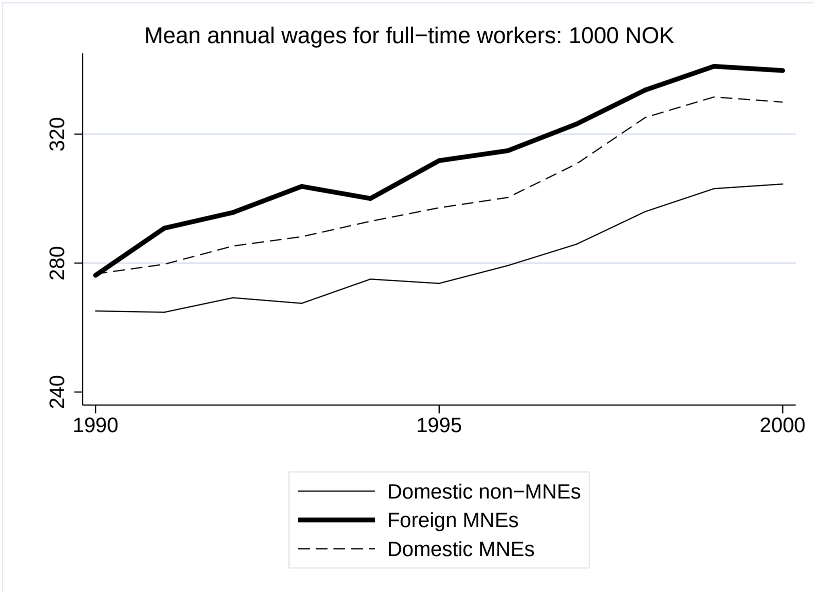
3.3 Is there a multinational wage premium?

A potential for spillovers from MNEs to non-MNEs requires that the local firms have something to learn from MNEs. One piece of evidence that would suggest such a potential is that MNEs pay higher wages than non-MNEs. Through on-the-job-experience (or training), workers in MNEs may get access to part of the MNE's superior technology, and bring valuable knowledge with them to a new employer. They may also set up a competing business. In order to prevent such spillovers, the MNE may pay a wage premium to reduce labour mobility, as discussed in the theoretical models of Fosfuri et al. (2001) and Glass and Saggi (2002). In these models the MNE shares rents with its workers. MNEs may also pay a wage premium because they are able to share rents across borders (Budd and Slaughter, 2004). Other explanations for the wage premium are that it is a compensation for a higher probability of plant closure (Bernard and Sjöholm, 2003), or higher labour demand volatility (Fabri et al., 2003). Both these hypotheses of compensating differentials are consistent with the existence of a foreign wage premium, but do not necessarily imply that the MNE has a firm-specific advantage that could be the basis for spillovers.[8]

For Norwegian manufacturing there are clear differences in unconditional mean wages between non-MNEs, domestic MNEs and foreign MNEs, see Figure 3.1. The difference between non-MNEs and foreign MNEs is around 10%. From Table 3.2 we see that domestic MNEs have on average more employees than foreign MNEs, and both types of MNEs are substantially larger than non-MNEs. In terms of labour productivity and wages, the domestic and foreign MNEs are relatively similar and both types of MNEs have higher

[8]Several papers investigate the extent of so-called wage-spillovers. Foreign direct investment by high productivity firms might lead to increased wages by affecting labour demand directly, but there could also be an indirect effect through knowledge diffusion. As noted by Aitken et al. (1996), labour turnover and knowledge diffusion should eventually increase wages also in domestic firms and thus reduce or eliminate the foreign wage premium (see also Barry et al., 2005). Indirect evidence of knowledge diffusion through wage-spillovers is found for the US (Aitken et al., 1996) and the UK (Girma et al., 2001; Driffield and Girma, 2003), while Aitken et al. (1996) find zero or even negative wage-spillovers for Venezuela and Mexico. As these studies do not follow workers between plants, they cannot say whether labour mobility played any role in facilitating the wage-spillovers.

Figure 3.1: Wages in MNEs and non-MNEs



productivity and wages than non-MNEs. In terms of mean age, experience and years of education of the workers, the three groups of plants seem very similar, though education levels are slightly higher in MNEs than in non-MNEs. The biggest difference is found in the length of tenure, where the Norwegian MNEs have considerably longer mean tenure (9.3 years) than both foreign MNEs (8 years) and domestic non-MNEs (7.3 years). The main reason for this difference is likely to be the age of the plants; the larger Norwegian MNEs are likely to be older than the other groups of plants. The mean tenure of foreign MNEs is to some extent affected by the recent entry of many of these plants.

When using plant level data for average wages it is a common finding that foreign firms pay higher average wages than domestically owned firms, and that the foreign wage premium is larger in developing countries than in developed countries.[9] In many plant level datasets it is not possible to control for the quality of the labour force when estimating the foreign wage premium, thus part of the wage premium may be due to foreign firms using more skilled labour than domestic firms. Studies of foreign wage premia using individual wage data typically find smaller wage premia than studies using only plant level average wages. This result suggests that part of the plant level premium can be explained by skill

[9] Aitken et al. (1996) provide evidence for Mexico, Venezuela and the United States. Lipsey and Sjøholm (2004) provide evidence for Indonesia, and evidence of foreign wage premia in UK manufacturing are found by Conyon et al. (2002), Girma et al. (2001) and Griffith and Simpson (2003).

Table 3.2: Worker and plant characteristics: Means of annual values 1990-2000

	Non-MNEs		Foreign MNEs		Domestic MNEs	
	Mean	Sd	Mean	Sd	Mean	Sd
Real monthly wage	23,513	13,078	26,631	11,580	25,102	15,182
Tenure	7.33	6.10	7.95	6.48	9.28	6.56
Experience	22.23	12.72	22.36	12.34	22.55	12.59
Age	40.08	11.74	40.59	11.26	40.72	11.52
Years of schooling	10.54	2.37	10.92	2.74	10.87	2.56
Plant size	30.39	68.65	106.23	185.59	164.14	234.85
Labour Productivity	1224	1635	2068	8299	1817	1363
Skill share	0.36	0.22	0.44	0.21	0.39	0.19
Female share	0.27	0.23	0.24	0.20	0.27	0.22
Worker/Plant obs.	1,215,480/48,820		516,450/5,450		365,390/2,270	

Notes: Experience=age-years of education-7, labour productivity is real output per employee, skill share is share of workers with more than 11 years of education.

composition.

I estimate wage premia and control for both plant and individual observable characteristics in the following wage regression:

$$w_{ijt} = \beta_0 + \beta_1 D_{jt} + X'_{ijt}\beta_2 + F'_{jt}\beta_3 + e_{it}, \tag{3.1}$$

where w_{ijt} is the log real wage of worker i employed in firm j at time t, X_{ijt} is a vector of observable individual characteristics and F_{jt} is a vector of observable plant characteristics, while e_{it} is an idiosyncratic error term. The main variable of interest is D_{jt}, which is a dummy indicating the status of the plant.

Table 3.3 reports the results from estimating equation (3.1) with OLS for Norwegian manufacturing workers. In the upper part of the table, I analyse wage differences between foreign and domestic plants. D_{jt} is a dummy for foreign ownership. The lower part of the table shows results for wage differences between MNEs and non-MNEs. In this case, the foreign ownership dummy is replaced by 2 dummies, one indicating whether the plant is a domestic MNE and the other indicating whether the plant is a foreign MNE. Columns 1-5 show results using the full panel with additional sets of control variables in each column. By comparing results in Columns 2, 3 and 4 of Table 3.3, we can see that differences in observable plant characteristics are more important than the observable individual characteristics of workers. The foreign wage premium is reduced by almost 50% between Column 2 and Column 3, and only plant characteristics account for the difference between these columns. Adding individual characteristics in Column 4 has hardly any further effect on the wage premium.

Column 6 shows the result from the model in Column 5, when the estimating sample includes only individuals with less than 11 years of education. The result in Column 7 is for individuals with more than 15 years of education. The unconditional foreign wage premium is around 10% in Column 1, and falls to 2.3% in Column 5 after adding industry dummies, plant and individual characteristics. This is comparable to the 2% premium found by Heyman et al. (2004) for Sweden in a very similar regression, while for Portugal, Martins (2004) finds a foreign wage premium of around 10% when controlling for both individual and plant characteristics. An interesting feature in the lower part of Table 3.3 is that domestic MNEs have lower wage premia than foreign MNEs. When controlling for both plant and individual characteristics in Column 5, there is no wage premium in domestic MNEs while foreign MNEs have a premium of 2.5%.[10] This contrasts the findings of Heyman et al. (2004), who find no significant difference in wage premia between foreign and domestic MNEs, and find a wage premium of 5% for foreign MNEs relative to non-MNEs in Sweden. In Columns 6 and 7 of Table 3.3, we can see that foreign MNEs pay higher wages than non-MNEs to both educational groups, while domestic MNEs only have a significant premium for the high education group. This premium is about half the size of that in foreign MNEs.[11]

The wage regressions in Table 3.3 do not control for unobserved individual or firm-fixed effects. The results are therefore likely to be affected by omitted variable bias. On the one hand, if MNEs to a larger extent tend to select 'better' workers along unobserved dimensions, this may explain part of the wage premium. On the other hand, if MNEs systematically select better workers than non-MNEs, they may also be able to use their human resources more efficiently. And the demand for 'good' workers may be connected with their MNE status. In addition, foreign MNEs may perform better along unobserved plant dimensions that increase their ability to pay higher wages. The results in Table 3.3

[10] The results in Table 3.3 are not changed if interactions of year and 2-digit industry dummies are included.

[11] Comparable OLS regressions using plant level average wages as the dependent variable show a somewhat higher wage premium of 5% for foreign plants when controlling for plant characteristics, labour productivity, year and industry dummies. Similar to the individual wage regressions, if we replace the foreign dummy with separate dummies for foreign and domestic MNEs, there is no significant domestic MNE wage premium, while the foreign MNE premium is 4.5%.

Table 3.3: Wage premia in foreign owned plants and in multinationals

	1	2	3	4	5	Low educ.	High educ.
Dependent variable is log individual wage							
Foreign dummy	.107***	.061***	.033***	.031***	.023***	.022***	.022***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.004)
Year dummies	yes	yes	yes	yes	yes	yes	yes
28 3-digit ISIC dummies	no	yes	yes	yes	yes	yes	yes
Plant characteristics	no	no	yes	yes	yes	yes	yes
Individual characteristics	no	no	no	yes	yes	yes	yes
Labour productivity	no	no	no	no	yes	yes	yes
N	2,092,,413	2,092,413	2,092,413	2,092,413	2,092,413	1,014,127	80,382
R-sq	.062	.156	.203	.398	.402	.329	.338
Dependent variable is log individual wage							
Foreign MNE dummy	.107***	.061***	.036***	.034***	.025***	.023***	.033***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.005)
Domestic MNE dummy	.073***	.050***	.012***	.008***	-.002	-.003*	.016*
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.006)
Year dummies	yes	yes	yes	yes	yes	yes	yes
28 3-digit ISIC dummies	no	yes	yes	yes	yes	yes	yes
Plant characteristics	no	no	yes	yes	yes	yes	yes
Individual characteristics	no	no	no	yes	yes	yes	yes
Labour productivity	no	no	no	no	yes	yes	yes
N	2,092,,413	2,092,413	2,092,413	2,092,413	2,092,413	1,014,127	80,382
R-sq	.059	.156	.203	.398	.403	.329	.338

Notes: Plant characteristics are log(number of employees) and its square, share of female workers, share of workers with more than 13 years of education, log(capital per unit of output). Individual characteristics are education in years, a quadratic in tenure, a quartic in experience (age minus education minus 7) and a gender dummy. Labour productivity is log(output per employee). The low education sample consists of workers with less than 11 years of education, high education corresponds to more than 15 years of education. ***, **, *= significant at 0.1, 1 and 5%, respectively. Standard errors clustered on individuals in parentheses indicates that to control for observable plant characteristics has more effect on the wage premium than to control for observable individual characteristics. Therefore it is likely that the remaining wage premium is partly due to unobservable plant effects connected with MNE status. This is consistent with the wage premium indicating a potential for spillovers from this group of plants.

3.4 The extent of labour mobility

In the matched panel from 1990 to 2000 we observe in total about 450 000 individuals working in manufacturing plants. Most of these individuals stay in the same plant all the years they are observed in a manufacturing industry, but around 20% of the workers change plants within manufacturing and generate around 110 000 incidents of plant change. Table 3.4 shows that almost 45% of these plant changes occur between non-MNEs. For the group of workers with low education this percentage is 48%, while only 27% of the job changes among the university educated workers occur between non-MNEs. For the university educated, the largest share of plant moves (39%) occurs between MNEs.[12] The flows of workers between MNEs and non-MNEs are roughly equal in both directions for all types of workers, thus the potential for spillovers through labour mobility seems equally large in both directions.

Table 3.4: Direction of mobility for incidents of plant change

		Education		
	All	1	2	3
Between non-MNEs	44.86	48.56	43.22	27.10
From non-MNE to MNEs	16.51	16.29	16.72	17.10
From MNE to non-MNEs	13.43	12.45	14.29	16.29
Between MNEs	25.20	22.70	25.77	39.51
Total moves (=100%)	110,377	61,736	39,431	9,210

Notes: 1=Non-technical education; 2=Vocational/technical education; 3=University education.

[12] I have divided the workers into 3 groups based on detailed educational codes from Statistics Norway. Group 1, the low-education group, includes individuals with missing education code and workers that have completed up to 1 year of education after compulsory schooling. In addition, this group includes workers with completed high school without technical fields. Group 2 includes workers with technical/vocational education at the high school level, while group 3 includes workers with university education.

Table 3.5: Within manufacturing mobility: Mean of annual values 1991-2000

	Low education		Vocational		University	
	N_t	% of N_{t-1}	N_t	% of N_{t-1}	N_t	% of N_{t-1}
Workers in non-MNEs in year t-1, are in year t found in:						
Same Plant	65,527	77.3	26,139	80.7	4,351	86.0
Non-MNE	1,681	2.0	983	3.0	141	2.8
Domestic MNE	192	0.2	110	0.3	28	0.6
Foreign MNE	358	0.4	282	0.9	57	1.1
% of N_{t-1} in manufacturing		80.0		84.9		90.5
Workers in foreign MNEs in year t-1, are in year t found in:						
Same Plant	23,106	78.7	12,241	81.8	3,699	85.4
Foreign MNE	317	1.1	223	1.5	90	2.3
Non-MNE	267	0.9	231	1.5	58	1.3
Domestic MNE	74	0.3	62	0.4	28	0.7
% of N_{t-1} in manufacturing		81.0		85.1		89.7
Workers in domestic MNEs in year t-1, are in year t found in:						
Same Plant	17,944	80.7	9,278	84.2	2,284	85.0
Domestic MNE	353	1.5	290	2.7	76	2.9
Non-MNE	115	0.6	100	0.9	31	1.1
Foreign MNE	112	0.5	92	0.8	33	1.2
% of N_{t-1} in manufacturing		83.3		88.6		90.2

Table 3.5 shows for each of the three groups of plants (non-MNEs, foreign MNEs and domestic MNEs) where workers that were employed in t-1 are found the following year. This indicates the size of the mobility flows relative to the size of the plants. Concentrating on the columns for workers with low education, we see that on average 77.3% of the workers in non-MNEs with low education are employed in the same plant from one year to the next. A total of 80% of these workers are still found within manufacturing. The remaining 20% not accounted for in the table have left manufacturing for jobs in other sectors, are out of the labour force or unemployed. Mobility is slightly lower in foreign and domestic MNEs than in non-MNEs, 80.7% of low education workers in domestic MNEs continue in the same plant from one year to the next. The lower mobility in MNEs is likely to be connected to the size of the plants, as bigger plants have more of an internal labour market, and also a lower probability of exit. The lower mobility in domestic MNEs correspond to the longer

tenure in these plants compared to non-MNEs, as revealed in Table 3.2. Workers with university education are substantially less mobile than workers with lower education. On average, around 85% of workers with university education stay in the same plant from one year to the next. This might indicate that workers with high education accumulate plant specific human capital to a larger extent than other workers.

Table 3.5 also indicates the presence of 'internal labour markets' within the group of multinational plants, in particular for domestic MNEs. On average 719 workers move from domestic MNEs to other domestic MNEs each year, while only 246 move from domestic MNEs to non-MNEs .[13] This gives a ratio of almost 3 movers from domestic MNEs to other domestic MNEs for each mover to a non-MNE. A rather different ratio from the average of less than 1 worker in domestic MNEs per 3 workers in non-MNEs, which can be calculated from Table 3.1. Movers from foreign MNEs spread evenly between other foreign MNEs and non-MNEs, with a ratio of approximately 1.1. Hence, workers in domestic MNEs tend to move within this group of plants to a much larger extent than their share of workers would suggest. This tendency is not so pronounced for movers from foreign MNEs.[14] One explanation for this feature is that domestic MNEs are more likely to be part of multi-plant firms, with workers moving between plants within the firm.

From Table 3.5 we find that on average, each year around 800 workers in MNEs move to non-MNEs.[15] This only accounts for about 1% of the workers in MNEs, cf. Table 3.1. This may suggest that the potential for knowledge diffusion is small. MNEs are far larger than non-MNEs, however. The mobility flows from MNEs may therefore look more important from the perspective of non-MNEs. Table 3.6 shows the percentage of workers in non-MNEs in 1995 and 2000 with recent experience from MNEs. Recent MNE experience is defined as having worked in an MNE for one or more of the last three years. Thus, a worker must have worked in a multinational for one or more of the years 1997-1999 to be counted as having MNE experience in 2000. In 1995 only 5.9% of the workers in non-MNEs had experience from MNEs, and this was roughly equally divided between foreign and domestic MNE experience. In 2000 15.1% of workers in non-MNEs had experience from MNEs, the majority from foreign MNEs. The percentage of workers with experience from domestic

[13]From the lower part of Table 3.5 we find 719 by adding 353+290+76 from the row indicating movers to domestic MNEs, similarly we find 249 by summing along the row of movers to non-MNEs.

[14]Martins (2006), in his study of foreign to domestic labour mobility in Portugal, finds similar evidence of 'internal labour markets' within the group of foreign firms.

[15]We reach this number by summing along the row indicating movers from foreign MNEs to non-MNEs (267+231+58), and by summing along the row of movers from domestic MNEs to non-MNEs (115+100+31).

Table 3.6: Workers in non-MNEs with experience from MNEs

	All	Education		
		1	2	3
1995				
Experience from MNE	5.9	5.2	7.4	7.9
Experience from domestic MNE	2.8	2.3	3.7	4.0
Experience from foreign MNE	3.2	2.9	3.7	4.1
Total workers	113,862	77,422	32,144	4,296
2000				
Experience from MNE	15.1	12.4	19.2	22.1
Experience from domestic MNE	6.1	4.9	7.5	9.9
Experience from foreign MNE	10.4	8.4	13.4	15.3
Total workers	107,502	68,959	26,617	11,926

Notes: Numbers in percent. 1 = Non-technical education;
2 = Vocational/technical education; 3 = University degree

and foreign MNEs respectively, do not sum to the percentage of workers with overall MNE experience (15.1%), because some of the workers may have experience from both types of MNEs. The largest increase in the incidence of MNE experience has come in the group of workers with university education. 22.1% of these workers had recent experience from MNEs in 2000, the majority with experience from foreign MNEs.

Table 3.7 shows the percentage of non-MNEs in 1995 and 2000 that employed workers with recent experience from MNEs. When comparing Tables 3.6 and 3.7 we see that although the percentage of workers with recent MNE experience is small, the percentage of plants employing such workers is much larger, 17.9% in 1995 (against 5.9% of workers) and 45.2% in 2000 (against 15.1% of workers). While at the individual level, the share of workers with MNE experience among the university educated in 2000 is larger than for the other groups, the picture is the opposite at the plant level. The percentage of plants that employ university educated workers with experience from MNEs is only 14.2% in 2000, while the share of university educated workers with MNE experience is 22.1%. Hence it is a rather small subset of non-MNEs that employ workers with university education.

Table 3.7: Non-MNEs employing workers with MNE experience

	All	Education		
		1	2	3
1995				
Experience from MNE	17.9	11.6	10.4	3.1
Experience from domestic MNE	8.0	4.6	4.6	1.5
Experience from foreign MNE	12.8	8.2	6.9	1.9
2000				
Experience from MNE	45.2	33.3	25.5	14.2
Experience from domestic MNE	24.7	15.6	12.2	6.7
Experience from foreign MNE	37.6	26.3	20.7	10.7

Notes: Numbers in percent. 1 = Non-technical education;
2 = Vocational/technical education; 3 = University degree

3.5 Productivity spillovers through labour mobility?

The evidence presented in Section 3.4 shows relatively small mobility flows. However, in terms of the potential for mobility to generate spillovers that affect plant productivity, the interesting issue is how the workers with MNE experience spread across the group of non-MNEs. The previous section also showed that during the 1990s there was a growing and fairly substantial percentage of plants that employed workers with previous experience from MNEs. I now proceed to investigate whether labour mobility gives rise to productivity effects at the plant level.

The empirical spillover literature surveyed by Görg and Greenaway (2004) has looked for evidence of productivity spillovers from foreign to domestic firms by regressing a measure of domestic plant productivity on a number of covariates, including a measure of foreign presence in the industry or region. As argued by Görg and Strobl (2005a), this approach treats the channels through which spillovers may occur as a black box. A measure of foreign presence at the industry level is not able to capture the fact that firms within the same industry have different degrees of contact with foreign firms.[16] Domestic firms with explicit contacts with foreign firms may be the most likely to benefit from knowledge

[16]If foreign presence is measured in the same industry as the domestic plants are located, this measure picks up intra-industry (also called horizontal-) spillovers (see e.g. Haddad and Harrison ,1993; Aitken and Harrison, 1999; Keller and Yeaple, 2002; Kinoshita, 2001). Regressions that include foreign presence in upstream or downstream industries from the domestic plants pick up inter-industry (also called vertical-) spillovers (Kugler, 2006; Smarzynska-Javorcik, 2004).

diffusion. Examples of contacts between foreign and domestic firms could, in addition to labour mobility, be technology licensing, R&D cooperation, or exchange of intermediate inputs. Unfortunately, information at the firm or plant level on such links between MNEs and non-MNEs is rarely available.[17] Görg and Strobl (2005a) use information on whether the owners of domestic firms have previous experience from MNEs, and this firm-specific link between domestic firms and multinationals has a positive effect on the productivity of domestic firms in their sample of manufacturing firms from Ghana.

With the Norwegian data I am able to construct plant-specific measures for the shares of workers in non-MNEs with recent experience from MNEs, and I include this measure in a Cobb-Douglas production function. The interpretation of the coefficient on the share of workers with MNE experience is based on Griliches (1967). He argues that in a Cobb-Douglas production function one could ask whether different types of labour are equally 'potent' in generating productivity growth.[18] I apply this idea to labour with recent experience from MNEs (L_M) and labour without such experience (L_N). Under the spillover hypothesis, we would expect that L_M should be weighted by a positive 'premium' δ in the production function. With two types of labour in the production function, effective labour L^* is

$$L^* = L_N + L_M(1+\delta) = L(1+\delta s),$$

where $s = L_M/L$ is the share of labour with MNE experience in the total use of labour, $L = L_N + L_M$. Given a Cobb-Douglas production function $Y = (K)^{\beta_K}(M)^{\beta_M}(L^*)^{\beta_L}$, the $\beta_L \ln L^*$ term in its log linearized version can be approximated by $\beta_L \ln L + \beta_L \delta s$, and we can estimate the following production function

$$\ln Y_{it} = \beta_K \ln K_{it} + \beta_M \ln M_{it} + \beta_L \ln L_{it} + \beta_L \delta s_{it} + \upsilon_i + \upsilon_t + \varepsilon_{it}. \tag{3.2}$$

In equation (3.2) $\ln Y$, $\ln K$, $\ln M$, and $\ln L$ are the natural logs of output, capital, material and hours in plant i, year t.[19] s_{it} is the share of workers that have experience from MNEs, υ_i and υ_t are plant and time fixed effects. When constructing the measures of s_{it}, I require the MNE experience of workers in non-MNEs to be relatively recent, i.e. for a worker to be counted as having MNE experience in year t, the worker had to work in a multinational

[17] Studies that find evidence consistent with spillovers through vertical linkages (e.g. Smarzynska-Javorcik, 2004) use aggregate input output tables to generate the variables representing the links between foreign and domestic firms, but these are not firm specific links.

[18] Griliches (1986) applies this idea to different types of R&D expenditure.

[19] For variable construction, see the variable definitions in the Appendix.

for one or more of the years $t-3$ to $t-1$.[20] Since β_L is estimated separately, the combined $\beta_L\delta$ term can be used to compute the δ term.[21]

Table 3.8 presents results of estimating equation (3.2) with plant fixed effects on the sample of non-MNEs. 28 industry dummies corresponding to ISIC 3-digit level and year dummies are added in all regressions. In Column 1, s_{it} is the share of workers in the plant with recent experience from both foreign and domestic MNEs. The coefficient on the share of workers with MNE experience is positive and significant. We can calculate the implied δ from the fixed effect results in Column 1 by combining the estimated coefficient on labour and the coefficient on the share of workers with MNE experience. The implied δ for workers with MNE-experience is found at the bottom of Column 1. $\delta = 0.27$, which means that workers with experience from MNEs contribute on average 27% more to the total factor productivity of the plant than workers without such experience. The effect is significant at the 5% level.[22] In Column 2, the measure of MNE experience is split into two parts; the shares of workers with experience from foreign and domestic MNEs, respectively. In this case both coefficients are positive, but not significant. More than 30% of plants that employ workers with domestic MNE experience also employ workers with foreign MNE experience, and this makes it difficult to identify the separate effects of foreign and domestic MNE experience. In Column 3, the workers with MNE experience are split by education, this time only the small group of university educated individuals is distinguished from the rest. In this case, only the coefficient on the largest group of workers with MNE experience, those without university education, is significant.

The way I have constructed the measure for the share of workers with MNE experience implies that this measure captures the newly hired employees with MNE experience in the plant, where newly hired means hired in year t, t-1 or t-2. If workers that change plants in general are better than stayers, the productivity premium found for newly hired workers

[20] This corresponds to the definition of recent MNE experience used in Tables 3.6 and 3.7 in Section 3.4.

[21] L is measured as total man-hours in the plant. This variable is from the Manufacturing Statistics. The share of workers with MNE experience is constructed from the matches between fulltime workers from the employee data and plants in the Manufacturing Statistics. The use of L together with the share s means that I assume that the share of matched workers with MNE experience approximates the share of hours by workers with MNE experience. At the aggregate manufacturing level the match of individuals to plants generates total manufacturing employment that corresponds to what we would get by using the employment information from the Manufacturing Statistics. At the plant level, the employment correspondence is more variable, thus I prefer to use the hours variable from the Manufacturing Statistics in the production function rather than constructing labour input from the number of individuals that I match to the plant level data.

[22] Including the interaction of year dummies and 9 2-digit industry dummies does not change the direction of the result in Column 1. The implied δ falls to 23%, but is significant at the 5% level.

Table 3.8: Share of workers with MNE experience and plant productivity

Dependent variable: Log(Output)				
	1	2	3	4
Share of workers with MNE-exp.	.096*			.099**
	(.037)			(.037)
Share of workers with foregin MNE-exp.		.069		
		(.037)		
Share of workers with domestic MNE-exp.		.115		
		(.078)		
Share with MNE-exp. and low education			.100**	
			(.038)	
Share with MNE-exp. and high education			.038	
			(.175)	
Share of new workers without MNE-exp.				.027
				(.014)
Log(Capital)	.053***	.053***	.053***	.053***
	(.004)	(.004)	(.004)	(.004)
Log(Materials)	.507***	.507***	.507***	.507***
	(.007)	(.007)	(.007)	(.007)
Log(Hours)	.355***	.355***	.355***	.354***
	(.008)	(.008)	(.008)	(.008)
N	33,405	33,405	33,405	33,405
R-sq	.83	.83	.83	.83
δ (MNE-exp.)	.270*			.280**
	(.107)			(.107)
δ (without MNE-exp.)				.076
				(.040)

Notes: All regressions include year dummies and 28 industry dummies. ***, **, *= significant at 0.1, 1 and 5%, respectively. Standard errors clustered on plants in parentheses.

with MNE experience may also apply to other newly hired workers. In Column 4 of Table 3.8 I check whether the productivity premium found for workers with MNE experience is an effect of newly hired workers in general being more productive than workers who have been longer in the plant. I do this by repeating Column 1 with the addition of a measure for the share of newly hired workers without MNE experience. The result clearly shows that there is a difference in the productivity premium connected with newly hired workers, depending on whether they do, or do not have, MNE-experience. The result for newly hired workers with MNE experience is more or less the same as in Column 1, with an implied productivity premium of 28%. In contrast, the implied productivity premium for newly hired workers without MNE experience is around 7%, and only significant at the 10% level.

I have also estimated equation (3.2) by dropping 2-digit sectors one by one. The estimated coefficient on the share of workers with MNE experience is in all cases of the same order of magnitude as in Column 1 of Table 3.8. It is also significant at the 5% level in all cases except when I drop the machinery and equipment industry. In that case the coefficient on the share of workers with MNE experience is significant at the 10% level. This suggests that the spillover effect from labour mobility is particularly strong in the Norwegian machinery and equipment sector. This is the largest manufacturing sector in Norway and employs around 35% of all manufacturing workers.

Table 3.9 includes the results for the estimated coefficient on the share of workers with MNE experience (cf. Column 1 of Table 3.8) from a number of different robustness checks. All regressions are estimated using the fixed effects (within effects) method. The first six rows of Table 3.9 repeat different variations of the regression presented in Column 1 of Table 3.8. The first two rows add control variables that are commonly used in the empirical literature on spillovers from FDI. These include foreign presence measured as the share of employment in foreign firms at the 5-digit industry level in Row 1, and variables to control for industry competition in Row 2.[23] In Row 3 I control for turnover and skill share at the plant level, since the hiring of workers with MNE experience could be systematically related to these variables. An alternative way to control for human capital is to replace the hours variable with a better measure of human capital at the plant level. I do this by multiplying hours with the average education level of the plant, and present the result in Row 4 of Table 3.9. As the result in Table 3.8 implies decreasing returns to scale, the regression in

[23]The competition variables were first proposed by Nickell (1996) and include market shares, profit margins, industry concentration and a measure of import competition. See variable definitions in Chapter 2.

Row 5 of Table 3.9 imposes constant returns to scale in the production function. In this case the coefficient on the share of workers with MNE experience is reduced, but is still significant at the 10% level. The implied δ in the constant returns to scale estimation is 0.18; also significant at the 10% level. In Row 6 I use the lagged share of workers with MNE experience instead of the current share when estimating equation (3.2). This is to account for the likely possibility that the effect of the new workers on productivity may take time to materialise. When comparing Column 1 of Table 3.8 and the first six rows of Table 3.9, we see that the result is not affected by these alternative specifications. In all cases the coefficient on the share of workers with MNE experience is positive and significant and implies a productivity premium of 24 to 28%. The exception is the regression imposing constant returns to scale in the production function, but even here the result is significant at the 10% level and implies a productivity premium for workers with MNE experience of almost 20% compared to workers without such experience.

Table 3.9: Robustness: Estimated coefficient on share of workers with MNE experience

	MNE-exp.		N	R-Sq	δ	
1. Industry level of foreign presence	.096*	(.037)	33,405	.83	.27*	[.011]
2. Competition variables	.1**	(.037)	33,405	.83	.28**	[.008]
3. Plant level skillshare and turnover	.093*	(.037)	33,405	.83	.26*	[.014]
4. Plant level human capital	.082*	(.038)	33,387	.83	.24*	[.033]
5. Impose constant returns to scale	.072	(.038)	33,405	.89	.18	[.062]
6. Lagged share of MNE-exp	.089*	(.035)	25,619	.81	.25*	[.011]
7. 3-digit industry input coefficients	.086**	(.031)	33,405	.85		
8. Dummy for MNE-exp	.015***	(.003)	33,405	.83		
9. TFP as dependent variable	.308***	(.059)	33,405	.07		
10. Levinsohn-Petrin residuals	.077*	(.033)	28,777	.05		
11. Labour productivity	.2*	(.085)	33,405	.04		

Notes: Rows 1-6 are different variations of the regression in Column 1 of Table 3.8 where the dependent variable is log(output). Log(output) is also dependent variable in Rows 7-8, but δ cannot be calculated. In Rows 9-11 the dependent variables are different productivity measures which are regressed on the share of workers with MNE experience, year and industry dummies. Standard errors in round brackets, P-values in square brackets. ***, **, *= significant at 0.1, 1 and 5%, respectively.

Rows 7-11 of Table 3.9 includes regressions that differ from the specification in equation (3.2), thus we cannot calculate the implied productivity premium for workers with MNE experience, but only estimate the effect of the share of workers with MNE experience in an augmented production function framework. Row 7 reports the result of a more general specification of the production function in equation (3.2) where the coefficients on capital, materials and hours are allowed to vary across 3-digit industries. In Row 8 of Table 3.9 the share of workers with MNE experience is replaced with a dummy equal to one if the plant employs one or more workers with MNE experience. This departs from the assumed linear relationship between the share of workers with MNE experience and plant level productivity that is implicit in equation (3.2). The estimated coefficient on the dummy is positive and significant at the 0.1% level.[24] In the last three rows of Table 3.9, I regress three different measures of plant level productivity on the share of workers with MNE experience while including year and industry dummies. The TFP-index used in Row 9 is described in the Appendix. In Row 10 I use the residuals from estimating a Cobb-Douglas production function at the 2-digit industry level according to the method proposed by Levinsohn and Petrin (2003). The method is developed in order to address the simultaneity problem in estimates of production functions.[25] The last row of Table 3.9 uses labour productivity measured as the log of output per hour as the dependent variable. In Rows 9-11, the results point in the same direction as before; the estimated coefficients on the share of workers with MNE experience are positive and significant. Thus the positive effect of MNE experience on plant level productivity is robust to several different measures of productivity.

To summarize, the estimation results suggest that workers with MNE experience contribute in the order of 20-25% more to the productivity of their plants than their colleagues without such experience. The mean share of workers with recent MNE experience is 7.7% for those non-MNEs that have workers with MNE experience, evaluated at the mean, these plants have 1.5-2% higher TFP than plants that have not recruited workers with MNE experience. The productivity premium attributed to workers with MNE experience is not associated with newly hired workers in general, as we do not find a similar productivity effect for newly hired workers without MNE experience.

[24]The robustness checks in Rows 1-7 of Table 3.9 would all give a positive and significant coefficient at the 1 or 0.1% level if the share of workers with MNE experience is replaced by a dummy variable as in Row 8.

[25]An alternative method to control both for unobserved plant fixed effects and input simultaneity is to use the GMM-System estimator recently developed by Blundell and Bond (1998). For a recent application to the question of whether foreign-owned firms are more productive than domestic firms, see Benfratello and Sembenelli (2006). I have tried variations of the GMM-System estimator using different lags of inputs and output as instruments. In all cases the validity of the instrument set was rejected.

3.6 Do workers benefit from mobility?

The results of the previous section indicated that workers with experience from MNEs are very important for the productivity of non-MNEs, and as such we would expect these workers to be rewarded in their new plants. The potential process of spillovers through labour mobility from MNEs to non-MNEs is similar to the process of R&D spillovers through labour mobility. The literature on R&D spillovers and labour mobility uses a human capital framework and focuses in particular on the relationship between mobility and wages. Since at least part of the knowledge acquired in a firm will move with the worker in the case of mobility, workers that get access to training/knowledge should be willing to pay for this by accepting a current pay cut in expectation of future private returns (Pakes and Nitzan, 1983).[26]

Table 3.10 shows mean wage growth in percent from the year before moving to the year after moving for different groups of movers. Their wage growth is also compared to the mean annual wage growth of workers who never change plant (stayers). The average wage growth of stayers is around 3% per year, while the movers experience wage growth of more than 5% upon moving from their old plant to a new one. Workers that change from a MNE to a non-MNE experience on average a wage growth of 7.2%, while the wage growth for movers in the opposite direction is 8.1%. These growth rates are higher than for workers that change plants within the group of MNEs or non-MNEs (5.6 and 5.7%).[27] The difference between average wage growth in the year of moving compared to annual average wage growth in the sample indicates that most job changes are voluntary, and that the movers increase their wage as a result of moving. This is consistent with the view that workers are attracted to their new plants by a deliberate policy by the hiring plant to acquire new workers to get access to their knowledge. It is also consistent with the view that the moving workers are earning a private return on general training received by the previous employer, and that this return is larger with a new employer who has not paid any of the training costs (Loewenstein and Spletzer, 1999).

In Table 3.10 the wage growth for MNE to non-MNE movers and for non-MNE to MNE movers is very similar. In fact, the movers from non-MNEs to MNEs experience

[26]I find no evidence that workers in MNEs pay for the knowledge they accumulate on the job through lower wages early in their career. Møen (2005) finds the opposite result for technical staff in R&D-intensive firms in the Norwegian machinery and equipment industry.

[27]Martins (2006) and Pesola (2006) investigate the private returns to mobility from foreign to domestic firms in Portugal and Finland, respectively. In Portugal foreign to domestic movers on average experience a pay cut upon moving, while the opposite is the case in Finland.

Table 3.10: Characteristics of movers and stayers

	Movers from MNEs		Movers from non-MNEs		Stayers	
	non-MNEs	MNEs	non-MNE	MNE	non-MNEs	MNEs
Wage before move	24,967	26,161	23,275	24,336	23,228	25,606
Wage after move	26,023	27,086	23,872	25,439	23,156	25,728
Wagechange %	7.2	5.5	5.8	8.1	3.0	3.3
Tenure	4.3	6.4	4.6	4.0	8.6	9.1
Age	35.0	37.9	36.4	35.2	41.1	40.8
Education	11.2	11.2	10.7	11.0	10.4	10.9
N	6,744	15,206	22,836	8,556	559,459	310,050

on average a larger wage jump than movers in the other direction.[28] As the wage growth numbers in Table 3.10 are unconditional means, they may be systematically affected by the characteristics of the movers or the plants they move between. For instance, when interpreting the wage growth of 8.1% for movers from non-MNEs to MNEs, we must bear in mind that most of these moves mean that the worker moves from a small plant to a larger plant (as the average size of MNEs is much larger than for non-MNEs). And since wages are positively correlated with plant size, the change in plant size may be an important factor in explaining the wage growth for non-MNE to MNE movers.

In order to investigate further the extent to which the movers may be selected out of their old plants and into their new plants, I follow the approach of Martins (2006). He compares the wages of foreign to domestic movers to the wages of their colleagues that do not move plants. He does this both before and after moving by estimating the following wage regression

$$w_{ijt} = \beta_0 + \beta_1 DM_{ij} + \beta_2 DN_{ij} + X'_{ijt}\beta_3 + F'_{jt}\beta_4 + d_j + e_{it}. \tag{3.3}$$

w_{ijt} is the log real wage of worker i employed in firm j at time t, X_{ijt} is a vector of observable individual characteristics, F_{jt} is a vector of observable plant characteristics, d_j is a plant fixed effect, while e_{it} is an idiosyncratic error term.

When comparing the wages of movers from MNEs before moving to wages of stayers in MNEs, DM_{ij} is a dummy equal to 1 if worker i of plant j moves to a MNE in the future,

[28]One possible explanation is that the MNEs may be actively seeking to attract good workers from non-MNEs as a form of technology sourcing.

while DN_{ij} equals 1 if the worker moves to a non-MNE in the future.[29] The results, presented in the first two columns of Table 3.11, indicate that future movers to non-MNEs, are paid no differently than their fellow workers who will stay in the plant. By contrast, workers who move to other MNEs in the future earn a premium of about 1,5%. There is no difference in the results from OLS and fixed effects between Columns 1 and 2. The lack of difference between the OLS and fixed effect results indicates that the wage premium for movers from MNEs to other MNEs is not caused by these movers coming from high-wage MNEs.

Table 3.11: Before moving: Wages of movers vs stayers in old plant

	Movers from MNEs		Movers from non-MNEs	
Movers to non-MNEs	-.006	.000	.003	-.003
	(.004)	(.004)	(.002)	(.003)
Movers to MNEs	.015*	.015*	.029*	.012*
	(.003)	(.003)	(.004)	(.004)
N	335,017	335,017	581,784	581,784
R-sq.	.42	.48	.34	.48
	OLS	Plant-FE	OLS	Plant-FE

Notes: Regressions include year and 28 industry dummies. Variables for plant and individual characteristics are the same as indicated in the note to Table 3.3. *= significant at 1 percent level. Standard errors clustered on individuals in parentheses.

I next use equation (3.3) to compare the wages of movers from non-MNEs before moving to wages of stayers in non-MNEs, and the results are presented in the last two columns of Table 3.11. Movers from non-MNEs to other non-MNEs are not paid differently from their fellow workers before moving, while movers from non-MNEs to MNEs receive a wage premium compared to stayers in non-MNEs. This wage premium is 2.9% with OLS estimation, but falls to 1,2% when taking account of plant fixed effects, thus part of the wage premium found with OLS estimation is due to MNEs recruiting from high-wage local plants.[30] In terms of the potential for knowledge diffusion, the evidence of a wage pre-

[29] Martins (2006) only considers movers from foreign to domestic firms and therefore uses only one dummy.

[30] All regressions in Table 3.11 require the movers to be observed in their old plant 3 years before moving, and the appropriate dummy applies for all these three years. (Similar results are obtained if the dummy only applies the last year before moving.) In addition, I only include movers that are observed moving in the indicated direction once during the period 1990-2000. For the stayers, I include only individuals that never change plant within manufacturing, and require that they are observed at least 5 years. Thus the wage regressions compare movers that were 'relatively stable' before moving to stayers that are 'relatively

mium for future movers from non-MNEs to MNEs points more in the direction of MNEs being better placed to benefit from mobility spillovers, since they are able to select better workers.

Table 3.12: After moving: Wages of movers vs stayers in new plant

	Movers to non-MNEs		Movers to MNEs	
Tenure from:				
MNE, <1 y.	.026*	.010	-.010	-.009
	(.007)	(.006)	(.006)	(.006)
MNE, ∈(1,3 y.)	.048*	.038*	.028*	.028*
	(.006)	(.006)	(.005)	(.006)
MNE, >3 y.	.059*	.048*	.051*	.036*
	(.005)	(.006)	(.004)	(.005)
Non-MNE, <1 y.	.009	-.007	-.019*	-.021*
	(.004)	(.004)	(.005)	(.005)
Non-MNE, ∈(1,3 y.)	.030*	.014*	-.001	.003
	(.004)	(.004)	(.006)	(.006)
Non-MNE, >3 y.	.026*	.020*	-.027*	-.01
	(.003)	(.003)	(.005)	(.006)
N	592,856	592,856	345,725	345,725
R-sq.	.34	.47	.42	.49
	OLS	Plant-FE	OLS	Plant-FE

Notes: Regressions include year and 28 industry dummies. Variables for plant and individual characteristics are the same as indicated in the note to Table 3.3. *= significant at 1 percent level. Standard errors clustered on individuals in parentheses.

So far we have only seen how the movers were doing before moving, but movers may be well paid relative to similar workers in their new plants, even though they may not seem particularly selected from (or well-paid in) their old plants. I investigate this using equation (3.3), but this time comparing wages of the movers after moving to wages of stayers in the plants they are moving to. In these regressions I account for the length of tenure in the plant prior to moving by replacing the dummy DM_{ij} in equation (3.3) with three dummies; the first equal to 1 if tenure in the MNE prior to moving is less than 1 year, the second capturing tenure of 1-3 years, and the third for workers with more than 3 years of tenure in the MNE before moving. Similarly, the dummy DN_{ij} is replaced by

stable'.

three dummies to capture the length of tenure in the non-MNE before moving.

The first two columns of Table 3.12 report the results for movers to non-MNEs.[31] In the OLS results in Column 1, movers from MNEs to non-MNEs earn a wage premium relative to the stayers in non-MNEs, and the wage premium increases with the length of tenure from the MNE. In the fixed effect results of Column 2 there is no significant wage premium for movers to non-MNEs with less than 1 year of tenure from the MNE prior to moving, while the wage premium is 4.7% for workers with more than 3 years of tenure from the MNE.[32] This wage premium is more than double that of movers from other non-MNEs. Thus, even though the results in Table 3.11 indicated no particular selection of workers from MNEs to non-MNEs, these movers are clearly doing better than their colleagues in their new plant.[33] Results for movers to MNEs are presented in the last two columns of Table 3.12. For movers from non-MNEs to MNEs, no length of tenure in a non-MNE gives an additional premium over and above tenure and experience in general. Thus, while the results in Table 3.11 indicated that these workers are selected out of the non-MNEs, they are not doing better than similar workers in their new plants. The evidence on the wages of movers from non-MNEs to MNEs is not consistent with a potential for spillovers from non-MNEs to MNEs, as there is no extra effect of prior experience in non-MNEs on the earnings of movers to MNEs.

3.7 Conclusions

The evidence provided in this chapter is consistent with labour mobility from MNEs to non-MNEs working as a channel for spillovers. First, as MNEs pay higher wages than non-MNEs, this suggests that MNEs have a firm-specific advantage, and hence that there is a potential for spillovers. Second, during the 1990s an increasing share of non-MNEs employ workers with previous experience from MNEs. Third, workers with MNE experience contribute substantially to the productivity of their new plants. According to the estimates here, workers with MNE experience contribute 20-25% more to the productivity of non-MNEs than workers without such experience. Thus, mobility is clearly a channel for

[31] In a similar way as for the results in Table 3.11, the wage regressions presented in Table 3.12 are comparing movers that are 'relatively stable' after moving to stayers that are 'relatively stable'. See Footnote 30.

[32] The results in both Tables 3.11 and 3.12 are unaffected by the inclusion of interaction terms between year and 2-digit industry dummies.

[33] Similarly, Martins (2006) and Pesola (2006) find that previous tenure from foreign plants pays off after moving to domestic plants.

knowledge diffusion in Norwegian manufacturing. Fourth, it is in particular workers moving from MNEs to non-MNEs that are rewarded in terms of higher wages in their new plants. This private return to mobility is an indication that the hiring plants value the knowledge these workers bring with them, and it is consistent with the productivity effects found at the plant level.

It could be argued that the productivity premium found for workers with MNE experience is not a result of knowledge diffusion from MNEs to non-MNEs, but merely a result of better selection of workers. If MNEs are better in selecting workers to their plants than non-MNEs, the non-MNEs could use previous MNE experience as a screening device when hiring new workers. As a result, even if new workers in non-MNEs with recent MNE experience learnt nothing while employed in MNEs, the possible selection effect may be sufficient to generate a productivity premium associated with these workers. The pure selection argument implies that length of tenure in the MNE should not be important for the wage premium received by workers moving from MNEs to non-MNEs. The evidence provided in Table 3.12 indicates that length of tenure from MNEs does have an effect on the wage premium. This is not consistent with a pure selection effect, but is consistent with learning over time in MNEs and knowledge diffusion through labour mobility from MNEs to non-MNEs.

The wage premium for movers from MNEs to non-MNEs with more than 3 years of experience from MNEs is almost 5% compared to stayers in non-MNEs with similar characteristics. This 5% wage premium is far less than the 20-25% productivity premium these workers have relative to workers without MNE experience in non-MNEs. The difference between the wage premium and the productivity effect suggests that the hiring non-MNEs do not fully pay for the value of the workers to the firm, and thus labour mobility from MNEs to non-MNEs seems to be a source of knowledge externality in Norwegian manufacturing.

3.A Appendix

Definition of variables used in the production function: Equation (3.2) in Section 3.5.

L_{it} Number of person hours in the plant. Rented labour hours are calculated from the costs of rented labour using the calculated average wage for own employees. Since only blue-collar hours are reported prior to 1983, and only total hours from 1983, total hours before 1983 are estimated by using information on the blue-collar share of the total wage bill.

K_{it} The estimate of capital services uses 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. The rate of return to capital is taken to be 0.07. The values for depreciation rates and the rate of return to capital are also used by Salvanes and Førre (2003) using the same data. 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, these values are smoothed using the perpetual inventory method. Fire insurance values are not recorded after 1995, thus from 1996 capital values are estimated by adding investments and taking account of depreciation. Where possible, I also use estimates of firm level capital values (distributed to the plant level according to employment shares) as starting values for plants with entry after 1995. These capital values are obtained from recent work to improve on capital estimates in Norwegian manufacturing, see Raknerud et al. (2003). Separate price deflators for inputs and output and for investment in buildings and machinery are obtained from Statistics Norway. The aggregation level for the price deflators is according to the sector classification used in the National Accounts, which is somewhere in 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, I subtract these and allocate them to the labour and capital measures respectively.

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

The total factor productivity (TFP) index used in Row 9 of Table 3.9 is calculated at the plant level as

$$\ln TFP_{it} = \ln Y_{it} - \alpha_t^K \ln K_{it} - \alpha_t^L \ln L_{it} - \alpha_t^M \ln M_{it}, \tag{3.4}$$

where the α_t^z's are the 5-digit means of cost shares of each factor z relative to output Y_{it}.

Chapter 4

The contribution of foreign entrants to employment and productivity growth

- joint with Stefanie A. Haller*

Abstract

We compare employment and productivity dynamics in foreign and domestic entrants, exitors, survivors and acquisitions in Norwegian manufacturing from 1979 to 2000. On average all types of foreign plants are more productive than their domestic counterparts. There is more gross job reallocation in domestic than in foreign plants. Contrary to common beliefs, foreign owners do not acquire highly productive domestic plants in order to lay off their employees. Instead they tend to reverse a negative trend in productivity and employment in the acquired plants. Moreover, during the 1992-97 expansion all foreign plants taken together accounted for 61% of productivity growth with a market share of only 38%.

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4.1 Introduction

It is recognised that the presence of foreign firms in a host country may affect the performance of domestic firms indirectly through knowledge spillovers, for a survey see Görg and Greenaway (2004). However, the direct effect which foreign entry has of bringing about a change in the composition of firms in the host country is less studied. As foreign firms tend to be larger and more productive than domestic firms[1], a rise in the share of foreign firms in a host country may increase aggregate productivity even without any spillovers taking place. At the same time, foreign firms also become actors in the local input markets. While they may not rely on the local capital market and intermediate input markets to the same extent as domestic firms, they usually source labour locally. On the one hand, this may increase demand for labour if foreign entrepreneurs set up new plants. On the other hand, however, foreign acquisitions are often associated with the fear of job loss as the new owners are expected to review and reorganise existing structures under efficiency considerations. Moreover, jobs in foreign-owned plants are frequently perceived to be less secure as it may be easier for multinational companies than for purely domestic firms to shift production or other activities between locations in different countries.[2]

Our goal in this chapter is to examine to what extent productivity and employment dynamics go hand in hand in the Norwegian manufacturing sector between 1979 and 2000. We distinguish between domestic and foreign exitors, survivors and entrants and focus in particular on foreign entry by acquisition. Our analysis employs tools from two literatures and extends them to include foreign acquisitions and divestures. We look at job reallocation using the methodology pioneered by Davis and Haltiwanger (1992). Their approach counts jobs created and jobs destroyed separately, and also accounts for the role of entry in job creation and the role of exit in job destruction. We examine productivity dynamics using the Haltiwanger (1997) decomposition. This method attributes the contributions to productivity growth to surviving, entering and exiting firms.

Distinguishing between foreign and domestic firms in productivity decompositions has confirmed that the contribution of foreign firms to aggregate productivity growth is substantial (Okamoto and Sjöholm (2005) for Indonesia, De Backer and Sleuwaegen (2003) for

[1]See Barba Navaretti and Venables (2004) for a survey of the empirical evidence on the performance of foreign versus domestic firms in a host country.

[2]Fabbri et al. (2003) investigate how the increase in multinational presence in the US and the UK affects labour demand elasticities, based on the argument that global production networks make it easier to transfer production activities across borders. They find an increase in demand elasticities for less-skilled labour parallel with an increase in multinational activity in these countries.

Belgium and Altomonte and Colantone (2005) for Romania). The productivity-employment-link for foreign and domestic firms, in contrast, has not yet received much attention. Baily et al. (1994) look at the connection between changes in labour productivity and employment levels in US manufacturing plants during the 1980s. De Loecker and Konings (2004) combine productivity decomposition and employment reallocation methods to examine the net entry process in Slovenia during the transition from a socialist to a market economy. These studies do not distinguish between foreign and domestic plants. Görg and Strobl (2005b) study employment dynamics in foreign and domestic firms in Ireland, but do not consider the connection to productivity. In addition, they do not account for foreign acquisitions, as most of the foreign entry in Ireland has come through greenfield entry.

As acquisition is the main mode of foreign entry into Norwegian manufacturing, we focus on acquired plants as a separate group in our analysis. This is an interesting exercise because productivity and employment dynamics are likely to develop quite differently in the two types of foreign entrants. While both greenfield and acquisition entrants would be associated with higher levels of productivity than domestic entrants at the time of entry, their employment and productivity growth dynamics may evolve differently. Greenfield entrants will contribute positively to productivity growth just by entering, moreover net job creation is likely to be positive in the first year or two. For foreign acquirers, in contrast, it may take time to transfer a productivity advantage to the local target firm and this process may be associated with job losses.

We find that on average all types of foreign plants have higher levels of productivity than their domestic counterparts. On the contrary, gross job reallocation is lower in foreign plants. Foreign entrants perform better than domestic entrants the first four years after entry in terms of both productivity levels and productivity growth. In line with results from other countries, we find that most of the productivity growth in Norwegian manufacturing is generated within surviving plants, both domestic and foreign, with foreign survivors having higher productivity growth than domestic survivors. Our results show that the contribution to productivity growth from foreign plants increased by more than the market share of foreign plants from the expansion period during the 1980s (1982-1987) to the next expansion period from 1992 to 1997. The market share of foreign plants increased from 8% in 1982-1987 to 38% in the period 1992-1997, while the total share of productivity growth attributed to foreign plants increased from 6% in 82-87 to 61% in 92-97. The process of entry and exit of plants accounted for around 10% of productivity growth in both periods, while at the same time causing net job destruction, primarily due to domestic exitors.

Almost half the growth contribution from foreign plants in 1992-97 stems from plants acquired by foreign owners during this period. This is surprising, given that our analysis shows that in the two years prior to a foreign takeover, the domestic plants concerned have on average negative productivity growth and are less productive than other domestic surviving plants. On average these plants also reduce employment before foreign takeover. For the average acquired plant this process is reversed in the year of the ownership change and continues for the next two years. Thus, our analysis suggests that foreign owners do not acquire highly productive domestic plants in order to strip their assets and lay off their employees, but rather turn domestic plants of average performance into highly successful plants in terms of both productivity growth and employment creation.

The remainder of this chapter is structured as follows. In Section 4.2 we describe data sources and define entry, exit and foreign ownership. This section also gives an overview of the development of foreign ownership and foreign entry in Norwegian manufacturing. Section 4.3 gives an overview of productivity and employment dynamics in domestic and foreign entering, exiting, surviving and acquired plants over the two decades. It also examines the plants' performance around crucial events such as acquisitions, entry and exit. Section 4.4 presents the decomposition of total factor productivity growth into the contributions from foreign and domestic entrants, survivors and exitors. In addition, it compares the contributions of the different groups of plants to productivity growth and employment creation. Section 4.5 briefly concludes.

4.2 Data

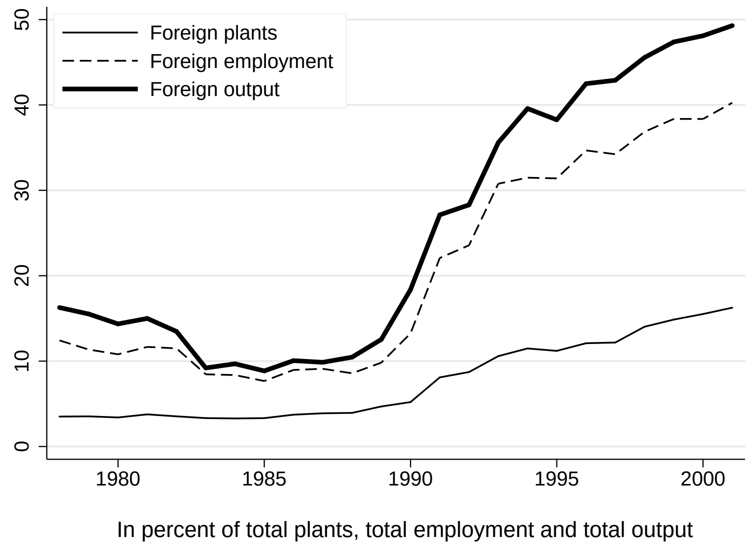
Our main data source is the annual census of all Norwegian manufacturing plants collected by Statistics Norway. The Norwegian Manufacturing Statistics are collected at the plant level, where the plant is defined as a functional unit at a single physical location, engaged mainly in activities within a specific activity group. The plant-level variables include detailed information on production, input use, location, and industry classification.[3]

Plants are classified into three ownership classes; plants that are part of firms where less than 20%, between 20-50%, or more than 50% of equity is foreign owned. Before 1990 only direct foreign ownership is recorded, while from 1990 onwards also indirect foreign

[3]For more detailed descriptions of the Manufacturing Statistics, see the documentation in Halvorsen et al. (1991) and Møen (2004).

ownership is documented.[4] We classify plants as foreign owned when either direct or indirect foreign ownership of equity is above the 20% threshold. As the indirectly foreign-owned plants are more similar to the directly foreign-owned plants than to the domestic plants in terms of mean size, we prefer to include them with the foreign-owned plants. Figure 4.1 illustrates the development of foreign ownership in our sample. It shows a dramatic increase in foreign presence during the 1990s, which is a combination of a trend increase in foreign ownership as well as a result of the extended definition and recording of foreign ownership. The extended definition of foreign ownership after 1990 means that the share of foreign ownership during the 1980s and early 1990s is underestimated and, hence, also the role of foreign plants in productivity and employment dynamics. It is difficult to assess the extent of underestimation, as the role of indirect ownership relative to direct ownership also increased during the 1990s.

Figure 4.1: Foreign presence in Norwegian manufacturing



The extent of foreign ownership in Norway is comparable to, if not larger than, in neighbouring Sweden and Finland. In Swedish manufacturing the share of employment in

[4] The foreign ownership variables are obtained from the SIFON register; a register of foreign ownership interests in Norway. For further details see Chapter 2. A firm has direct foreign ownership interests if foreigners own part of the equity of the firm. If 50% or more of equity in a plant is owned by another firm based in Norway (mother), and the mother is foreign-owned, this is defined as indirect foreign ownership in the SIFON-register.

foreign-owned firms increased from 17% in 1990 to 27% in 2000 (Karpathy and Lundberg, 2004), while Finland saw an increase from 6% to 22% in the same period (Huttunen, 2005). It is not clear whether the definitions of foreign ownership in the mentioned studies include indirect foreign ownership. The share of employment in foreign-owned firms in Norwegian manufacturing increased from 13 % in 1990 to 38 % in 2000; when excluding indirect foreign ownership the respective shares are 9 % and 16 %.

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

When defining entry and exit our main concern 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 a plant is not in operation if it is not observed in the census, we assume that when a plant is missing from the census for one or two consecutive years, this is due to lack of registration rather than a temporary closure. When a plant disappears for three or more consecutive years before it reappears in the census, we regard it 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 an entrant in year t if it appears for the first time in year t, or reappears in that year 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.[5] Plants that in year t have foreign ownership of equity above 20%, while this was below 20% in year $t-k$ are called foreign acquisitions. Instead, foreign divestures are those plants with a decrease in foreign ownership from above 20% in $t-k$ to below 20% in year t.

Plants with less than 8 employees throughout their lives, and observations of plants not in ordinary production (service units or plants under construction) are excluded from the analysis.[6] Further, we drop plants with missing information on inputs or output for

[5] Less than 2.5% of the plants in the sample have what we define as temporary closures.

[6] In addition, we drop plants that in the Norwegian Manufacturing statistics are classified as 'small' (defined as having less than 5 or 10 employees) throughout their life. The information for these plants comes mainly from administrative registers and is therefore less extensive than for large plants.

Table 4.1: Total employment, plant size and plant numbers by ownership

	1980	1985	1990	1995	2000	Mean
Total empl domestic	293,450	266,345	215,665	163,443	140,272	216,951
Total empl foreign	35,528	22,119	32,932	74,323	87,006	50,593
Mean size domestic	42.4	39.9	36.3	33.1	33.1	36.6
Mean size foreign	145.6	96.2	101.0	120.2	112.0	114.7
Domestic plants	6,925	6,681	5,936	4,949	4,243	5,839
Foreign plants	244	230	326	618	777	437
of which						
-Domestic entry	153	185	174	143	9	157
-Foreign entry	7	1	12	13	1	10
-Domestic exit	169	232	304	251	173	247
-Foreign exit	4	4	13	24	19	16
-Foreign divesture	24	16	36	63	7	27
-Foreign acquisition	14	23	63	59	35	57

80% or more of their life. Our resulting sample contains 138 000 observations from 10,200 plants. The cleaning procedure has only minor effects on average plant size, the share of foreign plants and industry composition.

Table 4.1 shows the number of foreign and domestic manufacturing plants in our sample for 5-year intervals. Over the period the number of foreign plants more than triples while domestic plants are reduced in numbers. Foreign firms have on average 3-4 times as many employees as domestic firms. While total employment in foreign-owned plants has more than doubled, employment in domestic plants in 2000 is about half of that in 1980. The lower part of Table 4.1 shows the total number of foreign and domestic entrants each year as well as the number of acquisitions. Acquisition is the main mode of foreign entry into Norwegian manufacturing, with an annual average of 57 acquisitions against 10 greenfield entries per year.

4.3 Evolution of employment and productivity

4.3.1 Employment

In order to get an overview of the possible differences with respect to job creation and job destruction between domestic and foreign plants, we look at employment dynamics over the period from 1979 to 2000. We measure job flows following Davis and Haltiwanger (1992). Job creation at time t equals employment gains summed over all plants that expand or start up between $t-1$ and t, with ΔN_{it}^{+} representing the plant level employment gain from $t-1$ to t. Similarly, job destruction at time t equals employment losses summed over all plants that contract or exit between $t-1$ and t, with ΔN_{it}^{-} representing the plant level employment loss from $t-1$ to t. The sum of job creation and job destruction is referred to as gross job reallocation, while the difference gives net employment creation. In order to obtain job creation and job destruction rates, we divide by the size of the group, defined as the average of employment in $t-1$ and t. We consider foreign and domestic survivors, foreign acquisitions and foreign divestures as separate groups. Hence, job creation and destruction rates for group h at time t can be written as

$$JC_{ht} = \frac{\sum_{i\epsilon I_{ht}} \Delta N_{it}^{+}}{N_{ht}} \quad \text{and} \quad JD_{ht} = \frac{\sum_{i\epsilon I_{ht}} \Delta N_{it}^{-}}{N_{ht}},$$

where I is the set of plants in group h at time t, and group size is $N_{ht} = (\sum_{i\epsilon I_{ht}} N_{it} + \sum_{j\epsilon I_{h,t-1}} N_{j,t-1})/2$.

Table 4.2 presents annual job creation and destruction rates for different groups of foreign and domestic plants. The job creation and job destruction rates include the contributions from entry and exit, respectively. We also report the contribution to job creation by domestic and foreign entrants and the contribution to job destruction by domestic and foreign exit separately. The columns for foreign acquisitions and foreign divestures show job creation and job destruction rates in the year of the ownership change. Overall, the job creation and destruction rates for domestic plants in Table 4.2 are very similar to what Klette and Mathiassen (1996) found when using the entire Norwegian manufacturing census from 1977 to 1986.[7] This suggests that leaving out the very small plants as we have done does not affect the job reallocation rates much. Gross job reallocation in Norwegian

[7] A related study on job reallocation in Norway is by Salvanes and Førre (2003) who use linked employer-employee data to provide evidence on job creation and destruction for different educational groups in Norwegian manufacturing. In addition, Salvanes (1997) looks at the impact of product and labour market rigidities on job reallocation rates comparing seven OECD countries, including Norway and the US.

Table 4.2: Employment dynamics

	Domestic plants				Foreign plants				Foreign divestures		Foreign acquisitions	
Year	JC	Entry	JD	Exit	JC	Entry	JD	Exit	JC	JD	JC	JD
1980	6.41	0.71	6.57	0.91	4.28	0.42	2.76	0.29	5.49	7.99	11.96	3.60
1981	6.26	0.99	7.85	1.32	2.38	0.01	4.45	0.25	2.37	41.42	14.52	5.05
1982	4.19	0.53	8.03	1.27	3.08	0.03	5.26	0.87	2.91	10.23	7.92	4.52
1983	5.30	0.98	12.18	2.25	4.63	1.42	8.07	1.98	0.77	7.03	5.32	12.18
1984	6.82	0.82	8.21	2.04	3.55	0.15	7.01	1.44	7.60	3.32	6.32	11.67
1985	7.48	0.98	7.15	1.43	5.55	0.05	6.31	2.15	4.96	6.15	12.93	5.93
1986	8.07	0.93	8.34	2.44	7.00	0.50	4.31	0.50	5.11	4.22	7.73	5.76
1987	7.01	1.13	7.65	2.05	8.43	1.79	5.99	0.47	0.42	8.96	8.25	9.73
1989	6.17	1.19	12.15	2.53	4.01	0.91	11.98	1.16	4.30	16.10	4.11	8.69
1990	8.41	1.82	9.29	2.28	4.63	0.89	12.66	1.00	14.58	6.33	1.78	9.66
1991	7.24	1.90	8.87	2.18	3.82	1.60	13.07	3.84	1.91	15.72	8.54	5.09
1992	5.98	1.01	9.12	1.68	6.80	1.31	10.66	4.03	40.83	4.06	7.26	11.07
1993	8.21	1.89	13.96	8.32	6.21	0.84	8.54	3.49	5.56	39.26	10.03	3.62
1994	8.84	1.01	5.40	0.89	7.53	2.74	6.15	1.35	1.75	5.74	4.91	4.33
1995	9.34	1.61	6.39	1.87	7.71	1.32	5.67	0.92	9.75	2.59	5.39	2.98
1996	8.29	1.09	7.96	2.99	7.12	1.27	5.33	2.06	7.13	5.94	11.52	2.96
1997	10.76	2.24	7.25	2.14	5.82	1.19	4.95	0.99	7.65	6.52	10.47	3.23
1998	9.92	1.95	10.33	4.39	6.03	1.45	5.18	1.07	7.03	11.49	8.84	7.71
1999	8.15	1.91	9.94	2.42	7.40	1.28	9.88	2.86	0.00	83.49	10.80	4.31
2000	5.73	0.10	12.05	4.10	6.10	0.01	12.66	1.75	4.17	10.47	7.41	15.26
Mean	7.43	1.24	8.93	2.48	5.60	0.96	7.54	1.62	6.71	14.85	8.30	6.87
Std. Dev.	1.63	0.56	2.24	1.64	1.72	0.72	3.20	1.15	8.76	19.34	3.19	3.64

1988 omitted due to missing information on foreign ownership for this year manufacturing is somewhat lower than what Davis and Haltiwanger (1992) find for US manufacturing. In line with previous studies of job reallocation (e.g. Davis and Haltiwanger, 1999), there is a clear business cycle component to gross job reallocation: during the downturn of the economy between 1989 and 1992, job destruction rates in all types of plants are substantially above average.

Table 4.2 reveals some differences between foreign and domestic plants. Both job creation and job destruction rates are mostly higher in domestic than in foreign-owned plants. As a result, the mean gross job reallocation rate over the two decades is higher for domestic plants (16.36%) than for foreign plants (13.14%). Over the period from 1980 to 2000 there is overall job destruction, which is in line with the decline in manufacturing employment as seen in Table 4.1. When looking at job creation and job destruction in plants that undergo a change in ownership, in most years foreign acquisitions generate more employment than they destroy. On average there is also more job creation and less job destruction in the year of foreign acquisition than is the case for continuing foreign plants. However, the volatility of job creation and destruction in acquisitions is much higher than in plants that do not change owner. Foreign divestures seem to destroy more jobs than they create, but the mean number of foreign divestures per year is less than half that of foreign acquisitions and varies substantially over time (cf. Table 4.1). Thus, the volatility in job creation and job destruction rates for foreign divestures is also very high.

Grouping the results for all manufacturing sectors together may hide differences in job creation and destruction rates in the different sectors as well as differences between foreign and domestic plants. To investigate this we calculate the numbers in Table 4.2 separately for nine 2-digit sectors, and present the resulting means of annual values in Table 4.8 in the Appendix. With the exceptions of the wood and paper sectors, job reallocation is smaller in foreign than in domestic plants as is the case in the aggregate dynamics. Similar to Table 4.2, in six of the nine sectors in Table 4.8, plants that are acquired by foreign owners tend to increase employment rather than to reduce their workforce, while foreign divestures on average are associated with net job destruction in eight of the nine sectors.

4.3.2 Productivity

We now turn to examining productivity dynamics in our different groups of plants. Plant heterogeneity has been identified as the main driver of within-industry reallocation of productivity. Changes in aggregate productivity are brought about by a combination of expansion and contraction within heterogenous plants, by market share reallocation between plants, and by entry and exit. A substantial empirical literature that decomposes productivity growth into the contributions of surviving, entering and exiting firms has confirmed the importance of this reallocation process for aggregate productivity dynamics, see Bartelsman and Doms (2000) for a survey.

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

$$\ln TFP_{it} = \ln Y_{it} - \alpha_t^K \ln K_{it} - \alpha_t^H \ln H_{it} - \alpha_t^M \ln M_{it}, \tag{4.1}$$

where Y_{it} is deflated plant output, measured as gross production value net of sales taxes and subsidies. H_{it} is the number of person hours in the plant.[8] 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. M_{it} is the 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. Rented labour hours are calculated from the costs of rented labour using the calculated average wage for own employees. The details of the construction of our estimate of capital services K_{it} can be found in the Appendix. 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, which is somewhere in between the 2- and 3-digit ISIC level. In equation 4.1 the α_t^z's are the 3-digit means of cost shares of each factor z relative to output Y_{it}. We impose constant returns to scale.[9]

Using this plant level TFP index, we calculate mean productivity in each 3-digit sector for entrants, exitors, survivors and acquisitions as well as the deviation in mean productivity of all groups from domestic survivors in each sector. Table 4.3 presents the averages of annual values for the periods 1980 to 1989 and 1990 to 2000.[10] The table shows foreign survivors to be significantly more productive than domestic survivors in both periods. Foreign entrants have higher productivity than domestic survivors as well, though this dif-

[8] A similar TFP measure is also used in the productivity decompositions by Foster et al. (2001), Disney et al. (2003), and Møen (1998).

[9] Klette (1999) estimated scale parameters for different sectors of Norwegian manufacturing, and concluded that constant returns to scale could not be rejected.

[10] Using labour productivity as an alternative measure yields a very similar picture for Table 4.3. However, the labour productivity differences between foreign and domestic plants are much larger than differences in terms of TFP, reflecting the fact that foreign plants are larger and more capital intensive than domestic plants.

ference is not significant. In contrast, domestic entrants have lower levels of productivity than domestic survivors. This may be surprising; however, recent research with output prices available demonstrates that entrants have higher physical productivity levels than incumbents but charge lower prices, hence, their revenue based productivity advantage (as measured here) is much less pronounced (Foster et al., 2005).[11] Plants that exit have lower productivity than domestic survivors, though this productivity deviation is not significant for foreign exitors. Both foreign acquisitions and divestures have on average higher productivity than domestic survivors in the year after the ownership change, although the difference is significant only in the 1990s.

Table 4.3: Deviation from productivity of domestic survivors

	1980s		1990s	
	Obs.	TFP	Obs.	TFP
Domestic survivors	60,815	0.0	50,131	0.0
Foreign survivors	2,044	6.0*	5,422	5.0*
Foreign divestures	184	2.9	369	4.8*
Foreign acquisitions	268	3.1	944	5.6*
Domestic entrants	1,652	-4.5*	1,434	-0.1
Foreign entrants	54	4.7	150	3.4
Domestic exitors	2,567	-13.2*	2,505	-11.0*
Foreign exitors	86	-8.5	259	-0.1

* indicates significant difference from domestic survivors at the 5% level

In Table 4.3 the productivity levels of entrants, exitors, and plants that change ownership represent only a single year for each plant. Foreign acquisitions are more productive the year after ownership change than domestic survivors, but we cannot tell whether this is due to the acquisition of high productivity domestic plants, or whether the ownership change has induced an improvement in productivity. In order to look more closely at the development of productivity around the time of ownership change, we follow plants from two years before a change in ownership until two years after the ownership change. The upper panel of Table 4.4 shows year-on-year TFP growth and the deviation in productivity

[11] The productivity of entrants is calculated the first year we observe the plant. For small plants, the first year may be more subject to data problems. If we calculate the productivity of entrants the second year, domestic entrants no longer have lower productivity than domestic survivors. We then get a TFP deviation for domestic entrants of -0.2 in the 1980s and 0.7 in the 1990s.

from domestic survivors for foreign acquisitions and foreign divestures. We also present the figures for job creation, job destruction and net employment flows.[12]

Plants that are acquired by foreign owners do not seem to perform exceptionally well before takeover. In the two years before domestic plants are taken over by foreign owners, they have on average negative productivity growth and are less productive than other domestic surviving plants. On average these plants also reduce employment before foreign takeover.[13] For the average acquired plant this process is reversed in the year of the ownership change and continues over the next two years with productivity increases and net employment creation.[14] For foreign divestures, the trends in productivity and employment before and after a domestic takeover are not as clear as in the case of foreign acquisitions.

In addition to ownership changes, Table 4.4 also includes productivity and employment dynamics in entrants and exitors. We follow entrants for 4 years after entry, and exitors for 4 years before exit, and include only plants that do not change ownership during the tracking period. Employment dynamics in entrants is very similar to that presented for US manufacturing plants in Davis and Haltiwanger (1992). Entrants have large net job creation rates the first years after entry, and then job creation falls as the plants get older. During the first four years of operation net employment creation is smaller in foreign than in domestic entrants. With the exception of the second year after entry, foreign entrants impress with their performance in productivity growth and productivity levels relative to domestic survivors. Overall, they seem to perform better in terms of productivity than domestic entrants the first four years after entry. Foreign and domestic exits perform similarly, their productivity deteriorates before exit and they reduce employment before closing down. Foreign plants seem to close down at higher productivity levels than domestic plants since their productivity levels are closer to that of the domestic survivors than is the case for domestic exitors (cf. the TFP-Dev. columns).

[12]The results are based on selecting plants that undergo one ownership change during the five year period, and with entry more than 2 years before and exit more than 2 years after the ownership change. Around 10% of ownership changes end in plant exit within 2 years after the ownership change. This share is the same for foreign acquisitions and foreign divestures.

[13]Note that also 5 to 3 years before a foreign takeover these plants show negative or small productivity growth, minor deviations in productivity from domestic survivors and, with the exception of year 5 before the acquisition, net job destruction. Hence the poor performance of these plants in the two years prior to the ownership change cannot only be attributed to possible insecurity in the expectation of a takeover.

[14]When estimating employment effects of foreign acquisitions, Girma and Görg (2004) find some evidence that takeovers reduce employment growth in the UK electronics industry.

Table 4.4: Productivity and employment dynamics in entrants, exitors and acquisitions

	TFP		Employment			TFP		Employment		
Age	Δ	Dev	JC	JD	Net	Δ	Dev	JC	JD	Net
	Foreign acquisitions					Foreign divestures				
-2	-0.5	-1.1	6.3	8.4	-2.1	-1.5	-0.5	8.0	5.1	2.9
-1	-2.6	-1.0	5.7	11.7	-6.1	1.5	0.6	10.7	7.9	2.9
0	2.5	2.9	9.5	8.3	1.2	1.5	2.6	6.1	34.6	-28.5
1	1.6	3.5	8.9	6.0	2.9	-5.9	-0.2	24.7	19.8	4.9
2	0.2	2.5	7.8	5.9	1.9	5.5	6.8	10.1	16.5	-6.3
	Foreign entry					Domestic entry				
1	6.7	10.7	24.1	10.9	13.2	4.0	0.8	31.3	6.7	24.7
2	-10.9	-4.0	17.7	5.5	12.2	1.5	2.5	17.1	8.0	9.1
3	9.4	5.6	10.6	9.5	1.1	-0.6	1.9	13.9	8.6	5.3
4	4.8	11.2	10.5	12.7	-2.2	-0.8	2.2	13.4	7.8	5.6
	Foreign exit					Domestic exit				
-3	4.1	5.1	8.3	8.2	0.1	-1.0	-3.2	7.2	10.7	-3.5
-2	-10.2	-2.9	3.7	12.8	-9.1	-1.2	-5.0	8.1	9.9	-1.9
-1	-1.2	-5.5	10.0	11.1	-1.1	-1.3	-5.7	8.1	12.7	-4.6
0	1.0	-2.5	12.0	31.4	-19.4	-5.9	-11.6	6.2	26.4	-20.1

Figures are averages of annual values from 1980-2000.

Δ = Growth rate from $t-1$ to t, Dev = Difference from TFP level of domestic survivors in year t.

4.4 Contributions to aggregate productivity growth and employment creation

So far we have seen that foreign-owned plants are generally more productive than domestic plants. In order to assess the contribution of foreign plants to aggregate productivity growth in Norwegian manufacturing, we continue with a decomposition of productivity growth. Decompositions of productivity are a common method to analyse the sources of aggregate productivity growth at the industry level. The method calculates the contributions to productivity growth coming from changes within and between existing plants in addition to entry and exit.

Different methods to decompose productivity growth have been proposed by Baily et al. (1992), Griliches and Regev (1995), Olley and Pakes (1996) and Haltiwanger (1997). We use the decomposition proposed by Haltiwanger (1997). This approach tracks changes in productivity relative to a reference point (i.e. industry averages) and is therefore straightforward to interpret.[15] The decomposition starts from an index of industry level productivity

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

where P_t is the index of aggregate industry productivity in year t, θ_{it} is the output 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 described in equation (4.1), with the cost shares α_t^z replaced by the average of year t and $t-k$. According to Haltiwanger (1997) the change in industry productivity between period t and $t-k$ can then be decomposed in the following way

$$\begin{aligned}\Delta P_t = &\sum_{i\epsilon S,A} \theta_{i,t-k} \Delta p_{it} + \sum_{i\epsilon S,A} \Delta\theta_{it} \left(p_{i,t-k} - P_{t-k}\right) + \sum_{i\epsilon S,A} \Delta\theta_{it} \Delta p_{it} \\ &+ \sum_{i\epsilon N} \theta_{it} \left(p_{it} - P_{t-k}\right) - \sum_{i\epsilon X} \theta_{i,t-k} \left(p_{i,t-k} - P_{t-k}\right),\end{aligned} \tag{4.2}$$

where S, A, N and X denote plants that survive, plants that survive and are acquired, plants that enter and exit between t and $t-k$, respectively. We take k to be 5 in the following decompositions. The first line in equation (4.2) shows the contribution to productivity growth from surviving and - in our case - acquired plants. 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). The contributions from survivors and acquisitions can be split into three parts: The first term in equation (4.2) shows the contribution to productivity growth from changes within surviving and acquired plants, the 'within' effect. The second term is the 'between' plants effect, which is positive if those plants that initially had above average TFP are the ones that gain market shares. The third term is a 'covariance' term that will be positive if plants with positive productivity growth increase their market shares or plants with negative productivity growth lose market shares. The last two terms

[15] A full discussion of the differences between alternative decomposition methods is provided in Foster et al. (2001) and in Disney et al. (2003). Petrin and Levinsohn (2005) examine the aggregation of plant-level measures of productivity growth to the economy-wide level in productivity decompositions. They also look at how productivity growth relates to welfare.

represent the contributions to productivity growth accounted for by entry and exit.

Figure 4.2: Business Cycle and TFP

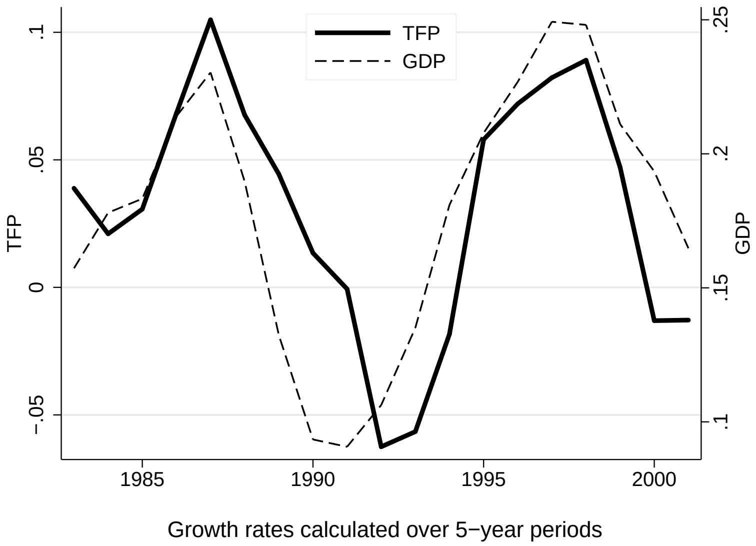


Figure 4.2 plots our measure of aggregate productivity growth from equation (4.2) against GDP growth in Norway. Productivity growth in manufacturing corresponds closely to the business cycle over the 2 decades. In order to compare two similar time periods in terms of the business cycle, we select the two periods of expansion ending at the peaks in 1987 and 1997. Thus for the decomposition of productivity growth we focus on the periods 1982-1987 and 1992-1997.

Table 4.5 shows the components of the decomposition. Entrants have market shares of around 6% in both periods. The market share of exiting plants is also rather constant at just below 10%. The big change from the boom during the 1980s to the boom during the 1990s is the increase in market shares of foreign plants, part of which is due to the inclusion of indirect foreign ownership in the 1990s. Taking foreign survivors and foreign acquisitions together, their market share increased from 8% in 1982 to 38% in 1992. In the TFP-columns of Table 4.5, the productivity of entrants in year t is compared to aggregate productivity in t-5, and we see that foreign entrants are more productive than domestic entrants and substantially more productive than the average as well.

Both domestic and foreign exitors have below average productivity, similar to the pattern in Table 4.3. Plants that experience foreign acquisitions have below average productivity before acquisition, in line with Table 4.4. From Table 4.5 also note that foreign survivors have higher productivity growth than domestic survivors.

Table 4.5: Components of the TFP decomposition

	Plants		Market share		TFP		TFP growth	
	82-87	92-97	82-87	92-97	82-87	92-97	82-87	92-97
Domestic survivors	5,327	3,971	75.24	49.29	-3.84	-7.06	4.41	1.80
Foreign survivors	122	314	5.88	23.95	-2.59	-3.72	11.55	4.87
Foreign divestures	77	90	7.08	2.63	5.20	-9.50	14.07	5.40
Foreign acquisitions	86	255	2.38	14.01	-3.10	-4.37	-1.83	6.34
Domestic entrants	849	651	5.05	4.13	2.34	-1.34		
Foreign entrants	36	84	0.62	2.10	17.99	10.52		
Domestic exitors	1,129	1,108	9.02	8.35	-10.10	-14.59		
Foreign exitors	32	114	0.39	1.77	-7.90	-11.14		

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 from 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.

Table 4.6 shows the results of the decomposition of aggregate TFP growth according to equation (4.2). As in most other TFP decompositions, productivity growth within surviving plants is the dominant driver of aggregate TFP growth. The total within effect accounts for 61% of aggregate TFP growth in the 1982-1987 period,[16] while its contribution is reduced to 43% in the 1992-1997 period. In line with their small market share, foreign plants play a negligible role in the within effect during the 1982-1987 period. Over the period 1992-1997 productivity growth in foreign survivors and foreign acquisitions accounts for 95% of the growth coming from productivity increases in surviving plants. 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;

[16] Calculated as the sum of the within entries for foreign and domestic survivors and acquisitions (4.75+0.38+1.99+0.16) divided by total TFP growth (11.87).

Table 4.6: Decomposition of TFP growth for 1982-1987 and 1992-1997

	Domestic	Foreign	Domestic	Foreign
Period	1982-1987		1992-1997	
Survivors-within	4.75	0.38	0.14	1.35
Survivors-between	-0.78	-0.15	-0.55	-0.27
Survivors-covariance	3.65	0.27	2.28	0.89
Acquisitions-within	1.99	0.16	0.00	1.34
Acquisitions-between	0.00	0.01	0.08	0.00
Acquisition-covariance	0.51	0.02	0.15	0.44
Entrants	0.72	0.10	0.22	0.30
Exitors	0.29	-0.03	0.21	-0.01
Total TFP growth	11.87		6.57	

Domestic acquisitions correspond to what we elsewhere refer to as foreign divestures.

which means that plants with positive productivity growth increase their market shares. In Table 4.6 both the entry and exit effects are positive. This indicates that the entry and exit process increases aggregate productivity growth, i.e. entrants are plants with above average productivity while plants that exit have below average productivity.

Based on table 4.6 we calculate the share of total productivity growth accounted for by each group of plants in the two periods. The results are presented in the first column of Table 4.7. In addition, Table 4.7 presents the contribution to job creation and job destruction over the two 5-year periods. From the table we see that net entry of foreign and domestic plants accounts for about 10% of TFP growth in both periods. This is slightly below a net entry effect of 14% for the US between 1982-1987 (Foster et al., 2001).[17] From 1982 to 1987 there is net job destruction in Norwegian manufacturing. 60% of the net reduction in employment is due to the exit of domestic plants destroying more jobs than the new domestic entrants create. During the boom from 1992 to 1997 there is net job creation in manufacturing. This is entirely due to job creation in surviving plants, as the process of domestic entry and exit still wipes out jobs.

In line with the small market share of 8% (cf. Table 4.5) for foreign plants in the 1982-

[17]The role of net entry or plant turnover in aggregate productivity growth is likely to be larger than what productivity decompositions suggest. The entry of new and efficient plants may increase competition and induce surviving plants to perform better. Bartelsman et al. (2004) demonstrate that plant turnover enhances productivity in surviving plants across a large number of developed and developing countries.

Table 4.7: Percentage of job creation and productivity growth due to different groups of plants

Share in	Prod. Growth	Employment Growth Net	JC	JD
		1982-1987		
Domestic Survivors	64.2	21.9	60.9	47.3
Foreign Survivors	4.2	2.3	2.5	2.5
Foreign Divestures	21.1	12.2	1.5	5.2
Foreign Acquisitions	1.6	2.9	1.7	2.1
Domestic entry/exit	8.5	60.6	30.7	41.2
Foreign entry/exit	0.6	0.0	2.7	1.7
Total growth/jobs	11.9	-27,429	51,186	-78,615
		1992-1997		
Domestic Survivors	28.5	144.3	47.7	23.7
Foreign Survivors	30.0	13.6	8.8	7.7
Foreign Divestures	3.5	9.1	3.1	1.6
Foreign Acquisitions	27.1	33.8	10.6	4.8
Domestic entry/exit	6.5	-103.7	21.5	52.7
Foreign entry/exit	4.4	2.8	8.3	9.6
Total growth/jobs	6.6	12,089	60,681	-48,592

Where numbers in the columns do not add up to 100, this is due to rounding.

1987 period, the contribution of foreign firms to both employment change and productivity growth is also small, 5-6%. During this period in the 1980s, the domestic survivors account for 64% of productivity growth and 22% of net job destruction. Ten years later the market share of foreign plants has increased to 38%, and the overall share of productivity growth attributed to foreign plants increased by even more to 61%. With respect to net job creation, the domestic survivors are by far the largest contributors to employment growth, but also plants that are acquired by foreign owners are substantial contributors to employment growth.

4.5 Conclusions

In this chapter we analyse employment and productivity dynamics in foreign and domestic plants over two decades. In addition to the standard treatment of entrants, survivors and exitors, we also consider foreign acquisitions and foreign divestures as additional groups. The presence of foreign ownership in Norwegian manufacturing increased substantially from the 1980s to the 1990s. All types of foreign plants are on average more productive than their domestic counterparts. Thus, along with the increase in market shares of foreign-owned plants, their contribution to productivity growth and employment dynamics also increased. We find that both job creation rates and job destruction rates are larger in domestic than in foreign plants. Plants that are acquired by foreign owners create more jobs than they destroy in the year of acquisition, while the opposite seems to be the case for plants where foreigners reduce their ownership interests.

We compare two 5-year periods at similar points of the business cycle, and find that the contribution of entry and exit of plants accounted for about 10% of aggregate manufacturing productivity growth in both the boom during the 1980s and the boom during the 1990s. In both periods the entry and exit process was associated with net employment destruction. Foreign entrants are more productive than domestic entrants, and foreign plants also seem to close down at higher productivity levels than domestic exitors.

The main mode of foreign entry into Norwegian manufacturing in the 1990s is by foreign acquisition. Foreign owners do not seem to 'cherry-pick' when targeting domestic takeover candidates. In fact, they manage to reverse a negative trend in productivity in the acquired plant and they are also likely to generate employment after the change in ownership. During the boom from 1992 to 1997, foreign surviving plants and foreign acquisitions taken together were the largest contributors to productivity growth in Norwegian manufacturing. What is more, foreign acquisitions are second only to domestic surviving plants in generating employment, and they create more jobs than foreign surviving plants. Thus, the common perception that foreign firms buy domestic firms to strip their assets and lay off their employees in order to generate productivity growth is not confirmed in this analysis.

4.A Appendix

Construction of the capital measure

K_{it}, our estimate of capital services, is constructed from 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. We take the rate of return to capital to be 0.07. The output and input definitions and values for depreciation rates and the rate of return to capital rely in large part on previous work with this data. See Chapter 2 and references therein. 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. Where possible, we also use estimates of firm level capital values (distributed to the plant level according to employment shares) as starting values for plants with entry after 1995. These capital values are obtained from recent work by Raknerud et al. (2003) to improve on capital estimates in Norwegian manufacturing.

Table 4.8: Employment dynamics by industry

	Domestic plants				Foreign plants				Foreign divestures		Foreign acquisitions		Share in employ-
Industry	JC	Entry	JD	Exit	JC	Entry	JD	Exit	JC	JD	JC	JD	ment
Food&Tobacco	7.98	1.21	8.17	1.90	5.97	1.32	8.03	1.76	5.37	10.62	11.07	7.35	17.90
Textiles	6.14	0.79	11.30	2.93	6.74	0.42	8.68	2.32	4.31	7.57	5.19	15.26	4.11
Wood	6.53	0.81	7.94	1.73	4.91	0.29	15.61	4.05	3.61	2.76	5.71	6.76	8.32
Paper&Printing	5.03	0.59	6.64	1.55	5.31	0.74	8.07	2.07	2.74	5.88	6.72	21.60	15.58
Chemicals	6.27	0.75	6.97	1.18	3.98	0.49	6.19	1.07	7.35	8.20	13.49	5.90	7.50
Minerals	6.59	0.99	7.77	1.20	4.58	0.78	6.64	1.09	3.69	7.73	12.07	5.97	2.98
Basic Metals	3.77	0.42	6.66	1.08	1.64	0.21	3.82	0.05	1.59	3.04	2.20	1.44	6.86
Metal Products	9.50	1.93	10.52	3.21	7.40	1.32	8.69	2.17	7.48	15.34	18.17	7.08	35.99
Miscellaneous	6.87	1.31	9.04	3.46	4.87	0.00	7.29	1.16	1.11	1.55	1.51	1.02	0.96

Figures are averages of annual values for each 2-digit ISIC sector from 1980-2000, excluding 1988.

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