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

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Abstract

We examine the contributions of foreign entrants to productivity growth as well as their impact on the productivity of local firms in a panel of Norwegian manufacturing firms. While high-productivity greenfield entrants contribute more than proportionally to productivity growth, they exert a negative effect on the productivity of domestic firms. Even without an initial productivity advantage, foreign acquired firms also contribute substantially to productivity growth. In addition, they have a positive impact on the productivity of domestic firms. This highlights the importance of considering the mode of foreign entry when analysing potential spillover effects from foreign firms.

Keywords: mode of foreign entry, productivity (growth), competition, spillover effects

JEL Classification: D24, L1, F14

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1 Introduction

Multinational enterprises (MNEs) play an increasing role in global production. The most common explanation for the emergence of MNEs is that they have some advantage over other firms which enable them to become multinational.[1] Empirical evidence confirms that foreign owned firms typically are larger, more productive, more capital- and research-intensive and pay higher wages than their domestically owned counterparts.[2] Foreign ownership of firms in a host economy can come about by greenfield entry or by foreign acquisition of assets in existing domestic firms. Greenfield entry, by adding new production capacity, may increase competition in the host market, while foreign acquisitions of host country firms may at best leave the degree of competition unchanged or even reduce competition in the short run (UNCTAD, 2000). In addition, it could be argued that knowledge externalities from foreign to domestic firms are more likely in the case of acquisitions because the domestic firms that are acquired may allready have established links with other domestic firms. Therefore, there are reasons to believe that the effect of MNEs on host country firms may depend on the mode of foreign entry.

MNEs may improve firm level performance in the host country by two main routes (Barba Navaretti and Venables (2004)). The first route is a compositional effect; if MNEs are different from domestic firms in one or more dimensions, simply increasing the share of foreign firms will change aggregate performance along those dimensions. Secondly, foreign firms may also affect the performance of domestic firms by changing their behaviour (spillover effect). Focusing on total factor productivity (TFP) as our measure of firm performance, the aim of this paper is to investigate aspects of both the compositional effect and the spillover effect for Norwegian manufacturing. We add to the current literature by considering the separate effects of greenfield entry and foreign acquisitions. To the best of our knowledge, none of the existing empirical studies of the effect of foreign direct investment on host country firms consider the possibility that greenfield investment may have a different effect on host country firms than foreign acquisitions of domestic

[1] See Markusen (1995) for a survey. In addition the new trade theory with heterogeneous firms typically predict that only the most productive firms find it profitable to establish subsidiaries abroad (Helpman et al. (2004)).

[2] Most of the existing evidence is from manufacturing. See Barba Navaretti and Venables (2004) for a survey of empirical evidence.

firms (see for instance the survey in Görg and Greenaway (2004)).[3]

We investigate the compositional effect for Norwegian manufacturing by following the strand of empirical literature that has focused on the impact of entry and exit on productivity growth through changing the composition of firms in an industry. This is done by decomposing productivity growth into the contribution from surviving firms and the contribution from entry and exit.[4] We extend the analysis of previous studies that decompose productivity growth into contributions from foreign and domestic firms by splitting the group of surviving firms not only into foreign and domestic, but also into categories for foreign acquisitions and foreign divestures. In addition, we compare the decomposition results from a 5-year period during the 1980s to the results from a period during the 1990s with similar overall productivity growth in order to document the changing contribution of foreign firms over time. In line with previous studies we find that the largest contribution to productivity growth is generated within existing plants - both domestic and foreign. Reflecting the substantial increase in foreign presence in Norwegian manufacturing from the 1980s to the 1990s, the foreign contribution to overall productivity growth increased from negligible in the 1980s to being larger than that of domestic firms in the 1993-1998 period. The contribution to TFP growth from foreign acquisitions is substantial, even though these plants are not more productive than domestic incumbents at the time of acquisition. Similar to the findings by De Backer and Sleuwaegen (2003) and Okomoto and Sjøholm (1999), foreign greenfield entrants have much higher productivity than their domestic counterparts and thus contribute substantially more to productivity growth than suggested by their market share.

A point made in several of the decomposition studies is that much of the productivity growth in surviving plants could be due to the impact of entry of

[3] Dimelis and Louri (2002) and Blomstrøm and Sjøholm (1999) ask whether the degree of foreign ownership matters for spillovers to domestic firms, while Driffield and Love (2001) ask whether the motivation for FDI matters for spillovers. Neither of these questions capture the greenfield vs. acquisition distinction.

[4] See Bartelsman et al. (2004) for a survey of decomposition methods and international comparisons of evidence. Country specific studies can be found in Baily et al. (1992), Olley and Pakes (1996) and Foster et al. (1998) for the US; Griliches and Regev (1992) for Israel; Oulton (2000), Disney et al. (2003) and Criscuolo et al. (2004) for the UK; and Møen (1998) for a previous study of Norwegian manufacturing. We are aware of only two studies that decompose productivity growth into the contributions from foreign and domestic firms, De Backer and Sleuwaegen (2003) for Belgium and Okamoto and Sjøholm (1999) for Indonesia.

new and efficient firms that increase competitive pressure (see Bartelsman et al. (2004)). This implies that the contribution of foreign firms to aggregate manufacturing performance go beyond the accounting contribution found in the decomposition of productivity growth. Studies of how competition (and thus indirectly entry) affect productivity in existing firms can be found in Nickell (1996), Olley and Pakes (1996) and Disney et al. (2003). These studies do not consider the role of foreign entry. The argument that entry may affect productivity growth in existing firms is closely related to the strand of empirical literature that considers the second route through which MNEs may affect firm level performance in the host country, namely through spillovers to domestic firms.[5]

Spillovers from foreign to domestic firms that increase the productivity of domestic firms may be due to improved technology or a change in the scale of production of domestic firms. Improvements in technology could be the result of market transactions between MNEs and domestic firms, knowledge externalities, or increased competitive pressure from MNEs. Foreign firms may affect the domestic scale of production either through competition (a market stealing effect), market transactions (demand from a domestic upstream sector) or various kinds of pecuniary externalities. With economies of scale in production, this will affect measured total factor productivity. A common approach in this literature is to estimate an augmented production function with a variable capturing the extent of foreign presence in the industry. FDI is treated as homogeneous, and it is not taken into account that different types of FDI may affect host country firms differently. A positive and significant coefficient on the foreign presence variable is taken as evidence of positive spillovers from FDI. The coefficient on foreign presence may capture knowledge externalities, pecuniary externalities and positive or negative effects of competition. The evidence of positive spillovers from foreign to domestic firms in the same industry is mixed, and lack of significance is often explained by a negative market stealing effect cancelling out any knowledge externalities (Aitken and Harrison 1999).[6]

[5]See Görg and Greenaway (2004) for a recent survey of this literature. See also Görg and Strobl (2001).

[6]Keller and Yeaple (2003) and Haskel et al. (2002) find evidence of positive productivity spillovers for the US and UK respectively, while Aitken and Harrison (1999) find negative spillovers for Venezuela. Görg and Strobl (2004) argue that even though it is hard to find positive productivity spillovers to domestic firms, this does not preclude that there may be benefits to domestic firms along other dimensions such as domestic plant survival (Görg

In this paper we argue that since the competition effect of FDI may differ between greenfield entry and foreign acquisitions, combining FDI into one measure of foreign presence is inappropriate.[7] In addition, the role foreign entrants play in the internal restructuring of surviving firms may be more important than that of domestic entrants. Thus, it seems reasonable to consider explicitly the impact entry of foreign firms have on the productivity of host country firms. Therefore our analysis complements that of Disney et al. (2003) by including foreign entry rates in the productivity-competition relationship.[8] In our econometric analysis of the effect of foreign firms in Norwegian manufacturing we differentiate between greenfield and acquisition FDI. In addition, we also depart from the current literature on spillovers by investigating the effect of foreign entry rates on productivity rather than the effect of the accumulated presence of foreign firms in each sector. Thus, we are able to capture the competition effect of foreign entry more directly than with the usual measures. Our results indicate that there is a direct effect from foreign entry on the productivity of incumbent firms which differs substantially according to the mode of foreign entry. Greenfield entry seems to be associated with a market stealing effect as it has a negative impact on the productivity of the local firms. This effect is more pronounced when considering only those firms that are Norwegian owned throughout their time in the panel. Foreign entry via acquisitions, instead, results in productivity gains for the local firms. This is suggestive of spillover effects as the foreign acquired plants should be well interlinked and integrated in the local economy.

The remainder of this paper is structured as follows. In section 2 we describe data sources, definitions of entry and exit, our cleaning procedures and present some descriptive statistics. We explain our TFP measure in section 3, while section 4 presents the decomposition of total factor productivity growth into the different contributions from foreign and domestic entrants, survivors and exitors. In section 5 we analyse the direct impact from green-

and Strobl (2003)), domestic entry rates and employment growth in domestic firms.

[7] Girma et al. (2004), investigating both horizontal and vertical spillovers for the UK, differentiate between export oriented and domestic market oriented FDI in the UK. Unfortunately our data do not contain information on exports, thus we are unable to control for the export orientation of foreign firms in Norway.

[8] Aghion et al. (2004) investigate the effect of entry on productivity growth in UK manufacturing, and their measure of entry is increase in foreign presence captured by an increase in the share of employment in foreign firms.

field entry and entry by acquisition on the productivity of the incumbent firms. Section 6 briefly concludes.

2 Data and Descriptive Statistics

2.1 The Norwegian Manufacturing Statistics

Our main data is the annual full census of all manufacturing plants in Norway collected by Statistics Norway. The Norwegian Manufacturing Statistics is collected at the plant level, where the plant is defined according to international standards as a functional unit at a single physical location, engaged mainly in activities within a specific activity group. The plant level variables include, among other things, detailed information on production, input use, investment, location, and industry classification.[9] The industry classification changed in 1996 from ISIC rev. 2 to NACE, with some change in coverage as a result. Since ISIC-codes have been imputed after 1996, we use ISIC-codes as the industry classification in our analysis.[10]

We drop plants defined as small all their life, plants with less than 8 employees all their life, and observations of plants not in ordinary production (service units or plants under construction). The resulting large plant sample contains 151 500 observations and 11 100 plants for the period 1978-2001. This is only 54% of the initial number of observations and only 33% of the initial number of plants in the full census, which indicates that small plants have a shorter life and higher entry and exit rates than large plants. In terms of employment and output, the large plant sample still contains 94% of total manufacturing output and employment. Average plant size increases from 25 employees in the full census to 43 employees in the large plant sample, and the percentage of observations with foreign ownership above 20%, increases

[9] The information for small plants comes mainly from administrative registers and is therefore less extensive than for large plants. In particular, there is no investment information for small plants, which means that we are unable to construct TFP-measures for this group. The criterion for classifying a plant as small or large has changed over time, and has also been somewhat different between sectors. The main picture is that plants with less than 5 employees were classified as small before 1992, while after 1992 the upper threshold for small plants was raised to 10 employees.

[10] For more detailed descriptions of the Manufacturing Statistics, see the documentation in Halvorsen et al. (1991), and the annual publications from Statistics Norway (Manufacturing Statistics), where the aggregate results from the census are published.

from 4,5% to 7.1%. In terms of the distribution across 2-digit ISIC sectors, the large plant sample has roughly the same distribution as the full census.

2.2 The SIFON Register

Our information about foreign ownership for the period 1990-2001 is from the SIFON-register, which is a record of foreign ownership of equity in Norwegian firms. The SIFON- register contains information about the value and share of equity held by the largest foreign owner of the firm, the total share of equity held by foreign owners and the country of the largest owner.[11] It was initiated in 1972, and recorded only direct foreign ownership before 1990, while from 1990 indirect foreign ownership was also included in the register.[12]

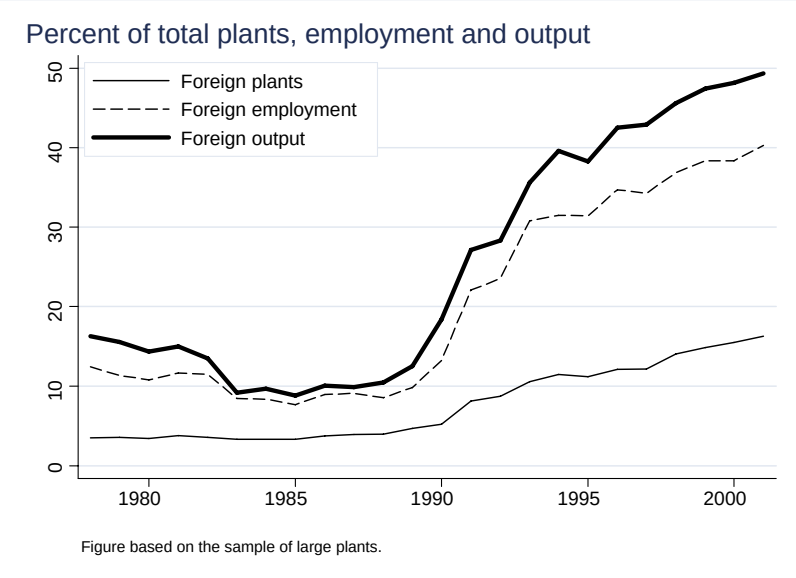
Before 1990, our information about foreign ownership is from the Manufacturing Statistics where plants are classified into three ownership classes; plants that are part of firms where less than 20%, 20-50%, or more than 50% of equity is foreign owned. Since this information is obtained from the SIFON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

It is not unlikely that the registration of indirect foreign ownership in 1990 was particularly low as this was the first year this type of foreign ownership was recorded. This is illustrated in figure 1, which shows the development of foreign ownership among large plants in Norwegian manufacturing from 1978 until 2001. Indirect and direct foreign ownership is combined after 1990, and in 1991 the curve for the share of plants that are foreign owned is shifted 3.5 percentage points upwards due to the inclusion of indirect foreign ownership. The comparable curves for employment and output are shifted upwards by 13.5 and 17 percentage points by including indirect foreign ownership in the figure. This indicates that indirectly foreign owned plants are even larger than directly foreign owned plants. The rate of increase in the number of indirectly foreign owned plants during the 1990s was higher than that of directly foreign owned plants, and by 2001 the number of indirectly foreign owned plants exceeded the number of plants with direct foreign ownership

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

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

Figure 1: Foreign presence in Norwegian manufacturing



interests. Global trends in corporate ownership structures may partly explain this shift towards indirect foreign ownership. Despite such trends, 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 1991.[13]

Comparing the extent of foreign ownership in manufacturing found in studies from different countries is not straightforward, since both the definition of foreign ownership and the sample selection criteria tend to differ between studies. Compared to neighbouring Sweden and Finland, the extent of foreign ownership in Norway seems to be larger in terms of the percent of total manufacturing employment accounted for by foreign firms. In Swedish manufacturing the share of employment in foreign owned firms increased from 17% in 1990 to 27% in 2000 (Karpathy (2004)), while Finland had an increase from 6% to 22% in the same period (Huttunen (2004)). Aghion et

[13]There was a change in the Norwegian laws concerning foreign ownership of assets in 1989. If that change can be argued to affect indirect foreign owership more than direct foreign ownership, the underestimation of foreign ownership during the 1980s may still be small.

al. (2004) report a foreign employment share of 16% in 1993 for UK manufacturing, while Haskel et al. (2002), using a different data source, report a foreign employment share of 23% in 1993 for the UK.[14] Ireland had a foreign employment share in manufacturing of 47% in 1995 (Görg and Strobl (2002)).[15]

2.3 Entry, Exit and Foreign Acquisitions

In the Norwegian Manufacturing Statistics each plant is assigned an identification number which it keeps throughout its life. A plant will even keep its previous identification number when it re-enters the panel after a time of inactivity if production restarts in the same geographic location. Mergers or buyouts at the firm level do not affect the plant identification code. Since our data is from a census, we avoid the problem of possible false entries and exits due to plants not being sampled. Apart from data errors, false entries and exits may occur in our data set if plants move location by closing down in one location just to reopen in another location. In such cases the plant will get a new identification number and will be counted as an entrant.[16]

Our main concern when defining entry and exit is how to treat plants that are present in the panel for one or more years and then absent for some years before they reappear in the panel again. Although the logic of the census would imply that all missing years in the time series for a single plant is due to the plant not being in operation that year, we assume that one or two consecutive years out of the sample is due to lack of registration rather than a temporary closure. When plants disappear for three or more consecutive years before they reappear again, we regard them as temporary 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,

[14] Haskel et al. (2002) use the ARD data set, while Aghion et al. (2004) use ONS data.

[15] It is not clear whether the definitions of foreign ownership in the mentioned studies include indirect foreign ownership.

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

but reappear with a new owner (a new firm identification number). Thus we define a plant as entering in year t if it appears for the first time in year t, or reappears in year t after a temporary closure. Similarly we define an exit in year t if the plant is present in year t and temporary closed in $t+1$, or absent all subsequent years.[17]

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

E_t :	Number of plants present in t, but not in $t-k$.
X_{t-k} :	Number of plants present in $t-k$, but not in t.
P_t :	Total number of plants present in period t.
AF_t :	Number of plants with increase in foreign ownership from $t-k$ to t.

Entry and exit rates are then:

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

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

and the netentry rate is the difference between the entry and exit rate. For annual entry and exit rates we take k to be 1, but we could calculate entry and exit rates over longer periods by making k larger. We calculate entry and exit rates separately for foreign and domestic firms. Since foreign ownership can be established either by greenfield entry (captured in the foreign entry rate) or by acquiring assets in an existing firm, we also define an acquisition rate. We give a plant an indicator for foreign acquisition in year t if foreign ownership in the plant increased from $t-k$ to t. We only count increases in foreign ownership when the plant changes foreign ownership category, i.e. crosses the 20% threshold. The foreign acquisition rate is then

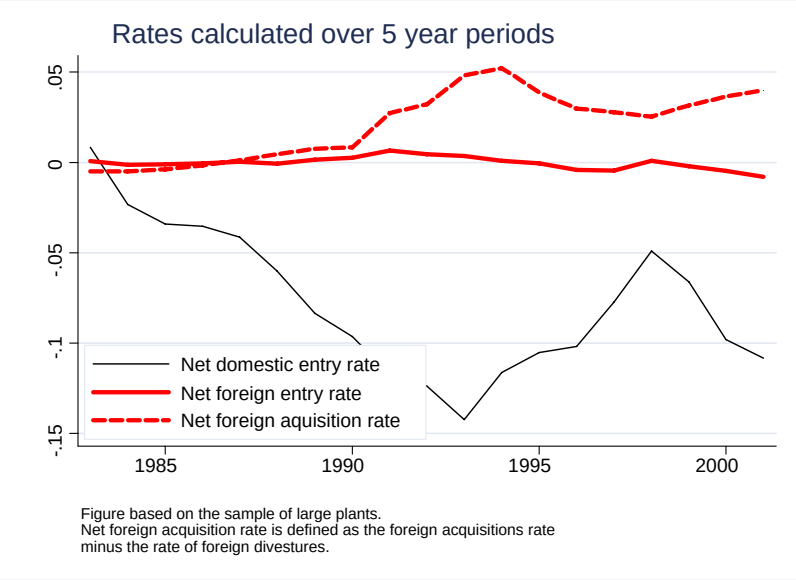
$$AFR_t = AF_t/P_{t-k},$$

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

Figure 2 shows net foreign and domestic entry rates, and the net foreign acquisition rate calculated for overlapping 5 year periods. The foreign net entry rate has been very small for the whole period, while the domestic net entry rate has been negative, with a peak in the exit rate during the

[17] Only 2.5% of the plants in the sample used for TFP decompositions have what we have defined as temporary closures.

Figure 2: Net foreign and domestic entry rates



recession in the early 1990s. The negative net entry rate reflects the overall trend in the economy of moving resources out of manufacturing into service production. During the period of analysis the number of observations in the large plant sample was reduced from 6 990 plants in 1978 to 4 850 plants in 2001. During the same period total employment declined by 33% to 220 000 in 2001.[18] By comparing the development in foreign acquisitions with the foreign and domestic net entry rates in figure 2, we can conclude that the increase in foreign presence in Norwegian manufacturing over the last 25 years is due mainly to net exit of domestic plants and foreign acquisitions of domestic plants.[19]

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

[19] That foreign entry by acquisition is more frequent than greenfield entry is also found for instance for the UK, see Griffith et al. (2004).

2.4 Data Cleaning and Descriptive Statistics

To construct a dataset for the TFP decomposition and the econometric analysis, we have to clean the data with respect to missing observations and outlier observations. First, we drop plants with missing information for 80% or more of their life on the variables central for TFP calculation. We then define outliers as observations with TFP outside the range of 3 times the difference between the 25th and the 75th percentile from the mean TFP in the same 5-digit sector that year. All plants with more than one outlier observation are dropped, while we keep plants with one outlier observation, dropping only that observation. This procedure gives a sample of 134 700 observations and 9 400 plants. This constitutes 92% of the initial large plant sample from 1978-2001. Dropping outliers did not change the 2-digit ISIC distribution of the sample much, average plant size is almost the same (from 43 to 44 employees), and the share of foreign plants falls from 7.1% to 6.7%. The main reason for the fall in the share of foreign plants in the sample is that the cleaning procedures drop somewhat more observations per year after 1997 than during the 1980s, due to problems with capital values after 1996 when information on fire insurance values were not collected anymore (more about this in section 3). The number of plants per year in our estimating sample is 6 350 in 1978, down to 4 410 in 2001.[20]

3 Total Factor Productivity of Entrants, Exitors and Survivors

We use an index of total factor productivity (TFP) at the plant level calculated as

$$\ln TFP_{it} = \ln \widetilde{Q}_{it} - \sum_{j=K,L,M} \alpha_t^j \ln \widetilde{X}_{it}^j, \tag{1}$$

[20] We have experimented with 2 different cleaning procedures (outliers defined as observations in the 1st and 99th percentile, or outside 2 standard deviations from the mean). The first of these outlier measures entails dropping 6% of the sample, while with the second outlier measure we would drop 30% of the observations. If we drop all plants with 1 or more outliers or missing TFP observations according to the second outlier measure, we end up dropping 40% of our sample. This would increase average plant size the most, from 43 to 48 employees. All outlier measures drop plants evenly distributed across 2-digit sectors and domestic versus foreign plants. All procedures drop more observations after 1995. The main results in sections 3 and 4 are the same for all 3 cleaning procedures.

where $\ln \widetilde{Q}_{it}$, $\ln \widetilde{X}^j_{it}$ are deflated plant output and inputs, respectively, and α^j_t is the average 5-digit industry cost share.[21] The variable definitions rely in large part on previous work with this data.[22] Output is defined as the gross production value net of sales taxes and subsidies. Material input is 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. We measure labour input by the 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 information about the costs of rented labour by using the calculated average wage for own employees.

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

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

where R_{it} is the cost of rented capital in the plant, V^m_{it} and V^b_{it} are the estimated values of machinery and buildings at the beginning of the year, $\delta^m$and δ^b are the depreciation rates. We take the rate of return to capital to be 0.07[23]. We use 3-digit depreciation rates (constant over the whole period of the panel) obtained from recent work to improve on capital estimates in Norwegian manufacturing (see Raknerud et al. (2003)). The estimated values of buildings and machinery are obtained from information on fire insurance values. To reduce noise and avoid discarding too many observations with missing fire insurance values, we smooth these values using the perpetual inventory method. Fire insurance values are not recorded after 1995, thus from 1996 we estimate capital values by adding investments and taking account of depreciation. We have separate price deflators for inputs, output and investment in buildings and machinery, obtained from Statistics Norway. The aggregation level is according to the sector classification used in the National Accounts, and is somewhere in between the 2- and 3-digit ISIC level.

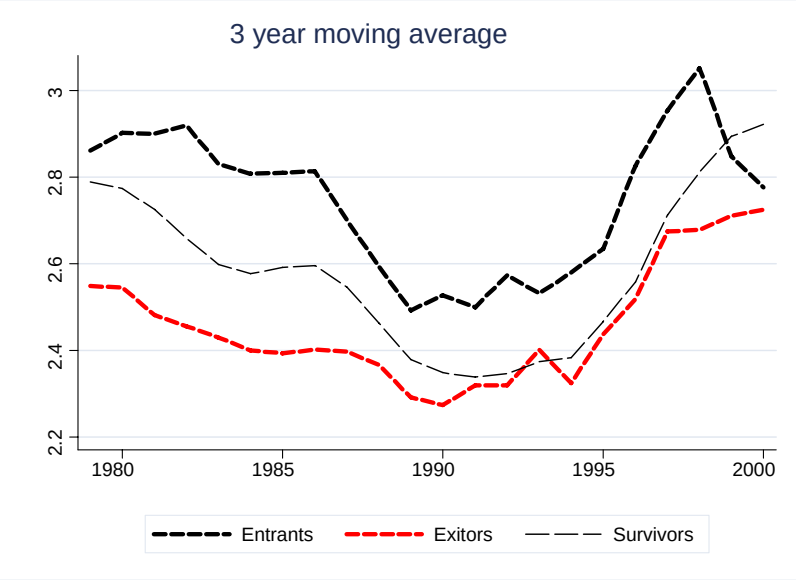
If the reallocation process of the market is "efficient", we should observe that plants that exit have lower productivity than the continuing plants,

[21] TFP decompositions for Norwegian manufacturing have previously been done using this Solow-type exact index (see Møen (1998)). This measure is also used in the productivity decompositions by Foster et al. (1998), and Disney et al. (2003).

[22] E.g. Griliches and Ringstad (1971), Klette (1994), Simpson (1994) and Møen (1998).

[23] Close to that used by Griliches and Ringstad (1971) and Klovland (1999)

Figure 3: Average TFP of entrants exitors and survivors



while new plants should have higher productivity. Overall, the reallocation process seems to be efficient when looking at figure 3, which shows smoothed annual average productivity of entrants, exitors and survivors for all manufacturing. The average productivity of entrants is above that of survivors all years, while the productivity of exitors is below that of survivors in most years. Although during the recession in the early 1990s, there seems to have been exit of plants with above average productivity.[24]

To investigate the pattern evident in figure 3 further, we split the entrants, exitors and survivors by ownership and calculate unweighted annual average TFP for each group. The averages for the periods 1979-1989 and 1990-2000 relative to the average TFP of domestic survivors are shown in table 1. The columns marked N show the number of plants in each group during the two periods. From the table we observe that both foreign and domestic entrants have on average higher TFP than domestic survivors, while domestic

[24]The pattern in figure 3 is similar for TFP calculated with hours or employment as labour input. It is also robust for capital values calculated with fixed depreciation rates at 6% for machinery and 2 % for buildings, or with 3 digit depreciation rates with average depreciation rate of more than 20% for machinery and 5-6% for buildings.

Table 1: Average TFP relative to domestic survivors

	1979-1989		1990-2000	
	TFP	N	TFP	N
Dom-entrants	*106.84	1683	*106.92	1301
For-entrants	103.50	50	*118.21	124
Dom-exitors	*93.55	2513	*97.10	2254
For-exitors	95.31	79	102.20	222
Dom-survivors	100.00	61971	100.00	46105
For-survivors	*97.26	1977	*97.29	4669
For-divestures	*90.64	183	*89.79	326
For-acquisitions	101.29	259	96.09	835

exitors have lower TFP than survivors. Foreign exitors have higher TFP than domestic survivors in the last period, and this could then be the reason for the average TFP of exitors in figure 3 being close to the average TFP of survivors. Contrary to the common perception that foreign owned plants are more productive than domestic plants, we find that foreign survivors have lower productivity than domestic survivors. To check the significance of the results in table 1, we estimated the following regression

$$\ln TFP_{it} - \overline{\ln TFP}_t = \alpha + \beta D_{it}^j, \tag{2}$$

where $\overline{\ln TFP}_t$ is the average TFP of domestic survivors in year t, and $\ln TFP_{it}$ is plant level TFP, while D_{it} is a dummy equal to 1 for each of the 7 other groups of plants; domestic and foreign entrants, exitors, foreign acquisitions or divestitures and foreign survivors. We have marked with * the results in table 1 that are significantly different from the average TFP of domestic survivors at the 95% confidence level. Due to the low numbers of foreign entrants and exitors, the average TFP of these groups are measured rather imprecisely. It is worth noting that table 1 does not suggest that foreign owners target high productivity plants for acquisitions since the average TFP of plants with an increase in foreign ownership is not significantly above that of domestic survivors, while it does seem that foreign owners sell their interests in low productivity plants. When running the regression in (2) at the 2-digit level for the whole period 1979-2000, 5 (4) out of 9 sectors have foreign divestures (foreign acquisitions) with lower productivity than

domestic survivors (90% confidence level). Domestic exitors in 6 out of 9 sectors have lower productivity than survivors, while the same is true in 3 sectors for foreign exitors. Domestic entrants have significantly higher productivity than survivors only in 2 sectors (34, 38), while in 3 sectors foreign entrants have significantly higher productivity than the survivors (90% confidence level), these three sectors account for 80% of all foreign entry during the period 1979-2000. Foreign survivors have a significant productivity advantage over domestic survivors only in the food and beverages sector and the miscellaneous manufacturing sector (39), while a significant disadvantage in 4 sectors.

4 Productivity Decompositions and Restructuring

4.1 Measurement

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

Different methods to decompose productivity growth have been proposed in the literature. We use the decomposition proposed by Haltiwanger (1997). This approach has a clear interpretation by tracking changes in productivity relative to a reference point (i.e. to industry averages).[25] The decomposition starts from an index of industry level productivity

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

[25] A full discussion of how this method compares to alternative decompositions as those suggested by Baily et al (1992) and Grilliches and Regev (1992) is provided in Foster et al (1998) and in Disney et al (2004).

where P_t is the index of aggregate industry productivity in year t, θ_{it} quantifies the market share of plant i in the industry (this can be hours, employment or output) and p_{it} is the plant's productivity measure. In our case p_{it} is the TFP measure introduced in equation (1), with the cost shares α_t^j replaced by the average of year t and $t-k$. We use output as our market share variable. The change in industry productivity between period t and $t-k$ can then be decomposed in the following way

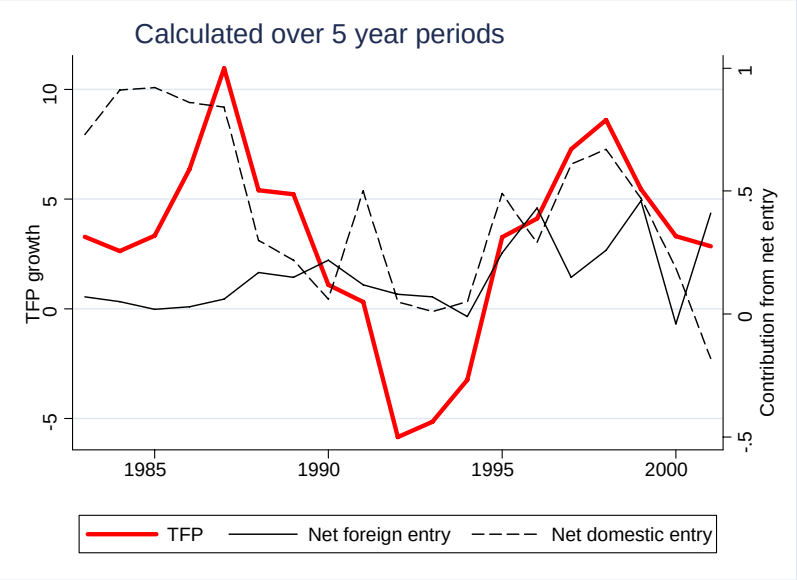
$$\begin{aligned}\Delta P_t &= \sum_{i\epsilon S}\theta_{i,t-k}\Delta p_{it} + \sum_{i\epsilon S}\Delta\theta_{it}\left(p_{i,t-k}-P_{t-k}\right) + \sum_{i\epsilon S}\Delta\theta_{it}\Delta p_{it} \\ &\quad + \sum_{i\epsilon N}\theta_{it}\left(p_{it}-P_{t-k}\right) - \sum_{i\epsilon X}\theta_{i,t-k}\left(p_{i,t-k}-P_{t-k}\right), \qquad (3)\end{aligned}$$

where S, N and X denote those plants that survive, enter and exit between t and $t-k$, respectively. We take k to be 5 in the following decompositions. The first term in equation (3) shows the contribution to productivity growth from TFP changes within surviving 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 when market shares increase (fall) for plants with positive (negative) productivity growth. The last two terms represent the contributions to productivity growth accounted for by entry and exit. The sum of the entry and exit effect is the net entry, or turnover effect. These terms are positive when there is entry (exit) of plants with above (below) average productivity.

Though many studies have made similar decompositions of aggregate TFP growth to study the relative role of internal versus external restructuring, we are aware of only two studies that explicitly investigate the role of foreign firms in such decompositions; Okamoto and Sjøholm (1999) for Indonesia and De Backer and Sleuwaegen (2003) for Belgium. We also do the decomposition in equation (3) by making a distinction between domestic and foreign owned plants, but in contrast to the mentioned studies we split the surviving plants in 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 finally plants that change ownership and end up as domestic in year t (foreign divestures).[26]

[26] Okamoto and Sjøholm (1999) drop plants that change ownership during the period

Figure 4: Aggregate TFP growth and contribution from net entry



4.2 Decomposition results

Figure 4 shows aggregate TFP growth calculated for overlapping 5 year periods from 1978 until 2001. Aggregate manufacturing productivity growth was obtained by weighting the TFP growth of each 3-digit industry with that industry's share of total manufacturing output.[27] The Norwegian business cycle is strongly evident in the figure; with two major booms (peaking in 1987 and 1998) and a recession in between. On a separate scale, figure 4 also shows the contribution from the turnover of domestic and foreign plants. It is evident that the contribution from net entry closely follows the business cycle.

For further results from the productivity decomposition, we have selected two periods at similar points in the two different booms, that is the 5-year periods 1982-1987 and 1993-1998 ending at the peaks. Table 2 shows some of the components of the decomposition. In table 2, the market shares of the different groups are aggregated from 3 digit level by using each sectors' share

for which they calculate TFP growth.

[27] The output share of each industry is the average of output shares in t and $t-k$.

of total output. The market share of entrants is calculated in year t while that of survivors and exitors is calculated in t-5. From the table we see that the market share of entrants and exitors have not changed much from the first to the second boom. Entrants and exitors have market shares of less than 10% in both periods. The big change from the boom during the 1980s to the boom during the 1990s is the increase in market shares of foreign plants. The sum of foreign survivors and foreign acquisitions increased their market share from 8% in 1982 to 39% in 1993. The columns marked TFP in table 2 show the unweighted average TFP of each group of plants relative to aggregate TFP of the sector of the plant. For entrants this means that we compare plant level TFP in year t with aggregate TFP in t-5, for exitors and survivors we compare plant level TFP with aggregate TFP in t-5 (this follows from the decomposition equation (3)). The TFP of entrants is above average TFP and that of exitors is below average, also here the foreign survivors have below average TFP, and the plants experiencing ownership changes have initially TFP below average. The last part of table 2 shows unweighted TFP growth for the surviving plants, and here it is worth noting that the unweighted TFP growth of domestic plants is lower than the TFP growth of foreign plants.

Table 2: Components of the TFP decomposition

	Market share		TFP		TFP growth	
	82-87	93-98	82-87	93-98	82-87	93-98
Dom-entrants	0.05	0.05	0.07	0.07		
For-entrants	0.01	0.03	0.26	0.12		
Dom-exitors	0.09	0.07	-0.05	-0.05		
For-exitors	0.00	0.02	0.00	-0.02		
Dom-survivors	0.75	0.46	0.01	-0.03	0.04	0.05
For-survivors	0.06	0.26	-0.00	-0.04	0.08	0.09
For-divestures	0.07	0.06	0.05	-0.07	0.12	0.04
For-acquisitions	0.02	0.13	-0.04	-0.02	0.02	0.09

Table 3 shows the results of the decomposition of aggregate TFP growth according to equation (3). As in most other TFP decompositions, the within effect is the dominant driver of aggregate TFP growth (Bartelsman et al. (2004)). The total within effect accounted for almost 70% of aggregate TFP growth in the 1982-1987 period, while its contribution is reduced to 60% in

the 1993-1998 period. Foreign plants played a negligible role in the within effect during the first period, but in the second period the contribution to aggregate TFP growth from foreign survivors and foreign acquisitions is more than twice as large as that of its domestic counterparts. 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 during the 5 year periods we study here. The covariance effect is positive; which indicates that plants with positive productivity growth increase their market shares. The contribution from net entry equals the sum of the entry and exit effect[28], its contribution to TFP growth has increased from the boom in the 1980s to the boom 10 years later. From table 2 we observed that the market share of entrants and exitors was the same in both periods, thus the increased role of net entry in aggregate productivity growth means that the entrants have higher productivity relative to the average than in the first period.

Table 3: Decomposition of TFP growth for 1982-1987 and 1993-1998

	Domestic	Foreign	Domestic	Foreign
Years	1982-1987		1993-1998	
Survivors-within	5.24	0.30	1.14	2.05
Acquisitions-within	1.74	0.16	0.34	1.64
Survivors-between	-0.33	-0.16	-0.31	-0.21
Acquisitions-between	-0.10	0.03	0.03	0.20
Survivors-cov	2.72	0.25	1.37	0.84
Acquisitions-cov	0.22	0.01	0.11	0.47
Entrants	0.79	0.10	0.72	0.27
Exitors	0.06	-0.05	-0.05	-0.01
Total TFP growth	10.98		8.61	

In table 6 in the appendix the sectoral decompositions at the 3-digit level are shown for sectors with more than 30 plants in total each period and with more than 10 foreign plants. Though the picture at the 3-digit level is diverse, the within effect is dominant in most sectors, and most sectors have an increase in the role of the foreign within effect from the first to the second

[28]In table 3 an exit effect larger than zero indicates that exit increases aggregate productivity growth; i.e. that it is plants with below average productivity that exit the industry.

period. The net entry effect is negative in many sectors and this is due to a negative exit effect in most sectors.

5 Mode of Foreign Entry and Local Productivity

From the above analysis it is apparent that at least since the 1990s foreign firms have become non-negligible players in the Norwegian economy. Not only has the overall amount of foreign presence and in particular foreign acquisitions risen over time, but even more striking is the contribution of foreign entrants to TFP growth given their small share in the overall number of entrants. Recent research on a number of countries by Bartelsman et al. (2004) indicates that an ongoing entry and exit process promotes also the productivity growth of incumbent firms. In this section, we therefore examine in more detail whether entry of foreign firms has a direct impact on established firms in the market that cannot be read from the productivity decompositions. We focus in particular on how the mode of foreign entry affects the productivity of established firms.

To do so we estimate production functions of the following form

$$\ln Y_{it} = \alpha_1 \ln K_{it} + \alpha_2 \ln M_{it} + \alpha_3 \ln h_{it} + \beta \mathbf{Z}_{it} + \upsilon_i + \upsilon_t + \varepsilon_{it.} \qquad (4)$$

Equation 4 states that output Y depends on inputs K (capital), M (material) and h (hours), a vector of variables $\mathbf{Z}$, plant fixed effects υ_i and time effects υ_t and a random error. In contrast to $\ln TFP$ used above, we do not constrain the output elasticities of the inputs to be the factor shares, but estimate them.

When it comes to possible determinants of $\mathbf{Z}$ the literature has considered for example product market competition (Nickell et al. (1992); Nickell (1996); Disney et al. (2004)), trade liberalisation measures (Pavcnik (1999)), as well as the impact of foreign presence or foreign direct investment (some recent contributions are e.g. Haskel et al. (2002), Keller and Yeaple (2003), Damijan et al. (2003), Smarzynska-Javorick (2004)). Our two main variables of interest in $\mathbf{Z}$ are the employment-weighted entry rate of foreign firms, $ENTRY_{It}$, and the employment-weighted rate of foreign acquisitions, $ACQUIS_{It}$, which are constructed as indicated in section 2.3. However, as foreign entry might be competition-enhancing as well as generating knowledge spillovers, we also include a set of competition variables in $\mathbf{Z}$.

A fairly large literature on the impact of foreign presence on domestic productivity has produced rather mixed results on this matter (see Görg and Greenaway (2004) for a survey). Görg and Strobl (2001) emphasize the sensitivity of the results in these studies on the way foreign presence is measured. In fact, it is likely that measures of foreign presence such as the share of employment in foreign owned firms or the share of output of foreign owned firms will capture some combination of competition effects and potential spillovers from foreign to domestic firms.[29] In addition, these measures are not able to distinguish between acquisitions of domestic firms by foreigners and newly established foreign owned plants (greenfield entry). However, greenfield entry and foreign acquisitions are likely to have a different impact on the market structure in the industry.[30] While greenfield entry will increase production capacity and therefore also competition, an acquisition does 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. Changes in market structure through foreign entry may affect the effort and therefore the productivity of local firms. But also the pure presence of foreign firms may have an impact on the productivity of domestic firms, especially in the case of technology spillovers. Regarding our foreign entry variables, we expect a negative competition effect from foreign entry ($ENTRY_{It}$) on domestic productivity at least in the short run. As foreign acquisitions will not have an immediate market structure effect, we expect the coefficient on $ACQUIS_{It}$ to be around zero. In the longer run we might expect a positive effect if the increase in competition is such that it leaves the domestic firms time to catch up or if there are spillovers.

To control for 'regular' market competition we use a set of variables that was first suggested in Nickell (1996). These variables are industry concentration ($CONC_{It}$), market share ($MSHARE_{it}$), profit margins (PM_{it}) and industry import penetration (IMP_{It}). Concentration is measured as CR5, i.e. the joint market share of the 5 largest firms in an industry in terms of output. $MSHARE_{it}$ is measured by plant output as a share of industry output. Technological differences across industries imply very different requirements in terms of size and scale for firms to be able to operate in

[29] Sembenelli and Siotis (2002) attempt to disentangle the two effects.

[30] See e.g. UNCTAD (2000, p.145) for an informal description and Haller (2004) for a more formal exposition.

their respective environment (Sutton (1996)), thus high market shares need not indicate lack of competition. However, changes in market structure over time are still going to be a reasonably good measure of changes in the competition. The profit margins measure (PM_{it}) is net output less material and wage costs over net output. It is thought to capture possible rents that may be available to shareholders and workers in the form of higher pay and lower effort. We expect an inverse relationship between both market shares and profit margins with estimated productivity. As higher efficiency would raise both profit margins and market shares, these variables are potentially endogenous, which could result in a positive coefficient. We address this problem by lagging both measures by two years and note that endogeneity would bias the coefficients towards zero. With the exception of the import penetration variable, these measures are constructed at the 5-digit ISIC level. As we do not have plant level trade data, we compute import penetration at the 3-digit ISIC level as the rate of imports over domestic consumption ($IMP_{It} = M_{It}/(Y_{It} + M_{It} - X_{It})$)[31]. This measure is thought as an indicator of foreign competition.

To eliminate plant and industry fixed effects we estimate equation (4) in first differences. If there are important unobservable variables that differ both across firms and over time (e.g. managerial ability), the error term will not be white noise. Olley and Pakes (1996) propose a structural approach that addresses this issue by assuming that such shocks can be reflected in investment behaviour as it is not correlated with current output. However, this approach relies on the assumption of perfectly competitive markets, which seems inappropriate when looking at competition effects. A further issue is that our sample of firms will consist only of firms that are active in the market but not of those firms that exit, i.e. our estimations are likely to be biased by selection. To address this issue we also estimate the model using the Heckman selection model with two different specifications for the selection equation.

[31]The import and export data are reported in OECD ITCS International Trade Data SITC rev. 2 and have been converted to 3digit ISIC rev 2 codes using a conversion table provided by Maskus (1989). The data are converted into NOK using the annual average exchange rate provided in the International Financial Statistics. The output measure is constructed from our intitial sample.

Taking first differences of (4) our estimation equation is

$$\begin{aligned}\Delta \ln Y_{it} &= \alpha_1 \Delta \ln K_{it} + \alpha_2 \Delta \ln M_{it} + \alpha_3 \Delta \ln h_{it} \\ &+ \sum_{k=1}^{T} \beta_1^k \Delta ENTRY_{It-k} + \sum_{l=1}^{T} \beta_2^l \Delta ACQUIS_{It-l} \\ &+ \beta_3 \Delta MSHARE_{it-2} + \beta_4 \Delta PM_{it-2} + \beta_5 \Delta CONC_{It} \\ &+ \beta_6 \Delta IMP_{It-2} + \upsilon_t + \xi_{it,}\end{aligned} \tag{5}$$

where k takes the values 1 to 4 and l takes values 0 to 3.[32] It seems important to include lagged differences of the foreign entry variables as there is evidence from the literature on productivity spillovers that the effects from foreign presence may take time to materialise (see in particular Mansfield and Romeo (1980) and Sembenelli and Siotis (2002)). We estimate equation (5) for the full sample of firms as well as for a sample of firms that are Norwegian owned throughout their presence in our panel. Summary statistics of the variables used in the regressions are presented in tables 7 and 8 for each of the two samples.

Table 4 presents the results from the estimations using the full sample. We first estimate equation 5 without the foreign entry variables (column I). All inputs are highly significant, the variables capturing product market competition are negatively signed with the exception of import penetration. That is decreases in market shares and profit margins are conducive to the productivity of established plants, the coefficient on market shares is not significant, however. Higher concentration implies lower productivity. Foreign competition in the form of import penetration seems to enhance the productivity of local firms, but not significantly so.

In columns II and III we include the entry rate of foreign firms $ENTRY_{It}$ and the foreign acquisition rate $ACQUIS_{It}$. When the foreign entry rate is included (column II) the coefficients and significance of the input and competition variables are unaffected. Most interestingly, however, in column II the lagged differences of $ENTRY_{It}$ are negatively signed and apart from the second lagged difference also significant. $\sum ENTRY_{It}$ reports the total effect over all lagged differences which is significant as indicated by the p-value in brackets. This suggests that the entry of strong foreign owned competitors with new plants has a significant and lasting negative impact on the

[32] We have tried to include higher lagged differences of both $ENTRY_{It}$ and $ACQUIS_{It}$, they are, however not significant.

Table 4: Foreign Entry, Competition and Productivity - Full Sample

Dependent variable $\Delta \ln Y_{it}$

column	I	II	III	IV	$S_I(HAZ)$	$S_{II}(OP)$
$\Delta \ln K_{it}$	.070** (.002)	.070** (.002)	.069** (.002)	.070** (.002)	.067** (.003)	.067** (.003)
$\Delta \ln M_{it}$	.524** (.002)	.524** (.002)	.524** (.002)	.524** (.002)	.515** (.005)	.515** (.005)
$\Delta \ln h_{it}$	.288** (.002)	.289** (.002)	.288** (.002)	.288** (.002)	.277** (.004)	.277** (.005)
$\Delta MSHARE_{it-2}$	−.032 (.039)	−.031 (.039)	−.032 (.039)	−.031 (.039)	−.029 (.040)	−.029 (.040)
ΔPM_{it-2}	−.059** (.007)	−.059** (.007)	−.058** (.007)	−.058** (.007)	−.059** (.008)	−.060** (.008)
$\Delta CONC_{It}$	−.046** (.014)	−.045** (.014)	−.044** (.014)	−.043** (.014)	−.046** (.016)	−.038** (.016)
ΔIMP_{It-2}	.021 (.007)	.020 (.017)	.020 (.017)	.020 (.017)	.025 (.017)	.025 (.017)
$\Delta ENTRY_{It-1}$		−.083** (.028)		−.098 (.028)	−.100** (.045)	−.100** (.040)
$\Delta ENTRY_{It-2}$		−.047 (.035)		−.060 (.035)	−.070 (.045)	−.070 (.045)
$\Delta ENTRY_{It-3}$		−.085* (.037)		−.079* (.037)	−.096** (.036)	−.095** (.035)
$\Delta ENTRY_{It-4}$		−.103** (.030)		−.098** (.030)	−.107** (.037)	−.106** (.037)
$\Delta ACQUIS_{It}$			.042** (.009)	.041** (.009)	.043** (.010)	.044** (.010)
$\Delta ACQUIS_{It-1}$			.017 (.012)	.016 (.012)	.013 (.012)	.013 (.012)
$\Delta ACQUIS_{It-2}$			.068** (.012)	.070** (.012)	.068** (.013)	.069** (.013)
$\Delta ACQUIS_{It-3}$			.047** (.010)	.047** (.010)	.048** (.011)	.049** (.011)
$\sum \Delta ENTRY_I$ [P]		−.317 [.002]		−.336 [.001]	−.373 [.002]	−.372 [.002]
$\sum \Delta ACQUIS_I$ [P]			.174 [.000]	.174 [.000]	.173 [.000]	.174 [.000]
N	82,364	82,364	82,364	82,364	83,854	83,980
R^2	.76	.76	.76	.76	-	-
$\chi^2(1)$ $\rho(SE)$	-	-	-	-	22.13 −.070(.015)	8.90 −.023(.008)

**,* indicate significance at 1% and 5% respectively.
Robust standard errors in round parentheses.

productivity of the firms present in the market already. To the extent that foreign entry increases competition over and above what is captured in the competition variables, this may be due to a market stealing effect by the new foreign firms which forces the established firms up their average cost curve and, hence, decreases their productivity.[33] This argument has been brought forward in earlier research by Aitken and Harrison (1999), however they do not control for product market competition. An alternative explanation for this negative effect might be that the new foreign entrants hire highly qualified workers away from existing plants. If the affected plants had difficulties to replace these workers adequately, this will have a detrimental impact on their productivity.

In column III then, the difference of the foreign acquisition rate $ACQUIS_{It}$ and its lags are included together with the competition variables. Again the input and competition variables are unaffected when compared to column I. The coefficients on the (lagged) change(s) in the $ACQUIS_{It}$ variable are positively signed throughout and jointly significant as indicated by $\sum ACQUIS_{It}$. This confirms our presumption that foreign acquisitions do not create stronger competition, at least not in the short run. They leave the existing firms in the market time to adapt and might even generate positive spillovers. As these firms have been in the market before becoming foreign, it is likely that they have established ties with other firms in the market through which technology diffusion can occur.

In column IV foreign entry and foreign acquisitions are included together. The results confirm those of columns III and IV where $ENTRY_{It}$ and $ACQUIS_{It}$ are included individually. Increases in foreign entry have a significantly negative impact on the firms already in the market, while foreign acquisitions lead to an increase in the productivity of existing firms. The negative effect from foreign entry is stronger which can be seen by comparing the relevant lags. Hence, even though there are much fewer foreign greenfield entrants than foreign acquisitions (cf. table 3) they exert a stronger negative impact on the existing firms.

The last two columns of table 4 estimate the model from column IV controlling for selection. By virtue of observability our sample consists of only those firms that survive, hence if foreign entry or foreign acquisitions

[33] When including the foreign entry rate based on a plant count instead, the effect is even stronger, while entering the entry rate of domestic firms does not yield significant results. This suggests that it is the addition of a new efficient foreign–owned plant rather than a large plant, that makes the difference.

affect the probability of survival our estimates from above may be biased. Therefore column $S_I(HAZ)$ conditions survival on a probit of the so-called hazard variables that have been found to determine exit (see e.g. Bernard and Jensen (2002)): age of the plant, age squared, size measured as the number of employees, productivity measured by our TFP measure from above and a multiplant dummy that takes value 1 if the plant is part of a multiplant firm. We also include the first differences of our foreign entry and acquisition variables. The variables in the selection equation are jointly significant as indicated by the χ^2 value and also the selection term is significant. In the estimation of the production function the standard errors rise slightly. The overall negative impact of foreign entry is somewhat larger than in column IV, whereas the overall impact of foreign acquisitions is about the same. In the last column $S_{II}(OP)$ we condition survival on investment and capital to capture the Olley and Pakes (1996) idea that investment which is observable but not correlated with current output can pick up unobservable shocks to productivity. In this equation selection is determined by plant's investment shares and their capital in logs both from levels up to their 4th powers.[34] The results from this specification are very similar to the selection equation based on the hazard variables; the selection variables are jointly significant and so is the selection term ρ.

We next repeat the above analysis for the sample of plants which are domestically owned throughout their presence in our panel, this applies to about 85% of the plants in the full sample. The results are reported in table 5. In the estimation with only inputs and the competition variables in column DI the results are very similar to those in column I of the full panel. The coefficients on inputs are almost unchanged. The coefficients on market share is slightly smaller (though still not significant), and the coefficients on profit margins, the concentration ratio and import penetration are slightly larger in absolute terms, indicating that these plants are somewhat more vulnerable to changes in product market competition. When including the (lagged) differences of foreign entry in column DII, all of them are significant and their joint impact $\sum ENTRY_{It}$ is larger in size than in the full sample. That is the productivity of the domestic firms suffer most from foreign entry. Regarding changes in the foreign acquisition rate which is included in column

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

DIII, the coefficients on $ACQUIS_{It}$ are positive and the overall effect is of similar size as in the full sample. This confirms our above conjecture that local firms that attract foreign interests have well enough developed linkages also with domestically owned firms to have a productivity-enhancing effect on these firms.

When including the foreign entry and acquisition rates together as in column DIV the picture is very much the same as in the full sample. The negative overall effect from foreign entry on the productivity of domestic firms is larger than in the full sample while the positive impact from foreign acquisitions is of similar size as in the full sample. In both the selection equations ($S_{DI}(HAZ)$ and $S_{DII}(OP)$) standard errors increase slightly. The overall impact of the foreign entry variables is larger than in column DIV, while the overall impact of foreign acquisitions is smaller and the first two of the individual coefficients on $ACQUIS_{It}$ turn insignificant. To the extent that the selection equations provide a more accurate picture of those domestic firms that survive in the panel, we can conclude that it is the domestically owned firms whose productivity suffers strongly from foreign entry. Moreover, it is also their productivity that does not benefit immediately from positive spillovers or linkages generated by foreign acquisitions.

6 Conclusions

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

To examine the impact of the mode of foreign entry on changes in the productivity of incumbent firms we estimate production functions controlling for 'regular' market competition. It turns out that the effects from greenfield entry and from foreign entry via acquisition on the productivity of incumbent

Table 5: Foreign Entry, Competition and Productivity - Domestic Firms

Dependent variable $\Delta \ln Y_{it}$

column	DI	DII	DIII	DIV	$S_{DI}(HAZ)$	$S_{DII}(OP)$
$\Delta \ln K_{it}$	.070** (.002)	.070** (.002)	.070** (.002)	.070** (.002)	.068** (.003)	.068** (.003)
$\Delta \ln M_{it}$	.529** (.002)	.529** (.002)	.529** (.002)	.529** (.002)	.519** (.005)	.519** (.005)
$\Delta \ln h_{it}$	.282** (.002)	.282** (.003)	.282** (.002)	.282** (.002)	.270** (.005)	.270** (.005)
$\Delta MSHARE_{it-2}$	−.023 (.057)	−.021 (.057)	−.023 (.057)	−.021 (.057)	−.013 (.062)	−.014 (.062)
ΔPM_{it-2}	−.068** (.007)	−.068** (.007)	−.067** (.007)	−.067** (.007)	−.067** (.008)	−.067** (.008)
$\Delta CONC_{It}$	−.057** (.015)	−.056** (.015)	−.056** (.015)	−.055** (.015)	−.046** (.017)	−.046** (.017)
ΔIMP_{It-2}	.024 (.019)	.024 (.019)	.023 (.018)	.023 (.019)	.030 (.019)	.030 (.019)
$\Delta ENTRY_{It-1}$		−.136** (.027)		−.148** (.027)	−.153** (.034)	−.152** (.034)
$\Delta ENTRY_{It-2}$		−.072* (.034)		−.082* (.035)	−.096* (.048)	−.095* (.048)
$\Delta ENTRY_{It-3}$		−.095** (.038)		−.089* (.038)	−.112** (.040)	−.112** (.040)
$\Delta ENTRY_{It-4}$		−.093** (.034)		−.088** (.034)	−.102* (.043)	−.101* (.043)
$\Delta ACQUIS_{It}$			.031** (.012)	.029** (.012)	.024 (.014)	.025 (.014)
$\Delta ACQUIS_{It-1}$			.033* (.015)	.032* (.015)	.020 (.014)	.021 (.014)
$\Delta ACQUIS_{It-2}$			.062** (.016)	.068** (.016)	.060** (.017)	.060** (.017)
$\Delta ACQUIS_{It-3}$			.044** (.013)	.046** (.013)	.042** (.015)	.042** (.015)
$\sum \Delta ENTRY_I$ [P]		−.396 [.000]		−.409 [.000]	−.464 [.001]	−.461 [.001]
$\sum \Delta ACQUIS_I$ [P]			.170 [.000]	.176 [.000]	.146 [.002]	.149 [.001]
N	68,498	68,498	68,498	68,498	69,861	69,977
R^2	.77	.77	.77	.77	-	-
$\chi^2(1)$ $\rho(SE)$	-	-	-	-	30.22 −.103(.019)	7.70 −.032(.012)

**,* indicate significance at 1% and 5% respectively.
Robust standard errors in round parentheses.

firms are very different. Greenfield entry has a negative impact on the productivity of established plants that is more pronounced for plants which are domestically owned throughout the sample period. We argue that this is due to a market stealing effect over and above changes in market structure and competition which forces the domestic plants up their average cost curves and consequently decreases their productivity. An additional explanation could be that foreign firms hired highly qualified or highly motivated workers form local plants resulting in productivity losses. Foreign acquisitions, in turn, have a positive impact on the productivity of local plants that is of similar size in the full and in the domestic plants sample. Existing local plants with foreign interests will have established linkages with other plants in the host economy which may serve as a basis for possible knowledge, technology or human capital spillovers. The main conclusion to draw from this analysis is that the mode of entry matters and that previously used measures of foreign presence are too general to be informative of possible spillover effects.

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A Appendix

Table 6: Decomposition of TFP growth by sector: 1982-1987 and 1993-1998

	Years	Domestic survivors	Foreign survivors	Domestic netentry	Foreign netentry	TFP growth
311	1987	2.81	0.05	0.44	0.00	3.29
	1998	1.68	1.29	0.41	0.21	3.59
312	1987	-13.12	-0.79	-0.31	0.35	-13.86
	1998	3.88	0.64	0.53	0.60	5.63
313	1987	9.47	0.00	0.72	0.00	10.18
	1998	0.78	-2.65	3.05	-4.01	-2.84
331	1987	8.11	0.40	1.06	0.00	9.55
	1998	1.79	-0.52	0.94	-0.18	2.04
341	1987	17.92	0.38	-1.08	-0.02	17.21
	1998	5.22	12.83	-1.32	0.16	16.88
342	1987	8.74	1.09	0.84	0.15	10.82
	1998	5.39	6.14	1.29	-0.74	12.07
351	1987	23.66	2.63	1.49	0.00	27.79
	1998	1.66	7.70	0.33	1.28	10.98
352	1987	4.76	0.05	-1.15	0.08	3.74
	1998	3.30	1.38	-0.11	-0.74	3.83
354	1987	-8.00	-1.25	-0.11	0.31	-9.04
	1998	10.23	1.09	-0.03	-0.09	11.22
356	1987	-0.21	0.16	0.60	-0.08	0.48
	1998	1.05	0.05	0.14	-0.06	1.18
369	1987	-11.93	-0.17	-1.58	0.02	-13.66
	1998	-1.98	-0.46	0.10	0.28	-2.06
371	1987	7.63	-0.07	0.29	0.00	7.85
	1998	6.07	10.22	-0.22	0.52	16.58
372	1987	17.07	0.63	-0.10	-0.01	17.59
	1998	3.31	20.01	-0.08	0.24	23.48
381	1987	8.67	0.62	1.63	0.01	10.94
	1998	2.52	0.97	1.31	1.07	5.89
382	1987	11.77	1.61	2.00	0.24	15.63
	1998	-3.24	0.43	1.33	0.90	-0.60
383	1987	6.92	-0.63	0.60	0.36	7.25
	1998	2.24	13.61	1.80	1.02	18.66
384	1987	28.87	2.03	4.05	-0.04	34.90
	1998	10.42	6.79	1.86	0.14	19.21
385	1987	8.51	1.73	1.90	0.00	12.15
	1998	5.14	9.67	2.62	0.50	17.92

Table 7: Summary statistics: Full sample

Variable	Mean	Std. Dev.	Min.	Max.	N
Levels					
$\ln Y_{it}$	9.795	1.441	4.982	15.763	82364
$\ln K_{it}$	7.536	1.448	1.355	14.264	82364
$\ln M_{it}$	8.984	1.613	1.898	15.715	82364
$\ln h_{it}$	3.551	1.275	0	9.725	82364
$MSHARE_{it}$	0.025	0.07	0	1	82364
PM_{it}	0.08	0.13	-4.747	0.921	82305
$CONC_{It}$	0.387	0.228	0.091	1	82364
IMP_{It}	0.364	0.269	-0.325	1.322	82364
$ENTRY_{It}$	0.002	0.02	0	1.229	82364
$ACQUIS_{It}$	0.02	0.062	0	1.022	82364
Differences					
$\Delta \ln Y_{it}$	-0.002	0.336	-5.464	5.952	82364
$\Delta \ln K_{it}$	0.005	0.336	-4.092	4.618	82364
$\Delta \ln M_{it}$	0.015	0.437	-6.603	7.142	82364
$\Delta \ln h_{it}$	-0.028	0.375	-5.043	5.44	82364
$\Delta MSHARE_{it}$	0	0.015	-0.719	0.769	82364
ΔPM_{it}	-0.006	0.131	-4.892	2.902	82239
$\Delta CONC_{It}$	0.003	0.045	-0.765	0.887	82364
ΔIMP_{It}	0.004	0.036	-1.138	0.795	82364
$\Delta ENTRY_{It}$	0	0.029	-1.229	1.229	82364
$\Delta ACQUIS_{It}$	0	0.086	-1.022	1.022	82364
Selection Variables					
age	16.693	5.89	5	28	82364
size	46.493	116.414	0	3753	82364
TFP	2.512	0.974	-4.453	5.749	82364
multiplant	0.158	0.365	0	1	82364
investment	0	0.002	-0.033	0.266	82364

Table 8: Summary statistics: Domestic Firms

Variable	Mean	Std. Dev.	Min.	Max.	N
Levels					
$\ln Y_{it}$	9.523	1.283	4.982	14.521	68498
$\ln K_{it}$	7.258	1.257	1.355	12.223	68498
$\ln M_{it}$	8.702	1.471	1.898	14.49	68498
$\ln h_{it}$	3.312	1.116	0	8.236	68498
$MSHARE_{it}$	0.016	0.045	0	1	68498
PM_{it}	0.079	0.129	-4.747	0.921	68441
$CONC_{It}$	0.361	0.215	0.091	1	68498
IMP_{It}	0.357	0.269	-0.325	1.322	68498
$ENTRY_{It}$	0.002	0.02	0	1.229	68498
$ACQUIS_{It}$	0.017	0.052	0	0.950	68498
Differences					
$\Delta \ln Y_{it}$	-0.004	0.336	-5.464	5.952	68498
$\Delta \ln K_{it}$	0.005	0.343	-4.092	4.618	68498
$\Delta \ln M_{it}$	0.014	0.436	-6.603	7.142	68498
$\Delta \ln h_{it}$	-0.03	0.378	-5.043	5.44	68498
$\Delta MSHARE_{it}$	0	0.012	-0.719	0.688	68498
ΔPM_{it}	-0.006	0.131	-4.892	2.626	68377
$\Delta CONC_{It}$	0.003	0.045	-0.765	0.887	68498
ΔIMP_{It}	0.004	0.035	-1.138	0.795	68498
$\Delta ENTRY_{It}$	0	0.028	-1.229	1.229	68498
$\Delta ACQUIS_{It}$	0	0.073	-0.950	0.950	68498
Selection Variables					
age	16.603	5.846	5	28	68498
size	29.776	60.788	0	2284	68498
TFP	2.527	0.904	-3.957	5.749	68498
multiplant	0.115	0.319	0	1	68498
investment	0	0	-0.009	0.031	68498