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Characterizing Euro Area Multinationals*

Ingo Geishecker, Holger Görg and Daria Taglioni

Abstract:
This study uses firm-level data on a large sample of European manufacturing firms to investigate the links between opening up foreign affiliates and firms' productivity. The analysis is guided by recent theoretical models of international trade with firm heterogeneity. The paper finds that while only a small share of euro area firms locate affiliates abroad, these firms account for over-proportionally large shares of output, employment and profits in their home countries. They have higher survival rates and their productivity growth is also higher. The strongest contribution is by productivity growth of existing firms with a multinational status rather than entry into the multinational status. Finally, there are performance premia for multinationals with a large number of affiliates abroad relative to those with a small number.

Keywords: multinational enterprises, productivity growth, productivity decomposition, survival

JEL classification: F23, F43, L25

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1 Introduction

The transfer of production activities from one country to another has become an important issue in the public debate on globalisation, especially in those countries that have seen a number of high-profile cases of outward relocation over recent years. The concern about outward transfers is largely due to their direct impact on employment, their connection with concerns about the competitiveness of firms and their common association with the challenges of a globalised economy. Yet, while the employment effects of moving production activities abroad are mixed, recent international trade models - in which firms are heterogeneous actors whose investment, production, price setting, and location strategies are crucial for the aggregate economy of a country - bring to the fore a number of possible channels through which their international activity through exporting (which has received most attention) or outward FDI is positively linked to a country's aggregate productivity (e.g. Melitz, 2003; Bernard, Eaton, Jensen and Kortum, 2003; Helpman, Melitz and Yeaple, 2004).

Recent analyses of micro-datasets tracking production and international involvement at the firm- and plant- level demonstrate that firms vary tremendously along a number of dimensions even within industries and this plays an important role in aggregate outcomes. The most widely cited predictions and testable hypotheses of theoretical models which account for this firm heterogeneity are twofold. Firstly, firms that serve foreign markets are expected to be more productive than their purely domestic competitors. Secondly, once countries open up to trade this modifies the set of firms that trade and invest abroad as well as the set of goods traded and the range of destinations served (the so called extensive margin of trade) leading to a new source of welfare gains generated by the important effects on aggregate productivity which the reallocation of factors of production among different types of firms implies. One would expect the least productive firms to exit and their market share to be reallocated to more productive foreign and domestic firms, thus raising aggregate industry level productivity. One would also expect that a country whose share of exporting and multinational firms increases over time will experience an increase in aggregate productivity as well as in aggregate competitiveness on international markets.

While many of the studies measuring productivity divergence among types of firms focus on performance differences between exporters and non-exporters (Greenaway and Kneller, 2007), a smaller literature has emerged extending this type of analysis to investigating productivity differences between multinationals, exporters and purely domestic

firms. The theoretical model by Helpman et al. (2004) suggests a productivity ranking which would show multinationals to be the most productive, followed by exporters and then non-exporters. Head and Ries (2003) using Japanese data, Girma, Görg and Strobl (2004) for Ireland, Arnold and Hussinger (2005) for Germany and Girma, Kneller and Pisu (2005) for the UK show that multinationals are the most productive among the three types of firms.

This paper relates to and extends this recent literature on differences between different firm types in terms of their international engagement. We will concern ourselves with the following questions. First, are multinational parent firms more productive than firms with exclusively domestic production facilities? Second, are the location choices for their foreign affiliates related to their relative productivity performances? Third, do multinational parent firms have a better chance of surviving than other firms? Finally, can they be considered important engines of productivity growth? While the first question has received quite a lot of attention recently our analysis is, to the best of our knowledge, the first to investigate whether the magnitude of foreign operations (in terms of numbers of affiliates) and the location thereof are related to productivity performance.[1] Another novelty of our paper is to apply a productivity growth decomposition a la Foster *et al.* (1998) with the explicit distinction between multinationals and domestic firms, and entry and exit into these groups.

A final innovation in our paper stems from the data used. We have assembled a large firm level dataset from the 12 countries that make up the euro area.[2] This allows us to investigate one large heterogeneous yet integrated economic area that operates under a common currency in Europe. Our large firm level panel dataset is obtained joining together the 2003 and 2006 releases of the AMADEUS database, which reports balance sheet data for about 240,000 firms for these countries, the 2003 release for the period 1996-2002 and the 2006 release up to 2005 (see appendix A for details about the data). We identify the firms in the dataset that were sampled as having foreign affiliates in 2000 (from the 2003 release) and in 2004 (from the 2006 release).

The remainder of the paper is structured as follows. Section 2 presents some first

[1] Related yet somewhat different questions on the relationship between international diversification of multinationals and performance have been investigated in the management literature, however. See, for example, Hennart (2007) and Li (2007).

[2] These countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain. Slovenia joined the Euro Area on 1 January 2007. However, Slovenia is not included in our analysis which covers a period before its accession.

insights into aspects of firm level heterogeneity in the data. Section 3 investigates the patterns of multinational activity, and assesses whether there are performance differences along a number of firm characteristics between euro area multinationals and other types of firms. In that section we also chart the magnitude and location of euro area multinationals' operations and the relationship between these aspects of multinational activity and firm performance. Section 4 then goes on to describe euro area firms' patterns of entry and exit into domestic and multinational markets between 2000 and 2004 and quantifies the contribution to aggregate domestic productivity growth of firms with multinational operations versus domestic firms, distinguishing, furthermore, between firms that were in operation in both years, firms that have exited the domestic or foreign markets between 2000 and 2004 and firms that have entered such markets. Finally, Section 5 summarises and concludes.

2 Firm Heterogeneity

In this section we investigate the pattern of heterogeneity among euro area firms sampled in the 2006 release of AMADEUS. In order to ensure comparability among the data, we take a snapshot of firms' size and performance in 2004, which is the most recent year with a satisfactory coverage. Overall, heterogeneity is a strong feature of our data that holds true for a variety of performance measures and, importantly, cuts across industries. Firms within narrowly defined sectors are comparatively as diverse and dispersed as firms from the overall distribution when measured in terms of their productivity (measured as value added per worker), profits, turnover and employment.

As Table 1 indicates manufacturing firms one standard deviation away from the median firm are 7 percent more labour-productive, 57 percent more profitable, sell 26 percent more and employ 63 percent more workforce. Such dispersion is barely lower within 241 narrowly defined NACE 4-digit sectors: firms one standard deviation away from the intra-industry median firm are 6 percent more labour-productive, 51 percent more profitable, have 24 percent higher turnover and employ 59 percent more workers. Furthermore, the same trends emerge if we measure dispersion from the mean instead of the median.[3] Hence,

[3]Our findings match measures of overall and intra-industry dispersion reported by other studies and measured on alternative datasets. For example, Bernard, Eaton, Jensen and Kortum (2003) find that the standard deviation of log productivity within 458 4-digit manufacturing sectors in the US has a value of 0.66, while the unconditional standard deviation is only slightly higher, at a value of 0.75. This indicates a high level of heterogeneity in their dataset. Pavcnik (2003) also provides evidence of substantial heterogeneity

evidence from the dataset exploited in the current study and from other empirical studies shows that it is difficult to speak about an average sectoral response to shocks and changes in the external environment since firms within industries exhibit substantial heterogeneity along a number of important firm level characteristics.

Table 1: Euro Area Firm Level Heterogeneity

How much bigger are euro area firms one standard deviation from median firm?

	Turnover	Employment	Productivity	Profits
All industries	126.4%	162.7%	106.6%	156.7%
within 2-digit NACE industries	125.3%	161.4%	106.4%	154.3%
within 4-digit NACE industries	123.7%	158.8%	106.2%	151.5%

How much bigger are euro area firms one standard deviation from average firm?

	Turnover	Employment	Productivity	Profits
All industries	125.7%	160.9%	106.6%	154.5%
within 2-digit NACE industries	124.7%	159.1%	106.4%	152.7%
within 4-digit NACE industries	123.3%	157.1%	106.2%	150.6%

Source: Amadeus and authors calculations

We also find that within the same industry, only a very small subset of firms owns foreign affiliates (see Table 2). However these firms account for a disproportionately high share of economic activity. On average, only about three percent of firms are multinational firms, i.e. firms with affiliates abroad. However, multinational firms account for 29 percent of total employment, 40 percent of turnover and 43 percent of value added in the sample. Firms that have operations in more than one foreign country account for roughly only 1 percent of the total number of manufacturing firms in our dataset, though they account for an over-proportional share of economic activity, generating 20 percent of employment, 30 percent of turnover and 33 percent of value added in the sample. Hence, they are on average much larger firms that contribute much higher levels of economic activity to the domestic economy.

Another interesting aspect borne out by the data is that not only is the subset of firms with international engagement very small, but also activity within the multinational groups of firms is very highly concentrated, with very few firms covering most of the multinational activity. The top largest one percent of multinationals in the euro area account for 38 percent of employment and 57 of turnover and value added generated by domestic establishments of multinationals.

in productivity among Chilean plants.

Table 2: Contribution of Euro Area Multinational Enterprises (MNEs) to Domestic Employment, Turnover and Value Added in Manufacturing Industries

	firms without foreign affiliates	MNEs	*of which:* *MNEs with affiliates in at least two locations*
Number of firms	97%	3%	1%
Employment	71%	29%	20%
Turnover	60%	40%	30%
Value Added	57%	43%	33%

Source: Amadeus and authors calculations

3 A Static Analysis of Euro Area MNE's

Recognising firm heterogeneity is important, since the interaction between firm characteristics and the involvement of the firm on international markets, via trade or sales through local affiliates, points to an important role for international trade and multinational activity in shaping aggregate domestic productivity via the intra-industry reallocation of market shares from the worst to the best performing firms. In this context, the model by Helpman, Melitz and Yeaple (2004) provides a useful theoretical background. It shows that all firms face a trade off between proximity to the market and concentration of production, but different types of firms respond differently to this challenge. Specifically, only the most productive firms will serve foreign markets. Among these, only the most efficient will engage in production abroad.[4]

As pointed out in the Introduction, the theoretical insights of the Helpman et al. (2004) model have been subjected to some empirical testing. It is, however, not the purpose of this paper to replicate these findings. Instead, we focus our attention on a hitherto unexplored aspect of heterogeneity in our data, namely the number of foreign affiliates a firm has and the locations the MNE covers. The Helpman et al. (2004) model assumes that a firm has to bear fixed costs for foreign investment (or exporting) in every country in which it decides to operate. Hence, the total fixed costs would be larger for a firm with more than one operation abroad and, hence, at an intuitive level, one may expect that multinationals with more than one foreign affiliate and more than one foreign location ought to be more productive than those with only one, which in turn dominate those with no foreign operations. We investigate this aspect in our data.

To do so, we estimate the average percentage difference between multinationals and non-multinationals for particular firm characteristics. The premia of being a multinational

[4]These findings are straightforward extensions of the basic Melitz (2003) model where it is assumed that the fixed costs of setting-up a subsidiary abroad are higher than the costs of simply selling abroad.

firm are estimated from OLS regressions of the log firm characteristics on an indicator variable indicating the firm's multinational status.

Table 3: Multinational Premia in Euro Area Manufacturing, 2004

	Simple OLS	OLS with country and industry fixed effects	OLS with fixed effects and employment control
MNEs vs. fully domestic firms			
log(Turnover)	3.41***	2.80***	0.49***
	(0.02)	(0.02)	(0.01)
log(Employment)	2.64***	2.30***	-
	(0.02)	(0.02)	-
log(Profit)	3.58***	2.83***	0.87***
	(0.03)	(0.03)	(0.02)
log(Value Added/Employment)	0.56***	0.34***	0.36***
	(0.01)	(0.01)	(0.01)
log(Turnover/Employment)	0.77***	0.50***	0.49***
	(0.01)	(0.01)	(0.01)
MNEs with one affiliate vs. MNEs with more than one affiliate			
log(Turnover)	0.89***	0.87***	0.19***
	(0.04)	(0.04)	(0.02)
log(Employment)	0.73***	0.74***	-
	(0.03)	(0.03)	-
log(Profit)	1.22***	1.09***	0.46***
	(0.05)	(0.05)	(0.04)
log(Value Added/Employment)	0.17***	0.13***	0.20***
	(0.02)	(0.02)	(0.02)
log(Turnover/Employment)	0.18***	0.14***	0.19***
	(0.02)	(0.02)	(0.02)

Source: Amadeus and authors calculations.
Note: Standard Errors in parenthesis, stars indicate t-probabilities (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$). Base year is 2004. The upper half of the table reports the OLS results of regressing the noted firm characteristics on a dummy variable indicating the plant multinational status (or lack thereof). The second and third columns include industry fixed effects and industry fixed effects plus employment as additional controls. The lower half repeats the same exercise on the subset of MNEs. Here the dummy variable takes value 0 if the MNE has only one subsidiary and value 1 if it has several subsidiaries.

Table 3 presents the results of these regressions. The upper half of the table reports the results from regressing the noted firm characteristics on a dummy variable indicating the plant multinational status (or lack thereof). The first column presents the results from a simple OLS regression. The next column includes industry and country fixed effects. These fixed effects are meant to capture within industry and within country differences in performance between multinational companies and firms with fully domestic operations. The lower half repeats the same exercise on the subset of MNEs. Here the dummy variable takes value 0 if the MNE has only one subsidiary and 1 if it has several. All coefficients in the OLS regressions are statistically significant at the one percent level. The results in the upper half of the table, second column, indicate that multinational firms are roughly 65 percent more productive in terms of turnover per employee, while this difference is 40 percent for value added per worker. Furthermore, MNEs with more than one affiliate are,

compared with MNEs with only one affiliate, 15 and 14 percent more productive in terms of turnover and value added per worker, respectively.[5]

Table 4: MNEs: Average number of foreign affiliates (overall, per location and per MNE), 2004

Average number of foreign affiliates			
Overall	27.0		
By group of firms according to performance criteria:			
	Least performing firms	Middle-performance firms	Best performing firms
Turnover	7.0	17.6	56.5
Profits	11.2	10.4	61.5
Labour productivity	9.0	13.0	57.9
Average number of foreign affiliates per location			
Overall	2.8		
By group of firms according to performance criteria:			
	Least performing firms	Middle-performance firms	Best performing firms
Turnover	1.6	2.4	4.5
Profits	1.7	2.0	4.8
Labour productivity	1.9	1.9	4.7
Average number of locations per multinational company			
Overall	2.5		
By group of firms according to performance criteria:			
	Least performing firms	Middle-performance firms	Best performing firms
Turnover	1.7	3.0	5.4
Profits	1.9	2.5	5.9
Labour productivity	2.1	2.7	4.2

Source: Amadeus and authors calculations.

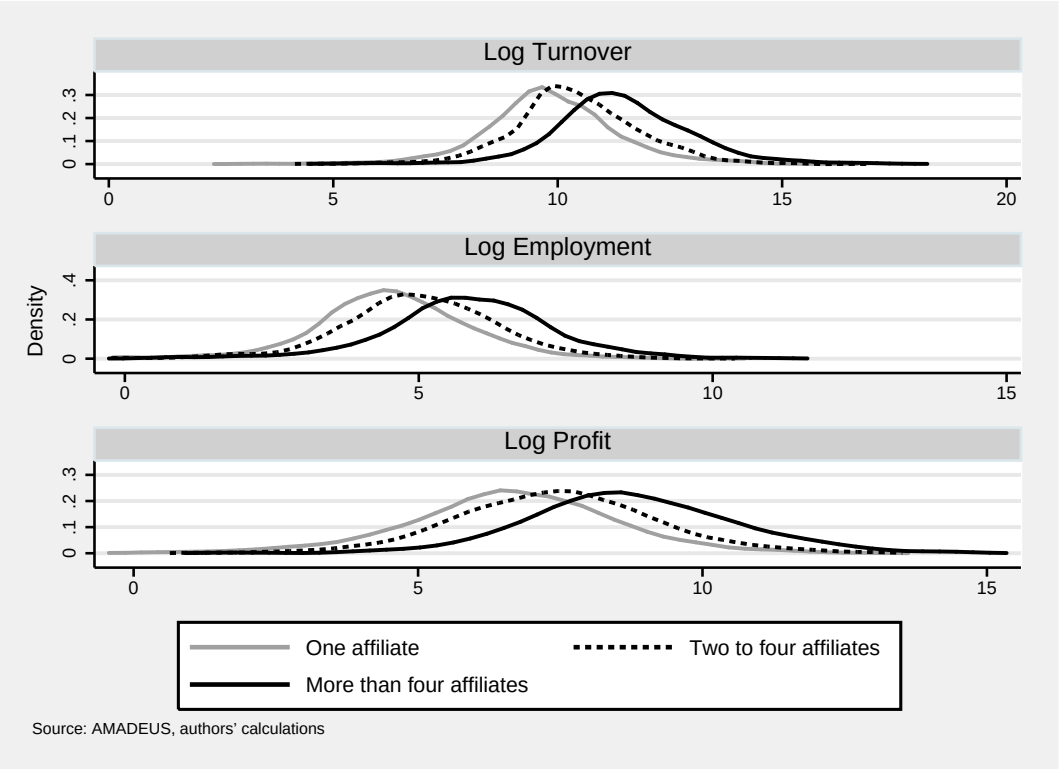
From the analysis thus far, multinational parent companies clearly emerge as the best performing group of firms against a wide range of indicators. We also find that multinationals with more than one affiliate outperform those with only one. Once we focus on the group of multinationals we can investigate further aspects of foreign operations. As Table 4 shows, within the group of multinationals, those parent firms that are on average the best performers in terms of productivity, profits and turnover (defined as being in the top third of the distribution) have a higher number of foreign affiliates – with the best performing multinationals having on average over 56 affiliates – while those multinationals in the bottom three percentiles of the distribution only have between 7 and 11 affiliates. Moreover, we also find that the best performers have, on average, two to four times more affiliates per location than the other two classes of firms. Finally, we also find that firms that are on average the best performers establish foreign affiliates in a larger number of locations than relatively poor performers. The contrast here is even starker than in terms

[5]Dummy coefficients in the log-linear model have to be transformed according to $(exp(\beta) - 1) * 100)$. Moreover, results are not solely driven by size differences: the last column provides results of an OLS regression where we control for size as measured by employment. The differences between MNEs and other firms remain statistically significant.

of firms per location. This latter type of firm on average establishes affiliates in 2 locations while the top 1/3 of the firms in the sample go to 4 to 6 locations, depending on the firm characteristic used to rank firms.

Another way of looking at the data is to compare graphically the distributions of various firm characteristics for the different types of firms. Figure 1 plots the Kernel density distributions of various size measures (turnover, employment and profits) and Figure 2 shows various productivity measures by firm status, distinguishing multinationals with one, two to four, and more than four foreign affiliates.[6] It becomes clear that firms with more affiliates abroad are larger and more productive than firms that only have one foreign subsidiary. Our conclusions are based on the fact that the size and productivity distributions for multinationals with more than one affiliate are substantially to the right of the same distribution for firms with only one affiliate, hence suggesting that they are larger and more productive.

Figure 1: Size distribution and number of foreign affiliates

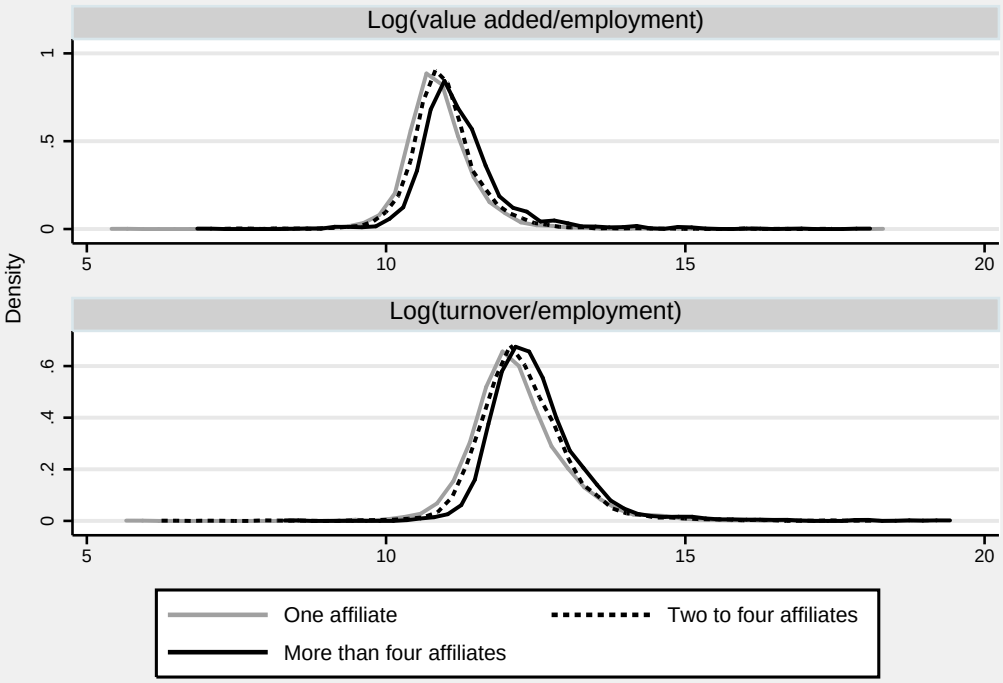


Source: AMADEUS, authors' calculations

In order to provide a more formal test, we invoke the concept of first order stochastic

[6]TFP is calculated using the methodology developed by Levinsohn and Petrin (2003). Production functions are estimated separately at the industry level. Note that all TFP based calculations are based on a reduced country sample (France, Finland, Spain, Portugal) as data for the remaining euro area countries is incomplete and prevents the computation of TFP.

Figure 2: Labour productivity distribution and number of foreign affiliates



Source: AMADEUS, authors' calculations

dominance as applied by Delgado et al. (2002) and Girma et al. (2004) in a similar context. Accordingly, if we have two cumulative distribution functions (F and G) for two comparison groups, say, productivity of multinationals with two to four affiliates and those with one affiliate, then first order stochastic dominance of F with respect to G is defined as F(z) - G(z) = 0 uniformly in z. In order to implement the comparison we adopt the nonparametric one-sided Kolmogorov-Smironov (KS) tests.[7] This essentially tests the hypothesis that F stochastically dominates G, i.e., F(z) - G(z) = 0. In order to conclude that this is the case we want to be unable to reject the null hypothesis for this one-sided test. As can be seen in Table 5, we are unable to reject the null in all cases, i.e., the cumulative distributions of multinationals with more than four affiliates stochastically dominates that of multinationals with two to four affiliates, which in turn dominates that of firms with only one affiliate. This dominance holds true for all reported firm characteristics.

The analysis thus far suggests an important aspect of heterogeneity in foreign investment that has until now been overlooked by the literature: there is a strong ranking of multinationals according to the number of affiliates as well as to the number of locations

[7] See, for example, Conover (1999) for more details on these procedures.

Table 5: Kolmogorov-Smirnov test - H_o: Distribution of MNCs with more foreign affiliates dominates distribution of MNCs with less foreign affiliates

	2-4 foreign affiliates vs. 1 foreign affiliate KS t-prob	more than 4 foreign affiliates vs. 2-4 foreign affiliates KS t-prob
Log Turnover	0.99	0.99
Log Employment	0.99	0.97
Log Profits	0.99	0.99
Labour productivity (turnover/employment)	0.79	0.99
Labour productivity (v.a./employment)	0.99	0.99
TFP	0.99	0.65

Source: Amadeus and authors calculations

in which the multinational enterprise is present with foreign affiliates, and this holds for a number of size and performance characteristics. Table 6 reports the estimates of the impact of the relationship between three MNEs characteristics (number of foreign affiliates, number of foreign affiliates per location and number of locations in which the MNE is present) and domestic size and performance of the MNE. The regressions reported include country and industry fixed effects and log-sales as an additional control variable. We find that, while the number of foreign affiliates seems to have no statistically significant relationship with the four performance characteristics considered (turnover, employment, value added per employee and turnover per employee), adding an additional location in which a multinational has affiliates, is associated with an increase in its domestic turnover by 1 percent and its domestic labour productivity, measured as value added per employee by 2 percent. The coefficients for employment and turnover per employee, on the contrary are not statistically significant. Furthermore an additional foreign affiliate per location is associated with an increase in labour productivity by 3 to 5 percent, and in turnover by 2 percent. The relationship with domestic employment is not statistically significant.

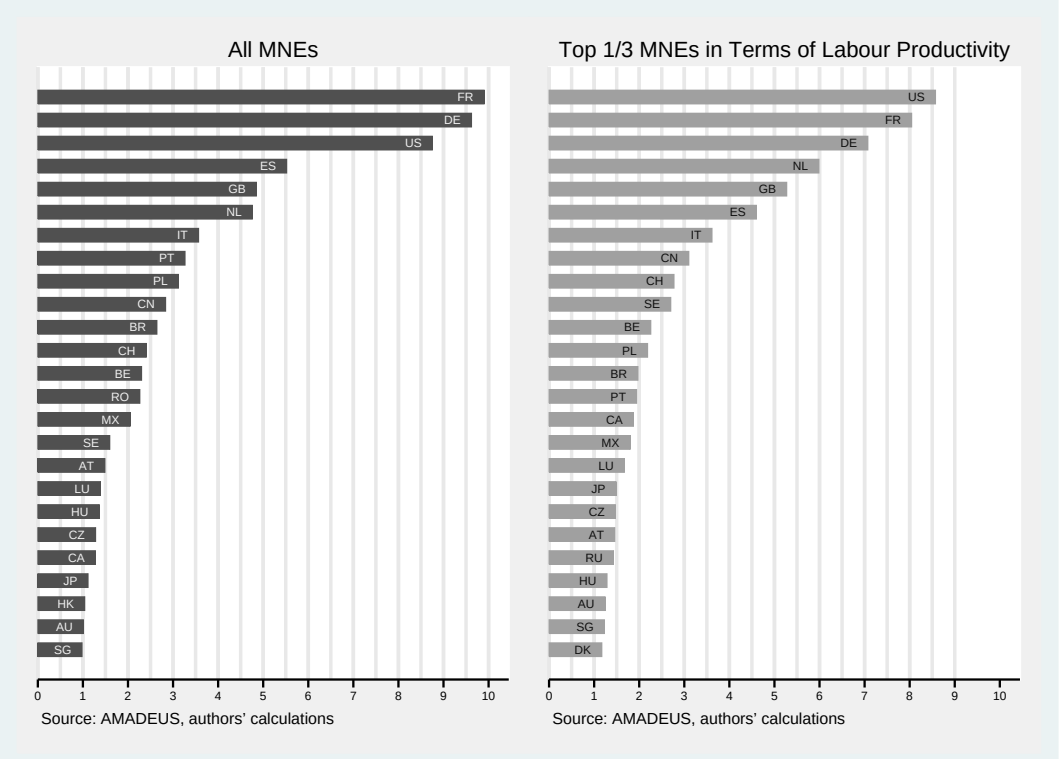
Table 6: MNE extension: premia in terms of size and performance

Dependent Variable:	log(turnover)	log(employment)	log(value added/ employment)	log(turnover/ employment)
Number of a MNE's foreign affiliates	n.s.	n.s.	n.s.	n.s.
Number of locations in which MNE is present	0.01***	n.s.	0.02***	n.s.
	(0.00)		(0.00)	
Number of MNE's foreign affiliates per location	0.02***	n.s	0.05***	0.03***
	(0.01)		(0.01)	(0.01)
ln(Sales)	0.98***	0.77***	0.05***	0.21***
	(0.00)	(0.01)	(0.01)	(0.01)
Country fixed effects	yes	yes	yes	yes
NACE 4 digit industry fixed effects	yes	yes	yes	yes

Source: Amadeus and authors calculations.
Note: Standard Errors in parenthesis, stars indicate t-probabilities (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$). n.s. - not significant, Base year is 2004.

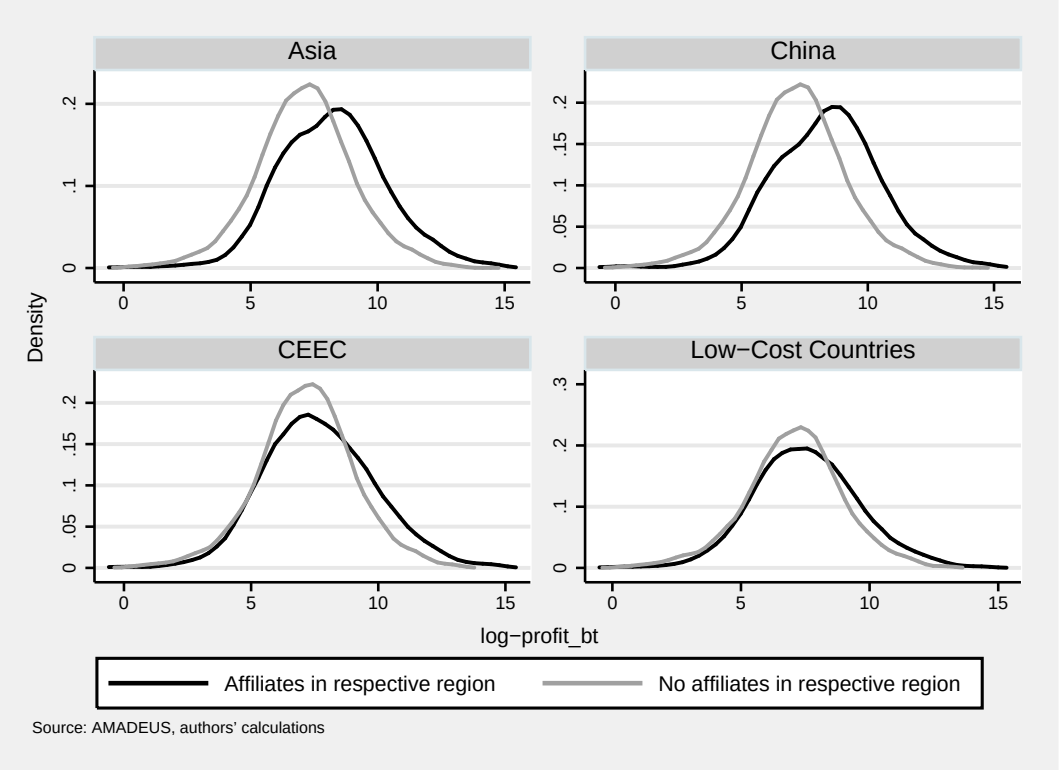
To explore this aspect of heterogeneity among multinationals further, we show in Figure 3 that foreign affiliates are also quite concentrated geographically. The three top destinations for euro area multinationals (France, Germany and the US) host over a quarter of all foreign affiliates, and as little as 8 countries receive over 50 percent of all foreign affiliates. While overall the most popular destination for euro area firms are France and Germany, once we focus on firms with high productivity, the most popular destination is the US. Assuming that this is due to geographic proximity and perhaps other factors, including that sunk costs for setting up affiliates in other euro area countries are less than those for setting up affiliates outside the euro area, this finding is in line with reasoning from an intuitive extension of the Helpman et al. (2004) model discussed above. Due to higher sunk costs, only the most productive firms will choose to predominantly go to the US, and our simple analysis is in line with this suggestion.

Figure 3: Most Frequent 25 Locations for Foreign Affiliates of EA Multinationals



It is also interesting to note that among the most frequent locations shown in the graphs, there are only three emerging countries excluding the new members of the European Union, namely, China, Mexico and Brazil, which could be seen as locations for firms attempting to serve markets with a high-growth potential but also as locations for firms attracted by their low factor costs. By far the largest share of foreign affiliates (above 65

Figure 4: Turnover distribution and location of foreign affiliates



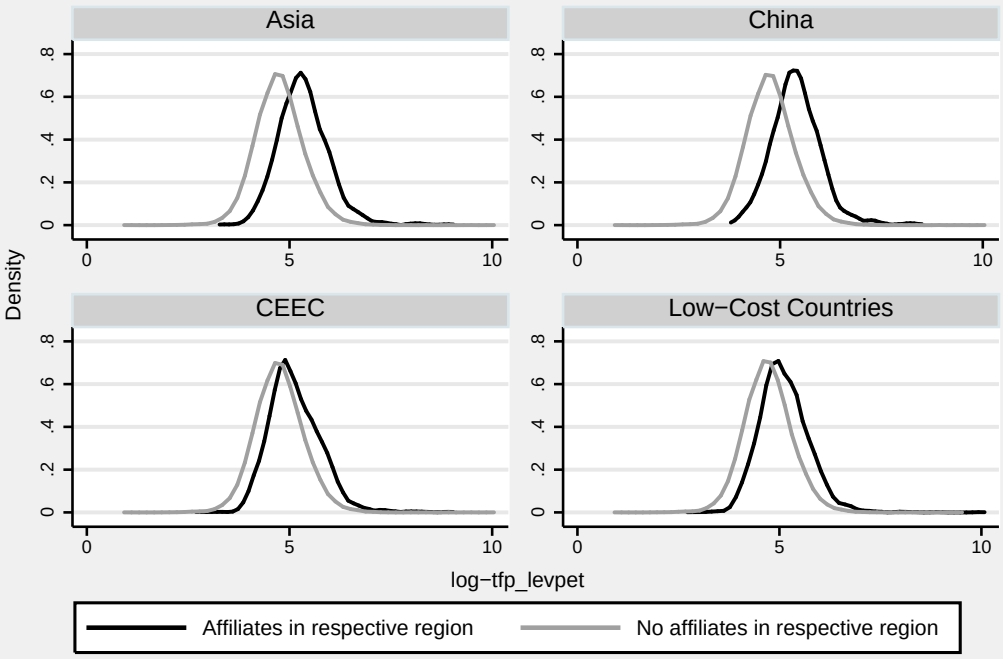
percent) are set up in the 24 high-income countries that, following the IMF classification, we identify as industrialised,[8] suggesting that market access is an important motive for investing abroad.

Given that investment by euro area firms in low cost countries is an important topic of political and popular debate, not least due to the feared job losses associated with such investment, we investigate this phenomenon a little further. We firstly establish whether there is an observable difference in the share of affiliates in low cost countries across best and poor performing multinational parent firms. We find that, while multinationals at the bottom third and multinationals at the top third of the productivity distribution have a similar share of their affiliates in low cost countries (about 35 percent), differences emerge in terms of the preferred low-cost location. Top performers are comparatively more present in Asia, with 11 percent of affiliates in Asian locations versus only 7 percent of poor performers. The latter have a higher share of affiliates in the nearby CEECs (almost 12 percent versus only 10 percent of the best performers).

We also look at the performance differences between firms that invest in a given location

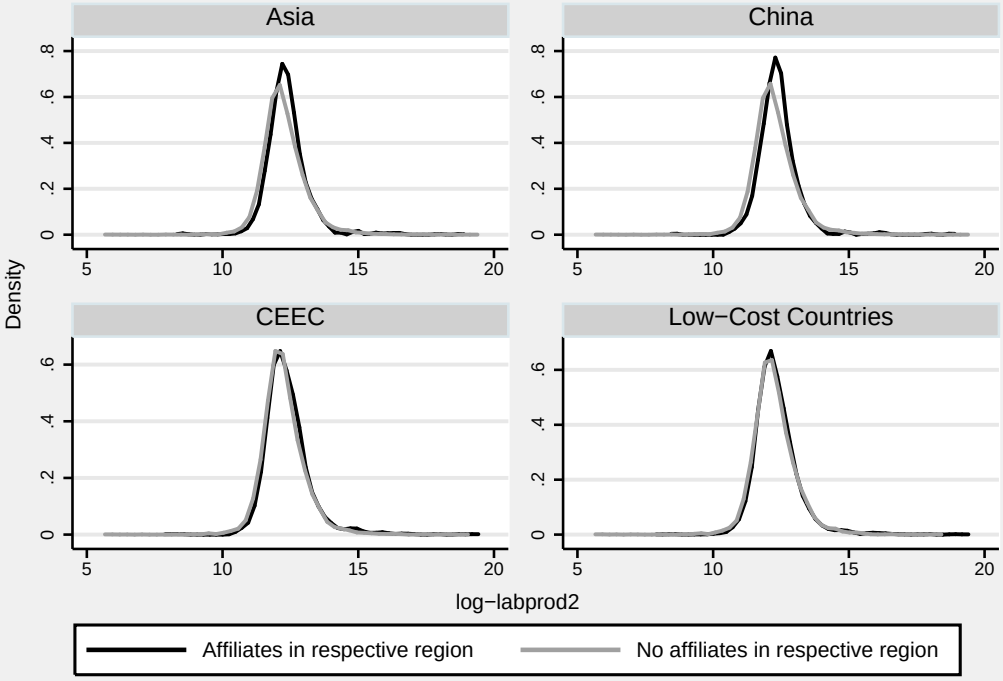
[8]The IMF identifies as industrialised countries the United States, Canada, Australia, Japan, New Zealand, the EU-15, Iceland, Norway, Switzerland and the Liechtenstein (*Source:IMF,"International Financial Statistics publication*)

Figure 5: Total factor productivity distribution and location of foreign affiliates



Source: AMADEUS, authors' calculations
Reduced sample: France,Finland,Italy,Spain,Portugal

Figure 6: Labour productivity distribution and location of foreign affiliates



Source: AMADEUS, authors' calculations

and those that do not. Specifically, do multinationals that establish foreign affiliates in low-cost countries have a better performance than firms that do not? Figures 4 to 6 present, similar to the analysis above, graphs of the density distribution of turnover and productivity, distinguished for those firms that invest in a given location and those that do not. Accordingly, firms that locate in low-cost countries, and in particular in China and Asia, have in general a superior performance over those that do not invest there. This result is also supported by Kolmogorov-Smirnov tests of first order statistical dominance which are, however, not reported here to save space.

How can the finding of performance premia for firms locating in low cost locations be explained? There are a number of different possibilities. Firstly, Asian low cost countries are distant from Europe. If investing in more distant countries involves higher sunk costs, then only highly productive firms will find it profitable to do so. Secondly, there may be additional costs related with locating in low cost countries, either due to the nature of the investment (vertical FDI which may imply high transaction costs) or the characteristics of the country (level of governance, infrastructure). In this case, again only the highly productive firms may be able to cover these costs. Thirdly, investment in facilities in low cost countries might also be partly driven by cost-saving considerations. These may have an impact on ex-post productivity of the multinationals through cost reductions, enhanced flexibility etc. A detailed analysis of the relative importance of these explanations is beyond the scope of this paper, however.

4 A Dynamic Analysis of the Multinational Advantage

Having established that firms with foreign affiliates perform better than other firms along a number of characteristics in a static context, this section takes a look at whether also the dynamic performance of this type of firms is superior to the one of the rest of the sample. In what follows we revert back to a comparison of domestic firms and multinationals, regardless of the number of foreign affiliates. This allows us to focus on the dynamic picture, and helps to keep the analysis relatively simple. We differentiate between incumbent firms as well as market exiters and entrants and take a closer look at the role of foreign affiliates for determining aggregate domestic productivity growth.

For this purpose we merge two Amadeus releases: September 2003 and September 2006. On this basis we can identify firms that existed in 2003 and have exited by 2006 (exits hereafter), firms that on the contrary did not exist in 2003 but are present in the

2006 sample (new entries hereafter) and firms that are sampled in both releases (surviving firms hereafter). For these firms we can observe whether they had foreign affiliates in 2003, in 2006 or at both dates.[9]

Classifying surviving firms is straightforward; these are firms that are sampled in both AMADEUS releases. Identifying market entries and exits deserves more attention. The first difficulty arises due to the fact that the sampling frames of the 2003 and 2006 releases are somewhat different, with slightly less and larger firms being sampled in 2003.[10] We therefore condition our analysis on the 2003 sampling frame, i.e. only consider firms that in principle could have been sampled in 2003, applying the requirements specified in footnote 10. Therefore, new market entries are of two types: "start-ups" and "new-bigs". If their date of incorporation is more recent than 2003, we classify them as "start-ups". If their date of incorporation, however, is antecedent to 2003, but they were sampled only in the conditional 2006 release while meeting the requirements to be sampled in 2003, we classify them as "new-bigs". Hence, these are firms that while being too small in 2003 to be sampled, have presumably grown large enough to be sampled by 2006. Finally, firms, that are only sampled in the 2003 release are classified as market exits. The term market exits is, however, somewhat misleading as these firms not necessarily have ceased to exist. They might have simply reduced their business activities so that they are no longer sampled under the 2006 sampling frame or they might have been acquired by or merged with other firms giving birth to a new enterprise.

4.1 Survival, Exit and Entry

For each category of firms (i.e. new entries, new-bigs, exits and survivors) and each of the two years we can differentiate between those firms that have exclusively domestic operations and multinational parent firms.[11]

Table 7 gives a summary of survival, exit and entry rates by multinational status. With an overall exit rate of 15 percent we observe a substantial demographic turnover

[9] Belgium is excluded from this part of the analysis, as firms identification issues in AMADEUS do not allow to match information regarding firms' multinational status in 2003 with their status in 2006.

[10] Firms where sampled in the the 2003 edition of the AMADEUS database if they fulfilled at least one of the following requirements: employees $\succeq$ 150, turnover $\succeq$ 15 Mill. Euro, total assets $\succeq$ 30 Mill. Euro. In the 2006 release there are no such thresholds.

[11] We therefore distinguish between nine different types of firms generated by the entry/exit status and the multinational/domestic status: (1) domestic survivors; (2) multinational survivors; (3) domestic survivors that became MNE's; (4) domestic "start-ups"; (5) multinational "start-ups", (6) domestic "new-bigs", (7) multinational "new-bigs", (8) domestic exits and (9) multinational exits.

of firms between 2003 and 2006. However, the exit rate of multinational firms is, with 13 percent, substantially lower than the overall one.[12] At the same time the entry rate for multinationals is substantially higher than the rate of new entry among firms without foreign affiliates at least for true "start-ups". Regarding the higher newcomer rate of "new bigs" among multinationals, we suppose that this is to a large extent driven by the fact that multinational firms on average are larger than purely domestic ones, i.e. the probability of "new bigs" to be in fact multinational is higher.[13] The lower unconditional exit rate for multinationals echoes similar findings on comparisons between survival and exit of domestic firms and multinationals by Bernard and Jensen (2007) for the US and Görg and Strobl (2003) for Ireland. Comparisons for entry rates for these types of firms are, to the best of our knowledge, not available in the literature.

Table 7: Exit and Entry Rates for the Euro Area

	All Firms	MNE's in 2003	MNE's in 2006
Exit Rate	15.34	12.66	
Survival Rate	84.66	87.34	100.00
"Start-Ups" Newcomer Rate	0.43		1.95
"New-Bigs" Newcomer Rate	1.58		17.38

Notes: base year 2003. Sample: Euro Area except Belgium and Luxembourg.

The table presents only a preliminary look at the patterns of entry and exit associated with firms categorised by their multinational or domestic status - an issue that has not received yet much attention in the academic literature. Nevertheless, this preliminary evidence seem to indicate that MNEs have a higher probability of surviving in the market. Naturally, it is not possible to impose any causalities on the basis of this descriptive statistics. However, corresponding to our static analysis of size and productivity differences between domestic firms and MNEs, we also identify a clear MNE advantage in terms of survival in the market, thereby confirming the superior ability of multinationals to stay in business as suggested by theory.

Given the high level of dynamism among MNEs, what is their productivity growth,

[12] By comparison, Caves (1998) reports annual average exit rates of 6.3, 4.6 and 9.5 percent for Belgium, Germany and Portugal in the early 1980s. The comparable figure for the US is 7.0 percent.

[13] A caveat to these findings should be mentioned here: while the entry rate of startups is much higher for multinationals than for the rest of the firms, results might be partly driven by the fact that our dataset under-represents small firms that are more likely to have fully domestic operations. This however leads one to think that the difference in exit rate between multinationals and domestic firms might be even larger if we were able to cover the whole panorama of firms

overall and for multinationals that newly set up their affiliates in foreign locations? Is it substantially different from the productivity of firms with purely domestic activities, so to justify the expectation of welfare gains out of the observed reallocation of domestic market shares from one type of firms to the other? Finally, what is their effective contribution to the overall productivity growth of the euro area economy? We turn to these questions in the remainder of this section.

4.2 Productivity and productivity growth by MNE Status

We now take a closer look at the productivity growth of survivors and at the relative productivities of new entrants and firms that exited the market over the period under analysis. To do so we calculate overall productivity growth between 2000 and 2004 using a simple labour productivity measure (turnover over employment) and a more elaborate total factor productivity measure.

While at a first inspection differences between domestic firms, incumbent MNEs and new MNEs do not seem to be very pronounced (as the Kolmogorov-Smirnov test for Kernel density distributions of the productivity growth for different types of firms reported in Table 8 shows), once we weight firm level productivity by their employment or turnover shares and calculate average growth measures for our sample we find pronounced differences between domestic and multinational survivors. Expanding on the established fact that euro area MNEs are more productive than their domestic counterparts, Table 9 shows that also their productivity is growing faster. In the sample used in this study, the rate of growth of total factor productivity for domestic firms is 2/3 the figure for incumbent MNEs and only 1/2 the figure for new MNEs. These differences are even more pronounced for labour productivity.

After establishing that MNE-survivors have on average stronger productivity growth, it is also interesting to look at productivity differences between the domestic and MNE market entries and exits. Table 10 shows the respective productivity differences for "start-ups" (NSU), "new bigs" (NNB) and market exits (X) as defined in Section 4.1.

Table 8: Kolmogorov-Smirnov Test of Survivors' Productivity Growth, p-values

	MNE survivors vs. domestic survivors	New MNE survivor vs. incumbent MNE
Simple Labour Productivity	0.031	0.093
TFP based on reduced sample	0.061	0.347

Notes: TFP figures for reduced sample (France,Finland,Italy,Spain,Portugal)

Table 9: Productivity Growth Rates of Survivors in percent

Simple Labour Productivity	Weighted by Employment	Turnover
Domestic Firms	1.38	-3.90
Incumbent MNEs	17.29	20.37
New MNE	8.93	8.97
TFP based on reduced sample	**Weighted by Employment**	**Turnover**
Domestic Firms	3.99	2.25
Incumbent MNEs	6.53	8.49
New MNEs	7.29	8.32

Notes: TFP figures for reduced sample (France,Finland,Italy,Spain,Portugal)

Table 10: Productivity Differences by MNE-status for Newcomers and Exiters

	Simple Labour Productivity					
	Weighted by Employment			Weighted by Turnover		
	Domestic	MNE	Diff MNE-Dom	Domestic	MNE	Diff MNE-DOM
NSU	5.24	5.57	0.34	6.34	6.04	-0.30
NNB	5.16	5.49	0.33	5.83	5.80	-0.03
X	5.06	5.34	0.28	5.70	5.72	0.02
	TFP based on reduced sample					
	Weighted by Employment			Weighted by Turnover		
	Domestic	MNE	Diff MNE-Dom	Domestic	MNE	Diff MNE-DOM
NSU	10.11	10.45	0.34	10.35	10.43	0.08
NNB	10.02	10.37	0.35	10.24	10.73	0.49
X	9.73	10.39	0.66	10.00	10.62	0.62

Notes: TFP figures for reduced sample (France,Finland,Italy,Spain,Portugal)

In general "start-ups" and "new bigs" with multinational operations display a much higher productivity than their domestic counterparts. Depending on the weighting scheme and productivity measure, the productivity advantage of MNEs can be as high as 6 percent for "start-ups" and "new bigs". The advantage is robust to different methods of measurement, the only exception being represented by the combination of labour productivity measured as turnover per worker. Furthermore, we find that multinational firms that exit the market are on average more productive than their domestic counterparts, irrespective of the productivity measure and weighting scheme one chooses. Thus, the exit of multinational firms reduces aggregate productivity more than the exit of domestic firms.

4.3 Productivity Growth Decomposition

The study has already established that multinational firms on average have higher productivity growth and that their productivity premium holds true even within the subsets of firms that enter or exit the market. But, what is the overall contribution of MNEs to the aggregate productivity growth as compared to firms with fully domestic operations?

We apply the same methodology to measure productivity growth as in the previous section and decompose aggregate productivity growth according to equation 1, where $\pi_{i,t}$ denotes firm i's productivity at period t (2004) and $\theta_{i,t}$ is the share of plant i in industry employment with $t-k$ denoting our base period 2000. Furthermore, S denotes surviving firms, NSU "start-ups", NNB "new bigs" as discussed in Section 4 and X market exits. The first term on the right-hand side of Equation 1 denotes the overall growth contribution of surviving firms reflecting individual productivity growth as well as changing industry shares. The second term represents the growth contribution of new market entries as start ups. Similarly, the third term denotes the contribution of market entries as "new bigs". The last term represents the growth contribution of market exits.

$$
\begin{aligned}
\triangle \Pi_t &= \sum_{i \epsilon S} (\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k}) \\
&+ \sum_{i \epsilon NSU} (\theta_{i,t} \times \pi_{i,t}) \\
&+ \sum_{i \epsilon NNB} (\theta_{i,t} \times \pi_{i,t}) \\
&- \sum_{i \epsilon X} (\theta_{i,\ t-k} \times \pi_{i,\ t-k})
\end{aligned}
\tag{1}
$$

Tables 11 and 12 show the contributions for each of the terms in equation 1 to labour productivity growth and TFP growth, respectively. Clearly, the relative importance of the single productivity growth components varies starkly depending of whether one weights firm level productivity with employment or turnover. However, in general the largest positive productivity growth contribution comes from what we call "new bigs", i.e. firms that between 2003 and 2006 became large enough to be sampled under the 2003 sampling frame. In comparison the contribution of true "start-ups" is much smaller. Furthermore, for most of our productivity measures and weighting schemes the growth contribution of "new bigs" and "start-ups" taken together is smaller than the negative growth contribution of market exits. Thus, netting out the effects, the overall growth contribution through

market entry and exit is negative.[14]

If, overall, the contribution of surviving firms is what essentially drives the positive aggregate productivity growth, once we focus on each of the components of Equation 1 separately and furthermore distinguish between MNEs and domestic firms, we notice interesting differences.[15] The respective growth decomposition can be denoted as in Equation 2, where DOM denotes domestic firms, MNE multinational enterprises and $MNENEW$ surviving firms that became multinationals between 2003 and 2006.

$$
\begin{aligned}
\triangle \Pi_t \;=\; & \sum_{i \epsilon S_{DOM}} (\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k}) \\
+ \; & \sum_{i \epsilon S_{MNE}} (\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k}) \\
+ \; & \sum_{i \epsilon S_{MNENEW}} (\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k}) \\
+ \; & \sum_{i \epsilon NSU_{DOM}} (\theta_{i,t} \times \pi_{i,t}) \\
+ \; & \sum_{i \epsilon NSU_{MNE}} (\theta_{i,t} \times \pi_{i,t}) \\
+ \; & \sum_{i \epsilon NNB_{DOM}} (\theta_{i,t} \times \pi_{i,t}) \\
+ \; & \sum_{i \epsilon NNB_{MNE}} (\theta_{i,t} \times \pi_{i,t}) \\
- \; & \sum_{i \epsilon X_{DOM}} (\theta_{i,\ t-k} \times \pi_{i,\ t-k}) \\
- \; & \sum_{i \epsilon X_{MNE}} (\theta_{i,\ t-k} \times \pi_{i,\ t-k})
\end{aligned}
\tag{2}
$$

(3)

In general, multinational firms contribution to aggregate productivity growth is considerable and goes well beyond their representativeness in terms of employment and turnover. Table 11 for instance shows the contribution of surviving MNE's to overall productivity growth to be 11 percentage points with an average employment share of 11 percent compared to a growth contribution of domestic survivors that is despite a about five times higher employment share only less than four times higher (41 percentage points). Similarly, new multinational "start-ups" contribute with an employment share of less than

[14] However, the reader should keep in mind that this result might be partly driven by the bias of our sample towards large firms. The theories on firm heterogeneity point to a clear positive relationship between firm size and productivity, suggesting that the net productivity effect of entry and exit might become positive - or at least less negative - if we would be able to sample the whole panorama of firms

[15] However, it should be noted that the results differ somewhat depending on the choice of weighting scheme (turnover or employment) and productivity measure (TFP or labour productivity).

one percent about 5 percentage points to aggregate productivy growth. In comparison domestic "start-ups" that have an employment share that is roughly double nevertheless contribute only less than twice as much to overall productivity growth. A similar story holds for domestic and multinational "new bigs". This of course does not come as a big surprise as we have established in the previous section that multinational surviving firms have higher productivity growth than domestic survivors and that multinational market entrants on average have a higher productivity than their domestic counterparts. Tables 11 and 12 confirm these findings and quantify the magnitude of the overall effect.

However, one interesting insight into the forces that determine aggregate productivity growth can be derived by calculating the net contribution of market entry and exit by multinational status. As becomes apparent from Tables 11 and 12 the net contribution of domestic entry and exit to aggregate productivity growth is negative, thus domestic firms that enter the market are one average less productive than domestic firms that exit the market. For multinational firms it is the other way round. Thus there is an immediate positive aggregate productivity effect through the exit and entry of multinational firms.

5 Conclusion

This paper analyses firm level data for euro area countries in order to investigate the links between opening up foreign affiliates and firms'productivity. The analysis essentially takes a snap shot of the data in 2004 and looks at changes in terms of firms entry and exit to the domestic and international markets since 2000. We furthermore investigate what share of euro area firms locate affiliates abroad, how many subsidiaries they have, and where they locate. We also look at the characteristics of firms that go abroad relative to those that do not, and whether these characteristics are different for multinationals depending on the magnitude and location of their foreign operations. Finally we look at how these investment decisions are related to individual firms and aggregate euro area productivity.

Exploiting new aspects of our data the empirical analysis should be regarded as exploratory rather than conclusive. Be that as it may, our findings unearth a number of interesting facts. While only a small share of euro area firms locate affiliates abroad these firms account for over-proportionally large shares of output, employments and profits in their home countries. We also find that, on average, firms that establish affiliates abroad are larger, more profitable and more productive than firms that do not. Furthermore they have higher survival rates and their productivity growth is also higher. While this, to some

Table 11: Simple Labour Productivity Decomposition 2000-2004, in percentage points

	Employment weighted				Turnover weighted			
	Overall	of which			Overall	of which		
		Domestic	MNE	New MNE		Domestic	MNE	New MNE
$\triangle\Pi$	6.78				8.07			
$\sum_{i\epsilon S}(\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k})$	60.30				56.93			
by MNE status		41.43	11.21	7.67		16.33	29.18	11.42
$\sum_{i\epsilon S} \theta_{i,t-k}$		53.60	10.15	9.82		47.02	13.67	12.54
$\sum_{i\epsilon S} \theta_{i,t}$		61.83	11.85	11.07		50.27	17.92	14.24
$\sum_{i\epsilon NSU}(\theta_{i,t} \times \pi_{i,t})$	14.93				22.95			
by MNE status		9.59	5.34			14.59	8.36	
$\sum_{i\epsilon NSU} \theta_{i,t}$		1.83	0.96			2.30	1.38	
$\sum_{i\epsilon NNBI}(\theta_{i,t} \times \pi_{i,t})$	65.97				80.72			
by MNE status		38.69	27.28			45.85	34.87	
$\sum_{i\epsilon NNBI} \theta_{i,t}$		7.50	4.97			7.87	6.01	
$\sum_{i\epsilon X}(\theta_{i,\ t-k} \times \pi_{i,\ t-k})$	134.42				152.53			
by MNE status		120.68	13.74			135.62	16.91	
$\sum_{i\epsilon X} \theta_{i,t-k}$		23.85	2.57			23.81	2.96	

Notes: Euro Area, excluding Belgium and Luxembourg

extent, mirrors findings in the previous literature (e.g., Helpman et al., 2004; Girma et al., 2004) we also find that in general multinational firms contribute more than domestic firms to enhance economy wide productivity growth, although the relative contributions are sensitive to both the type of productivity measured (TFP or simple labour productivity) and to the chosen weighting scheme (turnover or employment).

Moreover, there are performance premia (in terms of size, profits and productivity) for multinationals with a large number of affiliates abroad relative to those with a small number. Interestingly, in terms of locations, we find that multinationals generally have affiliates in more than one country. Among highly productive multinationals the US is the top destination, whereas other multinationals favour the two large core euro area countries, France and Germany. Furthermore, we find that multinationals that locate in low income countries, in particular in Asia, are larger and more productive than those that do not locate in these regions/countries.[16]

[16]Throughout the paper we have been careful to avoid statements about causality. While we embed our

Table 12: TFP Growth Decomposition 2000-2004, in percentage points

	Employment weighted				Turnover weighted			
	Overall	of which			Overall	of which		
		Domestic	MNE	New MNE		Domestic	MNE	New MNE
$\triangle\Pi$	11.24				11.99			
$\sum_{i\epsilon S}(\theta_{i,t} \times \pi_{i,t} - \theta_{i,\ t-k} \times \pi_{i,\ t-k})$	24.96				-17.51			
by MNE status		11.76	9.10	4.10		-36.32	23.96	-5.15
$\sum_{i\epsilon S} \theta_{i,t-k}$		58.63	13.75	10.74		51.76	17.93	13.84
$\sum_{i\epsilon S} \theta_{i,t}$		59.60	14.52	11.06		47.76	19.96	13.02
$\sum_{i\epsilon NSU}(\theta_{i,t} \times \pi_{i,t})$	31.58				38.79			
by MNE status		21.23	10.35			26.13	12.66	
$\sum_{i\epsilon NSU} \theta_{i,t}$		2.12	1.00			2.52	1.21	
$\sum_{i\epsilon NNBI}(\theta_{i,t} \times \pi_{i,t})$	120.20				162.74			
by MNE status		61.98	58.21			78.09	84.65	
$\sum_{i\epsilon NNBI} \theta_{i,t}$		6.13	5.57			7.63	7.89	
$\sum_{i\epsilon X}(\theta_{i,\ t-k} \times \pi_{i,\ t-k})$	165.50				166.70			
by MNE status		144.26	21.24			134.66	32.04	
$\sum_{i\epsilon X} \theta_{i,t-k}$		14.83	2.04			13.46	3.02	

Notes: Reduced sample: France,Finland,Italy,Spain,Portugal

Our analysis is a first step towards a better understanding of multinational activity at the firm level, and the implications for firm characteristics and ultimately economic activity in the country overall. It suggests that there is substantial heterogeneity across different firm types, not only among domestic firms, exporters and multinationals, as recognised in the literature to date but also in the much smaller sub-group of multinationals, where firm characteristics are importantly related to patterns of the magnitude and location of their investment abroad. This needs to be recognised by policy makers who are attempting to assess the possible implications of increasing levels of outward investment on domestic performance.

analysis into the theoretical models which assume selection effects it is of course also plausible that firms acquire performance premia as a result of their expansion into foreign markets. Focusing on causality is an important issue, however, that needs to be tackled in further research.

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Appendix

A Data Description and Representativeness of the sample

A.1 Data

This paper uses a cross section of about 240,000 manufacturing firms from the 12 countries that formed the Euro Area until 31 December 2006.[17] The data are from the Amadeus database (Bureau van Dijk, BvD) which provides comparable firm-level balance-sheet data for 4 million companies in 34 European countries at the 4-digit NACE sectoral detail and covers all industries with exception of the bank and insurance sectors. All variables are measured at the firm level. By construction, we have no plant data but only firm level account information. In our data we treat affiliates of foreign firms in a country as domestic firms unless they have themselves affiliates abroad. We, hence, focus on two groups of firms: those with affiliates abroad and those without, regardless of their nationality.

Amadeus gathers information on firms that satisfy country specific size-thresholds. By construction, the database is biased towards large companies. A further shortcoming of the data is that statutory reporting and filing requirements differ from country to country, and the amount of balance sheet information required by each country varies correspondingly, so that the data coverage is very unbalanced. Also Amadeus, to date, is less complete in countries where there is a lack of centralisation, with companies registering at offices based in their region rather than at a single registry. This is a problem in particular for Germany where, furthermore, value added data is available only for a small subset of companies.

A.2 Representativeness of the sample

Table 13 shows the coverage in terms of value added and employment for each country obtained comparing our sample with aggregate data for manufacturing taken from the 60-Industry Database of the Groningen Growth and Development Centre. Although some observations are missing for particular indicators and countries, our final sample is fairly representative of the overall economies in selected countries. Average employment and value added coverage are respectively around 44 percent and 40 percent, with peaks well above 60 percent for figures relative to Belgium, Finland, France and Spain.

[17] Slovenia joined the Euro Area on 1 January 2007. However, it is not included in our analysis which covers a period before its accession.

Table 13: Representativeness of the AMADEUS sample

	Number of firms in AMADEUS dataset	AMADEUS as share of GGDC 60 industries database	
		Employment(engaged)	Value Added (Euro thousands)
EURO AREA TOTAL	236289	44%	40%
of which:			
AT	4071	38%	22%
BE	6382	75%	92%
DE	27752	30%	16%
ES	70463	61%	64%
FI	8218	71%	64%
FR	80622	85%	83%
GR	6005	48%	n.a.
IE	409	15%	n.a.
IT	31095	35%	44%
LX	1	0.1%	n.a.
NL	794	11%	15%
PT	477	7%	13%

Source: Amadeus, 60-Industry Database of the Groningen Growth and Development Centre and authors calculations

Table 14 and Table 15 summarise number of firms, employment and value added distribution of our final sample broken down by size class, and broad sector. As expected, compared to the dataset we use as a benchmark, the OECD Business by Size Class (BSC) dataset, our sample systematically under-represents firms with less than 50 employees. Table 14 shows that the bias towards large firms is particularly important for three euro area countries (Belgium, the Netherlands and Portugal) and for Great Britain. Furthermore, table 15 indicates that sectors where production tends to be concentrated among a relatively smaller number of firms (eg. chemicals, rubber and plastics, transport equipment producing industries) tend to be over-represented due to their constituency of firms that are larger on average. By contrast, sectors with fairly dispersed production (as in printing and publishing industries, textiles and machinery) seem to be most under-represented in terms of both employment and value added generated. For the euro area as an aggregate, the weight of these sectors in manufacturing is on average between 2 and 3 percentage points smaller according to Amadeus than what reported in the 60-Industry Database of the Groningen Growth and Development Centre.

Table 14: Representativeness of the AMADEUS sample by size of employment: share of each size class over total, for the euro area and by country

	AMADEUS			OECD BSC		
	Firms	Employees	Turnover	Firms	Employees	Turnover
% SMALL FIRMS (less than 50 employees) OVER TOTAL SAMPLE						
EURO AREA	86%	23%	15%	96%	33%	21%
of which:						
AT	79%	19%	16%	93%	27%	16%
BE	75%	14%	12%	95%	26%	19%
DE	80%	12%	9%	90%	21%	10%
ES	92%	41%	24%	97%	48%	29%
FI	88%	21%	11%	95%	23%	12%
FR	90%	24%	13%	96%	29%	24%
GR	82%	30%	23%	n.a	n.a	n.a
IE	45%	9%	6%	81%	23%	7%
IT	73%	22%	23%	98%	49%	35%
LX	n.a	n.a	n.a	n.a	n.a	n.a
NL	46%	5%	9%	94%	33%	20%
PT	43%	7%	4%	96%	48%	28%
% MEDIUM FIRMS (from 50 to 249 employees) OVER TOTAL SAMPLE						
EURO AREA	11%	26%	21%	4%	25%	21%
of which:						
AT	16%	28%	24%	5%	28%	27%
BE	19%	29%	23%	4%	25%	21%
DE	15%	18%	15%	8%	24%	18%
ES	7%	27%	24%	3%	25%	23%
FI	9%	25%	17%	4%	23%	16%
FR	8%	22%	15%	3%	23%	16%
GR	16%	32%	26%	n.a	n.a	n.a
IE	44%	46%	20%	15%	32%	21%
IT	24%	39%	36%	2%	25%	26%
LX	n.a	n.a	n.a	n.a	n.a	n.a
NL	43%	36%	31%	5%	30%	25%
PT	43%	35%	21%	4%	30%	29%
% BIG FIRMS (250 or more employees) OVER TOTAL SAMPLE						
EURO AREA	3%	51%	64%	1%	43%	59%
of which:						
AT	5%	53%	60%	2%	45%	57%
BE	6%	58%	65%	1%	49%	60%
DE	5%	70%	76%	2%	55%	72%
ES	1%	31%	52%	0%	28%	48%
FI	2%	53%	72%	1%	55%	72%
FR	2%	54%	72%	1%	48%	60%
GR	3%	38%	52%	n.a	n.a	n.a
IE	11%	45%	74%	4%	44%	72%
IT	3%	39%	41%	0%	27%	39%
LX	n.a	n.a	n.a	n.a	n.a	n.a
NL	11%	59%	60%	1%	37%	55%
PT	14%	58%	76%	0%	22%	43%

Source: Amadeus, the OECD Business by Size Class (BSC) dataset and authors calculations

Table 15: Representativeness of the AMADEUS sample by sector, euro area

		Share of each sector over total manufacturing			
		Employment		Value added	
Industries	NACE codes	in AMADEUS	in GGDC	in AMADEUS	in GGDC
Food, Drinks and Tobacco	15-16	10%	13%	10%	12%
Textiles,Clothing, Leather, Footwear	17-19	6%	9%	4%	6%
Wood, Paper and Publishing	20-22	9%	11%	8%	11%
Chemical, Rubber and Plastics	24-25	13%	10%	17%	15%
Metals	23, 26-28	19%	20%	21%	19%
Machinery	29-30	11%	11%	10%	12%
Electrical, communication and optical equipment	31-33	9%	10%	9%	11%
Transport equipment	34-35	11%	9%	12%	11%
Total Manufacturing	D	100%	100%	100%	100%

Source: Amadeus, 60-Industry Database of the Groningen Growth and Development Centre (GGDC) and authors calculations