(Not so) easy come, (still) easy go?

Footloose multinationals revisited

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Abstract

This paper revisit the "footloose nature of multinationals" hypothesis. Using firm-level data for Belgium over the period 1997-2005, we rely on a Probit model and takes into account the endogeneity of the determinants of firm exit. Our results may be summarised as follows. First, the unconditional exit probability of MNFs is lower than that of domestic firms. Second, the probability of exit depends on age, Total Factor Productivity, sunk costs, competition on the product market, market concentration, and sector dummies. Third, controlling for these variables, the difference between the exit probability of MNFs and domestic firms becomes insignificant. Fourth, our results show that MNFs have a higher sensitivity to TFP than do domestic firms. In sum, although MNFs do not have a higher propensity to exit than domestic firms; they are more likely to exit when productivity falls..

JEL:
Keywords: firm exit, multinationals; Total Factor Productivity, sunk costs, panel data, Probit model,

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1. Introduction

Multinational firms (MNFs) exits matter for economies in general and public authorities for a number of reasons. For example, as MNFs are typically larger, the close down of MNFs leads to large employment losses. Indeed, the figures reported in Dhyne *et al*. (2010) show that, in Belgium over the period 1998-2005, among the 87 thousands jobs lost due to firms' exit, 25 thousands were due to multinationals; 13 thousands of which due to Belgian MNFs and 12 thousands due to foreign MNFs. On average, a foreign MNE closure induces the direct destruction of 100 jobs (without taking into account the indirect job losses in their co-contractors), while the closure of a Belgian owned firm only destroy 7,7 jobs.

Actually, MNFs are suspected to be more footloose than firms that operate solely on the national market because their international operation scale eases production reallocation from one country to the other. In addition to that, it has been argued that foreign-owned firms are less deeply rooted into the national economy, and so are less reluctant to close down their activities. This would imply that foreign MNFs are more footloose than Belgian MNFs. Among other factors, this may be due to the fact that closing has a different meaning for foreign and national MNFs. Indeed, when a foreign MNFs close down its activities in Belgium, it typically corresponds to closing a production plant. By contrast, for a national MNF it may represent closing the whole company, or full delocalisation of production and headquarters activities. This issue is especially relevant for a small country such as Belgium where the number of foreign MNFs is around 2.5 times larger than the number of Belgian MNFs.

An other important motivation to analyse the likelihood of MNFs to exit the local market is related to the evaluation of the opportunity for governments to develop incentives to attract foreign investors. Haskel *et al*.,(2007) describe a number of related examples in Europe.

These considerations call for a better understanding of the determinants of firms exit, and in particular on the differences between MNFs and domestic firms. Several papers have already investigated this question for several countries. Two main conclusions can be derived from the results of this literature. First, MNFs have an unconditional probability of exit that is smaller than that of domestic firms. However, controlling for intrinsic firm and sector-level characteristics that influence firm exit, it is found that MNFs have a similar or even higher exit probability than domestic firms (see, for example, Alvarez and Görg, 2009; Bernard and Jensen, 2006; Bernard and Sjôholm, 2003; Görg and Strobl, 2003, Mata and Portugal, 2002). For Belgium, it has been shown that MNFs have a lower survival probability (Van Beveren, 2007) and a higher propensity to relocate their activities (Pennings and Sleuwaegen, 2000, 2002).

The literature on this issue is quite extensive and has highlighted several candidate variables to explain firm exit.[5] Following the theoretical works of Jovanovic (1982) and Ericson and Pakes (1995), several papers have investigated the role of firm size and age on firm survival (e.g. Mata and Portugal, 1994), An additional variable that influences the decision of exit is the firm's performance, in particular its productivity. Further, the economic environment may also have some influence. For example, firms' exits may be more frequent in growing and/or less concentrated

[5] To read? Audretsch and Mahmood 1995; Dunne and Hugues 1994; Doms and Jensen 1988

industries than in declining and/or less competitive sectors (see, for example evidence in Alvarez and Görg, 2009; and Görg and Strobl, 2003).

An additional important determinant of exit is the importance of sunk costs. Sunk costs actually generate barriers to entry as well as barriers to exit (and re-entry) (Sutton, 1991). Because sunk costs are lost when the firm exits and have to be paid again in the case of re-entry, they may refrain firms to exit the market if they have positive future prospects (see, Blanchard et al., 2010, for an empirical investigation). In addition, as pointed out by O'Brien and Folta (2009), firms may delay their exit decision when the profitability in the sector is more uncertain. Furthermore, the option value of waiting to take such decision increases with the level of sunk costs.

Other candidates to explain firm exit are numerous. Several authors have examined the role of firm involvement in international trade (see Alvarez and Görg, 2009; Bernard and Jensen, 2006; Bernard and Sjôholm, 2003). Firstly, trade participation may be an indicator of firms' performance, and also be related to prospects of future growth.. Secondly, international trade may be considered as a way for firms to diversify risks, which would make them less connected to local conditions. Indeed, selling production on different markets reduce the risk associated to each market specific demand shocks. Although one could argue that the gain of market diversification may be counterbalanced by this argument an additional risk related to exchange rate fluctuations, this effect is of likely minor importance for Belgian firms that export most of their products and services within EU borders.

When comparing MNFs to domestic firms, some authors have examined the role of workforce characteristics on the ground that MNFs typically employ a large fraction of high-skill workers and pay higher wages. The impact of wages on the probability to exit is however ambiguous. On the one hand, firms that pay higher wages experience higher costs than their competitors; this may reduce their survival probability. On the other hand, higher wages may reflect higher productivity, due for example to higher skills. In this case, higher wages may be associated with lower probability of firm exit. For example, Bernard and Jensen (2006), find a negative effect of wages on the profitability of firm exit. Bernard and Sjôholm (2003) find that firms with lower wages experience higher survival probability, after controlling for the fraction of white-collar wages. Van Beveren (2007) reports mixed results for the effect of average firm wage.

Lastly, it has been argued that the decision to exit or stay on the market may depend from different factors for domestic firms and MNFs. In MNFs such decision may be part of international strategy of the group and may therefore be less sensitive to local conditions compared to other firms exit. Empirically however, Mata and Portugal (2002) find no difference in the sensitivity of foreign firm survival to a set of firm characteristics, compared to domestic firms.

The aim of this paper is to test whether MNFs have a different probability of exit than domestic firms, and what variables explain this difference. We rely on a panel of Belgian firms, for manufacturing industries, construction and market services, over the period 1998-2005. Precisely, we estimate Probit models for firm exit. As explanatory variables, we consider Total Factor Productivity, sunk costs, age, export status, market concentration and demand uncertainty.

Total Factor Productivity is estimated following the method proposed by Ackerberg *et al.* (2006). We rely on data on international trade in goods and trade in services to define the export status. Thanks to information provided in the individual annual accounts on investment, the capital

stock, leasing, depreciation and sales and disposals for both tangible and intangible fixed assets, we are able to construct a measure of tangible and intangible sunk costs. Further, we take advantage of the qualitative information on firms' expected demand reported in the business survey to construct a sector-level measure of demand uncertainty, using Theil (1952)'s disconformity index. We also investigate the role of additional variables such as workforce composition and wages.

Other determinants of firm exit are proposed in the literature but we do not consider in this paper. R&D and marketing activities are not formally considered but are linearly related to our measure of intangible sunk costs. In the same vein we disregard capital intensity because of its obvious relation to tangible sunk costs. Although group membership may provide management expertise, services support from the group, reputation advantages, better access to finance, collateral provision and intra-group lending, we do not consider the effect of being member of a group, beyond MNF membership, due to a lack of information. Group membership is only partly controlled for by the MNFs dummy since this variable only captures membership to an international group. Therefore domestic firms may include single-plant firms, multi-plant firms as well as members from a Belgian group with activities only on the local market. We suspect that the latter concerns a minority of them. Lastly we disregard financial factors such as financial constraints and access to financial markets. The reason is that such variables may be difficult to construct for firms that are member of a group and especially for members of MNFs. Indeed, intra-group lending and the provision of collateral may be decisive advantages but cannot be measured due to a lack of available data.

Following our discussion above, after controlling for these variables, differences between MNF and domestic firms may be attributed to differences in management practices, economies of scale in support services, better access to financing, through intra-group lending, collateral provision on financial markets, etc...

We take into account the endogeneity issues related to most determinants of firm exit. Indeed, as shown by Griliches and Regev (1995), plant closure is preceded by a fall in productivity, a phenomenon they call "the shadow of death". In other words, current productivity is endogenous to firm exit. The same reasoning may be applied to other variables such as firm size, sunk costs and export.

Our findings may be summarised as follows. First, the unconditional exit probability of MNFs is lower than that of domestic firms. Second, the probability of exit depends on productivity, sunk costs, market structure, firm's age, ... Third, these variables explain part of the difference in the probability of exit between MNFs and domestic firms. Nationality and the export status further contribute to explain the difference. Fourth, even after controlling for these variables, we do not find evidence that MNFs, especially foreign ones, have a higher propensity to exit than domestic firms.

2. Data description, variables definition and preliminary statistics

The dataset is obtained after merging several sources of information. The Central Balance Sheet Office provides us with firms' annual accounts; the Survey on Foreign Direct Investment was

used to identify MNFs. We construct firm-level information on trade in goods and trade in services using, respectively, the Transaction Trade dataset and the Balance of Payments dataset.

Appendix A describes in more details the construction of the dataset, including annualisation of annual accounts, extrapolation of missing value, trimming for outliers and definition of the variables used. Briefly, we consider firms that report their accounts using the more detailed scheme, employed at least 10 employees, have nominal physical capital stock above 100 euro, positive value added and positive intermediate inputs consumption and at least two consecutive observations. We restrict our attention to manufacturing industries, construction and trade, market services and financial intermediation (i.e. two-digits 2003 NACE codes between 15 and 73) and exclude firms that may not be considered as "profit maximizing" firms, according to their judicial form, e.g. we exclude non profit associations and public administrations. Real values are constructed based on 2-digits nace-level deflators.

MNFs are defined as firms with either outward FDI, or foreign participation above 50%. Among MNFs, we distinguish between Belgian and foreign MNFs. Foreign MNFs are firms with at least 50% foreign ownership; Belgian MNFs are firms that undertake outwards FDI and are not controlled by foreign ownership for more of 50%. Other firms are classified as domestic.[6]

Although the dataset contains information such as the date of constitution, that can be used to measure firm age, and judicial form of the firm, the data on their judicial situation is not exhaustive over the sample period, and could not reliably be used to identify firms' closure and takeovers. Therefore, following Mata and Portugal (1994), we identify firm exit based on their exit from the sample. The firm is considered as exiter at time *t* if it does not report its annual account, at least, the next two consecutive years (*t*+1 and *t*+2).

In this paper, we consider a broad set of potential determinants of firm exit, such as Total Factor Productivity (TFP), sunk costs, uncertainty, an index of concentration of firm sales on domestic and foreign markets, a measure of competition on the product market, as well as firm size (measured by total employment),

To estimate TFP we extend the method of Ackerberg *et al*. (2006) to account for firm exit, consistently with the focus of the paper. TFP is estimated based on value added, initial capital stock at the beginning of the period, two labour inputs - blue-collar workers employment and white-collar employment - and intermediate consumption as a proxy to control for productivity shocks. In order to identify the labour and capital coefficients, we assume, as in Dhyne et al. (2010), that capital at the beginning of the period is orthogonal to the current productivity shock, and that white-collar as well as blue-collar employment adjust with delay to current productivity shocks. Appendix A reports the estimated production function coefficients.

Sunk costs are defined as retrospective costs that have already been incurred and cannot be recovered. They concerns the part of capital investment that is not leased and cannot be resold on the second-hand market, following Blanchard et al. (2010). We construct sunk costs, for tangible and intangible sunk costs following equation (1)

$$sunk_{it} = (P^{I}_{it}I_{it} - P^{I}_{it}I^{leased}_{it}) + (1-\delta_{it})(1-\gamma_{it}).(P^{K}_{it-1}K_{it-1} - P^{K}_{it-1}K^{leased}_{it-1}) \quad (1)$$

6 This includes Belgian firms with no outwards FDI as well as affiliates of foreign MNFs.

where $P^{I}_{it}I_{it}$ represents nominal investment, and $P^{I}_{it}I^{leased}_{it}$ nominal investment in the form of leasing, $P^{K}_{it-1}K_{it-1}$ is the nominal capital stock at the beginning of the period, and $P^{K}_{it-1}K^{leased}_{it-1}$ the nominal capital stock that is leased at the beginning of the period, δ_{it} the depreciation rate, and γ_{it}, the re-sale rates, the ratio of the capital stock sold in second-hand market over the capital stock. We estimate δ_{it} by the yearly sector-level mean depreciation rate γ_{it} is approximated by the sales and disposals rate of the capital stock, instead of the sales rate due to data limitation. The re-sales rate is intended to capture the possibility for firms to resell capital stock on the second-hand market rather than the effective resale. Therefore, we opt for a resale rate that is the same for all firms within a sector so that it also accounts for firms never resale their capital stock. The other advantage of this measure is that it evolves over time and may thereby better capture changes in resale price of capital. Appendix A explains in more details the trimming procedure and consistency checks used to construct the *re-sale* rate and depreciation rates.

We define total sunk costs as the sum of tangible and intangible sunk costs. The advantage over introducing separately tangible and intangible sunk costs is that total sunk costs provide a continuous measure. By contrast, because the number of firms reporting intangible assets is small, intangible sunk costs involve a lot of zeros.[7] Nevertheless, we also provide estimates with tangible and intangible sunk costs considered separately in Appendix.

A variable that may be related to sunk costs is uncertainty. Indeed, uncertainty is especially relevant in the case of sunk costs, because investment cannot be easily reversed.. Thanks to the qualitative data reported in the monthly business cycle survey, we construct a sector-level measure of demand uncertainty. In this survey, firms are asked the following question:

> *Do you expect demand for your product, in the next three months (A) to rise, (B) to remain unchanged, (C) to decrease, with respect to its average level at that time of the year?*

It is important to note that the question refers to the firm total demand, i.e. on the local and foreign markets. Because the answer to this question is qualitative, we cannot compute the within variance of the answers. Rather, following Fuss and Vermeulen (2008), we use the disconformity index proposed by Theil (1952), and defined as

$$\sigma_{st}=a.[(\%_{up}+\%_{down}) - (\%_{up}-\%_{down})^2] \quad (2)$$

where the scaling factor a is set to one, $\%_{up}$ is the average percentage of firms of sector s in year t that expect an increase in the demand for their product, and $\%_{down}$ is the sector-level average percentage of firms that expect an decrease in the demand for their product. This measure captures disagreement among respondents. For example, if all firms report the same response, either (A) rise, (B) unchanged, or (C) decrease, the Theil index takes value zero. If one third of the firms expect a rise, one third expect a decrease, and the last third expect that the situation remains

7 While nearly all firms report tangible sunk costs, only one half of them reports intangible sunk costs (0.48 of domestic firms and 0.68 for MNFs do).

unchanged, the index takes the value of 0.67. Lastly, if one half of the firms expect a rise and the other half a decrease, the index is equal to 1. We define sectors at the nace 2-digit level.

We also consider the importance of export as control variable in the analysis of the probability of exit. More precisely, we want to capture the fact that a firm active on several markets diversifies demand risk. Therefore, we construct a firm-level Herfindahl index of export shares, called *concentration*$_{it}$, i.e. the sum of the squares of the firm sales shares of the 50 largest markets (domestic and foreign). We consider both goods and services sales on the domestic and foreign markets. For this purpose, we match the firm-level datasets on trade in goods (Transaction Trade dataset) and trade in services (Balance of Payment dataset) with our dataset. This may provide a more accurate description of export activities given that our sample covers not only the manufacturing sector but also construction and the services sector, Further, this ensures consistency between firm sales of goods and services, as reported in annual accounts, and firm exports. For robustness, we also report results using the number of markets served by the firm, and those using the firm export share.

Because firm exit is more likely in more competitive sectors, we also control for the degree of competition within the sector. We use the competition measure proposed by Boone et al. (2007) explained in more details in Appendix. Competition is measured by the elasticity of firms' profits with respect to marginal costs. A higher value of this profit elasticity suggests more intense competition. The idea is that as firms in less competitive markets have some market power over their prices, a given percentage increase in costs will lead to a smaller decline in profits than for firms in more competitive markets. One advantage of this measure over, for example, the Herfindahl index, is that it can take into account increases in competition that do not lead to a reduction in market shares, as may be the case, for instance following market liberalisation when it leads low-performance firms to exit. We also report in Appendix results obtained with alternative measures of competition, the nace 2-diit markups estimated by Christopoulou and Vermeulen (2008) and the Herfindahl index based on value added shares.

Table 1 reports the mean and median of the potential determinants of firm exit and examine differences between MNFs and domestic firms. The last two columns of Table 1 report the estimated difference and t-statistic with respect to purely domestic firms, controlling for NACE 2-digit sector and year. Specifically, we perform the following regression:

$$x_{it} = a + b_B D_{it}^{Belgian\ MNE} + b_F D_{it}^{foreign\ MNE} + \delta_s + \delta_t + \varepsilon_{it} \qquad (1)$$

Note that δ_s is omitted when x_{it} stands for uncertainty, which is defined at the NACE 2-digit sector level. The figures reported in Table 1 confirm previous findings in the literature. Multinational companies, especially foreign ones, are larger and more productive. Possibly related to their productivity advantage, MNFs offer a substantial wage premium, consistent with previous evidence (see, for instance, Almeida, 2007; or Malchow-Møller *et al.*, 2007). Also consistent with their higher productivity and the predictions of trade models with heterogeneous firms (e.g. Melitz, 2003) a larger number of MNFs do trade with other countries than domestic firms and diversify their sales across several markets, as shown by a lower concentration index. Table 1 also highlights substantial differences in sunk costs across types of firms. MNFs have, on average, tangible sunk

costs that are more than 6 times larger than that of domestic firms. On average, the level of intangible sunk costs is much smaller than that of tangible sunk costs. Nevertheless, the ratio of average intangible sunk costs for MNFs and domestic firms is still higher, reaching a factor of 12.9. Lastly, MNFs seem to concentrate in less uncertain and more competitive sectors.

Table 1 - Descriptive statistics

	mean	median	Conditional difference wrt domestic firms coef	t-stat
Size				
Domestic	65.99	46		
MNF	214.65	144	142.77	86.70
Belgian MNF	201.80	125	127.43	42.91
Foreign MNF	219.32	150	148.40	78.97
Apparent labour productivity				
Domestic	0.06	0.05		
MNF	0.08	0.07	0.02	44.32
Belgian MNF	0.07	0.06	0.01	13.66
Foreign MNF	0.09	0.07	0.03	45.26
Total Factor Productivity				
domestic	78.69	65.74		
MNF	101.98	69.98	33.62	47.30
Belgian MNF	84.92	58.40	19.22	15.02
Foreign MNF	108.17	75.40	38.90	48.05
Average annual wage (in thousands euro)				
Domestic	37.04	36.30		
MNF	45.91	43.99	8.23	66.53
Belgian MNF	41.23	40.07	4.01	18.11
Foreign MNF	47.61	45.64	9.78	69.72
firm concentration				
Domestic	0.77	0.94		
MNF	0.52	0.44	-0.19	-47.08
Belgian MNF	0.50	0.41	-0.20	-27.76
Foreign MNF	0.52	0.46	-0.18	-40.26
Total sunk costs (in thousands euro)				
Domestic	7.38	3.35		
MNF	42.47	17.00	32.62	38.48
Belgian MNF	28.70	13.69	18.95	12.41
Foreign MNF	47.46	17.88	37.64	38.94
Intangible sunk costs (in million euro)				
Domestic	0.27	0.00		
MNF	3.47	0.20	3.09	28.05
Belgian MNF	1.78	0.19	1.42	7.14
Foreign MNF	4.08	0.20	3.70	29.49
Tangible sunk costs (in million euro)				
Domestic	7.11	3.20		
MNF	39.00	14.97	29.54	36.27
Belgian MNF	26.92	12.44	17.54	11.95
Foreign MNF	43.38	16.12	33.94	36.55
profit elasticity (competition measure)				
Domestic	5.74	6.15		
MNF	6.10	6.12	0.06	2.63
Belgian MNF	6.18	6.12	0.15	3.55
Foreign MNF	6.07	6.12	0.03	1.09
Demand uncertainty (sector-level)				
Domestic	0.36	0.35		
MNF	0.34	0.33	-0.02	-18.60
Belgian MNF	0.34	0.33	-0.02	-10.60
Foreign MNF	0.34	0.33	-0.02	-16.02

Note: 36036 observations, 7089 firms over 1997-2005; 'conditional difference' reports the conditional difference and t-stat, controlling for nace 1 digit sector and year dummies; for uncertainty, year dummies are included but not sector dummies. .

Concerning the probability to observe a firm exit, Figure 1, which reports Kaplan-Meier estimates for domestic and multinational firms, suggests that the unconditional survival probability is higher for multinational plants than for domestic firms. The next section examines whether, this remains true after controlling for intrinsic firm and sector characteristics,

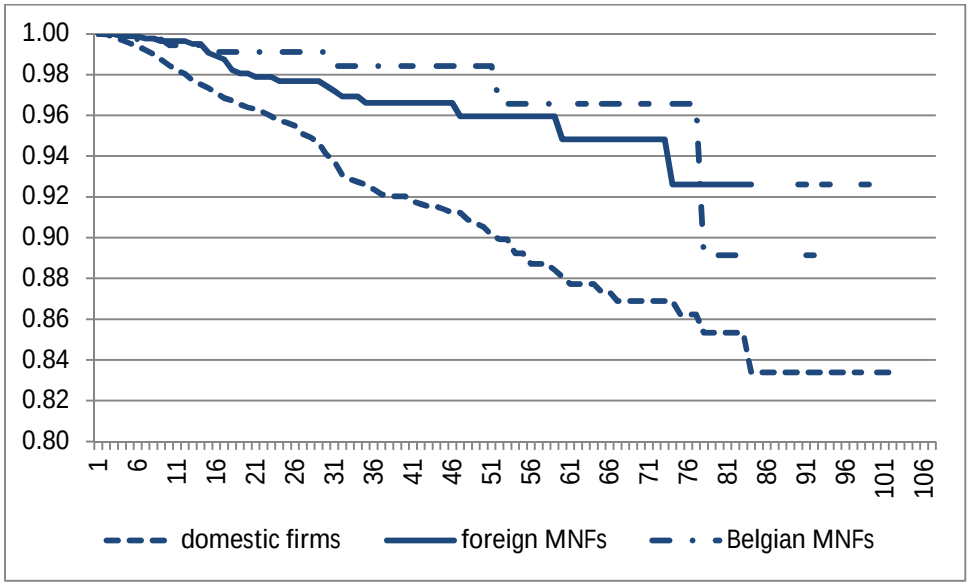

Figure 1 - Kaplan-Meier survival estimates

3. Estimation results

Marginal effect estimates of Probit models reported in Table 2 all include NACE 1-digit sector effects and time dummies, and no random effects.[8] This allows controlling for the fact that MNFs may concentrate in some industries. It has been argued that they are indeed more present in more high-tech industries, more concentrated industries with higher economies of scale. As shown in column (2), controlling for productivity, age, sunk costs, market competition and firm concentration reduces the difference between the exit probability of MNFs and domestic firms by around two third.

Consistent with earlier results in the literature, our results show that the probability of exit is lower for older and more productive firms, and higher for firms operating in more competitive environment. As in Blanchard et al. (2010), our results also point to a non negligible role of sunk costs in restraining firm exit. Furthermore, sales diversification across several, local and foreign, markets, also reduce *ceteris paribus* the risk of exit.

In columns (3) to (5) we examine the role of some other variables that have been considered in the firm exit literature; some further covariates are considered in Appendix B.[9] Contrary to expectation, demand uncertainty within the sector has no significant impact on firm exit. Results

8 As shown in Table B.1 in Appendix B, random effects are insignificant.

9 Table B.2 shows that the interaction between sunk costs and uncertainty is not significant. Tangible sunk costs play a significant role in the exit rate, while intangible sunk costs do not. Further, the sector-level value-added growth and firm-level characteristics related to their workforce and wages (wages, wages of blue-collar workers and that of white-collar workers, the percentage of blue-collar workers) are not significant. Table B.3 also report estimates using alternative definitions of the variables.

reported in Appendix B.2 show that the interaction between uncertainty and sunk cost is also insignificant. Therefore our results confirm that sunk costs are impediments to firm exit, but their role is not larger in more uncertain sectors.[10]

A typical explanatory variable of firm exit is firm size. Our results show, however, that, when controlling for other characteristics - productivity, age and in particular sunk costs - size is not significant. Results reported in Appendix C suggest that size may be considered as a proxy for sunk costs. Firstly, its correlation with sunk costs is equal to 0.55; secondly, size is significant when sunk costs are excluded but becomes insignificant once sunk costs are controlled for.

One additional factor that may explain differences between MNFs and purely domestic firms is nationality. Belgian MNFs may be more reluctant to abandon their activities in their own country, due to organisation reasons, reputation issues, etc... The last columns of Table 2 does not give strong support to this hypothesis. Controlling for productivity, age, sunk costs, market concentration and export orientation, foreign MNFs do not have a significantly different exit probability than firms that operate solely on the local market. Belgian MNFs have a lower conditional probability of exit but the difference with foreign MNFs is not significant at conventional significance levels.

Note that we never find that MNFs have a higher exit probability than domestic firms with comparable firm and sector characteristics.

As shown in Tables B.1, B.2 and B.3 in Appendix B, our results are robust to additional explanatory variables (such as value-added growth at the sector level, the share of blue-collar workers, wages), to alternative definition of competition on the product market and international diversification and to the inclusion of random effects.

[10] None of our sector-level variables, uncertainty and value added growth (see Tables B.2.and B.3. in Appendix) is significant. This may not be attributed to the fact that the time variation in these variables is too small and that the cross-section heterogeneity is captured by the sector effects. Our sector-level variables are defined at the nace 2-digit level and vary over time, while sector effects in the estimation are defined at the nace 1-digit level. Furthermore, as shown in Table B.4, these variables remain insignificant when we exclude the sector dummies.

Table 2 - Probit models for the probability of exit - marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
MNF_{it}	-.00393***	-.00044	-.00047	-.00028	-.00042	.00025
	(-4.50)	(-0.46)	(-0.48)	(-0.27)	(-0.45)	(0.21)
Bel. MNF_{it}						-0.00349*
						(-1.670)
TFP_{it}		-0.00006***	-0.00006***	-0.00006***	-0.00006***	-0.00006***
		(-4.547)	(-4.543)	(-4.502)	(-4.520)	(-4.593)
Age_{it}		-0.00009***	-0.00009***	-0.00009***	-0.00009***	-0.00009***
		(-3.060)	(-3.002)	(-3.060)	(-3.080)	(-3.037)
$Sunk_{it}$		-0.00008**	-0.00008**	-0.00006	-0.00008**	-0.00008**
		(-2.099)	(-2.023)	(-1.450)	(-2.126)	(-2.139)
Profit $elasticity_s$		0.00050*	0.00058*	0.00052*	0.00053*	0.00050*
		(1.766)	(1.928)	(1.810)	(1.859)	(1.772)
$Concentration_{it}$		0.00686***	0.00682***	0.00682***	0.00680***	0.00679***
		(3.948)	(3.925)	(3.920)	(3.919)	(3.927)
σ_{st}			0.00733			
			(0.774)			
$Size_{it}$				-0.00557		
				(-0.753)		
$\Delta\log(VA_{st})$					-0.02308	
					(-1.087)	
log L	1853.34	1776.58	-1776.28	1776.28	1775.98	1775.69

Note: All equations include year and sector dummies; z-statistic in italic, 38713 observations.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Finally, we considered a specification that allows MNFs to have different marginal effects with respect to the determinants of firm exit. Results, presented in Table 4, reveal that multinationals do not significantly differ from domestic firms, except in their response to changes in TFP. The interaction term between TFP and MNF is negative. This may be interpreted as evidence of the footloose nature of multinational firms, in the sense that they may more strongly react to deterioration of the productivity of their international plants. Our results therefore offer a reinterpretation of teh footloose nature of multinationals. According to our estimates, MNFs do not have a higher propensity to exit the national market than domestic firms in general. However, they will be more likely to exit. in response to adverse economic developments, such as a negative shock on TFP

Table 3. - Probit models with interactions with MNF dummy - marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MNF_{it}	-.00044	.00356	-.00134	-.00063	.00142	-.00210	.00008
	(-0.46)	(1.31)	(-0.97)	(-0.57)	(0.38)	(-1.43)	(0.02)
TFP_{it}	-0.00006***	-0.00005***	-0.00006***	-0.00006***	-0.00006***	-0.00006***	-0.00005***
	(-4.547)	(-3.754)	(-4.546)	(-4.533)	(-4.548)	(-4.604)	(-3.712)
$MNE*TFP_{it}$		-0.00008**					-0.00010**
		(-2.061)					(-2.376)
Age_{it}	-0.00009***	-0.00008***	-0.00010***	-0.00009***	-0.00009***	-0.00009***	-0.00009***
	(-3.060)	(-3.017)	(-3.100)	(-3.036)	(-3.055)	(-3.060)	(-3.064)
$Sunk_{it}$	-0.00008**	-0.00008**	-0.00008**	-0.00009*	-0.00008**	-0.00008**	-0.00008*
	(-2.099)	(-2.116)	(-2.109)	(-1.705)	(-2.104)	(-2.046)	(-1.649)
Profit $elasticity_s$	0.00050*	0.00050*	0.00050*	0.00050*	0.00054*	0.00049*	0.00050*
	(1.766)	(1.834)	(1.758)	(1.763)	(1.850)	(1.740)	(1.821)
$Concentration_{it}$	0.00686***	0.00671***	0.00687***	0.00686***	0.00683***	0.00612***	0.00565***
	(3.948)	(4.002)	(3.952)	(3.941)	(3.931)	(3.341)	(3.215)
$MNE* Age_{it}$			0.00006				0.00007
			(0.767)				(0.901)
$MNE*Sunk\ cost_{it}$				0.00002			0.00002
				(0.302)			(0.227)
$MNE*Profit\ elasticity_s$					-0.00045		-0.00022
					(-0.591)		(-0.282)
$MNE* Concentration_{it}$						0.00526	0.00737
						(1.139)	(1.560)
log L	-1776.58	-1774.13	-1776.29	-1776.53	-1776.40	-1775.92	-1772.30

Note: All equations include year and sector dummies; z-statistic in italic.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

The interpretation of the results of this type of model is that firms with, say, higher productivity compared to other firms experience a lower probability of exit. However, in panel datasets, productivity captures the evolution of productivity over time, in addition to the productivity level of the company relative to that of other firms. The estimates reported in Table 2 may reflect the fact that productivity falls prior to exit (the "shadow of death" phenomenon, Griliches and Regev, 1995), rather than the fact that firms that are less productive have a lower survival rate. The problem may be translated to the firm market concentration since export activities have been shown to be related to the productivity level. It has also implications for sunk costs. Consider, for example a firm that experiences a sizeable adverse shock, such as a substantial fall in demand. It may have strong incentives to reduce its operating scale on the national market, whether or not it has decided to ultimately close its activities in the future or is uncertain about a closing decision. Consequently, it may sells part of its activities and plants in a stepwise manner.[11] This will translate into disinvestment and lower capital stock, therefore on lower measured sunk costs.

In order to take into account this endogeneity issue, we follow the two steps instrumental variable approach for Probit panel data models of Rivers and Vuong (1988). In the first step, endogenous variables are regressed on instrumental variables and other exogenous variables of

11 For example, the closing of car assembly lines by foreign MNFs in Belgium in the nineties and in the recent past took more than a year to become effective. In the meanwhile, firms substantially downsize.

the Probit equation. In the second step the residual of the first stage is included in the Probit equation together with the fitted value. The significance of the residual in the Probit equation provides a test of endogeneity of the variable. In Table 4 we report the estimates of our preferred specification, i.e. equation (2) of Table 3, taking into account endogeneity of TFP, sunk costs and firm market concentration. We run the first step regression year by year in order to allow for time-varying coefficients for the instrumental variables. We consider as instruments real value added and employment at the nace1 digit sector level, as well as one lag of the endogenous variable.

The results of the Rivers and Vuong (1988). test indicate that only firm market concentration is endogenous. This suggests that prior to exit firms start to disinvest from foreign market, while disinvestment in terms of physical or intangible capital has a much slower response.

Our findings suggest that, controlling for endogeneity, productivity, age, sunk costs and firm market concentration explain part of the lower exit probability of MNFs compared to domestic firms, and that MNE tend to exit faster following a productivity decline.

Table 4 - Probit models for the probability of exit - marginal effects - endogeneity

	(1)	(2)	(3)	(4)
MNF_{it}	.00713	.00588	.00627	.00555
	(1.41)	(1.24)	(1.37)	(1.32)
TFP_{it}	-0.00006***	-0.00006***	-0.00006***	-0.00006***
	(-3.131)	(-3.220)	(-3.619)	(-3.518)
$MNE*TFP_{it}$	-0.00011**	-0.00010**	-0.00010**	-0.00010**
	(-2.143)	(-2.055)	(-2.053)	(-2.112)
Age_{it}	-0.00014***	-0.00015***	-0.00015***	-0.00015***
	(-4.119)	(-4.282)	(-4.134)	(-4.266)
$Sunk_{it}$	-0.00011**	-0.00008*	-0.00011**	-0.00008*
	(-2.232)	(-1.893)	(-2.238)	(-1.856)
Profit $elasticity_s$	0.00049	0.00057*	0.00056*	0.00050
	(1.531)	(1.774)	(1.759)	(1.554)
$Concentration_{it}$	0.00809***	0.00864***	0.00855***	0.00814***
	(3.887)	(4.338)	(4.328)	(3.880)
RV_TFP	-0.00006**	-0.00006**		
	(-2.148)	(-2.149)		
RV_MNE*TFP	-0.00007	-0.00007		
	(-0.611)	(-0.607)		
RV_sunk	0.00013		0.00013	
	(0.874)		(0.848)	
RV_concentration	0.01643**			0.01656**
	(2.553)			(2.549)
log L	-1594.92	-1616.32	-1615.57	-1595.86

Note: All equations include year and sector dummies; z-statistic in italic.
RV stands for the Rivers and Vuong test of endogeneity
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

For robustness test, we report in Tables B.4 and B.5 Appendix below the results obtained with two alternative instruments set, all of which include sector-level real value added and employment. The first alternative set of instrument includes the endogenous variable lagged 2. The aim is to allow for cases where the shadow of death effect is longer than one year, e.g. when firm restructuration takes two years. Our previous results remain valid.

The second set of instruments excludes lags of the endogenous variable. In this latter case, the explanatory power of the instruments is smaller. The R^2 of the regression of TFP, sunk costs and firm markets concentration are, respectively 0.45, 0.08, 0.32 in this case, while they are equal to 0.87, 0.97 and 0.94 when we allow for one lag of the endogenous variable, and 0.80, 0.94 and 0.90

when we take lag 2 of the endogenous variable. Excluding the lagged endogenous variable, the results suggest that all three variables, TFP, sunk costs and firm market concentration are endogenous. Taking into account endogeneity the only variable that remains significant is the interaction term between multinationals and TFP.

To summarise, our results indicate that older, more productive firms, facing higher sunk costs, operating in more concentrated markets, and exporting abroad have a lower probability of exit than younger, less productive firms, with lower sunk costs, selling their production on the local market only and in more competitive sectors. These factors also explain a large fraction of the difference between the exit probability of MNFs and domestic firms. However, MNFs might still be considered as footloose, in the sense that they more strongly react to deterioration of TFP.

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Appendix A: Data construction

We focus on firms that report full annual accounts[12], at least once over the period 1997-2007, have employed at least 10 employees, at least once over the period considered, have positive value added, positive and nominal fixed assets over 100 euro. The last two criteria are used in order to reduce indivisibility issues and downwards bias in estimated production coefficients.

The focus on full annual accounts is motivated on two grounds. Firstly, they provide more detailed information, such as intermediate consumption, needed to estimate Total Factor Productivity, and investment of fixed tangible assets in the form of leasing, used to construct sunk costs. Secondly, because the identification of MNFs rely on a survey that focus on larger firms, and since, over the period 1997-2005, 95% of MNFs fill in full annual accounts, we restrict our attention to firms that also fill in full annual accounts to obtain a comparable control sample..

We focus on manufacturing industries, construction and trade, market services and financial intermediation (i.e. two-digits 2003 NACE codes between 15 and 73) and we also restrict our sample to "profit maximizing" firms, defined according to their judicial form, e.g. we exclude non profit associations and public administrations.

We perform a small set of corrections of date and year or apparently erroneous number of months of annual accounts.[13] Then, annual account information has been annualised, to guarantee consistency with other firm-level datasets such as FDI or foreign trade information, ensure relevant cross-section comparisons, the use of appropriate yearly deflators.[14] Lastly, we extrapolate missing values by taking the average difference between the previous and the next year. We allow up to two consecutive missing values.

We use the 2-digits 2003 nace deflators published in the National Accounts to obtain real values of the nominal variables. Firm-level nace codes are provided in the annual accounts dataset based on the main activity of the firm. We correct temporary nace codes to avoid discontinuity, and possible exclusion of firms for some estimation procedures.[15]

We also extrapolate missing participation rates of inwards and outwards FDI, which, given the stability of participation rates, appear to be due to missing reporting.

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12 According to Belgian accounting legislation, a company falls within this category, in 2007, either when the yearly average of its workforce is at least 100 *or* when at least two of the following thresholds are exceeded: (1) yearly average of workforce is 50, (2) turnover (excluding VAT) amounts to at least EUR 7,300,000, (3) total assets exceed EUR 3,650,000. In general, the latter two thresholds are altered every four years in order to take account of inflation.
Less than 10% of the companies in Belgium report full annual accounts, but these account for most of value added and employment.

13 For example when the ending date was 2 January 2005, we change the date into 31 December 2004. By doing this we attribute the values reported in the annual account to the year 2004 instead of 2005.

14 Flows are adjusted by taking a weighted average of t and t+1 flows. Stocks are adjusted by adding to the current year stock the weighted stock variation between current and next year. The procedure attributes a missing value when there is not enough information to recover the entire year, for example when information about the first months or the last months of a given year are missing. This does not apply for the last year the firm is observed and for flows of the first year the firm is covered.

15 We use the following rule: firms that have two, three or four different nace codes over the period 1996-2007 take a single nace code over the entire period if the most frequently observed code is reported for at least 8 periods and the least observed ones for at most 2 periods. In this case, firms are given the most frequently observed nace code for the entire period.

Firm-level information on wages for all workers, blue-collar workers and white-collar workers is provided by the Social Security DataWarehouse. Consistency between the Social Security database and the annual accounts is not perfect because the former refers to the gross labour compensation received by the employee, while the latter is related to the employers' labour costs. We restrict the sample to firm-year observations where the ratio of the total wage bill reported in the annual accounts and that constructed from Social Security data lies between 0.532 and 1.114.[16] Second, in order to correct Social Security wages by the discrepancy between wage bill and labour costs, we concentrate on firm-year observations where the ratio of total labour cost to the wage bill, as given in the annual accounts is greater than one but smaller than 2.

In order to reliably estimate production function coefficients and Probit models for the probability of firms exit, we trim the sample as follows. We exclude the 99th percentile of gross employment flows of blue-collar workers and of white-collar workers, which may capture takeover events. We drop the sector "other business activities", which includes temporary workers agency, because this may severely bias job flows estimates.[17]

In order to estimate production function coefficients, we retain only firm-year observations where firms employ both blue-collar and white-collar workers, and where the value of capital is above 100 EUR and intermediate consumption is positive. We finally remove outliers by keeping observations where the log of apparent labour productivity, the log of the ratio of real average wage bill over apparent labour productivity and the log of the capital-labour ratio, lie within the range defined by the median minus or plus three times the inter-quartile range. This criterion is applied by year and nace 2-digit sectors. Lastly, we focus on firms with at least two consecutive observations and continuous spells[18].

TFP estimation

TFP estimates are based on the Ackerberg, Caves and Frazer (2006) procedure extended to account for firm selection. To clarify our correction for firm selection, remind that the objective is to estimate the following production function (in log):

$$y_{it} = \beta_k k_{it} + \beta_b lb_{it} + \beta_w lw_{it} + \omega_{it} + \varepsilon_{it} \qquad \text{(a.1)}$$

where

y_{it} = log of value added of firm i at time t

k_{it} = log of real capital stock of firm i at the start of period t;

lb_{it} = log of blue collar employment of firm i at time t;

lw_{it} = log of white collar employment of firm i at time t;

ω_{it} = productivity observable to the firm when making its input decision,

16 These thresholds represent the 2.5 and 97.5 percentile of the distribution of the ratio of the wage bill reported in the annual accounts and the one constructed from the Social Security data.

17 Also, we require consistency between total employment exits and the sum of reported exits due to layoffs, those due to retirement, those due to early retirement, and those due to other reasons.

18 In case of discontinuity we consider only the last spell (provided it covers at least two years).

ε_{it} = unobserved shock or measurement error.

Following Olley and Pakes (1996) and Levinsohn and Petrin (2003), the productivity shock may, under certain conditions, be inverted from a non linear function of the fixed or quasi-fixed factors, the capital stock and labour in our application, and a proxy, the log of material inputs, m_{it}, in our application:

$$y_{it} = \beta_k k_{it} + \beta_b lb_{it} + \beta_w lw_{it} + f_t^{-1}(k_{it}, lb_{it}, lw_{it}, m_{it}) + \varepsilon_{it} \quad \text{(a.2)}$$

We first estimate the non linear equation (a.2), separately for each year.

Second, we estimate the probability of firm survival, ϕ_{it}, based on a non linear model with time-varying coefficients, that depends on firm age, sunk costs, market concentration, capital and the proxy used to invert productivity, consistent with the model developed in the paper.

We extend the Ackerberg, Caves and Frazer (2006) framework by assuming that ω_{it} follows a first order Markov process *conditional* on firm survival. In this case, productivity can be expressed as the sum of expected productivity and productivity shock, ξ_{it}, where expected productivity depends on firm survival probability

$$\omega_{it} = E[\omega_{it}|\omega_{it-1}, \phi_{it-1}] + \xi_{it} \quad \text{(a.3)}$$

Lastly, capital and labour production function coefficients are identified assuming that the capital stock available at the beginning of the period is independent of the current productivity shock, ξ_{it}. Identification of the labour coefficients rests on the assumption that the demand for labour inputs adjust with some delay. This assumption is consistent with the existence of labour adjustment costs, as evidenced in Dhyne et al. (2010).

In practice, for given values of β_k, β_b, and β_w, we estimate equation (a.2) and compute $\widehat{\omega_{it}}$. Then we regress $\widehat{\omega_{it}}$.on a fourth order polynomial function of $\widehat{\omega_{it-1}}$ and $\widehat{\phi_{it-1}}$, and compute $\widehat{\xi_{it}}$. Lastly, we evaluate the sample analogue to the moment conditions used to identify the production function parameters, i.e.

$$\frac{1}{N}\frac{1}{T}\sum_t \sum_i \widehat{\xi_{it}} \begin{pmatrix} k_{it} \\ lb_{it} \\ lw_{it} \end{pmatrix}$$

The procedure is repeated for different values of the parameters. We use the genetic algorithm. This random search procedure substantially improves the traditional grid search procedure used to implement the Ackerberg, Caves and Frazer (2006) method.[19]

Production function coefficients are estimated at the sector level. In order to run the estimation on samples of sufficient size, we estimate TFP at the nace 1-digit level. Table A.1. reports the number of observations and firm per sector, together with estimated production function coefficients and bootstrap standard errors.

19 Using a very fine grid search, we verify that the grid search and genetic algorithm yield the same coefficients estimates.

Table A1. Estimates of production coefficients

sector	# obs.	# firms	α^K	α^B	α^W
(1) Food and textile	4139	840	0.178	0.424	0.388
			(0.011)	(0.015)	(0.016)
(2) Wood, paper, chemicals, metal and non	10000	1877	0.161	0.358	0.437
metal products, machinery			(0.006)	(0.009)	(0.009)
(3) Equipment and recycling	2294	448	0.138	0.354	0.433
			(0.011)	(0.013)	(0.018)
(4) Energy and construction	3564	762	0.106	0.502	0.338
			(0.007)	(0.007)	(0.006)
(5) Trade and hotels and restaurants	13318	2806	0.126	0.176	0.561
			(0.005)	(0.005)	(0.008)
(6) Communication and financial	2958	697	0.163	0.268	0.361
intermediation			(0.005)	(0.006)	(0.007)
(7) Real estate and business activities	1299	265	0.179	0.071	0.612
			(0.013)	(0.018)	(0.034)

Note: Final sample on 1997-2005; 37572 observations and 7605 firms, standard errors in bracket.
K stands for the capital stock, L^B for the number of blue-collar workers, L^W for the number of white-collar workers.
ACF stands for Ackerberg, Caves and Frazer (2006), mean values and standard errors of the bootstrap estimates

For comparison, we aslo report the production function coefficients estimated using the Olley and Pakes (1996) and Levinsohn and Petrin (2003) procedures, corrected for sample selection.

Table A2. Estimates of production coefficients using Levinsohn and Petrin (2003) and Olley and Pakes (1996) procedures.

	Levinsohn and Petrin			Olley and Pakes		
sector	α^K	α^B	α^W	α^K	α^B	α^W
(1) Food and textile	0.096	0.343	0.277	-0.050	0.314	0.343
	(0.018)	(0.007)	(0.007)	(0.024)	(0.008)	(0.007)
(2) Wood, paper, chemicals, metal and non	0.078	0.316	0.311	-0.057	0.328	0.401
metal products, machinery	(0.011)	(0.004)	(0.005)	(0.014)	(0.005)	(0.005)
(3) Equipment and recycling	0.138	0.346	0.401	-0.014	0.360	0.429
	(0.014)	(0.009)	(0.009)	(0.031)	(0.009)	(0.009)
(4) Energy and construction	0.044	0.426	0.271	-0.045	0.435	0.336
	(0.013)	(0.007)	(0.007)	(0.013)	(0.007)	(0.006)
(5) Trade and hotels and restaurants	0.069	0.153	0.430	-0.044	0.171	0.469
	(0.011)	(0.004)	(0.004)	(0.015)	(0.004)	(0.005)
(6) Communication and financial	0.120	0.236	0.352	-0.041	0.225	0.382
intermediation	(0.009)	(0.007)	(0.009)	(0.025)	(0.008)	(0.008)
(7) Real estate and business activities	0.111	0.046	0.426	-0.040	0.056	0.526
	(0.022)	(0.012)	(0.016)	(0.047)	(0.012)	(0.013)

Note: Final sample on 1997-2005; standard errors in bracket;

In the Levinsohn-Petrin estimates, the sample has 38713 observations and 7660 firms;

In the Olley-Pakes estimates, the sample has 35408 observations and 7241 firms;

Measurement of sunk costs

As explained in section 2 of the paper, our measure of sunk costs, for tangible capital and intangible capital, is based on the following equation:

$$sunk_{it} = I_{it} + (1-\delta_{it})(1-\gamma_{it}).K_{it-1} \qquad (a.1)$$

where I_{it} represents investment beyond leasing, K_{it-1} is the capital stock that is not leased at the beginning of the period, δ_{it} the depreciation rate, and γ_{it}, the re-sale rate, the ratio of the capital stock sold in second-hand market over the capital stock. In order to obtain unbiased estimates of depreciation rate and re-sales rates, we exclude rates that exceed unity or are negative.[20] We then trim depreciation rates of firms with non zero, respectively tangible or intangible, capital stock and on re-sales rates of firms with non zero tangible fixed assets.[21] The trimming was based on the range defined by the median minus three times the interquartile range and the median plus three times the interquartile range. For observations where depreciation rates are not missing, we construct sunk costs using the average depreciation and re-sale rates by nace 2-digit sector and year. Note that in order to construct sunk costs and estimate the Probit models of firm exit, we restrict the sample to observations where depreciation rates and re-sale rates are not missing.

20 This may be due to the fact that, for tangible capital, we substract leasing from total capital stock.

21 We do not trim re-sale rates of intangible fixed assets because there is no re-sales in more than 75% of the observations. This makes the criterion unenforceable.

To evaluate our re-sale rates, we compare the re-sale rates by sector and year with the one computed from the National Accounts statistics. Because the former includes both sales and disposals, while the latter focus on sales on second-hand market, the former should be larger than the latter. This happens in 92.64 percent of the cases.. Table A.3. below reports descriptive statistics on estimated firm-level depreciation rates and re-sales rates in our sample for firms with respectively tangible fixed assets and intangible fixed assets.

Table A3. Descriptive statistics on estimated depreciation and re-sales rates of tangible and intangible fixed assets

	mean	std	Q1	median	Q3
$\delta^{tang}{}_{i}$	0.080	0.039	0.053	0.073	0.100
$\delta^{intang}{}_{i}$	0.111	0.080	0.048	0.104	0.165
$\gamma^{tang}{}_{i}$	0.026	0.027	0.008	0.019	0.036
$\gamma^{intang}{}_{i}$	0.038	0.072	0.000	0.000	0.055
$\delta^{tang}{}_{st}$	0.087	0.021	0.074	0.085	0.103
$\delta^{intang}{}_{st}$	0.117	0.037	0.105	0.121	0.139
$\gamma^{tang}{}_{st}$	0.030	0.019	0.015	0.026	0.039
$\gamma^{intang}{}_{st}$	0.045	0.020	0.036	0.045	0.054

Measurement of demand uncertainty

We measure demand uncertainty at the nace 2-digit sector level, by applying Theil (1952)'s disconformity index to the firms' qualitative answers to the question.

> *Do you expect demand for your product, in the next three months (A) to rise, (B) to remain unchanged, (C) to decrease, with respect to its average level at that time of the year?*

The index is applied to all firms of sector s and all months of year t. Note that the question slightly differ from one economic sector to the other. In particular in services, the business survey asks

> *Do you expect demand of your clients (or your turnover), in the next three months (A) to rise, (B) to remain unchanged, (C) to decrease, with respect to its average level at that time of the year?*

The firm's sales market concentration, export share and number of markets served are constructed based on data on both trade in goods and trade in services. Information on trade in goods results from two sources of information, customs data that covers all transactions, and Intrastat data for trade within the EU, that reports foreign transactions of trade in goods for firms that export or import more than 250,000 euro a year. Trade in services, collected mainly through financial intermediaries, is reported for all transactions of 12,500 euro and more. We focus on trade

in goods that imply a transfer of ownership and exclude trade in services related to items such as commissions.

Measures of competition

We rely on three measures of competition on the product market. First, we follow Boone et al. (2007) and measure competition by the elasticity of firms' profits with respect to marginal costs. More specifically, we regress the log of profits on the log of marginal costs. Marginal variable costs are defined as variable costs over turnover. We exclude outliers as firms with variable costs over turnover and profits over total assets outside the range defined by the median minus or plus three times the inter-quartile range For each nace 2-digit sector, we estimate the following regression with firm-specific fixed effects for the period 1997-2007:

$$\ln \text{profits}_{it} = \alpha_i + \gamma_t - \beta_t \ln \text{marginal costs}_{it} + \varepsilon_{it}, \qquad \text{(a.2)}$$

where β_t is the profit elasticity and π stands for profits. As a robustness check, also consider the sector-level estimates of price-cost margins constructed by Christopoulou and Vermeulen (2007) for nace 2-digit sectors for the US and several EU countries, including Belgium. We also use the Herfindahl index, defined by nace 2-digit and year from market shares defined as the proportion of a firm's value added in the total value added of the sector. Table A4 reports the three measures of competition as well as correlations with median firm size in the sector, the number of firms within the industry, the firms' entry and exit rates.

Table A4. Measures of competition

nace 2-digit	profit elasticity	markup	Herfindahl index
15	5.78	1.07	0.02
16	4.80	1.04	0.16
17	8.02	1.07	0.02
18	8.64	1.10	0.17
19	12.64	1.09	0.60
20	6.07	1.11	0.04
21	5.73	1.10	0.04
22	5.28	1.13	0.02
23	1.83	1.08	0.30
24	5.12	1.13	0.05
25	8.74	1.12	0.02
26	5.59	1.08	0.03
27	8.26	1.19	0.11
28	6.12	1.11	0.01
29	9.47	1.20	0.04
30	8.54	1.38	0.16
31	7.00	1.11	0.06
32	4.71	1.04	0.15
33	3.46	1.17	0.07
34	9.63	1.06	0.09
35	4.23	1.07	0.15
36	7.90	1.03	0.01
45	6.81	1.15	0.00
50	1.84	1.21	0.02
51	6.67	1.14	0.01
52	6.15	1.20	0.04
60	1.71	1.25	0.21
63	2.72	1.33	0.02
64	4.42	1.46	0.19
65	1.40	1.33	0.16
67	4.72	1.27	0.09
70	1.41	3.65	0.01
71	0.91	1.54	0.03
72	4.40	1.20	0.01
73	4.35	0.95	0.15

Notes: *profit elasticity* is the competition measure used by Boone et al. (2007; markup is taken from Christopoulou and Vermeulen (2007); *Herfindahl*, the Herfindahl index is calculated based on value-added market shares.

Appendix B: Robustness tests

Table B.1 - random effects estimates of Probit models of Table 2 - marginal effects

	(1)	(2)	(3)	(4)
MNF_{it}	-0.00044	0.00357	0.00007	0.00426
	(-0.46)	(1.31)	(0.07)	(1.50)
TFP_{it}	-0.00006***	-0.00005***	-0.00002	-0.00001
	(-4.55)	(-3.75)	(-0.54)	(-0.37)
$MNE*TFP_{it}$		-0.00008**		-0.00006
		(-2.06)		(-1.11)
Age_{it}	-0.00009***	-0.00009***	-0.00008***	-0.00008***
	(-3.06)	(-3.02)	(-2.85)	(-2.81)
$Sunk_{it}$	-0.00008**	-0.00008**	0.00020***	0.00019***
	(-2.10)	(-2.12)	(3.34)	(3.28)
Profit $elasticity_s$	0.00050*	0.00050*	0.00046*	0.00046*
	(1.77)	(1.83)	(1.71)	(1.78)
$Concentration_{it}$	0.00686***	0.00671***	0.00251	0.00243
	(3.95)	(4.00)	(0.41)	(0.41)
log L	-1776.58	-1774.13	-1769.14	-1766.58
σ_u	0.0009	0.0023	0.0028	0.0017
std(σ_u)	0.0643	0.0316	0.0343	0.0310
$X^2(\rho)$	0.0000	0.0001	0.0001	0.0000
p-value(X^2)	0.499	0.496	0.496	0.497

Notes: All equations include year and sector dummies; z-statistic in italic.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

σ_u is the estimated standard deviation of random effects; $X^2(\rho)$ is the Chi-squared test for the significativity of random effects. (3) and (4) we apply Mundlak's correction

Table B.2 Additional variables - marginal effects of Probit estimates

	(1)	(2)	(3)	(4)	(5)	(6)
MNF_{it}	-.00044	-.00044	-.00044	-.00042	-.00064	-.00085
	(-0.46)	(-0.46)	(-0.45)	(-0.45)	(-0.66)	(-0.82)
TFP_{it}	-0.00006***	-0.00006***	-0.00006***	-0.00006***	-0.00007***	-0.00006***
	(-4.547)	(-4.541)	(-4.513)	(-4.520)	(-4.723)	(-4.513)
Age_{it}	-0.00009***	-0.00009***	-0.00009***	-0.00009***	-0.00009***	-0.00009***
	(-3.060)	(-3.057)	(-3.003)	(-3.080)	(-3.106)	(-3.179)
$Sunk_{it}$	-0.00008**		-0.00003	-0.00008**	-0.00008**	-0.00007**
	(-2.099)		(-0.178)	(-2.126)	(-2.190)	(-2.006)
Intangible $sunk_{it}$		-0.00008				
		(-0.356)				
Tangible $sunk_{it}$		-0.00008**				
		(-1.984)				
Profit $elasticity_s$	0.00050*	0.00050*	0.00059*	0.00053*	0.00050*	0.00041
	(1.766)	(1.765)	(1.943)	(1.859)	(1.790)	(1.433)
$Concentration_{it}$	0.00686***	0.00686***	0.00682***	0.00680***	0.00695***	0.00690***
	(3.948)	(3.947)	(3.923)	(3.919)	(4.013)	(4.002)
σ_{st}			0.00842			
			(0.811)			
σ_{st}* $Sunk_{it}$			-0.00014			
			(-0.258)			
$\Delta log(VA)_{st}$				-0.02308		
				(-1.087)		
$Wage_{it}$					0.00000	
					(1.307)	
%blue $collars_{it}$						-0.00579***
						(-3.036)
log L	-1776.58	-1776.58	-1776.24	-1775.98	-1775.76	-1772.02

Notes: All equations include year and sector dummies; z-statistic in italic.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table B.3 Alternative definition of variables - marginal effects of Probit estimates

	(1)	(2)	(3)	(4)	(5)
MNF_{it}	-0.00070	-.00052	-.000455	-.00054	-.00023
	(-0.463)	(-0.57)	(-0.45)	(-0.59)	(-0.24)
TFP_{it}	-0.00006***	-0.00006***	-0.00006***	-0.00006***	-0.00006***
	(-4.547)	(-4.601)	(-4.541)	(-4.581)	(-4.449)
Age_{it}	-0.00009***	-0.00008***	-0.00009***	-0.00009***	-0.00008***
	(-3.060)	(-2.853)	(-3.030)	(-3.093)	(-2.907)
$Sunk(\delta_{st})_{it}$	-0.00008**	-0.00007*	-0.00008**	-0.00008**	-0.00007*
	(-2.099)	(-1.929)	(-2.257)	(-2.155)	(-1.851)
profit $elasticity_s$	0.00050*			0.00047	0.00046
	(1.766)			(1.643)	(1.640)
$markup_s$		-0.00422*			
		(-1.766)			
Herfindahl $index_s$			0.00332		
			(0.326)		
$Concentration_{it\ t}$	0.00686***	0.00647***	0.00638***		
	(3.948)	(3.776)	(3.713)		
export $share_{it}$				-0.00585***	
				(-3.277)	
number of $markets_{it}$					-0.00018***
					(-3.894)
log L	-1776.58	-1776.47	-1778.11	-1779.00	-1776.12

Note: All equations include year and sector dummies; z-statistic in italic.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table B.4 - Probit models for the probability of exit - marginal effects - lag 2 of endogenous variable as instrument

	(1)	(2)	(3)	(4)
MNF_{it}	.00858	.00759	.00930	.00798
	(1.46)	(1.40)	(1.43)	(1.35)
TFP_{it}	-0.00006***	-0.00006***	-0.00005***	-0.00005***
	(-2.733)	(-2.709)	(-2.605)	(-2.589)
$MNE*TFP_{it}$	-0.00011**	-0.00011**	-0.00009*	-0.00009*
	(-2.010)	(-1.994)	(-1.907)	(-1.917)
Age_{it}	-0.00014***	-0.00015***	-0.00014***	-0.00015***
	(-3.607)	(-3.767)	(-3.587)	(-3.831)
$Sunk_{it}$	-0.00009	-0.00006	-0.00009	-0.00006
	(-1.591)	(-1.483)	(-1.641)	(-1.515)
Profit $elasticity_s$	0.00067*	0.00071*	0.00069*	0.00069*
	(1.830)	(1.950)	(1.906)	(1.860)
$Concentration_{it}$	0.00851***	0.00918***	0.00923***	0.00867***
	(3.568)	(4.171)	(4.199)	(3.595)
RV_TFP	-0.00003	-0.00003		
	(-0.997)	(-1.009)		
RV_MNF*tfp	-0.00004	-0.00003		
	(-0.376)	(-0.365)		
RV_sunk	0.00005		0.00005	
	(0.342)		(0.352)	
RV_concentration	0.01063*			0.01066*
	(1.865)			(1.849)
log L	-1207.81	-1214.66	-1215.23	-1209.11

Note: All equations include year and sector dummies; z-statistic in italic.
RV stands for the Rivers and Vuong test of endogeneity;
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Table B.5 - Probit models for the probability of exit - marginal effects - no lag of endogenous variable as instrument

	(1)	(2)	(3)	(4)
MNF_{it}	.01352	.01149	.00269	.00325
	(0.90)	(1.21)	(0.53)	(0.62)
TFP_{it}	-0.00015	-0.00010	-0.00006***	-0.00006***
	(-1.357)	(-1.184)	(-3.674)	(-3.645)
$MNE*TFP_{it}$	-0.00012**	-0.00012**	-0.00009**	-0.00009**
	(-2.115)	(-2.110)	(-2.075)	(-2.075)
Age_{it}	-0.00014***	-0.00009***	-0.00012***	-0.00009***
	(-2.653)	(-2.910)	(-2.995)	(-2.954)
$Sunk_{it}$	0.00008	-0.00009**	-0.00000	-0.00009**
	(0.486)	(-2.215)	(-0.039)	(-2.149)
Profit $elasticity_s$	0.00164	0.00058*	0.00077**	0.00031
	(1.303)	(1.909)	(2.028)	(0.537)
$Concentration_{it}$	0.03216	0.00774***	0.00768***	-0.00203
	(0.953)	(4.116)	(4.115)	(-0.109)
RV_TFP	-0.00006***	-0.00006***		
	(-3.663)	(-3.651)		
RV_MNF*tfp	-0.00005	-0.00005		
	(-0.876)	(-0.891)		
RV_sunk	-0.00009**		-0.00008	
	(-2.270)		(-0.886)	
RV_concentration	0.00771***			0.00770***
	(4.103)			(4.105)
log L	-1745.08	-1745.71	-1745.89	-1746.13

Note: All equations include year and sector dummies; z-statistic in italic.
RV stands for the Rivers and Vuong test of endogeneity
*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Appendix C: The role of firm size

The correlation between firm size and total sunk costs reaches 0.55 in our sample. Comparing columns (1) and (2) of Table B.3. shows that when sunk costs is ommitted, size indeed explains the probability of exit. Furthermore, the difference in exit probability between MNFs and domestic firms is reduced compared to the base case, where the difference amounts to -0.0039 (see the column (1) of Table 2 in the main text). However, when sunk costs are included in the model, size is no longer signifciant.

Table C.1. The role of firm size - marginal effects of Probit estimates

	(1)	(2)	(3)
MNF_{it}	-.00044	-.00050	-.00028
	(-0.46)	(-0.52)	(-0.28)
TFP_{it}	-0.00006***	-0.00006***	-0.00006***
	(-4.547)	(-4.649)	(-4.502)
Age_{it}	-0.00009***	-0.00010***	-0.00009***
	(-3.060)	(-3.258)	(-3.060)
$Sunk_{it}$	-0.00008**		-0.00006
	(-2.099)		(-1.450)
Profit $elasticity_s$	0.00050*	0.00058**	0.00052*
	(1.766)	(2.004)	(1.810)
$Concentration_{it}$	0.00686***	0.00703***	0.00682***
	(3.948)	(3.986)	(3.920)
$Size_{it}$		-0.01174*	-0.00557
		(-1.818)	(-0.753)
log L	-1776.57	-1777.51	-1776.28

Note: All equations include year and sector dummies; z-statistic in italic.
*** significant at the 1% level, ** at the 5% level, * at the 10% level.