Multinational Firms and Export Dynamics*
(Very Preliminary and Incomplete)

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February 2, 2016

Abstract

This paper provides new evidence on the dynamics of multinational firms and exporters based on firm-level panel data for Norway, France, and Germany. First, exit rates for new exporters almost triple the ones for new affiliates of multinational firms, while multinational firms with previous export experience show the lowest exit rates. Second, new affiliates of multinational firms have flatter sales growth profiles than exporters. Finally, firms that transition from exporting to FDI are larger than continuing multinational firms.

We show that a simple dynamic extension of a model in which firms choose to serve a foreign market through exports or affiliate sales facing a "proximity-concentration tradeoff", as in Helpman, Melitz, and Yeaple (2004), captures these patterns qualitatively. We show that quantitatively the model goes a long way in explaining the dynamic patterns observed in the data.

JEL Codes: F1; F2. Key Words: International trade; Multinational firm; Foreign direct investment; Dynamics; Markov process; Sunk costs.

*All errors are our own.

1 Introduction

Global firms are without doubt key actors in the current economy. Not only they command most of the international trade, but also most of the innovation and production activities around the world.[1] Yet, some key aspects of their operations are not well understood mostly due to the lack of appropriate data. In particular, their micro-level behavior over time has been relatively unexplored.

We document new facts on the dynamics of multinational firms (MNE) and compare their dynamic behavior with the behavior of exporters and domestic firms. We exploit the unique characteristics of firm-level Norwegian panel data, spanning the period 1996-2006, and confirm our findings—whenever possible—with panel data for German MNEs, as well as French MNEs and French exporters. The differences between the dynamic behavior of MNEs and their affiliates *vis-a-vis* exporters are striking. First, new exporters into a market have three times higher exit rates than new affiliates of MNEs in the same market; a similar pattern is observed for brand-new exporters versus brand-new MNEs. The higher exit rate for exporters is preserved in the long run: this rate is double for exporters than for MNEs. Interestingly, new MNEs (and new affiliates of MNEs in a market) have lower exit rates if they have previous exporting experience. Second, new exporters grow much faster upon entry into a market than new affiliates of MNEs, even relative to home sales: New affiliates of MNEs start much bigger than new exporters and their growth rates are flatter, while new exporters start smaller and grow subsequently very fast. MNEs with export experience present growth profiles that are in-between the profiles of exporters and MNEs. Finally, exporters that transition into Foreign Direct Investment (FDI) are larger than the average MNE.

To capture the patterns in the data, we propose an extension to a dynamic setting of the model of trade and FDI in Helpman, Melitz, and Yeaple (2004) [9]—henceforth, HMY. We introduce dynamics into the symmetric two country version of the model by assuming that firm productivity, rather than being a fixed parameter, evolves according to a Markov process. Additionally, we assume that multinational activities are subject to a sunk cost, paid once when operations in the foreign country are set up. In this way, we add persistence to the multinational status since the sunk cost creates hysteresis, i.e., a productivity range in which firms do not exit even though the expected stream of discounted profits does not cover the sunk cost. Following HMY, we assume that there is a per-period fixed cost of exporting, as well as a standard iceberg-type cost of shipping goods internation-

[1] According to UNCTAD, by 2007, sales of affiliates of multinational firms represented 58 percent of world GDP and were twice as large as exports.

ally, and a per-period fixed cost of running a foreign affiliate, which is higher than the one for exporters. With these assumptions, we preserve the proximity-concentration tradeoff present in HMY and ensure that the model delivers the well-established cross-sectional fact of MNEs being larger than exporters.

Despite its simplicity, the model qualitatively captures the patterns in the data. MNEs with previous export experience have a lower probability of exiting the foreign market than MNEs which were not exporters previously. The presence of a sunk cost for FDI implies that exporters that transition into FDI are larger than the average MNE.

We calibrate the model to moments of the Norwegian data. Even though the quantitative model is able to capture the higher exit rates for new exporters upon entry, this rate is only half the one observed in the data. In contrast, the flatter exit profile for new MNEs is well captured by the model, despite the fact that we did not target this dynamic feature of the data. Relatedly, the model is able to capture extremely well the growth profiles of new MNEs, and after exporters growth profiles are corrected by partial-year-effects, the model does quite a good job at matching those profiles as well. Our findings points out to MNEs being "exceptional": After controlling for size and age, the advantage of a MNE in terms of exit rates survives. The canonical model, however, cannot capture this feature of the data. Additionally, our findings point out to sunk costs of exporting that are much lower than previously found; in fact, in our calibrated model they are zero and still, the model cannot match the very high exit rates observed for new exporters.

Our paper is related to the literature studying exporters' dynamics, such as Robert and Tybout (1997) [14], Das, Robert, and Tybout (2007) [5], Alessandria and Choi (2007) [2], and Impulliti, Irrarazabal, and Opromolla (2013) [10], all of which introduce sunk costs of exporting in a risky environment to create persistence on the export status. Among this strand of the literature, our paper is close to Ruhl and Willis (2013) [16] which study exporters dynamics in a Melitz-type model with sunk costs of exporting and uncertainty both at the firm level (productivity) and aggregate level (real exchange rates). Using Colombian data, they document two analogous facts to ours for new exporters: survival probabilities increase sharply after entry and the export-to-domestic sales ratio for new exporters achieves its "steady-state" value after six periods, doubling in the first year after entry. Our findings for Norwegian new exporters are, interestingly, of similar magnitude; the key difference with their work is that we compare new exporters with new MNEs.[2] They show that the model delivers new exporters that grow too large too fast, and survival probabilities are decreasing, not increasing, in age. They add a reduced-form learn-

[2]The exit rates of new exporters for Colombia, at the firm-destination level, documented in Eaton, Eslava, Kugler, and Tybout (2008) [6] are also similar to the ones we document for Norway.

ing process for demand to show that the model can then match the patterns observed in the data.

A smaller, but growing, literature is devoted to the study of multinational firms' dynamics. In particular, Fillat and Garetto (2014) [8] study the dynamics of trade and multinational firms in an environment with sunk costs for these activities and aggregate demand shocks; they focus on the asset market implications of the model. Ramondo, Rappoport, and Ruhl (2013) [15] embed the proximity-concentration tradeoff model in HMY in an environment with aggregate uncertainty. While they show that properties of the international business cycle affect the choice of the entry mode into foreign markets, their model is intrinsically static and cannot address issues related to firm dynamics. Finally, in a different note, the seminal work by Rob and Vettas (2003) [13] features demand uncertainty together with capacity constraints to study the mechanisms behind the choice of firms of exporting and opening affiliates in the same market.

A related international trade literature has focused on the dynamics of trade associated with learning (see Eaton et al. (2014) [7], Albornoz et al. (2012) [1], and Morales et al. (2014) [12]). Our paper makes special contact with Conconi et al. (2014) [4] who study the dynamics of exports and MNEs, and in particular, of MNEs which entered a market as exporters before opening an affiliate. Contrary to their finding for Belgium, where almost all MNEs experienced the foreign market as exporters, we find that only half of new Norwegian MNEs were exporters previously—and only 0.17 percent of exporters become MNEs. The crucial difference with their paper is that we do not need to assume any learning process to capture the existence of MNEs which were previously exporting to the foreign market; uncertainty in firm-level productivity together with sunk costs embedded in a model of the proximity-concentration tradeoff suffices. This simple extension of the setup in HMY is able to capture the fact that new MNEs with previous export experience have lower exit rates.

2 Multinational Firms and Exports Dynamics: New Facts

We document new facts about the dynamics of multinational firms (MNE) and compare them to the dynamic behavior of exporters. Whenever the data allow it, we document the behavior of multinational firms that were exporters to a market before opening an affiliate—we call them "experienced MNEs". Our facts are possible to compute from rich firm-level data sets that follow firms through time and space. We use data for Norway, Germany, and France. Only the Norwegian data allow us to compute all the facts, but

being a small country, the sample size is relatively small. To prove the robustness of our facts, we compute the same facts as for Norway using data for Germany and France. Given the size of these economies, the number of observations is large in these data sets. Unfortunately those data sets allow us to compute some aspects, but not all, of our facts. While the German data have very detailed information of the affiliates of German MNEs abroad, no information on exporters is available—which implies that "experienced MNEs" cannot be observed. The opposite is true for the French data, which provide extremely detailed data on exports and affiliate location, but no data on the sales of affiliates of French MNEs abroad.

2.1 Data

Norway. The firm-level data for Norway nest data for the Norwegian manufacturing sector from Statistics Norway's Capital Database, customs declarations by destination country, and data on firms' foreign operations from the Directorate of Taxes' Foreign Company Report which comprises affiliate sales by destination.[3] The data span the years 1996-2006. The coverage is comprehensive: all foreign affiliates of Norwegian firms in the manufacturing sector are included as well as 90 percent of Norwegian manufacturing revenues.[4]

The sample size varies from 8,044 in 1996 to 8,838 firms in 2002. 3,544 of the firms in our sample are present during all the period spanned by the data set, while the remaining firms either enters or exits the Norwegian market in the period under consideration.

In 2005, only 1.5 percent of Norwegian firms have affiliates abroad, and almost 40 percent are non-MNE exporters; overall, 59 percent of Norwegian firms do not engage in international activities. Norwegian MNEs represent almost 13 percent of total employment in Norway, while exporters represent 67 percent. The median (mean) Norwegian MNE operates in 2 (4.6) markets, with a maximum at 29 markets, while the median (mean) exporter serves 3 (6.9) markets, with a maximum at 115 markets.

Both in the Norwegian and French data, we define as an "experienced MNE" a new affiliate in a given destination market which had exported to that market in any year before entering as an MNE. Additionally, if we observe that a domestic exporter changes ownership previously, or contemporaneously, to entering the market as MNE, we consider that MNE as having previous export experience. With this definition, 49 percent of

[3] Affiliate sales are defined as total revenue of the affiliate adjusted by the parent's ownership share. A 20 percent ownership threshold is used to distinguish direct investment from portfolio investment. Direct investment comprises investors' share of equity in foreign companies and investors' debt to and claims on foreign companies.

[4] Only non-oil firms are included.

multinational firms were exporters before opening production facilities abroad. At the firm-destination level, 56 percent of affiliates had previous export experience.

France. For France, we use firm-level information on domestic sales, exports and foreign affiliates. The export data are provided by the French customs. The data on domestic sales are taken from FICUS/FARE and the data on ownership links between different firms in France and firms in France and abroad from are taken from LiFi; these data bases are provided by INSEE.[5] The data contains information about French exporters and the location of foreign affiliates of French MNEs, for each year; there is no data, however, on affiliates' sales.[6] Importantly, exports are recorded at the monthly level allowing us to make corrections when it is needed. The information on MNEs is at the parent-affiliate level and records direct participations of French firms in foreign affiliates. We restrict our attention to majority-owned foreign affiliates whose parent operates in the manufacturing sector in *at least* one year in which they are active. For domestic firms, we restrict the sample to firms with sales of at least 100,000 Euros that are active in the manufacturing sector in *at least* one year.

Unlike the Norwegian data, the French data can be used consolidated or unconsolidated; that is, if firm A and B belong to firm C, the French data allow to consolidate all three of them since they belong to the same group. Baseline results are presented unconsolidated to keep comparability to the Norwegian data. For robustness, we follow Kleinert, Martin and Toubal (2015) [11] and consolidate the information on foreign affiliates and exports to the level of the French group.

The data span the years 1999-2011 with a total of 1,337,697 firm-year observations. Of those ones, only 4.3 percent are MNEs; the remaining observations belong to exporters. For each year, the sample size varies between 3,572 and 5,661 for MNEs, and between 484,723 and 537,301 for exports, at the firm-destination level. The sample contains between 930 and 1,340 MNEs, and between 84,459 and 107,506 exporters, each year, which represent, approximately . Of those, only 204 MNEs (23,468 exporters) are present during all our sample period.

The median (mean) French MNE operates in 2 (4.1) markets, with a maximum above 95 markets, while the median (mean) exporter serves 2 (5.3) markets, with a maximum above 164 markets. Moreover, at the firm-destination level, 15 percent of affiliates abroad has previous export experience; this share is much lower than the one for a small and open country as Norway.

[5]The FICUS/FARE data bases provide balance sheet data on virtually all French firms. The principal data source are firms' tax statements (amongst others under the so-called BRN).

[6]Data on affiliates' employment are available but almost 50 percent of observations are zero.

Germany. The source of data for Germany is the Microbase Direct investment (MiDi), consisting of information about affiliates abroad of German firms. The data set spans the years 1999 to 2011 and contains detailed balance sheet information about affiliate firms, but limited information about parent firms (such as total revenues and number of employees).[7]

The observations are at the parent-affiliate level, both for direct and indirect ownership. We consolidate ownership shares and restrict our attention to majority-owned affiliates, in each year, whose parent operates in the manufacturing sector in *at least* one year in which they are active, or whose parent is a holding company belonging to a corporate group in the manufacturing sector (in at least one year).[8] This is equivalent to keeping about half of all parent-year pairs available in the data.[9]

More than 95 percent of parent-country observations in our sample are present in the panel for consecutive years, including only one year, while only five percent of the observations in our sample have a repeated entry/exit pattern; 13 percent of observations are present during the whole period spanned by the panel.

Buch et al. (2005) [3] report that, in 2002, 0.21 percent of manufacturing firms were MNEs and they accounted for 27 percent of total sales in Germany. Our sample of majority-owned affiliates covers 189,000 observations in 175 countries, in the manufacturing sector.[10] The median (mean) parent firm operates in one (2.9) markets.

Table 1 summarizes the sample size across firms with different international status, for both firm-level-year and firm-level observations, for Norway.

[For France: TBA]

2.2 Fact I: Exit rates are lower for new MNEs than for new exporters

The upper panel of figure 1 documents, for the Norwegian data, that new MNE's have much lower exit rates than new exporters, and this is true both at the firm and firm-

[7] For instance, it is not possible to distinguish domestic sales from exports.

[8] In practice, we first restrict the sample to affiliates with either participation of ten percent and revenues of at least ten million DM (Euro equivalent), or participation of at least 50 percent and revenues of at least three million Euro. Then, we consolidate ownership shares and select the affiliates with more than 50 percent ownership. This procedure avoids the problem of some parents reporting on affiliates which should not be reported; if we consolidated first, we would treat those differently from affiliates belonging to firms following the reporting rules.

[9] Parents change sectors over time; in particular, about a fifth of parents in manufacturing in some year(s) switch to a non-manufacturing sector, mainly holding sector, in some other year(s).

[10] Only 11,000 observations are lost by restricting the sample to majority-owned affiliates.

Table 1: Number of observations: Norway.

$t-1 \setminus t$	firm-destination-year domestic	exporter	MNE	total	firm-year domestic	exporter	MNE	total
domestic	244,529 (80.2)	60,042 (19.7)	247 (0.09)	304,818 (100)	21,703 (93.6)	1,484 (6.4)	5 (0.02)	23,192 (100)
exporter	52,261 (27.3)	138,546 (72.5)	126 (0.17)	190,933 (100)	1,084 (4.4)	23,404 (95.3)	60 (0.24)	24,548 (100)
MNE	276 (5.9)	326 (6.9)	4,080 (87.1)	4,682 (100)	5 (0.5)	95 (8.7)	993 (90.8)	1,093 (100)
total	297,066 (59.3)	198,914 (39.7)	4,653 (0.93)	500,633 (100)	22,792 (46.7)	24,983 (51.2)	1,058 (2.2)	48,833 (100)

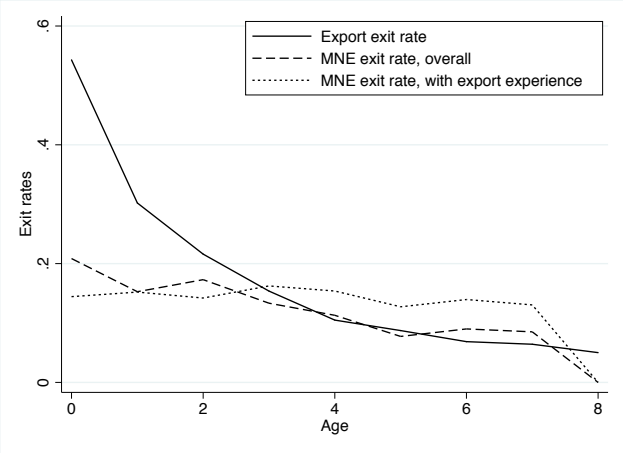
Notes: Firms in the manufacturing sector. Exporters refer to non-MNE exporters. Numbers in parenthesis indicate percentage of total observations in each row, for each level of observations. Each cell shows number of observations at time t under mode m (column) given mode m' at time $t-1$ (row).

destination level. In both panels of figure 1, the x-axis refers to the number of years after entry—year zero is the entry year. The y-axis are defined as follows. In figure 1a, exit rates are calculated as the number of multinational (exporting) firms that exit a given destination, relative to the number of active Norwegian multinational (exporting) firms in that destination, for each year t. For the sub-set of experienced MNEs, the exit rate refers to MNEs that opened an affiliate in a given destination at time zero, but that were exporting to that market in any of the previous years, relative to the number of active experienced MNEs in that market, for year t. Figure 1b shows exit rates at the firm level, not firm-destination level; hence, the figure captures the exit rates of first-time MNEs and first-time exporters. Exit refers to exiting the current mode of international operation (export or MNEs).

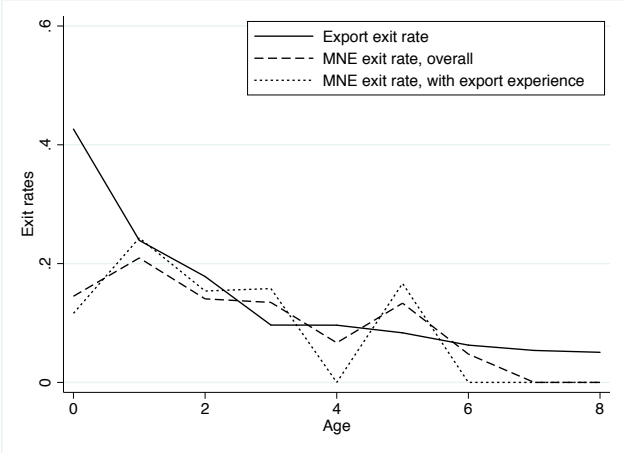
The exit patterns are distinct between the two modes of international entry: Upon entry, exporters are three times more likely to exit the destination market than MNEs. For both types of firms, exit rates are declining—more drastically for exporters—but remain much higher in the long run for exporters than for MNEs. Unconditional exit rates (i.e., fraction of *all* exit firms in each mode, in each year and market) are 32 and 16 percent, respectively, for new exporters and new affiliates. A similar pattern is found when we consider exit rates at the firm, rather than firm-destination, level (figure 1b): Exit rates upon entry among first-time exporters reach almost 50 percent, while for first-time MNEs exit rates are around 15 percent, and in the long run, exporters are much more likely to exit than MNEs. As shown in figure 1a, previous export experience seems to confer an advantage in the first year upon entry with respect to survival in the market (26 vs 18 percent exit rates for all and experienced new affiliates, respectively).

Figure 1: Exit Rates: New MNEs and new exporters.

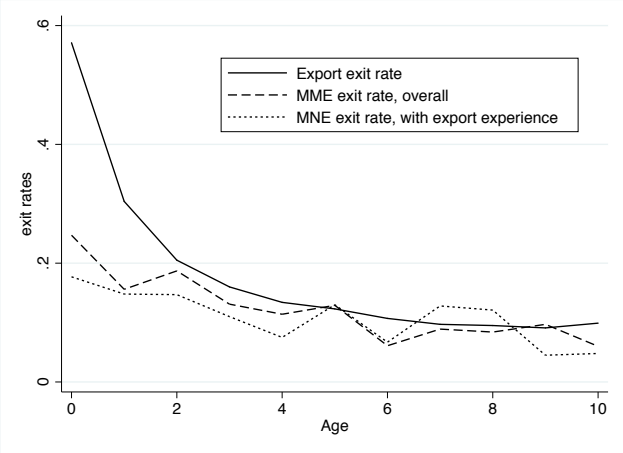
(a) Firm-destination level, Norway



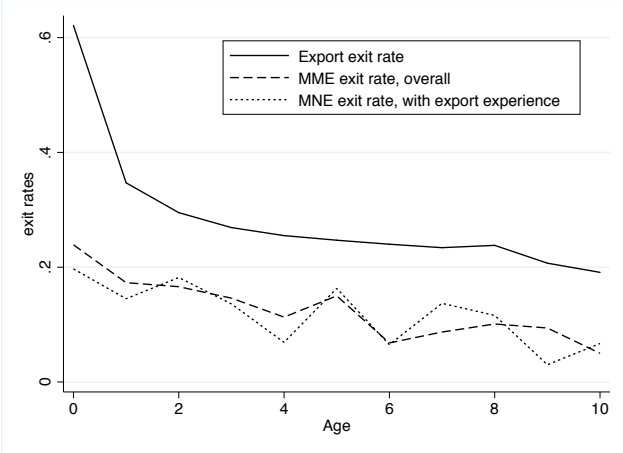
(b) Firm level, Norway



(c) Firm-destination level, France



(d) Firm level, France.



Notes: In left panels, exit rates are defined as the number of firm-destination exits relative to the number of active firm-destinations, in each mode (exporters or MNE affiliates), by age. In right panels, exit rates are defined as the number of firm exits relative to the number of active firms, in each mode (exporters or MNEs), by age. "Experienced MNEs" refers to the subset of foreign affiliates (MNEs) with one or more years of export experience before opening an affiliate (before becoming MNE). Exit refers to exit the current international mode of operation (export or MNEs). Sub-sample of new firms with no re-entry.

Figures 1c and 1d shows results for France. The sample is restricted to firm-country observations with at most one exit per mode. Strikingly, exit profiles look, on average, extremely similar to the ones for Norwegian firms: 57, 25, and 18 percent, respectively, for new exporters, affiliates, and experienced affiliates.

Patterns in the figures are confirmed formally by estimating, using Ordinary Least Squares (OLS),

$$D(Exit_{inmt}) = \beta_0 mne_{int} + \beta_1 age_{inmt} + \beta_2 mne_{int} \times age_{inmt} + \beta_3 exp_{inmt} + \beta_4 mne_{int} \times exp_{inmt} + \epsilon_{inmt}, \quad (1)$$

The variable $D(Exit_{inmt})$ is a dummy equal to one the year t in which firm i exits mode m in market n, and zero otherwise; the variable mne_{int} is one if the firm i enters market n in year t as an MNE, and zero if it enters as an exporter; the variable age_{inmt} denotes the age of the firm i in market n and mode m at time t; and exp_{inmt} is one if firm i who enters market n at time t under mode m has previous experience in mode m', $m \neq m'$. Table 2 shows the results for observations at the firm-destination and firm level.

Clearly, the dummy mne_{int} always has a negative coefficient indicating that affiliates of MNEs are significantly less likely to exit a given market n in year t. Additionally, as hinted by figure 1, exit profiles are declining with age, as indicated by $\beta_1 < 0$. Results at the firm level are similar and also confirm the patterns shown in figure 1b. [11] The regression does not show any effect of previous export experience on exit rates of MNEs, except for the specification that includes destination-year specific effects. This result may be due to the relatively small number of observations for this type of firms. The French data are then used to explore this issue.

Table 3 shows estimates for France. We find that previous experience as an exporter in a market significantly lowers the probability of exit the market for an affiliate (column 2): while, on average, a new affiliate without previous export experience in a market has almost 30 percent lower exit probability relative to a new (unexperienced) exporter, a new affiliate which has already experienced the market as an exporter has almost almost 33 percent lower probability, relative to the same reference group.

Turning to the data on German multinational firms, we are able to confirm the smooth decreasing exit probability for new MNEs, both at the country-firm and firm level, found

[11] Including cohort-specific dummies and their interaction with the dummy indicating whether firms enter a market with an affiliate or exports (mne_{int}) reinforces the results shown in figure 1: while the age dummy is negative for all years after entry (indicating that exit rates are lower after the entry year), the interaction term is positive in all years after entry indicating that the exit profile for MNEs is flatter than for exporters.

Table 2: Exit rates: New MNEs and new exporters. Norwegian data.

Dep variable	$D(Exit_{inmt})$				$D(Exit_{imt})$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
mne_{int}	-0.22***	-0.23***	-0.21***	-0.22***			
	(0.027)	(0.032)	(0.034)	(0.016)			
age_{inmt}	-0.044***	-0.044***	-0.042***	-0.045***			
	(0.0018)	(0.002)	(0.002)	(0.001)			
$mne_{int} \times age_{inmt}$	0.026***	0.026***	0.028***	0.033***			
	(0.006)	(0.006)	(0.006)	(0.005)			
exp_{inmt}		-0.063	-0.019	-0.021			
		(0.054)	(0.055)	(0.028)			
$mne_{int} \times exp_{inmt}$		0.073	0.057	0.047			
		(0.064)	(0.065)	(0.034)			
mne_{it}					-0.17***	-0.17***	-0.11***
					(0.027)	(0.027)	(0.031)
age_{imt}					-0.039***	-0.039***	-0.033***
					(0.002)	(0.002)	(0.002)
$mne_{it} \times age_{imt}$					0.028***	0.028***	0.026***
					(0.008)	(0.008)	(0.008)
exp_{imt}						0.14	0.14*
						(0.11)	(0.08)
$mne_{it} \times exp_{imt}$						-0.14	-0.096
						(0.105)	(0.091)
$\log sales_{it,nor}$			-0.03***	-0.03***			-0.066***
			(0.004)	(0.001)			(0.006)
Year fe	yes	yes	yes	no	yes	yes	yes
Destination fe	yes	yes	yes	no	no	no	no
Industry fe	yes	yes	yes	yes	yes	yes	yes
Destination-year fe	no	no	no	yes	no	no	no
Observations	114,426	114,426	109,092	109,092	13,842	13,842	13,602
R-squared	0.066	0.066	0.0774	0.0691	0.0437	0.0439	0.0786

Notes: $D(Exit_{inmt})$ is one if firm i exits market n and mode m at time t, and zero otherwise; the variable mne_{int} is one if the firm i enters market n as an MNE in year t, and zero if it enters as an exporter; the variable age_{inmt} denotes the age of the firm i in market n and mode m at time t; and exp_{inmt} is one if firm i who enters market n under mode m in year t has previous experience in mode m', $m \neq m'$. $sales_{it,nor}$ denotes sales of firm i at time t in Norway. In columns 1-3, observations are at the firm-destination level, while in columns 4-6 are at the firm level. Robust standard errors, clustered by industry, are in parentheses. Levels of significance are denoted $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

Table 3: Exit rates: New MNEs and new exporters. French data.

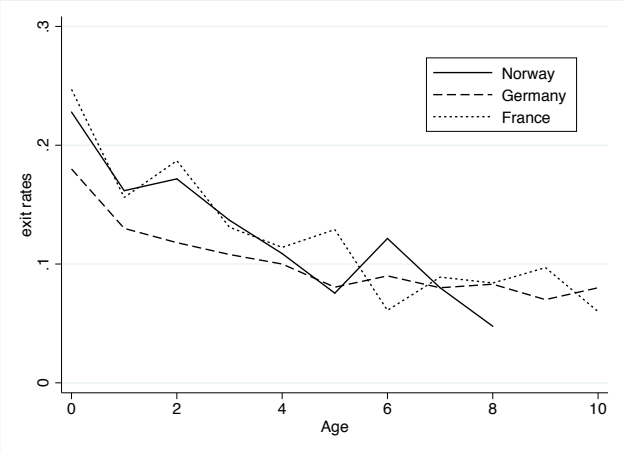
Dep variable	$D(Exit_{inmt})$				$D(Exit_{imt})$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
mne_{int}	-0.287***	-0.282******	-0.214***	xx			
	(0.021)	(0.022)	(0.022)				
age_{inmt}	-0.072***	-0.072***	-0.055***	xx			
	(0.004)	(0.004)	(0.002)				
$mne_{int} \times age_{inmt}$	0.048***	0.048***	0.039***	xx			
	(0.004)	(0.005)	(0.003)				
exp_{inmt}		-0.135***	-0.116***	xx			
		(0.011)	(0.011)				
$exp_{inmt} \times mne_{int}$		0.109***	0.176***	xx			
		(0.014)	(0.019)				
mne_{it}					-0.321***	-0.312***	-0.111***
					(0.008)	(0.009)	(0.033)
age_{imt}					-0.052***	-0.052***	-0.031***
					(0.000)	(0.000)	(0.001)
$mne_{it} \times age_{imt}$					0.033***	0.033***	0.015***
					(0.002)	(0.002)	(0.004)
exp_{imt}						-0.117***	-0.128***
						(0.017)	(0.017)
$exp_{imt} \times mne_{it}$						0.084***	0.125***
						(0.020)	(0.037)
$\log sales_{it,fra}$			-0.035***				-0.039***
			(0.001)				(0.001)
Year fe	yes	yes	yes	no	yes	yes	yes
Destination fe	yes	yes	yes	no	no	no	no
Industry fe	no	no	no	no	no	no	no
Destination-Year fe	no	no	no	yes	no	no	no
Observations	2,158,576	2,158,576	925,990		482,639	482,639	104,437
R-squared	0.135	0.120	0.126		0.078	0.078	0.069

Notes: $D(Exit_{inmt})$ is one if firm i exits market n and mode m at time t, and zero otherwise; the variable mne_{int} is one if the firm i enters market n as an MNE in year t, and zero if it enters as an exporter; the variable age_{inmt} denotes the age of the firm i in market n and mode m at time t; and exp_{inmt} is one if firm i who enters market n in year t under mode m has previous experience in mode m', $m \neq m'$. s_{imt} denotes sales of firm i at time t under mode m globally, while $sales_{it,fra}$ denotes sales of firm i at time t in France. In columns 1-3, observations are at the firm-destination level, while in columns 4-6 are at the firm level. Robust standard errors are in parentheses. Levels of significance are denoted $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

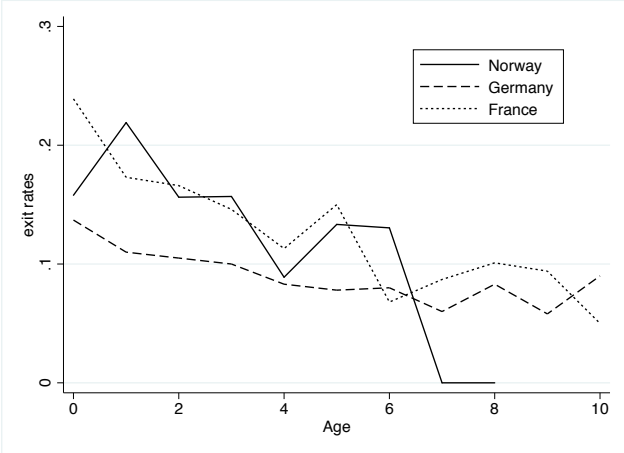
for France and Norway. As figure 2 shows, the sample of multinational firms for our three countries behave extremely similar both in terms of patterns of exit as well as magnitudes.[12]

Figure 2: Exit rates for new MNEs: German, French, and Norwegian data.

(a) Firm-destination level



(b) Firm level



Notes: In figure 2a, exit rates are defined as the number of affiliate-destination exits relative to the number of active affiliates-destinations, by age. In figure 2b, exit rates are defined as the number of MNEs exits relative to the number of active MNEs, by age.

Robustness. The baseline results are not different to the following: 1) Using age dummies, both for France and Norway, in the regressions for exit rates; 2) Splitting the sample in EU and non-EU countries, for France, to address concerns on the different reporting thresholds for exports to EU members and exports to non-EU members; 3) Imputing ownership to years with missing data on this variable, for France; 4) Correcting for partial-year-effects for exit rates of exporters, for France; 5) Using the consolidated rather than the unconsolidated data (see figure 12 in the Appendix); and 6) Considering a stricter definition of experienced MNEs (exports before becoming MNE in any previous year vs the immediate previous year). Naturally, using the consolidated data (i.e., consolidating all firms belonging to the same group) leads to a much higher number of experienced MNEs, as share of total MNEs, than the number obtained with the unconsolidated data (42 vs 15 percent of observations at the firm-destination level). Finally, one potential concern that we plan to address in the future is whether affiliate exit in a destination market is a true exit or simply a merger$ acquisition. The French data record foreign affiliates in France which we can analyze, with a particular emphasis on Norwegian and German affiliates.

[12]For Germany, no difference is observed between different modes of FDI entry, "greenfield FDI" vs. M&A. Additionally, even though first-year exit rates upon entry vary across sectors, from 10 to 30 percent, the exit profiles by age are similar. A regression analysis confirms the results.

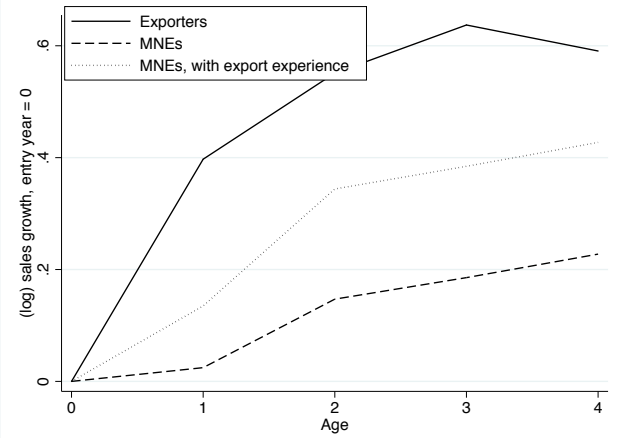
2.3 Fact II: Growth profiles are flatter for new MNEs than new exporters

We now turn to analyze the dynamics of the intensive margin of multinational operations and exporters. We focus on sales as our intensive-margin variable.

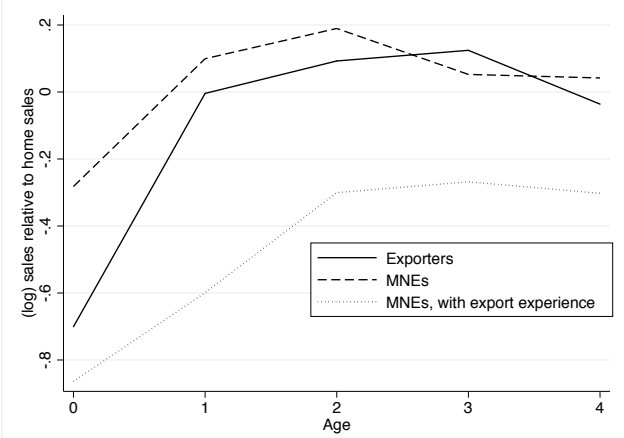
Figure 4a shows mean growth rates of exports and affiliate sales upon entry, relative to the entry year.

Figure 3: Foreign sales: New MNEs and new exporters. Norwegian data.

(a) Sales — rel. to entry year



(b) Sales — rel. to home sales



Notes: Figure 4a shows firm-destination (log of) exports (affiliate sales), relative to firm-destination exports (affiliate sales), in the year of entry, while figure 4b shows exports (affiliate sales) in a market relative to home sales. "Experienced MNEs" refers to the subset of foreign affiliates with one or more years of export experience before opening an affiliate. Means are taken over all firm-destination pairs with five or more years in the market, in each mode (export or MNE). (Log of) exports (affiliate sales) are first demeaned by subtracting industry, year, and destination fixed effects.

The pattern is clear: while exporters enter small and growth much faster till reaching by age four the "steady state" size, affiliates of MNEs enter large, closer to their "steady state" size.[13] Interestingly, the growth profile for sales of experienced affiliates is in-between the ones for non-experienced affiliates and exporters. Relative to home sales, new affiliates sales grow at a more similar pace than domestic new firms of the same age.

Results are confirmed formally by estimating, using OLS,

$$\log sales_{inm,t} - \log sales_{inm,t-1} = \beta_0 mne_{int} + \beta_1 age_{inmt} + \beta_2 mne_{int} \times age_{inmt} + \beta_3 exp_{inmt} + \beta_4 mne_{int} \times exp_{inmt} + \epsilon_{inmt}. \quad (2)$$

The variable $sales_{inmt}$ denotes sales of firm i in year t who enters destination n under

[13] Calculating growth rates relative to all firms, not only the ones surviving five or more years, does not change the results.

mode m; mne_{int} is one if the firm i enters market n in year t as an MNE, and zero if it enters as an exporter; the variable age_{inmt} denotes the age of the firm i in market n and mode m at time t; and exp_{inmt} is one if firm i who enters market n at time t under mode m has previous experience in mode $m^{'}$, $m \neq m'$. Table 4 shows results for observations at the firm-destination and firm level.

Table 4: Foreign sales: New MNEs and new exporters. Norwegian data.

Dep variable	$\log s_{inm,t} - \log s_{inm,t-1}$			$\log s_{im,t} - \log s_{im,t-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
mne_{in}	-0.064**	-0.071	-0.132**			
	(0.032)	(0.065)	(0.065)			
age_{inmt}	-0.04**	-0.040***	-0.041***			
	(0.006)	(0.006)	(0.006)			
$mne_{in} \times age_{inmt}$		0.002	0.006			
		(0.014)	(0.016)			
exp_{inm}			-0.039			
			(0.110)			
$mne_{in} \times exp_{inm}$			0.301			
			(0.135)			
mne_i				-0.28***	-0.32***	-0.38***
				(0.042)	(0.098)	(0.089)
age_{imt}				-0.042***	-0.042***	-0.045***
				(0.007)	(0.007)	(0.007)
$mne_i \times age_{imt}$				0.042**	0.040*	0.049**
				(0.021)	(0.022)	(0.023)
exp_{im}					-0.039	-0.058
					(0.489)	(0.481)
$mne_i \times exp_{im}$					0.016	0.196
					(0.501)	(0.496)
$\log sales_{it,nor}$			0.017**			0.029***
			(0.001)			(0.008)
Observations	67,987	67,987	67,987	9,507	9,507	9,333
R-squared	0.0053	0.0053	0.0054	0.0045	0.0046	0.0058

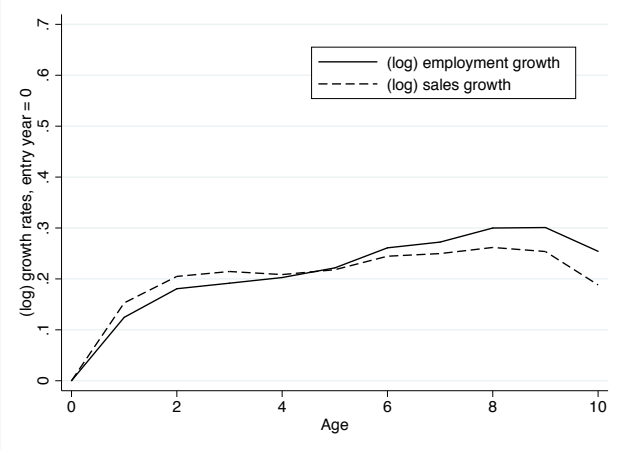
Notes: $y_{inm,t}$ are sales of firm i in year t and market n under mode m; the variable mne_{int} is one if the firm i enters market n as an MNE, and zero if it enters as an exporter; the variable a_{int} denotes the age of the firm i in market n at time t in mode m; exp_{inm} is one if firm i who enters market n under mode m has previous experience in mode $m^{'}$, $m \neq m'$; and $sales_{it,nor}$ refers to sales of firm i in year t in their home market (Norway). In columns 1-4, observations are at the firm-destination level, while in columns 5-7 are the firm level. All regressions with year, destination, and industry fixed effects. Robust standard errors, clustered by industry, are in parentheses. Levels of significance are denoted $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

The dummy mne_{int} always has a negative coefficient indicating that affiliate sales

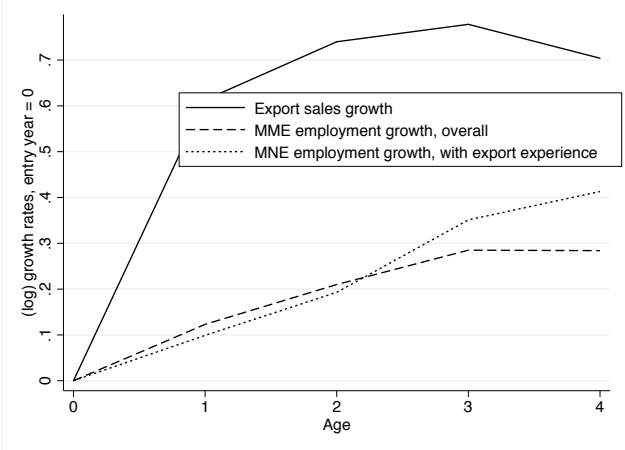
growth at a lower rate after entry than export sales in a given market n and year t.[14] The pattern is particularly strong if we look at the firm level (columns 4-6). As expected, growth rates are lower the longer the firm stays in the market, as indicated by $\beta_1 < 0$. Growth rates for experienced MNEs are higher than for non-experienced MNEs, but due to having few observations, the coefficient is not significant.

Figure 4: Foreign affiliates: Employment vs Sales.

(a) Germany



(b) France



Notes: Figure 4a shows firm-destination (log of) affiliate sales (employment), relative to the year of entry, for Germany. Figure 4b shows firm-destination (log of) exports sales and affiliates' employment, relative to the entry year, for France. "Experienced MNEs" refers to the subset of foreign affiliates with one or more years of export experience before opening an affiliate. Means are taken over all firm-destination pairs with five or more years in the market, in each mode (export or MNE). (Log of) exports (affiliate sales) are first demeaned by subtracting industry, year, and destination fixed effects.

Unfortunately, the French data do not provide information on the sales of foreign affiliates of French firms, by year. Hence, growth profiles as in figure 3 and regressions as in table 4 cannot be calculated. Affiliates' employment is, however, available, with the caveat that around half of the firm-destination-year observations are non-zero. Additionally, the German data provide both sales and employment data for foreign affiliates of German MNEs. Hence, in figure 4a, we compare growth rates of sales and employment, for new German affiliates abroad. The growth profiles look extremely similar. Based on this evidence, we safely use employment growth as a proxy for sales growth, for foreign affiliates of French MNEs. Results are shown in figure 4b, which also shows exporters' growth. As founds for Norway, affiliates sales also growth very smoothly in comparison

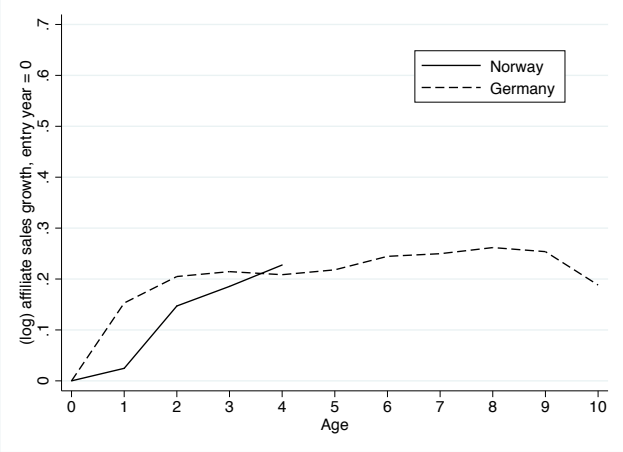
[14]The coefficient β_0 is always significant (and negative) at five percent if we include cohort dummies, rather than the age variable age_{inmt}, and the interactions between those dummies and mne_{int}. The cohort dummies have all negative (and significant) coefficients indicating that growth is lower after the year of entry, while the interactions have positive (most of them significant) coefficients, which indicates that growth profiles for MNEs are flatter.

to export sales, for France.

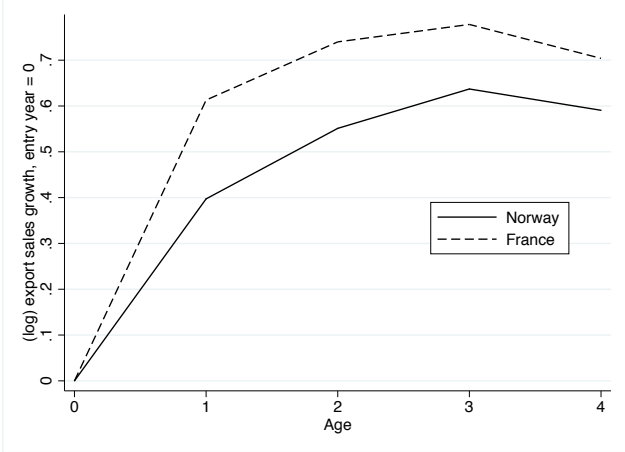
Further evidence on new exporters' and MNEs affiliates' growth profiles across countries is provided in figure 5. First, foreign affiliates of German MNEs have similar growth profiles to foreign affiliates of Norwegian firms.[15] Additionally, exporters' growth profiles have the same shape for France and Norway, being steeper the first year after entry.

Figure 5: New foreign sales: French, German, and Norwegian data

(a) Affiliate sales



(b) Export sales



Notes: Firm-destination (log of) affiliate sales (export sales) relative to firm-destination affiliate sales (export sales) in the year of entry. Means are taken over all firm-destination pairs with five or more years in the market. (Log of) affiliate sales are demeaned by subtracting industry, year, and destination fixed effects.

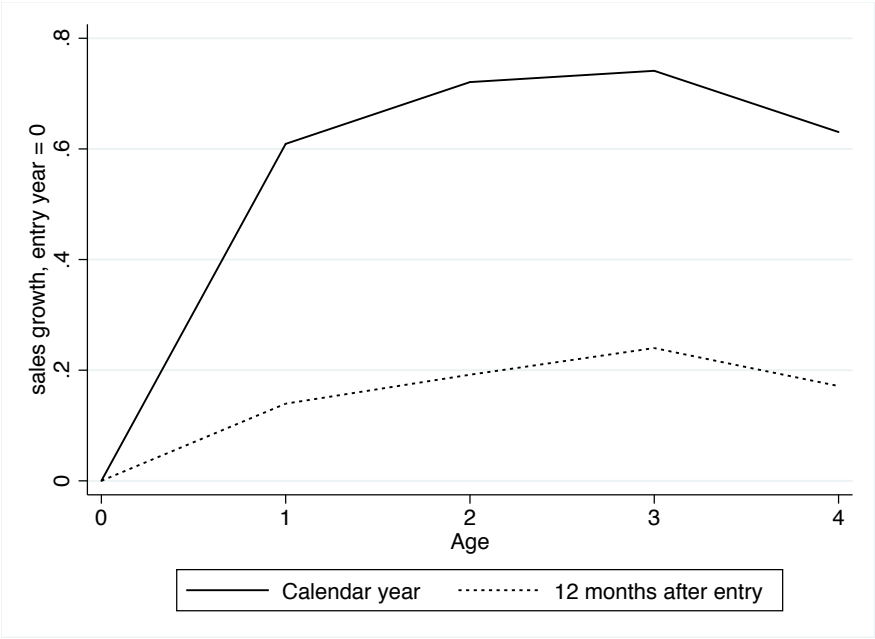
Steep growth profiles in the first year after entry, however, might well be an artifact of the data. For instance, a firm that started exporting by the end of the previous year would show large growth simply because we are comparing a whole year of sales against a couple of months. Bernard et al. (2014) show that these effects lead to erroneously high growth rates in the first year upon entry, for new exporters. The French export data record international shipments monthly, allowing us to make adjustments to the exporters growth profiles and eliminate partial-year effects.[16] Figure 6 shows the growth profile for new exporters recomputed taking into account the month of the year in which the firm started exporting. The adjustment is substantial: After entry, the growth rate of sales for new exporters in a given market, when partial-year effects are taken into account, is a third of the growth rate obtained using the yearly data. This magnitude is similar to the

[15] Unfortunately, the German data do not allow to distinguish between sales of the parents at home and exports so that figure 4b cannot be reproduced with these data.

[16] The procedure that corrects for partial-year effects takes into account the month of the year in which the first international shipment is observed into a given destination, for a French firm. Annual growth rates are then computed considering one year, two years, ..., with respect to the entry month.

one obtained by Bernard et al. (2014) for Peru, of more than 100 percent. [Adjustment for Norway TBA] This adjustment would make growth profiles of both exports' and affiliates' sales extremely similar (and the calibrated model proposed below more in line with this pattern).

Figure 6: New exporters sales: Partial-year effects. France.



Notes: Firm-destination (log of) exports relative to firm-destination exports in the year of entry. Means are taken over all firm-destination pairs with five or more years in the market. (Log of) exports are demeaned by subtracting industry, year, and destination fixed effects.

2.4 Fact III: Experienced MNEs are larger than incumbent MNEs

The following transition matrix shows, at the firm-destination level, the size of revenues for firms who transition from one mode of international operation to another. Some interesting features arise. First, as previously documented, domestic firms are smaller than exporters, that in turn are smaller than multinational firms. Exporters that become MNEs are among the largest exporters, while firms that exit international markets are smaller, on average. Interestingly, exporters that become MNEs are on average larger than incumbent MNEs, as are MNEs that become exporters (0.38 vs -0.35).

Table 5: Transition Matrix: Size. Norwegian data.

$t-1 \setminus t$	Firm-destination-year level				Firm-year level			
	domestic	exporter†	MNE	total	domestic	exporter†	MNE	total
domestic	0.37 565,349	0.96 61,861	2.04 262	0.43 627,472	-1.77 41,960	-1.06 5,279	-0.57 12	-1.69 47,251
exporter†	0.97 51,849	1.46 138,014	3.04 324	1.33 190,187	-1.16 4,314	-0.29 23,331	1.44 60	-0.42 27,705
MNE	1.59 195	2.53 340	2.66 4,264	2.61 4,799	-0.90 11	0.88 99	1.15 1,023	1.11 1,133
total	0.42 617,393	1.31 200,215	2.65 4,850	0.65 822,458	-1.71 46,285	-0.43 28,709	1.15 1,095	-1.19 76,089

Notes: Mean log of revenues, controlling by year fixed effects, and number of observations. Each cell shows size at time t under mode m (column) given mode m' at time $t-1$ (row). †: non-MNE exporters.

2.5 Additional Facts

2.5.1 Country characteristics and exit rates

What are the characteristic of markets which firms tend to exit? Are they more distant? Smaller markets? The next figure shows exit rates for exporters and affiliates of Norwegian MNEs across markets of different size and distance from Norway.

The cross-country patterns of exit between the two modes of international operation are strikingly different: while exporters operating in smaller and further away markets are more likely to stop operations there, it is not clear that affiliates of MNEs do.[17] The same pattern for new exporters with respect to destination-market size and distance from the home market is found in the French data, for both exporters and MNEs affiliates as well as in the German data for MNEs affiliates.[18] Figure **??** in the Appendix shows the results.

2.5.2 Size and "experienced" MNEs

Another interesting feature focus on the size distribution across different modes of entry into markets. Figure 8 shows that affiliates' sales of new affiliates are larger than sales

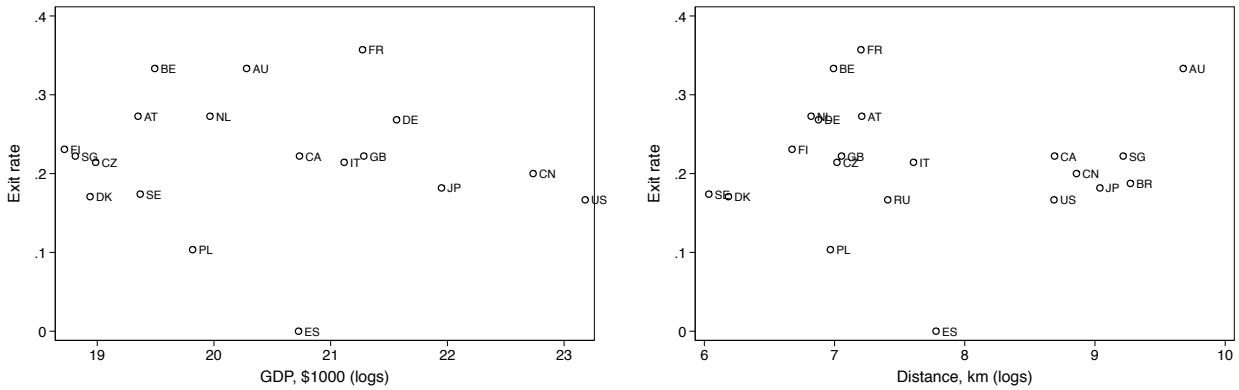
[17] Controlling by year and industry specific effects, for exporters, the exit probability increases by 15 percentage points when distance increases by one percent, and decreases by six percentage points when GDP increases by one percent; the effects on affiliates of MNEs are insignificant.

[18] For Germany, the coefficients of first-year exit rates on (log of) GDP and geographical distance, respectively, are not significant.

Figure 7: Exit rates and market characteristics. Norway.

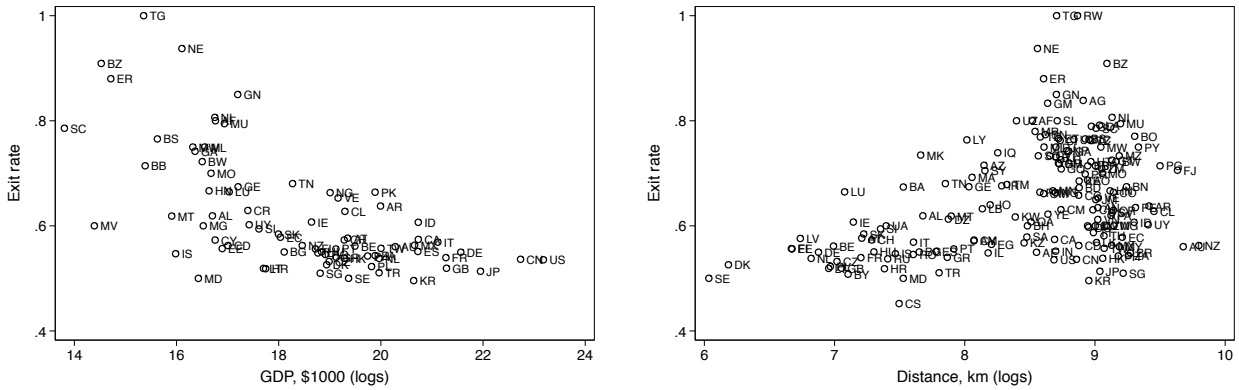
(a) MNEs – market Size

(b) MNEs – distance



(c) Exporters – market size

(d) Exporters – distance

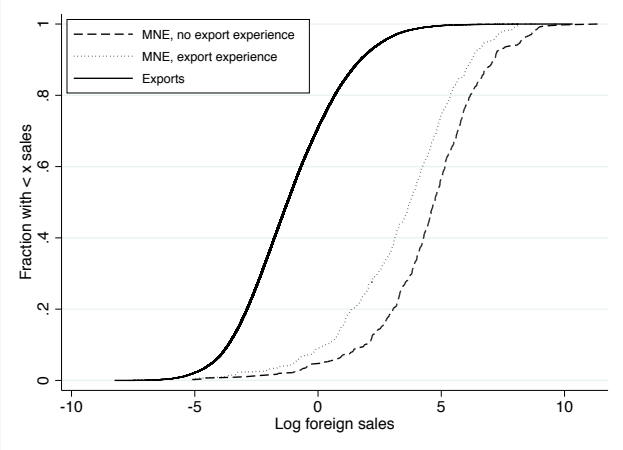


Notes: Exit rates are defined as the number of affiliate-destination exits, relative to the number of active affiliates-destinations, in the first year upon entry. Destinations with 10 or more firm-year observations.

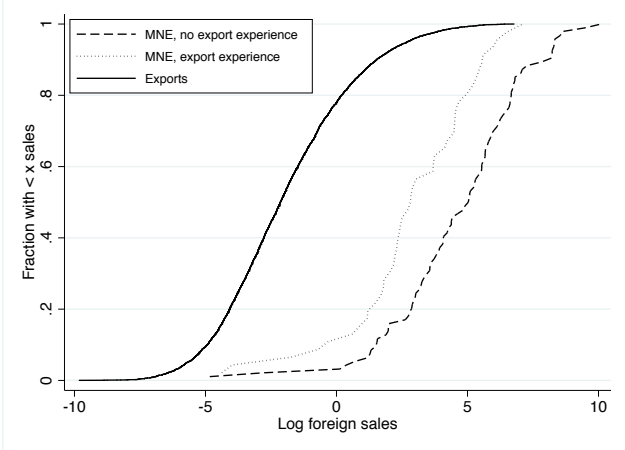
of new exporters into a given destination, the first year after entry. Additionally, as the previous literature has documented, overall, new MNEs are larger than new exporters in terms of employment (and revenues) in the Norwegian market as well as in the international market (in terms of global sales). Interestingly, MNEs with export experience in a given market are smaller than MNEs without any export experience; new MNEs that were previously exporters are also smaller in terms of their global sales.

Figure 8: Size Distribution at Entry. Norwegian data.

(a) firm-destination level — foreign sales



(b) firm level — corporation-wide foreign sales



Notes: Figure 8a shows the cumulative distribution function (CDF) of (log of) sales in the year of entry in market n and mode m. Figure 8b shows the CDF of (log of) total corporation-wide foreign sales for firm i in year of entry into mode m. (Log of) sales are first demeaned by subtracting industry, year, and destination fixed effects in 8a, and industry and year fixed effects in 8b. Export experience = affiliates that enter market n in year t and were exporters to n in $t-1$ or earlier. No export experience = affiliates that enter market n in year t and did not export to n previously.

Results are confirmed formally by estimating, using OLS,

$$\log s_{inm,0} = \beta_0 mne_{int} + \beta_1 mne_{int} \times exp_{inmt} + \epsilon_{inmt},, \tag{3}$$

for firm i in year t who enters destination n under mode m. The variable $s_{inm,0}$ denotes sales in the year of entry into market n and mode m; the variable mne_{int} is one if the firm i enters market n at time t as an MNE, and zero if it enters as an exporter; and exp_{inmt} is one if firm i who enters market n at time t under mode m has previous experience in mode $m^{'}$, $m \neq m'$. Table 6 shows the results for observations at the firm-destination and firm level.

These results confirm: (1) that affiliates of MNEs are larger upon entry than export shipments into market n, as figure 4b indicates; and that (2) "experienced MNEs" not only

Table 6: Size Distribution at Entry. Norwegian data.

Dependent variable:	$\log s_{inm,0}$			$\log s_{im,0}$		
	(1)	(2)	(3)	(4)	(5)	(6)
mne_{int}	6.11***	5.77***	5.73***			
	(0.139)	(0.156)	(0.222)			
exp_{inmt}	0.766*	0.515	-0.06			
	(0.451)	(0.484)	(0.492)			
$mne_{int} \times exp_{inmt}$	-1.27***	-1.36***	-1.19**			
	(0.439)	(0.516)	(0.523)			
mne_{it}				7.04***	6.22***	5.94***
				(0.294)	(0.284)	(0.333)
exp_{imt}				-1.02**	-1.71***	-1.46***
				(0.489)	(0.587)	(0.550)
$mne_{it} \times exp_{imt}$				-0.548	-0.241	-1.37*
				(0.688)	(0.789)	(0.756)
$\log sales_{it,nor}$			0.24***			0.62***
			(0.017)			(0.035)
Year fixed effects	yes	yes	yes	yes	yes	yes
Destination fixed effects	no	yes	yes	no	no	no
Industry fixed effects	no	yes	yes	no	yes	yes
Observations	51,644	51,644	49,513	5,109	5,109	5,014
R-squared	0.108	0.120	0.157	0.151	0.149	0.251

Notes: $s_{inm,0}$ are sales of firm i in the year of entry into market n under mode m, while $s_{im,0}$ are corporation-wide foreign sales of firm i under mode m in the year of entry; mne_{int} is one if the firm i enters market n at time t as an MNE, and zero if it enters as an exporter; exp_{inmt} is one if firm i who enters market n at time t under mode m has previous experience in mode $m^{'}$, $m \neq m'$; and $sales_{it,nor}$ refers to sales of firm i in year t in their home market (Norway). In columns 1-3, observations are at the firm-destination level, while in columns 4-6 are the firm level. Robust standard errors, clustered by industry, are in parentheses. Levels of significance are denoted $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

have smaller affiliates in a given market, but also they are smaller MNEs in terms of global sales.

3 A Simple HMY Dynamic Model

In this section, we extend the model of trade and FDI by Melitz, Helpman, and Yeaple (2004) [9] to a dynamic setup.

Time is discrete. There are two symmetric countries, Home and Foreign. Labor is the only factor of production and supplied in quantity L. Any kind of fixed, sunk, or entry costs are paid in units of labor. Goods that are exported to a foreign country are subject to an iceberg-type trade cost, $\tau \geq 1$.

Additionally, a firm that exports to a foreign market incurs a fixed cost, f^x, while a firm that operates an affiliate in a foreign market incurs a per-period fixed cost f^m, with $f^m > f^x$. There is also a sunk cost of opening an affiliate in the foreign market, $f_e^m > 0$.[19] All these three costs are paid in units of labor in the home market.

There exists a continuum of firms that compete monopolistically, each of which have access to a continuum of differentiated products. Preferences are CES, and the elasticity of substitution among different goods is denoted by σ. We consider the case in which the mass of firms, N, is fixed and normalized to one.

A firm is characterized by its country of origin, and a core efficiency level at time t, $\phi_t \equiv \exp(z_t)$. The core efficiency evolves over time in the following way

$$z_t = \rho z_{t-1} + \sigma_\epsilon \epsilon_t,$$

where $0 \leq \rho < 1$ and $\epsilon_t \sim N(0,1)$.

Firms optimally set prices such that the firm charges for each product a constant mark-up $\kappa = \frac{\sigma}{\sigma-1}$ over marginal costs, so that sales follow the standard CES formula. Let $E \equiv \kappa^{1-\sigma} X / P^{1-\sigma}$. Domestic sales are

$$s_d(\phi) = E\phi^{\sigma-1} w^{1-\sigma}, \tag{4}$$

Exports to the foreign market from Home are

$$s_x(\phi) = E\phi^{\sigma-1} (\tau w)^{1-\sigma}, \tag{5}$$

[19] We abstract for now from a sunk cost of exporting.

while sales of Home affiliates in Foreign are

$$s_m(\phi) = E\phi^{\sigma-1}(w)^{1-\sigma}, \tag{6}$$

In terms of production locations, the firm has two possible states: producing in the domestic market only (D) or in both markets (M).

The value of being a multinational with core productivity ϕ is given by

$$V(\phi, M) = \frac{s_d(\phi)}{\sigma} + \max\left\{ \frac{s_m(\phi)}{\sigma} - wf^m + \beta EV(\phi', M \mid \phi), \max(0, \frac{s_x(\phi)}{\sigma} - wf^x) + \beta EV(\phi', D \mid \phi) \right\}. \tag{7}$$

A multinational firm has to choose between continue its operations abroad, for which the per-period fixed cost f^m is incurred, shutting down the affiliate and becoming an exporter, for which the per-period fixed cost f^x is incurred, or abandoning international activities altogether.

The value of being a domestic firm with core productivity ϕ is given by

$$V(\phi, D) = \frac{s_d(\phi)}{\sigma} + \max\left\{ \frac{s_m(\phi)}{\sigma} - wf^m - wf_e^m + \beta EV(\phi', M \mid \phi), \max(0, \frac{s_x(\phi)}{\sigma} - wf^x) + \beta EV(\phi', D \mid \phi) \right\} \tag{8}$$

A domestic firm can choose to become a MNE, for which the per period fixed cost f^m as well as the entry sunk cost f_e^m are incurred, to export with per-period fixed cost f^x, or to operate only in its home market.

A domestic firm will export whenever $\bar{\phi}^x < \phi < \bar{\phi}_e^m$, where the lower bound export cutoff is defined by

$$\frac{1}{\sigma} s_x(\bar{\phi}^x) - wf^x = 0. \tag{9}$$

The upper bound export cutoff, which is equivalent to the lower bound MP entry cutoff ($\bar{\phi}_e^m$), is defined by the value of ϕ for which the firm is indifferent between choosing D or M in the problem defined in equation (8).

The firm will stop being a multinational if choice D leads to larger profits than choice M. Denote the cutoff value of productivity by $\bar{\phi}^m$. It is straightforward that $\bar{\phi}^m < \bar{\phi}_e^m$, whenever $f_e^m > 0$. A firm that wants to enter multinational production faces the additional hurdle of overcoming f_e^m, which is not faced by the incumbent multinational firm. Whether $\bar{\phi}^m > \bar{\phi}^x$ depends on parameters. The following proposition states formally the result.

Proposition 1. Assume that $f^m > f^x(\frac{1}{\tau})^{1-\sigma}$, and $f_e^m > 0$. Then,

$$\bar{\phi}^x < \bar{\phi}^m < \bar{\phi}_e^m.$$

When $\phi \in [\bar{\phi}^m, \bar{\phi}_e^m]$, domestic firms wait to become multinationals and just export. This is the "inaction" zone that exists by virtue of the sunk cost of doing FDI. Additionally, with this ordering of cutoffs, it follows naturally that multinational firms are more productive than exporters, that in turn, are more productive than domestic firms; this is the fact documented in the previous literature and captured by the static models of the proximity-concentration tradeoff. The difference in size between exporters and MNEs subsists in the time series. It is not obvious, however, what happens with experienced MNEs. The next proposition turns to that feature of the model.

Proposition 2. The probability that a new MNE exits right after entry is lower if the firm previously served the market as an exporter.

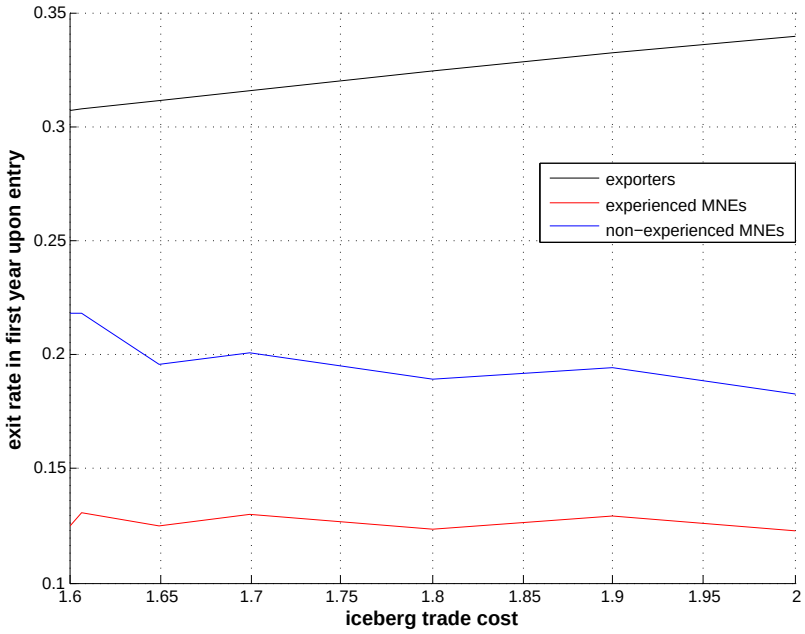
This theoretical result captures the fact portrayed in figure 1 and table 2. Firms who have export experience, according to the model, enter the multinational status with a productivity level that is larger than the productivity level of a firm with no export experience. Since the exit cutoff is the same for both types of firms, larger firms at the time of entry are less likely to have a productivity shock that leads their productivity level to fall below the exit cutoff in the subsequent period. While the fact that new MNEs with export experience are less likely to exit may have been interpreted as evidence consistent with learning, it is worth noting that a simple dynamic model of trade and FDI without learning delivers the same prediction.

The counterpart of capturing the fact that experienced MNEs have lower exit rates upon entry, is that experienced MNEs are larger than non-experienced MNEs; this result is the contrary to what is observed in the data at the firm-destination level, but it matches the fact that experienced MNEs are larger in the domestic market.

Additionally, as suggested by the transition matrix in table 5, the model correctly implies that new firms that experienced the foreign market by exporting before opening an affiliate are more productive, on average, than the incumbent multinational firms: this is due simply to the fact that $\bar{\phi}^m < \bar{\phi}_e^m$. However, this group of firms is less productive than firms that become multinational directly the year of entry, as shown in figure 8—-the model fails to capture this feature of the data. Moreover, multinational firms that exit the FDI mode in order to become exporters are the least productive multinationals, but they are, on average, very productive exporters. Additionally, exporters that eventually become multinational firms are the most productive exporters.

Furthermore, the model explains why exit rates for exporters vary with GDP and transport costs and exit rates for MNEs do not (see figure 7). Sunk costs for multinational entry cause hysteresis, or state dependence: The productivity level required for MNE entry exceeds the productivity level at exit. The higher the sunk costs, the higher the option value of staying in a country and hence, the less sensitive the exit behavior to differences in variable profits due to differences in market size and transport costs (conditional on entry). Figure 9 illustrates the point through a simple simulation.

Figure 9: Variable trade costs and exit rates. Model.



Notes: Simulation results for different values of variable trade costs, τ on firms' exit rates in the first year upon entry.

Finally, the model predicts growth rates *at the firm level* should be the same at home and in the foreign market, either for exporters or MNEs (so that, by assumption, the model cannot reproduce the increasing growth profile of foreign relative to domestic sales in figure 4b). The differences in growth profiles between exporters and MNEs arise due to the extensive margin (i.e., entry and exit) by virtue of which in any cross section we observe firms of different age.

In the next section, we ask: how far does the model go in capturing *quantitatively* the patterns observed in the data?

Table 7: Model Parameters

Parameter	Description	Value
τ	trade iceberg cost	1.607
ρ	persistence of idiosyncratic shock	0.966
σ_ϵ	S.D. of idiosyncratic shock	0.095
f^x	per-period export fixed cost	0.040
f^m	per-period FDI fixed cost	3.930
f_e^m	FDI entry cost	2.472

4 Calibration

We use moments from the Norwegian data to calibrate key parameters of the model. The goal is to compare the facts in section 2 with the simulated data.

We set $\sigma = 5$ which implies a mark-up over unit cost of 20 percent. The discount factor for firms, captured by the parameter β, is set to 0.95 which implies an interest rate of five percent. The measure of firms M in each country is normalized to one in each country. The remaining parameters to calibrate are listed in table 7.

The parameters characterizing the Markov process for firm-level productivity, ρ and σ_ϵ, come from an AR(1) regression of domestic sales (unbalanced panel), for Norwegian firms: $\rho_s = 0.966$ and $\sigma_s = 0.38$, which imply $\rho_z = \rho_s = 0.966$ and $\sigma_\epsilon = \sigma_s/(\sigma-1) = 0.095$.[20]

The variable trade cost is directly pinned down by (the transformation of) the ratio of exports to domestic sales, $(s_x(\phi)/s_d(\phi))^{1/(1-\sigma)}$, which, for a firm with productivity ϕ, is constant and equal to τ. The average ratio for of export to domestic sales, for Norwegian firms, is 0.15, which together with $\sigma = 5$, implies $\tau = 1.607$.

Per period fixed costs of exporting, f^x, and FDI, f^m, as well as sunk costs of FDI, f_e^m, are jointly calibrated by targeting the remaining three moments described in the upper panel of table 8. The lower panel of table 8 shows non-targeted moments.

As proved in Proposition 2, the calibrated model correctly captures the fact that new experienced MNEs have lower exit rates than non-experienced MNEs.Yet, the calibrated model delivers virtually zero new MNEs which were not previously exporters; this group, however, is also very small in the data (0.09 percent of domestic firms become MNEs).

Figure 10 shows the ability of the model to capture the exit profiles observed in the

[20]The first-order autoregressive process is estimated including year and industry fixed effects, with robust standard errors clustered by industry, using all firms in Norway. Results using employment are similar.

Table 8: Moments: Data and Model

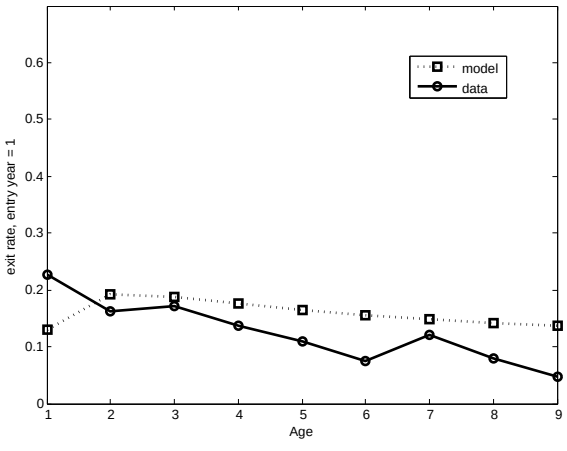
Targeted moments	data (in %)	model (in %)
fraction of non-MNE exporters	39.6	40.8
fraction of MNEs	1.5	1.41
probability of MNE exit in the 1st. yr after entry	21	13
Non-targeted moments		
fraction of "experienced MNE" (in all MNE)	56	15.2
probability of export exit in the 1st. yr after entry	58	30.7
probability of becoming "experienced MNE"	0.17	0.52
probability of becoming "non-experienced MNE"	0.09	0
probability of becoming exporter (being domestic)	19.7	7.07
probability of "experienced MNE" exit in the 1st. yr after entry	16	13
probability of "non-experienced MNE" exit in the 1st. yr after entry	27	21.8

Notes: Moments in the data refer to observations at the firm-destination level, for Norway.

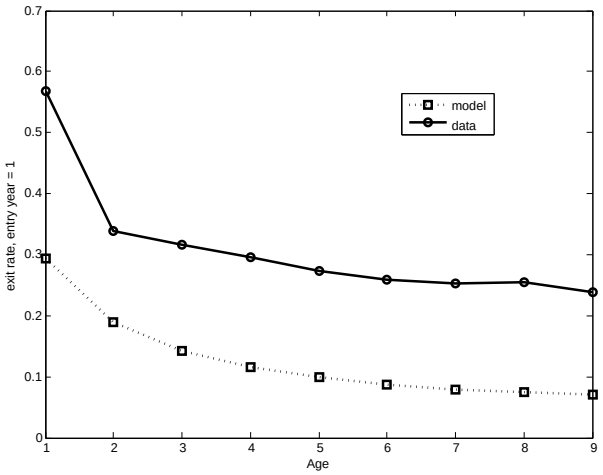
data. The quantitative model captures fairly well the exit patterns across new MNEs in different cohorts. Still, the model fails to capture the steepness of the exit profile for exporters: It only captures half of their initial exit rate and, in the long run, their exit rate is lower than for MNEs.

Figure 10: Exit Rates: New MNEs and new exporters. Model and data.

(a) MNEs



(b) Exports



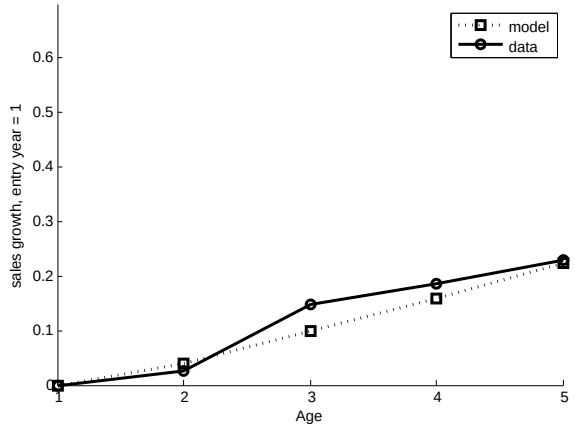
Notes: Data are from Norway, at the firm-destination level, as in figure 1a.

Figure 11 shows the ability of the model to capture the growth profiles for new MNEs and new exporters depicted in figure 4a for Norway. The calibrated model does a rela-

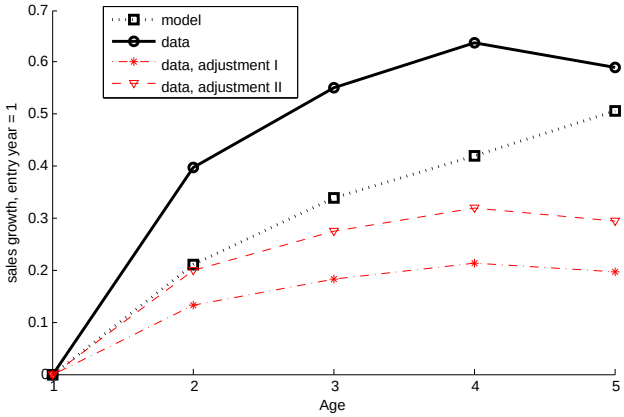
tively good job at picking growth profiles for new MNEs, though it cannot capture the abrupt growth in exports. Interestingly, if we apply the correction to control for partial-year effects, as suggested by the French data, the smooth growth observed in the model is present also in the data. Still, exporters in the model growth too much in the longer run with respect to the data.

Figure 11: Foreign Sales: New MNEs and new exporters. Model and data.

(a) Affiliate sales —rel. to entry year



(b) Exports — rel. to entry year



Notes: Sales growth is relative to the entry year. Data are for Norway, at the firm-destination level, as in figure 4a. Exports growth in the data is adjusted to partial-year effects using a factor of 1/3 ("adjustment I") and 1/2 ("adjustment II").

5 Conclusions

TBA

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A Proofs

A.1 Proof of Proposition 1

Define $\mu^D(\bar{\phi}^m) \equiv EV(\phi', D/\bar{\phi}^m)$ and $\mu^M(\bar{\phi}^m) \equiv EV(\phi', M/\bar{\phi}^m)$. Also, define $\pi^m(\phi) \equiv s^m(\phi)/\sigma - f^m$, and $\pi^x(\phi) \equiv s^x(\phi)/\sigma - f^x$.

Then, in the stationary equilibrium, for $\phi = \bar{\phi}^m$, (7) can be written as

$$V(\phi, M) = \max\left\{\pi^m(\bar{\phi}^m) + \beta\mu^M(\bar{\phi}^m), \pi^x(\bar{\phi}^m) + \beta\mu^D(\bar{\phi}^m)\right\}, \tag{10}$$

while (8) is

$$V(\phi, D) = \max\left\{\pi^m(\bar{\phi}^m) - wf_e^m + \beta\mu^M(\bar{\phi}^m), \pi^x(\bar{\phi}^m) + \beta\mu^D(\bar{\phi}^m)\right\}. \tag{11}$$

The productivity cutoff for exporters is given, from (9), by

$$\bar{\phi}^x = (\frac{\sigma w f^x}{E})^{\frac{1}{\sigma-1}}(\tau w), \tag{12}$$

while the productivity cutoff for multinationals who exit is

$$\bar{\phi}^m = (\sigma\frac{\beta\mu^D(\bar{\phi}^m) - \beta\mu^M(\bar{\phi}^m) + wf^m - wf^x}{E((w)^{1-\sigma} - (\tau w)^{1-\sigma})})^{\frac{1}{\sigma-1}}. \tag{13}$$

Hence, $\bar{\phi}^x < \bar{\phi}^m$, as long as

$$\beta(\mu^D(\bar{\phi}^m) - \mu^M(\bar{\phi}^m)) < f^m - f^x(\frac{w}{w\tau})^{1-\sigma}. \tag{14}$$

Since the left-hand side of the inequality is always negative, and $f^m > f^x(\frac{w}{w\tau})^{1-\sigma}$, then it follows that $\bar{\phi}^x < \bar{\phi}^m$.

With $f_e^m > 0$, it is straightforward that the multinational entry productivity cutoff, $\bar{\phi}_e^m$, has to be the largest,

$$\bar{\phi}_e^m = (\sigma\frac{\beta\mu^D(\bar{\phi}_e^m) - \beta\mu^M(\bar{\phi}_e^m) + wf_e^m + wf^m - wf^x}{E((w)^{1-\sigma} - (w\tau)^{1-\sigma})})^{\frac{1}{\sigma-1}}. \tag{15}$$

■

A.2 Proof of Proposition 2

Since any previously exporting firm had higher productivity than any any previously non-exporting firm (in the period before becoming a multinational), we will prove the proposition by showing that if a firm had lower productivity in the period before becoming a multinational, this firm is more likely to exit in the year after entry.

Let

$$f(a) = \frac{\int_{\log \bar{\phi}_e^m}^{\infty} \Pr(\rho x + \sigma\epsilon \leq \log \bar{\phi}^m \mid x) g(x - \rho a) dx}{1 - G(\log \bar{\phi}_e^m - \rho a)}$$

denote the probability of exit from multinational status in t+1 for a firm that is not yet a multinational in t - 1 and that has a productivity level of a in t-1. The functions $g(\cdot)$ and $G(\cdot)$ denote the pdf and CDF of a normal distribution with mean zero and dispersion parameter σ.

Let $\eta > 0, \eta \to 0$. We want to show that

$$f(a) - f(a - \eta)$$

$$= \frac{\int_{\log \bar{\phi}_e^m}^{\infty} \Pr(\rho x + \sigma\epsilon \leq \log \bar{\phi}^m \mid x) g(x - \rho a) dx}{1 - G(\log \bar{\phi}_e^m - \rho a)} - \frac{\int_{\log \bar{\phi}_e^m}^{\infty} \Pr(\rho x + \sigma\epsilon \leq \log \bar{\phi}^m \mid x) g(x - \rho a + \rho\eta) dx}{1 - G(\log \bar{\phi}_e^m - \rho a + \rho\eta)}$$

$$= \frac{\int_{\log \bar{\phi}_e^m}^{\infty} \Pr(\rho x + \sigma\epsilon \leq \log \bar{\phi}^m \mid x) \left(g(x - \rho a)(1 - G(\log \bar{\phi}_e^m - \rho a + \rho\eta) - g(x - \rho a + \rho\eta)(1 - G(\log \bar{\phi}_e^m - \rho a) \right.}{(1 - G(\log \bar{\phi}_e^m - \rho a))(1 - G(\log \bar{\phi}_e^m - \rho a + \rho\eta)}$$

$$< 0$$

Note that the denominator is always positive so it will be sufficient to show that the numerator is negative. Further note that $\Pr(\rho x + \sigma\epsilon \leq \log \bar{\phi}^m \mid x)$ is decreasing in x and that

$$\frac{\int_{\log \bar{\phi}_e^m}^{\infty} g(x - \rho a) dx}{1 - G(\log \bar{\phi}_e^m - \rho a)} - \frac{\int_{\log \bar{\phi}_e^m}^{\infty} g(x - \rho a + \rho\eta) dx}{1 - G(\log \bar{\phi}_e^m - \rho a + \rho\eta)} = 0.$$

Therefore, if we can show that there only exists one point $m \in [c, \infty]$ s.t. when $x < m$, $g(x - \rho a)(1 - G(\log \bar{\phi}_e^m - \rho a + \rho\eta)) - g(x - \rho a + \rho\eta)(1 - G(\log \bar{\phi}_e^m - \rho a)) < 0$ and when $x > m$,

$g(x-\rho a)(1-G(\log\bar{\phi}_e^m-\rho a+\rho\eta))-g(x-\rho a+\rho\eta)(1-G(\log\bar{\phi}_e^m-\rho a))>0$, then we can show that $f(a)-f(a-\epsilon)<0$.

Since, when $\eta>0$ and $\eta\to 0$, $G(x-\eta)=G(x)-\eta g(x)$ and $g(x-\eta)=g(x)-\eta g'(x)$, we can simplify

$$
\begin{aligned}
&g(x-\rho a)(1-G(\log\bar{\phi}_e^m-\rho a+\rho\eta))-g(x-\rho a+\rho\eta)(1-G(\log\bar{\phi}_e^m-\rho a))\\
&=g(x-\rho a)(1-G(\log\bar{\phi}_e^m-\rho a)-\rho\eta g(\log\bar{\phi}_e^m-\rho a))-(g(x-\rho a)+\rho\eta g'(x-\rho a))(1-G(\log\bar{\phi}_e^m-\rho a))\\
&=g(x-\rho a)(-\rho\eta g(\log\bar{\phi}_e^m-\rho a))-\rho\eta g'(x-\rho a)(1-G(\log\bar{\phi}_e^m-\rho a))\\
&=g(x-\rho a)\rho\eta\left(-g(\log\bar{\phi}_e^m-\rho a)+\frac{x-\rho a}{\sigma^2}(1-G(\log\bar{\phi}_e^m-\rho a))\right)
\end{aligned}
$$

,

where the last equality follows from $g'(x-\rho a)=-\frac{x-\rho a}{\sigma^2}g(x-\rho a)$.

Setting this last term equal to zero and dividing by $g(x-\rho a)\rho\eta>0$, illustrates that there exists only a unique $x=m$ that solves this equation.

We next show that when $x<m$ expression above is negative and positive if $x>m$. Denote

$$
k(x)=\left(-g(\log\bar{\phi}_e^m-\rho a)+\frac{x-\rho a}{\sigma^2}(1-G(\log\bar{\phi}_e^m-\rho a))\right).
$$

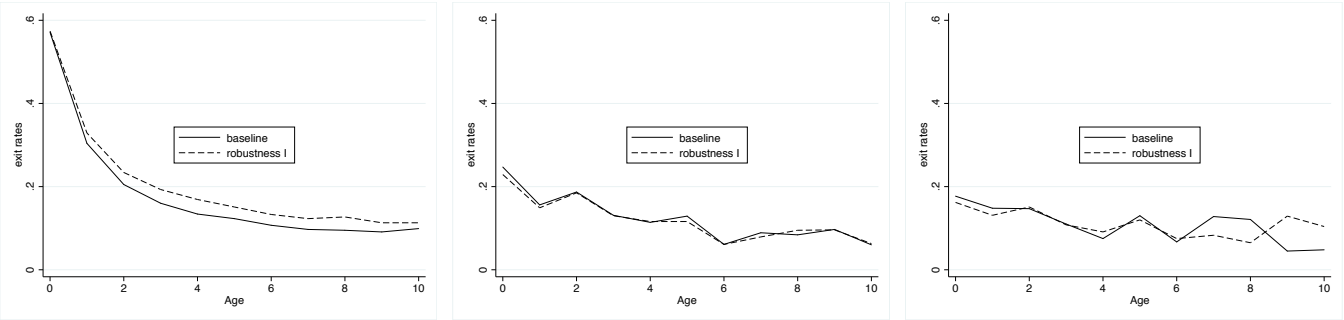
Because $(1-G(\log\bar{\phi}_e^m-\rho a))$ and $g(\log\bar{\phi}_e^m-\rho a)$ are positive constants, suppose that $\frac{g(\log\bar{\phi}_e^m-\rho a)}{(1-G(\log\bar{\phi}_e^m-\rho a))}$=c > 0, then $\frac{m-\rho a}{\sigma^2}=c\Rightarrow m=c\sigma^2+\rho a$. Because $k'(x)=\frac{(1-G(\log\bar{\phi}_e^m-\rho a))}{\sigma^2}>0$, when $x<m$, $k(x)<k(m)=0$, and when $x>m$, $k(x)>k(m)=0$.

Therefore it is shown that $f(a)$ is a decreasing function. ■

B Additional figures

Figure 12: Exit Rates: Consolidated vs Unconsolidated data. France.

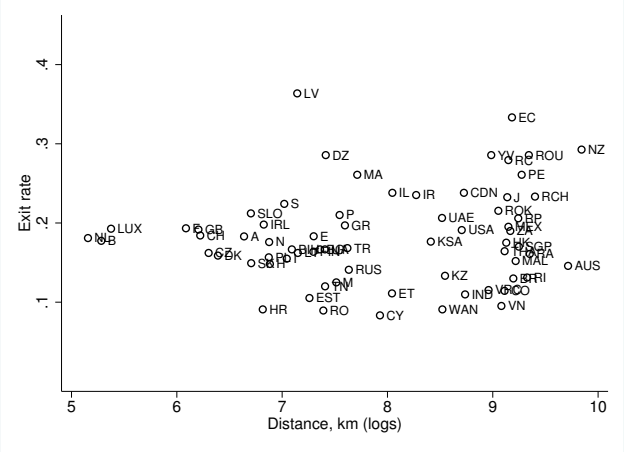
(a) exports (b) MNEs (c) experienced MNEs



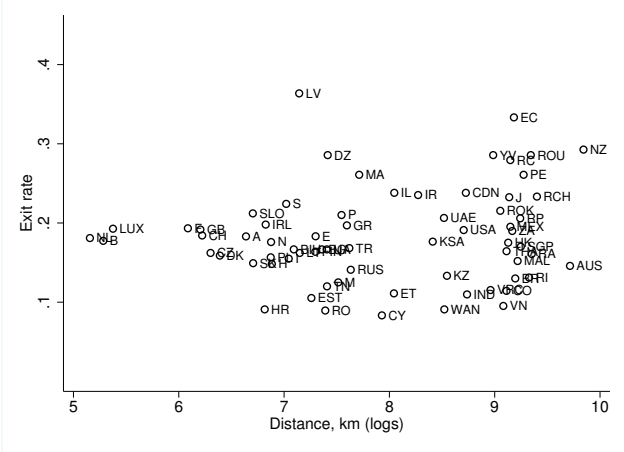
Notes: Exit rates are defined as the number of affiliate-destination exits, relative to the number of active affiliates-destinations. Baseline refers to unconsolidated data while robustness I refers to consolidated observations (i.e. aggregated at the group level).

Figure 13: Exit rates and market characteristics. France and Germany.

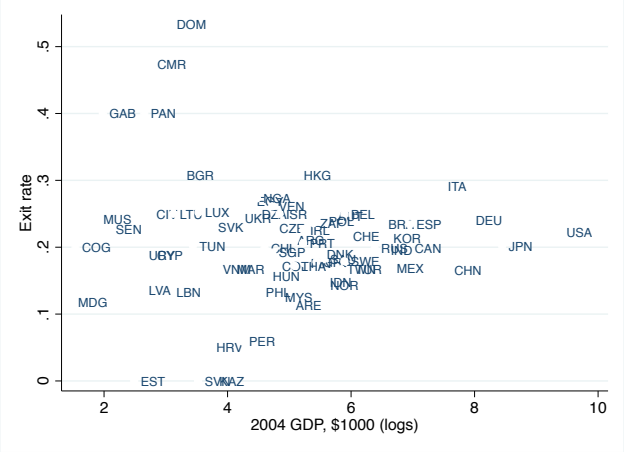
(a) MNEs – market size, Germany



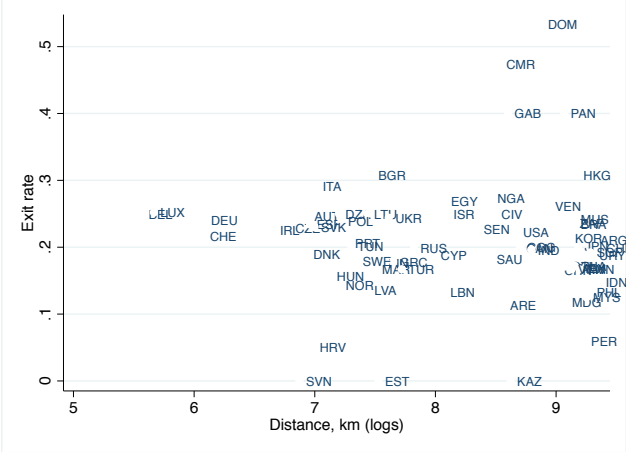
(b) MNEs – distance, Germany



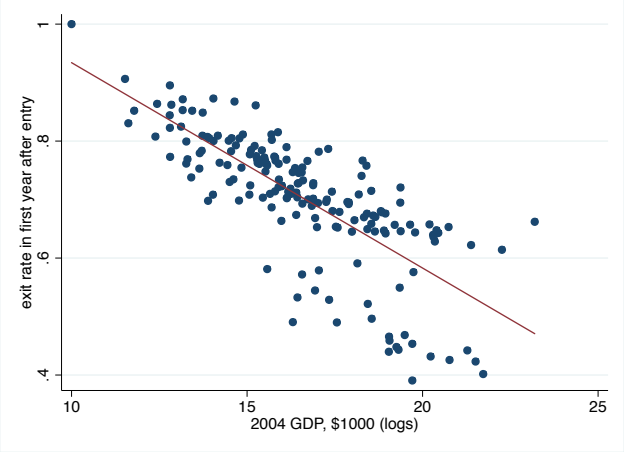
(c) MNEs – market size, France



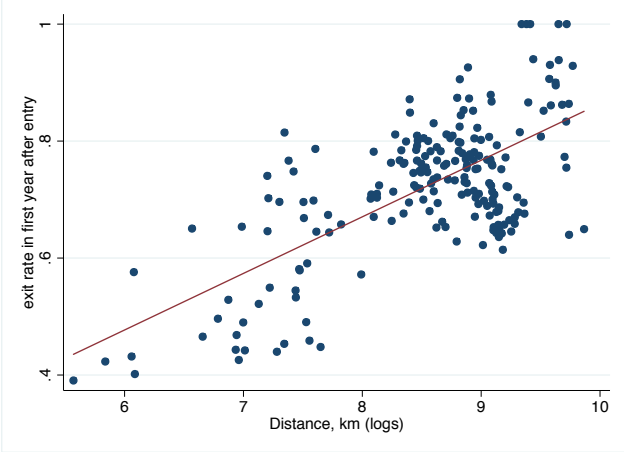
(d) MNEs – distance, France



(e) Exporters – market size, France



(f) Exporters – distance, France



Notes: Exit rates are defined as the number of affiliate-destination exits, relative to the number of active affiliates-destinations, in the first year upon entry.