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Small, young, and early exporters: New evidence on the determinants of firm growth

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Abstract

This work investigates how the interaction of firms? age, size and export status contribute to shape the relative growth patterns of business firms. We address this research question resorting to a novel set of data that covers the universe of Italian firms and detailed data on export transactions. We find that, even when accounting for the role of age, the negative size-growth relationship does not disappear, contrary to some recent evidence. Exploiting available trade data we identify firms that since the beginning of their activity are engaged in international trade. Those firms are characterized by both higher efficiency and willingness to take up growth opportunities. We show that, once accounted for size differences, the value of exports of born-global firms within each product-country destination is at least as big as that of more mature exporting firms. We also provide support for such result and alleviate potential endogeneity concerns by investigating the reactions of firms? exports to an exogenous source of variation such as real exchange rate shocks.

Jelcodes:L25,O

1 Introduction

An important stream of literature within industrial economics has for long been interested in assessing the contribution to employment creation stemming from the different firm-size classes. In this respect, at least since Birch (1981), small firms have been considered as a much relevant source of job creation. The increasing availability of firm level dataset has further contributed to foster research on the issue, starting from the seminal works of Davis and Haltiwanger (1992) and Davis et al. (1996). These studies represented a relevant advancement for the understanding of employment and industrial dynamics, in that they confirmed, by means of new methodological and empirical tools, that smaller firms are major players in terms of job churning, hence contributing both to employment creation and destruction.

A much related stream of literature, dating at least as back as to Penrose (1959), while still centered on the general issue of firm growth, was relatively more focused on the determinants of business growth rather than on industry or economy wide implications. Also this stream of literature has conspicuously benefited from the growing availability of firm-level dataset which provided the researchers the unprecedented opportunity to empirically investigate for a variety of potential determinants of firm growth, from innovation to financial performance, from relative productivity to export status and many other firm-specific factors (a recent survey of this rich literature is in Coad, 2009).

The recent economic slowdown and its consequences further complicated the task of the policy analyst and that of the economist seeking to identify the determinants of firm growth and the role of distinct categories of firms in contributing to aggregate growth. In most industrialized countries, over the last five years the growth rate of GDP per capita has been close to zero, if not negative (Fig. 1.1 from OECD, 2012). In such a scenario, also the most standard and reliable predictors of firm performance, such as productivity or export status, did not regularly allow to discriminate between high and low growth firms. Rather unexpectedly, higher than industry average productivity does not appear to translate into higher firm growth (for evidence on both Europe and US see Bottazzi et al., 2010; Dosi et al., 2012, 2013). In this respect, also the long standing evidence according to which smaller firms tend to display higher growth rates has been challenged recently. Haltiwanger et al. (2013) and Lawless (2014), for example, show that once accounting for firm age, the inverse relationship between growth and size declines very markedly or even disappears.

The contribution of the paper to the literature on firm age and performance is twofold. First, by resorting to the uncensored population of Italian manufacturing firms we investigate the role of several firm characteristics in explaining the growth of companies. In this respect, the unprecedented availability of the universe of firms enables us to insulate against recurring issues due to censoring, truncation or selection bias. We use such data to investigate the property of the growth process for firms of different age classes. Second, building upon the literature on firm age and growth recalled above, we identify and focus our analysis on a category of firms, young exporters, which displays several of the characteristics of high growth businesses. The fact that productivity is not systematically related to firm growth suggests that such pure efficiency measure might not adequately capture the willingness to take up new business opportunities. In this respect, the setting up of a new firm which exports since its very inception, signals both the existence of the skills and capabilities required to engage in international trade and, at least as relevant, the willingness to look for growth opportunities not only domestically, but also abroad.

In this respect, we borrow from the entrepreneurship literature the concepts of "willingness to growth" (Davidsson, 1989) and that of "born-global" (Knight and Cavusgil, 2004). The entrepreneurship literature acknowledges the relevance of motivation, especially managerial motivation, in determining different patterns of firm growth even when accounting for different levels of human capital (Delmar and Wiklund, 2013). Having, for example, pursued a long education does not force anyone to pursue growth. However, if a manager wants their firm to expand, then it appears that having extensive education or rich experience is helpful for making such ambitions materialise (Davidsson and Wiklund, 2013). What we try to argue and show in this paper is that one might well observe a analogous relation with productivity: higher efficiency per se need not to translate into higher growth, however above average productivity *and* willingness to growth are more likely to result in actual firm growth.

We put into operation the concept of higher firm efficiency *and* willingness to growth by looking at the category of early exporters or born globals,[1] which are defined as business organizations that, from or near their founding, are engaged in international trade (Autio et al., 2000; Zahra et al., 2000; Knight and Cavusgil, 2004). The effectiveness of the export status as a signal for growth willingness is rather limited to the first years of activity of a firm: if among smaller firms, exporting is the exception, it becomes more common as the firm gets older and bigger (cf. Table 2 and 5 below).

We investigate the role of age on performance employing an integrated set of data merging information from the census of active Italian firms and data based on customs records covering all Italian exporting firms. Our findings reveal that, as could be expected, age impacts significantly on the propensity to export, with young firms less likely to be engaged in international trade. In this respect the status of "young exporter" is coherent with the firm level characteristics of willingness to grow and higher efficiency. In particular, with respect to the latter, following recent theoretical models and empirical results in the trade literature, we interpret the presence on international markets as evidence of higher productivity (Melitz, 2003; Bernard et al., 2007). In general, exporters report higher growth rates over all the age spectrum, although the difference between exporters and non exporters is more apparent among younger firms. More in detail, we find that, controlling for age, the negative size-growth relationship does not disappear, contrary to the recent evidence mentioned above. We also exploit the rich firm-product-country dataset for exporting firms to control for potential endogeneity issues and to further investigate the role of young exporters in foreign markets. Rather surprisingly, once accounted for size differences, the value of exports of born-global within each product-country combination is not smaller than that of older firms. Remarkably, in some years the value of exports is even bigger, and this is the results of born global being able to ship bigger quantities. Early exporters also appear to be well equipped to face exchange rates variations as their exports decrease less following a currency appreciation.

The paper is organized as follows. Section 2 describes the data. Section 3 provides a first account of the age-size profile and the growth patterns of firms, also employing non-parametric analysis of growth rate distributions of exporting and non exporting firms. Section 4 presents the results of the regression analysis. Section 5 concludes.

[1] In this paper we will use interchangeably the terms born global and young (or early) exporters.

Table 1: Observations by year and export status

Year	All firms	Non exporters	Exporters	Exporters(%)
2000	1,217,251	1,107,791	109,460	8.99
2001	1,252,809	1,140,341	112,468	8.98
2002	1,335,538	1,219,673	115,865	8.67
2003	1,387,156	1,271,768	115,388	8.32
2004	1,418,365	1,305,327	113,038	7.97
2005	1,435,918	1,326,702	109,216	7.61
2006	1,494,419	1,380,913	113,506	7.59

Note. All firms, excluding self-employment. Exporters are defined as firms with strictly positive exports.

2 Data

The analysis is based upon two firm-level datasets collected by the Italian statistical office (ISTAT), namely the Business Register known as "Archivio Statistico Imprese Attive" (ASIA) and Statistiche del Commercio Estero (COE). ASIA is the register of all active Italian businesses. It covers the period 1998-2006 and contains information on firms' operations including the number of employees, total turnover,[2] geographic location of the firm, and much relevant for this work, firm's age, defined as the year of incorporation. The COE dataset consists of all cross-border transactions performed by Italian firms and it covers the period 2000-2007. Further, the data can be disaggregated at the firm-product-country level, meaning that it is possible to know the value of export of each firm in each product-country destination in which it is active. Since data on physical quantity are also available, it is possible to compute the unit values of transaction within each product-country pair. Using the unique identification code of the firm, we link the firm-level export data from COE to ISTAT's archive of active firms. The data collection and building process of the integrated database are described at length in Grazzi et al. (2013).

Notice that the resulting dataset is not a sample but rather it covers the universe of Italian active firms and all international trade transactions of Italian firms over the period. In the reminder of the paper a firm is defined as a legal entity reporting a positive number of full-time equivalent employees during the calendar year. Hence the present analysis excludes self-employment.[3] In the end the dataset employed in the empirical analysis consists of $9,541,456$ observations spanning from 2000 to 2006.

Table 1 reports the breakdown of our dataset by years and export status. The number of active businesses slightly increases over time, whereas the number of exporters, even if increasing in absolute terms, is decreasing as percentage of the total.[4] Export Participation over the universe of firms is rather low, around 9% in 2000, which is somewhat lower than in most other countries for which evidence is available (Bernard et al., 2007; International Study Group on Exports and Productivity, 2008). The reason is twofold. First, data from Structural Business Statistics are usually available only for firms above

[2]Information on total turnover is available only in 2000 and 2003.

[3]See Davis et al. (2009) for a discussion of nonemployers' dynamics and its relationship with employer firms.

[4]Note that we only consider firms with a positive number (or fraction) of employees, thus excluding self-employment. This is why we get a few less exporting firms than in Bernard et al. (forthcoming) which employs the same set of data.

Table 2: Observations by sector of economic activity in year 2000

Sector	All firms					> 20 employees				
	(I)	(II)	(III)	(IV)	(V)	(I)	(II)	(III)	(IV)	(V)
Manufacturing	291,156	23.92	40.42	23.83	87.29	33,094	51.58	44.60	70.11	92.27
Energy	3,832	0.31	1.10	8.74	0.14	581	0.91	1.47	20.48	0.14
Construction	191,764	15.75	8.46	1.02	0.26	5,203	8.11	4.28	8.40	0.22
Wholesale trade	109,557	9.00	6.65	22.89	9.04	5,165	8.05	4.72	66.21	4.48
Retail trade	144,715	11.89	6.58	4.76	0.74	2,734	4.26	5.23	27.91	0.48
Transport & TLC	47,084	3.87	9.93	3.09	1.22	3,849	6.00	13.43	12.18	1.30
Financial	171,871	14.12	15.54	1.61	1.18	7,396	11.53	17.88	7.56	1.03
Other services	257,272	21.14	11.32	0.62	0.12	6,136	9.56	8.38	4.09	0.07
Total	1,217,251	100	100		100	64,158	100.00	100		100

Note. (I) Number of firms; (II) distribution of number of firms (%); (III) distribution of employment (%); (IV) percentage of exporting firms within each sector (%); (V) distribution of export volumes (%) .

a certain size threshold. Given the known positive relationship between size and export status, left truncation of the size distribution provides an overestimation of the percentage of exporting firms. This is the case, for instance, of the dataset employed in Serti and Tomasi (2008) and Grazzi (2012) which report a rather high export participation (around 70% for manufacturing firms) for firms bigger than 20 employees. Second, and related, the firm size distribution of Italian business companies is even more left skewed than that of other countries, hence left truncation causes a bigger bias than for countries with a less skewed distribution of firm size.

Although we cannot report direct evidence on Italian firms, data on a wide set of countries from the World Bank Business Environment and Enterprise Performance Survey (BEEPS) document that on average, the ability to export indirectly (i.e. through export intermediaries) increases by one third the number of firms that can reach foreign markets with their goods (Grazzi and Tomasi, 2014). Given the disproportionate presence of small firms in the Italian economy (see more below) it is reasonable to expect that many small domestic manufacturers would resort to intermediaries to access to foreign destinations.

Table 2 reports the distribution of firms across economic activities and it also shows that imposing a size threshold has also a relevant impact on the distribution of firms across sectors of economic activity. When accounting for the universe of firms, the manufacturing sectors account for less than one quarter of the total number of firms and firms in other services, including bars, restaurants and hotels are almost as numerous. On the contrary, when imposing the 20 employees threshold, a standard cutoff on many firm level dataset, one recovers the disproportionate share of manufacturing firms that is accustomed to observe. Given the wide variation in the organization of business across sectors of economic activity, in the remainder of the paper, we focus only firms in the manufacturing sectors. Manufacturing firms - as expected - also account for the largest share of exports of goods.[5]

3 Export participation and the age-size profile

The relation between firm size and export propensity has been much investigated in the literature, and the empirical consensus of a positive relationship (Wagner, 2001; Bernard et al., 2007) is well accounted by existing theories of sunk costs for export market

[5]For a comparative analysis of the role of manufacturers, vis a vis wholesalers, refer to Bernard et al. (forthcoming).

Table 3: Distribution of firms by age class and export status in 2000

Age class	All firms %	Exporters %
Age < 5	21.15	15.59
Age 5-10	20.49	21.16
Age 11-20	28.42	23.97
Age 21+	29.94	31.34
Total	100.00	

Note. The second column reports the distribution of firms across the four age classes; the third column reports the percentage of exporters over the total number of firms for each age class. Pearson's chi-squared test of equal distribution of age classes across exporters and nonexporters: $\chi^2_3 = 5200$; Probability = 0.

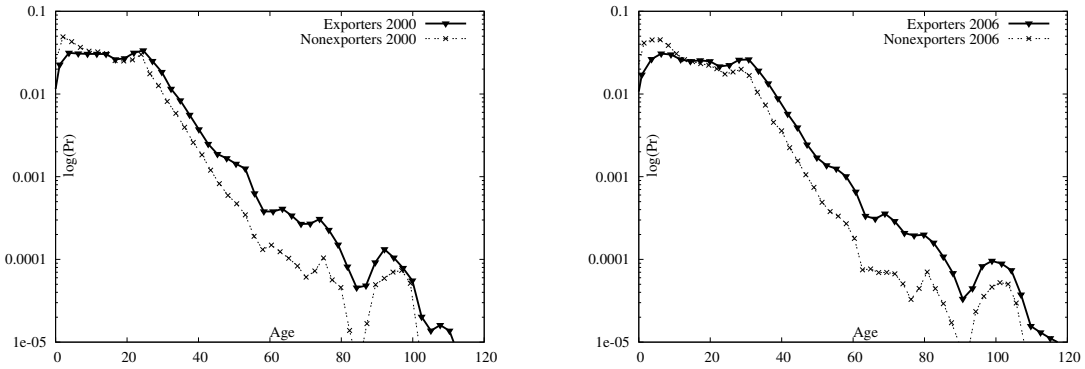


Figure 1: Kernel density of the age distribution for exporters and nonexporters, in 2000 and 2006. Kernel densities are computed using an Epanechnikov kernel

participation (Melitz, 2003). On the contrary, the role of firm age in explaining firm propensity to export has been much neglected, mostly due to data limitations. This paper provides the first evidence on the subject exploiting the universe of Italian manufacturing firms.

The descriptive evidence suggests that export market participation rates vary with age. Table 3 assigns firms to four age classes, respectively, less than five years from incorporation, between 5 and 10, between 10 and 20, and more than 20 years from incorporation. In the expanding literature on the role of firm age, such classification is employed, among the others, also by Lawless (2014). Note that the universe of firms is rather evenly distributed across age classes and the same occurs for non exporting firms. On the contrary, exporters are more concentrated in the category of firms with more than 20 years, as more than one third of exporters belong to such class (not reported in the table). The export propensity is increasing within age categories, going from 15.59% of the first class to 31.34% of the last class. Overall, one notices that if being an exporter is already an exception with respect to the universe of manufacturing firms (24%, cf. Table 2) being a young exporter is even a much rarer event.

The relation between firm age and export status is also shown in Figure 1 by means of kernel density estimation for the years 2000 and 2006. The linear decay in the distributions over most of their support suggests that an exponential law would be an acceptable

Table 4: Transition matrix in and out of exporting

	Age < 5		Age 5-10		Age 11-20		Age 21+	
	0	1	0	1	0	1	0	1
0	95.12	4.88	95.69	4.31	95.60	4.40	95.03	4.97
1	17.05	82.95	16.42	83.58	13.94	86.06	11.00	89.00

Note. 0 and 1 represent the status of nonexporter and exporter.

representation of empirical distributions, with departures from the linear fit among the youngest and the oldest firms, in line with the evidence emerging from other studies (Coad, 2010; Coad and Tamvada, 2012; Barba Navaretti et al., 2014). In particular, notice that the modal age among non exporters is 2 years in 2000, whereas it is 24 years among exporters: this implies that the departure from the exponential benchmark is negligible in the case of nonexporting young firms, while it is quite pronounced in the case of young exporting firms.[6] One possible explanation of this is the increase in net entry rate into export markets observed during the first years of a firm's lifecycle (see below). Finally, Figure 1 shows that the age distributions is almost unchanged over time.

Somewhat surprising, age has only a limited impact on the persistency of the export status, as shown by Table 4, which reports the annual transition matrix in and out of exporting for each age class. The probability to export in $t + 1$, given that a firm was already exporting in the previous year, is around 83% in the first age class, and is only mildly increasing throughout the four classes. In general, the observed persistency in export status is quite high, in agreement with the available evidence from other countries (see Roberts and Tybout, 1997 for data on Colombia, Bernard and Jensen, 2004 for U.S. and Grazzi, 2012 for sample of medium and large Italian firms). Both the high persistency and the low entry rate into export markets (first row of Table 4) provide supporting evidence to the sunk costs hypothesis (Melitz, 2003) for engaging into international trade. In particular, the high persistency in the export status displayed in Table 4 shows that the explanation of exporting behaviour based on sunk costs is robust to age disaggregation.

As recalled above, firm size is known to be a relevant characteristic to predict the export status, since exporters are usually found to be bigger than nonexporters. In Table 5 we take advantage of information on both size and age to provide, for the year 2000, a complete descriptive account of the joint distribution of the variables we are mostly interested in: age, size and export status. In order to do so, we divide firms in four size classes: class 1 contains firms with employees > 0 and ≤ 1; class 2-9 contains firms with employees > 1 and ≤ 9; class 10-19 contains firms with employees > 9 and ≤ 19; class 20+ contains firms with employees > 19. Such classification of firms across size classes is borrowed from Haltiwanger et al. (2013) and then adapted to the peculiarity of the Italian context by grouping together firms bigger than 20 employees which are rather few absolute numbers $(35,058)$ and represent only the 12.04% of the population. Each cell of Table 5 reports the number of firms, the percentage over the total, and the percentage of exporting firms in the cell. The first two size classes account for more than 72% of all firms, which are distributed across age classes more or less according to the aggregate distribution observed above, with most firms aged between 11 and 20. Exporters are quite rare, in relative terms, among small firms: export propensity is around 6.5% in the

[6] An exponential distribution would predict a modal age equal to the very youngest age group (Coad, 2010, p. 10).

Table 5: Distribution of firms by age, size class and export status in 2000

	Size class				
Age Class	1	2-9	10-19	20+	All
Age < 5	18,504	32,860	6,584	3,646	61,594
	6.36	11.29	2.26	1.25	21.15
	6.84	14.28	27.84	49.70	15.59
	0.29	3.05	2.16	6.55	12.05
Age 5-10	13,613	32,289	8,551	5,199	59,652
	4.68	11.09	2.94	1.79	20.49
	7.18	17.32	34.92	59.03	21.16
	0.25	3.21	2.83	7.54	13.83
Age 11-20	16,276	42,383	14,421	9,671	82,751
	5.59	14.56	4.95	3.32	28.42
	5.86	16.87	37.21	65.88	23.97
	0.32	4.38	4.82	12.81	22.33
Age 21+	14,376	41,236	15,005	16,542	87,159
	4.94	14.16	5.15	5.68	29.94
	6.16	17.38	42.49	77.90	31.34
	0.30	4.36	5.04	42.09	51.79
All	62,769	148,768	44,561	35,058	291,156
	21.56	51.10	15.30	12.04	100.00
	6.50	16.54	37.16	68.85	23.83
	1.15	15.01	14.84	69.00	100.00

Note. Each cell reports, top to bottom, the number of firms, the percentage over the total (%), the percentage of exporting firms in that cell (%), the share of employment (%).

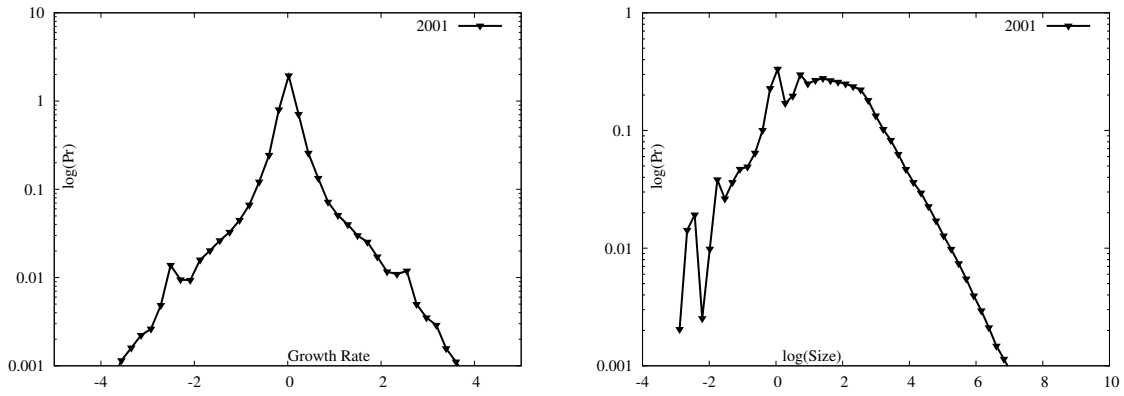
first size class, and around 16.5% in the second class. In these two size classes, export propensity is quite stable across age classes.

The ratio of exporters over nonexporters increases dramatically among firms in the last two size classes, which contain less than 30% of all firms, but with an export propensity which goes from around 37% in the class 10-19, to around 69% in the class 20-max. Focus in particular on this latter size class, here export propensity is markedly increasing in age, going from around 50% among young firms (age < 5), to around 78% among old firms (age 21+). Finally, as could be easily expected, even though the distribution of firms is much concentrated in the two classes of smaller size, the largest share of employment (69.00%) is accounted for the firms bigger than 20 employees.

3.1 Growth rates

In order to study the pattern of growth of the different categories of firms (i.e. with respect to size, age and export status) we focus on the yearly growth rates of employment, as such variable is available for each year. In line with most of the previous literature, the growth rate is computed as the log-difference between two consecutive years:

$$g_{i,t} = \ln Size_{i,t} - \ln Size_{i,t-1} \tag{1}$$



(a) Growth rates Distribution, 2001 (b) Size distribution, 2001

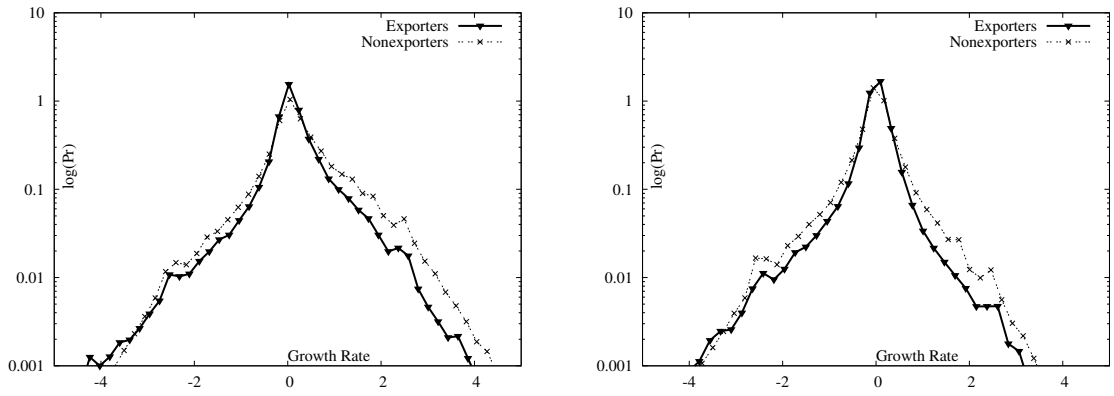
Figure 2: Kernel density estimation of growth rates and firm size.

Figure 2 (left) presents the distribution of growth rates for all firms in 2001, together with the size distribution (right) in the same year. Notice that this is the universe, and not the sample of Italian firms. The growth rates distribution displays the familiar "tent-shape" which has been found in several datasets (see, among others, Stanley et al., 1996; Bottazzi and Secchi, 2006; Coad, 2007; Bottazzi et al., 2011) and that confirms the existence of a large share of 'lumpy' growth events, of both positive and negative sign. This work also presents for the first time the size distribution of the whole population (i.e. no left truncation) of Italian manufacturing firms. The right tail of the distribution is quite close to the Pareto benchmark, i.e. a straight line of negative slope on log-log axes (Axtell, 2001). As expected, the right tail of the size distribution is much similar to that computed on the left-truncated sample available in previous version of the same dataset (Bottazzi et al., 2007). The modal value for the number of employees is one full-time equivalent, 25,827 enterprises reported only one employee in 2001; whether on the left tail, 36,603 firms reported only a fraction of full-time equivalent. These figures confirm the known evidence of the Italian industrial structure characterized by an overwhelming presence of small-medium firms that faces many difficulties to expand (Dosi et al., 2010, 2012). More in detail, performing the same analysis as in Hsieh and Klenow (2014) we find that Italian firms in the 30-34 age class are only around 3.5 times bigger than those of the 10-14 age class. This is a somewhat smaller than the 6.5 factor reported in Hsieh and Klenow (2014) which employed a more limited set of data.

As far as the differences in export status are concerned, Figure 3 presents the growth rate distributions for exporters and nonexporters by age class, pooled over the years. We define exporters based on the firm's export status at time $t-1$.

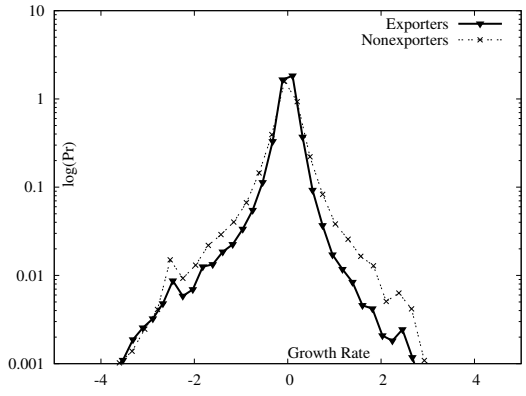
Quite interestingly, across the four age classes, the support of the distributions of growth rates for both exporters and non exporters, appears to shrink, especially on the right, with young firms experiencing high growth episodes more frequently than older firms. This is consistent with some recent empirical evidence from other countries (see Coad et al., 2013 for Spain, and Barba Navaretti et al., 2014 for a comparative perspective across France, Italy, and Spain) and broadly in tune with theoretical learning models of firm growth *á la* Jovanovic, which predict that younger firms have both higher and more variable growth rates (Jovanovic, 1982).

Focusing on the differences related to the export status, it appears that although the supports of the distributions for both exporters and non exporters is not much different,

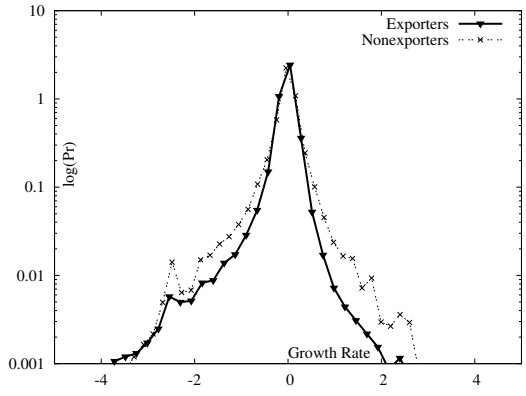


(a) Age 0-4

(b) Age 5-10



(c) Age 11-20



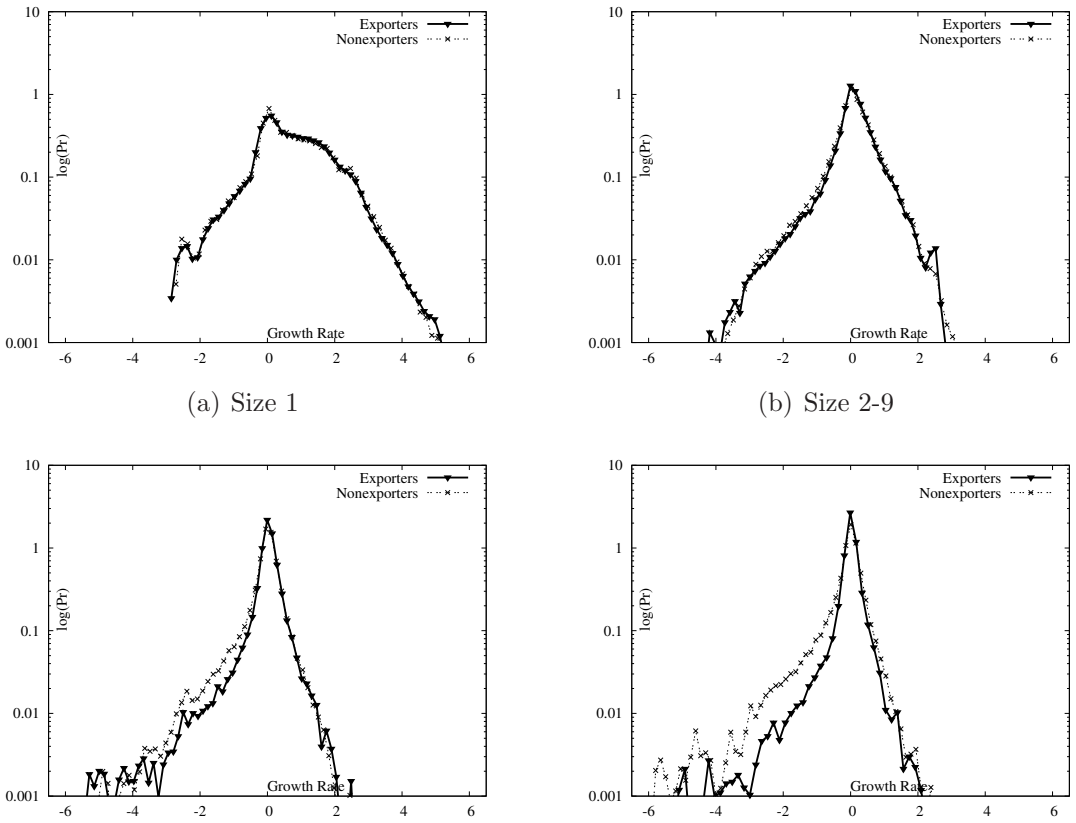
(d) Age 21+

Figure 3: Kernel density estimation of employment growth rates for exporters and non-exporters, by age class. Pooled data over 2000-2006.

the growth rates of exporting firms are more concentrated around the modal value than non exporting firms.

Figure 4 shows, only for young firms, the distributions of growth rates of exporters and non exporters broken down by size class. Among firms born in the last five years, the bigger ones experience less frequently large growth episodes (the right tail is steeper), whereas the probability of a downsizing becomes more likely (the left tail is not a straight line but more convex to the origin). As for the difference related to the export status, exporters display a distribution of growth rates more concentrated around the mode, and such difference is more apparent among firms of bigger size (10-19 and bigger than 20 employees).

We now move from graphical analysis to a formal test of the distributional equality between exporters and nonexporters. A range of tests are in principle available. There are however some specific features of our data which must be carefully considered in selecting the most appropriate alternative. First of all, the number of firms within the groups of exporters and non-exporters does not need to be the same, and therefore we would need a test for the case of two uneven samples. Second, other works employing similar data and variables (see for instance Bottazzi et al., 2007; Grazzi, 2012) have shown that the distributions we are going to compare display clear non-normalities and unequal variances, suggesting that non-parametric tests should be preferred over parametric ones. Further,



(a) Size 1

(b) Size 2-9

(c) Size 10-19

(d) Size 20+

Figure 4: Kernel density of employment growth rates for young (age < 5) exporters and nonexporters, by size class. Pooled data over 2000-2006.

within the class of non-parametric tests, a common feature is to implicitly assume that the samples to be compared only differ for a shift of location, while their distributions possess identical shapes. However, when distributions with different shapes are compared, looking at the relative location of medians, modes or means might no longer be very informative, as the very meaning of these measures changes with the nature of the underlying distribution. The Fligner-Policello (FP) test does not require neither equal shapes nor symmetry for the in comparisons of two distributions.

Let F_E and F_{NE} be the distributions of growth rates of exporters and nonexporters. Denote with $\boldsymbol{X}_E \sim F_E$ and $\boldsymbol{X}_{NE} \sim F_{NE}$ the associated random variables, and with X_E and X_{NE} two respective realizations. The distribution F_E is said to have stochastic dominance over F_{NE} if Prob $\{X_E > X_{NE}\} > 1/2$. That is, if one randomly selects one exporter and one nonexporter, the former has a higher probability of having a greater value. Remembering the equality:

$$Prob\{X_E > X_{NE}\} > 1/2 = \int dF_E(X)F_{NE}(X)$$

the statistical test to assess which of the two distributions dominates over the other can be formulated as a test of

$$H_0 : \int dF_E F_{NE} = \frac{1}{2} \text{ vs } H_1 : \int dF_E F_{NE} \neq \frac{1}{2}$$

Table 6: Fligner-Policello test of stochastic equality

	Size class			
Age class	1	2-9	10-19	20+
Age < 5	28.47	26.65	7.01	6.18
	(0.00)	(0.00)	(0.00)	(0.00)
Age 5-10	2.52	-2.57	5.14	15.45
	(0.00)	(0.00)	(0.00)	(0.84)
Age 11-20	0.98	-3.21	1.54	16.18
	(0.33)	(0.00)	(0.12)	(0.00)
Age 21+	-0.17	-7.28	-2.28	7.32
	(0.86)	(0.00)	(0.02)	(0.00)

Note. Distributional comparison between growth rates of exporters and nonexporters. Pooled data over 2000-2006. p-value in parentheses.

The procedure developed in Fligner and Policello (1981) provides a valid statistic for H_0. Notice also that, in case of rejection of the null, the sign of the Fligner Policello (FP) statistic tells us which of the two group of firms is dominant: a positive (negative) sign means that exporters (non-exporters) have a higher probability to experience higher growth rates.

Table 6 reports the results of the distributional comparison between exporters and nonexporters for each age-size class combination. Among firms less than 5 years old, the FP statistic is always positive and significant, meaning that the growth rate distribution of young exporters dominate the growth rate distribution of nonexporters. In the other age classes, the picture is less clear-cut. In general, we observe that, moving to older age classes, exporters dominate over nonexporters in fewer size classes. Among firms aged between 5 and 10 years, the statistics is positive and significant for firms in the first and third size class; in the last two age classes, the difference is still positive only among big firms (21+). In the remaining cases, the statistics is either not significant or negative (four cases), meaning that nonexporters dominate over exporters.

4 Export participation and firm growth

The descriptive and statistical analysis performed so far has already put forth some compelling evidence on the role of firm size, age and the export status. Whether the number of firms is much concentrated in the smaller size classes, the largest share of employment is accounted for by firms belonging to the class of largest size. Exporting is a rather rare event, around 9% overall the whole distribution, and around 24% among manufacturing firms, and even more so for young (and small) firms. However the FP test of stochastic equality shows that it is for such category, young firms, that being in the export status exerts the most apparent effect in telling apart the distribution of exporting and non exporting firms. In this section we verify these results in a multivariate regression framework.

This section uses a multivariate regression framework to investigate how export activity and size are related to firm growth within each age class. Our dependent variable, $g_{i,t}$, is the growth rate of firm i at time t, and is defined, as before, as the log-difference between firm's employment in two consecutive years. We relate $g_{i,t}$ to the regressors through the following specification:

Table 7: Growth, size and export status

	(1) All firms	(2) Age < 5	(3) Age 5-10	(4) Age 11-20	(5) Age 21+
$D^{exp}_{i,t-1}$	0.056***	0.050***	0.061***	0.035***	0.029***
	(0.001)	(0.004)	(0.003)	(0.002)	(0.002)
$\ln Size_{i,t-1}$	−0.280***	−0.466***	−0.302***	−0.225***	−0.124***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
$\ln(Size_{i,t-1})^2$	0.055***	0.085***	0.063***	0.050***	0.023***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
$\ln Age_{i,t}$	−0.087***				
	(0.001)				
N	1,599,078	250,455	361,402	440,849	546,372
R^2	0.155	0.282	0.126	0.084	0.038

Note. Dummies for years, 2-digits sectors, and geographical location (provinces) included. Robust standard errors clustered at the firm-level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$$g_{i,t} = c + \alpha D^{exp}_{i,t-1} + \beta \ln Size_{i,t-1} + \gamma \ln(Size_{i,t-1})^2 + \varepsilon_{i,t} \tag{2}$$

where $D^{exp}_{i,t-1}$ is a binary variable taking value one if the firm exports, and zero otherwise, $Size_{i,t-1}$ is the firm's employment, which also appears with its square ($\ln(Size_{i,t-1})^2$) to account for non linearity in the relationship (for similar specifications, see Evans, 1987; Lawless, 2014).

Results from OLS estimation of Equation (2) are presented in Table 7, with the first column pooling all firms and taking into account also the role of age ($\ln Age_{i,t}$), and the remaining columns showing the results separately for each age class. Column (1) shows that, controlling for size, firm growth decreases with age and that exporters enjoy, on average, an increase in growth rate of 5.6%. This support our earlier finding that young firms grow more, and also underlines the additional advantage deriving from being an exporter. Columns (2)-(5) test whether the export advantage remains significant when the relationship is estimated within each age class, and the answer is positive: both young and old exporters growth more than nonexporters, controlling for size.

The coefficient on $\ln Size_{i,t-1}$ is negative and significant, whereas that on $\ln(Size_{i,t-1})^2$ is positive and significant, and both are declining, in absolute values, throughout the four age categories. This implies that, contrary to the prediction of the Gibrat's law, growth and size are not independent, but firm growth decreases with firm size, and the negative effect of size is lower for older firms. It is worth noticing, moreover, that the magnitude of the coefficients are quite high, implying that an increase of one (log) employee is related to an average decrease in growth rate of around 46% for firms less than five years old.

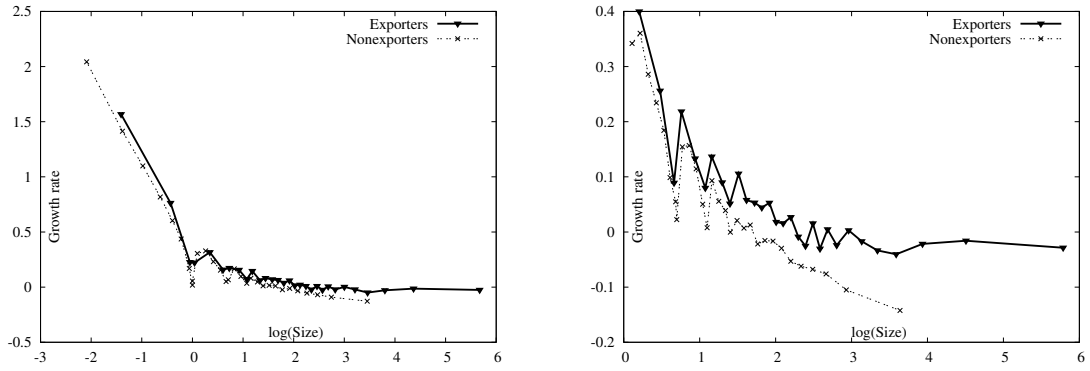
These results continue to hold when we consider separate cross-sections for each year. In Table 8, we report the coefficients from the estimation of Equation (2) for all firms, and accounting for $\ln Age_{i,t}$, for each of the six years for which we can compute growth rates. It is apparent that the patterns did not change much over time; moreover, the average values of the coefficients across years are strikingly similar to those reported in Table 7, column (I).

Figure 5 plots the binned relationship between size and growth for exporters and

Table 8: Growth, size and export status: all firms, by year

	(1) 2001	(2) 2002	(3) 2003	(4) 2004	(5) 2005	(6) 2006
$D^{exp}_{i,t-1}$	0.058***	0.068***	0.053***	0.054***	0.060***	0.040***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
$\ln Size_{i,t-1}$	−0.277***	−0.279***	−0.321***	−0.278***	−0.291***	−0.203***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
$\ln(Size_{i,t-1})^2$	0.054***	0.054***	0.062***	0.056***	0.056***	0.041***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\ln Age_{i,t}$	−0.107***	−0.093***	−0.108***	−0.075***	−0.075***	−0.064***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	255,567	263,873	270,889	272,302	269,215	267,232
R^2	0.168	0.153	0.224	0.139	0.164	0.082

Note. Dummies for 2-digits sectors and geographical location (provinces) included. Robust standard errors clustered at the firm-level in parentheses. Average values across years: $D^{exp}_{i,t-1} = 0.055$, $\ln Size_{i,t-1} = -0.275$, $\ln(Size_{i,t-1})^2 = 0.054$, $\ln Age_{i,t} = -0.087$. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$



(a) All firms (b) Excluding size class 1

Figure 5: Binned relationship between growth and size for young (age < 5) exporters and nonexporters

nonexporters aged less than 5. In subfigure (a), we consider firms from all size classes. It is apparent that firms which reports full-time employees between 0 and 1 have growth rates that are many times larger than the growth rates of all other firms. This is due to the fact that for firms whose size is close to 0, very small increases in size correspond to very large percentage growth rates. In subfigure (b), we plot the same growth-size relationship excluding firms from size class 1. The relationship becomes much smoother, and does not seem to be dominated by a single group of firms.

To check whether our results were driven by the micro firms (with employees between 0 and 1), we estimate Equation 2 after excluding firms that were in size class 1 (at time $t-1$). Results are reported in Table 9. Looking at column (1), we observe that both the coefficient on $\ln Age_{i,t}$ and $D^{exp}_{i,t-1}$ are still significant and with the expected sign. From columns (2)-(5), we see that exporters grow more across the four age classes, with an advantage which is now markedly declining with age. Greater differences are observed for coefficient on $\ln Size_{i,t-1}$ and $\ln(Size_{i,t-1})^2$. As before, we observe that the effect of size on growth is declining in firm age and size, with point estimates which are now much

Table 9: Growth, size and export status: excluding firms in size class 1

	(1) All firms	(2) Age < 5	(3) Age 5-10	(4) Age 11-20	(5) Age 21+
$D^{exp}_{i,t-1}$	0.036***	0.059***	0.051***	0.026***	0.008***
	(0.001)	(0.004)	(0.003)	(0.002)	(0.001)
$\ln Size_{i,t-1}$	−0.060***	−0.235***	−0.070***	−0.023***	0.005***
	(0.001)	(0.005)	(0.003)	(0.002)	(0.002)
$\ln(Size_{i,t-1})^2$	0.010***	0.030***	0.011***	0.005***	0.001***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
$\ln Age_{i,t}$	−0.053***				
	(0.001)				
N	1,304,083	180,604	289,651	364,458	469,370
R^2	0.019	0.040	0.014	0.010	0.008

Note. Dummies for calendar years, 2-digits sectors, and geographical location (provinces) included. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

smaller.

These patterns show that, contrary to recent findings (see Haltiwanger et al., 2013; Lawless, 2014), size impacts on firm growth rates even after taking into account the role of age, and that the Gibrat's hypothesis of independence is still rejected when we consider mature firms (Age > 20) and exclude micro firms (employees between 0 and 1). For an extensive survey of the Gibrat's law see Lotti et al., 2003 and Coad, 2009, chapter 4.

4.1 Young exporters and product-country destinations

In this section, we take advantage of the finer level of detail that is available for exports over the years 2000-2006 (Section 2) and we disaggregate total firm's exports in a given year, in the sum of exports to each product-country destination served by the firm in that year.

Following Bernard et al. (2007) and Bernard et al. (forthcoming) a firm's total exports to a product-country destination can be decomposed into extensive (quantity) and intensive margins (unit values),[7]

$$\ln X_{fpc} = \ln Quantity_{fpc} + \ln UnitValue_{fpc} \tag{3}$$

where $\ln X_{fpc}$ is the log value (in euro) of exports by firm f in product p to country c, $Quantity_{fc}$ is the physical quantity of the good p exported to country c and $UnitValueX_{fpc}$ is the unit value of the transaction in that year. This of course results in a larger number of observations which we employ, first, to compare young exporters and older exporters within product-country destinations, and second, to study the sensitivity of young firms and older firms to annual exchange rate movements by considering export value, quantity and unit value.

Using exports to Extra-EU destinations, we estimate the following regression equation:[8]

[7]For a detailed description of the transaction level trade data and the product classification employed refer to Bernard et al. (forthcoming).

[8]We focus on exports to Extra-EU destinations for several reasons. Most importantly, firm-level

$$\ln X_{fpc} = c + \alpha D_f^{young} + \beta \ln Size_f + d_{pc} + \varepsilon_{fpc} \quad (4)$$

where $\ln X_{fpc}$ denotes the logarithm of, respectively, the total value, quantity and unit value of the firms exports in the country-product pair, D_f^{young} is a dummy for firms with $Age < 5$, and d_{pc} denotes country-product fixed effects. The results in the first column of Table 10 show that young exporters have a substantially lower total value of exports relative to older exporters within product-country pairs. However, the difference in exports across firm types change sign after controlling for firm employment (column (2)): in four years, we do find that young firms are able to record higher exports than older firms. Columns 3-6 report the decomposition of the results as accounted by quantity and unit values. The difference in exports are mainly driven by differences in export quantities; in most cases, unit values are not statistically different for young and older exporters. Notice also that these results are largely unchanged when we control for (log) sales instead of (log) employment for the two years (2000 and 2003) in which this information is available. Moreover, the results continue to hold when we compare young exporters in 2006 with older firms that were already exporting for at least four years.[9]

These results give a first evidence about the different behavior of young and well established exporters. Quite surprisingly, we do find that "born-global" firms are able to perform at least as well, and in many cases better than, more experienced firms in terms of exports and quantity sold on foreign markets. Although, we cannot further interpret such result here, this finding is for instance consistent with the evidence of Huergo and Jaumandreu (2004b,a), who show that young firms have a higher propensity to innovate; the higher innovativeness of young firms might in turn impact on their competitiveness (Dosi et al., 2014). Since the analysis presented above about the levels of exports does not allow to control for unobservable characteristics that might be specific to the firm (or to the firm-product varieties), we expand our analysis to correct for such potential source of bias.

In the following analysis, we control for firm, as well as for firm-product specific effects by studying the differential response of firms' exports to an exogeneous shock, such as real exchange rates variations. In particular, following an emerging stream of empirical literature in international trade we investigate how different firms, in our case born globals and established exporters, respond to the same exogeneous shock within a product-country destination, and how such effects is accounted for by quantity and unit values variations (see among the others, Berman et al., 2012; Chatterjee et al., 2013).

The regression framework that we consider is

$$\Delta \ln X_{fpct} = c + \alpha D_{ft}^{young} + \beta \Delta \ln RER_{ct} + \gamma \Delta \ln RER_{ct} * D_{ft}^{young} + d_j + \varepsilon_{fpct} \quad (5)$$

where $\Delta \ln X_{fpct}$ is the change (log difference) in firm-level product-country export value, quantity or unit value, D_{ft}^{young} is a dummy for firms with $Age < 5$, $\Delta \ln RER_{ct}$ is the change in the log of the real bilateral exchange rate of the Italian currency which is computed with data from the International Financial Statistics database. RER_{ct} for each year is the product between the nominal Italian exchange rate expressed as the number

exports to the EU are not recorded for all exporters and these criteria have changed over time. Also, real exchange rate changes within the eurozone countries are driven entirely by changes in relative price levels.

[9]These additional results are available upon request.

Table 10: Firm's exports, quantity and unit value by product and country, by different type of firms

	(1) ln X_{fcpt}	(2) ln X_{fcpt}	(3) ln $Quantity_{fcpt}$	(4) ln $Quantity_{fcpt}$	(5) ln $UnitValue_{fcpt}$	(6) ln $UnitValue_{fcpt}$
2000						
D_f^{young}	-0.123***	0.058***	-0.090***	0.083***	-0.033*	-0.024
	(0.017)	(0.013)	(0.025)	(0.023)	(0.017)	(0.018)
ln $Size_f$		0.238***		0.227***		0.012**
		(0.004)		(0.007)		(0.005)
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
N	956,796	956,796	956,400	956,400	956,400	956,400
adj. R^2	0.159	0.199	0.401	0.418	0.642	0.642
2001						
D_f^{young}	-0.127***	0.027**	-0.119***	0.029	-0.007	-0.001
	(0.017)	(0.013)	(0.026)	(0.025)	(0.019)	(0.019)
2002						
D_f^{young}	-0.136***	0.015	-0.139***	0.007	0.004	0.009
	(0.015)	(0.013)	(0.024)	(0.024)	(0.017)	(0.017)
2003						
D_f^{young}	-0.113***	0.041***	-0.115***	0.038	0.002	0.004
	(0.017)	(0.013)	(0.025)	(0.023)	(0.017)	(0.017)
2004						
D_f^{young}	-0.079***	0.059***	-0.085***	0.046*	0.006	0.013
	(0.020)	(0.016)	(0.027)	(0.026)	(0.017)	(0.017)
2005						
D_f^{young}	-0.089***	0.031	-0.114***	-0.006	0.024	0.036*
	(0.023)	(0.022)	(0.031)	(0.031)	(0.019)	(0.019)
2006						
D_f^{young}	-0.113***	-0.003	-0.128***	-0.026	0.016	0.024
	(0.020)	(0.019)	(0.027)	(0.026)	(0.019)	(0.019)

Note. Table reports results of regressions at the firm product country level, using data on exports, quantity and unit value for years 2000-2006. Columns (2), (4) and (6) control for log of employment. We report coefficient on ln $Size_f$, N and adj. R^2 only for 2000. Robust standard errors clustered at firm level in parenthesis. [a] $p < 0.01$, [b] $p < 0.05$, [c] $p < 0.10$

of foreign currency units per home currency unit (ER_{ct}) and the ratio of the domestic consumer price level and the consumer price index abroad ($\frac{CPI_t}{CPI_{ct}}$).[10] $\Delta \ln RER_{ct} * D_{ft}^{young}$ is their interaction, and d_j a set of of fixed effects.

Results in Table 11 show that while the volume of exports to a given product-country destination (Col. 1 and 2) decreases for all firms following a currency appreciation, such reduction is cut by more than half (Col. 2) for young firms, as accounted by the interaction term. Such evidence is much surprising as such firms are new comers, and it also lends support to the category of born globals as firms that are both highly efficient and willing to growth. This result is further reinforced by the analysis of quantities and unit values as the smaller response of firms' exports is actually the result of two opposite effects: a smaller reduction in the quantity sold (Col. 3 and 4), which more than compensate a higher reduction in unit values (Col. 5 and 6).

Overall, the evidence from Table 11 suggests that young exporters react to exogeneous

[10]We employ the Consumer Price Index as it provides data for many more countries than the Wholesale Price Index.

Table 11: Exchange rates and firm's exports, quantity and unit value by product and country over time, by different type of firms

	Annual Differences					
	(1) $\ln X_{fcpt}$	(2) $\ln X_{fcpt}$	(3) $\ln Quantity_{fcpt}$	(4) $\ln Quantity_{fcpt}$	(5) $\ln UnitValue_{fcpt}$	(6) $\ln UnitValue_{fcpt}$
D_{ft}^{young}	0.062***		0.063***		-0.000	
	(0.005)		(0.005)		(0.002)	
$\Delta \ln RER_{ct}$	-0.283***	-0.342***	-0.250***	-0.314***	-0.033***	-0.028***
	(0.088)	(0.104)	(0.092)	(0.108)	(0.010)	(0.010)
$\Delta \ln RER_{ct} * D_{ft}^{young}$	0.053	0.186**	0.096**	0.226***	-0.043***	-0.040*
	(0.044)	(0.078)	(0.048)	(0.084)	(0.016)	(0.021)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	No	Yes	No	Yes	No
Firm-Product FE	No	Yes	No	Yes	No	Yes
N	2,680,136	2,680,136	2,680,136	2,680,136	2,680,136	2,680,136
adj. R^2	0.004	-0.005	0.003	-0.007	0.001	0.030

Note. Table reports results of regressions at the firm product country level, using data on exports, quantity and unit value between 2000 and 2006. The dependent and independent variables are defined as annual differences. Robust standard errors clustered at country-year level in parenthesis. Year dummies included. (^{a} $p < 0.01$, ^{b} $p < 0.05$, ^{c} $p < 0.10$

exchange rate shocks in such a way as to minimize the losses in terms of exports and quantity growth rates; and they are able to achieve this by lowering their prices more than other established exporters.

5 Conclusions

In this paper we showed how size, age, and export status jointly concur to determine the different patterns of firm growth. In particular, we found that small, young and early exporting firms display a more pronounced attitude towards growth both on the domestic and on the international markets. Further, notwithstanding their much limited experience, born globals also appear to be well equipped to face unfavorable shocks, such as a real exchange rate appreciation.

The growth performance of early exporters supports the idea that the attitude towards growth opportunities is a meaningful and sometimes neglected determinant of firms growth, corroborating the robust evidence that growth processes are also shaped by behavioural factors (as for instance suggested in Zahra et al., 2000; Knight and Cavusgil, 2004; Davidsson and Wiklund, 2013). Indeed, this attitude of firms towards growth is already apparent from the very early stage of firm's life-cycle and it represents one of the 'idiosyncratic' covariates regarding, so to speak, the "identity cards" of individual firms, ideally revealing also their technological and organizational capabilities (more in Dosi and Grazzi, 2006). Being involved in international activities at a very early stage captures both the capabilities of firms to compete on foreign markets and also their intention to "grab" new growth opportunities.

References

Autio, E., H. J. Sapienza, and J. G. Almeida (2000): "Effects of Age at Entry, Knowledge Intensity, and Imitability on International Growth," *The Academy of Management Journal*, 43, 909–924.

Axtell, R. L. (2001): "Zipf Distribution of US Firm Sizes," *Science*, 293, 1818–1820.

Barba Navaretti, G., D. Castellani, and F. Pieri (2014): "Age and firm growth: evidence from three European countries," *Small Business Economics*, 43, 823–837.

Berman, N., P. Martin, and T. Mayer (2012): "How do Different Exporters React to Exchange Rate Changes?" *The Quarterly Journal of Economics*, 127, 437–492.

Bernard, A. B., M. Grazzi, and C. Tomasi (forthcoming): "Intermediaries in International Trade: Products and Destinations," *The Review of Economics and Statistics*.

Bernard, A. B. and J. B. Jensen (2004): "Why Some Firms Export," *The Review of Economics and Statistics*, 86, 561–569.

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott (2007): "Firms in International Trade," *Journal of Economic Perspectives*, 21, 105–130.

Birch, D. L. (1981): "Who creates jobs," *Public Interest*, 65, 3–14.

Bottazzi, G., E. Cefis, G. Dosi, and A. Secchi (2007): "Invariances and Diversities in the Evolution of Italian Manufacturing Industry," *Small Business Economics*, 29, 137–159.

Bottazzi, G., A. Coad, N. Jacoby, and A. Secchi (2011): "Corporate growth and industrial dynamics: evidence from French manufacturing," *Applied Economics*, 43, 103–116.

Bottazzi, G., G. Dosi, N. Jacoby, A. Secchi, and F. Tamagni (2010): "Corporate performances and market selection: some comparative evidence," *Industrial and Corporate Change*, 19, 1953–1996.

Bottazzi, G. and A. Secchi (2006): "Explaining the Distribution of Firms Growth Rates," *RAND Journal of Economics*, 37, 235–256.

Chatterjee, A., R. Dix-Carneiro, and J. Vichyanond (2013): "Multi-product Firms and Exchange Rate Fluctuations," *American Economic Journal: Economic Policy*, 5, 77–110.

Coad, A. (2007): "A Closer Look at Serial Growth Rate Correlation," *Review of Industrial Organization*, 31, 69–82.

——— (2009): *The Growth of Firms: A Survey of Theories and Empirical Evidence*, New Perspectives on the Modern Corporation, Edward Elgar, Cheltenham, UK.

——— (2010): "Investigating the exponential age distribution of firms," *Economics - The Open-Access, Open-Assessment E-Journal*, 4, 1–30, http://dx.doi.org/10.5018/economics-ejournal.ja.2010-17.

Coad, A., A. Segarra, and M. Teruel (2013): "Like milk or wine: Does firm performance improve with age?" *Structural Change and Economic Dynamics*, 24, 173 – 189.

Coad, A. and J. Tamvada (2012): "Firm growth and barriers to growth among small firms in India," *Small Business Economics*, 39, 383–400.

Davidsson, P. (1989): "And After? A study of growth willingness in small firms," *Journal of Business Venturing*, 4, 211–226.

Davidsson, P. and J. Wiklund, eds. (2013): *New Perspectives On Firm Growth*, Edward Elgar, Cheltenham, UK.

Davis, S. J. and J. Haltiwanger (1992): "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, 107, 819–863.

Davis, S. J., J. Haltiwanger, R. S. Jarmin, C. Krizan, J. Miranda, A. Nucci, and K. Sandusky (2009): "Measuring the Dynamics of Young and Small Businesses: Integrating the Employer and Nonemployer Universes," in *Producer Dynamics: New Evidence from Micro Data*, National Bureau of Economic Research, Inc, NBER Chapters, 329–366.

Davis, S. J., J. C. Haltiwanger, and S. Schuh (1996): *Job Creation and Destruction*, MIT Press: Cambridge, MA.

Delmar, F. and J. Wiklund (2013): "The Effect of Small Business Managers' Growth Motivation on Firm Growth: A Longitudinal Study," in *New Perspectives On Firm Growth*, ed. by P. Davidsson and J. Wiklund, Edward Elgar, Cheltenham, UK.

Dosi, G. and M. Grazzi (2006): "Technologies as problem-solving procedures and technologies as input–output relations: some perspectives on the theory of production," *Industrial and Corporate Change*, 15, 173–202.

Dosi, G., M. Grazzi, and D. Moschella (2014): "Technology and costs in international competitiveness: from countries and sectors to firms," LEM Papers Series 2014/10, Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies, Pisa, Italy.

Dosi, G., M. Grazzi, C. Tomasi, and A. Zeli (2010): "Turbulence underneath the big calm: what is happening behind the flat trend of productivity in Italy," LEM Working Papers 2010/03, Scuola Superiore Sant'Anna.

——— (2012): "Turbulence underneath the big calm? The micro-evidence behind Italian productivity dynamics," *Small Business Economics*, 39, 1043–1067.

Dosi, G., D. Moschella, E. Pugliese, and F. Tamagni (2013): "Productivity, market selection and corporate growth: comparative evidence across US and Europe," LEM Papers Series 2013/15, Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies, Pisa, Italy.

Evans, D. S. (1987): "Tests of Alternative Theories of Firm Growth," *The Journal of Political Economy*, 95, 657–674.

Fligner, M. A. and G. E. Policello (1981): "Robust rank procedures for the Behrens-Fisher problem," *Journal of the American Statistical Association*, 76, 141–206.

Grazzi, M. (2012): "Export and Firm Performance: Evidence on Productivity and Profitability of Italian Companies," *Journal of Industry, Competition and Trade*, 12, 413–444.

Grazzi, M., R. Sanzo, A. Secchi, and A. Zeli (2013): "The building process of a new integrated system of business micro-data 1989-2004," *Journal of Economic and Social Measurement*, 38, 291–324.

Grazzi, M. and C. Tomasi (2014): "Productivity sorting and mode of export," Lem working papers, S. Anna School of Advanced Studies.

Haltiwanger, J., R. S. Jarmin, and J. Miranda (2013): "Who Creates Jobs? Small versus Large versus Young," *The Review of Economics and Statistics*, 95, 347–361.

Hsieh, C.-T. and P. J. Klenow (2014): "The Life Cycle of Plants in India and Mexico," *The Quarterly Journal of Economics*, 1–50.

Huergo, E. and J. Jaumandreu (2004a): "Firms' age, process innovation and productivity growth," *International Journal of Industrial Organization*, 22, 541 – 559.

——— (2004b): "How Does Probability of Innovation Change with Firm Age?" *Small Business Economics*, 22, 193–207.

International Study Group on Exports and Productivity (2008): "Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries," *Review of World Economics (Weltwirtschaftliches Archiv)*, 144, 596–635.

Jovanovic, B. (1982): "Selection and the Evolution of Industry," *Econometrica*, 50, 649–70.

Knight, G. A. and S. T. Cavusgil (2004): "Innovation, organizational capabilities, and the born-global firm," *Journal of International Business Studies*, 35, 124–141.

Lawless, M. (2014): "Age or Size? Contributions to job creation," *Small Business Economics*, 42, 815–830.

Lotti, F., E. Santarelli, and M. Vivarelli (2003): "Does Gibrat's Law hold among young, small firms?" *Journal of Evolutionary Economics*, 13, 213–235.

Melitz, M. J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71, 1695–1725.

OECD (2012): *Compendium of Productivity Indicators*, OECD Publishing.

Penrose, E. T. (1959): *The theory of the growth of the firm*, Oxford: Blackwell, 3rd ed.

Roberts, M. J. and J. R. Tybout (1997): "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs," *American Economic Review*, 87, 545–64.