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FIRM SIZE AND EXTENSIVE MARGIN: HUNGARIAN EXPORTS¹

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ABSTRACT: *In this paper we rely on firm-product-destination level data to analyze Hungarian trade expansion between 1992 and 2003. We decompose trade growth to the number of firms, the number of markets and products per firm, and analyze these dimensions by firm size. We also distinguish between new firms and continuing exporters. The results suggest that the majority of small exporters exit exporting after a few years, but the survivors grow very quickly in every dimension. Firm dynamics across size categories is intensive. Large exporters grow slowly, and macro shocks, destination market and product heterogeneity strongly affect their performance*

Keywords: *export, extensive margin, firm size, transaction level data, Hungary*

JEL: F12, L25

1. INTRODUCTION

Recent models of international trade building on firm-level heterogeneity emphasize the role of the extensive margin, i.e. the change in the number of exporting firms or exported products resulting from trade liberalization (Melitz, 2003). On the empirical side, Bernard et al. (2007) estimated the relationship between gravity variables and both the extensive and intensive margins (export volume per product per firm) of US exports. Their results show that both the number of firms and the average number of exported products per firm are increasing in the partner country's GDP, but strongly decreasing in distance, while the intensive margin is increasing both in GDP and distance. Mayer and Ottaviano (2007) decomposed trade volume to a number of different margins for European countries. They showed that when explaining exports of a country, variation in the number of exporting firms is the most important predictor of exports across destination countries, followed by the number of exported products.

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Eaton et al. (2008) use transaction-level data from Colombia to estimate export dynamics. They find that nearly half of exporting firms are new exporters every year, and that most of these firms exit in a few years. As these firms are usually very small, year-to-year changes in aggregate export volume are dominated by the sales of large and stable exporters. However, a few firms from every cohort of new exporters expand rapidly.

The aim of this paper is to decompose Hungarian export growth to the extensive and the intensive margins using firm-product-destination level data between 1992 and 2003. The detailed nature of our dataset makes possible to analyze different dimensions of the extensive margin. First, total exports can be decomposed to the number of firms (firm-extensive margin) and export volume per firm. Export volume per firm can be further decomposed to within-firm extensive margin and within-firm intensive margin. The extensiveness of firm-level export activities is reflected by the number of export markets served by a firm on average (destination extensive margin) and the number of products exported by the firm (product extensive margin). For a full decomposition, however, one also needs the number of firm-country pairs the firm exports to (within-firm extensive margin). An important contribution of this paper is the analysis of all these margins of exporting, distinguishing between the margins of new and continuing firms as well.

Our second important contribution is that we decompose trade growth and its margins by firm size to compare the export growth of different firms. In this exercise we define firm size in terms of exports rather than employment or revenue, as our main interest lies in heterogeneity by export volume. This exercise uncovers some characteristic differences between small and large exporters. Small exporters are very likely to exit, but surviving small exporters grow quickly on average. As a result, while new exporters do not add too much to export volume in the short run, their contribution to the aggregate trade volume becomes very large in a longer term. Such stylized facts may help explain firm-level exporting decisions, and suggest that different policy approaches may be appropriate for small and large exporters. The effect of firm size is also analyzed by Eaton et al. (2008) for Colombia. Our results are comparable to that study, and we show some interesting differences between the two countries.

In this time period Hungary was an interesting place to address these questions. At the beginning of our sample, Hungarian trade was still declining as a result of the collapse of the former Soviet market and transitional recession. At about 1994-1995, following macroeconomic reforms and restructuring, Hungary began to integrate strongly into the EU single market, and started its period of strong export-led growth. At the end of the period Hungarian growth was slowing down again as a result of misguided policies, parallel with the full integration of the country into the EU, becoming a full member on 1st May 2004.

2. DATA

The data used for our empirical analysis were obtained from the Customs Statistics. The dataset consists of *all Hungarian exports* between 1992 and 2003. One observation in the database is the export of product i by firm j to country k in year t .⁴

The product dimension of the dataset is highly disaggregated; it is broken down to 6-digit Harmonized System (HS) level. We define a product as a 6-digit category, although using more aggregated (4-digit) categories does not change our results. "Motor cars and vehicles for transporting persons" is an example for a 4-digit category, while "Other vehicles, spark-ignition engine of a cylinder capacity not exceeding 1,500 cc" is an example of a 6-digit category. Note that in most cases (like in the car example) further disaggregation of the data would not reduce potential quality differences within each category to zero. As a consequence, during the following analysis we define a product as a 2-digit category because further disaggregation would yield too much similarity between categories. The dataset includes both export values and quantities at this highly disaggregated level, thus unit values are calculated as the ratio of these two variables.

The customs database can be merged with balance sheet data, which includes industry identifier of the firm. This data also includes main financial indicators and the number of employees. We drop exports of individual entrepreneurs and individuals limiting our analysis to proper firms. In particular, we focus on manufacturing firms, as most trade theories are more easily applied in case of these firms than agricultural firms or wholesalers and retailers. In terms of numbers such exporters are the majority: in the customs datasets there are 79,348 exporters, from which only 13,540 are proper manufacturing firms. These manufacturing firms, however, were responsible for 86.8 percent of Hungarian exports in 2003. We have calculated the results for these other sectors as well, and the figures show that trade is even more dynamic in these sectors compared to manufacturing. However, the qualitative patterns are similar. Finally, to reduce noise, exports below US\$ 2000 will be disregarded. One motivation is that these smaller export shipments follow different patterns than what is supposed by standard trade theories (Békés and Muraközy, 2011).

3. METHODOLOGY

In terms of methodology, we follow Eaton et al. (2008) in our baseline tables, and extend the approach in order to find more patterns, especially related to the product dimension of our dataset. The basic cross-sectional decomposition of total export volume in year t to country n , $X_n(t)$ has two components, the number of firms and the average export per firm:

$$\ln X_n(t) = \ln N_n(t) + \ln \bar{X}_n(t),$$

⁴ A more detailed description of our data can be found in Békés et al. (2011).

where $N_n(t)$ is the number of exporting firms, and $\bar{X}_n(t)$ is the average export revenue of these firms.

As we are more interested in the dynamic rather than the cross-sectional role of the extensive margin, following Eaton et al. (2008) we further decompose export growth into the share of continuers, entrants and exiting firms:

$$\begin{aligned} & \frac{X_{nHU}(t) - X_{nHU}(t-1)}{[X_{nHU}(t-1) + X_{nHU}(t)]} = \\ & \left(\frac{\sum_{j \in CN_n^{t-1,t}} \frac{[x_n(j,t-1) + x_n(j,t)]}{2}}{[X_{nHU}(t-1) + X_{nHU}(t)]} \right) \left(\frac{\sum_{j \in CN_n^{t-1,t}} [x_n(j,t) - x_n(j,t-1)]}{\sum_{j \in CN_n^{t-1,t}} [x_n(j,t-1) + x_n(j,t)]} \right) \\ & + \frac{NEN_n^{t-1,t} \bar{x}_n(t-1)}{[X_{nHU}(t-1) + X_{nHU}(t)]} + \frac{\sum_{j \in EN_n^{t-1,t}} [x_n(j,t) - \bar{x}_n(j,t-1)]}{[X_{nHU}(t-1) + X_{nHU}(t)]} \\ & - \frac{NEX_n^{t-1,t} \bar{x}_n(t-1)}{[X_{nHU}(t-1) + X_{nHU}(t)]} - \frac{\sum_{j \in EN_n^{t-1,t}} [x_n(j,t) - \bar{x}_n(j,t-1)]}{[X_{nHU}(t-1) + X_{nHU}(t)]} \end{aligned}$$

where $X_{nHU}(t)$ denotes Hungarian exports to country n in year t , and $x_n(j,t)$ is the export of firm j to country n . $CN_n^{t-1,t}$ represents (pairwise) continuers that exported both in $t-1$ and t , $EN_n^{t-1,t}$ denotes (pairwise) entrants, which did not export $t-1$ but exported in t , and $EX_n^{t-1,t}$ is (pairwise) exiting firms, which exported in $t-1$ but did not in t . $NEN_n^{t-1,t}$ and $NEX_n^{t-1,t}$ represents the number of entrants and exiting firms, respectively.

The left-hand side of the equation measures the growth of Hungarian exports to country n in year t . The first line of the right-hand side is the contribution of pairwise continuer firms. It is decomposed into two terms. The first represents the share of these firms in year t , while the second one is the export growth of these firms.

The second line shows the contribution of pairwise entrants. The first term in this line is the potential contribution of entrants, assuming that these new firms had the same average export volume as those of the average firm in $t-1$. The second term shows the size difference between year t entrants and the year $t-1$ average firm. The third line represents the contribution of exiting firms. Similarly to the entrants, it is composed of two terms: (i) what would be the contribution of exiting firms if they had the same average export volume as those of the average firm in $t-1$, and (ii) the term correcting for the difference in export revenue.

4. DECOMPOSITION OF HUNGARIAN EXPORT GROWTH

Figure 1 provides a view on the role of extensive margin in Hungarian trade. It shows the relationship between (ln) total export volume and the (ln) number of firms for each destination in 2003. Similarly to Eaton et al (2008), it shows a strong positive and log-linear relationship between the two variables. The slope of the line is 0.56, suggesting that doubling the market size is associated with 56 % more exporting firms.

Figure 1: *Total export by destination and number of firms, 2003*

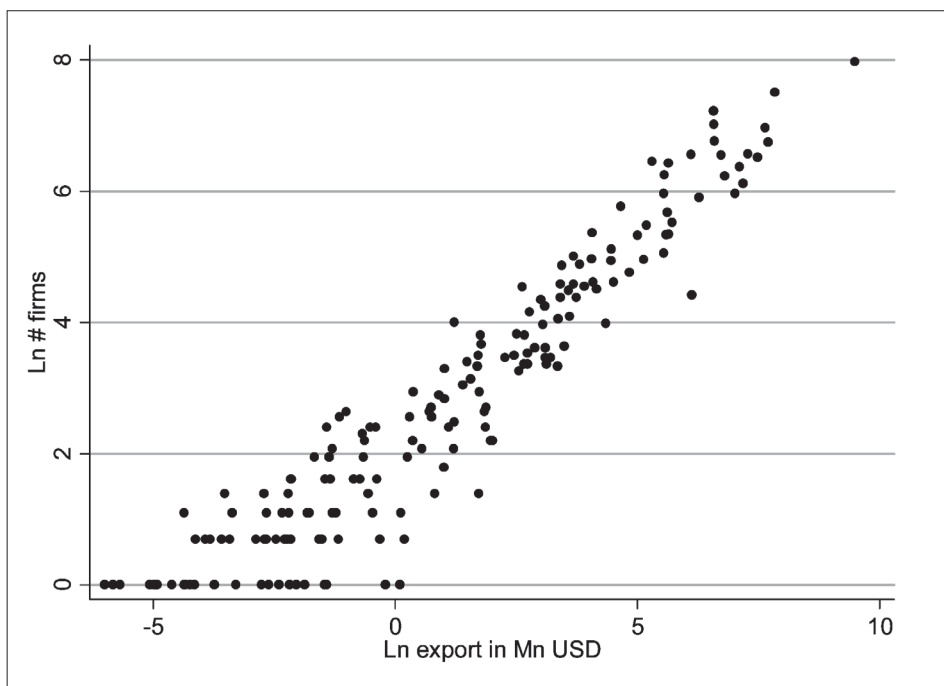


Table 1 shows the number, the total export revenue and the average export revenue for entering, continuing, exiting and single-year firms in each year. Note that single-year exporters are excluded both from the set of entering and exiting firms. These measures of export performance increased steadily during the period under study. The number of exporters nearly doubled from about 3,000 to nearly 5,800. Total trade volume increased sixfold, and as a result, the growth in average export by firm increased from about US\$ 2 million to US\$ 6.4 million. The extensive growth was more important until 2001, after which the number of exporting firms stabilized, but export volume per firm still grew fast. Also, the Russian crisis in 1999 led to a decrease in the number of exporters and slowed down the growth of total exports.

The table indicates rapid dynamics: a large share of firms enter and exit exporting every year. On average, firm entry was larger to a great extent than exit in seven years, but there is an interesting pattern from 1999. In that year, reflecting the Russian crisis, firm entry was relatively low, while exit remained about the same, so the latter almost outweighed the former. In the following year, namely 2000, firm entry rose significantly and exit declined considerably as well, so the gap between the two became very large. For the last two years, firm exit rose relatively high, while entry dropped. Entering and exiting firms are 5-10 times smaller than the average continuing firm. In some years, however, with the entry or exit of large firms, the average entering and exiting firm size becomes very large. It is also clear, that the overwhelming majority of exports is realized by pairwise continuing firms, and they are responsible for the majority of year-to-year export growth as well.

Table 1: *Entering, exiting, continuing and single-year exporters, 1992-2003*

Year (t)	Number of firms				
	Entering	Continuing	Exiting	Single-year	Total
1992	-	-	-	-	3,068
1993	949	1,636	438	343	3,366
1994	804	2,119	466	335	3,724
1995	673	2,478	445	414	4,010
1996	782	2,688	463	351	4,284
1997	792	3,024	446	381	4,643
1998	719	3,296	520	472	5,007
1999	578	3,483	532	379	4,972
2000	879	3,693	368	342	5,282
2001	689	3,848	724	478	5,739
2002	765	3,785	752	519	5,821
2003	-	-	-	-	5,792
Year (t)	Total Value of exports (million US\$)				
	Entering	Continuing	Exiting	Single-year	Total
1992	-	-	-	-	6,348
1993	546	4,810	281	45	5,678
1994	525	6,760	174	23	7,481
1995	324	8,860	377	65	9,625
1996	1,070	11,300	273	67	12,740
1997	416	15,600	255	31	16,328
1998	315	19,600	319	27	20,222
1999	327	19,600	2,390	25	22,336
2000	1,710	21,200	485	83	23,491
2001	415	25,500	1,500	21	27,470
2002	331	29,200	563	33	30,079
2003	-	-	-	-	36,856

Year (t)	Exports per firm (thousand US\$)				
	Entering	Continuing	Exiting	Single-year	Total
1992	-	-	-	-	2,069
1993	575	2,938	641	132	1,687
1994	653	3,190	372	70	2,009
1995	481	3,575	847	157	2,400
1996	1,362	4,217	589	191	2,974
1997	526	5,167	571	81	3,517
1998	439	5,935	613	56	4,039
1999	565	5,626	4,490	66	4,492
2000	1,941	5,745	1,318	242	4,447
2001	602	6,636	2,067	45	4,786
2002	433	7,702	749	63	5,167
2003	-	-	-	-	6,363

Table 2 presents the decomposition of export growth for total Hungarian exports. The first column shows total growth. Between 1992 and 1993 exports were still declining with 11 % as a consequence of collapsing eastern export markets and strong domestic transformational recession. From 1994 onwards, however, massive export growth began, with reaching its peak in 1996, increasing by 28% (in US\$ terms). Column 2 shows the share of continuers. In 1993, this was 85%, small relative to 97-98% at the end of the period. The latter number suggests that pairwise continuers are responsible for the overwhelming majority of export volume. This does not seem to be unique in Hungary; Eaton et al. (2008) reports very similar values for Colombia. Except in 1993, continuers were able to increase robustly their exports in every year, contributing with nearly 100% to total export growth in each year. In Colombia, in 3 of 9 years continuers' export decreased significantly, together with total exports.

Analyzing the number of entering and exiting firms, some characteristic patterns emerge. First, the number of entering firms was 7-8 percentage points larger than that of exiting firms until 2001, showing a very large increase in terms of the firm-extensive margin. In line with Table 1, the number of entrants and exiting firms was about equal in 2002 and 2003. In terms of absolute values, as can be expected, the share of entering firms decreased to a large extent: from 44% to about 20%. For exiting firms this measure was smaller during our sample period, but decreased in a similar way. Third, relative to Colombia the share of entering and exiting firms is low: Eaton et al. (2008) reports numbers between 35 and 45 % for most years. Both entering and exiting firms are smaller than the average firm in the previous year. Here, however, it can be important that we restrict our attention to proper firms and drop export transactions below US\$ 2000.

During the whole decade, a somewhat different picture emerges. First, firms exporting through the whole period were responsible for the majority of trade growth. Second, a very large number of firms entered during this long period, which exported much above

the average on 2003. Third, exiting firms were about as productive as the average firm, thus exit did not contribute significantly to export growth.

We draw two main conclusions from this dynamic decomposition. First, in every year there is very significant entry and exit from exporting. Second, nearly 100 percent of year-to-year export growth comes from the intensive margin, the increasing exports of pairwise continuing firms.

Table 2: *Contribution of pairwise entry and exit to the growth of total manufacturing exports between t-1 and t (%)*

Year (t)	Contribution of pairwise continuers			Contribution of pairwise gross entry		Contribution of pairwise gross exit	
	Growth of exports	Continuers' share in t-1 exports	Growth of exports by continuers	Added number of firms	Exports of entering firms relative to the average	Dropped number of firms	Exports of exiting firms relative to the average
1993	-11	85	0	44	-35	-34	13
1994	27	93	26	29	-21	-20	15
1995	25	97	24	26	-21	-19	17
1996	28	93	23	24	-14	-18	14
1997	25	97	25	24	-21	-17	14
1998	21	98	21	23	-21	-16	14
1999	10	98	10	18	-17	-19	17
2000	5	91	9	24	-16	-18	7
2001	16	98	16	20	-19	-12	10
2002	9	97	14	21	-20	-20	15
2003	20	97	18	19	-15	-20	18
1992-2003	141	30	112	47	77	-21	5

5. EXPORTER SIZE AND EXPORT GROWTH

In this section, we analyze the relationship between exporter size and export growth with different approaches. First, for continuers and exiting firms, we repeat the decomposition exercise for each size quintile to see how firm size affects differences in the decomposition of export growth. We also ask the question, whether patterns are different for different destination markets and products. Second, by presenting a transition matrix and regression results, we ask how frequently firms move between quintiles. As a natural expansion of this, we calculate the trade growth of entrant cohorts, and show their contribution to the total Hungarian export volume in the long run. Third, we investigate

further the firm-level trade growth by showing how firms expand the number of their export markets and exported products.

The effect of exporter size

Eaton et al. (2008) emphasizes that Gibrat's law does not characterize export growth; smaller exporters increase their exports more than proportionally. Following their work, we decompose the export growth of continuing exporters by quintiles. Table 3 shows these results. Firms are classified to quintiles based on their export volume in year $t-1$. Note that this calculation is based on firms exporting in year $t-1$, so entry is not taken into account. This has the advantage that there is no composition effect. The table shows export growth of continuers, export growth corrected by exiting firms, and total export volume of firms in the different quintiles (averaged over year t and $t-1$). Several patterns can be seen in this table. First, as shown for example by Bernard et al. (2007) and Mayer and Ottaviano (2007), export revenues are highly skewed: in 2003 the contribution of the first quintile was US\$ 49.4 million, while it was above US\$ 36 billion for the largest quintile.⁵ Also, the results show that total export in the first quintile was changing little during more than 10 years, while it increased nearly fivefold for the largest quintile. The increasing skewness of the exporter size distribution can also be observed in Colombia, although at a lower degree. The widening gap between the average first and fifth quintile firm can be interpreted as a confirmation of the intra-industry reallocation prediction of heterogeneous firm theories: as a result of trade liberalization, more productive firms are able to expand their export sales rapidly. While it is a possible explanation, the entry of multinational firms may have played a much more important role in practice. The composition of the largest quintile changed radically between 1992 and 2003. In 1992, firms in the top quintile were mainly state-owned post-socialist giants, but after 1996, the overwhelming majority consisted of multinational affiliates.

The numbers for trade growth strongly reject Gibrat's law. While the smallest exporters increased their exports well above 100 percent each year, the export growth of largest firms was between 5 and 15 percent in most years. One cannot see a clear trend in export growth for most quintiles, except for the two largest. In 1993, continuing firms suffered a decrease at these quintiles reflecting the loss of their main export markets. In more recent years, however, continuers in the top quintiles were able to increase their export volume in a stable way. Smaller firms, on the other hand, increased robustly their export volumes even in the early years. This comparison shows the duality of the economy: former state-owned firms struggled for survival, while dynamic small new exporters were able to rapidly enter foreign markets in this phase of transition.

The effect of exit seems to be qualitatively unimportant for most quintiles and years. However, it proved quite important for the largest firms in the beginning of the period, when large exporters disappeared or were radically restructured.

⁵ The table also shows that outliers may affect strongly the yearly results. The rapid growth of a few foreign-owned firms in 1996, for example, leads to very large increase in the first two quintiles.

Table 3: Export growth by quintiles of value of exports in year $t-1$, continuing and exiting manufacturing firms

Year (t)	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between $t-1$ and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between $t-1$ and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between $t-1$ and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between $t-1$ and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between $t-1$ and t (million US\$)
1993	160	158	32	76	70	51	40	33	156	15	1	490	-5	-28	4,990
1994	172	171	46	126	124	91	76	74	205	48	45	554	18	12	5,410
1995	152	151	37	82	80	86	53	51	257	35	33	802	20	17	7,180
1996	195	194	408	150	149	254	36	35	283	51	49	1050	7	2	8,620
1997	141	139	39	103	102	130	38	37	294	16	15	953	23	21	12,900
1998	129	127	34	87	86	119	48	47	324	22	21	1040	20	18	16,600
1999	125	123	36	53	52	100	21	20	302	7	6	1080	10	8	19,600
2000	94	91	23	59	57	97	30	29	319	13	12	1060	7	-5	20,500
2001	111	110	24	64	63	89	18	17	281	18	17	1100	16	14	23,800
2002	110	107	26	52	50	82	27	25	280	13	12	1090	13	7	27,100
2003	108	105	27	68	66	102	36	35	307	26	25	1170	17	16	31,100
Annual Average	136	134	67	84	82	109	39	37	273	24	21	944	13	8	16,200

These average patterns are similar for different destination markets, as can be inferred from Table 4. Small firms were able to increase their exports rapidly, well above 125% per year on each of the 10 most important destination markets (in terms of the number of exporting firms). The largest continuing firms were also able to increase their export volume on average to each country. In the top quintile the effect of multinationals is obvious: the largest trade growth can be observed to countries of large multinationals being present in Hungary: Germany, the Netherlands and France.

We have also decomposed export growth by the industry of the firm (Table 5). The firm size distribution is very different in different industries. In the textiles the exporter revenue in the first quintile is very large compared to other industries, but this is not the case for the largest quintile. As a result, skewness is low in textiles compared to other industries. Chemicals is the other extreme of the skewness distribution, where the smallest quintile exported US\$ 4 million, while the export volume of the largest quintiles was more than US\$ 2 billion on average. Theoretically skewness of the export distribution should be related to Pareto- k parameter of firm productivity distribution. Melitz and Ottaviano (2008, p 45.) calculate this for different industries in Italy and France. The estimated Pareto- k is low in textiles in both countries, which is in line with our results. The Pareto- k of chemicals is also low, however, especially in France, which would predict a relatively low skewness of export distribution in this industry. The large skewness of Hungarian chemical exports can be explained by the fact that a few very large pharmaceutical firms are operating in Hungary, affecting strongly the size distribution.

In terms of export growth, there is no evident difference across industries in the lower quintiles: there is a rapid growth for smaller firms. The only exception is the textiles, where the growth of 'only' 103 percent is significantly different from the growth rates in other industries, 120-140 percent. Industry differences are more pronounced for larger firms. Large machinery firms (mainly multinational affiliates) were expanding their export volume with a robust 19 percent per year. The slowest growth in the larger quintiles can be observed for food and textiles, where – taking account of exit – export growth of firms exporting in $t-1$ was -4 and -5 percent, respectively. This suggests that the duality between small and large firms was the most important in these industries: a steady decline in export revenues of large firms was paralleled with strong export growth of small firms.

We were interested whether product-level heterogeneity is related to the patterns of export growth. For this, we decomposed export growth by the homogeneity of the product using the liberal classification of Rauch (1999). The results are shown in table 6. There is a very large difference in terms of skewness by homogeneity. The ratio of total exports of the smallest and largest quintile is 180 for homogeneous products, 337 for reference priced goods and 457 for differentiated goods. Productivity distribution in the homogeneous goods industries has a lower skewness parameter, reflecting smaller firm size differences.

Similarly to previously examined dimensions of heterogeneity, export growth differences by product homogeneity are less obvious for smaller firms than for larger ones. In the bottom quintile average export growth of firms already exporting in year $t-1$ is 123% per

Table 4: *Export growth by quintiles of value of exports in year t-1, continuing and exiting manufacturing firms*

	Ten most popular destinations. Annual Average 1992-2003														
	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5						
	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)	Export Growth Continuing Firms (%)					
	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)	Mean Total exports between t-1 and t (million US\$)					
Germany	139	137	27	89	87	72	31	29	136	19	16	413	12	6	5,910
Austria	136	132	7	83	79	15	42	37	32	26	21	95	8	1	1,380
Romania	142	136	3	98	92	5	64	56	11	35	27	28	8	-2	235
Italy	150	147	8	88	83	17	40	36	39	17	11	103	7	-1	870
Slovakia	138	132	3	80	73	4	51	45	8	27	21	20	15	7	193
France	143	139	5	90	86	12	42	37	23	22	16	60	16	8	783
Switzerland	126	120	2	74	68	5	46	39	9	14	7	19	2	-6	172
Czech Republic	128	123	2	90	85	5	50	45	10	32	28	29	9	2	275
The Netherlands	144	140	4	85	80	8	47	41	15	31	23	52	16	3	622
Poland	144	140	3	102	96	7	60	55	13	34	27	35	12	5	312

Table 5: *Export growth by quintiles of value of exports in year t-1, continuing and exiting manufacturing firms*

Manufacturing category	Manufacturing categories, Annual Average 1992-2003														
	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Export Growth Exiting Firms (%)	Mean Total exports between t-1 and t (million US\$)
Food and Tobacco	129	127	6	67	64	18	35	31	55	15	9	170	4	-4	1,140
Textiles	103	102	14	35	34	43	16	14	112	6	2	258	3	-5	1,270
Wood, paper and printing	122	117	2	66	61	4	29	24	10	14	10	30	12	6	417
Chemical industry	132	130	4	90	88	9	30	28	20	22	20	82	11	7	2,210
Other non-metallic products	117	113	1	50	47	2	46	44	7	13	10	27	5	1	228
Metal products	121	118	4	59	56	11	38	34	30	22	17	79	7	0	1,020
Machinery	140	138	42	106	105	41	51	49	83	39	37	358	19	14	9,510
Other manufacturing	126	123	2	42	39	3	21	17	9	13	7	29	7	-3	164

Table 6: *Export growth by quintiles of value of exports in year t-1, continuing and exiting manufacturing firms*

Product type	Rauch classification. Annual Average 1992-2003													
	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5					
	Export Growth Continuing Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Mean Total exports between t-1 and t (million US\$)	Export Growth Continuing Firms (%)	Mean Total exports between t-1 and t (million US\$)				
Homogenous	130	3	79	71	5	47	41	15	25	18	59	2	-11	490
Reference-priced	145	7	110	106	13	53	49	28	35	32	121	6	1	2250
Differentiated	137	24	95	93	81	44	42	163	23	21	570	15	9	11100
Total	135	42	85	84	119	41	39	275	24	21	927	13	7	15700

year for homogeneous goods and it is 137% for differentiated goods. In the top quintile, on the other hand, average growth was 2% for homogeneous, 6% for reference priced and 15% for differentiated goods in the largest quintile. Also, the difference in growth rates explained by exit was more than twice as much for homogeneous than for differentiated goods. These results document the fundamental restructuring in Hungarian trade: the declining importance of homogeneous goods was driven by a low growth of exports by continuing firms and significant exit of large homogeneous-goods exporting firms. This was, however, paralleled by the strong growth of small homogeneous good exporters.

Firm dynamics across quintiles

Let us see how individual firms increase their exports, and move across quintiles. Table 7 presents the transition matrix for the quintiles of export: what is the probability that a firm in quintile i at $t-1$ will be in quintile j at year t ? We also include a non-exporting category, consisting firms which exported for at least one year between 1992 and 2003, but did not export in that year. The matrix is an average of the transition probabilities in all sample years, thus it shows average yearly probabilities.

The most obvious characteristic of the matrix is its persistence: firms are likely to remain in the quintile where they are. It is not surprising, that the two most persistent quintiles are the top quintile and the non-exporting category. Generally, persistence decreases with firm size, which can be explained by the large probability that firms exit from exporting altogether: this is 48% for firms in the bottom quintile, 26% for firms in quintile two, and there is even a probability of 7% that the largest exporters quit the export market every year. Interestingly these exiting probabilities are even larger in Colombia, where there is a 76% probability that firms in the first quintile stop exporting, and this probability is 10% for firms in the top quintile.

‘Upward mobility’ is present too. Small exporters in the first quintile face a 24% probability to move up to a larger quintile, compared to 28% probability of staying in quintile 1. It is less likely that larger exporters move up, but its probability is still significant: for example, firms in the third quintile move up with a probability of 19%.

Table 7: *Transition matrix for the quintiles of exports to which a firm belongs*

Final quintile (y)	Initial quintile (x)					
	Non-exporting	1	2	3	4	5
Non-exporting	0.87	0.48	0.26	0.15	0.09	0.07
1	0.06	0.28	0.15	0.04	0.01	0.00
2	0.03	0.17	0.36	0.14	0.02	0.00
3	0.02	0.05	0.19	0.48	0.12	0.01
4	0.01	0.01	0.03	0.17	0.63	0.08
5	0.01	0.00	0.01	0.02	0.13	0.84

Notes: Conditional probability of transiting from quintile of exports x in $t-1$ to quintile y in t

We checked the robustness of these results with regression analysis. We estimated how firm size, i.e. the initial quintile of the firm relates to the probability of export growth. For comparability with the previous table, we define export growth as a transition to a higher quintile. We model the probability of this 'upward' transition between periods t and $t+1$ with the firm's quintile in t and labor productivity⁶ (turnover/employees), its 2-digit industry classification and year dummies. We only consider firms exporting in t and exclude firms in quintile 5 in year t , as they cannot move up to another quintile. We estimate a probit model, and report the marginal effects at the sample mean.

The results of the regression analysis are in line with the descriptive patterns. Upward mobility is more important for smaller firms, and its probability declines monotonically with firm size. As expected, more productive firms are also more likely to 'jump up' to a higher quintile.

Table 8: *Probability of export growth*

	All firms		Continuers	
Quintile 2	-0.020*** (0.007)	-0.024*** (0.007)	-0.162*** (0.009)	-0.164*** (0.009)
Quintile 3	-0.056*** (0.007)	-0.064*** (0.007)	-0.258*** (0.008)	-0.263*** (0.008)
Quintile 4	-0.136*** (0.006)	-0.155*** (0.006)	-0.391*** (0.008)	-0.409*** (0.008)
Turnover/employees	0.273*** (0.081)	0.358*** (0.082)	0.424*** (0.109)	0.567*** (0.112)
2-digit industry dummies	no	yes	no	yes
Observations	31,185	31,176	23,948	23,942
Pseudo R-squared	0.0276	0.0379	0.0925	0.102
Log-likelihood	-16,797	-16,614	-13,554	-13,401

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Earlier results showed that small exporters grow very fast, but their contribution is quite small in the year of their entry. It is very natural to ask: how much these firms contribute to aggregate export growth in the long run? Following Eaton et al. (2008), we analyse the evolution of different cohorts of exporters in Table 9. The first cohort, firms already exporting in 1992, includes all firms which started exporting in that year or earlier.

Similarly to the transition matrix, the table shows the extensive churning of exporters over time: from the cohort entering in 1993, only about 34% exported in 2003. Compared to Colombia, however, churning is relatively low: there only 8% of the cohort entering

⁶ We have chosen labour productivity because it is easy to interpret. Including TFP estimated with different methods (OLS, fixed effects, Olley-Pakes) did not change the results significantly.

1997 continued exporting until 2005. Surviving firms, on the other hand, were able to increase their export volume massively. Exporters entering in 1993 and 1994 exported a similar amount on average than firms already exporting in 1992 (and possibly much earlier).

These numbers show the dominance of the firm extensive margin in the long run. First, the total export of firms already exporting in 1992 increased by only 56% compared to the 480% increase in total export volume. These firms contributed only by 27% to total exports in 2003, and the remaining 73% was realized by firms that started exporting after 1992.⁷ As a comparison, the contribution of firms already exporting in 1996 was 76.5% to total exports in 2003. Structural change and rapid trade liberalization in Hungary led to an export growth mainly driven by the entry of new exporters, the firm-level intensive margin. Also, this is not only a result of very early entering firms. Firms entering after 1994 contributed 42% to total export volume in 2003.

The table provides information about exporter survival, too. Exit was very frequent in the long run: only 28% of exporters in the 1992 cohort exported continuously in the whole period. Interestingly, however, there are no large differences in shorter term survival across different phases of transition.

Table 9: *Firms by initial export year cohorts, 1992-2003*

Year (t)	Number of firms												Total
	First year of report between 1992 and 2003												
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
1992	3,068	-	-	-	-	-	-	-	-	-	-	-	3,068
1993	2,074	1,292	-	-	-	-	-	-	-	-	-	-	3,366
1994	1,742	949	1,033	-	-	-	-	-	-	-	-	-	3,724
1995	1,544	797	736	933	-	-	-	-	-	-	-	-	4,010
1996	1,413	733	632	590	916	-	-	-	-	-	-	-	4,284
1997	1,312	664	565	503	636	963	-	-	-	-	-	-	4,643
1998	1,243	620	545	493	519	661	926	-	-	-	-	-	5,007
1999	1,161	580	509	420	473	538	580	711	-	-	-	-	4,972
2000	1,092	560	475	382	418	499	507	433	916	-	-	-	5,282
2001	1,025	540	470	388	401	493	481	402	689	850	-	-	5,739
2002	940	497	419	348	356	444	424	345	538	521	989	-	5,821
2003	866	441	389	306	324	400	360	293	456	395	619	943	5,792

⁷ This is not only a characteristic of manufacturing firms. The result for all exporters is strikingly similar: 26.7 percent.

Value of exports (million US\$)													
First year of report between 1992 and 2003													
Year (t)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
1992	6,350	-	-	-	-	-	-	-	-	-	-	-	6,348
1993	5,090	591	-	-	-	-	-	-	-	-	-	-	5,678
1994	5,630	1,320	529	-	-	-	-	-	-	-	-	-	7,481
1995	6,480	1,700	1,090	352	-	-	-	-	-	-	-	-	9625
1996	7,060	1,990	1,420	1,690	578	-	-	-	-	-	-	-	12,740
1997	8,060	2,270	2,180	2,460	966	403	-	-	-	-	-	-	16,328
1998	8,600	2,410	3,970	2,900	1,200	839	305	-	-	-	-	-	20,222
1999	8,530	2,360	4,930	3,050	1,180	1,290	697	298	-	-	-	-	22,336
2000	7,850	2,360	5,480	2,460	973	1,050	826	898	1,600	-	-	-	23,491
2001	8,050	3,030	4,930	2,930	789	1,110	1,000	1,230	3,990	418	-	-	27,470
2002	8,320	4,800	5,160	2,620	842	1,160	1,050	974	4,030	787	329	-	30,079
2003	9,950	5,050	6,420	1,660	1,110	1,490	1,480	1,300	5,470	1,010	638	1,270	36,856
Exports per firm (million US\$)													
First year of report between 1992 and 2003													
Year (t)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
1992	2,069	-	-	-	-	-	-	-	-	-	-	-	2,069
1993	2,453	458	-	-	-	-	-	-	-	-	-	-	1,687
1994	3,234	1,389	513	-	-	-	-	-	-	-	-	-	2,009
1995	4,196	2,135	1,485	378	-	-	-	-	-	-	-	-	2,400
1996	4,997	2,710	2,255	2,865	631	-	-	-	-	-	-	-	2,974
1997	6,140	3,413	3,859	4,884	1,519	418	-	-	-	-	-	-	3,517
1998	6,918	3,895	7,285	5,879	2,306	1,269	329	-	-	-	-	-	4,039
1999	7,349	4,065	9,688	7,258	2,503	2,395	1,201	419	-	-	-	-	4,492
2000	7,186	4,222	11,500	6,444	2,329	2,099	1,629	2,074	1,743	-	-	-	4,447
2001	7,851	5,604	10,500	7,561	1,967	2,251	2,082	3,059	5,790	491	-	-	4,786
2002	8,855	9,665	12,300	7,524	2,365	2,617	2,477	2,822	7,488	1,511	333	-	5,167
2003	11,500	11,400	16,500	5,410	3,415	3,733	4,112	4,453	12,000	2,568	1,030	1,350	6,363

Within-firm extensive margins

In the previous section we analyzed how the total export volume of continuing firms changed. In this section we decompose these firms' export growth to see how they extended the number of their export markets and the export products. We will categorize firms according to the number of their export markets/exported products in year $t-1$, and calculate the growth in the number of these variables for each group separately. Finally, we calculate the within-firm extensive margin, i.e. the number of destination-product pairs the firms export to, and decompose it in a similar way.

Table 10 presents how the most important firm-level variables were related to the firm-level extensive margin in 2003. These variables are the real value added per employee, the capital to labor ratio and the number of employees in relative terms compared to the industry average. As a comparison, the table also includes all firms, which did not export in 2003, using balance sheet data.

The largest differences can be observed in terms of number of employees followed by added value. Also, there is a strict sorting of firms by these variables both in terms of the number of export markets and number of products. In terms of capital to labor ratio, there is only a strict sorting of firms in terms of destination-product pairs, rather than the two components of the within-firm extensive margin.

Table 10: *Firms' characteristics and number of destinations, products and destination-product pairs in 2003*

Number of destinations	Mean(ry)	Mean(rk)	Mean(rl)	Mean(l)	Number of firms
0	0.84	1.08	0.38	15.84	8,515
1	1.01	0.82	0.66	27.81	2,600
2-5	1.20	0.86	1.51	68.54	2,172
6-10	1.58	1.11	3.18	162.61	509
11-30	1.89	0.97	6.45	356.89	439
31-50	2.70	1.64	17.67	920.97	57
50+	3.51	3.51	44.87	2,831.47	15
Total	1.00	1.00	1.00	48.26	14,307
Number of products	Mean(ry)	Mean(rk)	Mean(rl)	Mean(l)	Number of firms
0	0.84	1.08	0.38	15.84	8,515
1	1.05	0.83	0.69	28.83	2,800
2-5	1.30	0.87	1.90	88.43	2,423
6-10	1.71	1.31	5.69	313.62	446
11-20	1.71	1.05	13.52	768.71	114
21-50	5.22	0.32	53.36	3,679.11	9
Total	1.00	1.00	1.00	48.26	14,307
Number of destination-product pairs	Mean(ry)	Mean(rk)	Mean(rl)	Mean(l)	Number of firms
0	0.84	1.08	0.38	15.84	8,515
1	1.00	0.86	0.50	20.84	1,877
2-5	1.12	0.83	1.12	46.95	2,338
6-10	1.43	0.95	2.09	102.66	726
11-50	1.68	1.02	5.21	276.99	767
50+	3.03	1.59	24.27	1,425.25	84
Total	1.00	1.00	1.00	48.26	14,307

Note: ry, rk and rl are value added per employee, capital to labor ratio and number of employees in relative terms, i.e. ratio of firm i to sector j . l is number of employees.

Table 11 shows how continuing firms exporting to different numbers of destinations increased the number of their export markets in the following year. The average number of export markets per firm does not follow any clear trend, which is surprising given the fundamental changes in the Hungarian trade structure.

Like in our earlier tables it can be seen that Gibrat's law does not seem to apply. Continuing firms exporting to only one market export to 1.4 markets in the next year, while the growth is only 0.6 for firms exporting to at least 11 markets.

Also, there is important variation over time. On the one hand, it is not surprising, that at the beginning of the period the number of export markets decreased strongly for large firms. On the other hand, this decrease was less pronounced for firms exporting to 6-10 countries than for firms exporting to more than 10 markets, showing that these large exporters were able to keep their export markets to a larger degree even in such turbulent times. Parallel with this, continuing small firms were very fast in expanding the number of their export markets.

After the initial period of transition, the growth of small exporting firms slowed down significantly from 0.59 in 1994 to 0.31 in 2003, suggesting that a number of small exporters exported steadily to one export market. Cyclical effects seem to be more important for larger firms. In 1999, as the consequence of the Russian crisis, the number of export markets decreased for all firms, except the bottom two categories.

Table 11: *Expanding exporting activity by number of destinations in year t-1, continuing firms*

Year (t)	Growth: number of destinations					Total
	1	2	3 - 5	6 - 10	10+	
1993	0.55	0.30	-0.07	-0.74	-0.34	4.07
1994	0.59	0.41	0.36	0.40	0.68	4.35
1995	0.49	0.42	0.23	0.34	0.72	4.61
1996	0.42	0.08	0.17	-0.05	0.19	4.56
1997	0.40	0.27	0.18	0.13	-0.23	4.58
1998	0.33	0.24	0.07	-0.11	-0.29	4.49
1999	0.32	0.10	-0.22	-0.06	-0.32	4.38
2000	0.32	0.21	0.20	0.14	0.18	4.52
2001	0.35	0.08	-0.02	0.11	0.14	4.45
2002	0.28	0.10	-0.06	0.12	-0.12	4.47
2003	0.31	0.16	-0.06	0.15	0.00	4.60
Annual Average	0.40	0.22	0.07	0.04	0.06	4.46

This analysis may be upward biased in the sense that firm exit is ignored. To get a more complete picture we present a transition matrix in Table 12. Most entering firms enter only 1 market in the first year, but about 25% of new exporters start exporting to more than one market. Firms exporting to one market exit with a probability of 45%, and expand to new markets with a probability of 13%. Exporters selling to more markets also exit with relatively high probability: even firms exporting to more than 10 markets exit from exporting with a yearly probability of 3%. Also, the matrix shows a 'downward' drift: with the exception of firms exporting to 1 market, all other firms are more likely to move downward than upward, suggesting, in line with Table 11, that large exporters are unlikely to expand the number of their export markets quickly. We also checked whether these patterns differ across product groups classified by heterogeneity. We did not find systematic differences.

Table 12: *Transition matrix for number of destinations*

Final number of destinations (y)	Initial number of destinations (x)					
	0	1	2	3-5	6-10	10+
0	0.87	0.31	0.17	0.11	0.09	0.07
1	0.09	0.51	0.25	0.08	0.01	0.00
2	0.02	0.12	0.34	0.17	0.02	0.00
3-5	0.01	0.05	0.21	0.49	0.21	0.01
6-10	0.00	0.00	0.02	0.14	0.53	0.10
10+	0.00	0.00	0.00	0.01	0.15	0.81

Notes: Conditional probability of transiting from exporting to x destinations in t-1 to y destinations in t

The second dimension of the within-firm extensive margin is the number of products exported per firm, which is shown in Table 13. Remember, that these are quite aggregated, 2-digit product categories. The pattern by firm size is quite surprising: only small firms, exporting only 1 product increased the number of exported products every year on average. Firms exporting 2-5 products increased the number of products only in 4 years; larger firms reduced the number of their exported products in all years, with only one exception. For large firms, the decrease is very spectacular in 1993 and 1994, suggesting that restructuring led to a serious reduction in the number of their product lines.

Table 13: *Expanding exporting activity by number of products in year t-1, continuing firms*

Number of exported products	Growth of number of exported products				Total
	1	2 - 5	6 - 10	11+	
Year (t)					
1993	0.45	-0.24	-1.50	-2.84	2.30
1994	0.48	-0.02	-0.98	-3.16	2.33
1995	0.48	0.08	-0.62	-0.36	2.48
1996	0.46	-0.09	-0.84	-1.41	2.48
1997	0.41	0.04	-0.40	-3.04	2.58
1998	0.40	-0.02	-0.53	-1.11	2.59
1999	0.33	-0.08	-0.47	-1.31	2.59
2000	0.32	0.02	-0.72	-1.05	2.63
2001	0.36	0.17	0.18	-0.88	2.75
2002	0.32	-0.02	-0.37	-0.51	2.76
2003	0.31	0.01	-0.35	-0.80	2.82
Annual Average	0.39	-0.01	-0.60	-1.50	2.57

These results are reinforced by the transition matrix of the number of products, which is shown in Table 14. On average, firms exporting more than one product decreased the number of products exported. For example, firms exporting 6-10 products face 7% probability of exit, 39% probability of reducing their exported product range and only 9% probability of moving to a higher category. These results are in line with the prediction of Bernard et al. (2011) that as a result of trade liberalization firms drop their marginal products and concentrate on their core competencies.

Compared to the transition matrix for the number of destinations, two other differences can be observed. First, the probability that firms exporting at least 20 products exit in the next year is 11%, which is larger than the exit probability of firms exporting to a large number of markets, suggesting that market-specific fixed costs are more important than product-specific ones. Second, the persistence of the number-of-products transition matrix is stronger than that of the number-of-markets matrix.

Table 14: *Transition matrix for number of products a firm sells*

Final number of products (y)	Initial number of products (x)					
	0	1	2-5	6-10	11-20	21-50
0	0.87	0.30	0.13	0.07	0.08	0.11
1	0.10	0.51	0.18	0.02	0.01	0.00
2-5	0.03	0.18	0.64	0.32	0.06	0.00
6-10	0.00	0.00	0.06	0.50	0.30	0.00
11-20	0.00	0.00	0.00	0.09	0.52	0.30
21-50	0.00	0.00	0.00	0.00	0.03	0.58

Notes: Conditional probability of transiting from exporting x products in t-1 to y products in t

Finally, Table 15 shows the growth of the within-firm extensive margin. Its behavior is very similar to the pattern for the number of export markets. On average this measure declined from 26.5 in 1992 to 23.62 in 1999, and increased after it to 25.1. When decomposed by firm size, the growth is the largest in the bottom quintile, but it is decreasing with the passage of time. Its growth is negative in some years for the largest firms, especially in the beginning of the period and around the Russian crisis.

Table 15: *Expanding exporting activity by number of destination-product pairs in year t-1, continuing firms*

Number of destination-product pairs	Growth of number of pairs					Total
	1 - 4	5 - 9	10 - 20	21 - 44	45+	
Year (t)						
1993	0.61	-0.35	-1.22	-0.76	-2.90	26.54
1994	0.88	0.19	0.98	1.32	-2.09	26.96
1995	0.73	0.31	1.33	2.10	3.55	26.13
1996	0.59	0.29	0.22	0.27	-3.68	24.59
1997	0.53	0.47	0.21	-0.24	0.63	24.66
1998	0.46	0.24	0.18	0.26	-2.32	24.38
1999	0.33	0.02	-0.23	0.56	-4.36	23.62
2000	0.44	0.24	0.39	1.04	1.23	24.43
2001	0.40	0.42	1.36	1.50	3.72	25.35
2002	0.32	0.12	0.04	1.14	2.54	25.15
2003	0.34	0.13	0.29	0.43	1.32	25.14
Annual Average	0.51	0.19	0.32	0.69	-0.21	25.18

6. CONCLUSIONS

This paper analyzed the Hungarian export growth between 1992 and 2003, concentrating on different dimensions of the extensive margin. One of our main aims was to present stylized facts on the relationship between firm size and elements of trade growth.

The estimates show very strong dynamics in terms of entry and exit to exporting. The new entrants, however, are very small, and do not contribute too much to the year-to-year export growth. New entrants are likely to exit in a few years, but surviving new entrants grow quickly. This also means, that their share in total exports increases fast: in 2003, 73 % of export volume was realized by firms which started exporting after 1992.

Hungarian exports are not characterized by Gibrat's law. Small exporters are growing very quickly, why trade growth of larger firms is smaller. When decomposing across destination countries, industries and products, we found small differences in growth rates of smaller firms, but significant heterogeneity for larger firms.

When analyzing firm-level exports in more detail, we found similar patterns: surviving small firms are likely to export to new markets and introduce new export products. This growth was smaller for larger firms, and macro shocks (transition and the Russian crisis) affected them strongly. Also, firms exporting the largest number of products consistently reduced the number of their exported product lines.

Some of our results are comparable with Eaton et al. (2008) for Colombia, with the qualification, that we only considered proper firms and the manufacturing sector. The main patterns in the Hungarian data are in line with their findings, but there are some differences in the details. We have found less entry and exit, but stronger growth of surviving firms and an even larger effect of entry in the long run. Also, we found that larger firms are more likely to exit in Hungary than in Colombia. These differences can be explained by the specificities of transition or by the extent of trade liberalization between Hungary and the EU market.

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