FIW Research Reports 2009/10 N° 01
October 2009

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Johannes Pöschl, Robert Stehrer and Roman Stöllinger

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In this study we provide detailed evidence on the importance and performance of exporters compared to non-exporters in Austrian manufacturing, based on firm level data. The results are in line with those found in other studies pointing towards the exceptional role of exporting firms with respect to various size and performance measures. We provide both descriptive as well as econometric evidence on these 'export premia' along these lines and further present a brief comparison with results found for other countries. Our findings however also suggest the existence of quite large differences across industries with respect to the export premia which deserves further attention.

The FIW Research Reports 2009/10 present the results of four thematic work packages 'Microeconomic Analysis based on Firm-Level Data', 'Model Simulations for Trade Policy Analysis', 'Migration Issues', and 'Trade, Energy and Environment', that were commissioned by the Austrian Federal Ministry of Economics, Family and Youth (BMWFJ) within the framework of the 'Research Centre International Economics" (FIW) in November 2008.

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Johannes Pöschl, Robert Stehrer and Roman Stöllinger

FIW – Research Centre International Economics

Paper written as part of the project 'Forschungsschwerpunkt Internationale Wirtschaft (FIW)', Work package No. 1: Microeconomic Analysis based on Firm-level Data including Issues of Firm Location, FDI Decisions, Trade Flows and Labour Markets, financed by the Austrian Federal Ministry of Economy, Family and Youth (BMWJF).

Vienna, September 2009

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JEL classification: F14, L25

Keywords: exports, firm heterogeneity, export premium, Austria

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1 Introduction

The recent development in the theory and empirics of international economics has been characterized by the emergence of a rich and rapidly growing branch of research referred to as 'new new' trade theory. Research along these lines put individual firms at the centre of the analysis (for a recent overview see Helpman, 2006). From a theoretical point of view the main novelty of new new trade theory is that the assumption of industries (or even countries) being populated by identical firms is dropped. This assumption was at the core of the models named 'new trade theory' which started in the 1980s with the seminal contribution by Paul Krugman (Krugman, 1979) based on the monopolistic competition model developed by Dixit and Stiglitz (1977). Instead, firm heterogeneity is explicitly allowed for which in most cases is modelled as productivity differences across firms. From an empirical point of view this strand of research was triggered off by empirical contributions (e.g. Clerides, Lach and Tybout, 1998) pointing towards the fact that exporting firms differ from non-exporting firms in many respects (such as in productivity, size, etc.) and that the bulk of exports (or trade in general) is driven by a small number of firms only. A second aspect in empirical research was the availability and accessibility of firm-level data which allows for empirical research along these lines.

The insight that an economy and the industries therein are not populated by identical firms is not exactly new and is well known from other strands of research, in particular in industrial economics and firm growth (e.g. Gibrat, 1931; Penrose, 1959; Marris, 1963; Steindl, 1965; Ijiri and Simons, 1974; Jovanovic, 1982; and Evans, 1987 to name a few) and other strands like evolutionary economics (Nelson and Winter, 1982). What is new is that such firm-level databases are used to investigate the consequences of firm heterogeneity for international trade and the performance of exporters compared to non-exporting, i.e. purely domestic, firms together with theoretical models which have meanwhile been developed. Hence, the creation of firm-level data sets including trade-related information for individual firms is what was required to allow empirical researchers to put the actual actors in trade – i.e. firms – at the centre of their analysis. Trade theories incorporating firm heterogeneity, in most respects, do not replace the existing trade models but rather build on them and add new elements. For example, models based on heterogeneous firms still use the established incentives for trade of existing models such as comparative advantages or increase in product varieties. Additional elements come in as comparative advantages might be caused by additional factors and there are new sources of gains from trade (like within industry reallocations). Nevertheless, some major assumptions of existing theories are challenged, if not by the new theories then at least by empirical research. The most prominent example in this respect is the existence of 'exports sectors'. In fact, Bernard et al. (2003) show for example that in the case of the US economy, knowing a firm's industry does not tell much about whether or not it is an exporter (Bernard, Eaton, Jensen and Kortum, 2003).

The purpose of this paper is to provide evidence on the systematic differences between exporting and purely domestic firms in the Austrian economy which might be comparable

across countries to a certain extent. Whereas the empirical research in the field of firm heterogeneity and international trade flourishes worldwide, such an analysis for Austria is still missing when it comes to analysing performance and characteristics of exporting and non-exporting firms based on firm-level data.[1] Hence, this paper tries to fill this gap by providing a first analysis of the exporting activities of Austrian firms. In particular, we investigate the number of firms involved in exporting and changes over time for the manufacturing sector and individual industries. We provide extensive descriptive evidence on the relevance of exporting firms in terms of total manufacturing sales, employment and other size measures. We also look at the average size of exporters in terms of sales, employment, wages and investment and compare it to their purely domestic peers and investigate the performance of the exporting firms with respect to productivity, investment intensity and wages per employee for the period covered. These latter aspects will also be investigated by means of regression analysis of the size and performance variables on export status and other control variables like industry dummies, etc. The econometric approach will follow the contributions by Bernard and Jensen (1999) subsequently used in a number of other contributions. These estimations allow us to reveal whether in Austria there exists an 'export premium', i.e. the extent to which exporting firms are larger, have higher productivity, higher capital intensity, and pay higher wages. The magnitude of a 'wage premium' in exporting firms is interesting from a policy perspective as it may be used as a crude measure of the distribution of the gains from trade between rents and wage income. Furthermore, we compare our results with the stylized facts from the literature with respect to exporter performance, export concentration and export intensity.

The reminder of this paper is structured as follows: Section 2 gives a very brief overview of related literature. Section 3 describes the data set which is used in Section 4 to describe the characteristics of Austrian exporters when compared to non-exporting firms. This section explores the differences in several size and performance measures such as firm sales, employment and productivity. It also investigates whether exporters enjoy a so-called export premium. In Section 5 we analyse the same firm parameters as Section 4 but use regression analysis to analyse size and performance measures of exporting firms. Section 6 puts our results into perspective by comparing them with those found in other country studies. Section 7 concludes.

2 Related literature

The first empirical studies dealing with firm heterogeneity and exporting activity based on firm level data include the contribution of Clerides et al. (Clerides, Lach and Tybout, 1998) on Colombia, Mexico and Morocco and the highly influential paper by Bernard and Jensen

[1] This lack of studies is mainly caused by the rather strict regulations concerning access to individual and firm-level data. Nonetheless, there already exists some studies based on similar data (e.g. see CESIS, 2007, and European Commission, 2008, for selected aspects related to this paper).

(Bernard and Jensen, 1999) for the US economy. Both studies find a superior performance of exporting firms when compared to non-exporting firms, particularly in terms of productivity. They also investigate the causes of this finding, in particular whether the correlation between higher productivity and export status implies a causality running from productivity to exporting or vice versa. For industrialized countries, the empirical results point towards a causality going from productivity to exporting with only limited 'learning by exporting' effects (e.g. Arnold and Hussinger, 2005 for Germany).

The Bernard and Jensen paper proposes a straightforward way to estimate an 'export premium', i.e. the extent to which exporters are more productivity, pay higher wages and have higher investment and innovation intensities. Despite the fact that this approach uses the export status as the explanatory variable – which is not suggested by the results on causality – it inspired much of the following empirical work in this field. Results provided in this paper are no exception in this respect as the intention is to provide comparable results for the Austrian economy.

The work by Clerides et al. (1998) and Bernard and Jensen (1999), as well as several other empirical studies preceded the theoretical work on firm heterogeneity and trade. It was the seminal work by Melitz (2003) which delivered the theoretical underpinning for a clear relationship between exporting and productivity, i.e. a selection process of more productive firms into exporting[2]. In the Melitz model (for an exposition of the static version, see Helpman, 2006) firms randomly draw their productivities before entering a specific industry. This market entry is costly and firms also bear the risk that their productivity is too low to produce profitably at the (endogenous) market price. The set-up of the model implies that firms charge a constant mark-up on its marginal cost so that differences in productivity translate directly into differences in prices charged. Given that consumers have a strong 'love for variety' they wish to consume all goods but buy more of the goods with lower prices. This results in more productive firms having higher sales (because they charge lower prices) and also earning higher profits. One of the major implications of the Melitz model is the self-selection process of firms into export markets, by which not all but only the more productive firms start exporting when a country is opening up to international trade. Assuming that trade involves a fixed export costs (and possibly variable trade costs), exporting constitutes an opportunity for additional profits only for the set of firms whose profit margin is large enough to cover the (fix) trade costs. These are the more productive firms. Hence, the Melitz model suggests that the most productive firms – those with productivity above the export productivity cut-off – self-select into export markets. Firms with lower productivities only serve the domestic market. All exporting firms also serve the domestic market. With additional competition from trade, the cut-off productivity level for

[2] Another contribution is Bernard et al. (2003) assuming Bertrand competition building on Eaton and Kortum (2002) assume perfect competition with a probabilistic formulation of comparative advantage. Fix costs of exporting are already emphasised in Roberts and Tybout (1997).

staying in the market also increases leading to the market exit of the least productive firms. The implied intra-industry reallocations of labour towards more productive firms are an additional source of productivity gains from international trade[3]. International trade brings about extra profits for the most productive exporters but it also leads to the exit of firms that were previously operating. So the output expansion of the most productive firms, coupled with the exit of the least productive firms following opening up of trade, implies that international trade props up aggregate productivity. These are an additional element in gains from trade not covered in models of the new trade theory.

The Melitz model has been adapted and expanded in various ways. For example, Melitz and Ottaviano (2008) give the model an interesting twist by allowing for variable mark-ups. In this model firms located in larger markets charge lower average mark-ups because they operate in a more competitive environment. The selection process into export markets is similar as in the Melitz model (although it does not require fixed trade costs). There is also a pro-competitive effect of trade leading to an increase in aggregate productivity and the exit of the least productive firms. The intra-industry resource reallocation and the change in the distribution of firms, however, operate via another channel than in the Melitz model: the exit of low productivity firms is caused by a decrease in price of goods and not competition on factor markets[4].

Bernard, Redding and Schott (2007) combine the heterogeneous firm assumption in a set-up à la Melitz with comparative advantages based on factor endowment and also allow for different size of trading partners and varying bilateral trade costs. This model is not analytically solvable but numerical solutions offer some interesting results. One of the major implications is that in comparative advantage industries, the distance between the zero-profit productivity cut-off level (which firms must meet to not exit the market) and the export productivity cut-off is smaller. Assuming identical ex-ante distribution of firms across industries, this implies that the share of exporting firms is, other things equal, higher in comparative advantage industries. But other factors of course do influence the zero-profit and the export cut-off productivity levels. These factors include the size of (variable and fixed) trade costs and the relative size of the trading partners. Higher trade costs and a larger domestic market relative to the export market tend to make exporting more difficult. The self-selection of more productive firms into export markets that works as in the Melitz model leads to stronger intra-industry reallocations in the comparative advantage industries. This implies that (costly) trade reinforces existing cross-country differences in comparative advantages because the different ex-post cross-country industry distributions

[3] The logic behind the rise in the cut-off productivity level and consequent exit of the least productive firms is that exporters with prospects for extra-profits from trade increase their output, whereby their extra demand for labour drives wages up.

[4] A more extensive literature survey also including issues of organization of firms can be found in Helpman (2006).

add a Ricardian type comparative advantage (based on superior technology) to the pre-existing Heckscher-Ohlin comparative advantages.

In parallel to the development of theoretical models that could explain both the co-existence of heterogeneous firms and the self-selection of firms into export markets (and into multinational firms as in Helpman, Melitz and Yeaple, 2004) also empirical research identified and created a plethora of country-specific studies on the performance of exporting firms, compared to purely domestic firms. For European countries, Mayer and Ottaviano (2007) investigated several features of exporters and their role for the respective economy. Building on firm-level data from Germany, France, United Kingdom, Italy, Hungary, Belgium and Norway they established a series of 'stylized facts' concerning exporters. The most important ones in the context of this paper are that typically a small number of exporters account for the bulk of a country's aggregate exports. For example, the top 1% of exporters in Germany and Hungary are responsible for 59% and 77% of aggregate exports, respectively. Also, only a few firms export a large fraction of their output[5]. Comparisons of exporters with non-exporters typically reveal that firms engaged in exporting are larger in terms of output and employment but that they are also superior to their purely domestic peers in performance measures such as labour productivity, total factor productivity, wages employee and capital intensity.

With more and more country studies becoming available, efforts to undertake meaningful cross-country comparisons also intensified. This is not an easy task since each firm-level data set has its peculiarities, collected according to individual methodologies. One of these efforts to make country studies based on firm-level data comparable is undertaken within the Micro-Dyn project.[6] While many methodological features as well as the coverage of the data sets will always differ from country to country, first harmonizations of key variables, in particular the definition of the export status, have been achieved making results from Bulgaria, France, Hungary, Italy, Poland, Slovenia and Spain somewhat more comparable (see Altomonte and Ottaviano, 2008). We will present a comparison of these results with ours for Austria in Section 6.

3 Data

In this paper we use data provided by Statistics Austria via 'remote execute'.[7] The basic dataset is the 'Leistungs- und Strukturerhebung' for the period 1997-2006 and NACE

[5] These two empirical regularities explain the title of the Mayer-Ottaviano publication, 'The Happy Few'

[6] This project is commissioned by the European Commission under the Framework 6 Programme; for details see www.micro-dyn.org.

[7] We would like to thank Mag. Wally, who was invaluable in solving the administrative and juridical hurdles and problems in accessing the data. We further thank ADir RR Mazanek, who provided assistance in setting up the database and the export markers in particular and a number of useful comments.

categories C to F; in this paper, we only use data for the manufacturing sector (NACE D).[8] There has been a methodological change in 2002 which we have to take into account.

This data provide firm-level information on a number of indicators on a yearly basis of which we use the number of firms in each manufacturing NACE 2-digit industry, production value, sales, employment, total investment and wages and salaries. Unfortunately this data does not provide information on the export behaviour of firms. For information on the export status of firms the data from the 'Leistungs- und Strukturerhebung' has to be combined with the 'Konjunkturstatistik'[9] which is on a monthly basis and includes a lower number of firms sampled and provide also fewer indicators. The 'Konjunkturstatistik', however, provides information on sales in the domestic economy and export sales. Using this information it was possible to generate indicators on export sales ('export marker'). These export markers allow distinguishing firms as non-exporters and firms exporting equal to or less than 5, 30, 50 and more than 50 percent of their sales respectively. This information was merged to the indicators taken from the 'Leistungs- und Strukturerhebung'. As the sample size in the 'Konjunkturstatistik' is smaller than that in the 'Leistungs- und Strukturerhebung' there remains a number of firms for which no information on their export status is available (see Table 1 below). Further, due to confidentiality issues, cells with less than 4 firms are not used in the results reported below[10].

Table 1

Sample overview, manufacturing (NACE D), 1997-2006

Year	Total number of firms	Firms with exports status known	Exporters	Non-exporters	Share of exporters (%)
1997	9388	5342	2967	2375	55.54
1998	9531	5379	3045	2334	56.61
1999	9609	5106	2959	2147	57.95
2000	9421	5000	2931	2069	58.62
2001	9218	4952	2921	2031	58.99
2002	27572	5973	3218	2755	53.88
2003	28581	6054	3303	2751	54.56
2004	28609	5949	3340	2609	56.14
2005	28374	5719	3248	2471	56.79
2006	28712	6326	3537	2789	55.91

[8] Detailed information on definitions and methods are provided in 'Standard-Dokumentation: Metainformationen (Definitionen, Erläuterungen, Methoden, Qualität) zur Leistungs- und Strukturstatistik, Teilprojekt Produzierender Bereich', downloadable from www.statistik.at.

[9] For details see 'Standard-Dokumentation: Metainformationen (Definitionen, Erläuterungen, Methoden, Qualität) zur Konjunkturstatistik im Produzierenden Bereich', downloadable from www.statistik.at.

[10] Results dealing with only the *number* of firms but not their characteristics are not covered by this rule.

Let us shortly present a general overview of our data and the number of firms involved in exporting in the Austrian economy over the period 1997-2006. Throughout the paper we will take care of the fact that there is a break in the series due to a change in the data collection method of Statistic Austria, so we split the period 1997-2006 into two sub-periods, with period 1 ranging from 1997-2001 and period 2 ranging from 2002-2006.

As Table 1 indicates, the total number of firms for which data is available tripled from the first to the second period due to the methodological change. However, the number of firms for which the export status is known is increased by a much smaller amount, jumping from roughly 5,000 to roughly 6,000 firms. Therefore, our actual sample, i.e. the number of firms for which information on the export status is available, varies from 4,952 firms in 2001 to 6,326 firms in 2006, the last year for which we have data.

For all calculations and results in this paper we chose the simplest (and also most widely used) definition of the export status. According to this definition, a firm is considered to be an exporter in any particular year if its export sales are greater than zero. This implies that individual firms can switch from being a non-exporter to being an export in the next year and vice versa[11].

Neglecting the break in the time series the share of exporters in our sample seems to be relatively constant over the entire period with roughly 56% both in 1997 and 2006. This, however, hides an interim low in 2002 (53.88%) and a peak of 58.99% in the preceding year with the jump possibly caused by the break in the time series. Looking at the two time periods 1997-2001 and 2002-2006 separately it appears that the number of exporting firms in the Austrian economy has been slightly increasing over time. This increase is however not too impressive. The increase in the share of exporting firms between 2002 and 2006 of slightly less than 1 percentage points annually can be compared with the rather dynamic development of aggregate Austrian exports rising from EUR 77.4 billion to EUR 103.8 billion, an increase of more than one third or 7.6% annually. This would point to the fact that incumbent exporter increased their volume of exports rather than that the number of exporters have increased. In the terminology of the new new trade literature this is equal to saying that the firm *intensive* margin, i.e. the value of exports per exporting firms, could be more important in explaining aggregate exports than the firm *extensive* margin, i.e. the number of exporters. This would be in contrast to the stylized fact established for other European countries. Using data on bilateral exports and the so-called gravity equation, the firm extensive margin is found to matter most for explaining the positive impact of the size of the trading partners and the negative impact of trade barriers on the volume of bilateral trade (Ottaviano and Mayer, 2007). More recent research based on very detailed French firm-level export data, however, come to different conclusion, suggesting that the firm

[11] An alternative, more narrow, definition of the export status is to consider a firm as an exporter only if it is exporting equal to or more than 5% of its sales in two consecutive years.

intensive margin is most important for explaining changes in aggregate export values (Buono, Fadinger and Berger, 2009) Unfortunately, we cannot redo either of these exercises with our data set since we do not have precise information on export sales of firms and completely lack information on the destination of individual firms' exports. Therefore we prefer to remain silent on the issue of the 'margins of exports' since the simple comparison of the number of exporting firms and the increase in aggregate exports is not an appropriate way to take up this question.

4 Role and characteristics of exporting firms in the Austrian economy

In this section we present descriptive evidence on the structure of exporters across industries, the respective firm characteristics (size measures in particular) and firm performance measures (as productivity). For this we only report results for the period 2002-2006 for reasons mentioned above and concentrate on the manufacturing sector (NACE D) only.

4.1 Industry export participation

Table 2 reports the number of firms and exporters together with the share of exporters in 2002 and 2006 for individual manufacturing industries (NACE 15 – 37) and total manufacturing. The results suggest that the share of exporters in the total number of firms, a variable which we refer to as industry export participation, is fairly high in most manufacturing industries. These shares are graphically presented in Figure 1 where we have ranked the industries by industry export participation in 2006. This shows that in more than half of the industries the shares are well above 80%. Industries with the lowest shares of exporters are food and beverages (NACE 15) and non-metallic mineral products (NACE 26) not considering manufacturing n.e.c. (NACE 37). The manufacturing-wide share of exporters (56%) is rather low when compared to individual industry averages. This is explained by the fact that the four industries with the lowest industry export participation industries (NACE 15, 28, 36 and 29) also turn out to be the ones with the highest number of firms in our sample. The largest industry – in terms of the number of firms – which is food and beverages (NACE 15) is also the industry with the lowest export participation, reaching only 28% in 2006 (see Table 2).

In Figure 2 we present the change in shares between 2002 and 2006. The figure reveals that the (modest) manufacturing-wide rise in the share of exporters of 2% stretches across a number of industries with shares rising to various extent however. Largest increases were observed in publishing and printing (NACE 22), the machinery and equipment industry (NACE 29) and the automotive industry (NACE 34). There are also a few industries with declining shares. These are in most cases industries with a relatively small number of firms which also explains the rather large changes of the shares in percentage points.

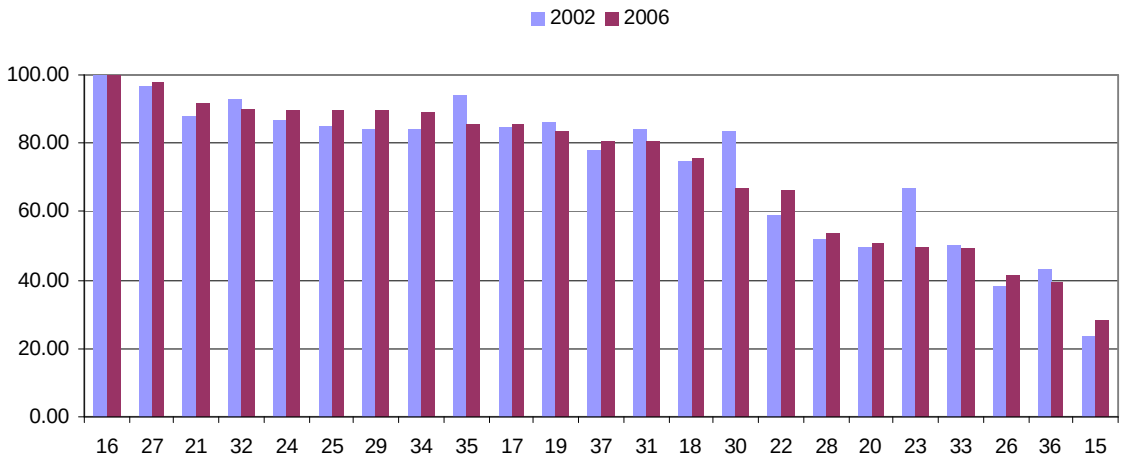
Table 2

Number and relative share of exporters, 2002 and 2006

		2002				2006			
NACE	Industry	Non-exporter	Exporters	Total number of firms	Share of exporters	Non-exporter	Exporters	Total number of firms	Share of exporters
15	Food and beverages	900	278	1178	23.60	862	334	1196	27.93
16	Tobacco products	0	1	1	100.00	0	1	1	100.00
17	Textiles	25	135	160	84.38	21	123	144	85.42
18	Wearing apparel	25	73	98	74.49	20	62	82	75.61
19	Leather	5	31	36	86.11	4	20	24	83.33
20	Wood	273	273	546	50.00	296	308	604	50.99
21	Pulp and paper	10	73	83	87.95	7	75	82	91.46
22	Publishing and printing	169	245	414	59.18	152	300	452	66.37
23	Refined petroleum	1	2	3	66.67	2	2	4	50.00
24	Chemicals	15	100	115	86.96	13	114	127	89.76
25	Rubber and plastic products	33	191	224	85.27	23	200	223	89.69
26	Non-metallic mineral products	208	127	335	37.91	197	140	337	41.54
27	Basic metals	3	90	93	96.77	2	92	94	97.87
28	Fabricated metal products	429	461	890	51.80	487	568	1055	53.84
29	Machinery and equipment	86	460	546	84.25	56	483	539	89.61
30	Office machinery and computers	2	10	12	83.33	2	4	6	66.67
31	Electrical machinery	21	108	129	83.72	28	116	144	80.56
32	Radio, TV, communication	3	40	43	93.02	5	46	51	90.20
33	Precision & optical instruments	97	98	195	50.26	130	126	256	49.22
34	Motor vehicles	12	62	74	83.78	10	82	92	89.13
35	Other transport equipment	1	15	16	93.75	3	18	21	85.71
36	Manufactures n.e.c.	433	331	764	43.32	464	302	766	39.43
37	Recycling	4	14	18	77.78	5	21	26	80.77
15-37	Total manufacturing	2755	3218	5973	53.88	2789	3537	6326	55.91

Figure 1

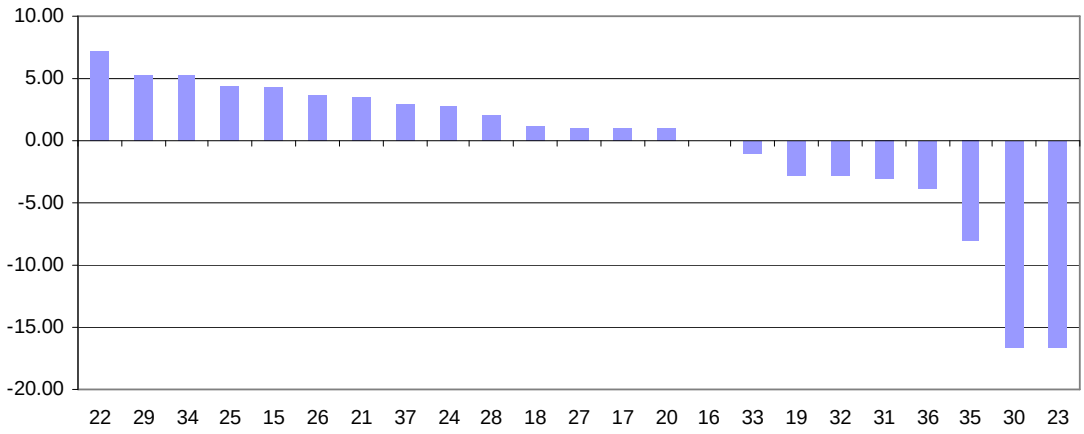
Share of exporters in per cent, 2002 and 2006



Note: The numbers on the horizontal axis refer to the respective NACE industry.

Figure 2

Change in industry export participation in percentage points, 2002-2006

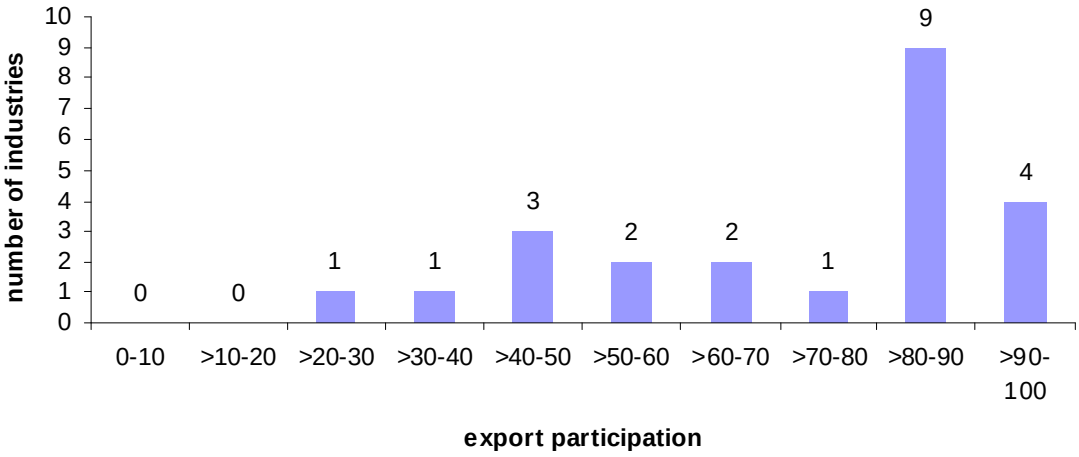


Note: The numbers on the horizontal axis refer to the respective NACE industry.

In Figure 3 we show the distribution of industry export participation across NACE industry 15-37. Industry export participation in Austrian manufacturing was 80% or more in 12 industries in 2006.

Figure 3

Industry export participation rates (2006)



Note: Total number of industries is 23.

The high industry export participation in most industries implies that in the case of the Austrian economy, knowing the industry a firm belongs to, helps predicting whether the firm is an exporter or not. For example, picking randomly a food producing firm implies a probability of only 20%-30% that the firm is exporting, which contrasts largely with the average expectation of 56% in favour of picking an exporting firm in entire manufacturing sector. Likewise, knowing that a firm is producing motor vehicles raises the probability of

randomly drawing an exporting firm to 80%-90%. Nevertheless, there remains significant uncertainty about the export status of a particular firm, in particular for those firms belonging to the industry bins with medium export participation, i.e. those with export participation greater than 30% and less than 70%. In these cases, the information about the firms' industry is of limited value with respect to the export status of a particular firm[12]. This phenomenon causes difficulty for traditional trade theory because it suggests that there should exist only pure 'export sectors' (of which there is only one in Austria) and (non-exporting) import-competing sectors in case of trade based on comparative advantages (of which there is none) and full export participation of firms in parallel with imports in case of trade based on differentiated products and love for variety on the side of consumers. This highlights the importance of considering firm heterogeneity in the field of international trade.

4.2 Firm export intensity

In addition to export participation on an industry level our data allows us to make inferences about export intensity of firms. To this end all firms in the sample are classified according to the share of exports in their total sales ('export intensity'). Obviously, non-exporting firms' export intensity is zero ('none'), whereas we label exporters which export up to 5% of their sales as having 'marginal' export intensity. Exporters with exports between 5% and 30% of total sales are considered to have 'low to medium' export intensity. 'High intensity' indicates that firms' exports account for more than 30% and up to 50% of sales and for 'very high intensity' exporters this share is above 50%[13].

What type of distribution should we expect for firm export intensity? The guidance provided by theory is limited because it does not suggest a unique pattern. Melitz' workhorse heterogeneous firm model assumes identical countries with symmetric trade costs. In this set-up, there emerge only two groups of firms – non-exporters and exporters with the latter all generating the same relative share of their revenues from exporting, i.e. identical export intensity. It requires cross-country differences in terms of market size, average productivity of industries or factor endowment and/or varying degrees of bilateral trade costs to allow for varying export intensities of firms within the same country (e.g. Melitz and Ottaviano, 2008, appendix 2). Albeit simulations for the firm export intensity of individual countries exist (Bernard, Eaton, Jensen and Kortum, 2003 for the US or Del Gatto, Mion and Ottaviano, 2007 for France) there is no unique pattern to be derived from the analytical models. Rather, the distribution will depend on the size of the exporting country, comparative advantages, the country's openness, the number and openness of its trading

[12] Bernard et al. show that for the US economy even more uncertainty about the export status of firms remains once the industry they belong to is known, even though their calculations are based on plant-level data and 4-digit industry level (Bernard, Eaton, Jensen and Kortum, 2003).

[13] We do not have knowledge about the exact export sales figures of firms but we know the number of firms in each export intensity group.

partners and the differences in trade costs among trading partners. All these factors may vary widely from industry to industry within one country, so we may expect very different patterns to emerge. This is indeed the case in Austrian manufacturing as an inspection of the firm export intensity within Austrian manufacturing and individual industries reveals. Table 3 provides an overview of the export intensities of Austrian manufacturing firms across industries. Panels (a) to (d) in Figure 4 show the distributions of firm export intensity graphically.

Table 3

Firm export intensity by NACE industries (2006) – number of firms

NACE	Industry	Non-exporters	Marginal	Low to medium	High	Very high	Total
15	Food and beverages	862	115	122	46	51	1196
16	Tobacco products	0	0	1	0	0	1
17	Textiles	21	7	21	23	72	144
18	Wearing apparel	20	3	22	14	23	82
19	Leather	4	3	2	1	14	24
20	Wood	296	54	89	52	113	604
21	Pulp and paper	7	7	14	11	43	82
22	Publishing and printing	152	141	117	18	24	452
23	Refined petroleum	2	0	1	1	0	4
24	Chemicals	13	8	26	15	65	127
25	Rubber and plastic products	23	13	58	34	95	223
26	Non-metallic mineral products	197	33	58	14	35	337
27	Basic metals	2	3	10	11	68	94
28	Fabricated metal products	487	146	198	78	146	1055
29	Machinery and equipment	56	43	84	58	298	539
30	Office machinery and computers	2	0	0	0	4	6
31	Electrical machinery	28	9	28	12	67	144
32	Radio, TV, communication	5	2	7	8	29	51
33	Precision & optical instruments	130	20	19	16	71	256
34	Motor vehicles	10	10	14	8	50	92
35	Other transport equipment	3	1	3	3	11	21
36	Manufactures n.e.c.	464	65	110	47	80	766
37	Recycling	5	1	3	2	15	26
15-37	Total manufacturing	2789	684	1007	472	1374	6326

Note: Export intensities are defined as follows: non-exporters = 'none'; >0% - 5% of turnover exported = 'marginal'; >5% - 30% of turnover exported = 'low to medium'; >30% - 50% of turnover exported = 'high'; >50% of turnover exported = 'very high'.

At the aggregated level, the Austrian manufacturing sector in our sample is populated by a large number of non-exporters – about 44% in 2006 (Panel (a) of Figure 4). Within the group of exporters, the number of firms is rather unevenly distributed across export intensities but with a higher number of very high export intensity firms. Together with the peak in the group of non-exporters this results in a bimodal distribution. A similar bimodal

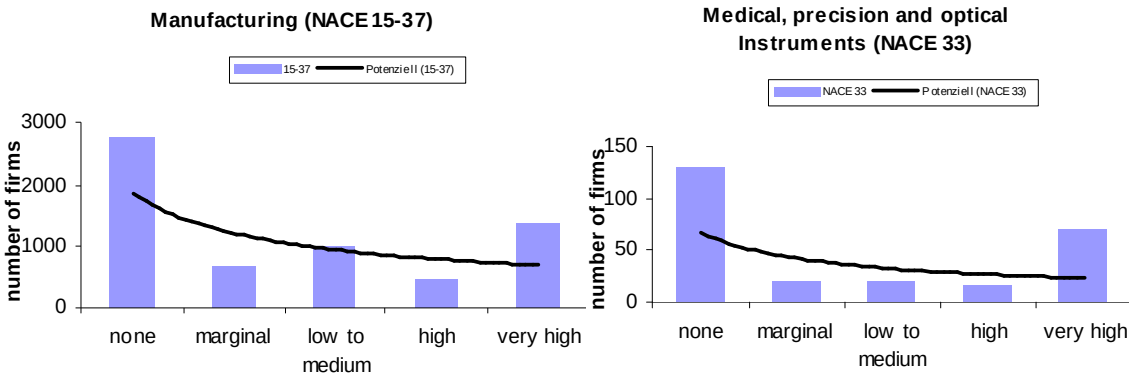
distribution also occurs in the medical, precision and optical instruments industry (NACE 33) and the wood industry (NACE 20). In the former industry, 130 non-exporting firms coexist with a significant number of firms with very high export intensity (71) and hardly any firms in between. This pattern, however, is rather the exception across industries. In the case of the entire manufacturing sector the bimodal distribution results from different patterns observed in individual industries. It thus does not provide a representative picture of the firm export intensity in individual manufacturing industries. This is also the case for the high share of non-exports which – as pointed out already above – mainly reflects the large number of non-exporters in two industries (food and beverages and fabricated metals).

In Panel (b) of Figure 4 the distribution of firm export intensity for food and beverages (NACE 15) and publishing and printing (NACE 22) is shown. These industries are characterized by a large number of firms with no exports or low export intensity. We stress again, however, that this pattern is not the ex-post distribution after the self-selection process of firms into exporting as would be expected from the Melitz (2003) model for example.

Figure 4 (a) - (d)

Patterns in the distribution of firm export intensity (2006)

Panel (a) Industries with bimodal distribution



Panel (b) Low export intensity industries

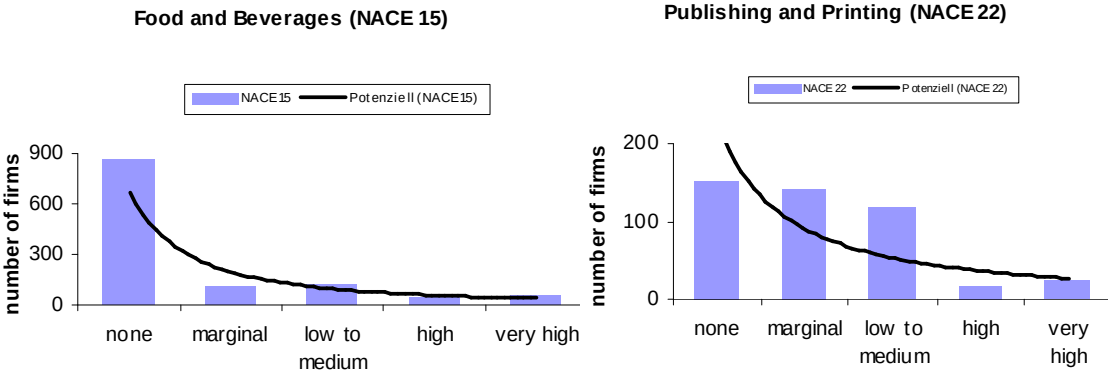
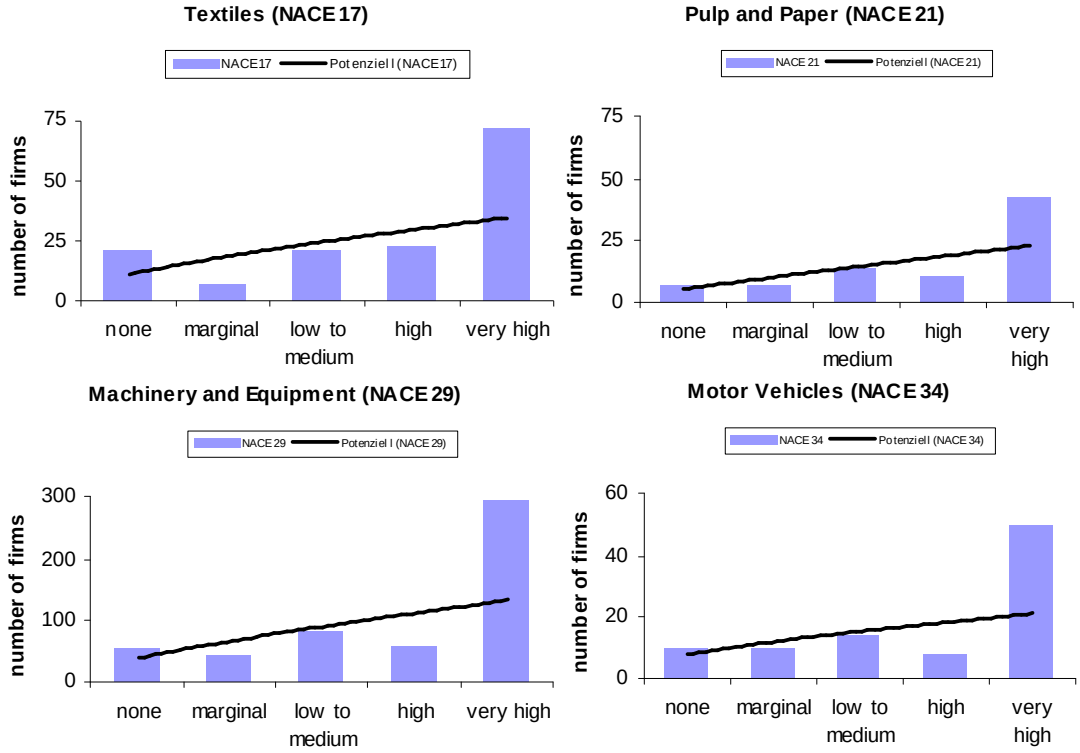


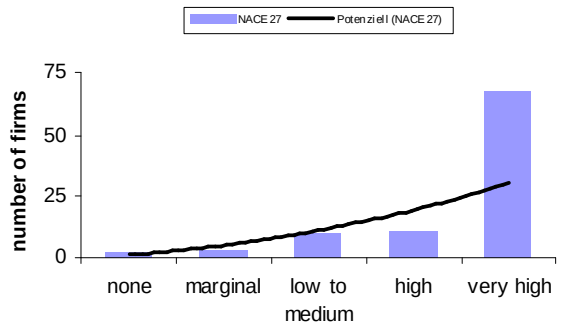
Figure 4 (a) - (d) continued

Figure 4 (a) - (d) (continued)

Panel (c) Export oriented industries



Panel (d) Pure export industries



The low export intensities could reflect comparative disadvantages, high trade costs, including non-tariff barriers such as food safety regulation, and highly differentiated consumer preferences with a strong national bias.[14] Despite featuring a similar pattern, there exists a major difference between the food and beverages industry and publishing and printing. In the latter we find a much higher number of marginal and low to medium intensive exporters, pointing towards a lower export cut-off level in the publishing industry. Export intensity may, however, be limited due to existing language barriers which limits the number of potential export markets – in the Austrian case to Germany and Switzerland.

[14] Austrian trade data suggest a revealed comparative advantage (RCA) in the food and beverages industries in 2006, but there exist pronounced differences in consumer preferences, for example in alcoholic drinks such as beer or wine but also in dairy products, including cheese. The RCA for the publishing and printing industry is negative and among the most pronounced (2006) (wiiw calculations based on COMEXT data).

The predominant pattern found in our sample of the Austrian manufacturing industries is one with bulk of firms are exporters with very high export intensity. Examples of those are shown in Panel (c) of Figure 3 which occurs in eight industries out of 21[15]. Most of these industries – including machinery and equipment (NACE 29) and motor vehicles (NACE 34) – are also characterized by high increasing returns to scale. The textile industry demonstrates, however, that also industries with low increasing returns to scale may display such a pattern[16]. The textile industry is also the only one among the four industries in Panel (c) for which Austrian trade data does not indicate a revealed comparative advantage (RCA) vis-à-vis the rest of the world. In all industries shown in Panel (c) 50% or more of the firms generate more than half of their total revenue from exports. We associate this pattern with the situation of a small open economy such as Austria[17]. The pattern would be consistent with the expected situation in comparative advantage industry in an environment with low trading costs. Resource reallocations induced by trade towards most productive firms are strongest in comparative advantage industries which lead to a situation where the domestic cut-off productivity level and the export productivity level move closer together resulting in a high number of exporters (Bernard – Redding – Schott, 2007). Low trading costs and small differences in trading costs among major trading partners – which is the case due to the high share of intra-EU trade in Austrian exports (70% in 2006 according to COMEXT data) allow exporters to serve a wide array of foreign markets. In combination with a small domestic market these factors result in a (very) high share of revenues earned in export markets.

This allows us to return to Panel (a) of Figure 4 to interpret the pattern that emerges for the entire manufacturing sector. As mentioned before, the overall shape of the distribution is not necessarily representative of individual industries but rather reflects the existence of comparative disadvantage industries with relatively important trade barriers and a series of comparative advantage industries with the majority of firms heavily engaged in exporting, including almost 1,400 firms with very high export intensity. A factor that we can not take into account due to lack of information is the impact of foreign direct investment (FDI) and foreign ownership on firm export intensities. If foreign firms set up subsidiaries in Austria, these firms are supposed to be among the most productive ones (Helpman, Melitz and Yeaple, 2004). We lack, however, information on ownership status as to investigate this issue and the impact of FDI on the distribution of firm export intensities found in our data.

There exists also a fourth type of distribution of firm export intensity (Panel (d) of Figure 4) which we can distinguish – although it may also be considered as a sub-case of the export

[15] We deal with 21 instead of 23 industries because the tobacco industry (NACE 16) and the refined petroleum industry (NACE 23) are omitted due to the very low number of firms.

[16] For a recent overview of studies on scale economies see World Bank (2009).

[17] We admit, however, that the cumulation of firms in the very high export intensity group may partially be due to the rather broad definition of that group, which includes a bandwidth of 50% to 100% of exports in total turnover.

orientated industries. We label this 'pure export industry' pattern. As the sole representative of this type of pattern we identified the basic metal industry (NACE 27), where almost all firms are exporting (92 out of 94) and the large majority of firms (68 out of 94) have very high export intensity.[18]

For the sake of completeness we also report the relative share of the different export intensities within the group of exporting firms only (Table 4). This way of presenting the data highlights the fact that a large fraction of exporting firms has very high export intensity, standing at 39% for the entire manufacturing sector and reaching 74% in the basic metals industry (NACE 27) and 70% in the leather industry (NACE 19). In the computer industry (NACE 30) all exporting firms have a very high export intensity but these are only four firms.

Table 4

Firm export intensities (2006), relative shares within group of exporting firms

NACE		Marginal	Low to medium	High	Very high
15	Food and beverages	34.4	36.5	13.8	15.3
16	Tobacco products	0.0	100.0	0.0	0.0
17	Textiles	5.7	17.1	18.7	58.5
18	Wearing apparel	4.8	35.5	22.6	37.1
19	Leather	15.0	10.0	5.0	70.0
20	Wood	17.5	28.9	16.9	36.7
21	Pulp and paper	9.3	18.7	14.7	57.3
22	Publishing and printing	47.0	39.0	6.0	8.0
23	Refined petroleum	0.0	50.0	50.0	0.0
24	Chemicals	7.0	22.8	13.2	57.0
25	Rubber and plastic products	6.5	29.0	17.0	47.5
26	Non-metallic mineral products	23.6	41.4	10.0	25.0
27	Basic metals	3.3	10.9	12.0	73.9
28	Fabricated metal products	25.7	34.9	13.7	25.7
29	Machinery and equipment	8.9	17.4	12.0	61.7
30	Office machinery and computers	0.0	0.0	0.0	100.0
31	Electrical machinery	7.8	24.1	10.3	57.8
32	Radio, TV, communication	4.4	15.2	17.4	63.0
33	Precision & optical instruments	15.9	15.1	12.7	56.4
34	Motor vehicles	12.2	17.1	9.8	61.0
35	Other transport equipment	5.6	16.7	16.7	61.1
36	Manufactures n.e.c.	21.5	36.4	15.6	26.5
37	Recycling	4.8	14.3	9.5	71.4
15-37	Total manufacturing	19.3	28.5	13.3	38.8

Note: Export intensities are defined as follows: non-exporters= 'none'; >0%-5% of turnover exported = 'marginal'; >5% - 30% of turnover exported = 'low to medium'; >30%-50% of turnover exported = 'high'; >50% of turnover exported = 'very high'

[18] Again, we do not consider the tobacco industry to be a pure export industry because it consists of only one firm.

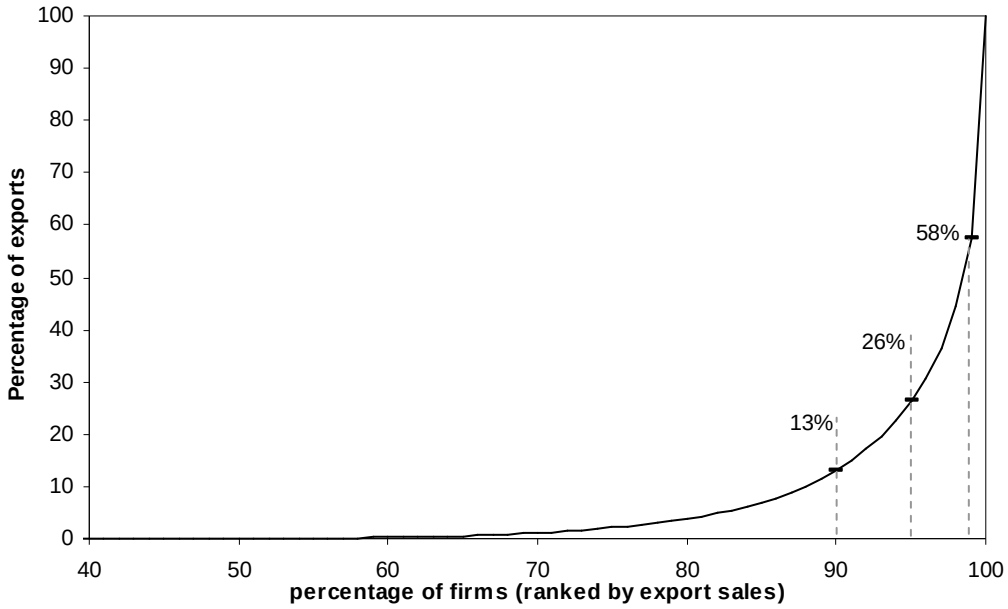
This type of representation also has the advantage that the aggregate result for manufacturing (NACE 15-37) reflects somewhat better the pattern found in the majority of individual industries because it removes the first peak in the bimodal distribution.

4.3 Export concentration

Despite the high export intensity of Austrian manufacturing firms, it is nevertheless a rather small number of firms that account for the bulk of total exports. To arrive at this conclusion we had to make assumptions about firms' export sales for which we could not get exact data. Instead we used information on the export intensity of firms (non-exporter, low, low-to-medium, large and very large export intensity) and assumed that all exporters of a particular group exports the average percentage of the group. For example, a marginal exporter – which we know exports between 0% and 5% of its sales – is assumed to export 2.5% of its total sales and likewise for all other groups of firms[19].

Figure 5

Export concentration in the Austrian manufacturing sector (2006)



Using this assumption we derived a very crude proxy of Austrian manufacturing firms' export sales. By ranking firms according to these calculated export sales we can calculate the export concentration in the manufacturing sector. We find that the largest 1% of firms account for no less than 42% of exports in 2006. Moreover, the largest 5% and 10% make up for 74% and 87% of total exports respectively[20]. This high export concentration among

[19] Calculations based on the upper and the lower bound of the bandwidth of the respective groups instead of averages only yield marginal differences. A better account of the export concentration could only be achieved by using the shares of exports in total sales which is not available to us.

[20] In the calculation of the percentiles non-exporters are included.

the largest exporters is graphically shown in Figure 5. The graph of the cumulative distribution function of exports increases very slow and the first 90%, and 95% of firms only account for 13% and 26%% of exports but the slope of the graph gets very steep in the segment of the largest 10% of the firms.

4.4 Size measures of Austrian exporters

So far we have mainly analysed the role of exporting firms in the Austrian economy by just looking at the number of firms and a measure of export concentration. We now turn to the firm characteristics, starting with size measures[21]. In particular we are interested in firm sales, employment, wages and salaries (henceforth 'wage sum') and gross investments undertaken by firms. We start with an overview of the sum of sales, persons employed, investments and the wage sum paid out by firm type for the year 2006 which are reported in Table 5.

A first observation is that the firms for which we do not have information on their export status – we only have this information for approximately 6,300 firms out of a total of roughly 28,700 firms in 2006 – matter much less in terms of sales, employment, wage sum and investment than their number would suggest.[22] Our sample of firms with known export status (column 3 in Table 5) covers 90% or more of total manufacturing sales, the wage sum paid and gross investments and still over 85% of manufacturing employment (columns 8 and 9 in Table 5)[23]. Considering the firms with known export status only, it is obvious that the share of exporters in terms of all size measures is considerably higher than their share of 56% in terms of the number of firms (column 6 in Table 5). Exporters account for nearly 90% of manufacturing sales and investment and still 84% of employment. If we assumed that all firms in the dataset for which we have no information on the export status are non-exporters, the share of exporters would still be 84% in terms of sales and investment and 72% in terms of employment (column 8 in Table 5).

The fact that exporters – and especially firms with very high export intensity – account for a larger share of sales, employment, wage sum and investments than their share in terms of the number of firms, implies that exporters, on average, are larger than their purely domestic peers in all these dimensions. Since this is a major point we make it explicit and present average firm sizes by type of firms and by industry in Tables 6 to 9. This tables show the averages for the years 2002 to 2006.

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[21] Performance measures will be dealt with in Section 4.5.

[22] The reason for this is the sampling in both surveys and the fact that exporters are larger.

[23] The number of firms for which the export status and the size measures of interest are known is slightly less than the one reported in the previous sections because we lose some firms due to confidentiality constraints, i.e. in our sample all information on firms is suppressed in case the number of firms in the respective firm grouping (e.g. non-exporters) is less than four.

Table 5

Exporters' role in manufacturing in terms of sales, employment, wage sum and investment

Size variable	(1) Exporters	(2) Non-exporters	(1)+(2)=(3) Total of firms with export status known	(4) Firms with export status unknown	(3)+(4)=(5) Total industry	(1) / (3) = (6) Exporters in % of total with export status known	(2) / (3) = (7) Non-exporters in % of total with export status known	(1) / (5) = (8) Exporters in % of total industry	(2) / (5) = (9) Non-exporters in % of total industry
Sales (EUR million)	113676	12992	126669	8523	135192	89.7	10.3	84.1	9.6
Employment	445477	87384	532861	81711	614572	83.6	16.4	72.5	14.2
Wages and salaries (EUR million)	16990	2416	19403	1360	20764	87.6	12.5	81.8	11.6
Gross investment (EUR million)	4848	590	5443	362	5803	89.1	10.8	83.5	10.2
Number of firms	3507	2780	6287	22384	28671	55.8	44.2	12.2	9.7

The comparison between exporters and non-exporters in terms of size measures clearly documents that exporters are much larger compared to their purely domestically operating peers. For the manufacturing sector (NACE 15-37) this result holds true for all size measures. For example, exporters are on average more than seven times as large as non-exporters in terms of sales and they employ more than four times as many personnel. Moreover, average firm size is also steadily increasing with export intensity. Marginal exporters are already somewhat larger than exporters and firms with very high export intensity are by far the largest. For example, exporters with very high export intensity invest far more than ten times the amount than non-exporters and employ almost seven times as many people. The size premia reported here – i.e. the ratio between the average size of exporters and non-exporters – are calculated as global averages over exporters and non-exporters. Note, however, that if we do not pool all manufacturing firms by the type of firm and then calculate averages but calculate unweighted industry averages instead, the 'size premia' of exporters appear to be less pronounced. The difference comes about mainly by the fact that the unweighted industry averages do not take into account the relative importance of sectors (in terms of number of firms). In contrast, this way of calculating averages captures the fact that the firm size – independent of the export status – varies considerably among industries, an aspect that is lost in the global average.

The major result found for aggregate manufacturing, i.e. that exporters are larger than non-exporting firms, is also found in most industries with only few exceptions[24]. When considering averages of sales, employment numbers, wage sum and investment across the years 2002 to 2006, only two 'anomalies' are found, meaning that non-exporting firms turn out to be larger than exporters. These anomalies occur in the chemical industry (NACE 24), where the average exporting firm – albeit being larger in terms of sales and investment – employs on average less people (201 against 292) and also pays out a lower wage sum (EUR 8.4 million against 12.6 million) than the average non-exporting firms. Non-exporters even turn out to be larger than firms with very high export intensity[25]. We do not have a clear explanation at hands for this anomaly but can only speculate that some of the largest firms do not report any exports in their accounts because their export operations are handled by an independent export company and not organized in-house.

In addition to exporters being larger on average, the pattern that firm size is increasing with export intensity is also found in individual industries. It is, for example, clearly present in the food and beverages industry (NACE 15). The gap between exporters and non-exporters is among the largest in this industry and exporters firm size is neatly increasing with export

[24] Although there are large and interesting differences between industries with regards to size measures, our interest here is in differences between the different types of firms within individual industries.

[25] When looking only at the figures for the year 2006, for example, a couple of additional 'anomalies' occur, notably in the sales of firms in the automotive industry (NACE 34) and in the investment activities of firms in the leather industry (NACE 19) and the rubber and plastics industry (NACE 25). As can be seen in Figures 6 and 9, these seem to be due to particularities in the year 2006 which disappear in the average figures for the period 2002-2006.

intensity along all dimensions. We would interpret this as the co-existence of two different types of firms: a first group of small-scale producers that survive in the domestic market due to proximity to consumers and possibly superior knowledge about consumer preferences; and a second group of firms which are much larger and which produce mainly for international markets. Another sector, where the pattern turns out very nicely is the basic metals industry (NACE 28). In this sector, the situation, however, is slightly different insofar as the difference in size between non-exporters and marginal exporters is relatively small but firms with very high export intensity are really big compared to all other firms. This suggests that in the metal industry the difference between the big players and all other firms including other exporters is larger than the difference between non-exporters and exporters, whereas in the food industry the dividing line is rather between non-exporters and exporters. There are several other industries where the difference in size is most pronounced for firms with very high export intensity and modest between non-exporters and marginal exporters. Examples include the textile industry (NACE 17) and the rubber and plastic industry (NACE 25). In these industries the average marginal exporter is even smaller than the average non-exporter. In the paper industry (NACE 21) non-exporters are relatively large not only compared to marginal exporters but also compared to firms with low-to-medium export intensity. They even invest more and have higher average sales than exporters with high export intensity. In contrasts, they are considerably smaller than the average firm with very high export intensity.

An interesting phenomenon appears in the electrical and optical equipment industry (NACE 32), where the difference between the average exporter and non-exporter is largest – reaching a ratio almost 17 for sales – but the largest firms turn out to be the high intensity exporters and not those with very high export intensity. Moreover, the difference is quite significant with the former selling about three times the value of the latter and employing close to three times as many personnel.

In conclusion we can establish that the size premium of manufacturing exporters is considerable reaching a factor of 7.2 for sales, 4.1 for employment, 5.5 for the wage sum and 6.2 for investment. Moreover, the size premium varies considerably over individual exporters. Given the size advantage of exporters, heterogeneous firm models predict that exporters should also be more productive, an issue we will investigate in the subsequent sub-section along with other performance measures.

Table 6

Sales per firm in thousand EUR, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Size premium
15	Food and beverages	2755	30005	20956	28727	42358	46163	9727	10.9
16	Tobacco products								
17	Textiles	4926	14726	2031	6645	7971	20249	13302	3.0
18	Wearing apparel	1187	12004	2879	5528	7171	23830	9568	10.1
19	Leather	8280	35008			3247	45337	30636	4.2
20	Wood	2478	16433	5813	8672	12333	29488	9784	6.6
21	Pulp and paper	40267	67429	4083	20483	51346	97581	64612	1.7
22	Publishing and printing	3651	12843	11401	10322	10369	37253	9464	3.5
23	Refined petroleum								
24	Chemicals	43820	68254	13866	28167	52488	97870	65764	1.6
25	Rubber and plastic products	7285	23070	5705	10315	26834	32869	21157	3.2
26	Non-metallic mineral products	8334	26241	15020	14743	41560	48434	15571	3.1
27	Basic metals	6859	102336	6363	58470	34364	127062	98358	14.9
28	Fabricated metal products	3635	13993	5093	8564	14243	28922	9134	3.8
29	Machinery and equipment	10370	27925	8760	11309	13891	39294	25845	2.7
30	Office machinery and computers		81955				81955	81955	
31	Electrical machinery	7753	43375	10971	19543	16988	67658	37481	5.6
32	Radio, TV, communication	9455	159227		49595	407721	130719	144282	16.8
33	Precision & optical instruments	2294	11073	3789	2823	6352	17184	6766	4.8
34	Motor vehicles	112741	147415	19846	23774	25035	226424	143166	1.3
35	Other transport equipment		126348			67698	147676	126348	
36	Manufactures n.e.c.	1512	10684	2672	6816	13348	22529	5484	7.1
37	Recycling	4002	16066			14025	17086	13427	4.0
15-37	Total manufacturing	4144	29892	9926	13610	26092	53771	18418	7.2
	Unweighted industry average	14821	49829	8703	18500	43467	65980	44849	5.7

Table 7

Employment per firm in persons, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Size premium
15	Food and beverages	29	112	101	112	129	124	51	3.9
16	Tobacco products								
17	Textiles	40	102	22	49	68	135	93	2.6
18	Wearing apparel	20	101	45	54	64	183	82	5.1
19	Leather	78	193			36	244	174	2.5
20	Wood	25	76	48	64	52	110	52	3.0
21	Pulp and paper	126	225	38	119	231	288	214	1.8
22	Publishing and printing	29	62	59	54	58	127	50	2.1
23	Refined petroleum								
24	Chemicals	292	201	91	124	177	258	211	0.7
25	Rubber and plastic products	59	127	41	79	141	166	118	2.2
26	Non-metallic mineral products	47	164	86	83	226	345	94	3.5
27	Basic metals	47	350	59	196	110	434	337	7.4
28	Fabricated metal products	30	86	46	61	88	152	60	2.9
29	Machinery and equipment	75	144	80	74	91	187	135	1.9
30	Office machinery and computers		113				113	113	
31	Electrical machinery	61	207	88	107	94	305	183	3.4
32	Radio, TV, communication	66	620		249	1433	530	565	9.4
33	Precision & optical instruments	25	79	42	27	47	115	52	3.2
34	Motor vehicles	46	414	67	95	93	621	369	9.0
35	Other transport equipment		355			215	406	355	
36	Manufactures n.e.c.	20	75	34	59	95	125	44	3.8
37	Recycling	20	38			31	41	34	1.9
15-37	Total manufacturing	32	132	62	76	119	215	88	4.1
	Unweighted industry average	59.7	183.0	59.2	94.5	174.0	238.5	161.2	3.7

Table 8

Wage sum per firm in thousand EUR, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Size premium
15	Food and beverages	593	3532	3211	3316	4181	4403	1345	6.0
16	Tobacco products								
17	Textiles	1059	2866	505	1166	1768	3903	2603	2.7
18	Wearing apparel	315	2115	798	1172	1428	3823	1710	6.7
19	Leather	1701	4341			696	5526	3909	2.6
20	Wood	573	2198	1172	1728	1455	3397	1424	3.8
21	Pulp and paper	4829	8728	1057	4198	8430	11554	8323	1.8
22	Publishing and printing	1109	2384	2221	2138	2232	4833	1915	2.1
23	Refined petroleum								
24	Chemicals	12645	8406	3341	4508	6805	11272	8838	0.7
25	Rubber and plastic products	1619	4048	1193	2241	4555	5510	3754	2.5
26	Non-metallic mineral products	1595	5888	3044	2847	9081	12100	3330	3.7
27	Basic metals	1623	13815	1819	7583	4176	17226	13307	8.5
28	Fabricated metal products	841	2881	1330	1939	2812	5537	1924	3.4
29	Machinery and equipment	2550	5423	2837	2560	3105	7261	5083	2.1
30	Office machinery and computers		4062				4062	4062	
31	Electrical machinery	1896	7477	2850	4225	3319	10953	6554	3.9
32	Radio, TV, communication	2813	31056		12172	87316	23043	28237	11.0
33	Precision & optical instruments	624	2763	1043	858	1748	4170	1713	4.4
34	Motor vehicles	1388	15483	1918	2988	3108	23591	13756	11.2
35	Other transport equipment		14528			8348	16775	14528	
36	Manufactures n.e.c.	416	2113	753	1562	2803	3817	1151	5.1
37	Recycling	703	1227			876	1403	1113	1.7
15-37	Total manufacturing	856	4732	1972	2458	4541	7931	3005	5.5
	Unweighted industry average	2046.9	6920.7	1818.3	3364.8	7912.1	8769.5	6122.81	4.4

Table 9

Total investment per firm in thousand EUR, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Size premium
15	Food and beverages	153	1416	1235	1353	1876	1626	476	9.3
16	Tobacco products								
17	Textiles	205	529	47	274	236	734	482	2.6
18	Wearing apparel	54	275	130	104	123	572	225	5.1
19	Leather	235	688			60	892	614	2.9
20	Wood	134	813	214	441	655	1463	489	6.1
21	Pulp and paper	3412	4577	177	1781	4395	6272	4456	1.3
22	Publishing and printing	349	606	513	452	561	2038	511	1.7
23	Refined petroleum								
24	Chemicals	3439	3862	1089	1589	1702	5824	3819	1.1
25	Rubber and plastic products	1044	1186	208	482	984	1854	1169	1.1
26	Non-metallic mineral products	491	1904	960	890	2652	4143	1062	3.9
27	Basic metals	555	6188	204	2779	1275	7961	5954	11.1
28	Fabricated metal products	192	741	265	423	703	1603	483	3.9
29	Machinery and equipment	524	982	351	401	667	1337	928	1.9
30	Office machinery and computers		437				437	437	
31	Electrical machinery	316	1345	259	420	572	2194	1175	4.3
32	Radio, TV, communication	542	7298		3487	9251	7847	6623	13.5
33	Precision & optical instruments	63	595	118	143	475	925	334	9.4
34	Motor vehicles	1799	6895	235	484	1274	10893	6270	3.8
35	Other transport equipment		3374			2488	3696	3374	
36	Manufactures n.e.c.	72	383	105	203	484	856	206	5.3
37	Recycling	579	1016			864	1092	920	1.8
15-37	Total manufacturing	230	1429	498	629	1080	2635	895	6.2
	Unweighted industry average	745.2	2148.1	381.9	923.9	1564.9	3060.0	1905.1	4.7

4.5 Performance measures of Austrian exporters

In the previous sub-section we have seen that exporting firms in Austria are larger in terms of various size measures. Following empirical evidence, theoretical models predict that there also exist export premium for productivity measures. This chapter will give an overview on performance measures with respect to exporting and non-exporting firms using descriptive analysis. The findings for both size and performance premia will be underlined in the next section with econometric evidence following the approach introduced by Bernard and Jensen (1999).

The performance measures considered are labour productivity defined as production value per employee, investment intensity and wages per employee. In order to get rid of temporary shocks and short-term fluctuations, the average over the second sample period, the years 2002-2006, has been calculated. Table 10 shows investment intensity including

investment in fixed assets, machines, equipment and software per industry. The global average over all manufacturing firms shows that the investment intensity of exporters is higher by a factor of 1.8 compared to non-exporters. The difference is exceptionally high for the food and beverages industry (NACE 15). As stated before, we interpret this as a result of two different types of firms: a group of specialized firms producing small quantities for the local market versus a growing number of capital intensive, more industrialized exporters. Similar results for industries with a sufficiently large number of firms in order to compare the results can be found for the industries wood and wood products (NACE 20), chemicals (NACE 24), electrical machinery (NACE 31) and medical, precision and optical instruments (NACE 33). The anomaly in the sector motor vehicles (NACE 34) is driven by a small number of companies in the last years of the sample and gets smaller when looking at the median exporter instead of the average exporter but still remains[26].

Table 10

Investment intensity in thousand EUR, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Performance premium
15	Food and beverages	3.7	11.7	10.5	11.7	15.1	11.3	5.7	3.2
16	Tobacco products								
17	Textiles	3.3	4.3	1.8	4.2	3.1	4.9	4.1	1.3
18	Wearing apparel	1.9	1.9	2.2	2.0	1.3	2.0	1.9	1.0
19	Leather	3.2	2.9			1.1	3.5	3.0	0.9
20	Wood	4.9	10.1	5.9	8.9	12.3	12.0	7.6	2.1
21	Pulp and paper	12.3	16.0	5.1	9.9	20.7	18.6	15.6	1.3
22	Publishing and printing	8.6	9.1	9.7	8.0	10.9	9.1	8.9	1.1
23	Refined petroleum								
24	Chemicals	10.5	34.0	17.7	8.4	8.9	54.2	31.6	3.2
25	Rubber and plastic products	9.2	8.1	4.7	7.0	7.0	9.7	8.2	0.9
26	Non-metallic mineral products	9.0	9.6	9.8	9.3	9.7	9.7	9.2	1.1
27	Basic metals	12.5	11.0	2.5	8.3	10.1	12.2	11.1	0.9
28	Fabricated metal products	5.5	7.7	7.0	7.2	9.8	8.1	6.7	1.4
29	Machinery and equipment	5.7	7.0	5.9	7.2	7.1	7.0	6.8	1.2
30	Office machinery and computers		3.5				3.5	3.5	
31	Electrical machinery	3.4	5.7	2.6	3.9	5.1	7.4	5.3	1.7
32	Radio, TV, communication	5.8	10.3		11.0	9.5	10.4	9.9	1.8
33	Precision & optical instruments	2.4	8.3	3.7	3.9	27.0	7.7	5.4	3.4
34	Motor vehicles	29.1	10.5	6.1	6.2	15.5	11.9	12.8	0.4
35	Other transport equipment		8.0			6.4	8.6	8.0	
36	Manufactures n.e.c.	3.5	4.0	3.5	3.6	4.0	5.2	3.8	1.1
37	Recycling	23.7	28.5			20.0	32.7	27.4	1.2
15-37	Total manufacturing	5.0	9.0	7.5	7.4	9.4	10.8	7.2	1.8
	Unweighted industry average	8.3	10.1	6.2	7.1	10.2	11.9	9.4	1.5

[26] Anomalies that appear in industries with very few non-exporting firms are not further discussed. Examples are the leather (NACE 19) and basic metals (NACE 27) industries for investment intensity as well as other transport equipment (NACE 37) when looking at wages.

Following the finding that exporting firms are usually more capital intensive we expect (measured) labour productivity to be higher. Table 11 provides information on the production value per employee. The results show that the labour productivity premium of exporters across industries is 2 with an average production value of about 180 thousand EUR per employee and year. These findings exceed the labour productivity premium of exporters expected from the investment pattern and clearly indicate a productivity advantage of exporters. As expected, labour productivity is also rising within the group of exporters depending on the export intensity. We observe that those firms with very high export intensity (above 50% of revenues generated by exports) have by far the highest labour productivity, exceeding the one of non-exporters by a factor of 2.6.

Table 11

Labour productivity in thousand EUR, average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Performance premium
15	Food and beverages	68.0	229.3	178.4	232.9	309.7	275.1	109.3	3.4
16	Tobacco products								
17	Textiles	76.8	118.7	77.3	94.8	94.0	136.8	112.6	1.5
18	Wearing apparel	45.9	94.9	59.1	87.4	92.9	114.4	83.9	2.1
19	Leather	91.6	132.9			73.5	152.2	126.1	1.5
20	Wood	86.7	168.8	107.7	128.2	182.0	223.7	129.7	1.9
21	Pulp and paper	181.3	501.6	100.8	149.3	181.5	766.2	468.4	2.8
22	Publishing and printing	107.7	165.3	175.4	149.0	152.9	193.1	144.1	1.5
23	Refined petroleum								
24	Chemicals	178.5	654.0	218.3	163.9	232.2	1042.0	605.5	3.7
25	Rubber and plastic products	113.4	140.6	102.8	112.8	154.8	160.2	137.3	1.2
26	Non-metallic mineral products	152.8	152.9	139.9	161.2	162.3	147.5	152.9	1.0
27	Basic metals	159.2	263.9	85.5	194.1	278.7	285.0	259.6	1.7
28	Fabricated metal products	96.8	133.5	103.0	117.6	140.9	177.8	116.3	1.4
29	Machinery and equipment	114.7	161.7	103.0	129.2	147.5	183.9	156.1	1.4
30	Office machinery and computers		365.4				365.4	365.4	
31	Electrical machinery	129.3	166.3	111.8	129.8	153.6	199.3	160.2	1.3
32	Radio, TV, communication	119.2	181.0		155.7	151.3	194.5	174.9	1.5
33	Precision & optical instruments	57.4	119.8	76.0	79.4	113.6	148.9	89.2	2.1
34	Motor vehicles	1734.0	208.8	122.0	157.8	271.3	231.1	395.7	0.1
35	Other transport equipment		259.2			164.6	293.6	259.2	
36	Manufactures n.e.c.	63.2	91.1	72.2	82.4	102.1	115.7	75.3	1.4
37	Recycling	247.2	288.5			322.6	271.5	279.5	1.2
15-37	Total manufacturing	91.8	180.1	129.6	136.6	165.7	244.1	140.8	2.0
	Unweighted industry average	201.2	219.0	114.6	136.8	174.1	270.4	209.6	1.7

The industries with the highest labour productivity appearing in our sample are pulp and paper (NACE 21), chemicals (NACE 24), office machinery and computer (NACE 30) and

motor vehicles (NACE 34). With the exception of motor vehicles[27], these industries are also characterized by a high difference in labour productivity between exporters and non-exporters. The most labour intensive industry on the other hand are wearing apparel (NACE 18), medical, precision and optical instruments (NACE 33) and manufactures not elsewhere classified (NACE 36) wherein furniture, coins and metals, sports goods, games and toys and imitation jewellery are the most important export goods in Austria[28].

The final performance measures we look at are wages and salaries per employee. There are a number of theories from which one would expect exporting firms to have higher wages. First of all, exporting firms throughout the sample exhibit higher investment per employee and are thus more capital intensive. This usually means that more low skill tasks are automated and done by machines. In order to set up and maintain these machines a higher educated workforce is needed, resulting in a higher average wage for more capital intensive firms. Recent studies using linked employer-employee datasets have looked at the positive link between the export activities of a firm and the level of wages paid with respect to the skill composition and other factors in greater detail. They found evidence that the effect on wages even remains after controlling for observed and unobserved characteristics of both the employer and the employees (see Munch and Skaksen, 2006 for Denmark, Alcalá and Hernández, 2007 for Spain, and Schank, Schnabel and Wagner, 2007 for Germany). The reason for a higher level of wages in exporting firms could be rent sharing of more productive firms or the expectation that higher efficiency wages lead to higher productivity of the workforce.

Table 12 provides an overview over the average wage per employee for the manufacturing sector and individual industries. As before, we differentiate between different types of firms, notable exporters and non-exporters. The reported annual wages in exporting firms show a wage premium of 1.35 compared to non-exporters. The findings are very similar if productivity is calculated as production value per hour worked (instead of production value per employee). We chose to use the results on the employee level for all performance measures since we do not know whether the 3.6% higher number of hours worked per year for exporting firms is a real difference in attendance time or just a measurement error. The inaccuracy for non-exporting firms could be the result of the size effect since small firms often lack time recording tools and therefore use default numbers.

As expected, we find little variation in the wage premium across industries compared to other performance measures. This is the case because of the competition of workers on the labour market and since wages of exporting and non-exporting firms are equally

[27] In fact, the labour productivity difference is also large for the automotive industry but the productivity advantage here is with non-exporters. Their productivity is exceptionally large, exceeding by far the productivities of all other firms and industries.

[28] Source: Comext Database, year 2006.

affected by unions. There are only a few industries standing out – among them the industry food and beverages (NACE 15) which is driving the average wage premium of 1.35 for total manufacturing due to the huge number of firms in this industry. This industry is also among the segment of the lower paying industries next to wearing apparel (NACE 18) and manufactures n.e.c. (NACE 36).

Table 12

Wage per employee (in thousand EUR), average 2002-2006

NACE	Industry	Non-exporter	Exporter	Marginal	Low to medium	High	Very high	All firms	Performance premium
15	Food and beverages	17.8	26.7	24.6	26.7	29.5	29.4	20.0	1.5
16	Tobacco products								
17	Textiles	21.5	24.9	22.6	22.2	23.0	26.5	24.4	1.2
18	Wearing apparel	14.4	19.9	16.9	19.2	19.9	21.7	18.7	1.4
19	Leather	21.5	23.4			18.0	25.2	23.1	1.1
20	Wood	21.1	24.1	22.0	23.8	24.1	25.3	22.6	1.1
21	Pulp and paper	32.4	34.3	27.5	32.4	33.3	36.2	34.1	1.1
22	Publishing and printing	31.3	34.2	33.3	35.2	35.2	34.9	33.2	1.1
23	Refined petroleum								
24	Chemicals	34.3	37.8	28.9	33.6	36.8	41.2	37.4	1.1
25	Rubber and plastic products	26.2	30.1	28.6	27.5	30.4	31.9	29.6	1.1
26	Non-metallic mineral products	30.0	32.5	29.8	33.1	34.9	32.7	31.0	1.1
27	Basic metals	33.6	35.9	27.4	33.5	37.7	36.6	35.8	1.1
28	Fabricated metal products	25.8	30.2	27.3	29.5	30.2	33.8	28.1	1.2
29	Machinery and equipment	29.4	34.2	29.7	31.0	32.9	36.2	33.6	1.2
30	Office machinery and computers		37.1				37.1	37.1	
31	Electrical machinery	29.6	33.6	28.1	33.5	34.6	34.8	32.9	1.1
32	Radio, TV, communication	36.4	39.7		42.3	40.6	38.8	39.4	1.1
33	Precision & optical instruments	21.9	31.8	26.1	26.4	28.8	36.0	26.9	1.5
34	Motor vehicles	28.3	32.0	25.3	30.4	33.4	33.5	31.6	1.1
35	Other transport equipment		37.3			35.3	38.1	37.3	
36	Manufactures n.e.c.	18.9	23.5	21.3	22.5	24.9	26.0	20.9	1.2
37	Recycling	33.1	30.1			26.5	31.9	30.7	0.9
15-37	Total manufacturing	22.2	30.1	27.1	28.6	29.5	32.9	26.6	1.4
	Unweighted industry average	26.7	31.1	26.2	29.6	30.5	32.7	29.9	1.2

Anyway, even when excluding the food and beverages industry (NACE 15), the positive wage effect for exporting firms in the rest of the sample remains at a factor of 1.23. As mentioned above, part of this effect might be caused by a different skill composition of employees in exporting and non-exporting firms as exporters tend to be more capital intensive. However, as we do not have access to skill-level information the size of the pure wage premium – accounting for employee characteristics – cannot be calculated. The majority of the empirical literature however suggests that a positive wage premium remains for exporting firms even after accounting for firm and workforce characteristics.

5 Econometric results

In the preceding section we provided extensive evidence for the existence of an 'export premium'. In a next step we want to confirm econometrically the results derived from the descriptive statistics.

In our empirical strategy we follow the approach first employed by Bernard and Jensen (Bernard – Jensen, 1999) which has since then been used intensively in empirical work on firm heterogeneity and trade. The basic idea is to regress a size or performance measures on a dummy variable (EXP) that takes the value 1 for exporting firms and 0 for non-exporters. The regression includes a set of dummy variables for individual industries and time fixed-effect year dummies as controls. These dummies are included to control for the fact that the average firm is bigger and more productive in some sectors than in others and the business cycle respectively. Therefore the panel regression – which we estimate by ordinary least squares – takes the form

$$\ln Y_{it} = \alpha + \beta * EXP_{it} + \gamma'_{(k)} * IND_{(k),it} + \delta'_{(T)} * YEAR_{(T),it} + \varepsilon_{it} \quad (1)$$

The dependent variable *Y* stands for one of the size and performance mentioned above (i.e. sales, employment, the wage sum, investment, labour productivity, wage per employee or investment intensity). *EXP* is our dummy variable for the export status. Its coefficient β is the main variable of interest and can be interpreted as the export premium. Since we assume exporters to be larger than non-exporters we expect β to have a positive sign. The variable *IND* is a k-dimensional vector of industry dummies with *k=23* representing the NACE industries 15 to 37. The dummy variable takes on the value 1 if a firm belongs to that industry and 0 otherwise. *YEAR* is a T-dimensional vector of year dummies with representing the years 2002 – 2006 (i.e. *T=5*). The error term is denoted by ε.

We employ this type of regression in order to make our results comparable to those of other country studies. In view of the large differences of the size and to a lesser extent the performance premia *across* industries we have documented in the Section 4 (see Tables 6 to 9 and 10 to 12) this specification is not without problems. The reason for this is that this specification forces a common coefficient of the export premium on all industries which, given the descriptive statistics might not be justified and our estimated coefficients run danger to be biased[29]. In this first assessment, however, we stick to this model in order to be in line with the existing literature and allow for cross-country comparison (see Section 6).[30]

[29] A second, more general difficulty with this regression model which is entirely unrelated to our data set is the causality between exporting and productivity and other size and performance measures. As pointed out earlier, empirical research points towards a causality running from productivity to exporting and not vice versa which would not suggest using productivity as the dependent variable.

[30] Sector-specific export premia on size and performance measures together with industry-specific business cycles could be taken into account in future work.

In Section 4 we have seen that the export premium is also rising with firms exporting a higher share of their turnover (i.e. those classified as marginal, low-to-medium, high and very high). Accordingly we also estimate a second regression which takes the form

$$\ln Y_{it} = \alpha + \beta'_{(m)} * EXINT_{(m),it} + \gamma'_{(k)} * IND_{(k),it} + \delta'_{(T)} * YEAR_{(T),it} + \varepsilon_{it} \quad (2)$$

In this specification we do not estimate a single export premium for exporters but individual export premia for our four groups of exporters *(m=4)* with export intensities *EXINT* ranging from marginal (1) to very high (4).

We have estimated these two specifications for the two periods 1997-2001 and 2002-2006 separately. Here we report the results for the 2002-2006 only.[31]

In order to see the importance of controlling for industry characteristics, we also include a third version of our model where these are omitted, yielding:

$$\ln Y_{it} = \alpha + \beta * EXP_{it} + \delta'_{(T)} * YEAR_{(T),it} + \varepsilon_{it} \quad (3)$$

The results for the size premia of these three specifications are shown in Table 13. As expected we find the coefficient on the export premium being positive and statistically highly significant for all size measures. Since we are using a semi-log specification we have to transform our coefficient estimates in order to interpret them as a performance premium for exporters with respect to non-exporters in the estimated dependent variable[32]. According to our main specification (model 1), exporters are larger than non-exporters by a factor of 3.56 in terms of sales and a factor of 3.75 times in terms of investment. The size premium for exporting firms with respect to personnel employed is 2.16 and 2.66 for the wage sum.

Despite the fact that the estimated size premia are of considerable magnitude, they are much smaller than the differences between exporters and non-exporters found in descriptive analysis where the factor was of the order 7 in terms of sales for example. One reason for the smaller magnitude of the export premium according to the regressions results is that by including industry dummies we control for size differences that exist across industries. If – as in our sample – average firm size is smaller in industries with a large number of non-exporters – the global manufacturing averages which we calculated in the descriptive part of the paper (section 4.4) overestimates the export premium. This is because with the global manufacturing average of the industry-specific differences are attributed to the export status. That industry-related differences matter can be seen in column (3) of Table 13 where we also report the regression specification without industry

[31] Other results are available upon request.

[32] We do this by simply making the estimated coefficient of *EXP* (size premium of the exporting firm) the exponent of *e*. This retrieves a variable we can interpret in the usual way.

dummies. Comparing the coefficient on the export status between our baseline specification (column 1) and the specification without industry dummies shows that including the industry dummies reduces the size of the coefficient considerably (employment being an exception) moving it closer to the results found in the descriptive statistics, albeit differences in magnitude still persist..

Table 13

Exporters' size premium

size measures

Variable	**sales**			**wage sum**			**employees**			**gross investment**		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
EXP	1.271		1.585	0.979		1.309	0.772		0.756	1.322		1.591
	(0)		(0)	(0)		(0)	(0)		(0)	(0)		(0)
EXINT1		0.719			0.548			0.425			0.761	
		(0)			(0)			(0)			(0)	
EXINT2		1.035			0.796			0.611			1.073	
		(0)			(0)			(0)			(0)	
EXINT3		1.417			1.061			0.826			1.462	
		(0)			(0)			(0)			(0)	
EXINT4		1.961			1.532			1.240			2.033	
		(0)			(0)			(0)			(0)	
IND	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes	no
YEAR	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
F	785.2	822.8	2297.1	736.2	746.0	2026.2	534.7	541.2	543.9	388.3	402.7	1095.8
R2	0.384	0.433	0.263	0.368	0.409	0.239	0.309	0.351	0.299	0.247	0.278	0.156
R2adj	0.384	0.433	0.263	0.368	0.408	0.239	0.308	0.35		0.246	0.277	0.156
Obs.	29840	29840	29840	29830	29830	29830	29827	29827	29827	28251	28251	28251

coefficients of constant, industry dummies and year dummies not shown. p-values in parentheses.

Implied size premium

EXP	3.564		4.879	2.662		3.702	2.164		2.130	3.751		4.909
EXINT1		2.052			1.730			1.530			2.140	
EXINT2		2.815			2.217			1.842			2.924	
EXINT3		4.125			2.889			2.284			4.315	
EXINT4		7.106			4.627			3.456			7.637	

Still related to the issue of the size premium of exporting firms, we also find the pattern of increasing premia in the coefficients of the dummy variables for the various export intensities – marginal, low to medium, high and very high (column (2) in Table 13). The coefficients on the export intensity (*EXINT1 – EXINT4*) suggest that the size premium of the exporters is increasing with their export intensity. This result is statistically highly

significant and holds for all our size variables and all specifications. This confirms the pattern already found in the descriptive statistics.

Turning to the performance measures, we also find statistically significant export premia (Table 14) which are again increasing with the export intensity (column 2). In the case of the performance measures, the difference between the coefficients resulting from our regression and the performance premium according to the descriptive statistics is less pronounced. Labour productivity per employee in exporting firms is 1.66 times higher than in non-exporting firms[33] compared to a factor of 2.0 found in the descriptive analysis. The superior labour productivity of exporters is only partially explained by their higher investment intensity per employee which is superior to that of non-exporters by an factor of 1.71. This is because capital is not the only production factor so that the difference in the investment intensity only accounts for a part of the total productivity difference.

If we look at wages, the performance premium is around 1.23 compared to a factor of 1.35 found in the descriptive analysis. The wage premium earned by employees in exporting firms is an interesting variable because it indicates to which extent more productive firms pass on their gains from higher productivity to their personnel. As stated in the previous chapter, the wage premium for workers employed in exporting firms may not entirely constitute economic rents. Part of this premium is attributable to a different skill composition of exporting and non-exporting firms. Nonetheless, the performance premium of 1.23 is equal to saying that exporters are 23% more productive than non-exporters which is roughly one third of the suggested productivity advantage (66%). This approximate 1:3 relation between wage and productivity premium also holds across the different firm groupings according to export intensities (column 2).

Summarizing, this econometric exercise has strongly confirmed the findings in the descriptive analysis: there exist size and performance premia of exporting firms both when comparing exporters and non-exporters only and when differentiating firms by export intensity classes. However, the descriptive analysis has also shown that there are non-negligible differences of the export premium across industries which we – following the literature – have not yet taken into account. Moreover, the export premia we find for the manufacturing industries – in particular for our size measures – by means of panel regression are lower than the ones found in the descriptive analysis. This holds true regardless of whether we compare our regression results with the export premia we find by calculating global manufacturing averages or calculating the unweighted industry averages. Since both methods of calculating averages and export premia in the descriptive

[33] When measuring labour productivity at the level of hours worked, the productivity premium of exporters is 1.62. This slight difference is explained by the fact that in our sample, employees in exporting firms work on average 57 hours more than employees in non-exporting firms. As mentioned in the previous section it is not clear whether this is a real difference in attendance time or a measurement error.

part neglect important information on the composition of our sample (different number of firms per industry) and sector-specific differences unrelated to the export status, we feel that the estimated export premia from our regression model – despite its shortcomings – makes better use of all available information and is therefore preferable. So our conclusion would be that the size premium in terms of sales is of a factor 3.6 and that for employment of the factor 2.2. With regards to performance premia we note a productivity premium of 1.65 and a wage premium of 1.23.

Table 14

Exporters' performance premium

Variable	**labour productivity** (per employee)		**labour productivity** (per hours worked)		**wage**		**investment intensity**	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
EXP	0.506		0.484		0.207		0.542	
	(0)		(0)		(0)		(0)	
EXINT1		0.302		0.288		0.124		0.336
		(0)		(0)		(0)		(0)
EXINT2		0.423		0.397		0.185		0.452
		(0)		(0)		(0)		(0)
EXINT3		0.586		0.568		0.235		0.625
		(0)		(0)		(0)		(0)
EXINT4		0.744		0.715		0.293		0.786
		(0)		(0)		(0)		(0)
IND	yes	yes	yes	yes	yes	yes	yes	yes
YEAR	yes	yes	yes	yes	yes	yes	yes	yes
F	561.638	560.131	503.306	505.907	862.923	811.675	127.874	126.796
R2	0.299	0.329	0.283	0.314	0.399	0.412	0.099	0.106
R2adj	0.299	0.328	0.283	0.313	0.398	0.411	0.098	0.105
Obs.	29814	29814	29810	29810	29819	29819	28243	28243

coefficients of constant and industry dummies and year dummies not shown. p-values in parentheses.

Implied performance premium

EXP	1.659		1.623		1.230		1.719	
EXINT1		1.353		1.334		1.132		1.399
EXINT2		1.527		1.487		1.203		1.571
EXINT3		1.797		1.765		1.265		1.868
EXINT4		2.104		2.044		1.340		2.195

6 Comparison with results found in other countries

In this section we compare our results with findings on the role of exporters and the existence of export premia from other country studies based on firm-level data. It should be

noted, however, that a strict comparison is not possible given the underlying datasets which differ in various details like sampling, unit of analysis, .etc.

Starting with the share of exporting firms (Table 15) we find that our results fit very well with those from other studies. The figures for other countries are taken from a recent Micro-Dyn study (Altomonte and Ottaviano, 2008). The share of exporting firms in the Austrian manufacturing sector of 56% is in between the share in France (61%) and Poland (50%). The fact that the data are for different years in different countries does not matter a lot because there is not much dynamic found in these shares (for the Austrian data this can be seen in Table 1).

Table 15

Relevance of exporters by number of firms (last available year)

NACE	Bulgaria	Spain	France	Hungary	Italy	Poland	Slovenia	**Austria**
15	26.30%	55.80%	38.08%	11.88%	66%	26%	16.70%	**27.93%**
16	78.60%	55.80%	28.57%	30%	100%			**100.00%**
17	71.60%	63.50%	73.49%	24.64%	81%	55%	37.60%	**85.42%**
18	54.00%	63.50%	64.06%	19.66%	84%	61%	29.20%	**75.61%**
19	52.50%	70.20%	62.81%	32.89%	86%	61%	47.50%	**83.33%**
20	40.00%	54.60%	41.61%	14.50%	65%	67%	37.90%	**50.99%**
21	40.00%	86.30%	57.29%	16.14%	68%	46%	39.50%	**91.46%**
22	21.60%	39.10%	36.09%	3.54%	48%	15%	6.00%	**66.37%**
23	33.30%		46.30%	36.36%	34%	47%	100.00%	**50.00%**
24	57.60%	81.40%	77.92%	27.90%	78%	48%	56.70%	**89.76%**
25	48.70%	87.00%	67.04%	26.59%	83%	55%	43.10%	**89.69%**
26	32.10%	40.10%	44.25%	13.82%	50%	45%	34.80%	**41.54%**
27	55.20%	67.80%	80.41%	42.41%	78%	64%	74.60%	**97.87%**
28	37.70%	57.90%	51.50%	19.82%	64%	55%	31.30%	**53.84%**
29	46.10%	92.00%	72.47%	18.76%	90%	54%	50.90%	**89.61%**
30	40.00%	86.70%	73.02%	8.37%	67%	27%	6.70%	**66.67%**
31	68.10%	83.30%	64.69%	23.91%	82%	55%	38.40%	**80.56%**
32	42.10%	83.30%	62.10%	22.93%	70%	56%	49.50%	**90.20%**
33	52.90%	86.70%	71.03%	13.23%	83%	50%	32.60%	**49.22%**
34	44.40%	81.80%	66.79%	43.67%	75%	64%	66.70%	**89.13%**
35	26.30%	76.10%	71.52%	20.87%	79%	55%	45.70%	**85.71%**
36	41.50%	85.90%	59.37%	12.66%	86%	68%	37.00%	**39.43%**
37		85.90%	68.14%	16.86%		50%	35.50%	**80.77%**
Total	**49.70%**	**66.90%**	**61.36%**	**16.00%**	**75%**	**50.17%**	**44.26%**	**55.91%**
	45.94%	71.37%	59.94%	21.80%	73.50%	51.09%	41.72%	72.83%

Source: Micro-Dyn (Altomonte and Ottaviano, 2008), authors' calculations. Latest year is 2001 for Bulgaria, 2002 for Slovenia, 2003 for Hungary and Italy, 2004 for France Germany and Spain, 2005 for Poland and 2006 for Austria.

Also the other measures fit quite well to those found in other studies. In Tables 16 and 17 we provide a comparison for the relevance of exporters in sales and employment for

individual industries and total manufacturing. The data is again taken from Altomonte and Ottaviano (2008). In general the shares of exporting firms for Austria are in line with those found for other countries, though there exist country and industry specific differences that are, however, not subject of this study.

Table 16

Relevance of exporters by sales (last available year)

NACE	Bulgaria	Spain	Hungary	Italy	Poland	Slovenia	**Austria**
15	37.00%	60.50%	57.85%	69%	44%	65.40%	**74.38%**
16	74.10%	60.50%	17.57%		16%	100.00%	
17	92.70%	88.00%	70.76%	90%	76%	77.40%	**86.86%**
18	67.90%	88.00%	77.68%	92%	64%	89.50%	**89.44%**
19	76.30%	85.30%	82.62%	96%	77%	96.40%	**87.34%**
20	78.40%	71.10%	57.29%	67%	85%	76.60%	**77.84%**
21	62.00%	90.80%	79.60%	66%	83%	93.00%	**91.73%**
22	11.30%	30.50%	14.95%	65%	22%	24.50%	**78.01%**
23	9.00%		99.36%	86%	29%	100.00%	
24	90.80%	88.30%	91.49%	61%	74%	96.40%	**89.58%**
25	78.30%	96.00%	81.69%	97%	74%	90.10%	**91.77%**
26	77.00%	58.50%	53.74%	80%	56%	76.20%	**62.46%**
27	97.10%	93.30%	66.16%	96%	88%	99.10%	**99.48%**
28	67.80%	83.60%	69.71%	85%	75%	79.40%	**70.24%**
29	71.40%	97.50%	66.77%	96%	76%	93.30%	**89.87%**
30	55.00%	92.20%	76.82%	99%	73%	10.40%	**80.81%**
31	92.30%	93.80%	95.98%	85%	86%	89.30%	**90.09%**
32	80.80%	93.80%	98.07%	85%	91%	82.80%	**97.70%**
33	61.60%	92.20%	53.21%	94%	57%	84.10%	**69.56%**
34	49.90%	99.10%	98.20%	89%	92%	94.90%	**85.04%**
35	34.00%	96.90%	56.83%	97%	82%	94.50%	**97.94%**
36	67.90%	70.30%	57.76%	96%	90%	89.10%	**72.16%**
37		70.30%	53.04%		59%	80.20%	**78.15%**
Total	70.30%	83.20%	68.57%	93%	68.22%	81.85%	**84.09%**

Source: Micro-Dyn (Altomonte and Ottaviano, 2008), authors' calculations. Latest year is 2001 for Bulgaria, 2002 for Slovenia, 2003 for Hungary and Italy, 2004 for France Germany and Spain, 2005 for Poland and 2006 for Austria.

The Austrian shares are calculated as exporters over number of total firms in the industry (column 8 in Table 5).

We also want to make some cross-country comparisons on the magnitude of the export premia for the size and performance measures we have found in our study. First we compare the results from our regression analysis with those from a Micro-Dyn study which used basically the same empirical strategy.[34]

[34] Despite the similarity with regards to empirical strategy, the comparability of results is still limited by differences in the compilation of data sets.

Table 17

Relevance of exporters by employment (last available year)

NACE	Bulgaria	Spain	France	Hungary	Italy	Poland	Slovenia	**Austria**
15	32.20%	60.10%	62.03%	52.07%	75%	40%	50.80%	**46.88%**
16	88.20%	60.10%	23.71%			24%	100.00%	
17	87.70%	77.00%	79.74%	68.03%	89%	67%	65.20%	**80.03%**
18	68.70%	77.00%	73.81%	56.70%	87%	63%	81.90%	**74.08%**
19	65.40%	74.70%	67.26%	71.62%	87%	69%	93.90%	**79.25%**
20	66.70%	64.20%	48.65%	34.11%	69%	76%	68.00%	**58.60%**
21	57.00%	90.70%	76.35%	45.71%	72%	64%	87.50%	**91.52%**
22	19.40%	34.60%	41.91%	17.10%	60%	17%	27.70%	**65.87%**
23	2.90%		67.34%	88.26%	37%	34%	100.00%	
24	88.30%	85.00%	85.49%	86.31%	81%	72%	96.50%	**79.67%**
25	77.10%	94.20%	83.38%	73.04%	94%	70%	86.60%	**87.79%**
26	58.20%	59.30%	71.43%	60.78%	74%	62%	79.10%	**63.55%**
27	86.10%	85.10%	91.89%	73.00%	92%	83%	98.00%	**98.82%**
28	49.60%	74.00%	68.16%	60.84%	78%	67%	73.50%	**63.94%**
29	73.60%	95.20%	85.82%	62.69%	95%	68%	91.10%	**84.97%**
30	54.20%	91.90%	96.51%	67.82%	91%	52%	12.90%	**73.42%**
31	82.60%	91.20%	85.35%	87.36%	87%	76%	85.80%	**84.40%**
32	47.50%	91.20%	86.60%	92.55%	93%	69%	87.90%	**95.90%**
33	52.90%	91.90%	88.29%	53.40%	91%	64%	88.10%	**54.49%**
34	63.00%	97.70%	94.44%	93.20%	92%	83%	95.50%	**95.52%**
35	28.50%	89.90%	95.06%	48.69%	97%	70%	94.80%	**93.83%**
36	61.20%	73.00%	73.28%	47.13%	93%	83%	89.60%	**51.92%**
37	73.00%		70.32%	42.26%		53%	70.20%	**54.60%**
Total	66.50%	78.50%	76.96%	61.15%	92%	62.00%	79.33%	**72.28%**

Source: Micro-Dyn (Altomonte – Ottaviano, 2008), authors' calculations. Latest year is 2001 for Bulgaria, 2002 for Slovenia, 2003 for Hungary and Italy, 2004 for France Germany and Spain, 2005 for Poland and 2006 for Austria. The Austrian shares are calculated as the number of exporters over the total number of firms in the industry (column 8 in Table 5)

Table 18

Coefficients on export premium for total manufacturing

	Bulgaria	Hungary	Spain	Italy	Poland	Slovenia	**Austria**
Size:							
Sales/output	2.067***	2.29***	0.461***	0.871***	0.639**	2.151***	1.271***
Employment	1.790***	1.64***	1.631***	0.663***	0.337**	1.726***	0.772***
Performance:							
Average wage	0.537***	0.45***	0.084***	0.068***	0.146**	0.180***	0.207***

Remark: Numbers for Poland are average values of the premia estimated on annual basis. Polish firms are subject to a threshold of at least 50 employees.

Source: Micro-Dyn (Altomonte and Ottaviano, 2008), authors' calculations. Latest year is 2001 for Bulgaria, 2002 for Slovenia, 2003 for Hungary and Italy, 2004 for France Germany and Spain, 2005 for Poland and 2006 for Austria.

As can be seen in Table 18 the estimates for Austria fit nicely with those reported for other countries. All coefficients for Austria are in the range of the other countries though country specific differences are quite large. The coefficient on sales or output ranges from 2.3 in Hungary to less 0.5 in Spain. For Austria we have found a coefficient of 1.3, making it the median country among the countries shown in Table 18[35]. Similarly, for size measured by employment the coefficients range from about 1.7 (Bulgaria and Slovenia) to less than 0.3 in Poland. Again, the coefficient for Austria with 0.7 lies in this range. The same is true for performance measure on the average wage where again the coefficient for Austria is in between those found for other countries.

Table 19

Export premium for total manufacturing (from descriptive statistics)

	Germany	France	United Kingdom	Italy	Hungary	Belgium	Norway	**Austria**
Employment	2.99	2.24	1.01	2.42	5.31	9.16	6.11	**3.10**
wage	1.02	1.09	1.15	1.07	1.44	1.26	1.08	**1.35**

Source: Ottaviano and Mayer, The Happy Few, wiiw calculation. Germany, Hungary, Italy and the UK have large firms only; French, Belgian and Norwegian data is exhaustive. For details on Austrian data see Section 3.

Table 19 shows employment and wage premium (wage per employee) for total manufacturing, calculated as the global average over all exporting and non-exporting firms[36]. Once more our results are in line with those found for other European countries. The employment premium of Austrian exporters is very much comparable in size to that of their German counterparts. In case of the wage premium of Austrian exporters the factor of 1.35 is relatively high in an international comparison and only second to the one found for Hungarian exporters.

Table 20

Export concentration (share of exports for top exporters) – 2003

	Top 1%	**Top 5%**	**Top 10%**
Germany	59	81	90
France	68	88	94
United Kingdom	42	69	80
Italy	32	59	72
Hungary	77	91	96
Belgium	48	73	84
Norway	53	81	91
Austria	**42**	**73**	**87**

Source: Ottaviano and Mayer, The Happy Few, wiiw calculation. Germany, Hungary, Italy and the U.K. have large firms only; French, Belgian and Norwegian data is exhaustive. For details on Austrian data see Section 3. Austrian export sales had to be estimated (see section 4.3).

[35] We report here the Austrian coefficients instead of the implied size premia because Table 18 solely serves the purpose of conducting a cross-country comparison.

[36] The values correspond to the rows denoted as 'manufacturing 15-37' in Tables 7 and 12.

We close this section on international comparisons by comparing our result on the export concentration with that of other European countries. Here we remind of the fact that lacking access to information on the precise export sales of firms, we had to estimate these for the Austrian manufacturing industry (see Section 4.3). Comparing our estimated export concentrations, i.e. the share of the top 1%, 5% and 10% of exporters, reveals that also in this regard the Austrian results fit into the picture. Export concentration in manufacturing, however, appears to be somewhat less pronounced in Austrian than in most European countries although the share of the top exporters is still impressive.

7 Conclusions

The new new trade theory emphasizes firm heterogeneity and the exceptional characteristics and performance of exporting firms compared to non-exporters together with the importance of exporting firms in industry measures such as output, employment and wages paid but also for other variables. By now a number of empirical studies for various countries exist which confirm this pattern. In this study an effort was made to provide detailed evidence along these lines (which so far has not existed) for Austrian manufacturing firms. Based on firm level data provided by Statistics Austria, we present evidence on the relative importance of exporting firms in Austrian manufacturing sectors at the NACE 2-digit level with respect to the number of exporters, their relevance in terms of industry sales, employment and additional size measures. Further, we provide a detailed descriptive analysis on the exceptional performance of exporting firms with respect to size and performance characteristics and present evidence for the existence of substantial export premia. We are also able to distinguish between various classes of exporting firms, differentiated by their share of exports in total sales, and show that in general the magnitude of the export premium is increasing with export intensity. The results fit those available for other countries and confirm the exceptional role of exporting firms. Finally, we also report on an econometric exercise – following the literature – confirming the results of the descriptive analysis. The estimated coefficients on the size and export premia are in the range of those found for other countries, though quite large country differences can be observed. The results of the descriptive analysis, however, would suggest that export premia on size and performance measures are industry specific – which was not taken into account in this study for reasons of comparability with other existing results. This would however be an avenue for future research. Furthermore, it should be stressed that in this study we have not tackled the issue of causality. Existing evidence suggests that the causality runs from exceptional firm performance to exporting. These results based on Austrian firm level data will hopefully provide a basis for further research in the field of firm heterogeneity and trade.

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9 Appendix

Table A.1

NACE classification

NACE	Description
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling