Heterogeneous firms, corporate taxes and export behavior:

A firm-level investigation for Italy

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Abstract

This paper analyses the effect of home corporate taxes on a firm's decision to expand the scale of its activity through exports using a rich data on Italian firms. Starting out from the observation that firms' export activity vary greatly among them and tend to be systematically related to firm's characteristics, we relate differences in firms' export choices to firm level incidence of corporate taxes. Our results suggest that (*i*) corporate taxes matter at both the extensive and the intensive margin and (*ii*) higher corporate taxes may increase the probability of new firms' entry in the foreign market while they decrease the export intensity of incumbent exporters.

Keywords: corporate taxation, exports, effective tax rates, mark-up
JEL Classification: H25, H32; F14; D22

1. Introduction

The rich literature on international trade has allowed a detailed investigation of export market participation. The expansion of domestic firms and their diversification into foreign markets represent an important channel to boost economic growth. The seminal papers by Melitz (2003) and Helpman et al. (2004) opened new frontiers for both theoretical and empirical economists along those lines.

Mostly, researchers have investigated the differences between exporters and non-exporters with respect to readily identifiable firm characteristics. A combination of trade barriers (either fixed or variable costs of exporting) and heterogeneity in the underlying characteristics of firms explains why not all firms export. Despite an overlap in the path of exports determinants across studies, the evidence is mixed.

Our aim is to contribute to a better understanding of how and why participation in international trade differs across firms in connection with the burden of home corporate taxes. We explore the extent to which taxes affect two important margins of trade: the extensive margin of

exporting—i.e. the propensity to export at all—and, conditional on positive exports, the intensive margin of the export–sales ratio at firm level. At the extensive margin, our exercise tell us about the relative importance of taxation as a fixed cost to access markets. At the intensive margin, it captures the relative importance of taxes as export variable costs relative to domestic sales costs.

In our opinion, the inclusion of corporate taxation as a source of heterogeneity in firm-specific costs is interesting as heterogeneity in other factors (Egger and Loretz, 2010). Indeed, starting out from the observation that firms' export activity vary greatly among them and tend to be systematically related to firm's characteristics, we may hypothesize that differences in firms' export choices depend also on firm level incidence of corporate taxes. Accordingly, when governments change corporate tax rates, by virtue of firms' heterogeneity in the composition of capital stock, investments financing and involvement in foreign markets, we expect heterogeneous effects across firms.

A key result is that corporate taxes matter at both the extensive and the intensive margin. In particular, our findings suggest that trade adjustments due to changes in the home profit taxation, occur mainly through the adjustment of export quantities of existing exporters, rather than through changes in the number of exporting firms. The extensive margin of trade responds differently to change in corporate taxation with respect to the intensive margin in the presence of firm heterogeneity. Short-run dynamics of exports is dominated by the intensive margin: new exporters or firms that stop exporting are much less important for year-to-year changes in export volumes. Firms' heterogeneity plays, in fact, a central role in understanding the way corporate taxes affect firms' internationalization strategy. The use of micro data is particularly appealing to study this relationship, as one can observe the corporate tax burden directly at the firm level instead of solely relying on aggregate data. This allows detecting the relationship between taxes and firm-level export opportunities and outcomes, thereby providing additional evidence of the underlying features of the Italian firms export behavior.

The evolution of corporate tax systems has always been at the heart of policymakers' debates as well as public finance academics. It is well understood that company taxation can have large effects on firms' performance impinging directly on the incentive to accumulate capital, which represents one of the main drivers of economic growth. Thus, it is not surprising that starting from the mid-80's many OECD countries have undertaken significant reforms of their business tax system to reduce nominal corporate tax rates and this trend shows no sign of stopping. The downward pressure on capital tax rates can be justified because of increased globalization that

has characterized the world at least in the last two decades, making competition among national tax system fiercer. In order to foster domestic firms' competitiveness as well as to attract internationally mobile capital, governments have to offer a business environment comparable to that of other countries. Profit taxation is clearly a relevant part of that environment and this explains why most countries have reduced their taxes on mobile capital.

To start, a brief description of some of the relevant aspects of the Italian corporate tax system follows.

In the early 90s, Italy's system of corporate taxation was pointed to as an obstacle to firm's competitiveness, as well as to foreign investments in the country. Despite that, Italy was a latecomer to the corporate tax cut process described above. Indeed, from its inception in the early 70s, its business income tax regime changed only marginally for over twenty years and until the mid-90s, Italy moved in the opposite direction than other industrialized countries, actually increasing the corporate tax rate mainly due to its budgetary constraints. In 1994, the corporate tax system contemplated a tax on corporate income, an additional local tax on profits, and a tax on company wealth. The combined rate was 53.95%, among the highest in Europe. Then, starting in 1997, a reform of tax system on corporate financial policy system was introduced. The new system, by introducing relief for equity finance, explicitly aims at influencing corporate financial policy. The main tax changes that occurred in 1997-98 were: a) the introduction of a new system for taxing corporate income, termed Dual Income Tax (DIT); b) the introduction of a new regional tax on business activity (IRAP); c) the reduction in the profits tax rate through the abolition of the ILOR tax.

Fig. 1 reports the trends of the statutory tax rate (STRs), the effective average tax rate (EATRs), and the effective marginal tax rate (EMTRs) between 1994 and 2006, that are firm-specific effective tax rates[1].

Fig. 1 - Statutory corporate tax rate, effective average (EATR) and marginal (EMTR) corporate tax rates. Years 1994-2006.

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[1] For a description of detailed calculations of EATRs and EMTRs, see Appendix 1.

60

50

40

30

20

10

0

-10

-20

1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006

STRs
EATRs
EMTRs

Because of the tax changes over the whole period the statutory corporate tax rate declined from 53.95% to 37.3%. The primary policy objective of the 1998 reform was a selective reduction in the burden of taxation, to lessen the tax distortion between equity and debt financing. In particular, the reform pursued the design of a more neutral corporate tax with respect to financial decisions because a tax system that favors debt may have considerable negative impact on the allocation of resources.

The main change introduced to this end was an Allowance for Corporate Equity system (ACE), which is a tax that provides deductibility for both interest payments and the opportunity cost of equity finance. The system worked as a dual-rate scheme where a lower statutory rate was applied to the share of profits stemming from equity capital invested by the company[2]. The 1998 reform also introduced a local tax on firm value added (*Imposta sul Reddito delle Attività Produttive*, IRAP) and abolished the pre-existing local tax on business income and the wealth tax. Due to the introduction of the 1998 reform, the EATR lowered by about 8 percentage points. Between 1998 and 2001, the introduction of a temporary tax relief for equity-funded investments that could be cumulated with the ACE system, strengthening its effects and its general purposes, further reduced the EATR from 36.5% to 32.1%.

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[2] Such systems have been in operation in several countries, though with differences in their practical application. The basic idea behind an ACE is to provide a deduction of a notional return on the company equity from taxable profits so to address the difference in the tax treatment of debt and equity. Assuming that tax parameters are chosen correctly, an ACE regime ensures neutrality between debt and equity financing.

The EMTR followed the same descending trend, falling from 34.8% in 1997 to only 2% in 1998, and became even negative in 1999-2001. Indeed, the ACE scheme and the investment tax relief strongly reduced the cost of capital for equity-funded marginal investments (i.e. for which the return equals the marginal cost) and taxation at the margin actually turned into a subsidy.

In 2001 and 2002 a new tax relief, applying to both-equity and debt-funded investments was enacted in substitution of the previous one. Because of the generous operation of the new investment incentive the cost of capital for marginal investments further decreased resulting in a lower (-19%) EMTR in 2002 compared to 2001. Moreover, in 2001 when a new government took office, some changes were made to the ACE scheme in order to curb its effects. These changes anticipated the intention of the (new) policy maker to repeal the dual-rate allowance. The 2004 regime definitively repealed the ACE scheme and reinstated a uniform tax rate. Furthermore, it modified the corporate tax base by introducing a participation-exemption regime and eliminating the full imputation of dividends, and brought in an optional consolidated tax treatment for corporate groups. Because of these changes, in 2004 the EATR slightly reduced from 37.6% to 36.8% and remained stable until 2006.

The remainder of the paper is organized as follows. Section 2 provides a background of the relevant literature. Section 3 present the data and descriptive statistics. The empirical approach and results are set out in Section 4. The main implications are discussed in the concluding section.

2. Literature

Our paper fits into the large empirical literature that takes up the issue of firm heterogeneity in affecting both the origin and the patterns of international trade. Reviews of this literature can be found in Bernard et al. (2012), Greenaway and Kneller (2007), Melitz and Redding (2014) and Wagner (2012). Bernard et al. (2007) and Melitz (2003) are the pioneering studies that theoretically explore the relationship between exports and firm heterogeneity, represented by productivity, in a general equilibrium framework[3]. Although based on different models, these studies explain the fact that the higher the firm productivity, the more it is likely to be exporter. This prediction is confirmed in many empirical studies that utilize firm/plant level longitudinal panel data and for different countries. A positive relationship has been found for USA (Bernard

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[3] For reviews of the theoretical literature on heterogeneous firms and trade, see Helpman (2006) and Redding (2011).

and Jensen, 1995, 1999, 2004; Bernard et al. 2007); Canada (Baldwin and Gu, 2003); European Countries (Bernard and Wagner, 2001; Mayer and Ottaviano, 2007); Asian countries (Aw et al., 2000; Hallward-Driemeier et al., 2002); Japan (Kimura and Kiyota, 2006; Wakasugi et. al., 2008; Yashiro and Hirano, 2010).

Successful export performance is due to certain firms having high enough productivity to overcome the costs of exporting (see, e.g., Bernard et al. 2007; Melitz, 2003; Melitz and Ottaviano, 2008). In addition, it is widely recognized that the productivity premium of exporters vis-à-vis non-exporters largely reflects that more productive firms only self-select into exporting activities. However, many papers suggest that productivity plays a statistically significant but quantitatively a limited role in determining firms' internationalization. Firm-specific attributes and sector wide characteristics have been employed to model export propensity. Among these, besides productivity, firm size, firm age, product and export market diversification have been focused upon (see, e.g., Bernard and Jensen 1995, 1999; Bernard et al. 2007; Eaton et al. 2011, 2008; Wagner 2007; Mayer and Ottaviano, 2008; Ogawa and Tokutsu, 2015).

There is also a large and growing literature that suggests that financial health matters in exporting decisions (see for example Minetti and Zhu (2011), Berman and Hericourt (2010), Bellone et al. (2010), and Greenaway et al. (2007).

A relatively recent research strand explores the relationship between firm specific pricing behavior (or markup) and exporting status. Firm characteristics in connection with the competitive environments as well as trade costs would induce exporters to employ a different pricing strategy with respect to non-exporters. Since exporting activity imply costs, firms could charge higher markups on foreign markets than on domestic ones in order to recover their additional trade costs. Melitz and Ottaviano (2008) predict that markups are positively related to firm productivity as well as to export intensity. Their model also shows that markups, in different export markets, differ systematically because of different competitive conditions. Mayer, Melitz and Ottaviano (2014) has expanded this model to multi-product firms to generate new predictions on the product mix of exporters.

Furthermore, differences in productivity and size imply that the market power of exporting firms may be larger. De Loecker and Warzynski (2012) provide evidence that exporting firms charge higher markups. Using Slovenian firm-level data for the period 1994-2000, they find that exporters charge on average higher markups and firms' markups increase upon export entry. Similarly, Görg and Warzynski (2003) find that exporters have higher markups than non-exporters for differentiated goods. Finally, Moreno and Rodríguez (2010) suggest that non-

exporters have smaller margins than persistent exporters, but larger export ratio is negatively associated with margins for persistent exporters, largely due to higher competitive pressure in international markets. However, export market participation decisions may have an ambiguous association with markups. The effects of tougher competition on export markets may offset productivity self-selection, which explains much of the export premia. If competitive environment is tougher in foreign markets than in domestic market, exporters should charge lower markups in order to keep competitiveness.

Though a growing body of literature has focused on the role played by taxes in defining the volume and direction of FDI[4], a few papers test empirically the effects of corporate taxation on trade. Moreover, these studies mainly analyzed the effects of taxes on trade at macro-level using an implicit tax rate calculated as the ratio between corporate tax revenue and GDP.

Among these, Keen and Syed (2006) set up a two-period model, where investments are undertaken in period 1 and yield output in the following period. Corporate taxation drives investments until its after-tax marginal productivity equals the gross interest rate. A source-based corporate tax reduces domestic investment and results in greater capital exports in the first period. Consequently, the country runs a trade surplus that reduces in the second period given higher income flowing from abroad due to the investment undertaken abroad in the first period[5]. Keen and Syed (2006) test empirically the impact of corporate taxation on net exports using a panel covering OECD countries in the period from 1967 to 2003. They find a significant and robust positive effect of corporate taxation (measured as the ratio of corporate tax revenue on GDP) on export performance. However, this effect would fade in the long run (after ten years) where the overall impact of corporate taxation on net exports converges to zero. This is in line with increased income from abroad because of the initial reallocation of capital abroad, as discussed above.

Alworth and Arachi (2008) test the relation between the corporate tax rate (corporation tax revenue over GDP) and net exports in goods and services for a panel of OECD countries from 1970 to 2005. The authors suggest a positive relation and show that the sensitivity of net exports to the corporation tax has increased after the introduction of the Euro. These results are

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[4] Davies and Eckel (2007, 2010) incorporate recent innovations from the trade literature on mobile firms into a tax competition model.

[5] On the opposite, a residence-based tax has no effect on domestic investments since it does not affect the return required by non-resident investors. Therefore source-based or residence-based taxes actually have very different effects on the pattern of net exports and the questions of whether considering actual systems as source-based ore residence-based becomes central. The authors conclude that most corporate tax systems are close to source-based schemes.

somehow in line with those of earlier studies. For instance, Slemrod (2004) finds a positive nexus between corporation taxes, again measured in terms of tax revenue/GDP ratio, and trade intensity.

Furthermore, Gravelle and Smetters (2006) show that the tax burden falls mainly on capital and to a lesser extent on labor, though the shared burden depends on the values of the model parameters[6]. One interesting and novel result of the incidence analysis developed by Gravelle and Smetters is that some of the burden can be "exported", that is falls on foreign production factors. Gravelle (2013) provides an in-depth review of open economy general equilibrium incidence models, focusing in particular on U.S. studies. The author identifies five parameters that play an important role in determining the distribution of the burden of the corporate taxes: the degree of capital mobility; the substitutability between domestic and foreign products; the size of the country; the degree of substitutability of labor for capital and factor intensities. However, the literature on the open-economy incidence of the corporate tax takes place within the context of a unitary tax levied at the national level. We aim to extend the analysis of the effects of corporate taxation on export performance at firm level. In particular, computation of average and marginal effective corporate tax rates builds on the methodology developed by Egger et al. (2009) which, consistently with the empirical analysis, allows calculation of firm-specific effective corporate tax rates (see Appendix 1).

3. Data and descriptive statistics

The paper uses a balanced panel combining Italian firms' survey data with company accounts for the period 1998-2006. Our main data source is the *Indagine sulle Imprese Manifatturiere*, a survey carried out by the Italian banking group Capitalia. The data collection started in 1972 and has been performed through a questionnaire submitted to a sample of firms of the manufacturing sector every three years[7]. Overall, the survey comprises a representative sample of firms with 10–500 employees and the universe of firms with more than 500 employees. The firms included in the survey represent about 9% of the population in terms of employees and 10% in terms of value added. Specifically, we use the last three waves of the Capitalia survey, three periods, between 1998 and 2000, from 2001 to 2003, and from 2004 to 2006. Survey data

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[6] These results are in line with the recent literature on tax incidence (see also Auerbach, 2006), but not on the original conclusions of Harberger (2008) who argued that in the long-run capital does not bear the tax burden at the expense of labour.

[7] The Capitalia Group stopped the survey in 2008 and Unicredit Group started a new survey (EFIGE) in 2012 coordinated by Bruegel (Brussels).

are matched against company accounts made available through CERVED, a consortium of private equity funds that evaluates businesses reliability and their financial structure. Company financial records are available for the entire corporate sector (about 700,000 companies) and throughout the entire period considered in this paper.

The final dataset included 855 corporations (7,695 observations for the whole period) and contains information on firm's characteristics (size, employment structure, legal status, participation in groups or consortia, ownership structure), and measures of firm's activities (outputs, investments, assets). In the dataset are recorded detailed information on firm's export activities, such as markets for the firm's products, export intensity (the percentage of export in total sales) as well as details on the internationalization process.

Data also provide all the relevant variables to compute firm-specific effective corporate tax rates, as explained in detail in Appendix 1.

Table 1 displays a breakdown of companies present in the panel by Pavitt's original 1984 taxonomy and size (number of employees).

Table 1 - Number of companies by Pavitt classification and firm size
(Years 1998-2006)

	Number	%
Sector		
Traditional sectors	426	49.8
Scale sectors	146	17.1
Specialized sectors	256	29.9
High-tech sectors	27	3.5
Size (number of employees)		
Up to 10	18	2.1
11-20	99	11.6
21-50	172	20.1
50-100	266	31,1
100-500	240	28.1
More than 500	60	7.0
Total	855	100.0

Source: Survey on the manufacturing firms (*Unicredit*) and company accounts (CERVED)

The majority of corporations belongs to traditional (about half of the panel) and specialized sectors (almost 30% of the whole panel). Turning to firm size we note that about 65% of firms of the panel can be classified as small-medium sized companies (with up to 100 workers), in line with the well-known features of the Italian manufacturing sector.

Table 2 presents the summary statistics for the main variables used in the empirical estimation and the corporate taxation indicators.

Table 2. Mean values and standard deviation of variables
(Years 1998-2006**)**

	Median	Standard deviation
EATR	0.375	0.019
EMTR	0.265	0.063
Labor taxes	0.049	0.029
Size	110	261.853
Age	32	25.593
Labor productivity	17,128	84,941
Capital-labor ratio	85,810	392,231
Debt-equity ratio	0.216	0.187

Source: own calculations

Labor taxes are proxied by the ratio between taxes on employed labor, i.e. social insurance contributions and payroll taxes, to operating surplus. Labor productivity is measured as value added per worker while the capital-labor ratio is the total amount of company fixed assets on the number of employees. Finally, the debt-equity represents the ratio between financial debts and company total assets.

Table 3 shows characteristics of exporting and non-exporting firms: number, operating surplus, the return on sales (ROS, given by operating surplus ratio to turnover), labor productivity, and markup (computed as the sum of sales and annual change in inventories on the sum of payroll taxes and material costs).

Tab. 3 – Summary statistics of exporting and non-exporting firms
(Years 1998-2006; median values**)**

	Exporting	Non-exporting
Number	4,608	1,281
Operating surplus	522,278	304,887
ROS	0.044	0.043
Labor productivity	8,721	7,990
Markup	0.321	0.31

Source: own calculations

Over the period considered the number of exporting firms is greater than the number of non-exporting ones. About 78% of the sample are exporting firms[8]. A remarkably large proportion of Italian firms export, and this share is higher than in any other industrialized economy on which comparable research has been devoted. For example, Mayer and Ottaviano (2008) report that in 2003 the shares of exporting firms in France, Germany and Italy were, respectively, 67%, 59% and 74%. On average exporters charge slightly higher markups than non-exporters and they are generally more profitable and more productive than domestic firms are. This is consistent with the existence of a productivity premium for exporters as suggested in heterogeneous-firms settings (see De Loecker and Warzynski, 2012). Moreno and Rodríguez (2010) show that non-exporters have smaller margins than persistent exporters, but larger export ratio is negatively associated with margins for persistent exporters, largely due to higher competitive pressure in international markets.

To analyze how markups differ between exporters and non-exporters we simply correlate the firm's markup to its export status in a regression framework. We control for productivity, size and factor intensity. Once estimated the parameter associated with the export status, we compute the markup difference by applying the percentage difference to the constant term, which captures the domestic average markup. The well-documented export (markup) premium, is confirmed by our results as well: markups are higher for exporters than non-exporters and the percentage difference amounts to 0.018[9]. Table 4 presents the results.

Tab. 4 - Markup premium

	Estimates
Export propensity	0.0147***
	(0.0046)
Log Size	0.0070*
	(0.0036)
Log Capital-Labor ratio	-0.0096***
	(0.0026)
Log Labor productivity	0.0192***
	(0.0015)
Constant	0.1668***
	(0.0389)
Observations	7,695
Number of firms	855

[8] If we refer to the year 2006, the number of exporting firms is 683 (75%) compared to 217 (25%) domestic firms. Let us note that our sample does not include firms with less than 10 employees.

[9] Specifically, the premium is computed through the following calculation: $0.0147 * e^{0.1668}$.

Table 5 provides further insights into the features of our dataset. Statistics are presented by quantiles of the Return on Investments index (ROI), measured by operating surplus and invested capital, and firm's exporting status[10]. In addition to labor productivity, the capital-labor ratio, and mark-up, the table displays the ratio between company debts and total assets, the ratio between cash flow and total assets. We include also an indicator of company profitability, the Return on Assets (ROA), expressed by the ratio operating surplus/company assets.

Tab. 5 - Summary statistics by quantiles of ROI and firm exporting status

Quantiles	Labor productivity	Capital-labor	Debt equity	Cash flow	ROI	ROA	Markup
			Exporting firms				
I	-6334	92,604	0.22	0.02	-1.00	-0.03	0.25
II	11,716	95,028	0.19	0.06	0.31	0.04	0.29
III	17,926	71,132	0.13	0.07	0.83	0.06	0.32
IV	34,172	96,895	0.09	0.09	2.10	0.09	0.34
V	66,370	174,544	0.07	0.10	14.85	0.12	0.37
Mean	**23,660**	**104,072**	**0.14**	**0.08**	**3.14**	**0.06**	**0.32**
			Non-exporting firms				
I	-6476	85,236	0.24	0.03	-1.53	-0.05	0.23
II	18,666	84,654	0.17	0.07	0.31	0.04	0.29
III	17,922	82,262	0.16	0.07	0.79	0.06	0.32
IV	22,917	64,007	0.10	0.08	2.14	0.09	0.34
V	27,905	86,318	0.16	0.09	10.76	0.10	0.31
Mean	**17,491**	**80,369**	**0.16**	**0.07**	**3.01**	**0.05**	**0.31**

Source: own calculations

As expected exporting firms are more productive, capital intensive and profitable than non-exporting ones. Furthermore, the differences are more marked for firms of the upper quantile. Interestingly, there is evidence that, on average, exporting firms are financially stronger than non-exporting ones. The dissimilarity in the leverage ratio is sizeable for companies of the upper quantile, suggesting that firms that are more profitable might also be more able to pay off production and tax induced costs if they export.

Table 6 reports the number of exporting firms broken down by destination regions and the related markup (median values).

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[10] Fryges and Wagner (2010), adopting a continuous treatment approach, provide evidence of the profitability premium of exporters compared to non-exporters for German enterprises.

Tab. 6 - Exporting firms and markup by destination areas

(Years 2001-2006)

	N	%	Markup
EU	1620	35.2	0.313
Asia	835	18.1	0.314
North-America	910	19.0	0.330
Total	4608	100.0	0.321

Source: own calculations

The majority of firms (35.2%) exports in the EU, while 19% of firms export in North America and 18% in Asia. As expected, Italian firms export most to the Eurozone. Interestingly, firms exporting in EU charge a lower markup than firms exporting to the other areas.

As predictable, the launch of Euro in 1999 and its generalized use in 2002 increased competition and therefore depressed markup. This might also explains the weak difference in the distribution of market power across domestic and exporting firms.

Finally, in Tab. 7, we report synthetic measures of firms' heterogeneity measured by the standard deviation of the turnover and labor productivity. In particular, estimates show the relationships between turnover and productivity and some firms' attributes. Among the covariates, we consider export intensity, capital and skill intensities, size, average firms EATR incidence.

Tab. 7 - Standard deviation of turnover and labor productivity

Variables	Standard deviation log turnover	Standard deviation log labor productivity
Log exporting intensity	0.0072***	0.0351***
	(0.0027)	(0.0050)
Log capital labor ratio	0.0056***	0.0175***
	(0.0018)	(0.0034)
Log size	0.0032	0.0214***
	(0.0035)	(0.0064)
EATR	1.5069***	0.7200***
	(0.0511)	(0.0940)
Log skilled labor	0.0112***	0.0597***
	(0.0014)	(0.0026)
Constant	0.6413***	0.6671***
	(0.0357)	(0.0658)

Observations	7,695	7,695
Number of firms	855	855
R-squared	0.2692	0.2288

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The overall results reveal substantial firms' heterogeneity. Furthermore, both the dispersion of turnover and labor productivity are strongly positively correlated with export status and the EATR. This evidence is suggestive of the potential role of export activity and EATR in explaining the heterogeneity pattern across firms in our dataset.

4. The empirical strategy

To evaluate the impact of firm-level corporate taxes on exports we first examine the extensive margin of trade, that is, the probability of exporting. Then, we extend the analysis to firms' export volumes by considering the change in export intensity to corporate taxation i.e. the intensive margin.

The choice of the appropriate tax index when analyzing the effects of corporate taxes on export decisions (and more generally investments) needs further discussion. Export propensity of the firm can be interpreted as a discrete choice between serving only the domestic market and engaging in exports. This decision is similar to the choices a firm faces, for instance, when deciding whether to undertake R&D investments, or the choice of a multinational company when deciding between a given number of mutually exclusive locations for its investment, as well discussed by Devereux and Griffith (1998). In binary choices, given the net present value of the investment, the firm evaluates the impact of taxes on the post-tax present value for each choice (in our case, exporting or serving the domestic market), that is how taxation affects the infra-marginal units. Therefore, in these cases the most appropriate indicator is the average tax rate (EATR). The effective marginal tax rate (EMTR), in contrast, measures how taxation affects the marginal unit, for which the return equals the marginal cost. In this, it refers to the intensive margin and it is thus believed to be relevant for the growth of exports.

4. 1 Export Propensity

The theoretical decision to export can be expressed as a binary choice[11] model where the dependent variable (EXP_{it}) equals to one if firm i reports positive exports at time t (and zero otherwise). We assume that a firm exports if current and expected revenues from exporting are greater than costs:

$$EXP_{it} = \begin{cases} 1 \text{ if } \Pi_{it}{}^e > 0 = EXP_{it}{}^* > 0 \\ 0 \text{ if otherwise,} \end{cases}$$

where $\Pi_{it}{}^e$ is the unobserved (latent) net present value of current and expected profits from exporting. Drawing from results of previous research on export participation' drivers, the vector of control variables includes several firm-level characteristics, such as size, age, labor productivity, capital intensity, R&D expenditure, markup, financial constraints, as crucial determinants of a firm's exporting decisions (see Appendix 2 for variables definition).

In any firm-level analysis of export activity, endogeneity of the key regressor caused by either reverse causality or omitted variables need to be discussed. This is potentially also a problem for our analysis.

As a first step to correct inverse causality issues between export choices of firms and tax rates, and because it does not lack of economic sense, we consider the effect of the lagged tax rates on current export status. However, we need to deal also with exogenous shocks that may affect the tax rate and hence firm-level decisions such as export participation.

In order to overcome these sources of potential endogeneity between the corporate tax variable and the outcome export propensity, we use standard pooled instrumental variable (IV) two-stage least square (2SLS) procedure with robust errors. Valid instruments that directly influence the effective corporate tax rate are the firm residence region and the firm assets composition[12]. Indeed, part of the overall tax rate depends on exogenous regional variations in the rate of the local tax on productive activities (IRAP) as Regions set the IRAP tax rate within given limits[13]. Furthermore, firms with different assets composition benefit from different tax depreciation rates and therefore bear different effective tax rates (as explained in Appendix 1). Because in

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[11] As known, the two standard binary outcome models are the logit and probit models. The corresponding coefficient estimates are scaled quite differently. However, the predicted probabilities are similar across the two models.

[12] Therefore, we use three instruments: the residence region of the company, defined by a numeric variable varying from 1 to 20, fixed assets relative to total assets, intangible assets over total assets.
[13] As said in the introduction, IRAP (*Imposta regionale sulle attività produttive*), introduced in Italy in 1998, is a flat rate tax levied on the value added generated by all sectors of the Italian economy. Regions are allowed to increase or decrease the national rate.

the regression we rely on the lagged value of the EATR, the asset composition variables are lagged too. We also include firm and year fixed effects to control for unobserved heterogeneity across firms[14].

Next, to exploit the panel dimension of our dataset we complement the empirical analysis by estimating a fixed effect panel data to control for unobserved individual and time heterogeneity. We add firm and time effects to the model. However, fixed effect approach to nonlinear models in the Probit framework suffers from the incidental parameter problem (Neyman and Scott, 1948). To deal with the incidental parameter problem we adopt the bias corrections recently developed by Cruz-Gonzalez and al. (2017) for nonlinear panel models with two-way fixed effects. These corrections apply to panel datasets where the two dimensions (N and T) are moderately large. They developed specific commands in Stata to implement bias correction methods for nonlinear panel models. In particular, the authors compute analytical and jackknife corrections for fixed effect estimators of probit (and logit) models with individual and/or time effects.

4.1.1 Results

Tab. 8 presents parameters estimates.

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[14] The Durbin-Wu-Hausman test leads to the conclusion that the (lagged) EATR is indeed endogenous thus reinforcing the use of an instrumental variable procedure. Furthermore, the weak instrument test reveals that the F statistic is robust to the use of the selected instruments.

Tab. 8 – Export extensive margin – Probit estimates

	Panel with bias correction		Instrumental Variable Pooled	
	Analytical	Jackknife		
Lag EATR	2.62736***	2.64761***	6.0950***	3.8923***
	(1.3999)	(1.3999)	(0.6934)	(0.6882)
Lag export	9.9156***	8.7258**	0.9165***	0.9131***
	(2.835)	(2.835)	(0.0093)	(0.0101)
Lag labor taxes	-2.0591**	-1.8013*	-0.5884*	-0.9734***
	(0.7674)	(0.7674)	(0.2336)	(0.2282)
Services imports	0.4995***	0.5012***	0.0654***	0.0904***
	(0.0750)	(0.0750)	(0.0126)	(0.0108)
Log size	0.2346***	0.2280***	0.0600***	0.0602***
	(0.0211)	(0.0211)	(0.0055)	(0.0051)
Log age	-0.0141	-0.0642*	-0.0008	0.0145
	(0.0290)	(0.0290)	(0.0080)	(0.0076)
Log labor productivity	0.0398*	0.0425*	0.0117*	0.0183**
	(0.0210)	(0.0210)	(0.0060)	(0.0057)
R&D intensity	9.6756***	9.1558***	1.4980***	1.1681***
	(1.5662)	(1.5662)	(0.2651)	(0.2551)
Mark-up	0.4086**	0.4648**	0.1083*	0.1125*
	(0.1520)	(0.1520)	(0.0498)	(0.0506)
Debt equity	-0.1589**	-0.1947**	-0.0122***	-0.0112***
	(0.1207)	(0.1207)	(0.0034)	(0.0050)
Cash flow	0.4047	0.3542	0.0216	-0.0035
	(0.4885)	(0.4885)	(0.1317)	(0.1288)
Pavitt sector	0.0472*	0.0468*	0.0156**	0.0078
	(0.0222)	(0.0222)	(0.0054)	(0.0058)
Globalization index			0.0106**	0.0068**
			(0.0037)	(0.0337)
Firm fixed effects	Yes	Yes	No	Yes
Year fixed effects	Yes	Yes	No	Yes
Obs.	7695	7695	7695	7695
Number of firms	855	855	855	855

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In general, results are in lines with expectations. The coefficients on EATR are positive and statistically significant in all specifications. However, let us note that the IV coefficients are larger than their panel counterparts are.

From the perspective of a potential exporter, a change in the EATR affects positively the probability that the firm expands its activity by serving the foreign market with parameter

values ranging from 2.6 to 6.1. This result, perhaps surprisingly, might seem unexpected as evidence suggests that as taxation lowers firm's investment returns, it may reduce export projects. However, in line with the predictions of the tax incidence theory, the extra burden of higher EATR induces firms to "re-locate" their investments and "committing" them to high levels of sales. Nonetheless, it is possible that firms are more likely to choose serving foreign demand by relocating sales abroad. As already discussed above, the EATR refers to a discrete "location choice" (domestic or/and export participation), i.e. the extensive margin of exports. It is reasonable to assume that even in the short run, internationalized firms have greater ability than domestic firms do to face market constraints, and therefore to shift the tax related cost, possibly in an attempt to exploit "profit shifting" opportunities, e.g. through more aggressive tax planning strategies (for a review see Dharmapala, 2014).

Another potential explanation for this result might be related to the theories of business literature that identify a channel through which firm characteristics, firm strategy and external environment affect export decisions. Enterprises trying to shift the tax burden, attempt to earn larger market shares and profits in domestic and foreign markets. When domestic competition gets "tougher", domestic rivalry pushes firms to improve efficiency as well as identifying foreign market opportunities: perceived competition enhances firms' export involvement (Cloughety and Zang, 2009). Labor taxes seem to deter firms from entering foreign markets. This fits the hypothesis that a higher labor tax rate increases firm's production costs and eventually reduce export propensity (Keen and Syed, 2006).

The effects of the control variables are in line with the already well-established literature on the determinants of export involvement. Larger firms are significantly more likely to export. Our framework relies on a dynamic model of participation in export markets in the presence of sunk costs (Das et al., 2007), which assumes that the decision to export depends on past exporting experience. Our empirical result supports the hypothesis that firms' current foreign participation is a function of previous exporting history and the existence of sunk cost hysteresis in exports. Thus, export experience in the previous period increases the future likelihood of exporting. However, in our dataset firms that change their participation status are much smaller in average than incumbents are.

As well-documented in the literature the role of the age on export propensity is ambiguous and this result is confirmed in our estimation. On one hand, older firms may have had more time to establish international networks, as well as gain market positions in export markets. On the other hand, older firms may experience inertia in the face of changing market conditions. Those

firms that are more intensive in capital are more inclined to exporting. Companies investing in internal R&D have a competitive advantage over their competitors and more likely will enter foreign markets.

Firms which are leveraged to a greater extent in terms of a higher debt ratio (and, hence, more credit constrained) are less likely to be exporters. That is, a relatively high exposure of the firm on the debt side suggests that the firm is likely to face some difficulties in further increasing its reliance on external funds and this is detrimental to the extensive margin of exporting. The choice to export involves both higher fixed costs and riskier revenues than domestic firms that can be offset by a bigger collateral held by exporting companies. Empirical studies based on firm-level trade data show a clear correlation between financial health and export propensity, as the former determining the financial resources available to a firm, which in turn affects its internationalization strategy (Chaney, 2005; Greenaway et al., 2007; Manova, 2008, 2013; Bellone et al., 2010; Egger et al. 2014). In contrast, the cash flow seem to be of no importance as determinant of export market entry.

Furthermore, the more productive the firm, the higher the *ex-ante* probability of exporting.
In the estimation, we included a measure related to the profitability of firms, the markup, calculated as operating revenues over operating profit. Specifically, to proxy for firms' market power, we use the information provided in the panel to construct firm-level markups. Following Campa and Goldberg (1999), the markup for firm, *i* in year *t* is defined as:

$$Markup_{it} = \frac{\text{value of sales}_{it} + \Delta \text{ inventories}_{it}}{\text{payroll}_{it} + \text{cost of materials}_{it}}.$$

Admittedly, the most appropriate measure of a firm's market power is the Lerner index. As the marginal costs are not directly observable, we derive the markup measure from accounting data, a procedure largely used in the empirical literature. As expected, the estimation provides predictions of a positive relationship between markup and firm-level export behavior.
In order to capture (pieces of) fixed export costs, we include the *KOF index of globalization,* one of the most used globalization measures in the international economics literature. Indeed, the KOF index is widely used as a measure for the *decreasing* barriers that firms can face when entering foreign markets as consequences of globalization[15]. The overall index covers the

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[15] There are several strands within the trade literature that deal broadly with firm performance and globalization.

economic, social and political dimensions of globalization. In the definition of the index [16]: *"globalization is conceptualized as a process that erodes national boundaries, integrates national economies, cultures, technologies and governance and produces complex relations of mutual interdependence"*. We find evidence, as expected, that international openness, measured by the KOF index (its economic dimension), has a positive impact on export entry.

4.2 EXPORT INTENSITY

Further interesting information can be extracted from a more detailed analysis of exports intensity.

The dependent variable in the empirical model is the share of exports over total sales, the export/sales ratio. We expect that controlling for firms' characteristics, the effect of EMTR on exporting intensity is likely *ceteris paribus* to be negative.

We draw on the extensive literature on firms' export supply to select additional controls. Variables that have been suggested as potentially determinants of exporting behavior include past export experience, labor productivity, age, R&D intensity, markup, size. In addition, as an underlying measure of firm-level uncertainty, we included firm specific demand shocks, proxied by the standard deviation of the level of sales across the years a firm is covered in the data.

We exploit the panel dimension of our dataset to explore the relationship between corporate marginal taxes and firm's export performance. Formally, the model has the following structure:

$$y_{it} = \gamma_1 y_{i,t-1} + \beta_1 X_{it} + \rho_t + \eta_i + \varepsilon_{it,}$$

where y is the dependent variable, X_{it} is a vector of the explanatory variables, β is a vector of the estimation coefficients associated with the explanatory variables, ρ_t and η_i are time and firm-specific effects, respectively, and ε_{it} is the vector of *i.i.d.* errors. The presence of the lagged endogenous variable on the right-hand-side of the equation and the fact that we have a panel data set with large N and relatively short T determines our choice of the estimation procedure.

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[16] The KOF Index of Globalization was first introduced by Dreher (2006) and is described in detail in Dreher, Gaston and Martens (2008). Data are available on a yearly basis for 207 countries over the period 1970 – 2013. The economic component of the index takes into account trade, FDI, portfolio investment, hidden import barriers, taxes on international trade and capital account restrictions.

The model is estimated following a dynamic generalized method of moments (GMM) instrumental variable (IV) approach. Specifically, we use a two-step system GMM estimator with finite-sample correction and robust standard errors (Holtz-Eakin et al. 1988; Arellano and Bover, 1995; Blundell and Bond, 1998)[17]. This estimator allows handling not only the dynamic structure of the model and predetermined or endogenous explanatory variables, but also the "unobserved heterogeneity" present in firm-level datasets, heteroskedasticity, and autocorrelation of individual observations. As well known, the GMM has a potential advantage in dealing with endogeneity and simultaneity of the right hand side variables with the error term by using past variables as instruments for endogenous variable.

The dynamic GMM model applied captures dynamic effects in the dependent variable. Future export profiles thus depend on past export experiences. Such effects are likely to be important due to the presence of fixed costs of exporting.

Our primary interest is to determine the elasticity of export intensive margin with respect to an increase in EMTR.

We employ the following specification:

$$\begin{aligned} EXP_{it} = \beta_0 &+ \beta_1 EXP_{i,t-1} + \beta_2 EMTR_{i,t-1} + \beta_3 LTAX_{i,t-1} + \beta_4 CF_{it} + \beta_5 LPROD_{i,t} + \beta_6 R\&D_{i,t} \\ &+ \beta_7 MRK_{i,t-1} + \beta_8 EMTR_{i,t-1} x MRK_{i,t-1} + \beta_9 IMP_{i,t} + \beta_{10} SDTURN_{i,t} \\ &+ \beta_{11} KOF_t + \eta_i + \varepsilon_{it}, \end{aligned}$$

where the dependent variable is the exports to sales ratio. *EMTR* is the lagged effective marginal tax rate. *LTAX* are lagged labor taxes, *CF* is the cash flow, *LPROD* is the log of labor productivity, *R&D* is the Research & Development intensity, *MRK* is markup, *EMTR * MRK* is the interaction variable between the lagged marginal tax rate and markup, *IMP* is services imports, *SDTURN* is the standard deviation of turnover. We also include the globalization index (*KOF*). Finally, η_i is a fixed effect and ε_{it} is the idiosyncratic error term.

The two-step system GMM procedure allows to derive consistent estimators by IV estimation using appropriate lags of regressors and lagged dependent variable as instruments.

4.2.1 RESULTS

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[17] To implement the system GMM estimator we use the xtabond2 command in STATA introduced by Roodman (2006). Although the two-step estimator is asymptotically more efficient, the reported standard errors tend to be downward biased (Arellano and Bond 1991; Blundell and Bond 1998). To compensate, xtabond2 makes available a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2006). This can make two-step robust estimations more efficient than one-step robust, especially for system GMM.

The empirical model presented in Section 4.2 explain firms' export activity as a function of firm characteristics. Table 9 reports parameter estimates[18].

The EMTR has an economically and statistically significant negative impact on export intensity, that is, exporters' profitability is significantly affected by changes in corporate marginal taxes. Expressed in percentages, one-per cent increase in the EMTR decreases export intensity on average by 1.92 per cent. This result shows that higher home marginal corporate tax burdens make exports more expensive as the firms' capacity to capture investment and market share opportunities is negatively affected by a reduction in the after tax profits. The sensitivity of the relationship between taxes and export intensity is caught by the interaction term between taxation and markup. It measures how the impact of the corporate taxes on the export promotion depends on the firm's markup. The negative coefficient on the interaction term shows that the EMTR estimated effect is lower in magnitude for higher markups, indicating that the higher markup firms may partially offset the impact of increase in EMTR on export turnover by absorbing a fraction of the shocks.

There is a growing literature on how a firm's own experience can influence its export decisions for several reasons. Our results show that previous export experience is key driver of future export decisions as the relative estimated coefficient is positive and statistically significant. An increase in firm demand uncertainty reduces the export activity as it makes firm-level outcomes more volatile and firms more cautious. Hence, it substantially has negative impact on firm turnover.

A similar phenomenon occurs with labor taxes as labor adjustment costs, affecting competitiveness, worsen export performance. In addition, our results confirm that firms that are more productive not only are more likely to become exporters, but also more likely may exhibit an increase in their average export growth. Evidence for this "self-selection" effect is widespread and holds for a number of countries.

The positive link that we find between innovation efforts (measured by firm' R&D intensity) and both the participation in exports and the share of exports in total sales is a stylized fact that has been found in many studies and for a large number of countries (Altomonte et al., 2013). Investment in R&D normally generates new products and processes that aid a firm to achieve a competitive advantage in the international markets. Indeed, our evidence on the relation between R&D and firm performance provides support to R&D subsidies policies.

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[18] We fit the model using two lags of the endogenous variable and the following instruments: log of *SIZE*, *R&D*, *LPROD*, *IMP*, *KOF*, the Pavitt sector. The test for errors serial correlation and the test of over identifying restrictions show that the model is correctly specified and that our instruments have identification power.

Our findings confirm that KOF index affect exports in the expected way, but the reaction of firms at the extensive margin seem more important than the export volume decisions. One implication of this result is that a fixed export cost affects a firm's initial decision to export, less the subsequent export volume choices.

Tab. 9 – Export intensive margin - Dynamic panel regression estimates

	Estimates
Lag Export intensity	0.8142***
	(0.0252)
Lag EMTR	-1.9244***
	(2.3708)
Lag labor taxes	-4.8680***
	(10.7592)
Cash flow	2.6110***
	(3.5338)
Debt Equity	-5.2124
	(4.5947)
Log Labor productivity	0.2241***
	(0.0706)
R&D intensity	0.1246***
	(0.0276)
Markup	6.1834***
	(0.9129)
Lag EMTR*Lag Markup	-10.5994*
	(6.3631)
Services imports	0.1455**
	(0.0685)
SD turnover	-1.1841***
	(0.1912)
Area	-0.5184***
	(0.1288)
KOF index	0.0290*
	(0.0196)
Constant	3.2058*
	(1.6379)
AR(1) test: p-value	0.000
AR(2) test: p-value	0.355
Sargan test	0.146
Observations	7,695
Number of firms	855

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

We detect a statistically significant and positive correlation between cash-flow adjustments and export growth while finance constraints (proxied by the debt- to- equity ratio) do not seem to have an impact on the export-to-sales ratio. This suggests that financial constraints affect the

fixed costs to export, and – hence the extensive margin of exports – but such constraints are reduced once firms engage in exporting activity – that is does not affect the variable trade cost associated with exporting activity.

We also find that services imports exert a positive influence on export performance. The rational is that exporting firms purchase abroad higher quality and/or complex services compared to those domestically available. Using imported services in the production process improves the firms' ability to obtaining higher-quality output and, thus the exporting activities potential.

Finally, area dummies indicating firms headquarter location show that been headquartered in Southern Italy may be an obstacle to expanding export sales. Indeed the main geographical areas of Italy, i.e. the North, the Center and the South, differ substantially in infrastructure, GDP and institutional environments. The inclusion of the area dummies is also useful as firms located in the North is closer to the EU markets where the Italian firms mostly export. To be located in the South of Italy seems to generate export barriers affecting negatively sales abroad.

4.3 Quantile regression

To complete our analysis and to take into account the possibility that the relation between taxation and firm-level export values may be non-linear we apply a quantile regression to the pooled data.

If it is acknowledged that exporters are heterogeneous, one is encouraged to suspect that the effects of the variables explaining the behavior of firms in foreign markets are not the same for all firms. As we are interested in the relationship between the export intensity and a set of firm characteristics (taxation, R&D intensity, size, etc.), if we regress the export intensity on these independent variables using ordinary least squares, there is no room for firm heterogeneity. OLS assumes that the conditional distribution of the export/sales ratio, given firm characteristics, is homogeneous. A quantile regression estimator appears superior allowing researchers to fit parsimonious models to an entire conditional distribution, thus providing a convenient way to introduce heterogeneous effects across firms with the aim of capturing nonlinear effects of the independent variables.

A discussion of technical details of quantile regression is beyond the scope of this paper, canonical references are the paper by Koenker and Bassett (1978) and the survey by Buchinsky (1998), while Koenker and Hallock (2001) provide a non-technical introduction.

Be enough it to say that in quantile regression, the estimated coefficients can be interpreted as the marginal change in the dependent variable at the kth conditional quantile due to a marginal

change in each independent variable. We consider five quantiles, q=10, q=0.25, q=0.5 (the median), q=0.75 and q=0.90. The estimated parameters are the partial derivative of the conditional quantile of the share of exports in total sales with respect to a particular regressor (e.g., EMTR). For each quantile, it is then possible to compare the magnitude of this effect with other quantiles.

Endogeneity of covariates renders the conventional quantile regression inconsistent for estimating the causal effects of variables (in our case the EMTR) on the quantiles of outcomes of interest (export intensity). Instrumental variables quantile regression (IVQR) provide a powerful tool for identifying and estimating the various quantiles of the potential outcomes in the presence of endogeneity (Chernozhukov and Hansen, 2005). Identification and estimation of the kth quantile of export intensity are obtained using, as instrumental variables, firm residence and assets composition that satisfy, as before, conventional independence and relevance conditions from the instrumental variables literature.

4.3.1 Quantile results for the pooled sample

Tab. 10 reports the results of the quantile regression for the export intensity equation at various quantiles using pooled data covering the period 2001-2006. Findings show that the impact of the marginal taxation varies across the conditional export intensity distribution[19]. In particular, EMTR is negative and statistically significant for all quantiles. As for the magnitude of the effects, we observe that the coefficient continuously decreases from the lower to upper quantile. This indicates that EMTR matters less when a certain export level is achieved. It also appears that labor taxes are not significant in the lower part of the distribution, but highly significant in the middle and upper part of the distribution. That is, labor taxes do not affect firms' strategies with low export sale profiles. Furthermore, findings point out to the key role of productivity in explaining dynamic behavior of exporters across the distribution. Markups are positively related to firm export intensity and seem affecting the firms' relative exposure to foreign markets. At the 0.1 quantile is not significantly different from zero. Markup is not effective in firms with relatively lower level of the export turnover. This is not surprising, as the extent of competitive pressure in international markets tends to be higher for exporters with lower export intensity. Estimation also suggests that firm size affects their relative exposure to foreign markets. The relationship is positive and almost quasi-monotonic across firms' distribution.

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[19] This is confirmed by *F-tests* that reject the null hypothesis that the coefficients are equal between pairwise quantiles.

Tab. 10 – Export intensive margin – IV quantile regression estimates

	Q=10	Q=25	Q=50	Q=75	Q=90
Lag EMTR	-6.9396***	-5.9266***	-4.6806***	-3.1961***	-3.4536***
	(0.9026)	(0.6760)	(0.5398)	(0.4871)	(0.4632)
Lag labor taxes	-3.0828	-1.1476	-3.4856***	-3.7926***	-3.3441***
	(1.9399)	(1.6797)	(1.0624)	(0.9328)	(0.9360)
Log Size	1.1824***	1.1496***	0.9834***	0.8801***	0.8120***
	(0.0405)	(0.0302)	(0.0255)	(0.0199)	(0.0180)
Log Labor productivity	0.3857***	0.4195***	0.3237***	0.2852***	0.3013***
	(0.0678)	(0.0447)	(0.0294)	(0.0201)	(0.0145)
Dummy year	-0.3079**	-0.2098***	-0.1616***	-0.1311***	-0.1029*
	(0.1404)	(0.0806)	(0.0587)	(0.0467)	(0.0571)
Markup	-0.0058	0.6494**	0.4667**	0.6739***	0.5923***
	(0.4192)	(0.2562)	(0.2029)	(0.1647)	(0.1603)
Constant	0.5363	2.5751***	5.5340***	6.8085***	6.9108***
	(0.7516)	(0.7934)	(0.5816)	(0.4020)	(0.3595)
Observations	3,441	3,441	3,441	3,441	3,441

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

5. CONCLUSIONS

This paper offers evidence of the importance of corporate taxes to Italian exporters. Our findings show that corporate taxes matter at both the extensive and the intensive margin. Higher corporate taxes seem to increase the probability of new firms' entry in the foreign market, that is, the number of export market entrant's rise. Hence, the paper highlights a positive relationship between corporate taxation and export participation pointing to some substitution of firms' sales between domestic and foreign markets. In contrast, taxes decrease the export intensity of incumbent exporters. Furthermore, a quantile regression suggests that the impact of corporate taxation and export turnover varies along the size distribution of export/sales ratio.

The main conclusion is that the inclusion of corporate taxation as a dimension of heterogeneity in firm-specific costs seem to be particularly important. Starting out from the observation that firms' export activity vary greatly among them and is systematically related to firm's characteristics, the paper establishes a relationship between firms' export choices and firms' level incidence of corporate taxes. Accordingly, when governments change corporate tax rates, by virtue of firms' heterogeneity in the composition of their capital stock, investments financing and involvement in foreign markets, they induce heterogeneous effects across firms. One of the

novel contributions of this study is its attempt to evaluate the impact of changes in corporate income taxes on both the mass of exporters and the average firm exports.

To summarize, our results indicate what many have asserted: *when it comes to international trade, taxes matter.* There is good reason to be concerned about the impacts of government tax policy on the economy's international competitiveness. An understanding of these mechanisms is important for policy-makers concerned with fostering firms' competiveness.

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APPENDIX 1

Computation of effective corporate tax rates

To compute corporate effective average tax rates (EATR) we follow the methodology proposed by Egger et al. (2009) that allows us to calculate firm-specific effective tax rates. In turn, this bases upon the approach originally developed by Devereux and Griffith (1998) to calculating forward-looking effective tax rates, and widely used in the literature. The idea behind the approach is to compute the tax burden falling on a hypothetical investment project incorporated into a neoclassical investment model, by taking into account the main determinants of the corporate tax system (statutory tax rates, tax allowances, specific investment tax credits) and of personal taxation. In addition, such rates are defined, as forward-looking effective tax rates and have the advantage of being independent of tax planning activities of the company. Hence, they are exogenous from an empirical perspective.

In this Appendix, we describe the basic model we used to derive the effective tax rates for Italy, and refer to the original paper of Egger et al. (2009) for technical descriptions of the model. EATRs measure the average tax burden on an investment giving a pre-defined rate of profitability. They are calculated as the difference between the pre-tax net present value of investment (R^*) and its after-tax net present value (R) over the pre-tax rate of return on capital, defined by the ratio between the rate of profitability p and $(1+r)$ where r is the market interest rate.

Formally, we have that:

[1] $$\text{EATR} = (R^* - R)/p/(1+r),$$

where $R^* = (p-r)/(1+r)$.

The expression of R^* depends on the various items of the corporate tax system that can be modelled, as well as on the source of financing, that is debt, new equity issues, retained earnings (see Egger et al., 2009).

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This approach also allows to compute effective marginal tax rates (MTRs), measuring the tax burden on an investment giving no-extra profits, that is an after-tax return which equals the return on an alternative assets. While EATRs usually inform on the effects of the tax system on firm binary choices, EMTRs study the impact of the tax system on company investment decisions (at the margin) and its funding sources. We will discuss this point further in section 5.

Formally:

[2] $$EMTR = (p' - r')/p'$$

where p' is the cost of capital, that is the before-tax rate of return of the investment. For the equation of the cost of capital, depending again on the company financing sources, see again Egger et al. (2009). Because we abstract from shareholders' taxation[20], $r'=r$.

Below we report the parameters used in the calculation of EATRs and EMTRs, actually based on the relevant literature:

1. profitability rate: p=0.20;

2. interest rate: r=0.05;

3. inflation rate: $\pi = 0.025$;

4. rate of economic depreciation for machinery: $\delta^m=0.01225$;

5. rate of economic depreciation for building: $\delta^b=0.0361$;

6. rate of economic depreciation for inventories: $\delta^{inv}=0$;

7. rate of economic depreciation for intangible assets: $\delta^I=0.15$.

Computation of firm-specific tax rates comes from the use of weights reflecting the actual (based on information available in the dataset) company assets structure and its financial policy. The first one is used in the calculation of the net present value of economic depreciation rates[21] (see equation 11 in Egger et al., 2009). The second one is used when weighting the combinations of financing opportunities to obtain overall measures of EMTRs and EATRs. Specifically, we assume companies have two choices, equity capital and debt. Choices are

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[20] This is in line with the literature (see Egger et al., 2009 and Devereux and Griffith, 1998). Indeed, considering that other companies own a relevant part of the companies and that this choice cannot be modelled, personal taxation may not be so relevant and could lead to biased estimates of effective tax rates.
[21] Specifically, we calculate the share of tangible fixed assets, intangible fixed assets, and stock of current assets over total assets, for each firm.

weighted based on the actual debt-equity ratio computed for each firm considering accounts data available in the dataset[22] and therefore reflecting the companies' actual financial policy.

APPENDIX 2

TABLE A2

Variables Description

Variables	Description
Cash flow	Operating surplus plus devaluations and depreciations minus total taxes over total assets
EXP Participation	Dummy that takes 1 if the firm exports, 0 otherwise
EXP Intensity	Exporting turnover on total sales
EATR	Effective average corporate tax rate
EMTR	Effective marginal corporate tax rate
Labor taxes	Taxes (social insurance contribution and payroll taxes) on employed labor over operating surplus
Capital intensity	Fixed assets on total assets
Capital-labor	Fixed assets per employee
Labor productivity	Log of value added per employee
R&D intensity	R&D expenses on total sales
Cash flow	Operating surplus minus depreciations and devaluations minus income taxes on total assets
Debt-equity	Financial debts on total assets
Markup	Sales plus inventories variation over payroll and cost of materials sum
Return on Assets (ROA)	Operating surplus on total assets
Return on Investments (ROI)	Operating surplus on invested capital
Return on Sales (ROS)	Operating surplus on turnover
Standard deviation turnover	SD of turnover
Services Imports	Equals 1 if firm imports services from abroad, 0 otherwise
Size	Number of employees
Skilled labor	Dummy that takes value 1 if the share of employees with at least a secondary school degree, 0 otherwise
Age	Log of number of years since inception
Sector	Pavitt sector classification
Geographical Area	Equals 1 is the firm is located in a Northern region; 2 if the firm is located in a Central region; 3 if the firm is located in Southern regions or Islands
Dummy year	Equals 1 in year 2002 (Introduction of Euro)
KOF index	Economic, social and political dimensions of globalization
Instrumental variables	*Description*
Region	Variable varying from 1 to 20 (Northern to Southern regions and Islands)
Fixed assets ratio	Fixed assets on total assets
Intangible assets ratio	Intangible assets on total assets

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[22] The debt-equity ratio is defined as the ratio between current and non-current liabilities and company total assets. From the analysis, we exclude firms for which the debt-equity ratio is negative or greater than 1.