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EXPORT PRICING AT THE FIRM LEVEL WITH PANEL DATA

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Abstract

This chapter reviews the growing empirical literature that explores the determinants of export prices at the firm level. It first presents evidence from empirical studies that link firm export pricing to destination characteristics ('gravity-type' models). The main implications of channels that can generate price differentiation, namely quality customization, variable markups and exchange rate pass-through, and financial frictions are then explored. A newly compiled panel dataset from Greek exporting firms is used to present evidence from regressions with export price as the dependent variable and show how the main economic hypotheses derived in theoretical models are nested in empirical specifications.

JE- classification: F14, L11, L15

Keywords: firm exporting, pricing, quality, financial frictions, panel data.

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1. Introduction

Given the importance of exports for sustainable growth and long-run welfare, an extensive theoretical and empirical literature has emerged that attempts to explore and explain the behavior of exporting firms. This literature, prompted by the availability of large datasets at the micro level, has documented a number of robust facts about the substantial and systematic variation in export performance across firms. These include the higher probability of exporting by more productive firms, with the latter having greater size and exhibiting higher export revenues, entering more markets, paying higher wages, and being skill and capital intensive. Initiated by the work of Melitz (2003) and Bernard et al. (2003), the literature has emphasized the gains from intra-industry trade in markets with heterogeneous firms. Not surprisingly, empirical research with firm-level data has, to a large extent, replaced the traditional approaches with standard trade statistics at the product level.[1]

Stylized facts also show that exporters have a different pricing behavior compared to firms that serve only the domestic market. Export prices, defined as the ratio of export value over quantity for a given firm-product-destination category (also referred to as 'unit values'), are differentiated depending on the characteristics of the destination country and firm attributes. Notably, the empirical regressions on export pricing face the challenge of embedding mechanisms closely related to prices, like quality, markups and financial frictions, which are largely unobservable or hard to quantify.

In this chapter, the growing empirical literature dealing with the determinants of export prices is reviewed, a topic that has up to now received relatively less attention compared to other strands that have examined exporting decisions at the firm level (for instance, the entry/exit choice into/from the export market, or the determinants of total value and volume of exports). The study discusses how export pricing has been tackled in related empirical papers and how the main results identify theoretical channels, although in many cases ambiguities remain. A newly compiled panel dataset from Greek exporting firms that covers the period 2003-2015

[1] Bernard et al. (2007, 2012), Redding (2011), Melitz and Trefler (2012) and Melitz and Redding (2014) provide extensive surveys of related theoretical and empirical literature.

is then used to present a number of estimated regressions with export price as the dependent variable. These specifications link export prices to main destination features, like distance, remoteness, size and income ('gravity type' regressions) and firm attributes, and it is shown how they nest the main economic hypotheses introduced in theoretical models.

The rest of the chapter is structured as follows. Section 2 reviews the empirical literature on export pricing with emphasis placed on microeconomic studies that link firm-level data with destination characteristics. Section 3 reports evidence from studies on export quality and prices, and Section 4 reviews the literature on frictions in export pricing. Section 5 describes the dataset of Greek exporters and presents results from empirical specifications that are comparable with the rest of the literature. Section 6 concludes.

2. Export pricing with micro data: gravity-type models

The main motivation for studying export pricing comes from the frequent documentation of systematic heterogeneity in the prices charged for the same traded products. Starting with Schott (2004), it has been established that even within narrowly defined product categories, average prices differ systematically with the characteristics of exporting countries, like skill and capital intensity. In an extensive study on export pricing using trade data, Baldwin and Harrigan (2011) establish that disaggregated export unit values are positively related to distance -a result also found by Hummels and Skiba (2004)- and negatively related to market size.

Since many firms set different prices across destinations, even within narrowly defined product categories, explaining product-level findings on export price variations requires firm-level data. The main empirical studies on the determinants of export pricing with firm-level data are, in chronological order: Bastos and Silva (2010) for Portugal, Martin (2012) for France, Manova and Zhang (2012) for China, Harrigan et al. (2015) for the US, de Lucio et al. (2016) for Spain, and Görg et al. (2017) for Hungary. These papers use gravity-type regressions that relate export prices with destination characteristics, such as size (captured by gross domestic

product), income (captured by gross domestic product per capita), and market toughness (proxied by distance and remoteness). Some of these papers also control for firm attributes, like firm size and productivity. In this subsection, this strand of empirical literature is reviewed and the main implications are presented.

Bastos and Silva (2010) use a cross section dataset of Portuguese exporters for 2005 and provide evidence that firms set higher prices in richer and more distant countries, whereas they find no effect of market size on prices. These relationships reflect not only the typical sorting of heterogeneous firms across markets, but also the within-firm variation of prices across destinations. Within product categories, higher-productivity firms tend to set higher prices to a given destination and also serve more distant markets, which are interpreted as evidence of quality differentiation.

Martin (2012) uses shipments of French exporters for 2003 and also finds that firms charge higher free-on-board unit values on exports to more distant countries. His results indicate that, as distance doubles, the price charged by an exporter increases by 3.5%, whereas the estimated elasticity is 0.05, which is remarkably close to the one obtained by Bastos and Silva (2010) for Portugal (amounting to 0.052). Income has also a positive impact on prices as expected, whereas the size of the country does not turn out significant. Notably, prices within more differentiated industries are more responsive to changes in distance, which indicates that in these sectors, firms have more room to adjust their markups or their quality across destinations. Overall, the estimates imply that prices in more distant destinations are higher not only because distance increases transport costs, but also because firms charge higher prices net of transportation costs.

The most detailed study on the behavior of export prices is the one by Manova and Zhang (2012), who focus on Chinese exporters for 2005 and establish a number of stylized facts on export pricing at the firm level. Among others they show that, within narrowly defined product categories, firms charge higher prices in richer, larger, bilaterally more distant and less remote economies (with the elasticity with respect to distance amounting to 0.01). Notably, firms earn more revenues from a specific good in markets where they set higher prices, a pattern that is more

prominent in richer countries and for goods with bigger potential for quality upgrading. The authors also find that, within each product, firms serving more destinations offer a wider range of export prices, especially for products with greater scope for quality differentiation.

Harrigan et al. (2015) use data from US firms for 2002 and establish that within narrow product categories, exporters charge higher prices in more distant countries. The effect of distance on prices is the largest one compared to those reported in other studies (yielding an elasticity in the vicinity of 0.19). The authors also report that more productive firms set higher prices, whereas skill intensity and capital intensity firms have a positive and a negative effect on prices respectively. In contrast, they find no significant effect of firm size on export pricing. Their overall assessment is that these effects are indicative of quality, rather than cost, competition.

In a study with data from Spanish manufacturing exporters for 2014, de Lucio et al. (2016) add the transaction dimension to the analysis of export pricing. They confirm that more productive exporters set higher prices and that export prices are higher in more distant and richer destinations. In particular, they demonstrate that doubling the distance leads to a 3.1% increase in prices. In addition, they show that differences in firm prices at the product-destination level are associated with the number of varieties covered by each product category, the volume of transactions and the vertical differentiation of products within firms. Their findings point towards quality competition as a major driving force of pricing within Spanish exporters.

Görg et al. (2017) explore the relationship between export unit values and destination characteristics using panel data from Hungarian firms for 1998-2003 and show that export unit values increase with distance. Similarly to Martin (2012) and de Lucio et al. (2016), they find that a doubling of distance is associated with a 7.5% increase in average product prices. Prices are also positively correlated with destination income and negatively with destination size. These patterns of price discrimination across markets are consistent with firms shipping higher-quality varieties to higher-income and more distant markets, but also with firms charging variable markups across markets (pricing-to-market).

In summary, the common finding across the aforementioned papers is that exporters set higher prices in more distant and richer destinations. In addition, and in contrast to the prediction of Melitz-type theoretical models with heterogeneous firms that more productive firms self-select into exporting setting lower prices because of lower marginal costs, there is ample evidence that higher-productivity exporters set higher prices. These findings can be justified by several, not mutually exclusive, mechanisms: exporting firms may sell a range of varieties within product categories with different levels of quality across markets, charge variable markups across markets, or be subject to other frictions that affect their pricing decisions. In the following sections, these channels and their implications for export prices at the firm level are explored in the context of related empirical studies.

3. Quality and firm export pricing

A strand of the literature on exports has explored the role of product-quality differentiation for export pricing and has assessed that consumers are willing to pay a premium for high-quality, high-cost varieties, pointing out the importance of the quality of goods produced and exported for economic outcomes (see, among others, Hallak, 2006; Hallak and Schott, 2011; Hallak and Sivadasan, 2013; Hausmann et al., 2007; Hummels and Klenow, 2005; Sutton and Trefler, 2016; Verhoogen, 2008). In this vein, Schott (2008) has documented a large difference in product prices within the most disaggregated level of product classification: US consumers pay less for similar goods that are “Made in China” than for those “Made in OECD”. Fontagné et al. (2008) report that, on average, Japanese export prices are 2.9 times higher than Chinese, for the same products shipped to the same markets within the same year. Their empirical analysis indicates that the products of developed countries are not directly competing with those of developing countries. These stylized facts broadly support models where consumers value quality, but quality is expensive to produce. Consumers choose goods on the basis of “quality-adjusted” prices and are willing to pay a higher price for an expensive, high-quality good (Harrigan et al., 2015).

As heterogeneous firms compete on both prices and quality, high-quality firms might therefore become (growing) exporters despite charging higher prices: the

most profitable firms use higher-quality inputs to produce upgraded versions of their products and sell them, in possibly the toughest markets, at higher prices. Johnson (2012) estimates a multi-country trade model with heterogeneous firms using sectoral level data to examine within-exporter variation in prices across destinations. In accordance with the evidence reported by the papers surveyed in the previous section, he finds that prices in the majority of sectors are increasing in the difficulty of entering the destination market, proxied by distance. The overall picture is in line with the Alchian and Allen (1964) conjecture, which states that the demand for higher- quality (and more expensive) products should increase with transport costs, an effect known as 'shipping the good apples out'. Moreover, several studies have found that demand for high-quality goods increases with income per capita (Linder, 1961). The main implication is that, in addition to the 'efficiency sorting' of heterogeneous exporters, a 'quality sorting' of heterogeneous firms across markets arises, i.e. within product categories, higher-productivity firms tend to ship greater quantities at higher prices to a given destination, consistent with higher quality. Eckel et al. (2015) examine the implications of cost-based versus quality-based competence for multi-product Mexican exporting (and non-exporting) firms and find that firms in (non-)differentiated sectors exhibit (cost) quality competence.

Can export quality be linked to export pricing? The main challenge here is that product quality is unobserved. The empirical literature has attempted to exploit the availability of trade data at a highly disaggregated level and readily observable prices (unit values), calculated as values over quantities, have been used as a proxy for export quality. However, this assumption suffers from several shortcomings generated by differences in the composition of goods, production costs and pricing strategies within a given product category across exporters. If, for instance, exporters that use lower-cost inputs are systematically less productive than their competitors and sell more expensive varieties, then by measuring relative quality with relative prices, a positive effect on output quality may be spuriously detected. Moreover, standard supply or demand shocks will affect equilibrium prices, without necessarily affecting product quality. In a seminal contribution on assessing quality with trade data, Khandelwal (2010) exploits price and quantity information to

estimate the quality of US imports, based on a straightforward intuition extensively used in the industrial organization literature: "conditional on price, [...] higher market shares are assigned higher quality" (Khandelwal, p. 1451).

The main empirical evidence on export pricing and quality comes from studies with trade data. Hummels and Klenow (2005) infer quality by adopting the premise that if large exporters systematically sell high quantities at high prices, then they will also produce higher-quality goods. The authors show that richer countries export higher quantities of each good at modestly higher prices, consistent with higher quality. Hallak and Schott (2011) rely on trade balances to identify quality: holding observed export prices constant, countries with trade surpluses are inferred to offer higher quality than countries running trade deficits. Consumers are assumed to care about price relative to quality in choosing among products and, hence, two countries with the same export prices but different global trade balances must have products with different levels of quality. Vandenbussche (2014) develops an export quality indicator based on Di Comité et al. (2014), which disentangles quality (vertical differentiation) from cost and taste effects (horizontal differentiation), to generate quality ranks of EU manufacturing products over the period 2007-2011. The rankings confirm that quality upgrading results in higher willingness to pay by consumers and, therefore, quality offers a way to escape cost competition. Feenstra and Romalis (2014) add a supply-side dimension by arguing that as foreign demand rises less efficient exporters enter with lower quality, thus generating a negative relation between trade and quality. They decompose available unit values of internationally traded goods into quality and quality-adjusted price components using an endogenous quality decision, in order to aggregate individual products to industry-level indexes of export quality and prices. Henn et al. (2017) use reduced-form quality-augmented gravity-type equations based on Hallak (2006), to estimate aggregate and product export quality indices and find that quality upgrading is particularly rapid during the early stages of development.

At the firm level, Crozet et al. (2012) obtain direct assessments of quality for one exported product (French champagne) and show that firms with higher quality export higher quantities at higher prices, with quality explaining roughly one third of

export prices. Gervais (2015) shows that product demand may play an important role in explaining plant outcomes in addition to plant efficiency and obtains plant-level measures of product quality. The author uses US Census firm-level data and confirms that prices are increasing in quality after controlling for productivity (which affects prices negatively). Moreover, price variations understate variation in product quality across plants: a one standard deviation increase in estimated quality is associated with a half standard deviation increase in price.

4. Frictions in firm export pricing

4.1. Markups and exchange rate pass-through

Markups are an integrated component of export pricing in trade models, which typically adopt the assumption of monopolistic competition. However, in the Melitz (2003) model with CES preferences and iceberg trade costs, heterogeneous exporters charge a constant markup above marginal cost across countries and price discrimination is absent (see, for instance, Arkolakis et al., 2012). Melitz and Ottaviano (2008) extend the Melitz (2003) setup and use linear demand to introduce endogenous variations in markups across destinations, which respond to the toughness of competition in a market. They show that larger markets exhibit tougher competition in the form of hosting more, and larger, competing firms, leading to lower markups and prices. Gopinath et al. (2011) offer ample evidence in favor of market segmentation and show that markup gaps contribute to the variability in price gaps, suggesting that pricing-to-market takes place at the wholesale level.

De Loecker and Warzynski (2012) introduce a methodology for the estimation of firm- level markups and use data from Slovenian manufacturing exporting firms to establish that, after controlling for productivity, they charge on average higher markups and that firm markups increase upon export entry. De Loecker et al. (2016) extend this framework to obtain markups for multi-product large Indian exporting firms and show that the decline in marginal costs due to trade liberalization does not translate to equal price declines, because markups increase. Gullstrand et al. (2014) analyze the relationship between price variations in products across export destinations for firms in the Swedish food supply chain and find that exporters with

greater ability to discriminate between markets are associated with a higher markup.

On top of the evidence that exporters adjust, at least partially, their markups as part of their pricing strategies, there is also evidence that export prices do not change proportionately in response to changes in exchange rates. In an extensive study on the effects of exchange rate movements on export pricing, Berman et al. (2012) show that high-performance French exporting firms absorb, to a larger extent, exchange rate movements in their markups (pricing-to-market). Chatterjee et al. (2013) and Li et al. (2015) observe similar patterns for Brazilian and Chinese exporting firms respectively. Caselli et al. (2017) show that Mexican exporters increase their markups following a real depreciation and that the increase of markups is significantly higher for higher-performance products, which in turn translates into heterogeneity in producer price responses. Kalyvitis et al. (2017) explore the effects of euro adoption on Greek exporters and find that initially high-productivity firms raised their prices and markups following euro adoption, a finding that is interpreted as evidence of a positive demand shift for these firms. Chen and Juvenal (2016) use a sample of Argentinean wine exporters and confirm that pricing-to-market increases with firm productivity. Moreover, they link export prices, exchange rate pass-through and quality by showing that pricing-to-market rises with quality: prices rise in response to real exchange rate shifts more as the quality of the wines exported rises.

4.2. Financial constraints

The cost needs of exporters are inherently different compared to firms that serve the domestic market. Specifically, fixed and variable costs tend to be higher for exporters and need to be paid up front due to long time lags between production and sales due, for instance, to the need to build advertising and distributional networks, acquire specific legislative and regulatory information and requirements, and customize products. Also, the realization of revenues is uncertain and typically involves more complex, riskier and less enforceable contracts between the lender and the borrower. As a result, potential exporters must have enough liquidity at hand and, not surprisingly, there is empirical evidence that financial constraints

affect exporting decisions (Bellone et al., 2010; Berman and Héricourt, 2010; Feenstra et al., 2014; Greenaway et al., 2007; Manova et al., 2015; Minetti and Zhu, 2011; Muûls, 2015). When financial constraints affect variable and especially marginal costs, export prices are affected as well, as more credit-constrained exporters face higher marginal costs (Feenstra et al., 2014; Manova, 2013).

Financial constraints can therefore play a central role in export pricing decisions. Secchi et al. (2016) report that Italian firms facing tighter credit conditions charge higher prices than unconstrained firms exporting the same product to the same destination. More recent studies attempt to link export pricing with endogenous quality and financial constraints. Fan et al. (2015) introduce credit constraints and endogenous quality in a Melitz-type model and test the empirical relationship between credit constraints, quality and prices using Chinese firm-level panel data. They find that lower credit constraints increase both the price and the quality of products, which confirms the 'quality sorting' hypothesis, as also implied by the positive estimated association between prices and productivity. In a similar vein, Dinopoulos et al. (2017) document that less financially-constrained Greek exporters charge higher prices and have higher export revenues. They propose a model with endogenous product quality and credit constraints, which features variable price elasticity of demand, and find that less credit-constrained exporters face less elastic demand and export higher-quality products.

5. Inspecting the evidence: an application with panel data from Greek exporters

5.1. The dataset for Greek exporting firms

This section presents an empirical application on export pricing using a new dataset that combines data from two sources: international trade flows of Greek firms are identified at the firm-level and are matched through the ICAP database to firms' characteristics. More specifically, firm-level data on non-oil products for Greek manufacturing exporters from 2003 to 2015 are obtained from the Eurostat's Extra-

EU and Intra-EU trade statistics.[2] When goods are declared to the EU-statistics, they are classified according to the 8-digit Combined Nomenclature or CN8, which is the most detailed product classification system for keeping foreign trade statistics in the EU. Free-on-board export values are collected at a monthly frequency and are aggregated to annual values and quantities traded by firm to obtain export prices (unit values) as the ratio of these two variables. Defining products at a highly disaggregated level minimizes the scope for factors like product quality differences, which are likely to determine price variations within firms.

Following the main studies surveyed in the previous section, the behavior of aggregate export prices is examined by running gravity-type regressions of export prices on main features of the destination country, namely bilateral distance to Greece, overall economic remoteness, income and size. Following related empirical literature, data on GDP and GDP per capita are obtained from the World Bank's World Development Indicators. Bilateral distances from Greece are obtained from CEPII. Remoteness, which proxies geographical isolation from most other nations or closeness to small countries but far away from big economies, is measured as a weighted average of a country's bilateral distance to all other countries in the world using countries' GDP as weights. The degree of financial constraints for each firm is proxied by the credit rating score from the ICAP database, which is a ten-scale indicator controlling for insolvency, excessive and/or bad debts, overdue accounts, and other typical commercial risks, and is routinely used by Greek banks on their decisions to supply credit to firms. It is also used by firms in assessing the credibility of their clients and thus provides a form of extra liquidity through short-term financing from suppliers.

To address noise or error, data are trimmed using the following rules. First, quantities equal to one or two on a monthly basis are excluded to deal with rounding errors and misreporting. To avoid product classification inconsistencies, product codes that do not match through years are excluded. Also, the data are cleaned by dropping observations with large price variations across destinations. 'Large

[2] Extrastat is the system that produces statistics on trade in goods of EU Member States with non-EU Member States and Intrastat produces statistics on trade in goods between countries of the EU.

variations' refer to prices that differ from a factor of five or more from the mean across all destinations. Finally, the remaining price-based outliers are identified and excluded from the sample by censoring the extreme quantiles of each firm's price distribution, below the 1st and above the 99th percentile.

After dropping these outliers, the matched sample from 2003 to 2015 contains 161045 firm–product–destination matched observations. In Table 1, the summary statistics are shown. For the period 2003-2015, there is an average of 898.3 firms employing 110.4 persons with an export volume of 5.85 million euros per year, exporting 1908.3 CN8 products to 129.3 destinations. On average, for the same period, each exporter exports 5.8 CN8 products and exports to 6.5 destination markets. These figures are not far from those reported in other datasets and ensure that the dataset is comparable to those used in other empirical studies.[3]

5.2. Panel data evidence from Greek exporters

This subsection presents some empirical results on export pricing from Greek firms and compares them with those in the prior literature. Table 2 follows Manova and Zhang (2012) and considers in a gravity-type regression the correlation between average export prices across firms and features of the destination market. Average export prices are product-level prices obtained after aggregating the revenues and quantities of a certain product exported to a certain destination, such that they equal the values that product-level ('trade') data would report. Year dummies are included to control for symmetric developments common to all destinations; for instance, the world trade crisis or the overall evolution of Greek aggregates, like the wage rate (Berman et al., 2012). Product fixed effects, which capture systematic differences in prices due to the inherent characteristics of products across categories, such as differences in consumer appeal, comparative advantage, transportation and distribution costs, different units used across goods, and other product characteristics that affect all exporters equally, are also included (Manova and Zhang, 2012).

[3] For instance, Bastos and Silva (2010) report that Portuguese firms exported on average 9.9 CN8-classified products to 3.4 countries in 2005.

Column (1) of Table 2 reports the estimates from the regression of product-level prices in the sample and shows that the average export price is higher in less distant, less central, richer and bigger markets. The sample is also split in destinations above and below median income level. The negative association of product-level prices with distance and the positive association with market size are driven by poor destinations, whereas there are no associations for rich destinations. The rest of the coefficients retain their signs in both specifications, with the positive correlation between prices and market remoteness being more than five times stronger in poor destinations.

As discussed in detail in the survey of the literature on export pricing at the firm level in the previous sections, product-level prices do not distinguish in the different patterns between productivity, quality, or other heterogeneous characteristics across firms. The richness of the dataset is therefore exploited to present regressions on the determinants of firm-level export prices. These regressions always control for the following firm characteristics. First, the number of destinations as a proxy for the firm's productivity is included (Berman et al., 2012). Second, a standard feature of models with heterogeneous firms is that higher productivity translates into a larger firm. A standard measure of firm size is total (export) sales, which however represent quantities times prices; hence any measurement error in prices may appear on both sides in regressions with prices as the dependent variable. To address this concern, Kugler and Verhoogen (2012) proxy plant size by employment, which has the advantage that measurement error is likely to be less severe and, importantly, uncorrelated with measurement error in output values and quantities.

Following Manova and Zhang (2012), firm-product fixed effects are included that, in addition to subsuming the role of product characteristics common to all firms, like those included in Table 2 with product-level prices, are invariant across export markets and control for firm attributes such as overall production efficiency, managerial talent, labor force composition, general input quality, that affect the firm's export performance equally across products. They also help address the concern that consumers get different utilities from the products of different firms.

To account for the potential correlation in the error term across firms and destinations within a product, errors are clustered by product (or by destination-product when the destination-specific variables do not enter in the specification).[4]

Table 3 presents the results from the panel dataset with firm-level data. Columns (1)-(4) include sequentially the four destination variables as dependent variables along with the set of controls, whereas column (5) includes jointly the four destination characteristics. Turning first to the controls, employment systematically enters with a positive and statistically significant sign. The coefficient on the (log) number of employees suggests that the price elasticity with respect to firm size is economically significant: a firm with double employment charges higher prices by approximately 16% (exp(.15)-1). This value is somewhat higher than that obtained by Kugler and Verhoogen (2012) for Colombian plants (2.6%), but close to that of Secchi et al. (2015) for Italian firms (19.8%). On the other hand, the coefficient on the (log) number of destinations is insignificant.

Regarding the destination characteristics, the firm-product fixed effects imply that the coefficients of interest are identified purely from the variation in prices across destinations for a given exporter-product pair. As shown in columns (1) and (5), the estimates of the destination coefficient are now different compared to the product-level data in Table 2. Specifically, the coefficient on distance is insignificant, but remoteness remains positive and significant, although its magnitude is less pronounced. Destination income is also positive and significant, whereas the size of the country is not associated with prices.

Motivated by the findings of various studies on the differential impact of firm productivity on export pricing, in column (6) an exercise based on interaction terms is performed. Specifically, interaction terms of the number of destinations with country features are included in the empirical specification. These terms aim at capturing whether firms with different productivity (proxied by the number of destinations served) charge different prices depending on market characteristics.

[4] Robustness checks have been made, controlling for firm-specific variables, like age, and time dummies for the world trade crisis in 2008 and 2009. All the results are qualitatively similar to those presented here. Also, the results are similar when different sources of heteroskedasticity are allowed in the error term, or heteroskedasticity-robust standard errors are used

Notably, the interaction of the number of destinations with remoteness is positive, whereas the coefficient on remoteness turns out now insignificant. This finding implies that firms serving a larger number of destinations charge higher prices in less tough (more remote) destinations within the same product category. Income enters again with a positive sign, but the interaction term with the number of destinations is negative, indicating that this co-movement is less prominent for firms that supply more countries.

Next, the relationship between firm export prices and financial constraints is examined. The last three columns of Table 3 introduce the credit score of the firm as a measure of its financial constraints. Given that there are no destination specific variables, the simple product fixed effects are replaced by product-destination pair fixed effects, which implicitly control for product characteristics that are invariant across manufacturers and trade partners. They also condition on features of the importing country that affect all products and firms selling there, such as consumer income, regulatory restrictions, legal institutions, inflation, and exchange rates. These fixed effects take account of transportation costs, bilateral tariffs, demand conditions, market toughness, and other economic factors that influence exporters in any given destination-product market. Finally, destination-product fixed effects account for measurement error given the possibility that all firms have more incentives to be truthful about exports of some products to certain markets, or that customs officials are more conscientious about given goods in some countries (Manova and Zhang, 2012).

In column (7) the credit score is introduced as an independent variable and destination-related controls are suppressed. The rating enters with a positive and statistically significant sign, which indicates that a less financially-constrained exporter sets a higher price compared to that set by a constrained firm exporting the same CN8 product to the same destination market. The coefficient on the number of destinations has now a negative and statistically significant sign whereas the firm size is insignificant; both are identified by the variation within a destination-product and a firm-product market. The robustness of the finding on the coefficient of the credit score is further explored in column (8), in which a similar specification to that

of column (5) is adopted that controls for the destination characteristics. The coefficient on the rating remains positive, but is now only marginally significant. The rest of the coefficients are virtually identical to those obtained in column (5). Finally, in column (9) the four interaction terms are included. The broad picture, when compared to that without the credit score of the corresponding column (6), remains virtually unaffected with the credit score turning out again positive and marginally significant.

The main findings are therefore that Greek exporting firms set higher prices in richer and less central destinations. The association with centrality is more prominent for more efficient firms, whereas the association with income is less pronounced for these firms. These stylized facts on export pricing are identified from the variation across destinations within firm-product pairs. Given that trade models with heterogeneous firms predict either a constant markup (CES demand), or lower markups in markets where competition is tougher (linear demand), i.e. big, distant, and less remote destinations, the positive association of prices with destination remoteness and the lack of association with destination size indicate that variable markups within firm-product pairs could, at least partly, rationalize export pricing by Greek exporters. On the other hand, the quality differentiation channel can also be consistent with the positive association between prices and remoteness, which is stronger for more efficient firms –as anticipated by the Alchian-Allen hypothesis that the demand for higher-quality good increases with transport costs. Yet the finding that the positive association of prices with destination income is driven by less efficient firms, which have higher marginal costs and are also more likely to face tighter financial constraints, merits further examination.

6. Conclusions

Given the ever-increasing availability of micro data on exporting firms and their characteristics, the empirical literature on export pricing at the firm level is constantly maturing to the point where one can now sketch out a handful of empirical paradigms and use them to organize related empirical specifications. Our review of this evidence indicates that empirical papers on export pricing offer a

useful complement to theoretical studies. They deliver intuitive and sometimes quite compelling explanations for important patterns, including some that are difficult to quantify, like the choice of quality or variable markups.

It should be stressed that sprinkled throughout the survey are some discussions of research that are hard to categorize into a single canonical framework. For example, the association of pricing with quality may co-exist with financial constraints at the firm level, which in turn affect both outcomes. Complications like these suggest why observable outcomes, like prices, are associated with non-observable outcomes in industrial organization, like quality or frictions, in ways that are hard to quantify –although casual empiricism suggests that they are plausibly interrelated. The contrast between the implications of different results obtained in empirical papers on export pricing is a key reason why this research agenda area presents novel opportunities that may lead to important insights in international economics and beyond.

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Table 1. Summary statistics for Greek exporters: 2003-2015

average number of firms per year	898.3
average employment	110.4
average value of exports (in million euros)	5.851
number of destinations per year	129.9
number of destinations per firm	6.5
number of products (CN8 classification) per year	1908.3
number of products (CN8 classification) per firm	5.8

Table 2. Export pricing with average product-level ('trade') data

	Dependent variable: average price across firms		
	all	rich	poor
	(1)	(2)	(3)
distance	-0.015**	0.006	-0.026**
	(-2.08)	(0.78)	(-2.18)
remoteness	0.231***	0.068**	0.418***
	(8.20)	(2.20)	(10.43)
gdp per capita	0.088***	0.079***	0.084***
	(12.46)	(8.66)	(8.01)
gdp	0.029***	0.002	0.046***
	(5.62)	(0.43)	(4.82)
product FE	yes	yes	yes
# of observations	158792	78381	77131
R^2	0.751	0.779	0.758
cluster	CN8	CN8	CN8
# of clusters	3746	2732	3119

Notes: *t* statistics in parentheses. * denotes p<.10, ** denotes p<.05, *** denotes p<.01. All variables are in logs. A constant term and year fixed effects are included in all regressions. The dataset spans the years 2003-2015. The dependent variable is the average (across firms) log price, defined as revenue over quantity, of a product-destination in a year.

Table 3. Export pricing at the firm level

	Dependent variable: export price (firm-product-destination)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
distance	-0.000				0.004	0.014		0.004	0.014
	(-0.07)				(0.86)	(0.80)		(0.87)	(0.82)
remoteness		0.038**			0.077***	-0.040		0.077***	-0.042
		(2.39)			(4.97)	(-0.68)		(4.97)	(-0.72)
gdp per capita			0.042***		0.045***	0.102***		0.045***	0.102***
			(13.26)		(11.03)	(6.51)		(11.03)	(6.51)
gdp				0.010***	-0.001	0.003		-0.001	0.002
				(6.95)	(-0.32)	(0.25)		(-0.33)	(0.24)
rating							0.014**	0.017*	0.017*
							(2.24)	(1.78)	(1.83)
employment	0.155***	0.154***	0.156***	0.163***	0.150***	0.151***	0.019	0.147***	0.148***
	(20.72)	(19.87)	(19.05)	(21.83)	(16.52)	(14.60)	(0.78)	(15.56)	(14.01)
# of destinations	-0.010	-0.009	-0.007	-0.009	-0.007	-1.007*	-0.023***	-0.009	-1.038*
	(-1.07)	(-1.00)	(-0.80)	(-0.98)	(-0.84)	(-1.77)	(-3.46)	(-1.01)	(-1.82)
# of destinations X distance						-0.003			-0.003
						(-0.64)			(-0.66)
# of destinations X remoteness						0.029**			0.030**
						(2.09)			(2.14)

# of destinations X						-			-0.015***
						0.015***			
gdp per capita						(-4.12)			(-4.12)
# of destinations X						-0.001			-0.001
gdp						(-0.43)			(-0.41)
destination-product FE	no	no	no	no	no	no	yes	no	no
firm-product FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
# of observations	140788	139896	140096	140096	139563	139563	128450	139563	139563
R^2	0.888	0.889	0.890	0.889	0.890	0.890	0.916	0.890	0.890
cluster	CN8	CN8	CN8	CN8	CN8	CN8	CN8 & dest	CN8	CN8
# of clusters	3191	3181	3187	3187	3181	3181	19120	3181	3181

Notes: *t* statistics in parentheses * p<.10, ** p<.05, *** p<.01. All variables are in logs. A constant term and year fixed effects are included in all regressions. The dataset spans the years 2003-2015. The dependent variable is the firm log price, defined as revenue over quantity, of a product to a destination in a year.

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