Export Prices and Heterogeneous Firm Models

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Abstract. This paper examines the variation in export prices across firms, products and destinations to distinguish between alternative trade models with firm heterogeneity in productivity and quality. We use a unique new dataset on the universe of Chinese trading firms in 2005, and establish six new stylized facts. First, firms charge higher unit prices in larger, more distant markets. Second, higher export prices are associated with lower export quantities and greater revenues, both across firms within a destination and across destinations within a firm. Third, firms that export more to more destinations have higher average export and import prices, and fourth, they price discriminate more across trade partners. Fifth, more firms export to larger, more proximate markets. Finally, the maximum price observed across Chinese exporters in a given destination-product market rises with market size and falls with distance, while the opposite holds for the minimum export price. We interpret these results in the context of four recent (classes of) models, and conclude that none of them alone can match all stylized facts. We suggest that our findings are instead consistent with a framework in which firms adjust both quality and mark-ups across destinations.

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1 Introduction

A growing body of empirical literature has documented the extent of firm heterogeneity in international trade. In particular, studies consistently find that more productive firms are more likely to become exporters, have higher export revenues, and enter more markets.[1] This evidence has provided support for the first heterogeneous firm models, which emphasize variation in marginal production costs across firms, and predict that more productive firms will charge lower prices and become more successful exporters (Melitz 2003; Bernard, Eaton, Jensen and Kortum 2003; Melitz and Ottaviano 2008). At the same time, bigger exporters have also been shown to pay higher wages, source more expensive inputs, and be more skill and capital intensive.[2] Correspondingly, recent models have turned to quality differentiation across firms, and postulated that more productive firms have superior export performance because they sell higher quality products at higher prices (Baldwin and Harrigan 2007; Johnson 2007; Verhoogen 2008; Kugler and Verhoogen 2008; Hallak and Sivadasan 2008; Kneller and Yu 2008).

This paper is the first to use detailed firm-level data on export prices to distinguish between these alternative heterogeneous-firm models. A unique new dataset on the universe of Chinese trading firms in 2005 allows us to examine the variation in export revenues, quantities and (free on board) unit prices across firms, products and destinations. We establish six new stylized facts and interpret them in the context of four recent (classes of) heterogeneous-firm models. Our agnostic conclusion is that none of the existing models can match all patterns in the data. We suggest that our findings are instead consistent with a framework in which firms adjust both quality and mark-ups across destinations.

Understanding firms' export decisions is essential, not least because of its implications for aggregate trade patterns and growth. Reallocations across sectors and across firms within a sector appear equally important in the adjustment to trade liberalization and its effect on aggregate productivity (Pavcnik, 2002; Bernard, Jensen and Schott, 2006). How the rise of low-cost giants such as China and India will affect firms, workers, and cross-country income convergence also depends on the nature of firm heterogeneity. If the growth of such countries relies on their cost advantage, then the future of developed economies may rest with quality differentiation. Indeed,

[1] See Bernard and Wagner (1997), Bernard and Jensen (1999), Clerides, Lach and Tybout (1998), Aw, Chung and Roberts (2000), Bernard, Jensen and Schott (2007), and Eaton, Kortum and Kramarz (2004, 2005) among others for firm-level evidence, and Bernard, Jensen, Redding and Schott (2007) for a survey of the literature.

[2] See, for example, Bernard and Jensen (1995), Verhoogen (2008), and Kugler and Verhoogen (2008).

U.S. output and employment appear to be less vulnerable to import competition from low-wage countries in sectors characterized by longer quality ladders (Khandelwal, 2008).

We consider four classes of heterogeneous-firm models, which differ along two dimensions: demand structure and the nature of firm competition. In all frameworks, a unique firm characteristic, usually productivity, determines firms' production and export outcomes.[3] All firms above a certain productivity level sort into exporting, and more productive firms earn higher revenues and profits.[4] When firms with lower production costs capture a larger market share (efficiency-sorting models), the lowest-cost supplier is predicted to export everywhere, while the marginal, highest-price exporter will depend on the market size and distance of the export destination. On the other hand, when producers of higher-quality goods charge higher prices and perform better (quality-sorting models), the highest-price firm will export everywhere, but the minimum threshold price level will vary across importing countries. In both sets of models, the variation in firm prices across destinations depends on the underlying demand structure. Under constant elasticity of substitution (CES), firms charge the same constant mark-up over marginal cost in all markets. With linear demand, on the other hand, firms set lower mark-ups in big and remote countries where competition is tougher.

Our work builds on recent papers that use the variation in aggregate, product-level export prices across destinations to distinguish between efficiency- and quality-sorting models. Baldwin and Harrigan (2007), for example, find that U.S. export prices decrease with the importer's market size and proximity, a pattern consistent with quality-sorting and either CES or linear demand. Johnson (2007) analyzes product-level export prices for all country pairs and reaches a similar conclusion. In our data, by contrast, the average export price across all firms trading a given product is higher in bigger and more proximate destinations. This result is consistent with both efficiency sorting with CES demand and quality sorting with linear demand. Our findings thus indicate that examining aggregated prices alone may be inconclusive or misleading, because it precludes the separate evaluation of firm prices and firm selection into exporting. Moreover, even if aggregate prices behave in a manner consistent with a given model, firm-level prices may not.

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[3] Recent models of multi-product firms such as Bernard, Redding and Schott (2006a,b,c,) and Melitz and Ottaviano (in progress) consider the combination of firm-level "ability" and product-level "expertise". These models have similar predictions for firm-product level prices as Melitz (2003) and Melitz and Ottaviano (2008), respectively.

[4] See Hallak and Sivadasan (2008) for a heterogeneous-firm model with quality differentiation and an overlapping distribution of productivity across exporters and non-exporters.

The detailed nature of our dataset allows us to address this challenge. We establish six new stylized facts. First, we exploit the variation within a firm-product pair across destinations and find that firms charge higher prices in bigger and more remote export markets. None of the existing heterogeneous-firm models can account for this pattern. With CES demand, firms should charge all trade partners the same free on board price. While price discrimination is optimal in models with linear demand, they predict that mark-ups and prices should actually be lower in markets with tougher competition, typically understood as bigger, more remote countries. This suggests that firms' marginal production costs are higher when selling in such markets.

While existing quality-sorting models assume that firms sell the same-quality product worldwide, we believe firms may optimally both upgrade quality and lower mark-ups when they face tougher competition. In particular, firms may use more expensive, higher-quality inputs when manufacturing for more competitive target markets. If this increases marginal production costs sufficiently quickly, it will dominate the adjustment in mark-ups and generate higher export prices in big and remote destinations. Further support for this explanation comes from the observation that the effect of market size and distance on firm prices is stronger in richer destinations which may have a greater willingness to pay for quality. Moreover, these results hold only for non-homogeneous goods with scope for quality differentiation.

Second, we examine the relationship between firm-level export prices, revenues and quantities, and find results consistent with the quality explanation above. Among exporters within a given destination-product market, firms selling at a higher price trade fewer quantities but earn greater revenues. Similarly, across destinations, firms ship fewer quantities of a given product but have larger revenues when they charge a higher export price. Both sets of results are more pronounced in sectors with greater scope for quality differentiation, as proxied by product differentiation, sector R&D intensity, or the combined sector advertising and R&D intensity.

Third, if firms adjust the quality of their product across destinations, we would also expect that firms penetrating more markets will exhibit greater price dispersion across trade partners. Indeed, the standard deviation of export prices across countries within a firm-product pair is positively correlated with the number of destinations. Similarly, firms which on average offer higher-priced (higher quality) products are able to sell in more markets. As a model of quality differentiation across firms and destinations would predict, both of these results are stronger for goods with greater scope for quality variation.

Fourth, our explanation rests on the premise that firms optimally use inputs of varying quality to modify the quality of their exports across markets. While we do not observe the inputs that Chinese exporters buy domestically, we use the information on their imports as an imperfect signal of the quality range of all their inputs. As hypothesized, we find that firms which export more to more destinations at a higher average export price source more expensive imports on average. Moreover, firms which sell in more markets and price discriminate more across destinations also pay a broader range of import prices for the same product. Both of these results are consistent with exporters varying the quality of their products across destinations and more successful exporters selling higher quality goods in more markets.

Fifth, we consider the selection of firms into exporting, and find that more Chinese firms enter bigger, more proximate markets, in line with existing CES-demand models. Finally, we examine the distribution of prices across Chinese firms selling in a given destination-product market, and record the minimum and maximum prices observed. The highest price rises with the market size of the importer and decreases with its distance, consistent with extant efficiency-sorting models. However, the opposite holds for the lowest export price charged: it falls with GDP and increases with remoteness, speaking to current quality-sorting models. Clearly, none of the existing heterogeneous-firm models can match all three stylized facts about firm selection into exporting. We suggest that these patterns may emerge if firms adjust both mark-ups and quality across export destinations, but we leave developing a complete model accounting for this effect to future work.

Our results add to a small but growing literature on export prices as a litmus test for distinguishing between alternative trade models. In addition to the papers discussed above, our findings are also related to the work of Schott (2004), Hummels and Klenow (2005), Hallak (2006), and Mandel (2008). They show that aggregate export prices vary systematically with both trade partners' GDP per capita and with the relative factor endowments and productivity of the exporting country, and argue that cross-country quality differentiation can explain these facts.[5] Verhoogen (2008), Kugler and Verhoogen (2008), and Hallak and Sivadasan (2008) show firm-level evidence consistent with quality differentiation across firms. In particular, they find that exporters charge higher prices than non-exporters, plant size is positively correlated with output-

[5] See also Hallak and Schott (2008) for a method of decomposing countries' observed export prices into quality versus quality-adjusted-price components.

and input prices, and more productive firms pay higher wages to produce better quality goods. In concurrent work, Crozet, Head and Mayer (2009) show that highly-ranked French wine producers export more to more markets at a higher average price. To our knowledge, this paper is the first to explore firm-level export prices by product and destination. We uncover new stylized facts that present challenges to all existing heterogeneous firm models, and we offer a potential rationalization for these patterns in the data.

The remainder of the paper is organized as follows. The next section discusses the alternative trade models we consider and their implications for export prices. Section 3 describes the data and stylized facts about aggregate, product-level prices. Sections 4 and 5 present our results for firm prices and firm selection into exporting, respectively. The last section concludes.

2 Heterogeneous Firm Models in the Literature

All heterogeneous firm models we consider share the assumption that firms can be ranked according to a single attribute, productivity, which uniquely determines their export status, pricing, revenues and profits. All firms with productivity above a certain threshold level become exporters, and more productive firms perform better, though the underlying mechanism behind this pattern depends on the specifics of the model. This section briefly reviews the alternative models, and highlights the theoretical implications that we test to distinguish between them. For ease of reference, Table 1 summarizes all relevant empirical predictions.

2.1 Efficiency sorting with CES demand

One of the first heterogeneous firm models in the literature was the widely-adopted Melitz (2003) framework. Upon entering an industry, firms draw a productivity level, which fixes their marginal production cost. Firms then decide whether to immediately exit or produce for the domestic market and potentially export. With CES demand and product differentiation, firms optimally charge a constant mark-up above their marginal cost. Hence a firm's free on board (f.o.b.) export price does not depend on the identity of the destination, while c.i.f. (cost, freight and insurance) prices do because of an added iceberg transportation cost.

Since more productive firms have lower marginal production costs, they offer lower prices, sell higher quantities and earn greater revenues. The model thus predicts a negative correlation between the f.o.b. export price and both export value and volume at the firm level.

With fixed costs of exporting, only the most productive firms become exporters. The threshold productivity level for each export destination is pinned down by the marginal firm which makes zero profits in that market. This cut-off depends on the market size and distance of the importing country. With CES preferences, demand for any firm's product and firm revenues increase with aggregate spending in an economy. This implies that the productivity cut-off for exporting will be lower for bigger destinations. Since selling to more remote countries entails higher transportation costs and thus lower profits, the cut-off productivity level rises with distance.

From the perspective of a given exporting country such as China, these comparative statistics imply that more Chinese firms will sell to bigger, more proximate markets. The most efficient, cheapest exporter will supply all destinations, so the lowest Chinese export price observed in any given market should be independent of its size and remoteness. On the other hand, the highest price will be set by the marginal, least efficient Chinese exporter and should increase with the importer's GDP and fall with its distance. Aggregating up, the average export price across all firms selling in a given country should rise with size and fall with distance.

While the original Melitz (2003) model focuses on one sector, its implications carry over to a multi-sector world, where the productivity cut-off for exporting may vary across industries.[6] This is also true of the other models described below. In our empirical implementation, we explore the variation in prices across firms and destinations within narrowly defined product categories.

2.2 Efficiency sorting with linear demand

Melitz and Ottaviano (2008) provide an alternative heterogeneous firm model which maintains product differentiation and monopolistic competition, but assumes that firms face linear demand as in Ottaviano, Tabuchi and Thisse (2002). As in Melitz (2003), a productivity draw determines firms' marginal production cost. However, the price elasticity of residual demand is no longer exogenously fixed, but depends on the toughness of competition in a market. Firms thus optimally price discriminate, and charge lower mark-ups and lower f.o.b. prices in bigger destinations which attract more competitors. Exporters also absorb some of the transportation costs and grant lower f.o.b. prices to more distant countries. Since more productive firms have lower production costs, they still offer lower prices, sell higher quantities and earn greater revenues, although they charge

[6] For multi-sector versions of the model see, for example, Bernard, Jensen and Schott (2007) and Manova (2007).

higher mark-ups. This model thus also delivers a negative correlation between the f.o.b. export price and both export value and volume at the firm level.

With linear demand, it is still the case that only the most productive firms select into exporting. Fixed trade costs are not necessary for this result, since demand for any product is zero above a certain price level. This translates into a productivity cut-off for exporting, which depends on the toughness of competition in the destination market. The model predicts that this threshold is higher for bigger, more remote countries and we should observe fewer firms selling there.

In contrast to the case with CES demand, now both the minimum and the maximum price observed across successful Chinese exporters will vary systematically across countries. The most efficient firm will still supply all markets, while the marginal exporter will differ across destinations. However, because all firms price discriminate, the lowest, highest, and average price among all Chinese exporters in a given country will fall with its GDP and distance.

2.3 Quality sorting with CES demand

More recently, to match new empirical facts, a number of papers have incorporated quality differentiation in the Melitz (2003) framework, including Baldwin and Harrigan (2007), Johnson (2007), Verhoogen (2008), Kugler and Verhoogen (2008). In these models, product quality typically enters the CES utility function through a quantity-augmenting term. Because firms optimally sell at a constant mark-up above marginal cost, once again firm-level prices are unrelated to market size and distance.

While the micro-foundations of firms' quality choice differ across papers, they usually predict that more productive firms will sell higher quality goods.[7] For example, Johnson (2007) suggests that upgrading to higher quality entails a bigger fixed production cost which only more productive firms can afford, while Verhoogen (2008) generates output quality differentiation by allowing firms to choose the quality of their inputs.

The implication of these quality models for quality-adjusted firm prices is the same as in the basic Melitz (2003) framework: more productive firms sell greater quantities at lower quality-adjusted prices and earn bigger revenues. However, whether more productive firms charge absolutely higher or lower prices depends on parameters of the model. This arises because firms

[7] Baldwin and Harrigan (2007) assume that firms with higher marginal production costs produce higher quality. Their predictions for the correlation between firm productivity and various export outcomes are the inverse of those I describe here, but all price implications presented in Table 1 are the same.

optimally sell at a constant mark-up above marginal cost, and the latter falls with firm efficiency but rises with quality. If quality increases in productivity sufficiently quickly, so will marginal costs and absolute prices. Otherwise, all predictions of the quality-augmented model will be identical to those of Melitz (2003). In Table 1, we summarize the implications of the quality sorting – CES demand model in the former case only, because only in that case can the models be distinguished in the data. This is also the case that we focus on in the rest of this subsection.

With fixed trade costs, once again all firms more productive than a given threshold level become exporters. As in Melitz (2003), this cut-off is lower for more proximate destinations with bigger aggregate spending (GDP), implying that we should observe more Chinese firms selling in such markets. However, the predictions for the distribution of firm prices are rather different. The most productive, highest-quality firm will supply all destinations, and thus the maximum Chinese export price observed in any given market should be independent of its size and remoteness. On the other hand, the minimum price will be set by the marginal, lowest productivity (quality) Chinese exporter and should fall with the importer's GDP and rise with its distance. In contrast to Melitz (2003), the average export price across all Chinese firms selling in a given country should now fall with size and rise with distance.

2.4 Quality sorting with linear demand

Most recently, Kneller and Yu (2008) examine aggregate price data (in an exercise similar to that in Baldwin and Harrigan, 2007) and document important differences across sectors. To account for these findings, they propose a heterogeneous-firm model that imbeds quality differentiation in the Melitz-Ottaviano (2008) framework with linear demand. In this model, too, product quality enters the utility function through a quantity-augmenting term.

Kneller and Yu (2008) do not explicitly model quality choice, but instead directly assume that firms with higher marginal production costs produce higher quality.[8] Under linear demand, better quality firms charge higher prices, not only because of their bigger marginal cost, but also because quality makes them more competitive and allows them to charge a larger mark-up. While higher-priced products always sell in lower quantities, the correlation between firm export price and revenue depends on parameters of the model. If quality increases sufficiently quickly with

[8] Antoniades (2008, in progress) also studies a linear-demand model with quality differentiation, but inserts quality in the utility function slightly differently. He explicitly models firms' quality choice but the current draft does not fully develop the pricing implications of a multi-country equilibrium.

marginal costs (elasticity above 1), higher-quality, more expensive products will earn firms greater revenues. Otherwise, all predictions of this quality-augmented model will be identical to those of Melitz and Ottaviano (2008). As in the previous section, Table 1 reports the implications of the quality sorting – linear demand model in the former case only, because only in that case can the models be distinguished in the data. We discuss only this case in the rest of the subsection.

As in Melitz-Ottaviano (2008), with linear demand, the price elasticity of residual demand depends on the toughness of competition in a market. For this reason, firms optimally price discriminate, and charge lower mark-ups and lower f.o.b. prices in bigger destinations which attract more competitors. Exporters also absorb some of the transportation costs and grant lower f.o.b. prices (though higher c.i.f. prices) to more distant countries.

When quality is sufficiently elastic in production costs, export profits increase with quality and cost. Hence all firms with a marginal cost (quality) above a certain cut-off become exporters. This threshold level is higher for larger and more remote destinations, where competition is tougher. As in Melitz-Ottaviano (2008), this model thus also predicts that more Chinese firms should export to smaller, more proximate countries.

The implications of this set-up for the distribution of prices across successful exporters is a little more nuanced. The highest quality / highest price producer will supply all countries, and because every firm sets a lower price in more competitive markets, the maximum Chinese export price charged in a given destination will fall with its size and distance. The lowest price in any market will be set by the cheapest / lowest quality Chinese exporter selling there. On the one hand, this firm, too, will tend to charge lower prices in more competitive markets. On the other hand, this marginal firm will feature higher cost / better quality in such markets. Because of these two opposing effects, the correlation between the minimum Chinese export price observed in a given country and that country's GDP and distance is theoretically ambiguous. The same applies to the average price across exporters.

3 Data

We use a unique new database on the universe of Chinese firms which participated in international trade in 2003-2005.[9] These data are collected by the Chinese Customs Office and made available by the Chinese authorities. They report the value of imports and exports in U.S. dollars by product

[9] Manova and Zhang (2008) provide a detailed description of this dataset and an overview of Chinese trade patterns.

and trade partner for 243 destination/source countries and 7,526 different products in the 8-digit Harmonized System classification. The dataset also provides information on the quantities traded in one of 12 different units of measure (such as pieces, kilograms, square meters, etc.), which allows us to calculate unit prices. We have confirmed that each product is recorded in a single unit of measure, and we include product fixed effects in all of our regressions to account for the different units used across products. While the data is available at a monthly frequency, we focus on annual exports in the most recent year in the panel, 2005.

Some state-owned enterprises in China are pure "trading" companies which do not engage in manufacturing and serve exclusively as intermediaries between domestic producers (buyers) and foreign buyers (suppliers). In this paper, we examine the operations of firms that both produce and export goods, and leave the study of "trading" companies for future work. Since the data does not indicate these intermediaries, we use key words in the firms' names to identify them.[10] In the rest of the paper, we refer to all firms remaining in our data as trading firms.

Table 2 presents summary statistics for the variation in log export prices across 96,522 Chinese exporters, 6,908 products, and 231 importing countries. After removing product fixed effects, the average log price in the data is 0.00, with a standard deviation of 1.24 across goods, firms, and trade partners. Within a given HS-8 product, the standard deviation across exporters and destinations is 1.11 on average, but some goods feature much more price dispersion than others. There is also a lot of variation in prices across trade partners within a given firm-product pair. Focusing on firms that sell the same product to multiple countries, the standard deviation of log prices across destinations for the average firm-product pair is 0.46. While this variation may be random, it does suggest that models, in which firms price discriminate across markets, may be more successful in matching the data. Similarly, prices differ non-trivially across firms selling in a given country and product. The standard deviation of log firm prices for the average country-good pair is 0.90. This emphasizes the extent of firm heterogeneity in the data.

We use data on GDP and GDP per capita for 175 countries from the World Bank's World Development Indicators. Our bilateral distance measure comes from Glick and Rose (2002).

Based on the availability of data on market size and remoteness, we work with 242,311 observations across 175 countries and 6,879 HS-8 codes at the destination-product level, and 2,098,551 observations across 94,663 firms at the firm-destination-product level. The firm-level

[10] We drop 23,073 "trading" firms which mediate a quarter of China's trade by value.

regressions that do not require data on the importer's characteristics exploit the universe of trade flows for a total of 2,179,923 observations.

3.1 Average, product-level export prices

As Table 1 illustrates, alternative heterogeneous-firm models deliver very different predictions for the behavior of firm- and product-level export prices. To distinguish between these models, most of the prior literature has examined product-level unit values and their correlation with destination size and distance (Baldwin and Harrigan, 2007; Johnson, 2007; Kneller and Yu, 2008). For consistency with the prior literature and to motivate the need for firm-level analysis, in this section we explore the variation in the average Chinese export price across importing countries.

We aggregate the data by summing across the value and quantity of exports across all Chinese firms that export a specific HS-8 good to a given market. We then obtain the average export price for each destination-product by dividing total revenues by total quantities.

Table 3 Panel A demonstrates that the average unit price across all firms exporting a given product is higher in bigger and more proximate markets. The first column reports our basic results from a gravity-type regression of the average export price on destination GDP and distance, with all variables entering in logs. Both coefficient estimates are statistically significant at 1%. Since more developed countries may have a taste or greater willingness to pay for quality products, we control for GDP per capita in the second column, and find that average export prices are indeed higher in richer destinations. The correlation with market size is now imprecisely estimated, but that with distance remains unchanged. These results are consistent with the efficiency-sorting Melitz (2003) model, but also with the quality-sorting linear-demand framework. This ambiguity demonstrates that studying the behavior of aggregated prices alone can be inconclusive, and highlights the value of examining firm-level data.

The predictions of different heterogeneous firm models for average export prices are driven by the effects of market size and distance on both firm-level prices and the selection of firms into exporting. In models with CES demand, firms do not price-discriminate across countries, and the destination size and distance affect average export prices only through the selection of firms into exporting. These models would thus predict that the importer's characteristics should not affect average prices once we control for firm selection. By contrast, models with linear demand suggest that market size and distance both affect firm selection and reduce firm-level prices. Accordingly, once we condition on the number of successful exporters, we should observe a negative correlation between average unit value and both GDP and distance.

As a first step towards decoupling these effects, in the third column of Panel A we explicitly control for the log number of Chinese exporters by destination-product. The average export price is indeed lower when competition by other Chinese firms in the same destination is tougher, consistent with linear-demand models. However, market size (distance) continues to be positively (negatively) and significantly correlated with the average unit value once we control for firm selection. This suggests that none of the models in Table 1 alone may be able to match all facts, and justifies examining other aspects of the firm- and product-level data.

Our results are quite different from Baldwin and Harrigan (2007), who observe a positive (negative) coefficient on distance (GDP) in a similar regression for the U.S. and its biggest 100 importers. Their evidence thus points to quality-sorting with either CES or linear demand. Since we examine trade with 175 of China's trade partners, our results may differ because our sample covers relatively more small and poor destinations.

To explore this possibility, in Panel B of Table 3, we repeat our baseline regression separately for destinations above and below the median GDP per capita.[11] We find that the average export price increases with size and distance for the 88 richer countries, while the opposite holds in the poorer half of the sample. This pattern is robust to controlling for GDP per capita. Once again, these split-sample results do not conclusively point to one heterogeneous-firm model or another. They may be jointly accounted for by the quality-sorting model with linear demand. Alternatively, quality sorting with linear demand may describe exporting to richer countries who value quality more, while efficiency sorting with linear demand may be more relevant for trade with lower-income trade partners. In either case, once we control for the number of Chinese competitors in a given destination-product market, both samples behave similarly to the full sample in a fashion inconsistent with any model.

Since examining aggregated export prices may produce inconclusive or misleading results, in the rest of the paper we make use of the detailed nature of our data and study firm-level prices.

[11] We obtain similar results when we instead split the sample by market size (GDP).

4 Export Prices at the Firm Level

We begin the analysis by exploring the variation in export prices within firms across destinations of different market size and distance. We then study the relationship between export prices, revenues and quantities across firms within a given market, as well as across trade partners within a firm. Finally, we examine the link between firm's import prices and export performance. We document systematic patterns that pose a challenge to extant trade theory, and suggest that they may instead be attributed to firms varying both mark-ups and product quality across destinations.

4.1 Firm export prices and destination characteristics

Recall that both efficiency- and quality-sorting models with linear demand predict that firms should price discriminate across countries and set lower mark-ups in bigger and more distant destinations where competition is tougher. With CES demand, by contrast, firms should offer all trade partners the same free on board price. Table 4 presents robust evidence that firms in fact charge higher prices in larger and more remote markets.

The unit of observation in this table is a firm-product-destination triplet. Our sample covers 94,663 Chinese exporters active in 6,879 HS-8 products and 175 countries, for a total of 2,098,551 observations. We report results with errors conservatively clustered at the HS-8 product level, but note that all of our findings are robust to alternative clustering, such as by product-destination, firm, or firm-product.

We first examine the variation in prices within products across firms and destinations. In our baseline specification in column 1, we regress log firm price on the log market size and log distance of the trade partner, and condition on product fixed effects. We find positive and highly significant coefficients on both variables. These results continue to hold when we control for the importer's GDP per capita in column 2 or allow for country random effects in column 3.

We present results from a more rigorous test of the theoretical models in the right half of Table 4, where we repeat the estimation with firm-product pair fixed effects. The coefficients on market size and distance are now identified purely from the variation within a firm-product pair across destinations. In particular, the fixed effects control for each firm's marginal cost of producing a specific good, which in the models is determined by the firm's productivity level and unique product quality choice.[12,13] Hence any residual systematic variation in prices across countries should result from adjustments to the mark-up. Note that models with CES demand (linear demand) would predict no correlation (a negative correlation) between mark-ups and destination size and distance.

Our results strongly suggest that a given exporter charges a higher price for the same HS-8 good in bigger and more remote markets. While the point estimates drop in magnitude relative to those in our baseline specification with product fixed effects only, they remain economically significant: A one standard deviation increase in GDP or distance is associated with a 2.7% (1%) rise in the firm-product specific price, or 6% (2%) of a standard deviation. These results are difficult to reconcile with existing heterogeneous-firm trade models. They are robust to controlling for the destination market's income per capita or including country random effects. In addition, they are not driven by firms extracting higher mark-ups because of greater market power. In columns 3-6 of Table 5, we show that the positive correlations of export price with market size and distance obtain controlling for firm revenues or market share in that country and product.

How can we explain these results? The literature on quality differentiation in international trade is very recent, and it has so far typically assumed that firms sell product(s) of the same quality worldwide. Deviating from this approach, Verhoogen (2008) studies heterogeneous firms that choose two quality levels, one for domestic production and one for exports abroad. The predictions of his model for the variation in firm prices across export destinations are thus similar to those of the quality-sorting models we have discussed. Hallak and Sivadasan (2008), on the other hand, consider minimum quality requirements for exporting in a two-country model, but maintain the assumption that each firm produces a single quality. Even if different countries have different minimum quality requirements, their model could also not explain why the same firm charges a higher price for the same product in bigger, more distant trade partners.

There are two potential explanations for our findings. If we believe that firms do indeed sell essentially the same product in all countries, our results can only be explained by higher mark-

[12] While we examine models with single-product firms, the estimation allows the production cost to be good-specific. This is consistent with the theoretical predictions of multi-product heterogeneous-firm models in the literature, such as Bernard, Redding and Schott (CES demand, 2006a,b,c) and Melitz and Ottaviano (linear demand, in progress).

[13] In all models we study, all products enter the utility function symmetrically. This implicitly normalizes quantities by utils and not physical units. Technically, the models' predictions are for prices per utility-adjusted unit of output. Empirically, the concern is that consumers get different utils from the products of different firms. Firm-product pair fixed effects address this problem.

ups over marginal cost in larger and more remote markets. In view of the existing linear demand models, we think that this is unlikely.

A more plausible and appealing explanation is that firms tailor the quality of their product to the competitive environment or the specific preferences of the trade partner. Since our results condition on the destination's GDP per capita, cross-country differences in quality tastes cannot be purely driven by the importer's income or overall development to explain our findings. Instead, it is possible that firms optimally upgrade output quality by using higher-quality inputs when they face a tougher market, and this increases their marginal cost. Even if they reduce their mark-up, they may charge a higher absolute price. As in existing quality-sorting models, more productive firms may offer higher quality at higher prices in any given market and still have lower quality-adjusted prices.

This explanation, as well as models with variable mark-ups, attributes price discrimination across countries to the toughness of competition. While linear demand models suggest that market size and distance proxy for market toughness, a more direct indicator is the number of firms that a Chinese exporter has to compete with. If we were able to control for the total number of competitors in a given market, coming from any country of origin, we would expect no residual correlation between firms prices, market size and distance. In the absence of such data, in columns 1 and 2 of Table 5 we check how our results change when we control for the log number of Chinese exporters in the same destination-product market. Even with this imperfect measure, we find that the effect of distance on firm prices can be assigned to market toughness, although that of size survives.

The results in Tables 4 and 5 indicate that firms set higher export prices in richer countries. As Verhoogen (2008) argues, richer consumers have a lower marginal utility of income and are likely willing to pay more for a given level of quality. If firms adjust product quality to market toughness, we would expect that they would have a greater incentive to do so when they face wealthier customers. We test this prediction in Table 6 by including interactions of destination GDP and distance with income per capita. Indeed, we find that firm prices respond more to market size and remoteness when the trade partner is richer. Moreover, these results hold only for non-homogeneous goods with scope for quality differentiation. Using the Rauch (1999) product classification, we observe no systematic patterns for the export price of goods traded on organized exchanges or listed in reference-price journals. By contrast, all of our results obtain in the sample of differentiated products.

In the next two subsections, we provide further firm-level evidence consistent with a quality-sorting framework in which firms adjust both mark-ups and product quality across destinations.

4.2 Firm export prices and export performance

To better understand the nature of firm competition, we next examine the relationship between firm prices and export performance. In Table 7, we regress (log) firm export price on (log) export revenues or quantity, by HS-8 code and destination. We emphasize that our interest is in the sign of the correlations between these variables and not in a causal interpretation. Heterogeneous-firm models in fact predict that prices, demand and sales are all a function of an underlying firm characteristic, productivity, which we do not observe in the data.

The unit of observation in Table 7 is once again a firm-product-country triplet. Since this exercise does not require information about the trade partner, we use the universe of trade flows for 96,522 firms, 6,908 products, and 231 countries, for a sample size of 2,179,923. We explore different sources of variation in the data by varying the set of fixed effects included in the regression. For consistency, we cluster observations at the same level as the fixed effects employed, but note that all of our results are robust to alternative treatments of the error term.

We first study the total variation across firms and destinations within HS-8 categories, by controlling for product fixed effects. As the first two columns in Panel A show, higher prices are associated with lower export quantities and greater revenues.[14] For a more rigorous test of the heterogeneous–firm models, we next focus on the variation across firms within a given destination-product market by including country-good pair fixed effects. Within a market, firms selling at a higher price trade fewer quantities and earn larger revenues. Both relationships are highly statistically and economically significant.

These results are consistent with quality-sorting models, in which higher prices are associated with better quality and bigger revenues. We find more corroborative evidence when we

[14] Note that although the export price is calculated as the ratio of revenues to quantity, this does not impose any restrictions on the sign of the correlations of price with revenues and quantity.

compare products of varying scope for quality differentiation.[15] In column 3, we regress export price on firm sales and their interaction with the Rauch (1999) dummy for differentiated goods. The positive correlation between price and revenues across firms in a market is indeed stronger for non-homogeneous products. We obtain similar results in columns 4 and 5 when we instead proxy for differentiation potential with continuous measures of R&D intensity or combined advertising and R&D intensity. These measures come from Klingebiel, Kroszner and Laeven (2007) and Kugler and Verhoogen (2008), respectively. They are based on U.S. data for 3-digit ISIC sectors which we have matched to the HS-8 products in our sample.

To distinguish between different quality-sorting models, in Panel B of Table 7 we examine the variation in export prices within a firm-product pair across destinations. Controlling for exporter-good pair fixed effects, we find that firms ship fewer quantities but earn greater revenues when they charge a higher export price.[16] As column 3 shows, this correlation is not attributed to market power, as proxied by the firm's share in total Chinese exports in the same destination-product. Note that if firms sell the same quality of a given good in all markets, their marginal production cost would be captured by the fixed effects in this regression. Any residual variation in prices across trade partners would then be driven by variable mark-ups and inconsistent with CES demand. Our results would also imply that mark-ups are positively correlated with export revenue and negatively correlated with quantity. However, while the latter relationship obtains in linear demand models, the first one does not: Under linear demand, firms set higher mark-ups in smaller markets where they also export smaller quantities and earn lower revenues.

On the other hand, the variation in prices across destinations within firm-product pairs is consistent with firms adjusting quality across markets and earning higher revenues when they offer better quality. This interpretation is further supported by the systematic variation across goods in columns 4-6. The positive correlation between price and revenue is more pronounced in sectors with greater scope for quality differentiation, as measured by product differentiation, sector R&D intensity, or the combined sector advertising and R&D intensity.

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[15] If export quantities are measured with error, so would be the imputed export unit prices. Since prices are the outcome variable, this could introduce classical measurement error that would not bias coefficients but could reduce precision. If measurement error in quantities also affects the right-hand side variable, it could bias coefficients either up or down. Exploring the variation across goods with varying scope for quality differentiation addresses this concern since there is no *a priori* reason to believe that measurement error will vary systematically across products.

[16] The firm-product fixed effects implicitly control for differences across firms in the number of utils consumers derive from 1 physical unit of output. See footnote 13 for more details.

Heterogeneous-firm models predict that more productive firms will not only have bigger sales in any given market, but will also enter more markets because they will be above the exporting cut-off for more destinations. As a result, more productive firms will also earn larger total export revenues from their sales worldwide. Quality sorting thus implies that, across firms within a given product, firms' average export price (quality) should be positively correlated with firms' number of destinations and total export revenues. Conversely, these correlations should be negative under efficiency sorting.

To test these two predictions, we aggregate the data to the firm-product level by summing sales and quantities across destinations. We then take their ratio to construct firms' average export price. In the first two columns of Table 8, we regress the log of this average price on firms' log worldwide export revenues and quantities by HS-8 code.[17] In line with quality sorting, we find that within a given product, firms that charge a higher average price sell lower volumes worldwide but earn greater revenues. These results are highly statistically significant, obtain with product fixed effects and clustering by product, and are robust to alternative levels of clustering. Moreover, the positive association between price and revenues is once again more pronounced for goods with greater scope for quality differentiation.[18]

Panel A of Table 9 confirms the second quality-sorting prediction discussed above: exporters which supply more countries charge a higher average export price. This result obtains with product fixed effects and is thus based on the variation across firms within an HS-8 category. In addition, the correlation is entirely driven by products with potential for quality upgrading. As columns 2-6 show, no such systematic pattern holds in the sample of homogeneous goods or products with zero R&D- and advertising intensity.

These results for firms' total export revenues and number of trade partners are consistent with quality sorting and incompatible with efficiency sorting. They do not, however, clarify whether firms choose a unique quality level for their exports worldwide or instead vary product quality across destinations. In the latter case, we would expect that firms entering more markets would exhibit greater price dispersion across importers. The results in Panel B of Table 9 confirm

[17] Since the unit of observation is now at the firm-product level, the sample size is reduced to 898,247 data points.

[18] While the interactions of export revenues with the dummy for product differentiation and with the combined advertising and R&D intensity enter positively, the coefficient on the interaction of export revenues with R&D intensity is negative. This R&D intensity measure is very unevenly distributed in the data, with many values in the 0.00-0.03 range and a few sectors above 0.07. When we group sectors into high- and low-R&D intensity, the interaction of export revenues with a dummy for high-R&D intensity is positive.

that this is indeed the case. We obtain the standard deviation of export prices across destinations for each firm-product pair, and find that it is positively correlated with the number of export markets.[19] This pattern holds only for differentiated products (but not for homogeneous goods) and is more pronounced in R&D-intensive sectors.

To be precise, the fact that firms exporting to more destinations exhibit greater price dispersion across destinations does not by itself imply that firms vary quality across markets. It may also be that firms offer the same quality, at the same marginal cost worldwide but they adjust mark-ups across importers. However, the fact that firms charging higher average prices enter more export markets combined with the result for price dispersion is indicative of quality discrimination across countries.

Finally, we do not view the patterns in Tables 8 and 9 as representing causal relationships. Since the regressions include product fixed effects, we instead interpret them as conditional correlations consistent with firms varying product quality across destinations. Recall that exporters charge higher prices in bigger and more distant countries where competition is tougher (Table 4). We believe that more productive firms may be able to more effectively (cheaply) upgrade quality and thus successfully enter more competitive markets. In this way, more productive firms can record higher export revenues, more trade partners and greater price dispersion across destinations.[20] In addition, they would export products of higher average quality at a higher average price. Tables 8 and 9 can thus be seen as reporting the positive correlations between different indicators of export performance that are all uniquely determined by unobserved firm productivity.

4.3 Firm import prices and export performance

Existing models of quality sorting typically predict that more productive firms will choose to produce higher-quality products, though the micro-foundations for this choice differ across models. Johnson (2007), for example, proposes that upgrading to higher quality entails a higher fixed cost, which may be interpreted as the cost of adopting better technologies that allow the manufacturing of higher-quality products. Since more productive firms have higher revenues, they

[19] This measure of price dispersion is only defined for firm-product pairs with more than one export destination, hence the smaller sample size in these regressions.

[20] Appendix Table 1 provides more corroborative evidence. For a given product, firms selling in more markets charge a higher maximum and a lower minimum price across markets. In addition, these patterns are stronger for products with greater scope for quality differentiation.

can incur bigger fixed adoption costs while remaining profitable. Verhoogen (2008) and Kugler and Verhoogen (2008), by contrast, propose that more productive firms choose to use better quality and more expensive inputs, which increases marginal production costs but also delivers a higher-quality output.

The results we have presented so far are consistent with a quality sorting model in which firms manufacture different quality-versions of the same product for different destinations. This would not be optimal if firms need to pay a fixed cost for developing each quality level. If firms have to adopt better technologies to upgrade quality, they would instead choose the technology that allows them to produce the single quality level which maximizes worldwide export revenues.

We therefore believe it is more likely that firms use inputs of varying quality to modify the quality of their output product. For example, a Chinese shoe manufacturer may employ the same machine or worker to make shoes for Malaysia and the U.S., but use high-quality leather upper and water-proof soles for the American market and cheaper, lower-quality inputs for Malaysian exports. In this hypothetical example, we have chosen the U.S. and Malaysia merely to suggest that firms may respond to market toughness (GDP, distance) and consumers' willingness to pay for quality (GDP per capita) when choosing the profit-maximizing quality level for each market.

This rationalization is similar to but more flexible than that in Verhoogen (2008) and Kugler and Verhoogen (2008). To establish a link between input and output quality, it is sufficient for Kugler and Verhoogen (2008) to show that plant size in Colombia is positively correlated with plants' average input and output price. To argue that firms vary the quality of their product across destinations, we need to replicate this result but also demonstrate that firms source a range of input qualities to produce a range of output qualities.

While we do not observe the inputs that Chinese exporters buy domestically, we use the information on their imports as an imperfect signal of the quality level and quality range of all their inputs. Of the 96,522 exporting firms in our dataset, 58,337 are also importers for whom we observe import revenues, quantities and unit prices by HS-8 product and country of origin. In the rest of this section, we examine the correlation between import prices and export performance for this subset of firms. Since many firms import and export multiple products and we cannot match specific "inputs" to output categories, we use four different firm-level measures of export performance that have been aggregated across export goods and destinations: total exports worldwide; number of export destinations to which the firm ships at least one product; average export price across products and destinations; and standard deviation of export prices across products and markets. For each firm, the average export price is the weighted average of all observed (firm, export destination, HS-8 product) prices which have been demeaned by their HS-8 product average, with export revenue shares as weights. The standard deviation of the (log) export price within a firm across destinations and HS-8 goods is also based on demeaned export prices.

We first check whether more successful exporters use more expensive (higher-quality) inputs in Panel A of Table 10. We regress the (log) import price by firm, product and source country on each of the four different firm-level measures of export performance. We include product fixed effects and conservatively cluster errors by firm.[21] As hypothesized, we find that firms which export more to more destinations at a higher average export price source more expensive imports on average. This result is consistent with the idea that firms using higher-quality inputs produce higher-quality products and are above the quality cut-off for exporting in more destinations. As column 4 shows, exporters that price discriminate more across markets also tend to buy more expensive imports. This reinforces the notion that more productive firms can more easily upgrade quality, which allows them to both export higher average quality and offer a broader quality range.

In Panel B of Table 10, we test the second part of our hypothesis and examine the spread of prices that firms pay for a given imported product. The unit of observation is now a firm-imported product pair, and the left hand side variable is the standard deviation of (log) import unit prices across source countries within a firm and HS-8 code. We find that firms which sell more to more markets at a higher average export price and firms which price discriminate more across destinations pay a broader range of import prices for a given product. These conditional correlations are consistent with exporters varying the quality of their products across destinations by varying the quality of their inputs. We obtain similar results in Panel C, where we collapse the data to the firm level and study the total variation (standard deviation) in import prices across all products and source countries within a firm.

5 Firm Selection into Exporting

As Table 1 illustrates, alternative heterogeneous-firm models deliver very different predictions for the behavior of both firm-level prices and the sorting of firms into export markets. Having

[21] We obtain even higher t-statistics when we cluster by HS-8 product or use robust standard errors.

established stylized facts about the former, we next examine two aspects of firm selection into exporting: the number of exporters and price dispersion across exporters, by product and destination.

5.1 Number of exporters

We first study how the log number of Chinese exporters by destination-product varies across export markets. As Table 11 documents, within a given product, more Chinese firms ship to larger and more proximate markets. The effect is robust to controlling for GDP per capita or allowing for country random effects.[22] This result is consistent with existing heterogeneous-firm models with CES demand, and could obtain under either efficiency- or quality sorting. On the other hand, linear-demand frameworks generate a higher productivity cut-off for exporting and fewer firms selling in big and remote countries.

Our results for firm-pricing in the previous section lead us to believe that firms may be adjusting both mark-ups and quality across destinations in response to the toughness of competition. This signals the need for a modeling framework other than CES that possibly features linear demand. Whether such a model can generate the observed pattern for the number of exporters across destinations will depend on its general equilibrium properties and remains an open question for future work.

5.2 Minimum and maximum firm prices

We conclude by examining the range of prices observed across successful Chinese exporters in a given destination-product market. According to all heterogeneous-firms models, the extreme values of this distribution – the maximum and minimum export prices – will be set by either the most productive Chinese firm which supplies all countries or by the marginal firm just at the productivity cut-off for exporting to a specific market. As summarized in Table 1, however, how these extreme values will vary with destination size and distance depends on the particular modeling framework.

Panel A of Table 12 shows that the highest Chinese export price increases with market size and decreases with distance. Because all regressions include HS-8 product fixed effects, this result is identified from the variation within a product across trade partners. The coefficient point

[22] All results with country random effects use robust errors, since the estimation does not allow clustering by product.

estimates are highly statistically significant, and robust to controlling for GDP per capita or country random effects. They are also economically meaningful: a one-standard-deviation increase in log GDP or fall in log distance would raise the log highest export price in an average product by 0.65 or 0.22, respectively. By comparison, the standard deviation of the log maximum price across destinations is 1.43.[23] While price dispersion may be higher in a bigger sample of firms due to randomness, Column 3 confirms that our results are robust to controlling for the number of Chinese exporters in the particular destination-product market. Our findings are also not driven by outliers. The same patterns hold in Columns 5 and 6, where we restrict the sample to country-good pairs with at least 5 Chinese exporters or when we use the 90th percentile in the price distribution instead of the absolute maximum.

In Panel B of Table 12 we examine the lowest Chinese price in a given destination-product and find that it moves in exactly the opposite direction as the maximum price: The minimum price falls with GDP and rises with distance. A one-standard-deviation improvement in GDP (drop in distance) would reduce the lowest export price in a destination by 32% (12%) of a standard deviation. Once again, this finding is robust to controlling for GDP per capita or country random effects. The pattern also obtains when we condition on the number of Chinese exporters, restrict the sample to destination-product markets with at least 5 Chinese exporters, or use the 10th percentile in the price distribution instead of the absolute minimum.

A look at Table 1 makes it clear that none of the existing heterogeneous-firm models can systematically account for the behavior of both the lowest and the highest price across Chinese exporters in a given market. In the extant literature, only efficiency-sorting with CES demand can match the patterns for the maximum export price, while only quality-sorting with CES demand can explain the findings for the minimum unit value.

We believe it is possible that a model in which firms adjust both mark-ups and quality across destinations may be able to account for both stylized facts. However, this will likely depend on parameter values and result from ambiguous general equilibrium effects. To see this, recall that under quality sorting the higher price in any given market will be set by the most productive Chinese firm, while the lowest price will be fixed by the marginal exporter. If firms set higher quality but lower mark-ups when they face tougher competition, the total effect of market size and

[23] Comparative statics based on Column 1. We report the standard deviation in the log maximum price across products and destinations after removing product fixed effects.

distance on firm price will be theoretically ambiguous. If the effect of market size on quality upgrading dominates for the most productive firm, this can explain the positive correlation between the maximum price and GDP. Similarly, if the effect of size on the mark-up dominates for the marginal firm, this would generate the negative association between the minimum price and GDP. One could make similar statements about the effects of distance.

To summarize, our results for the selection of firms into exporting are difficult to reconcile with any of the existing heterogeneous-firm models. While it is possible that they may arise in a model of quality differentiation across and within firms, future theoretical work is needed to evaluate this possibility.

6 Conclusion

This paper examines the variation in export prices across firms, products and destinations to distinguish between four classes of heterogeneous-firm models of international trade. Efficiency-sorting models predict that more productive firms charge lower prices and become more successful exporters, while quality-sorting models postulate that higher-quality firms set higher prices and perform better. The predictions of both frameworks for firms' pricing behavior and export outcomes depend on the underlying demand structure, and we consider both CES and linear demand models. Understanding the nature of firm heterogeneity and firms' export decisions is important because of its implications for the effects of trade liberalization and trade policy on aggregate productivity and reallocations across firms and countries.

We use a unique new dataset on the universe of Chinese trading firms in 2005, and establish six new stylized facts. First, firms charge higher unit prices in larger, more distant markets. Second, higher export prices are associated with lower export quantities and greater revenues, both across firms within a destination and across destinations within a firm. Third, firms that export more to more destinations have higher average export and import prices, and fourth, they price discriminate more across trade partners. Fifth, more firms export to larger, more proximate markets. Finally, the maximum price observed across Chinese exporters in a given destination-product market rises with market size and falls with distance, while the opposite holds for the minimum export price.

We conclude that none of the existing models can simultaneously match all of these stylized facts. We suggest that our findings are instead consistent with a framework in which firms adjust both quality and mark-ups across destinations in response to market competition.

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Table 1. Alternative Heterogeneous Firm Models

This table summarizes the predictions of different heterogeneous-firm tarde models. Panel A indicates the correlation between firm-level free on board export prices on the one hand, and the value and quantity of exports, destination market size and distance on the other. Panel B tabulates theoretical predictions for the correlation between destination market size and distance with (1) the number of (Chinese) firms exporting to a given destination and product, the (2) average, (3) maximum and (4) minimum export price charged across all successful (Chinese) exporters in a given destination and product.

Panel A. Theoretical predictions for f.o.b. firm level prices

		Firm Price					
		Across firms in a country		Across countries within a firm			
	Relevant Papers	Export Revenue	Export Quantity	Export Revenue	Export Quantity	GDP	Distance
Efficiency sorting, CES demand	Melitz (2003)	-	-	0	0	0	0
Efficiency sorting, linear demand	Melitz-Ottaviano (2008)	-	-	-	-	-	-
Quality sorting, CES demand	Baldwin-Harrigan (2007), Johnson (2007), Kugler-Verhoogen (2008), Verhoogen (2008)	+	-	0	0	0	0
Quality sorting, linear demand	Kneller-Yu (2008), Antoniades (2008)	+	-	-	-	-	-
Data		+	-	+	-	+	+

Panel B. Theoretical predictions for product-level f.o.b. prices and number of firms

	# Firms		Avg Export Price		Max Export Price		Min Export Price	
	GDP	Distance	GDP	Distance	GDP	Distance	GDP	Distance
Efficiency sorting, CES demand	+	-	+	-	+	-	0	0
Efficiency sorting, linear demand	-	-	-	-	-	-	-	-
Quality sorting, CES demand	+	-	-	+	0	0	-	+
Quality sorting, linear demand	-	-	+/-	+/-	-	-	+/-	+/-
Data	+	-	+	-	+	-	-	+

Table 2. The Variation in Export Prices across Firms, Products and Destinations

This table summarizes the variation in export prices across 96,522 Chinese firms, 6,908 products, and 231 importing countries in 2005. Line 1: summary statistics for the raw data on firm-product-destination log prices. Line 2: summary statistics for firm-product-destination log prices, after taking out HS-8 product fixed effects. Line 3: for each HS-8 product, we take the standard deviation of log prices across firms and destinations. Line 3 shows how this standard deviation varies across 6,591 HS-8 products. Line 4: for each firm that exports a given product to multiple countries, we record the standard deviation of log prices across destinations, by product. Line 4 shows how this standard deviation varies across firm-product pairs. Line 5: for each destination-product market with multiple Chinese exporters, we record the standard deviation of log prices across firms. Line 5 shows how this standard deviation varies across destination-product pairs.

	# Obs	Average	St Dev	Min	5th Percentile	95th Percentile	Max
Variation in (log) prices across 96,522 firms, 6,908 HS-8 products, and 231 destinations							
1. firm-product-destination prices, raw data	2,179,923	1.34	2.15	-10.80	-1.44	5.35	17.89
Variation in (log) prices across firms and destinations within HS-8 products							
2. firm-product-destination prices, taking out HS-8 F.E.	2,179,923	0.00	1.24	-12.12	-1.93	2.02	13.65
3. st dev of prices across firms and destinations within products, taking out HS-8 F.E.	6,591	1.11	0.65	0.00	0.26	2.33	5.92
Variation in (log) prices across destinations within firm-HS-8 product pairs							
4. st dev of prices across destinations within firm-product pairs, taking out firm-HS-8 pair F.E.	303,935	0.46	0.49	0.00	0.01	1.39	9.14
Variation in (log) prices across firms within destination-HS-8 product pairs							
5. st dev of prices across firms within destination-product pairs, taking out destination-HS-8 pair F.E.	159,778	0.90	0.74	0.00	0.08	2.30	8.36

Table 3. Product-Level Average Export Prices and Destination Characteristics

This table examines the effect of destination market size and distance on average export prices. The outcome variable is the (log) average free on board export price across all successful Chinese exporters in a given destination and HS-8 product. Panel A presents results from the full sample of 175 countries, while Panel B shows estimates from separate regressions for 88 (87) countries with GDP per capita above (below) the sample median. Columns 3 and 6 control for the (log) number of Chinese exporters in the same destination-product. All regressions include a constant term and HS-8 product fixed effects, and cluster errors by HS-8 product. The right half of Panel A includes product fixed effects, country random effects, and robust standard errors. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel A. Dependent variable: (log) average unit price, by HS-8 product and destination

	Product FE			Product FE and Country RE		
(log) GDP	0.011	-0.002	0.038	0.003	-0.009	0.024
	(4.34)***	(-0.78)	(15.72)***	(0.84)	(-1.95)*	(7.51)***
(log) Distance	-0.015	-0.021	-0.050	0.000	-0.010	-0.037
	(-3.07)***	(-4.15)***	(-9.49)***	(0.03)	(-0.67)	(-2.59)***
(log) GDP per capita		0.027			0.023	
		(9.34)***			(3.02)***	
(log) # Firms in Same Product-Destination			-0.088			-0.064
			(-18.46)***			(-23.37)***
R-squared	0.853	0.854	0.854			
# observations	242,311	242,065	242,311	242,311	242,065	242,311
# HS-8 clusters	6,879	6,879	6,879	6,879	6,879	6,879
# destinations	175	174	175	175	174	175

Panel B. Dependent variable: (log) average unit price, by HS-8 product and destination

	88 Rich Countries, Product FE			87 Poor Countries, Product FE		
(log) GDP	0.016	-0.000	0.049	-0.026	-0.027	0.005
	(6.78)***	(-0.09)	(20.22)***	(-6.55)***	(-6.87)***	(1.30)
(log) Distance	0.016	0.039	-0.032	-0.096	-0.096	-0.128
	(2.83)***	(6.71)***	(-5.37)***	(-12.16)***	(-11.83)***	(-14.98)***
(log) GDP per capita		0.067			0.003	
		(14.96)***			(0.44)	
(log) # Firms in Same Product-Destination			-0.098			-0.118
			(-21.52)***			(-14.83)***
R-squared	0.854	0.855	0.855	0.876	0.876	0.877
# observations	162,011	161,765	162,011	80,300	80,300	80,300
# HS-8 clusters	6,774	6,773	6,774	5,857	5,857	5,857
# destinations	88	87	88	87	87	87

Table 4. Firm Export Prices and Destination Characteristics

This table examines the effect of destination market size and distance on firm-level export prices. The outcome variable is the (log) free on board export price by firm, destination and HS-8 product. The left half of the table explores the variation in prices across firms and destinations within products by including HS-8 product fixed effects. The right half of the table exploits the variation in prices across destinations within firm-product pairs by including firm-HS-8 product pair fixed effects. All regressions include a constant term and cluster errors by HS-8 product. Columns 3 and 6 also include country random effects and robust standard errors. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Dependent variable: (log) unit price, by firm, HS-8 product and destination

	Variation Across Firms & Destinations Within HS-8 Products			Variation Across Destinations Within Firm - HS-8 Product Pairs		
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP	0.071	0.079	0.077	0.012	0.006	0.014
	(27.29)***	(35.35)***	(54.01)***	(12.51)***	(6.61)***	(36.86)***
(log) Distance	0.098	0.095	0.112	0.017	0.017	0.023
	(14.50)***	(14.36)***	(24.49)***	(6.75)***	(6.68)***	(21.72)***
(log) GDP per capita		-0.020			0.016	
		(-5.76)***			(11.04)***	
Product FE	Y	Y	Y	--	--	--
Firm-Product FE	--	--	--	Y	Y	Y
Country RE	--	--	Y	--	--	Y
R-squared	0.671	0.671		0.954	0.954	
# observations	2,098,551	2,098,228	2,098,551	2,098,551	2,098,228	2,098,551
# HS-8 clusters	6,879	6,879	6,879	6,879	6,879	6,879
# firms	94,663	94,663	94,663	94,663	94,663	94,663
# destinations	175	174	175	175	174	175

Table 5. Firm Export Prices, Destination Characteristics and Market Structure

This table examines the role of market structure for the effect of destination market size and distance on firm-level export prices. The outcome variable is the (log) free on board export price by firm, destination and HS-8 product. The table exploits the variation in prices across destinations within firm-product pairs, by including firm-HS-8 product pair fixed effects. Columns 1 and 2 control for the (log) number of Chinese exporters in the same destination-product. Columns 3 and 4 control for (log) firm export revenues in the same destination and product. Columns 5 and 6 control for the share of the firm's exports in total Chinese exports, by destination and product. All regressions include a constant term and cluster errors by HS-8 product. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Dependent variable: (log) unit price, by firm, HS-8 product and destination

	Variation Across Destinations Within Firm - HS-8 Product Pairs					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP	0.022	0.017	0.007	0.001	0.014	0.009
	(18.34)***	(13.47)***	(6.59)***	(0.81)	(14.73)***	(9.27)***
(log) Distance	0.001	-0.002	0.021	0.021	0.014	0.013
	(0.51)	(-0.90)	(7.87)***	(7.80)***	(5.16)***	(5.05)***
(log) GDP per capita		0.020		0.016		0.016
		(14.61)***		(11.11)***		(11.34)***
(log) # Chinese Exporters	-0.025	-0.030				
in Product-Destination	(-12.71)***	(-14.88)***				
(log) Revenue			0.019	0.019		
			(13.42)***	(13.50)***		
Market Share					0.065	0.067
					(12.54)***	(13.08)***
Firm-Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.954	0.954	0.954	0.954	0.954	0.954
# observations	2,098,551	2,098,228	2,098,551	2,098,228	2,098,551	2,098,228
# HS-8 clusters	6,879	6,879	6,879	6,879	6,879	6,879
# firm-product pairs	869,159	869,065	869,159	869,065	869,159	869,065

Table 6. Firm Export Prices, Destination Characteristics and Willingness to Pay for Quality

This table examines the differential effect of market size and distance on firm export prices across countries with different GDP per capita. The outcome variable is the (log) free on board export price by firm, destination and HS-8 product. Columns 1 and 4 examine the full sample. Columns 2 and 4 (Columns 3 and 6) restrict the sample to homogeneous (differentiated) goods only, according to the Rauch (1999) classification. The left half of the table explores the variation in prices across firms and destinations within products by including HS-8 product fixed effects. The right half of the table exploits the variation in prices across destinations within firm-product pairs, by including firm-HS-8 product pair fixed effects. All regressions include a constant term and cluster errors by HS-8 product. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Dependent variable: (log) unit price, by firm, HS-8 product and destination

	Variation Across Firms & Destinations Within HS-8 Products			Variation Across Destinations Within Firm - HS-8 Product Pairs		
	All Goods	Hom. Goods	Diff. Goods	All Goods	Hom. Goods	Diff. Goods
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP	-0.060	-0.018	-0.028	-0.012	0.005	-0.009
	(-6.78)***	(-1.05)	(-2.40)***	(-2.64)***	(0.38)	(-1.54)
(log) GDP x	0.013	0.008	0.010	0.001	0.000	0.001
(log) GDP per capita	(13.09)***	(3.82)***	(7.45)***	(3.21)***	(0.34)	(1.90)*
(log) Distance x	-0.568	-0.279	-0.631	-0.131	-0.053	-0.154
	(-22.20)***	(-4.79)***	(-18.61)***	(-8.68)***	(-1.00)	(-7.55)***
(log) Distance	0.069	0.039	0.076	0.016	0.007	0.019
(log) GDP per capita	(22.88)***	(6.18)***	(18.97)***	(9.09)***	(1.20)	(7.88)***
(log) GDP per capita	-0.888	-0.508	-0.862	-0.148	-0.047	-0.162
	(-28.92)***	(-9.17)***	(-20.67)***	(-8.27)***	(-0.93)	(-6.91)***
Product FE	Y	Y	Y	--	--	--
Firm-Product FE	--	--	--	Y	Y	Y
R-squared	0.672	0.713	0.647	0.954	0.958	0.949
# observations	2,098,228	125,455	1,315,367	2,098,228	125,455	1,315,367
# HS-8 clusters	6,879	1,311	2,951	6,879	1,311	2,951
# firm-product pairs	869,065	58,715	541,261	869,065	58,715	541,261

Table 7. Firm Export Prices and Revenues by Product and Destination

This table examines the relationship between firm-level export prices, revenues and quantities. The outcome variable is the (log) export unit price by firm, destination and HS-8 product. The table explores how the correlation between export price and revenues varies across products with different scope for quality differentiation. The scope for quality differentiation is proxied by one of three measures: (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999); (2) R&D intensity by 3-digit ISIC sector from Klingebiel, Kroszner and Laeven (2007); or (3) the combined advertising and R&D intensity by 3-digit ISIC sector from Kugler and Verhoogen (2008).

The left part of Panel A explores the variation across firms and destinations within products, by including HS-8 product fixed effects. The right part of Panel A exploits the variation across firms within a destination-product market, by including country-HS-8 product pair fixed effects. Panel B studies the variation across destinations within firm-product pairs, by including firm-HS-8 product pair fixed effects. Column 3 in Panel B controls for the share of the firm's exports in total Chinese exports, by destination and product. All regressions include a constant term and cluster errors at the same level as the fixed effects included. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel A. Variation across firms within destinations and HS-8 products

Dependent variable: (log) unit price, by firm, HS-8 product and destination

	Variation Across Firms and Destinations Within HS-8 Products		Variation Across Firms Within Destination - HS-8 Product Pairs				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(log) Revenue	0.085 (32.57)***		0.081 (70.07)***		0.036 (9.36)***	0.077 (54.61)***	0.065 (35.32)***
(log) Quantity		-0.188 (-41.14)***		-0.183 (-144.72)***			
(log) Revenue x Different. Good					0.054 (12.97)***		
(log) Revenue x R&D Intensity						0.200 (3.17)***	
(log) Revenue x Adv.+R&D Intensity							0.616 (10.63)***
Controls	Product FE and Clusters		Destination-Product FE and Clusters				
R-squared	0.676	0.712	0.744	0.773	0.729	0.741	0.741
# observations	2,179,923	2,179,923	2,179,923	2,179,923	1,494,839	2,130,413	2,139,735
# HS-8 products	6,908	6,908					
# dest-product pairs			258,056	258,056	163,873	247,867	249,874

Table 7. Firm Export Prices and Revenues by Product and Destination (cont.)

This table examines the relationship between firm-level export prices, revenues and quantities. The outcome variable is the (log) export unit price by firm, destination and HS-8 product. The table explores how the correlation between export price and revenues varies across products with different scope for quality differentiation. The scope for quality differentiation is proxied by one of three measures: (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999); (2) R&D intensity by 3-digit ISIC sector from Klingebiel, Kroszner and Laeven (2007); or (3) the combined advertising and R&D intensity by 3-digit ISIC sector from Kugler and Verhoogen (2008).

The left part of Panel A explores the variation across firms and destinations within products, by including HS-8 product fixed effects. The right part of Panel A exploits the variation across firms within a destination-product market, by including country-HS-8 product pair fixed effects. Panel B studies the variation across destinations within firm-product pairs, by including firm-HS-8 product pair fixed effects. Column 3 in Panel B controls for the share of the firm's exports in total Chinese exports, by destination and product. All regressions include a constant term and cluster errors at the same level as the fixed effects included. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel B. Variation across destinations within firm - HS-8 product pairs

Dependent variable: (log) unit price, by firm, HS-8 product and destination

	Variation Across Destinations Within Firm - HS-8 Product Pairs					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Revenue	0.021 (34.52)***		0.020 (34.37)***	0.015 (7.01)***	0.018 (24.09)***	0.017 (14.76)***
(log) Quantity		-0.080 (-114.53)***				
Market Share			0.015 (3.95)***			
(log) Revenue x Different. Good				0.008 (3.50)***		
(log) Revenue x R&D Intensity					0.093 (3.09)***	
(log) Revenue x Adv.+R&D Intensity						0.145 (3.81)***
Controls	Firm-Product FE and Clusters					
R-squared	0.954	0.957	0.954	0.950	0.953	0.953
# observations	2,179,923	2,179,923	2,179,923	1,494,839	2,130,413	2,139,735
# firm-product pairs	898,247	898,247	898,247	619,357	871,596	875,097

Table 8. Worldwide Firm Export Prices, Revenues and Quantities by Product

This table examines the relationship between worldwide firm-level export prices, revenues and quantities. The table exploits the variation across firms within products, by including HS-8 product fixed effects. The outcome variable is the (log) average export price by firm and HS-8 product, constructed as the ratio of total revenues and total quantities exported by firm and product. The table explores how the correlation between export price and revenues varies across products with different scope for quality differentiation. The scope for quality differentiation is proxied by one of three measures: (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999); (2) R&D intensity by 3-digit ISIC sector from Klingebiel, Kroszner and Laeven (2007); or (3) the combined advertising and R&D intensity by 3-digit ISIC sector from Kugler and Verhoogen (2008). All regressions include a constant term and cluster errors by HS-8 product. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Dependent variable: (log) average export unit price, by firm and HS-8 product

	Variation Across Firms Within HS-8 Products					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Revenue	0.094 (49.25)***		0.040 (14.15)***	0.097 (48.26)***	0.091 (47.14)***	0.085 (41.31)***
(log) Quantity		-0.165 (-103.75)***				
(log) Revenue x Different. Good			0.065 (22.83)***			
(log) Revenue x R&D Intensity				-0.079 (-1.73)*		
(log) Revenue x High R&D Intensity					0.008 (4.67)***	
(log) Revenue x Adv.+R&D Intensity						0.362 (8.23)***
Controls	Product FE					
R-squared	0.644	0.671	0.642	0.637	0.637	0.637
# observations	898,247	898,247	619,357	871,596	871,596	875,097
# HS-8 products	6,908	6,908	4,276	6,182	6,182	6,252
# firm clusters	96,522	96,522	84,464	93,514	93,514	94,005

Table 9. Firm Export Prices and Number of Export Destinations

This table examines the relationship between firm export prices and the number of destinations, by firm and HS-8 product. The outcome variable in Panel A is the (log) average export price, constructed as the ratio of total revenues and total quantities exported by firm and product. The outcome variable in Panel B is the standard deviation of the log export price across destinations within firm-product pairs with more than one destinations. The table explores how the correlation between the outcome variable and the number of destinations by firm-product varies across products with different scope for quality differentiation. The scope for quality differentiation is proxied by one of three measures: (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999); (2) R&D intensity by 3-digit ISIC sector from Klingebiel, Kroszner and Laeven (2007); or (3) the combined advertising and R&D intensity by 3-digit ISIC sector from Kugler and Verhoogen (2008). All regressions include a constant term and cluster errors by HS-8 product. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

			Hom. Goods	Diff. Goods		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Dep. variable: (log) average export unit price, by firm and HS-8 product						
(log) # Destinations	0.014	0.010	0.010	0.022	0.004	-0.003
	(2.79)***	(1.41)	(1.40)	(4.12)***	(0.70)	(-0.46)
(log) # Dest x Different. Good		0.012				
		(1.50)				
(log) Revenue x R&D Intensity					0.428	
					(2.43)**	
(log) Revenue x Adv.+R&D Intensity						0.577
						(3.77)***
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.632	0.628	0.647	0.622	0.624	0.624
# observations	898,247	619,357	61,843	557,514	871,596	875,097
# HS-8 products	6,908	4,276	1,321	2,955	6,182	6,252
# firm clusters	96,522	84,464	23,390	76,793	93,514	94,005
Panel B. Dep. variable: st. dev. of (log) export unit price across destinations within a firm and HS-8 product						
(log) # Destinations	0.004	0.004	0.004	0.006	-0.002	0.007
	(2.12)**	(0.90)	(0.88)	(2.65)***	(-0.77)	(2.33)**
(log) # Dest x Different. Good		0.002				
		(0.53)				
(log) Revenue x R&D Intensity					0.248	
					(3.21)***	
(log) Revenue x Adv.+R&D Intensity						-0.112
						(-1.36)
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.139	0.137	0.200	0.126	0.135	0.136
# observations	303,935	210,419	18,741	191,678	296,777	298,032
# HS-8 products	5,852	3,666	1,026	2,640	5,365	5,426
# firm clusters	66,360	54,545	10,560	48,845	64,223	64,616

Table 10. Firm Import Prices and Export Performance

This table examines the relationship between firm-level import prices, export performance and export prices for Chinese firms that both import and export. The dependent variable in Panel A is the (log) import price by firm, source country and HS-8 product. In Panel B, it is the standard deviation of the (log) import prices across source countries within a firm and HS-8 product pair. All regressions in Panels A and B include HS-8 product fixed effects and cluster errors by firm. The dependent variable in Panel C is the standard deviation of the (log) import prices within a firm across source coutries and HS-8 products, after these prices have been demeaned by their HS-8 product average. The right-hand side variables include (log) total firm exports and the (log) number of export destinations. For each firm, the (log) average export price is the weighted average of (log) (firm, export destination, HS-8 product) prices which have been demeaned by their HS-8 product average, with export shares as weights. The standard deviation of the (log) export prices within a firm across destinations and HS-8 products is also based on demeaned (log) export prices. All regressions include a constant term. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel A. Dep. variable: (log) import unit price, by firm, source country and HS-8 product

	(1)	(2)	(3)	(4)
(log) Total Firm Exports	0.043			
	(11.08)***			
(log) # Export Destinations		0.031		
		(4.27)***		
(log) Average Export Price			0.059	
			(13.58)***	
St. Dev. of (log) Export Price				0.355
				(24.01)***
Product FE	Y	Y	Y	Y
R-squared	0.689	0.688	0.671	0.690
# observations	1,553,199	1,553,199	513,508	1,475,008
# HS-8 products	6,712	6,712	6,121	6,668
# firm clusters	58,337	58,337	15,419	52,508

Panel B. Dep. variable: st. dev. of (log) import unit price across source countries within a firm and HS-8 product

	(1)	(2)	(3)	(4)
(log) Total Firm Exports	0.018			
	(10.60)***			
(log) # Export Destinations		0.053		
		(17.22)***		
(log) Average Export Price			0.010	
			(4.81)***	
St. Dev. of (log) Export Price				0.101
				(16.59)***
Product FE	Y	Y	Y	Y
R-squared	0.208	0.211	0.193	0.209
# observations	234,672	234,672	75,729	225,290
# HS-8 products	5,117	5,117	4,175	5,068
# firm clusters	31,176	31,176	8,551	28,835

Table 10. Firm Import Prices and Export Performance (cont.)

This table examines the relationship between firm-level import prices, export performance and export prices for Chinese firms that both import and export. The dependent variable in Panel A is the (log) import price by firm, source country and HS-8 product. In Panel B, it is the standard deviation of the (log) import prices across source countries within a firm and HS-8 product pair. All regressions in Panels A and B include HS-8 product fixed effects and cluster errors by firm. The dependent variable in Panel C is the standard deviation of the (log) import prices within a firm across source coutries and HS-8 products, after these prices have been demeaned by their HS-8 product average. The right-hand side variables include (log) total firm exports and the (log) number of export destinations. For each firm, the (log) average export price is the weighted average of (log) (firm, export destination, HS-8 product) prices which have been demeaned by their HS-8 product average, with export shares as weights. The standard deviation of the (log) export prices within a firm across destinations and HS-8 products is also based on demeaned (log) export prices. All regressions include a constant term. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel C. Dep. variable: st. dev. of (log) import unit price within a firm across source countries and HS-8 products

	(1)	(2)	(3)	(4)
(log) Total Firm Exports	0.023 (18.04)***			
(log) # Export Destinations		0.044 (17.90)***		
(log) Average Export Price			0.057 (40.51)***	
St. Dev. of (log) Export Price				0.320 (69.23)***
R-squared	0.007	0.006	0.109	0.096
# observations (# firms)	49,934	49,934	13,407	45,203

Table 11. Firm Selection into Exporting and Destination Characteristics

This table examines the effect of destination market size and distance on the (log) number of Chinese exporters, by destination and product. Columns 1 and 2 include a constant term and HS-8 product fixed effects, and cluster errors by HS-8 product. Columns 3 and 4 include a constant term, product fixed effects and country random effects, and report robust standard errors. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Dependent variable: (log) number of firms exporting, by HS-8 product and destination

	Product FE		Product FE and Country RE	
	(1)	(2)	(3)	(4)
(log) GDP	0.311	0.299	0.345	0.342
	(89.31)***	(92.94)***	(140.85)***	(83.12)***
(log) Distance	-0.399	-0.405	-0.601	-0.608
	(-90.05)***	(-90.93)***	(-55.35)***	(-53.97)***
(log) GDP per capita		0.023		0.006
		(9.43)***		(1.04)
R-squared	0.536	0.537		
# observations	242,311	242,065	242,311	242,065
# HS-8 clusters	6,879	6,879	6,879	6,879
# destinations	175	174	175	174

Table 12. Lowest and Highest Product-Level Export Prices and Destination Characteristics

This table examines the effect of destination market size and distance on the distribution of export prices across firms. The outcome variable in Panel A (Panel B) is the log maximum (minimum) free on board export price across all successful Chinese exporters in a given destination and HS-8 product. The outcome variable in the last column is the log price at the 90th (10th) percentile instead. Column 3 controls for the number of Chinese exporters in the same destination-product. Column 5 reduces the sample to destination-product pairs with at least 5 Chinese exporters. All regressions include a constant term and HS-8 product fixed effects, and cluster errors by HS-8 product. Column 4 includes product fixed effects, country random effects, and robust standard errors. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

Panel A. Dependent variable: (log) highest unit price, by HS-8 product and destination

					# Firms >=5	90th Perc
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP	0.277	0.259	0.248	0.294	0.302	0.188
	(72.45)***	(68.45)***	(60.46)***	(76.21)***	(52.76)***	(72.00)***
(log) Distance	-0.386	-0.394	-0.344	-0.527	-0.453	-0.262
	(-50.77)***	(-52.87)***	(-43.39)***	(-30.82)***	(-38.25)***	(-39.35)***
(log) GDP per capita		0.039				
		(11.05)***				
# Firms			0.007			
			(10.94)***			
Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Country RE	--	--	--	Yes	--	--
R-squared	0.797	0.798	0.803		0.823	0.819
# observations	242,311	242,065	242,311	242,311	76,289	242,311
# HS-8 clusters	6,879	6,879	6,879	6,879	4,543	6,879
# destinations	175	174	175	175	162	175

Panel B. Dependent variable: (log) lowest unit price, by HS-8 product and destination

					# Firms >=5	10th Perc
	(1)	(2)	(3)	(4)	(5)	(6)
(log) GDP	-0.171	-0.172	-0.147	-0.197	-0.115	-0.105
	(-46.54)***	(-47.45)***	(-35.95)***	(-55.07)***	(-30.34)***	(-34.89)***
(log) Distance	0.260	0.261	0.226	0.408	0.307	0.182
	(44.92)***	(44.69)***	(35.55)***	(24.72)***	(41.20)***	(33.92)***
(log) GDP per capita		0.002				
		(0.75)				
# Firms			-0.006			
			(-8.56)***			
Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Country RE	--	--	--	Yes	--	--
R-squared	0.817	0.817	0.820		0.853	0.827
# observations	242,311	242,065	242,311	242,311	76,289	242,311
# HS-8 clusters	6,879	6,879	6,879	6,879	4,543	6,879
# destinations	175	174	175	175	162	175

Appendix Table 1. Range of Firm Export Prices and Number of Export Destinations

This table examines the relationship between firm export prices and the number of destinations, by firm and HS-8 product. The outcome variable in Panel A is the (log) maximum export price across destinations within a firm-product pair. The outcome variable in Panel B is the (log) minimum export price across destinations within a firm-product pair. The table explores how the correlation between the outcome variable and the number of destinations by firm-product varies across products with different scope for quality differentiation. The scope for quality differentiation is proxied by one of three measures: (1) a dummy variable equal to 1 for differentiated products as classified by Rauch (1999); (2) R&D intensity by 3-digit ISIC sector from Klingebiel, Kroszner and Laeven (2007); or (3) the combined advertising and R&D intensity by 3-digit ISIC sector from Kugler and Verhoogen (2008). All regressions include a constant term and cluster errors by HS-8 product. T-statistics in parenthesis. ***, **, and * indicate significance at the1%, 5%, and 10% level.

			Hom. Goods	Diff. Goods		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Dep. variable: max (log) export unit price across destinations within a firm and HS-8 product						
(log) # Destinations	0.387 (70.94)***	0.278 (34.51)***	0.278 (34.25)***	0.409 (71.86)***	0.336 (58.45)***	0.331 (52.52)***
(log) # Dest x Different. Good		0.131 (15.04)***				
(log) Revenue x R&D Intensity					2.370 (12.69)***	
(log) Revenue x Adv.+R&D Intensity						2.050 (12.53)***
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.628	0.625	0.644	0.619	0.621	0.620
# observations	898,247	619,357	61,843	557,514	871,596	875,097
# HS-8 products	6,908	4,276	1,321	2,955	6,182	6,252
# firm clusters	96,522	84,464	23,390	76,793	93,514	94,005
Panel B. Dep. variable: min (log) export unit price across destinations within a firm and HS-8 product						
(log) # Destinations	-0.281 (-51.56)***	-0.218 (-28.78)***	-0.218 (-28.57)***	-0.286 (-47.84)***	-0.268 (-44.74)***	-0.277 (-43.08)***
(log) # Dest x Different. Good		-0.068 (-7.86)***				
(log) Revenue x R&D Intensity					-0.647 (-3.65)***	
(log) Revenue x Adv.+R&D Intensity						-0.179 (-1.12)
Product FE	Y	Y	Y	Y	Y	Y
R-squared	0.630	0.626	0.642	0.620	0.623	0.623
# observations	898,247	619,357	61,843	557,514	871,596	875,097
# HS-8 products	6,908	4,276	1,321	2,955	6,182	6,252
# firm clusters	96,522	84,464	23,390	76,793	93,514	94,005