Markups, Quality, and Trade Costs*†

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Abstract

We investigate theoretically and empirically how trade costs such as bilateral distance or tariffs impact the markups of firm-level exports differentiated by quality. Our model, which features endogenous markups and per-unit trade costs, predicts that markups rise with distance and fall with tariffs. Moreover, these effects are heterogeneous and smaller in magnitude for higher quality exports. We find strong support for the predictions of the model using a unique data set of Argentinean firm-level wine exports combined with experts' wine ratings as a measure of quality. Our results therefore demonstrate that the variation in firm-level export unit values across markets is not only driven by quality differences but also by markup variation conditional on quality.

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1 Introduction

Recent empirical work demonstrates that firm-level markups are variable. For instance, they respond to trade liberalization (De Loecker, Goldberg, Khandelwal, and Pavcnik, 2016), exchange rate fluctuations (Berman, Martin, and Mayer, 2012), they vary with per capita income (Simonovska, 2015), and with firm-level characteristics (De Loecker and Warzynski, 2012).[1] Surprisingly, there is no evidence of how the markups of exporting firms vary across destinations depending on trade costs such as bilateral distance or tariffs. Nor is there any evidence of how product quality shapes the response of markups to changes in trade costs.

We fill these gaps by exploring theoretically and empirically how exporters adjust their markups across destinations depending on distance, tariffs, and the quality of their exports. Our model shows that for a given quality, markups rise with distance and fall with tariffs. Moreover, these effects are predicted to be smaller in magnitude for higher quality exports. We find strong support for the predictions of the model using a unique data set of Argentinean firm-level wine exports combined with experts' wine ratings as a measure of quality (Chen and Juvenal, 2016, 2018; Crozet, Head, and Mayer, 2012). Our paper is therefore the first to establish that distance and tariffs impact markups across international markets, and that their effects are heterogeneous across quality levels.

Our results contribute to understanding the robust finding in the empirical trade literature that export prices increase with distance. This empirical regularity is typically explained by a larger share of higher quality and more expensive goods being exported to more distant locations. This explanation is consistent with a *composition effect* that arises due to the presence of per-unit trade costs that lower the relative price, and increase the relative demand for higher quality goods in more distant countries (Alchian and Allen, 1964). It is also consistent with a *selection* (or *quality-sorting*) *effect* that occurs if firms choose to export higher quality varieties to more distant markets only. In this paper, we propose a different mechanism: *conditional on quality*, exporters price discriminate and set higher markups and therefore higher prices in more distant countries.[2,3]

As a first step, we model theoretically the effects of trade costs on the pricing strategies of exporters across destinations. We extend the monopolistic competition model of Martin (2012) where exporters maximize profits subject to a CES demand in each destination country. Trade costs are ad valorem but also per unit, and the introduction of per-unit trade costs generates variable markups that depend

[1] Also see Amiti, Itskhoki, and Konings (2014, 2019), Atkin and Donaldson (2015), Bellone, Musso, Nesta, and Warzynski (2014), Chen, Imbs, and Scott (2009), Chen and Juvenal (2016, 2018), and Fitzgerald and Haller (2014), among others.

[2] For evidence on the Alchian and Allen (1964) mechanism, see Emlinger and Lamani (2017), Hummels and Skiba (2004), and Takechi (2015). On selection, see Baldwin and Harrigan (2011), Bastos and Silva (2010), Crozet, Head, and Mayer (2012), Harrigan, Ma, and Shlychkov (2015), and Johnson (2012). Also see Görg, Halpern, and Muraközy (2017), Lugovskyy and Skiba (2015, 2016), Manova and Zhang (2012), and Martin (2012). An older literature on spatial price discrimination studies how firms set markups depending on the distance to the buyer (Greenhut, Ohta, and Sailors, 1985; Hoover, 1937). "Dumping" and "reverse dumping" arise if firms set lower or higher markups in more distant countries.

[3] Composition is a demand-side effect, while selection and price discrimination are supply-side mechanisms. On the supply side, firms may also upgrade their quality for more distant countries (Martin, 2012). Higher quality goods would then be disproportionately shipped at longer distances, resulting in higher prices in more distant countries.

on trade costs (Crozet et al., 2012; Irarrazabal, Moxnes, and Opromolla, 2015).[4] The model shows that for a given quality, Free on Board (FOB) export prices and markups increase with per-unit trade costs, and therefore with distance.[5] It also shows that prices and markups fall with ad valorem trade costs, and therefore with tariffs. As we assume that producing a higher quality entails higher marginal costs, the model further predicts that the effects of trade costs (i.e., distance and tariffs) on prices and markups are heterogeneous and smaller in magnitude for higher quality exports.

Our predictions are driven by the introduction of per-unit trade costs in the model because they generate an elasticity of demand with respect to the FOB price that depends on trade costs and quality. Specifically, the demand elasticity falls with per-unit trade costs, and therefore with distance, but it increases with ad valorem trade costs such as tariffs, especially for lower quality exports. To compensate for the lower demand they face due to higher trade costs, exporters find it profitable to raise their prices and markups in more distant markets, to lower them in high-tariff countries, and to a larger extent for lower quality exports. Notably, those predictions are not specific to our CES framework and we show that they continue to hold with alternative demand systems.

In a second step, we investigate empirically the effects of trade costs on the prices and markups of exports differentiated by quality. Our firm-level trade data set reports, for each export transaction between 2002 and 2009, the name of the exporting firm, the country of destination, the date of shipment, the FOB value (in US dollars) and the volume (in liters) of each wine exported. A crucial feature of our data set is that exports are reported at the *individual* product level as each wine is identified according to its name, grape (Chardonnay, Malbec, etc.), type (white, red, or rosé), and vintage year. This level of detail is unique given that trade statistics are generally only reported for aggregated product categories (defined, for instance, at the Harmonized System or HS level).

We rely on the value and the volume exported at the firm-product-destination-quarter level to compute FOB unit values as a proxy for export prices. Our unit values can plausibly be interpreted as prices as they are defined at the individual product level. To measure the quality of each wine at the name-grape-type-vintage year level, we rely on two well-known experts' wine ratings, the Wine Spectator and Robert Parker (Chen and Juvenal, 2016, 2018).[6] When we match unit values with the quality ratings of the Wine Spectator which has the largest coverage of Argentinean wines, our sample covers 41 percent of total wine exports over the period. It includes 237 multi-product wine producers

[4] Ad valorem (iceberg, or multiplicative) trade costs are applied as a percentage of the producer price per unit traded, while per-unit (additive, or specific) trade costs are defined as a constant cost per unit traded.

[5] Per-unit costs rise with distance as they vary with origin and destination (Irarrazabal, Moxnes, and Opromolla, 2015).

[6] A large body of theoretical and empirical work shows that quality plays a key role as a determinant of global trade flows and prices (Feenstra and Romalis, 2014; Hallak, 2006; Hummels and Klenow, 2005; Hummels and Skiba, 2004; Schott, 2004). As quality is unobserved, trade unit values are often used as a proxy. Recently, some papers have exploited direct measures of product quality. Atkin, Khandelwal, and Osman (2017) use artisan assessments for Egyptian rugs. Chen and Juvenal (2016, 2018) use the same quality ratings for Argentinean wines as in this paper. Crozet et al. (2012) use quality scores for Champagne. Emlinger and Lamani (2017) rely on the amount of time the eau-de-vie used to produce Cognac spends in oak. Medina (2018) identifies the quality of apparel products based on their composition of primary materials. Other papers derive alternative measures of quality. Khandelwal (2010) compares exporters' market shares conditional on price to infer export quality. Piveteau and Smagghue (2019) estimate quality using trade data.

shipping 8,361 different wines with heterogeneous levels of quality. Our focus on wine producers implies that each wine is exported by a single firm only.

For our purposes, our data set offers several advantages. First, thanks to the granularity of the data, we can compare the unit values of a given product exported by a single producer in a given quarter across destinations, holding quality constant. Second, we can identify the variation in markups by controlling for product-quarter fixed effects. As the product-quarter fixed effects enable us to isolate the variation in unit values across destinations for a given exporter and a given product at each point in time, they control for selection and composition effects across products within firms. And since product-specific marginal costs do not vary across destinations, the variation in unit values across markets captures the variation in markups. Third, in contrast to papers relying on unit values as a proxy for quality (Hallak, 2006; Hummels and Skiba, 2004; Kugler and Verhoogen, 2012), our external measure of quality allows us to explore how firms set their prices and markups across destinations depending on the quality they export. Fourth, shipping fees for wine are based on the volume exported, while insurance fees or tariffs are proportional to value (Crozet et al., 2012). Consistent with the assumptions of our model, wine exports are thus subject to both per-unit and ad valorem trade costs (we provide evidence that both types of trade costs are indeed present in our data).[7]

Our main results can be summarized as follows. First, export unit values increase with distance and fall with tariffs. On average, a doubling of distance raises unit values by 2.74 percent, while a doubling of tariffs lowers them by 1.37 percent. Second, the effects of distance and tariffs on unit values can be explained by variable markups. On average, markups rise by 1.47 percent and fall by 1.08 percent in response to a doubling of distance or tariffs, respectively. Variable markups thus explain around half of the impact of distance, and three-quarters of the effect of tariffs on the variation in within-firm unit values across markets, the rest being attributable to selection or composition effects across products within firms. Third, the response of markups to changes in trade costs is smaller for higher quality exports. At the 5^{th} percentile of the quality distribution, markups rise by 3.67 percent and fall by 2.73 percent in response to a doubling of distance or tariffs, respectively. Instead, no changes are detected at the 95^{th} percentile. Our results continue to hold once we control for the heterogeneous pricing-to-market behavior of exporters or the extent of competition faced by each quality segment in foreign markets. They also remain robust to a whole battery of sensitivity tests, and in particular to using alternative measures of quality, different samples, and to instrumenting tariffs and quality.

Next, we provide extensions to our main specifications. We show that the heterogeneous effects of trade costs on markups are stronger for exports to richer destinations. They are also predominantly driven by the higher quality firms, the larger firms, and the exporters who own a large share of the export market. As high performance firms tend to charge higher markups, they are better able to adjust them in response to changes in trade costs. Using data on the universe of Argentinean firm-level exports, we then extend our analysis to manufacturing industries other than wine. As quality is

[7] See Bosker and Buringh (2019), Daudin, Héricourt, and Patureau (2018), Hummels and Skiba (2004), Irarrazabal et al. (2015), Lashkaripour (2017), Lugovskyy and Skiba (2015), and Takechi (2015) for evidence on per-unit trade costs.

unobserved we estimate it for each 8-digit product category exported by each firm to each country in each time period (Khandelwal, 2010). As we only observe product categories we are unable to identify the variation in markups, but we find that trade costs have heterogeneous effects on export unit values differentiated by quality. Finally, we derive and test the predictions of our model for the effects of distance and tariffs on export volumes across quality levels.

Our results are important for several reasons. First, they provide strong evidence that the variation in firm-level export unit values across markets is not only driven by quality differences but also by markup variation conditional on quality. Due to market power, firms price discriminate across destinations. But they also price discriminate more aggressively for lower quality exports. Second, as the markup of a given product with a given quality varies across export markets depending on distance and tariffs, we conclude that trade costs play a key role in generating deviations from the Law of One Price. Trade costs thus matter in explaining the degree of international market segmentation. Lastly, as our results are driven by high performance firms that contribute to the bulk of aggregate exports, we expect our findings to matter quantitatively in explaining the variation in aggregate export prices.

The remainder of the paper is organized as follows. Section 2 presents the theoretical model. Section 3 describes our data set and provides descriptive statistics. Section 4 presents the empirical methodology and our main results. Section 5 discusses extensions. Section 6 offers robustness checks and Section 7 concludes.

The appendix provides additional results. Appendix A reports evidence that both per-unit and ad valorem trade costs are present in our data. Appendix B extends our model by letting the substitution elasticity depend on quality. Appendix C discusses the predictions of our model based on demand systems other than CES. Appendix D examines how the elasticity of demand with respect to the FOB price varies with trade costs and quality. Appendix E controls for selection bias across firms. Appendix F explains how we estimate quality for manufacturing exports. The sensitivity tests are reported in Appendix G.

2 The Model

We extend the monopolistic competition model of Martin (2012) where exporters maximize profits subject to a CES demand in each destination country.[8] Trade costs are ad valorem and per unit, and the introduction of per-unit trade costs generates variable markups that depend on trade costs.[9] We assume that quality is exogenous, but producing a higher quality entails higher marginal costs as it requires sophisticated inputs, skilled workers, and specialized equipment which are expensive. For simplicity we assume that firms export a single good, but in the data we extend the analysis to multi-product exporters.

[8] The theoretical model is available in the Martin (2010) working paper.

[9] In many models, including perfect competition models such as Eaton and Kortum (2002), or monopolistic competition models like Krugman (1980) or Melitz (2003), markups do not vary with country-level characteristics such as trade costs.

2.1 Setup

Researchers typically model trade costs as ad valorem such that more expensive products are more costly to trade. As in Martin (2012) we instead assume that trade costs t_{ij} have the following structure:

$$t_{ij} = p_{ij}^{cif} - p_{ij}^{fob} = (\tau_{ij} - 1)\, p_{ij}^{fob} + T_{ij}, \tag{1}$$

where p_{ij}^{cif} and p_{ij}^{fob} are the Cost, Insurance, and Freight (CIF) and FOB prices of a monopolistically competitive firm i exporting to country j, and τ_{ij} and T_{ij} are the ad valorem and per-unit components of trade costs, respectively. Trade costs are ad valorem only if T_{ij} is zero, while they are per unit only if τ_{ij} is equal to one. As long as T_{ij} is positive, trade costs are less than proportional to the FOB price.

The relationship between the CIF and FOB prices can be expressed as:

$$p_{ij}^{cif}\left(\tau_{ij}, T_{ij}, c_i(\theta)\right) = \tau_{ij} p_{ij}^{fob}\left(\tau_{ij}, T_{ij}, c_i(\theta)\right) + T_{ij}, \tag{2}$$

where $c_i(\theta)$ is the marginal cost of firm i which increases with quality θ. Producing a higher quality entails higher marginal costs because it requires higher quality and therefore more expensive inputs (Crinò and Epifani, 2012; Feenstra and Romalis, 2014; Johnson, 2012; Kugler and Verhoogen, 2012; Manova and Zhang, 2012; Verhoogen, 2008).[10]

When exporting to country j, firm i maximizes profits π_{ij}:

$$\pi_{ij} = \left(p_{ij}^{fob} - c_i(\theta)\right) q_{ij} = \left[\left(\frac{p_{ij}^{cif} - T_{ij}}{\tau_{ij}}\right) - c_i(\theta)\right] q_{ij}, \tag{3}$$

where q_{ij} is the quantity sold by firm i in market j (which depends on p_{ij}^{cif}).

The representative consumer in destination country j has preferences over the consumption of a continuum of differentiated varieties φ given by:

$$U(q_{ij}) = \left(\int_{\Phi} \theta(\varphi)^{\frac{\sigma-1}{\sigma}} q_{ij}(\varphi)^{\frac{\sigma-1}{\sigma}} d\varphi\right)^{\frac{\sigma}{\sigma-1}}, \tag{4}$$

where $\sigma > 1$ is the elasticity of substitution between varieties. The set of available varieties is Φ. Quality captures any intrinsic characteristic or taste preference that makes a variety more appealing for a consumer given its price. Therefore, consumers love variety, but also quality.

The inverse CES demand faced by firm i in country j is (Krugman, 1980; Melitz, 2003):

$$p_{ij}^{cif} = \kappa_j q_{ij}^{-\frac{1}{\sigma}} \theta^{\frac{\sigma-1}{\sigma}}, \tag{5}$$

[10] For evidence that producing higher quality wines entails higher marginal costs, see Chen and Juvenal (2016). For instance, the oak barrels in which higher quality wines mature are more costly than stainless-steel tanks.

where κ_j is a positive parameter (exogenous to the firm) which is a function of the size and price index of the destination country. A higher quality θ shifts up the demand curve faced by the firm.

When firm i maximizes profits in (3) subject to the demand in (5), the first order condition is:

$$p_{ij}^{cif} = \frac{\sigma}{\sigma - 1} \left(T_{ij} + \tau_{ij} c_i \left(\theta \right) \right), \tag{6}$$

and using equation (2) we can derive the FOB price:

$$p_{ij}^{fob} = \frac{1}{\sigma - 1} \left(\frac{T_{ij}}{\tau_{ij}} + \sigma c_i \left(\theta \right) \right). \tag{7}$$

As producing a higher quality entails higher marginal costs, a higher quality sells at a higher price. In the standard case where trade costs are ad valorem only (i.e., $T_{ij} = 0$), the FOB price is a constant markup over marginal costs $\sigma / (\sigma - 1)$. In other words, the FOB price and markup do not depend on trade costs. Instead, if trade costs are also per unit, the FOB price and markup depend positively on per-unit costs T_{ij}, and negatively on ad valorem costs τ_{ij}. If trade costs are per unit only (i.e., $\tau_{ij} = 1$), the FOB price and markup increase with trade costs.

2.2 Trade Costs and Quality

We assume that T_{ij} increases with distance while τ_{ij} is independent of distance but varies with ad valorem tariffs (Hummels and Skiba, 2004; Irarrazabal et al., 2015; Lugovskyy and Skiba, 2015). The elasticities of the FOB price and markup with respect to T_{ij} and τ_{ij} can therefore be interpreted as elasticities with respect to distance and tariffs, respectively.[11,12] We derive those elasticities and we show how they vary with export quality.

In our model, the introduction of per-unit trade costs is crucial for our predictions. In Appendix A we provide evidence that both per-unit and ad valorem trade costs are present in our data. We also show that trade costs become more per unit than ad valorem as distance increases.

Per-Unit Trade Costs Using equation (7), we derive the elasticities of the FOB price and markup $\mu^{fob} = p_{ij}^{fob} / c_i (\theta)$ with respect to T_{ij}. As the marginal cost $c_i (\theta)$ does not vary across destinations, the two elasticities are identical:

$$\epsilon_T^{p^{fob}} = \epsilon_T^{\mu^{fob}} = \frac{1}{\left(1 + \frac{\sigma c_i(\theta)}{T_{ij} / \tau_{ij}} \right)} > 0. \tag{8}$$

[11] Assuming that distance only increases per-unit trade costs, Irarrazabal et al. (2015) estimate that the elasticity of T/τ with respect to distance is equal to 0.23. Other papers instead assume that distance increases both per-unit and ad valorem trade costs but that the effect is larger for per-unit costs such that T/τ rises with distance (Crozet et al., 2012; Feenstra and Romalis, 2014; Martin, 2012; Takechi, 2015). In our model, our predictions remain the same whether we derive the elasticities of prices and markups with respect to T/τ or T.

[12] Some models yield predictions for the effects of distance and tariffs on export prices while assuming that markups are invariant to trade costs. See Baldwin and Harrigan (2011), Fajgelbaum, Grossman, and Helpman (2011), Hummels and Skiba (2004), Johnson (2012), and Lugovskyy and Skiba (2015, 2016).

The price and markup increase with per-unit trade costs, and therefore with distance, but as marginal costs increase with quality (i.e., $c_i'(\theta) > 0$) the magnitude of the elasticity decreases with quality.

Notice that the elasticity also depends on σ which is assumed to be constant in the model. In Appendix B and in Section 4.3.1 we address theoretically and empirically the implications of allowing for a variable σ that depends on quality.

Prediction 1 *The elasticity of the FOB price and markup with respect to bilateral distance is positive, and its magnitude decreases with quality.*

From an empirical point of view, Prediction 1 implies that in regressions that explain FOB prices or markups, we expect the coefficient on distance to be positive and the coefficient on the interaction between distance and quality to be negative.

Ad Valorem Trade Costs The elasticity of the FOB price and markup with respect to τ_{ij} is:

$$\epsilon_{\tau}^{p^{fob}} = \epsilon_{\tau}^{\mu^{fob}} = \frac{-1}{\left(1 + \frac{\sigma c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} < 0. \tag{9}$$

The price and markup decrease with ad valorem trade costs, and therefore with tariffs, but as marginal costs increase with quality the magnitude of the elasticity in (9) decreases with quality.

Prediction 2 *The elasticity of the FOB price and markup with respect to ad valorem tariffs is negative, and its magnitude decreases with quality.*

When explaining FOB prices or markups, Prediction 2 implies that the coefficient on tariffs should be negative, while the coefficient on the interaction between tariffs and quality should be positive.

The models of Crozet et al. (2012), Irarrazabal et al. (2015), and Martin (2012) also show that the FOB price (and markup) rises with per-unit trade costs (and therefore with distance) and falls with ad valorem trade costs (and thus with tariffs). The prediction that the magnitude of the elasticities of the price and markup with respect to distance and tariffs decreases with quality is, instead, novel.[13]

2.3 Mechanisms

Our predictions are driven by the introduction of per-unit trade costs in the model because they generate an elasticity of demand with respect to the FOB price that depends on trade costs and quality (Crozet et al., 2012; Irarrazabal et al., 2015; Martin, 2012). The elasticity of demand with respect to the FOB price ϵ^{fob} is given by:

$$\epsilon^{fob} = \frac{\epsilon^{cif}}{\left(1 + \frac{T_{ij}}{\tau_{ij} p_{ij}^{fob}}\right)} = \frac{-\sigma}{\left\{1 + \left[\frac{1}{\sigma-1}\left(1 + \frac{\tau_{ij}}{T_{ij}} \sigma c_i(\theta)\right)\right]^{-1}\right\}}, \tag{10}$$

[13] Crozet et al. (2012) derive the elasticity of the FOB price with respect to quality and show that it falls with distance.

where ϵ^{cif} is the elasticity of demand with respect to the CIF price which is equal to $-\sigma$. If trade costs are ad valorem only (i.e., $T_{ij} = 0$), the elasticities of demand with respect to the FOB and the CIF price are identical.

If trade costs are also per unit, the elasticity of ϵ^{fob} with respect to per-unit trade costs (i.e., distance) is negative. Moreover, it increases with the FOB price, and therefore with marginal costs and quality. As the demand in more distant markets is less elastic to changes in the FOB price, exporters find it profitable to raise their prices (by raising their markups) to compensate for the lower demand they face due to higher transport costs (as foreign demand falls with the CIF price which depends on per-unit trade costs, see equations 5 and 6). But firms raise their prices less for higher quality exports.

Instead, the elasticity of ϵ^{fob} with respect to ad valorem trade costs (i.e., tariffs) is positive, and it decreases with the FOB price and quality. The demand faced by exporters in countries with higher tariffs is therefore more elastic to changes in the FOB price. To compensate for the lower demand they face due to higher tariffs (as tariffs raise the CIF price which in turn lowers foreign demand), firms reduce their prices (by lowering their markups), but they reduce them less for higher quality exports.[14]

2.4 Alternative Demand Systems

The predictions of our model are driven by two mechanisms: (1) the elasticity of ϵ^{fob} with respect to per-unit trade costs is negative and increases with the FOB price (and with quality), and (2) the elasticity of ϵ^{fob} with respect to ad valorem trade costs is positive and decreases with the FOB price (and with quality). We now discuss whether the two mechanisms hold for preferences other than CES.

Irarrazabal et al. (2015) investigate whether the first mechanism holds for different types of preferences: (a) CES utility, (b) quadratic, non-separable utility (Ottaviano, Tabuchi, and Thisse, 2002), (c) translog preferences (Feenstra, 2003), and (d) additively quasi-separable utility (Behrens and Murata, 2007). They show that the elasticity of ϵ^{fob} with respect to per-unit trade costs is negative with CES. Depending on some parameter values, it is also negative with translog and additively quasi-separable utility. Instead, it is positive with quadratic preferences. They also demonstrate that for all demand systems, this elasticity increases with the FOB price.

We examine in Appendix C whether the second mechanism holds for each demand system. We show that the elasticity of ϵ^{fob} with respect to ad valorem trade costs is positive in all cases. It decreases with the FOB price when preferences are CES or translog, and with additively quasi-separable utility but for some parameter values only. Instead, it increases with the FOB price when preferences are quadratic. We therefore conclude that the predictions of our model are not specific to CES and can be derived from alternative utility functions with the exception of quadratic preferences.

[14] The elasticity of ϵ^{fob} with respect to per-unit trade costs is negative and increases with the FOB price as $\left(\partial\epsilon^{fob}/\partial T\right)\left(T/\epsilon^{fob}\right) = -\sigma\left(1 - T/p^{cif}\right) < 0$ and $\left(\partial/\partial p^{fob}\right)\left(\left(\partial\epsilon^{fob}/\partial T\right)\left(T/\epsilon^{fob}\right)\right) = T\tau/\left(\tau p^{fob} + T\right)^2 > 0$. The elasticity of ϵ^{fob} with respect to ad valorem trade costs is positive and decreases with the FOB price as $\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right) = T/\left(\tau p^{fob} + T\right) > 0$ and $\left(\partial/\partial p^{fob}\right)\left(\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right)\right) = -T\tau/\left(\tau p^{fob} + T\right)^2 < 0$. See Appendix C.

In Appendix D we estimate the elasticities of ϵ^{fob} with respect to per-unit (i.e., distance) and ad valorem (i.e., tariffs) trade costs and examine how they vary with quality (as opposed to the FOB price). We show that the elasticity of ϵ^{fob} with respect to distance is negative and rises with quality, while the elasticity of ϵ^{fob} with respect to tariffs is positive and falls with quality.

3 Data and Descriptive Statistics

Our data set combines information from different sources: firm-level customs data, wine experts' quality ratings, and macroeconomic indicators.

3.1 Customs Data

Firm-level exports are collected by the Argentinean customs and were purchased from a private vendor called Nosis (Chen and Juvenal, 2016, 2018). For each transaction between 2002 and 2009 we observe the name of the exporting firm, the destination country, the shipment date, the 12-digit Mercosur Common Nomenclature (MCN) code, the FOB value (in US dollars) and the volume (in liters) of each wine exported.[15,16] As exports are reported FOB they exclude transport costs, tariffs, and distribution costs in the importing country. We aggregate the data at quarterly frequency between 2002Q1 and 2009Q4. In Section 6 we show that our results remain robust to using our raw data at the transaction level, and to aggregating it at annual or monthly frequency.

The main advantage of our data set is its level of disaggregation as each wine is identified according to its name, type (red, white, or rosé), grape (Malbec, Chardonnay, etc.), and vintage year. We also observe the type of packaging used for shipping. Wines are mainly exported in boxes or bottles, but they are also shipped in wooden barrels, glass, tin, or tetra pak containers. As prices and markups may vary with the type of packaging used, we define a "product" based on a wine's name, grape, type, vintage year, and container type (while we define a "wine" according to its name, grape, type, and vintage year). Our sample includes 11,158 products corresponding to 8,361 different wines. If we aggregated our data at the 12-digit MCN level we would only observe ten different product categories.

By dividing the value by the volume exported at the firm-product-destination-quarter level, we compute FOB unit values as a proxy for export prices. As we do not observe the currency of invoicing, we measure unit values in US dollars per liter. The Datamyne, a private vendor of international trade data, indeed reports that 88 percent of Argentinean wine exports (HS 2204) between 2005 and 2008 were priced in US dollars. Given that unit values are defined for positive exports only, our analysis focuses on the intensive margin of adjustment (we deal with the extensive margin in Appendix E).

[15] Due to confidentiality reasons, the customs office does not report the exporter's name. Nosis therefore uses its own market knowledge to identify a first, a second, and a third probable exporter. To identify the exporter's identity we collected from the Instituto Nacional de Vitivinicultura the name of the producer and of the wholesaler authorized to export each wine, and we compared them against the probable exporters reported by Nosis.

[16] The first six digits of the MCN coincide with the HS and the next two are unique to Mercosur. Argentina adds three more digits and a letter.

We argue that our unit values can plausibly be interpreted as prices. On the one hand, unit values are defined at the *individual* product level. This means we can compare the unit values of a given product exported by a given firm at a given point in time across destinations, holding quality constant. This is clearly an advantage over other commonly used trade data sets where unit values can only be calculated for aggregated product categories and therefore measure the *average* price of different varieties with potentially heterogeneous levels of quality. On the other hand, as the volume is only reported in liters, the unit of measurement of our unit values is homogeneous across products.[17]

We clean the data in several ways. We only keep FOB transactions and exclude the wines produced outside of Argentina. We only keep wine producers in the sample such that each wine is exported by a single firm (wholesalers and retailers are excluded, but as we show in Section 6 our results remain robust to including them in the sample). We drop the shipments with less than 4.5 liters (which corresponds to six 75cl bottles) to discard commercial samples exported for marketing and promotion. We omit observations where the vintage year reported is ahead of the shipment year, and the cases where the value of exports is positive, but the reported volume is zero. To eliminate potential outliers, for each exporter in each time period we calculate the median unit value and we drop the observations for which the unit value exceeds 100 times the median, or falls below the median divided by 100.

3.2 Quality

We measure quality using the time-invariant quality ratings published by the Wine Spectator and Robert Parker (Chen and Juvenal, 2016, 2018). The wines are assessed in blind tastings, and the ratings are given on a (50,100) scale according to the wine's name, grape, type, and vintage year. A higher score indicates a higher quality. Table 1 describes the two rating classifications.

Table 1: Quality Ratings

Wine Spectator (50,100)		**Robert Parker (50,100)**	
Great	95–100	Extraordinary	96–100
Outstanding	90–94	Outstanding	90–95
Very good	85–89	Above average/very good	80–89
Good	80–84	Average	70–79
Mediocre	75–79	Below average	60–69
Not recommended	50–74	Unacceptable	50–59

Notes: Both the Wine Spectator and Robert Parker rating systems classify the quality scores into six different bins.

When we match the wines from the customs data set with the quality ratings of the Wine Spectator by name, type, grape, and vintage year, we end up with 237 exporters, 8,361 wines (11,158 products),

[17] Although exports are reported FOB, one concern is that export unit values may still include some costs of exporting to foreign destinations. One example are the costs incurred by exporters in order to satisfy the importer's national standards and technical regulations. For instance, strict labelling requirements in the US and the EU may necessitate the printing of different labels for each market, increasing the costs of selling to those destinations. Another example are the costs of promotional activities that aim to overcome informational frictions in some countries. Both types of costs can, however, be controlled for by including destination-time fixed effects. Finally, if packaging costs increase with distance (Martin, 2012), they may contribute to explaining the positive effect of distance on unit values. Still, they are unlikely to explain the heterogeneous effects of distance and tariffs across quality levels that we uncover in the data.

and 95 destination countries between 2002Q1 and 2009Q4. The sample represents 41 percent of the total value of red, white, and rosé wine exported over the period (91,810 observations). We observe 1,066 different wine names, three types, 24 grapes, and 22 vintage years (from 1977 to 2009). The lowest rated wine receives a score of 55, and the highest a score of 97.

When we merge the customs data with the Parker ratings we only observe 2,960 wines or 4,128 products (with 443 different names, three types, 21 grapes, and 20 vintage years), 151 firms, and 92 destination countries. The quality scores vary between 72 and 98 (i.e., we only observe four of the six bins listed in Table 1). As this sample only represents 24 percent of the value of wine exports over the period, we rely on the Wine Spectator for our main regressions and we use the Parker ratings as a robustness check. The mean absolute difference between the Wine Spectator and Parker ratings is equal to 1.96, with a standard deviation of 3.19. Still, the two ratings are positively correlated as Pearson's correlation is equal to 0.53, while Kendall's correlation index of concordance is 0.36.

3.3 Macroeconomic Data

We obtain bilateral distances (in kilometers) from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). We use the population-weighted great circle distance between the largest cities of two countries. Bilateral ad valorem tariffs for wine (HS 2204), at annual frequency, are extracted from the United Nations Conference on Trade and Development TRAINS database. We use the effectively applied weighted average tariff rates in percentage terms (our results are similar if we use the effectively applied simple average tariff rates). Annual PPP GDPs and GDPs per capita (in constant 2011 US dollars) come from the World Bank's World Development Indicators (measuring real GDP and GDP per capita without any adjustment for PPP yields similar results). Quarterly period-average nominal exchange rates are taken from the International Financial Statistics of the International Monetary Fund. Each country's annual wine production and consumption (total and per capita, in liters) are obtained from Anderson and Nelgen (2011).

3.4 A First Glance at the Data

Table 2 summarizes our trade data by year, and shows that the number of exporters, wines, and products increased threefold between 2002 and 2009. A total of 926 wines were exported by 70 different firms in 2002, while 191 firms exported 2,677 different wines in 2009. The number of export markets rose from 62 in 2002 to 77 in 2009. The mean number of exported wines and of destinations per firm, and the mean number of destinations per wine also increased over time (the number of observations, firms, destinations, and the mean number of destinations per firm and per wine fell in 2009 due to the global financial crisis, see Chen and Juvenal, 2018).

Table 3 reports descriptive statistics by quality bin of the Wine Spectator. "Good" and "Very good" wines represent the largest share of the sample (in terms of number of observations, firms, wines, products, destinations, and export share in the sample). Instead, "Great" and "Not recommended" wines have the smallest coverages. "Great" wines are exported to fewer countries which are, on average,

Table 2: Summary Statistics

Year	Observations	Firms	Products	Wines	Destinations	Wines per firm	Destinations per firm	Destinations per wine
2002	3,548	70	1,159	926	62	33.3	16.2	6.4
2003	6,087	94	1,536	1,201	61	35.1	18.1	8.2
2004	8,104	123	1,827	1,443	66	33.1	18.9	9.4
2005	11,072	143	2,270	1,784	67	35.6	20.9	11.1
2006	14,026	166	2,713	2,132	77	39.0	20.7	11.5
2007	16,018	178	2,961	2,391	78	40.1	22.5	12.8
2008	17,130	196	2,996	2,508	80	43.0	21.8	12.8
2009	15,825	191	3,208	2,677	77	45.7	20.4	10.8

Notes: For each year in the sample, the table reports the number of observations, exporters, products, wines, destinations, and the mean number of wines per exporter, destinations per exporter, and destinations per wine.

richer. Consistent with quality sorting and the Alchian and Allen (1964) conjecture, "Great" wines are also exported to more distant locations. Higher quality wines are on average more expensive (the correlation between unit values and quality in our sample is 35.7 percent).

Table 3: Descriptive Statistics by Quality Bin of the Wine Spectator

	Obs.	Firms	Products	Wines	Export shares	Unit values	Dest.	Distance	GDP per capita
Great	201	7	53	44	0.11%	27.98	30	9,511	33,782
Outstanding	12,944	79	1,686	1,282	16.61%	12.42	81	8,873	31,192
Very good	36,379	147	3,416	2,488	44.00%	4.71	91	8,970	30,162
Good	36,638	181	4,823	3,577	34.11%	4.28	90	8,977	30,866
Mediocre	5,218	97	1,100	909	4.39%	3.91	80	8,897	33,012
Not recommended	430	26	80	61	0.78%	3.89	52	8,391	29,252

Notes: For each quality bin, the table reports the number of observations, exporters, products, wines, the export share (in %), the mean unit value (in US dollars per liter), the number of destinations, the mean distance to export markets (in kilometers), and the mean income per capita of the destination countries (in PPP constant 2011 US dollars).

Table 4 describes our data by continent. North America is the main destination for wine exports (in terms of number of exporters, wines, and share of exports). Compared to Europe or Asia which have a similar income per capita, North America is larger, sets lower tariffs, and is closer to Argentina. South America only imports 13 percent of Argentinean wine exports. It is the closest region and sets the lowest tariffs, but it also has a low GDP and GDP per capita. The export share to Africa is negligible, but it is the smallest and poorest region and sets high tariffs. Besides, tariffs tend to rise with distance (their correlation is 42.5 percent). Unit values fall with tariffs (their correlation is −9.4 percent), but they do not appear to vary strongly with the distance to each region. Continents are, however, an imperfect proxy for distance (Argentina is for instance closer to North America than to Africa, but the distance to Canada is 9,391 kilometers against 7,702 kilometers to Ghana).

Lastly, we regress (log) unit values on product-quarter and destination country dummy variables. As the product-quarter fixed effects enable us to identify the variation in markups, the estimated country fixed effects capture the mean markup in each destination. In Panels (a) and (b) of Figure 1

Table 4: Descriptive Statistics by Continent

	Obs.	Firms	Wines	Export shares	Unit values	Dest.	Distance	GDP per capita	GDP	Tariffs
S. America	20,821	165	4,299	12.93%	5.98	11	2,612	10,895	1,020	3.86%
N. America	28,862	225	5,779	48.69%	5.71	20	7,983	35,913	7,770	5.53%
Africa	372	32	234	0.09%	3.91	8	8,493	6,546	131	25.81%
Europe	32,672	189	5,386	33.67%	5.29	36	11,602	38,590	1,240	28.67%
Asia	9,083	127	2,364	4.62%	5.84	20	17,066	32,689	2,500	19.68%

Notes: For each continent, the table reports the number of observations, exporters, wines, the export share (in %), the mean unit value (in US dollars per liter), the number of destinations, the mean distance (in kilometers), mean GDP per capita (in PPP constant 2011 US dollars), mean GDP (in billion PPP constant 2011 US dollars), and mean tariff (in %).

we plot the country fixed effects against (log) distance and (log) one plus each country's mean tariff. Panel (a) shows that markups rise with distance with a slope of 0.027 (significant at the one percent level). If distance doubles, markups increase by 1.9 percent ($2^{0.027} - 1$). Markups are highest for Luxembourg (LUX) which is a distant country, and they are low for Uruguay (URY) which is close to Argentina. They are also low for Saint Lucia (LCA) and Belarus (BLR) which are both relatively distant from Argentina, but the two countries also have a low GDP and GDP per capita. In Panel (b), markups fall with tariffs with a slope coefficient of -0.020 (significant at the one percent level). A doubling of tariffs (from their mean which is equal to 15.60 percent) lowers markups by 0.26 percent. Markups are relatively high in low-tariff countries such as Canada (CAN) or Japan (JAP), while they are lower in Jordan (JOR) which is the country with the highest tariffs.[18]

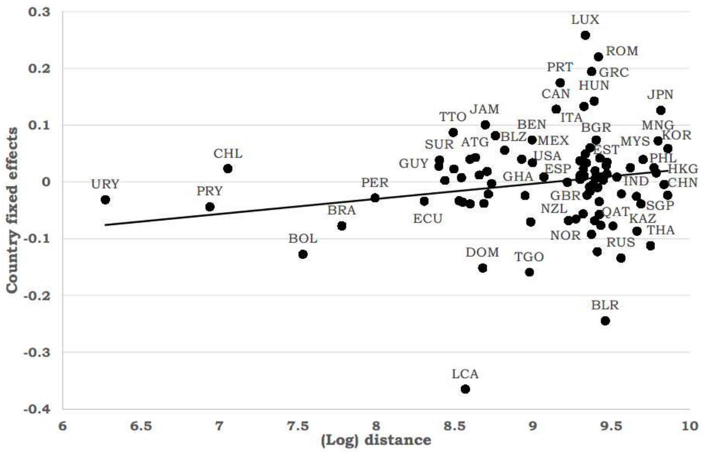
4 Empirical Analysis

To test the predictions of our model, and establish how exporters adjust their prices and markups across destinations depending on distance, tariffs, and the quality of their exports, we estimate:

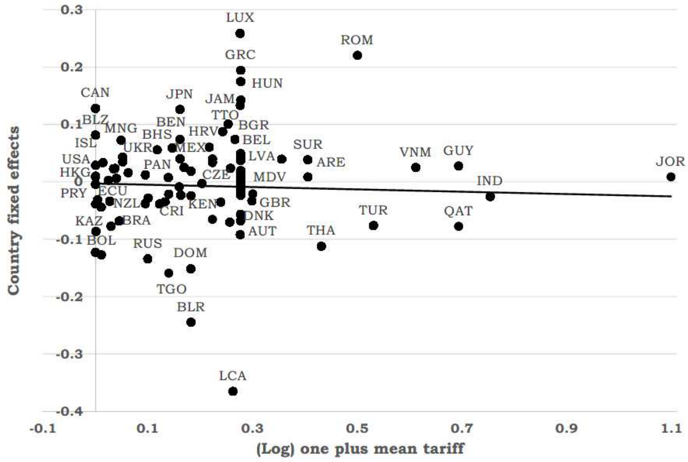
$$\begin{aligned} \ln uv_{ijk,t} &= \alpha_1 \ln dist_j + \alpha_2 \ln dist_j \times quality_k + \alpha_3 \ln tar_{j,t} + \alpha_4 \ln tar_{j,t} \times quality_k \\ &\quad + \alpha_5 z_{j,t} + D_{k,t} + \varepsilon_{ijk,t}, \end{aligned} \tag{11}$$

where $uv_{ijk,t}$ is the FOB unit value of wine product k exported by firm i to country j in quarter t (in US dollars per liter). The quality of wine k, denoted by $quality_k$, is measured by the Wine Spectator ratings. The distance $dist_j$ between Argentina and country j, and the (annual) tariff $tar_{j,t}$ imposed by country j on wine imports from Argentina in quarter t are both interacted with quality (we use the logarithm of one plus the tariff rate). As our model predicts that prices and markups rise with distance and fall with tariffs, especially for lower quality exports, we expect $\alpha_1 + (\alpha_2 \times quality_k) > 0$ with $\alpha_2 < 0$ (Prediction 1), and $\alpha_3 + (\alpha_4 \times quality_k) < 0$ with $\alpha_4 > 0$ (Prediction 2).

[18] Visual inspection of the data also provides evidence of price discrimination. If we consider the wine product shipped to the largest number of countries in a given quarter (35 countries in 2009Q2), its unit value in that quarter varies between 1.78 and 4.68 US dollars per liter for exports to Honduras (6,085 kilometers) and Belgium (11,305 kilometers). As the marginal cost is the same across markets, the higher unit value for the more distant country suggests a higher markup.



(a) Bilateral distance



(b) Mean tariffs

Figure 1: Destination-specific mean markups against (a) (log) bilateral distance and (b) (log) one plus the mean tariff. The mean markups are measured by the estimated country fixed effects obtained from regressing (log) unit values on product-quarter and destination country dummy variables.

We also control for destination-specific characteristics $z_{j,t}$ including (log) GDP, GDP per capita, and remoteness, measured at annual frequency.[19] We expect GDP per capita to be associated with higher unit values, reflecting that wealthier countries have a stronger preference for quality (Bastos and Silva, 2010; Görg, Halpern, and Muraközy, 2017; Hummels and Skiba, 2004; Lugovskyy and Skiba, 2015; Manova and Zhang, 2012; Martin, 2012). As unit values depend on average prices in each export market, they should also be higher in remote locations which are less competitive and have higher prices (Martin, 2012). They should instead be lower in larger countries where there is tougher competition (Baldwin and Harrigan, 2011; Görg et al., 2017; Harrigan, Ma, and Shlychkov, 2015; Martin, 2012).

[19] A country is remote if it is geographically isolated from other countries or is close to small countries but far away from large economies. Remoteness is calculated as $\sum_j (GDP_j/dist_j)^{-1}$ (Baldwin and Harrigan, 2011).

We perform within estimations and include product-quarter fixed effects $D_{k,t}$ (which are also firm specific). The direct effect of quality therefore drops out from the regression. As the product-quarter fixed effects enable us to isolate the variation in unit values across destinations for a given exporter and a given product at each point in time, they control for selection and composition effects across products within firms. And since product-specific marginal costs do not vary across destinations, the variation in unit values across markets identifies the variation in markups.[20] Robust standard errors are adjusted for clustering at the destination-quarter level (our results remain robust to multi-level clustering by destination and firm).

Next, we estimate a more stringent specification:

$$\ln uv_{ijk,t} = \phi_1 \ln dist_j \times quality_k + \phi_2 \ln tar_{j,t} \times quality_k + D_{k,t} + D_{ij,t} + \upsilon_{ijk,t}, \tag{12}$$

where the firm-destination-quarter fixed effects $D_{ij,t}$ control for factors such as the time-varying demand or taste of a country for a firm's exports, or the existence of contracts negotiated by some exporters in some destinations. They also absorb all destination-specific variables including distance, tariffs, GDP, GDP per capita, and remoteness.

In Section 4.1 we first revisit evidence from the prior literature that export unit values rise with distance and fall with tariffs. We then turn to our first contribution and show that the effects of distance and tariffs on unit values can be explained by variable markups. Our second contribution in Section 4.2 is to demonstrate that the effects of trade costs on markups are smaller for higher quality exports. Section 4.3 addresses the role of alternative mechanisms in explaining our findings.

4.1 Homogeneous Trade Cost Effects

To identify the homogeneous effects of bilateral distance and tariffs on unit values, we estimate equation (11) but we omit the two interaction terms with quality. Also, we replace the product-quarter fixed effects with firm-quarter dummy variables, and we control for product characteristics by including grape, type, vintage year, MCN-level, packaging, and province of origin of the grapes fixed effects. Fixed effects for the wine names are not included as they are collinear with the firm fixed effects (as each wine is exported by one producer only). The firm-quarter fixed effects control for time-varying characteristics of the exporters such as productivity, firm size, or credit constraints. They also imply that we identify the variation in unit values across products and destinations for a given exporter at a given point in time. The effects of distance and tariffs on unit values can therefore be driven by selection across products within firms, Alchian and Allen (1964) effects, and/or variable markups.

The results are reported in column (1) of Table 5. Unit values increase with distance and fall with tariffs (Görg et al., 2017; Hummels and Skiba, 2004; Lugovskyy and Skiba, 2016). They are higher in

[20] Selection and composition imply that unit values vary across markets because different wines are sold in different countries. Price discrimination captures that unit values vary across markets conditional on positive exports. By absorbing in each quarter the wines shipped to a single country, the product-quarter fixed effects control for selection and composition.

richer and remote destinations, and lower in larger markets. Column (2) further controls for quality. Higher quality wines are more expensive, as in equation (7). And for a given quality, unit values are higher in more distant countries, and lower in markets with higher tariffs.

Table 5: Homogeneous Trade Cost Effects

	(1)	(2)	(3)	(4)
ln distance	0.042^{***} (0.008)	0.039^{***} (0.008)	0.021^{***} (0.005)	–
$2,900$ km $\leq$ distance $< 7,700$ km	–	–	–	0.008 (0.008)
$7,700$ km $\leq$ distance $< 14,200$ km	–	–	–	0.040^{***} (0.012)
distance $\geq 14,200$ km	–	–	–	0.054^{***} (0.012)
quality	–	0.032^{***} (0.001)	–	–
ln tariffs	-0.115^{***} (0.040)	-0.113^{***} (0.040)	-0.086^{***} (0.022)	–
16% $\leq$ tariffs $<$ 32%	–	–	–	0.005 (0.009)
32% $\leq$ tariffs $<$ 48%	–	–	–	-0.022^{**} (0.010)
tariffs $\geq$ 48%	–	–	–	-0.040^{***} (0.012)
ln remoteness	0.048^{***} (0.013)	0.047^{***} (0.013)	0.011 (0.008)	0.015 (0.009)
ln GDP	-0.024^{***} (0.002)	-0.024^{***} (0.002)	-0.013^{***} (0.002)	-0.014^{***} (0.002)
ln GDP/cap	0.020^{***} (0.007)	0.021^{***} (0.007)	0.011^{**} (0.005)	0.011^{**} (0.005)
R-squared	0.584	0.596	0.838	0.838
Observations	91,307	91,307	71,952	71,952
Firm-quarter fixed effects	Yes	Yes	No	No
Product characteristics fixed effects	Yes	Yes	No	No
Product-quarter fixed effects	No	No	Yes	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels.

Column (3) includes product-quarter fixed effects and quality drops out from the regression (the coefficient on remoteness also becomes insignificant). Notably, the distance coefficient remains positive and the tariff coefficient negative. This specification provides direct evidence that exporters set higher markups in more distant locations, and lower markups in countries with higher tariffs.

Compared to a value of 0.039 in column (2), the distance coefficient falls to 0.021 in column (3). If distance doubles, unit values and markups increase by 2.74 and 1.47 percent. Variable markups thus contribute to around half of the effect of distance on the variation in within-firm unit values across markets, the other half being attributable to selection or composition effects across products within firms. Likewise, the magnitude of the tariff coefficient falls from -0.113 to -0.086. A doubling of tariffs (from their mean) lowers unit values and markups by 1.37 and 1.08 percent. Variable markups therefore explain three-quarters of the effect of tariffs on the variation in within-firm unit values across markets, the rest being due to selection or composition effects across products within firms.[21]

[21] Our model predicts that the elasticities with respect to distance and tariffs are the same for prices and markups

Column (4) reports non-parametric estimates and regresses unit values on distance and tariff interval dummy variables (the dummies for the first intervals of distance and tariffs are omitted).[22] Distance between 2,900 and 7,700 kilometers has no effect on markups. Instead, markups increase by 4.0 log points if distance lies between 7,700 and 14,200 kilometers, and by 5.4 log points if distance is greater than 14,200 kilometers. Markups do not vary with tariffs between 16 and 32 percent. But they fall by 2.2 log points if tariffs lie between 32 and 48 percent, and by 4.0 log points if tariffs exceed 48 percent.

4.2 Heterogeneous Trade Cost Effects

We now explore the heterogeneous effects of distance and tariffs on the markups of exports differentiated by quality. Column (1) of Table 6 includes an interaction term between distance and quality, while column (2) also interacts tariffs with quality. Consistent with Predictions 1 and 2, the coefficient on the distance interaction is negative, while the coefficient on the tariff interaction is positive. The elasticities of markups with respect to trade costs are therefore smaller in magnitude for higher quality exports. Column (3) reports the results of estimating equation (12). The coefficient on the distance interaction remains negative, while the one on the tariff interaction continues to be positive.[23,24]

How large are the heterogeneous effects of trade costs? Based on the estimates of column (2), Panels (a) and (b) of Figure 2 plot the distance and tariff elasticities evaluated at each quality level in our sample (between 55 and 97) and their confidence intervals. At the mean value of quality (equal to 85), the distance elasticity is equal to 0.022. It is equal to 0.052 at the 5^{th} percentile of the quality distribution (equal to 79), and falls to -0.007 (which is insignificant) at the 95^{th} percentile (equal to 91). Likewise, the tariff elasticity is equal to -0.094 at the mean value of quality. Its magnitude falls from -0.227 at the 5^{th} percentile of the quality distribution to 0.039 (which is not significant) at the 95^{th} percentile. For quality levels above 91, the distance elasticity becomes negative and the tariff elasticity positive. The effect of quality thus outweighs the effects of trade costs such that firms *lower* their markups in more distant markets, and *raise* them in high-tariff countries.

As we observe unit values only when a firm exports to a given country, our regressions do not control for the possibility that firms may decide to export to some markets but not to others. In

(equations 8 and 9). We therefore compare the results for markups in column (3) with the ones we obtain for unit values if we regress the specification in column (2) on the sample of column (3). The distance and tariff elasticities are equal to 0.028 and –0.072, respectively, and are therefore not identical but are very close to those in column (3).

[22] For distance, the first group (less than 2,900 kilometers) includes Argentina's neighboring countries. The second (2,900–7,700 kilometers) contains other Latin American countries. The third (7,700–14,200 kilometers) includes the US, Canada, Australia, New Zealand, Africa, Europe, and the Middle East. The last group (more than 14,200 kilometers) contains Asian countries. For tariffs, the first interval (below 16 percent) includes countries setting zero tariffs such as the members of Mercosur and low-tariff countries such as Australia. The second (16–32 percent) includes countries such as Japan, South Africa, and South Korea. The third (32–48 percent) mainly consists of EU countries. The most protectionist markets (above 48 percent) include Jordan, India, Qatar, and the United Arab Emirates, among others.

[23] Our results are consistent with Cavallo, Gopinath, Neiman, and Tang (2019) who find that higher tariffs reduce to a larger extent the export prices of undifferentiated goods.

[24] As in Irarrazabal et al. (2015), our model assumes that distance only increases per-unit trade costs. But if distance also affects ad valorem trade costs (Crozet et al., 2012; Feenstra and Romalis, 2014; Martin, 2012; Takechi, 2015), the magnitude of our coefficients on distance and its interaction with quality will be downward biased as the two variables partly capture the effects of ad valorem trade costs on export unit values differentiated by quality.

Table 6: Heterogeneous Trade Cost Effects

	(1)	(2)	(3)
ln distance	0.303^{***} (0.056)	0.446^{***} (0.061)	–
ln distance × quality	-0.003^{***} (0.001)	-0.005^{***} (0.001)	-0.003^{***} (0.001)
ln tariffs	-0.087^{***} (0.022)	-1.986^{***} (0.362)	–
ln tariffs × quality	–	0.022^{***} (0.004)	0.027^{***} (0.004)
ln remoteness	0.012 (0.008)	0.011 (0.008)	–
ln GDP	-0.013^{***} (0.002)	-0.013^{***} (0.002)	–
ln GDP/cap	0.010^{**} (0.005)	0.010^{**} (0.005)	–
R-squared	0.838	0.838	0.922
Observations	71,952	71,952	66,941
Product-quarter fixed effects	Yes	Yes	Yes
Firm-destination-quarter fixed effects	No	No	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels.

Appendix E we implement the three-step estimator of Harrigan et al. (2015) and show that our results remain robust to controlling for selection bias across firms. We explain export values using a two-step Heckman estimator and include the residuals as a selection control in the unit values regression.

4.3 Alternative Mechanisms

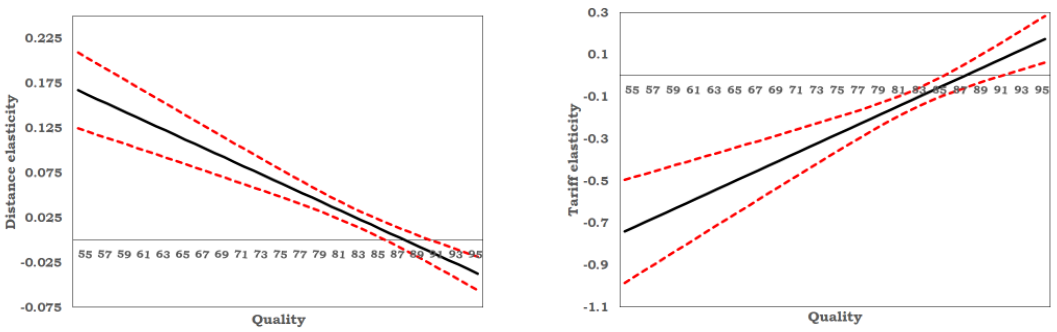
We consider alternative mechanisms that may explain the heterogeneous effects of trade costs on markups that we uncover in the data.

4.3.1 Intensity of Competition

In our model, the substitution elasticity σ determines the elasticity of demand with respect to the CIF price, and it therefore captures the degree of competition in foreign markets. We assume that σ is constant, but this may not be true in the data as σ could potentially vary across markets and/or quality levels.

Allowing for the possibility that σ is not constant is important as σ affects the elasticity of the markup with respect to distance and tariffs (equations 8 and 9). For the goods facing a higher degree of competition (i.e., with a higher σ), firms may adjust their markups less in response to changes in trade costs. Our estimates could hence be biased if a higher quality is associated with a higher σ.

To address this issue we estimate substitution elasticities that vary across countries and quality levels. We find that σ is *smaller* for higher quality exports. Moreover, the markups of exports with a lower σ, which tend to have a higher quality, respond less to changes in trade costs. In Appendix B we derive the predictions of our model once we let σ depend negatively on quality, and we show that under certain plausible conditions our predictions continue to hold.



(a) Distance

(b) Tariffs

Figure 2: Bilateral distance and tariff elasticities by quality level (based on the estimates reported in column 2 of Table 6). 95 percent confidence intervals reported as dashed lines.

To estimate the substitution elasticities, we follow Imbs and Méjean (2015) who adapt Feenstra's (1994) approach of estimating a demand schedule for US industries using country-industry fixed effects as instruments. Identification depends on the cross-section of exporters and is achieved in deviation from a reference country. When this approach yields estimates that do not match the theoretically plausible values for σ, Imbs and Méjean (2015) apply the grid search algorithm of Broda and Weinstein (2006) that minimizes the sum of squared residuals over the intervals of plausible values for σ, in which case the standard errors are boostrapped with 1,000 replications.

As we only observe one country exporting to many markets, to achieve identification we define each exporting entity as a firm. Besides, due to the small number of observations for "Great" and "Not recommended" wines, we group our data into three quality categories: *Low quality* (which includes the "Not recommended" and "Mediocre" wines), *Medium quality* ("Good" and "Very good" wines), and *High quality* ("Great" and "Outstanding" wines). All wines within each category are therefore assumed to be equally substitutable. Lastly, as we need lagged export values and unit values for the estimation, to maximize data coverage we aggregate our data at annual frequency. Due to limited data availability in 2002 and 2003 we restrict our estimation to the 2004–2009 period only.

We provide two sets of estimates. First, we estimate one substitution elasticity for each of the three quality categories, constraining them to be identical across importing countries. We find that σ is equal to 17.71 for *Low quality*, 11.82 for *Medium quality*, and 8.37 for *High quality*. Higher quality wines have a smaller elasticity of substitution, and therefore face less competition in export markets. Second, we let the three elasticities vary across destinations. This yields 75 different elasticities ranging from 1.41 to 41.73 with an average of 9.92 and a standard deviation of 9.27 (due to data limitations, we are unable to estimate σ for all countries and quality categories in our sample). The correlation between σ and quality is negative at -16.9 percent.

In column (1) of Table 7 we estimate equation (11) but we further interact distance and tariffs with the (log) elasticity of substitution that varies across destinations and quality categories. The coefficient on the interaction between distance and σ is positive, while the one on the interaction between tariffs and σ is negative. When trade costs increase, firms adjust their markups less for the wines with a lower σ, which also tend to have a higher quality. Most importantly, our main results continue to hold: firms raise their markups in more distant markets and lower them in high-tariff destinations, especially for lower quality exports.[25]

Table 7: Intensity of Competition in Foreign Markets

	(1)	(2)	(3)
ln distance	0.415^{***} (0.083)	–	–
ln distance × quality	-0.005^{***} (0.001)	-0.004^{***} (0.001)	-0.002^{*} (0.001)
ln distance × ln σ	0.027^{***} (0.006)	-0.002 (0.009)	0.076^{***} (0.024)
ln tariffs	-1.673^{***} (0.523)	–	–
ln tariffs × quality	0.023^{***} (0.006)	0.025^{***} (0.006)	0.010^{**} (0.005)
ln tariffs × ln σ	-0.197^{***} (0.039)	-0.404^{***} (0.060)	-0.660^{***} (0.124)
ln remoteness	-0.001 (0.014)	–	–
ln GDP	-0.024^{***} (0.003)	–	–
ln GDP/cap	0.020^{**} (0.009)	–	–
ln σ	-0.200^{***} (0.049)	0.102 (0.075)	–
R-squared	0.845	0.928	0.922
Observations	49,129	44,806	66,941
Product-quarter fixed effects	Yes	Yes	Yes
Firm-destination-quarter fixed effects	No	Yes	Yes
Substitution elasticity σ	Country-quality	Country-quality	Quality

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. The elasticity of substitution σ is estimated as in Imbs and Méjean (2015).

At the mean values of quality and σ, the distance elasticity is equal to 0.025. It is equal to 0.058 at the 5^{th} percentile of the quality distribution, and falls to -0.007 (which is insignificant) at the 95^{th} percentile. It is instead equal to -0.006 (which is insignificant) at the 5^{th} percentile of the distribution of σ, but to 0.054 at the 95^{th} percentile. Likewise, the tariff elasticity is equal to -0.162 at the mean values of quality and σ. Its magnitude falls from -0.304 at the 5^{th} percentile of the quality distribution to -0.022 (which is not significant) at the 95^{th} percentile. Conversely, it is equal to 0.063 (which is insignificant) at the 5^{th} percentile of the distribution of σ, and to -0.369 at the 95^{th} percentile.

In column (2) we further control for firm-destination-quarter fixed effects. In column (3) we estimate the same specification as in column (2) but we use the substitution elasticities that only vary by quality category. The coefficient on the interaction between distance and σ turns insignificant in column (2).

[25] If we regress unit values on distance, tariffs, quality, the substitution elasticity and the country-level controls (with firm-quarter and product characteristics fixed effects), a variance decomposition shows that 2.71 percent of the variation in unit values is explained by quality, 0.53 percent by the elasticity σ, 0.15 percent by distance, and 0.03 percent by tariffs.

But in both cases, the effects of trade costs on markups continue to be heterogeneous across quality levels. We conclude that the intensity of competition in foreign markets is not driving our results.

4.3.2 Country-Level Characteristics

Our estimates may be biased if distance and tariffs are correlated with other country-level characteristics that affect the pricing decisions of exporters in each quality segment. For instance, Chen and Juvenal (2016) show that the markups of higher quality exports are more sensitive to real exchange rate changes. To ensure that our results are not driven by the heterogeneous pricing-to-market behavior of exporters, we control for the exchange rate between the US dollar and the importer's currency (an increase indicates an appreciation of the US dollar) interacted with quality. As shown in column (1) of Table 8, the exchange rate interaction has a positive coefficient but its inclusion does not substantially modify the size and significance of the coefficients on the distance and tariff interaction terms.

Table 8: Country-Level Characteristics

	(1)	(2)	(3)	(4)	(5)
ln distance × quality	-0.004^{***}	-0.005^{***}	-0.004^{***}	-0.004^{***}	-0.009^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln tariffs × quality	0.026^{***}	0.029^{***}	0.030^{***}	0.030^{***}	0.015^{***}
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
ln exchange rate × quality	0.001^{**}	–	–	–	–
	(0.000)				
ln GDP/cap × quality	–	0.002^{***}	–	–	–
		(0.001)			
ln wine production/cap × quality	–	–	0.001^{**}	–	–
			(0.000)		
ln wine consumption/cap × quality	–	–	–	0.002^{***}	–
				(0.000)	
ln wine import share × quality	–	–	–	–	-0.004^{***}
					(0.001)
R-squared	0.922	0.922	0.924	0.925	0.922
Observations	66,941	66,941	56,605	44,410	66,939
Product-quarter fixed effects	Yes	Yes	Yes	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels. An increase in the exchange rate indicates an appreciation of the US dollar.

In a related study, Chen and Juvenal (2018) show that the markups of higher quality exports are more sensitive to changes in foreign income. In column (2) we therefore include an interaction between foreign real GDP per capita and quality. The coefficient on the interaction term is positive, but distance and tariffs continue to have heterogeneous effects on the markups of exports differentiated by quality.

Markups may also depend on each destination's wine production or consumption patterns. In columns (3) and (4) we include interactions between quality and each country's wine production or consumption per capita (we use the logarithm of one plus wine production per capita to account for the countries not producing wine). As markups could also be affected by the intensity of import competition in each country, in column (5) we interact each country's annual share of wine import quantities (HS 2204) from Argentina with quality (from the BACI data set, see Gaulier and Zignago, 2010). The effects of trade costs on markups remain heterogeneous across quality levels (our results also remain robust if we include interactions between remoteness or each country's GDP with quality).

5 Extensions

We investigate whether our results vary with the income level of export markets and across different types of exporters. We also extend our analysis to manufacturing industries other than wine. Finally, we derive and test the predictions of our model for export volumes.

5.1 Income Heterogeneity across Destinations

Consumers in richer countries are generally assumed to have a stronger preference for higher quality goods (Chen and Juvenal, 2016, 2018; Crinò and Epifani, 2012; Fajgelbaum, Grossman, and Helpman, 2011; Feenstra and Romalis, 2014; Hallak, 2006; Manova and Zhang, 2012; Simonovska, 2015). To establish whether per capita income matters for our results, we classify countries as rich or poor based on whether their income per capita is above or below the sample median. We estimate equation (12) and multiply the distance and tariff interactions with a dummy variable for the richer destinations.[26]

Table 9: Income Heterogeneity across Destinations

	(1)	(2)
ln distance × quality	-0.003^{**} (0.001)	-0.003^{***} (0.001)
ln distance × quality × rich	-0.001^{*} (0.000)	-0.001^{**} (0.000)
ln tariffs × quality	0.004 (0.005)	-0.007 (0.009)
ln tariffs × quality × rich	0.036^{***} (0.007)	0.038^{***} (0.009)
R-squared	0.922	0.922
Observations	66,941	66,941
Product-quarter fixed effects	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes
Rich versus poor	Median GDP/cap	World Bank GNI

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels.

The results are presented in column (1) of Table 9. The coefficient on the interaction of distance with quality is significant for the two groups of countries, but it is larger in magnitude for the richer destinations. Instead, the effect of tariffs is heterogeneous for the richer markets only. Column (2) shows that our results remain similar if we instead split our sample using the World Bank's classification of high and low income countries (the threshold is a GNI per capita of 4,035 US dollars in 2011). The heterogeneous effects of trade costs on markups are thus stronger for exports to richer destinations.

[26] Argentina's higher income export destinations such as the US and the EU also tend to be farther away. In our sample, the correlation between income per capita and bilateral distance is equal to 60.5 percent.

5.2 Firm-Level Characteristics

We explore whether our results vary across exporters depending on their average quality, their size, and their export market shares. To identify differential effects, we estimate equation (12) and we multiply the distance and tariff interactions with a dummy variable for the higher quality firms, the larger firms, and the exporters with larger export market shares.

First, to compare higher and lower quality exporters we divide our sample at the median of average firm-level quality. We define a higher quality exporter as one which average quality is above the median. As shown in column (1) of Table 10, the interactions of distance and tariffs with quality are only significant for the higher quality firms. Heterogeneity in the impact of trade costs on markups is therefore driven by the higher quality exporters.

Table 10: Firm-Level Characteristics

	(1)	(2)	(3)	(4)
ln distance × quality	−0.001 (0.001)	0.001 (0.001)	−0.003*** (0.001)	0.001 (0.001)
ln distance × quality × high quality firms	−0.005*** (0.001)	–	–	−0.004** (0.002)
ln distance × quality × large firms	–	−0.005*** (0.001)	–	−0.003** (0.001)
ln distance × quality × high market share firms	–	–	−0.001 (0.001)	−0.001 (0.001)
ln tariffs × quality	0.007 (0.005)	0.014** (0.007)	0.008 (0.007)	−0.009 (0.008)
ln tariffs × quality × high quality firms	0.033*** (0.008)	–	–	0.035*** (0.009)
ln tariffs × quality × large firms	–	0.017** (0.009)	–	−0.013 (0.011)
ln tariffs × quality × high market share firms	–	–	0.026*** (0.009)	0.034*** (0.011)
R-squared	0.922	0.922	0.922	0.922
Observations	66,941	66,941	66,941	66,941
Product-quarter fixed effects	Yes	Yes	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes	Yes	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels.

Second, we ask whether our results vary with firm-level productivity. As more productive firms tend to charge higher markups (Bellone, Musso, Nesta, and Warzynski, 2014; Berman et al., 2012; Melitz and Ottaviano, 2008), we expect those firms to be better able to adjust their markups in response to changes in trade costs. Without any data on firm-level value-added or employment which are required to calculate productivity, we instead rely on a measure of firm size as the latter correlates strongly with productivity. We calculate the total volume (in liters) of exports for each firm in each year, and we categorize a firm as large if its total yearly exports are above the sample median. Column (2) shows that the effect of distance is heterogeneous for the large firms only. The effect of tariffs is heterogeneous for all firms, but to a larger extent for the bigger firms.

Lastly, we compare firms based on their export market shares. Amiti, Itskhoki, and Konings (2014) and Atkeson and Burstein (2008) argue that exporters have higher markups in the countries where they own a large share of the market, making it easier to adjust their markups. We thus expect the effects of trade costs on markups to be more strongly heterogeneous for the high market share firms. We construct market shares as each firm's total exports as a share of the total value exported by all firms by destination and year. Relative to the median market share, we split the sample between high and low market share firms. Column (3) shows that the effect of distance is equally heterogeneous for the two groups of firms. Instead, tariffs have heterogeneous effects for the high market share firms only.

In column (4) we let the distance and tariff interactions vary with all firm-level characteristics. The coefficient on the interaction between tariffs and quality for the large firms becomes insignificant, but the sign and significance of all other coefficients remain unchanged. In our sample, larger firms have higher market shares (the correlation is 0.69), while the correlations between firm-level quality, on the one hand, and market shares and firm size, on the other hand, are only equal to 0.09 and 0.10.

5.3 Manufacturing Industries

To demonstrate that our results for export unit values generalize to industries other than wine, we rely on the universe of Argentinean firm-level exports (from Nosis). We observe the name of the exporter (the first probable exporter reported by Nosis), the destination country, the transaction date, the 12-digit MCN code, the FOB value (in US dollars) and the mass (in kilograms) of exports between 2002 and 2009. We focus on manufacturing industries (HS 30–38 and 42–97, Lugovskyy and Skiba, 2016), and we define a product at the 8-digit MCN level. We aggregate the data at quarterly frequency and unit values are in US dollars per kilogram. We drop the observations for which the unit value exceeds 100 times the median unit value per firm-product-quarter, or falls below the median divided by 100. As the data are disaggregated at the MCN level, we are unable to identify the variation in markups.

As quality is unobserved, we follow Bernini and Tomasi (2015) who adapt the Khandelwal (2010) procedure to estimate the quality of exports at the firm-product-destination-quarter level (Chen and Juvenal, 2018). See Appendix F for details. One potential caveat is that Khandelwal's (2010) proxy for quality is inferred from a framework with constant markups. Also, it embodies not only quality but also consumer tastes. Still, we believe that this measure should provide us with some useful information regarding the variation in quality across manufacturing exports. The effectively applied weighted average tariff rates (in percentage terms), obtained from the United Nations Conference on Trade and Development TRAINS database, are reported at the 6-digit HS level and at annual frequency. Our sample includes 9,724 exporters, 3,155 products, and 92 countries (462,127 observations). As each product can be exported by more than one firm we control for firm-product-quarter fixed effects.

Table 11 shows that unit values rise with distance, income per capita, and remoteness, and fall with a country's size and tariffs (column 1). Higher quality goods are more expensive (column 2). The effects of distance and tariffs on unit values are smaller in magnitude for higher quality exports (column 3), and this finding remains robust to controlling for firm-destination-quarter fixed effects (column 4).

Table 11: Manufacturing Industries

	(1)	(2)	(3)	(4)
ln distance	0.035^{***} (0.003)	0.035^{***} (0.003)	0.035^{***} (0.003)	–
quality	–	0.037^{***} (0.002)	0.056^{***} (0.008)	0.062^{***} (0.010)
ln distance × quality	–	–	-0.003^{**} (0.001)	-0.005^{***} (0.001)
ln tariffs	-0.101^{**} (0.046)	-0.084^{*} (0.045)	-0.079^{*} (0.045)	-0.007 (0.093)
ln tariffs × quality	–	–	0.102^{***} (0.035)	0.127^{***} (0.039)
ln remoteness	0.031^{***} (0.010)	0.040^{***} (0.011)	0.039^{***} (0.011)	–
ln GDP	-0.028^{***} (0.002)	-0.028^{***} (0.002)	-0.028^{***} (0.002)	–
ln GDP/cap	0.035^{***} (0.006)	0.028^{***} (0.006)	0.029^{***} (0.006)	–
R-squared	0.930	0.930	0.930	0.965
Observations	215,476	215,476	215,476	154,760
Firm-product-quarter fixed effects	Yes	Yes	Yes	Yes
Firm-destination-quarter fixed effects	No	No	No	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per kilogram). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels.

5.4 Export Volumes

Our model holds predictions for the effects of distance and tariffs on exports across quality levels. Using equations (5) and (6), the elasticities of export quantities q_{ij} with respect to T_{ij} and τ_{ij} are:

$$\epsilon_T^q = \frac{-\sigma}{\left(1 + \frac{c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} < 0, \tag{13}$$

$$\epsilon_\tau^q = \frac{-\sigma}{\left(1 + \frac{T_{ij}/\tau_{ij}}{c_i(\theta)}\right)} < 0. \tag{14}$$

Quantities fall with T_{ij} (and therefore with distance), especially for lower quality exports. Instead, quantities fall with τ_{ij} (and thus with tariffs), but to a larger extent for higher quality exports.[27] To investigate those predictions, we estimate the following reduced-form regression:

$$\begin{aligned} \ln q_{ijk,t} = {} & \xi_1 \ln dist_j + \xi_2 \ln dist_j \times quality_k + \xi_3 \ln tar_{j,t} + \xi_4 \ln tar_{j,t} \times quality_k \\ & + \xi_5 z_{j,t} + D_{k,t} + \nu_{ijk,t}, \end{aligned} \tag{15}$$

where $q_{ijk,t}$ is the export volume (in liters). We expect $\xi_1 + (\xi_2 \times quality_k) < 0$ with $\xi_2 > 0$, and $\xi_3 + (\xi_4 \times quality_k) < 0$ with $\xi_4 < 0$. As explaining positive trade flows only leads to a selection bias, we construct a balanced sample of all firm-wine-destination-quarter combinations with positive and

[27] Exports fall with the CIF price (equation 5), and hence with distance and tariffs (equation 6). Distance increases the CIF price directly but also indirectly through the FOB price. As the FOB price rises less for higher quality goods, their exports fall less compared to lower quality exports. Tariffs increase the CIF price directly but also reduce it by lowering the FOB price. As the FOB price falls less for higher quality goods, their exports fall more than lower quality exports.

zero trade flows (and for each wine we drop the years prior to its vintage year). We then estimate (15) by Poisson Pseudo-Maximum Likelihood (Head and Mayer, 2014; Santos Silva and Tenreyro, 2006).

Table 12: Export Volumes

	(1)	(2)	(3)
ln distance	-1.036^{***} (0.069)	-2.399^{***} (0.372)	–
ln distance × quality	–	0.016^{***} (0.004)	0.018^{***} (0.006)
ln tariffs	-2.346^{***} (0.245)	8.098^{***} (2.329)	–
ln tariffs × quality	–	-0.124^{***} (0.028)	-0.219^{***} (0.028)
ln remoteness	-0.713^{***} (0.109)	-0.713^{***} (0.109)	–
ln GDP	0.737^{***} (0.019)	0.737^{***} (0.019)	–
ln GDP/cap	0.942^{***} (0.062)	0.942^{***} (0.061)	–
Observations	2,472,069	2,472,069	421,691
Product-quarter fixed effects	Yes	Yes	Yes
Firm-destination-quarter fixed effects	No	No	Yes

Notes: The dependent variable is the FOB export volume (in liters). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** indicates significance at the one percent level.

As shown in Table 12, exports fall with distance and tariffs (column 1). A higher quality reduces the magnitude of the distance elasticity, and increases the magnitude of the tariff elasticity (column 2). This heterogeneity across quality levels remains robust to including firm-destination-quarter fixed effects (column 3). Firms export more to richer and larger markets, and less to remote destinations.

According to the estimates of column (2), at the mean, 5^{th}, and 95^{th} percentiles of the quality distribution the distance elasticity is equal to -1.040, -1.142, and -0.932, while the tariff elasticity is equal to -2.314, -1.540, and -3.147, respectively (all significant at the one percent level).

6 Robustness

We report in Appendix G a number of robustness exercises on the estimation of equation (12). Overall, the patterns we find are supportive of our main conclusions.

Column (1) of Table G1 shows that our results continue to hold once we include wholesalers and retailers in the sample (the share of wine exports handled by intermediaries is only equal to 4.80 percent in 2002 and 5.33 percent in 2009). As each wine can be exported by more than one firm we control for firm-product-quarter fixed effects.

In wine producing countries, wine producers may lobby for protectionism if import competition is strong. Therefore, tariffs may be endogenous. In column (2) we instrument the interaction of tariffs with quality with (the logarithm of one plus) each country's total wine production interacted with quality. The Kleibergen-Paap F statistic (equal to 83, Stock and Yogo, 2005) rejects the null of weak correlation between the instrument and the endogenous regressor.

The distance shipped by a given wine to a given country may vary depending on the port of exit from Argentina and the shipping mode. To address these concerns, we proceed as follows. First, as the Nosis data set reports the port of exit for each export transaction, we construct a new sample and define a wine product according to its name, grape, type, vintage year, packaging type, and port of exit (we do not observe the port of destination). Second, we extract from the Datamyne data set the shipping mode for Argentinean wine export transactions between 2005 and 2008 (road, air, sea, rail). We merge the Nosis and Datamyne data sets by shipping permit number, and we define a wine product based on its name, grape, type, vintage year, packaging type, and shipping mode. As shown in columns (3) and (4), controlling for the port of exit or the shipping mode does not alter our conclusions.

In December 2001, Argentina was in a crisis and the government froze all bank accounts and prohibited withdrawals from US dollar-denominated accounts. These measures lasted for a year and the lack of cash availability caused numerous problems for firms. The fixed exchange rate was abandoned, leading to a large depreciation of the peso, and default was declared on most of the country's debt. To account for these events in column (1) of Table G2 we exclude the year 2002 from the sample.

In column (2) we control for export volumes and their interaction with quality. This addresses the possibility that the pricing strategies of exporters depend on shipment size. In column (3) we include the shipments containing less than 4.5 liters in the sample. In column (4) we estimate equation (12) for wines as opposed to wine products (and therefore ignore the packaging type).

Table G3 addresses the measurement of quality. In column (1) quality is measured using the Parker ratings. In column (2) quality is rescaled to vary between one and six. Each value corresponds to one the Wine Spectator bins (Table 1), and a larger value indicates a higher quality. Column (3) excludes "Great" wines from the sample. Column (4) excludes the US from the sample because the Wine Spectator is a US-based rating and may not capture taste preferences for quality in other countries (Parker is also US based). As endogeneity could arise due to measurement error in the quality ratings (Chen and Juvenal, 2016, 2018), in column (5) we use the Parker scores to instrument the Wine Spectator ratings (both interacted with distance and tariffs) under the assumption that their measurement errors are uncorrelated. The Kleibergen-Paap F statistic (equal to 404, Stock and Yogo, 2005) rejects the null of weak correlation between the instruments and the endogenous regressors.

Based on the Khandelwal (2010) methodology, we estimate quality for each 12-digit MCN-level wine product category by firm-destination-quarter (see Appendix F). Our sample size more than doubles as many wines unrated by the Wine Spectator can be included in the sample. As shown in column (6), our results continue to hold. In column (7) we interact distance and tariffs with estimated quality and the Wine Spectator ratings. The coefficients on the interactions with the Wine Spectator ratings are significant and with expected signs, while the ones on the interactions with estimated quality remain significant. This finding most likely reflects the fact that the Khandelwal (2010) measure embodies not only quality but also consumer tastes (the correlation between estimated quality and the Wine Spectator ratings is equal to 13.7 percent).

To check if our results hold for both lower and higher quality wines, in column (8) we classify the "Very good," "Outstanding," and "Great" wines as high quality, the "Not recommended," "Mediocre," and "Good" ones as low quality, and we estimate different coefficients for the two quality categories.

In columns (1) and (2) of Table G4 we measure unit values at annual and monthly frequency, while in column (3) we use our raw data at the transaction level (the fixed effects and the clustering are defined at annual, monthly, and daily frequency, respectively). Column (4) relies on transaction-level unit values but the fixed effects (and the clustering) are measured at quarterly frequency.

Finally, in Table G5 we estimate the cross-sectional variation of our coefficients. We estimate equation (11) and interact the distance and tariff variables with year dummies. For the years 2004–2009, markups rise with distance, fall with tariffs, and these effects are larger in magnitude for lower quality exports. The insignificant results for 2002 and 2003 may be due to the economic crisis of 2002 (see above), or to the poorer data coverage compared to other years (see Table 2).

7 Concluding Remarks

Guided by the predictions of a model that features endogenous markups and per-unit trade costs, our paper provides robust empirical evidence that exporters adjust their markups across destinations depending on trade costs such as distance and tariffs. Firms raise their markups in more distant markets, but lower them in high-tariff countries. Moreover, the effects of trade costs on markups are heterogeneous and smaller in magnitude for higher quality exports. This heterogeneity is stronger for exports to richer countries, and is predominantly driven by the higher quality firms, the larger firms, and the exporters with larger export market shares.

Our results are important because they show that the variation in firm-level export unit values across markets is not only driven by quality differences but also by markup variation conditional on quality. Due to market power, firms price discriminate across destinations, but the way and the extent to which they do so depends on the size and the nature of trade costs (i.e., per unit versus ad valorem), and the quality of their exports. Trade costs therefore play a key role in inducing deviations from the Law of One Price, and they thus contribute to the degree of international market segmentation. Lastly, as they are driven by high performance firms that generate the bulk of aggregate exports, we expect our results to matter quantitatively in explaining the variation in aggregate export prices.

Our findings imply that trade models featuring markups that are invariant to country-level characteristics lack a key channel to explain the pricing strategies of exporters across international markets. Our results therefore militate in favor of trade models with variable markups that depend on trade costs. They also emphasize the importance of modelling trade costs more flexibly, and in particular that accounting for per-unit trade costs enables us to explain strong patterns observed in the data. We believe that understanding the welfare implications of our results would be an important next step.[28]

[28] Irarrazabal et al. (2015) and Lashkaripour (2017) show that the welfare gains from trade are larger in models with per-unit trade costs. Fan, Li, Xu, and Yeaple (2019) instead argue they are lower.

References

Alchian, A.A., Allen, W.R., 1964. University Economics. Wadsworth Publishing, Belmont, California.

Amiti, M., Itskhoki, O., Konings, J., 2014. Importers, exporters, and exchange rate disconnect. American Economic Review 104 (7), 1942–1978.

Amiti, M., Itskhoki, O., Konings, J., 2019. International shocks, variable markups and domestic prices. Review of Economic Studies 86 (6), 2356–2402.

Anderson, K., Nelgen, S., 2011. Global Wine Markets, 1961–2009: A Statistical Compendium. University of Adelaide Press, Adelaide.

Arkolakis, C., Costinot, A., Donaldson, D., Rodríguez-Clare, A., 2019. The elusive pro-competitive effects of trade. Review of Economic Studies 86 (1), 46–80.

Atkeson, A., Burstein, A., 2008. Trade costs, pricing-to-market, and international relative prices. American Economic Review 98 (5), 1998–2031.

Atkin, D., Donaldson, D., 2015. Who's getting globalized? The size and implications of intra-national trade costs, mimeo.

Atkin, D., Khandelwal, A.K., Osman, A., 2017. Exporting and firm performance: evidence from a randomized experiment. Quarterly Journal of Economics 132 (2), 551–615.

Baldwin, R.E., Harrigan, J., 2011. Zeros, quality, and space: trade theory and trade evidence. American Economic Journal: Microeconomics 3 (2), 60–88.

Bastos, P., Silva, J., 2010. The quality of a firm's exports: where you export to matters. Journal of International Economics 82 (2), 99–111.

Behrens, K., Murata, Y., 2007. General equilibrium models of monopolistic competition: a new approach. Journal of Economic Theory 136 (1), 776–787.

Bellone, F., Musso, P., Nesta, L., Warzynski, F., 2014. International trade and firm-level markups when location and quality matter. Journal of Economic Geography 16 (1), 67–91.

Berman, N., Martin, P., Mayer, T., 2012. How do different exporters react to exchange rate changes? Quarterly Journal of Economics 127 (1), 437–492.

Bernini, M., Tomasi, C., 2015. Exchange rate pass-through and product heterogeneity: does quality matter on the import side? European Economic Review 77, 117–138.

Bosker, M., Buringh, E., 2019. Iceberg transport costs. Evidence from the 19^{th} century ice trade. Economic Journal, forthcoming.

Broda, C., Weinstein, D.E., 2006. Globalization and the gains from variety. Quarterly Journal of Economics 121 (2), 541–585.

Cavallo, A., Gopinath, G., Neiman, B., Tang, J., 2019. Tariff passthrough at the border and at the store: evidence from US trade policy. American Economic Review: Insights, forthcoming.

Chen, N., Imbs, J., Scott, A., 2009. The dynamics of trade and competition. Journal of International Economics 77 (1), 50–62.

Chen, N., Juvenal, L., 2016. Quality, trade, and exchange rate pass-through. Journal of International Economics 100, 61–80.

Chen, N., Juvenal, L., 2018. Quality and the Great Trade Collapse. Journal of Development Economics 135, 59–76.

Crinò, R., Epifani, P., 2012. Productivity, quality, and export behaviour. Economic Journal 122 (565), 1206–1243.

Crozet, M., Head, K., Mayer, T., 2012. Quality sorting and trade: firm-level evidence for French wine. Review of Economic Studies 79 (2), 609–644.

Daudin, G., Héricourt, J., Patureau, L., 2018. International transport costs: new findings from modelling additive costs. CEPII Working Paper 2018–10.

De Loecker, J., Goldberg, P.K., Khandelwal, A.K., Pavcnik, N., 2016. Prices, markups, and trade reform. Econometrica 84 (2), 445–510.

De Loecker, J., Warzynski, F., 2012. Markups and firm-level export status. American Economic Review 102 (6), 2437–2471.

Eaton, J., Kortum, S., 2002. Technology, geography and trade. Econometrica 70 (5), 1741–1779.

Emlinger, C., Lamani, V., 2017. International trade, quality sorting and trade costs: the case of Cognac. CEPII Working Paper 2017–18.

Fajgelbaum, P., Grossman, G.M., Helpman, E., 2011. Income distribution, product quality, and international trade. Journal of Political Economy 119 (4), 721–765.

Fan, H., Li, Y.A., Xu, S., Yeaple, S.R., 2019. Quality, variable markups, and welfare: a quantitative general equilibrium analysis of export prices. Journal of International Economics, forthcoming.

Feenstra, R.C., 1994. New product varieties and the measurement of international prices. American Economic Review 84 (1), 157–177.

Feenstra, R.C., 2003. A homothetic utility function for monopolistic competition models, without constant price elasticity. Economics Letters 78 (1), 79–86.

Feenstra, R.C., Romalis, J., 2014. International prices and endogenous quality. Quarterly Journal of Economics 129 (2), 477–527.

Fitzgerald, D., Haller, S., 2014. Pricing-to-market: evidence from plant-level prices. Review of Economic Studies 81 (2), 761–786.

Gaulier, G., Zignago, S., 2010. BACI: International trade database at the product-level. The 1994–2007 version. CEPII Working Paper 2010–23.

Görg, J., Halpern, L., Muraközy, B., 2017. Why do within-firm-product export prices differ across markets? Evidence from Hungary. The World Economy 40 (6), 1233–1246.

Greenhut, M.L., Ohta, H., Sailors, J., 1985. Reverse dumping: a form of spatial price discrimination. Journal of Industrial Economics 34 (2), 167–181.

Hallak, J.C., 2006. Product quality and the direction of trade. Journal of International Economics 68 (1), 238–265.

Harrigan, J., Ma, X., Shlychkov, V., 2015. Export prices of US firms. Journal of International Economics 97 (1), 100–111.

Head, K., Mayer, T., 2014. Gravity equations: workhorse, toolkit, and cookbook, in: Gopinath, G., Helpman, E., Rogoff, K. (Eds), Handbook of International Economics, Vol. 4, Elsevier, Amsterdam, pp. 131–195.

Hoover, E.M., 1937. Spatial price discrimination. Review of Economic Studies 4 (3), 182–191.

Hummels, D., Klenow, P.J., 2005. The variety and quality of a nation's exports. American Economic Review 95 (3), 704–723.

Hummels, D., Skiba, A., 2004. Shipping the good apples out? An empirical confirmation of the Alchian-Allen conjecture. Journal of Political Economy 112 (6), 1384–1402.

Imbs, J., Méjean, I., 2015. Elasticity optimism. American Economic Journal: Macroeconomics 7 (3), 43–83.

Irarrazabal, A., Moxnes, A., Opromolla, L.D., 2015. The tip of the iceberg: a quantitative framework for estimating trade costs. Review of Economics and Statistics 97 (4), 777–792.

Johnson, R.C., 2012. Trade and prices with heterogeneous firms. Journal of International Economics 86 (1), 43–56.

Khandelwal, A., 2010. The long and short (of) quality ladders. Review of Economic Studies 77 (4), 1450–1476.

Krugman, P., 1980. Scale economies, product differentiation, and the pattern of trade. American Economic Review 70 (5), 950–959.

Kugler, M., Verhoogen, E., 2012. Prices, plant size, and product quality. Review of Economic Studies 79 (1), 307–339.

Lashkaripour, A., 2017. The international gains from declining transport costs, mimeo.

Lugovskyy, V., Skiba, A., 2015. How geography affects quality. Journal of Development Economics 115, 156–180.

Lugovskyy, V., Skiba, A., 2016. Positive and negative effects of distance on export prices. Journal of Economic Behavior and Organization 127, 155–181.

Manova, K., Zhang, Z., 2012. Export prices across firms and destinations. Quarterly Journal of Economics 127 (1), 379–436.

Martin, J., 2010. Markups, quality, and transport costs. CREST Working Paper 2010–17.

Martin, J., 2012. Markups, quality, and transport costs. European Economic Review 56 (4), 777–791.

Medina, P., 2018. Import competition, quality upgrading and exporting: evidence from the Peruvian apparel industry, mimeo.

Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71 (6), 1695–1725.

Melitz, M.J., Ottaviano, G.I.P., 2008. Market size, trade, and productivity. Review of Economic Studies 75 (1), 295–316.

Ottaviano, G., Tabuchi, T., Thisse, J.-F., 2002. Agglomeration and trade revisited. International Economic Review 43 (2), 409–435.

Piveteau, P., Smagghue, G., 2019. Estimating firm product quality using trade data. Journal of International Economics 118, 217–232.

Santos Silva, J.M.C., Tenreyro, S., 2006. The log of gravity. Review of Economics and Statistics 88 (4), 641–658.

Schott, P.K., 2004. Across-product versus within-product specialization in international trade. Quarterly Journal of Economics 119 (2), 647–678.

Simonovska, I., 2015. Income differences and prices of tradables: insights from an online retailer. Review of Economic Studies 82 (4), 1612–1656.

Stock, J.H., Yogo, M., 2005. Testing for weak instruments in linear IV regression, in: Andrews, D.W.K., Stock, J.H. (Eds), Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg. Cambridge University Press, Cambridge, pp. 80–108.

Takechi, K., 2015. The quality of distance: quality sorting, Alchian-Allen effect, and geography. RIETI Discussion Paper 15–E–018.

Verhoogen, E., 2008. Trade, quality upgrading and wage inequality in the Mexican manufacturing sector. Quarterly Journal of Economics 123 (2), 489–530.

A Per-Unit versus Ad Valorem Trade Costs

In line with the assumptions of our model, we show that Argentinean wine exports are subject to both per-unit and ad valorem trade costs. Also, consistent with the premise that per-unit trade costs rise with distance, we show that trade costs become more per unit than ad valorem as distance increases.

First, to identify the nature of trade costs in our data, we estimate the following reduced-form regression (Hummels and Skiba, 2004; Lashkaripour, 2017; Lugovskyy and Skiba, 2015):

$$\ln f_{ijk,t} = \psi_1 \ln uv_{ijk,t} + \psi_2 \ln dist_j + \psi_3 \ln q_{ijk,t} + D_{i,t} + D_p + \iota_{ijk,t}, \tag{A1}$$

where for each wine product k exported by firm i to country j in quarter t, $f_{ijk,t}$ are freight charges divided by the volume exported (in US dollars per liter), $uv_{ijk,t}$ is the export unit value (in US dollars per liter), $dist_j$ is the bilateral distance between Argentina and country j, and $q_{ijk,t}$ is shipment size (in liters). We expect freight costs to increase with distance. Freight costs should also increase with export unit values as more expensive goods may require heavier packaging, more careful and costly handling, and face higher insurance fees (Hummels and Skiba, 2004). Instead, freight costs should fall with shipment size if there are scale economies in transportation (i.e., it should be less costly to export a large shipment at once than many small shipments at different times).

The coefficient of interest is ψ_1 as it captures the extent to which freight costs are ad valorem or per unit. If freight costs are ad valorem only, they vary proportionally with export unit values such that $\psi_1 = 1$. If they are per unit only, they do not depend on export unit values such that $\psi_1 = 0$. An elasticity ψ_1 between zero and unity in turn indicates that freight costs are both per unit and ad valorem, and the smaller the elasticity, the larger the per-unit component of freight costs. As we want to identify the effect of unit values (and not of markups) on freight costs, we include firm-quarter $D_{i,t}$ and product characteristics D_p (grape, type, vintage year, MCN-level, packaging, and province of origin) fixed effects (the results remain similar if we instead include product-quarter fixed effects). Robust standard errors are adjusted for clustering by destination-quarter.

One issue is that unit values and shipment size are endogenous to freight costs. Freight costs rise with unit values because of higher insurance or handling requirements, but unit values increase with freight costs if they have a per-unit component (equation 7), resulting in a positive endogeneity bias. We therefore instrument, in each time period, the unit value of each wine product exported to a given country with its mean unit value on exports to other destinations. The mean unit value is exogenous by construction as it excludes the unit value to be instrumented. Besides, as the dependent variable divides freight charges by the volume exported, it is negatively correlated with shipment size. We use the destination's GDP and GDP per capita to instrument export volumes (Hummels and Skiba, 2004).

Our data set reports freight charges (in US dollars) at the firm-product-destination-transaction level. We aggregate the data at quarterly frequency, but due to incomplete coverage we only observe 107 firms, 1,440 wines (1,534 products), and 82 countries between 2005Q4 and 2009Q4 (6,802 observations).

Column (1) of Table A1 reports OLS estimates. Freight costs rise with distance and fall with export volumes. They increase with unit values and the elasticity is equal to 0.758 (significantly lower than unity at the one percent level). Column (2) instruments unit values and the elasticity falls to 0.713 (the OLS estimate in column 1 is therefore upward biased). Column (3) also instruments shipment size and the unit value elasticity falls to 0.667.[29] Freight costs are thus both per unit and ad valorem.

Table A1: Per-Unit versus Ad Valorem Trade Costs

	(1)	(2)	(3)	(4)	(5)	(6)
ln unit value	0.758^{***} (0.032)	0.713^{***} (0.043)	0.667^{***} (0.048)	1.285^{***} (0.299)	1.659^{***} (0.304)	1.512^{***} (0.304)
ln distance	0.062^{**} (0.031)	0.069^{**} (0.030)	0.068^{**} (0.030)	0.152^{***} (0.058)	0.228^{***} (0.062)	0.210^{***} (0.062)
ln unit value × ln distance	–	–	–	-0.059^{*} (0.034)	-0.107^{***} (0.035)	-0.096^{***} (0.035)
ln export volume	-0.121^{***} (0.012)	-0.133^{***} (0.014)	-0.187^{***} (0.022)	-0.120^{***} (0.012)	-0.132^{***} (0.014)	-0.186^{***} (0.022)
Unit value elasticities						
Mean distance	–	–	–	0.756^{***} (0.033)	0.702^{***} (0.043)	0.656^{***} (0.048)
5^{th} percentile of distance	–	–	–	0.810^{***} (0.039)	0.800^{***} (0.045)	0.744^{***} (0.049)
95^{th} percentile of distance	–	–	–	0.702^{***} (0.051)	0.604^{***} (0.061)	0.569^{***} (0.065)
R-squared	0.660	0.299	0.287	0.660	0.301	0.289
Observations	6,706	5,116	5,116	6,706	5,116	5,116
Firm-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Product characteristics fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	IV	IV	OLS	IV	IV
Kleibergen-Paap F	–	346.35	196.90	–	143.25	147.73

Notes: The dependent variable is the (log) freight cost of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. In (2), (3), (5), and (6), unit values are instrumented with mean unit values. In (5) and (6), the interaction term is instrumented with mean unit values interacted with distance. In (3) and (6), shipment size is instrumented with the destination's GDP and GDP per capita.

Second, we follow Lugovskyy and Skiba (2015) and we add to equation (A1) an interaction term between unit values and distance. If freight costs become more per unit than ad valorem at longer distances, the coefficient on the interaction term should be negative.

Column (4) reports OLS results and the coefficient on the interaction term is negative. It remains negative once we instrument unit values and the interaction term with mean unit values and their interaction with distance (column 5), and when we also instrument shipment size (column 6). Therefore, freight costs become more per unit than ad valorem at longer distances. At the mean value of distance, the unit value elasticity in column (6) is equal to 0.656. It is equal to 0.744 at the 5^{th} percentile of the distance distribution, and falls to 0.569 at the 95^{th} percentile (all elasticities are significantly lower than unity at the one percent level). Based on the Kleibergen-Paap F statistic, we reject in columns (5) and (6) the null of weak correlation between the instruments and the endogenous regressors.

[29] Unit values increase with mean unit values while shipment size increases with GDP and GDP per capita. The Kleibergen-Paap F statistic rejects the null of weak correlation between the instruments and the endogenous regressors.

B Elasticity of Substitution

In Section 2 we assume that the elasticity of substitution σ is constant. We now relax this assumption and let σ depend on quality. As we show in Section 4.3.1, σ depends negatively on quality. We therefore assume that $\sigma'(\theta) < 0$ and we derive the condition under which the elasticities of the FOB price and markup with respect to T_{ij} and τ_{ij} decrease in magnitude with quality.

According to equation (8), the elasticity of the FOB price and markup with respect to T_{ij} is:

$$\epsilon_T^{p^{fob}} = \epsilon_T^{\mu^{fob}} = \frac{1}{\left(1 + \frac{\sigma(\theta)c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} > 0. \tag{B1}$$

Its elasticity with respect to quality is:

$$\frac{\partial \epsilon_T^{p^{fob}}}{\partial \theta}\frac{\theta}{\epsilon_T^{p^{fob}}} = \frac{\partial \epsilon_T^{\mu^{fob}}}{\partial \theta}\frac{\theta}{\epsilon_T^{\mu^{fob}}} = \frac{-\tau_{ij}\theta\left(\sigma'(\theta)\,c_i(\theta) + \sigma(\theta)\,c_i'(\theta)\right)}{T_{ij} + \tau_{ij}\sigma(\theta)\,c_i(\theta)}, \tag{B2}$$

and it is negative if:

$$\frac{c_i'(\theta)}{c_i(\theta)} > \frac{-\sigma'(\theta)}{\sigma(\theta)} > 0, \tag{B3}$$

as $c_i'(\theta) > 0$ and $\sigma'(\theta) < 0$. If the condition is satisfied, the elasticity of the price and markup with respect to T_{ij} (i.e., distance) decreases in magnitude with quality.

Based on equation (9), the elasticity of the FOB price and markup with respect to τ_{ij} is:

$$\epsilon_\tau^{p^{fob}} = \epsilon_\tau^{\mu^{fob}} = -\epsilon_T^{p^{fob}} = -\epsilon_T^{\mu^{fob}} = \frac{-1}{\left(1 + \frac{\sigma(\theta)c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} < 0. \tag{B4}$$

It varies with quality according to the same expression as in (B2):

$$\frac{\partial \epsilon_\tau^{p^{fob}}}{\partial \theta}\frac{\theta}{\epsilon_\tau^{p^{fob}}} = \frac{\partial \epsilon_\tau^{\mu^{fob}}}{\partial \theta}\frac{\theta}{\epsilon_\tau^{\mu^{fob}}} = \frac{-\tau_{ij}\theta\left(\sigma'(\theta)\,c_i(\theta) + \sigma(\theta)\,c_i'(\theta)\right)}{T_{ij} + \tau_{ij}\sigma(\theta)\,c_i(\theta)}, \tag{B5}$$

which, again, is negative if (B3) is satified.

Under the assumption that (B3) holds, the model therefore predicts that the elasticities of the export price and markup with respect to trade costs are smaller in magnitude for higher quality exports.

C Alternative Demand Systems

Irarrazabal et al. (2015) predict that higher per-unit trade costs reduce the magnitude of the elasticity of demand with respect to the FOB price ϵ^{fob}, especially among low-price firms. They investigate whether this mechanism holds for different demand systems. We review their findings and we extend their analysis to examine how ϵ^{fob} varies with ad valorem trade costs and the FOB price.

As in Irarrazabal et al. (2015), we consider a general demand system for differentiated goods (Arkolakis, Costinot, Donaldson, and Rodríguez-Clare, 2019). All consumers have the same preferences. For a consumer with income y facing a vector of prices $\mathbf{p}$, her Marshallian demand for any good is:

$$\ln q\left(p^{cif}, p^*, y\right) = -\beta \ln p^{cif} + \gamma \ln y + f\left(\ln p^{cif} - \ln p^*\right), \tag{C1}$$

where q and p^{cif} are quantity and CIF price, $p^{cif} = \tau p^{fob} + T$ where p^{fob} is the FOB price and τ and T are the ad valorem and per-unit components of trade costs, respectively, and $p^*(\mathbf{p})$ is a price index which is symmetric in all prices $\mathbf{p}$. All other prices therefore affect demand only through their effect on the price aggregator p^*. Denoting $s = \ln p^{cif} - \ln p^* < 0$, this framework encompasses four different utility functions that have been widely used in the literature: (a) CES utility, in which case $\gamma = \beta = 1$ and $f(s) = (1-\sigma)s$; (b) quadratic, non-separable utility (Ottaviano et al., 2002), in which case $\gamma = 0$, $\beta = -1$, and $f(s) = -\ln \kappa_2 + \ln(e^{-s} - 1)$; (c) translog preferences (Feenstra, 2003), in which case $\gamma = \beta = 1$ and $f(s) = \ln \xi + \ln(-s)$; and (d) additively quasi-separable utility (Behrens and Murata, 2007), in which case $\gamma = \beta = 0$ and $f(s) = \ln \zeta + \ln(-s)$.

C.1 Per-Unit Trade Costs

For all four demand systems, Irarrazabal et al. (2015) calculate the elasticity of demand with respect to the FOB price ϵ^{fob} for $T = 0$ or $T > 0$. As shown in rows (1) and (2) of Table C1, whether $T = 0$ or $T > 0$ all demand systems yield $\epsilon^{fob} < 0$.

In a next step, they derive the elasticity of ϵ^{fob} with respect to per-unit trade costs. As shown in row (3), this elasticity is negative with CES, translog, and additively quasi-separable utility (for some values of s), while it is positive with quadratic preferences. Row (4) shows that in all cases the elasticity of ϵ^{fob} with respect to per-unit trade costs is increasing with the FOB price. See Irarrazabal et al. (2015) for the full derivations. We discuss the implications of these findings further below.

C.2 Ad Valorem Trade Costs

We extend the analysis to the case of ad valorem trade costs. In rows (5) and (6) of Table C1 we calculate ϵ^{fob} for $\tau = 1$ or $\tau > 1$, respectively, assuming that $T > 0$. Whether $\tau = 1$ or $\tau > 1$, all demand systems yield $\epsilon^{fob} < 0$.[30]

[30] The elasticities in rows (2) and (6) both correspond to the case where $T > 0$ and $\tau > 1$ and they are hence identical.

The prediction that export prices fall with ad valorem trade costs, especially for low-price/low-quality exports, requires the elasticity of ϵ^{fob} with respect to ad valorem trade costs to be positive and decreasing with the FOB price. For each demand system, we calculate the elasticity of ϵ^{fob} with respect to ad valorem trade costs and determine its sign. We also show how this elasticity changes with the FOB price. Rows (7) and (8) of Table C1 provide a summary of our results.

CES preferences The elasticity of ϵ^{fob} with respect to ad valorem trade costs is:

$$\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}} = \frac{T}{\tau p^{fob} + T} > 0, \tag{C2}$$

and it decreases with the FOB price:

$$\frac{\partial}{\partial p^{fob}}\left(\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}\right) = \frac{-T\tau}{\left(\tau p^{fob} + T\right)^2} < 0. \tag{C3}$$

Quadratic, non-separable utility The elasticity of ϵ^{fob} with respect to ad valorem trade costs is:

$$\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}} = \frac{T - p^*}{p^{cif} - p^*} > 0, \tag{C4}$$

because $p^{cif} - p^* < 0$ as $s = \ln p^{cif} - \ln p^* < 0$, and $T - p^* < -\tau p^{fob} < 0$ as $\ln p^{cif} - \ln p^* = \ln\left(\tau p^{fob} + T\right) - \ln p^* < 0$.

The elasticity of ϵ^{fob} with respect to ad valorem trade costs increases with the FOB price:

$$\frac{\partial}{\partial p^{fob}}\left(\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}\right) = \frac{-\left(T - p^*\right)\tau}{\left(\tau p^{fob} - p^* + T\right)^2} > 0, \tag{C5}$$

because $-\left(T - p^*\right)\tau > 0$ as $T - p^* < 0$.

Translog preferences The elasticity of ϵ^{fob} with respect to ad valorem trade costs is:

$$\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}} = \frac{s^2 T - sT + \tau p^{fob}}{-s p^{cif}\left(1 - s\right)} > 0. \tag{C6}$$

We know that $-s p^{cif}\left(1 - s\right) > 0$ because $s < 0$. In the numerator, the roots of $s^2 T - sT + \tau p^{fob}$ are $\left(T \pm \sqrt{T^2 - 4T\tau p^{fob}}\right)/2T$. As the function is strictly convex it is always positive for $s < 0$ whether the discriminant is positive (two positive roots), negative (no real roots), or zero (one positive root). The numerator of (C6) is therefore positive.

The elasticity of ϵ^{fob} with respect to ad valorem trade costs decreases with the FOB price. By the chain rule we know that:

$$\frac{\partial}{\partial p^{fob}}\left(\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}\right) = \frac{\partial}{\partial s}\left(\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}\right)\frac{\partial s}{\partial p^{cif}}\frac{\partial p^{cif}}{\partial p^{fob}}. \tag{C7}$$

As $\partial s/\partial p^{cif} = 1/p^{cif} > 0$ and $\partial p^{cif}/\partial p^{fob} = \tau > 0$, the sign of this derivative depends on the sign of $(\partial/\partial s)\left(\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right)\right)$. From (C6) we know that the denominator of $\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right)$ is always positive, and as the function in the numerator is strictly convex and reaches its minimum in the positive domain at $s = 0.5$, it follows that $(\partial/\partial s)\left(\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right)\right) < 0$ for $s < 0$. The sign of the derivative in (C7) is therefore negative.

Additively quasi-separable utility The elasticity of ϵ^{fob} with respect to ad valorem trade costs is:

$$\frac{\partial\epsilon^{fob}}{\partial\tau}\frac{\tau}{\epsilon^{fob}} = \frac{\tau p^{fob} - sT}{-sp^{cif}} > 0, \tag{C8}$$

because $-sp^{cif} > 0$ and $\tau p^{fob} - sT > 0$ as $s < 0$.

The elasticity of ϵ^{fob} with respect to ad valorem trade costs changes with the FOB price according to:

$$\frac{\partial}{\partial p^{fob}}\left(\frac{\partial\epsilon^{fob}}{\partial\tau}\frac{\tau}{\epsilon^{fob}}\right) = \frac{-\tau\left(Ts^2 + Ts - \tau p^{fob}\right)}{\left(-\ln p^{cif} + \ln p^*\right)^2\left(\tau p^{fob} + T\right)^2}. \tag{C9}$$

In the numerator, the roots of $Ts^2+Ts-\tau p^{fob}$ are $\left(-T \pm \sqrt{T^2 + 4T\tau p^{fob}}\right)/2T$. As $s < 0$, the relevant root is $\left(-T - \sqrt{T^2 + 4T\tau p^{fob}}\right)/2T$. As the function is strictly convex, the numerator of (C9) is positive for $\left(-T - \sqrt{T^2 + 4T\tau p^{fob}}\right)/2T < s < 0$, and negative for $s < \left(-T - \sqrt{T^2 + 4T\tau p^{fob}}\right)/2T$.

To sum up,

1. Prices and markups increase with distance if $\left(\partial\epsilon^{fob}/\partial T\right)\left(T/\epsilon^{fob}\right) < 0$. This condition is satisfied with CES. It also holds with translog and additively quasi-separable utility (for some values of s). It is not satisfied with quadratic preferences.

2. The effect of distance on prices and markups is smaller in magnitude for higher price (and higher quality) exports if $\left(\partial/\partial p^{fob}\right)\left(\left(\partial\epsilon^{fob}/\partial T\right)\left(T/\epsilon^{fob}\right)\right) > 0$. This condition holds in all cases.

3. Prices and markups fall with tariffs if $\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right) > 0$. This condition holds in all cases.

4. The effect of tariffs on prices and markups is smaller in magnitude for higher price (and higher quality) exports if $\left(\partial/\partial p^{fob}\right)\left(\left(\partial\epsilon^{fob}/\partial\tau\right)\left(\tau/\epsilon^{fob}\right)\right) < 0$. This condition is satisfied with CES, translog, and additively quasi-separable utility (for some values of s). It is not satisfied with quadratic preferences.

In other words, our predictions that (1) export prices and markups increase with distance, (2) fall with tariffs, (3) and to a larger extent for lower quality exports hold with CES, and with translog and additively quasi-separable utility (for some parameter values). Models with quadratic, non-separable utility can yield some, but not all, of our predictions.

Table C1: Alternative Demand Systems

	CES	Quadratic	Translog	Quasi-separable
Per-unit trade cost T				
(1) $\epsilon^{fob} = \frac{\partial \ln q}{\partial \ln p^{fob}} \|_{T=0}$	$-\sigma < 0$	$-\frac{1}{e^{-s}-1} < 0$	$\frac{1-s}{s} < 0$	$\frac{1}{s} < 0$
(2) $\epsilon^{fob} = \frac{\partial \ln q}{\partial \ln p^{fob}} \|_{T>0}$	$-\sigma\left(1 - \frac{T}{p^{cif}}\right) < 0$	$-\frac{1}{e^{-s}-1}\left(1 - \frac{T}{p^{cif}}\right) < 0$	$\frac{1-s}{s}\left(1 - \frac{T}{p^{cif}}\right) < 0$	$\frac{1}{s}\left(1 - \frac{T}{p^{cif}}\right) < 0$
(3) $\frac{\partial \epsilon^{fob}}{\partial T}\frac{T}{\epsilon^{fob}}$	< 0	> 0	$< 0\ if\ \frac{1-\sqrt{5}}{2} < s < 0$ $> 0\ if\ s < \frac{1-\sqrt{5}}{2}$	$< 0\ if\ s < -1$ $> 0\ if\ -1 < s < 0$
(4) $\frac{\partial}{\partial p^{fob}}\left(\frac{\partial \epsilon^{fob}}{\partial T}\frac{T}{\epsilon^{fob}}\right)$	> 0	> 0	> 0	> 0
Ad valorem trade cost τ				
(5) $\epsilon^{fob} = \frac{\partial \ln q}{\partial \ln p^{fob}} \|_{\tau=1}$	$-\sigma\left(\frac{p^{fob}}{p^{fob}+T}\right) < 0$	$-\frac{1}{e^{-s}-1}\left(\frac{p^{fob}}{p^{fob}+T}\right) < 0$	$\frac{1-s}{s}\left(\frac{p^{fob}}{p^{fob}+T}\right) < 0$	$\frac{1}{s}\left(\frac{p^{fob}}{p^{fob}+T}\right) < 0$
(6) $\epsilon^{fob} = \frac{\partial \ln q}{\partial \ln p^{fob}} \|_{\tau>1}$	$-\sigma\left(1 - \frac{T}{p^{cif}}\right) < 0$	$-\frac{1}{e^{-s}-1}\left(1 - \frac{T}{p^{cif}}\right) < 0$	$\frac{1-s}{s}\left(1 - \frac{T}{p^{cif}}\right) < 0$	$\frac{1}{s}\left(1 - \frac{T}{p^{cif}}\right) < 0$
(7) $\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}$	> 0	> 0	> 0	> 0
(8) $\frac{\partial}{\partial p^{fob}}\left(\frac{\partial \epsilon^{fob}}{\partial \tau}\frac{\tau}{\epsilon^{fob}}\right)$	< 0	> 0	< 0	$< 0\ if\ s < \frac{-T-\sqrt{T^2+4T\tau p^{fob}}}{2T}$ $> 0\ if\ \frac{-T-\sqrt{T^2+4T\tau p^{fob}}}{2T} < s < 0$

D Elasticity of Demand with Respect to the FOB Price

Equation (10) predicts that the elasticity of ϵ^{fob} with respect to per-unit trade costs is negative and increases with quality. It also predicts that the elasticity of ϵ^{fob} with respect to ad valorem trade costs is positive and decreases with quality. To determine whether the two mechanisms hold in our data we estimate (Irarrazabal et al., 2015):

$$\ln q_{ijk,t} = \Psi \left[\ln uv_{ijk,t} \times \ln dist_j \times quality_k\right] + \Upsilon \left[\ln uv_{ijk,t} \times \ln tar_{j,t} \times quality_k\right] + D_{ij,t} + \varpi_{ijk,t}, \quad \text{(D1)}$$

where $q_{ijk,t}$ is the export volume (in liters) of wine product k exported by firm i to country j in quarter t. We include a full set of interactions between unit values, bilateral distance as a proxy for per-unit trade costs, and quality. We also include a full set of interactions between unit values, tariffs as a proxy for ad valorem trade costs, and quality. The vectors of estimated coefficients are denoted by Ψ and Υ, respectively.[31,32] We control for firm-destination-quarter fixed effects $D_{ij,t}$, and robust standard errors are adjusted for clustering at the destination-quarter level. The demand elasticity ϵ^{fob} is given by:

$$\begin{aligned}\epsilon^{fob} = \frac{\partial \ln q_{ijk,t}}{\partial \ln uv_{ijk,t}} &= \Psi_1 + \Psi_2 \ln dist_j + \Psi_3 quality_k + \Psi_4 \ln dist_j \times quality_k + \Upsilon_2 \ln tar_{j,t} \\ &+ \Upsilon_4 \ln tar_{j,t} \times quality_k. \end{aligned} \quad \text{(D2)}$$

We expect $\Psi_2 > 0$ such that distance increases the negative ϵ^{fob} (i.e., ϵ^{fob} approaches zero), while $\Psi_4 < 0$ captures that the effect of distance on ϵ^{fob} is smaller for higher quality exports. Likewise we expect $\Upsilon_2 < 0$ such that tariffs decrease the negative ϵ^{fob} (i.e., ϵ^{fob} becomes more negative), while $\Upsilon_4 > 0$ indicates that the effect of tariffs on ϵ^{fob} is smaller for higher quality exports.

To address the endogeneity of unit values in equation (D1) we instrument, in each time period, the unit value of each wine product exported to a given country with its mean unit value on exports to other destinations (see Irarrazabal et al., 2015, and Appendix A). The mean unit value is exogenous by construction as it excludes the unit value to be instrumented. We also instrument the interaction terms involving unit values with the same interaction terms but with mean unit values.

The results are reported in Table D1. Column (1) reports OLS estimates, while in column (2) we instrument unit values and their interactions. Consistent with expectations, the coefficient Ψ_2 on the interaction between unit values and distance is positive, while the coefficient Ψ_4 on the triple interaction between unit values, distance, and quality is negative. Also, the coefficient Υ_2 on the interaction between unit values and tariffs is negative, while the coefficient Υ_4 on the triple interaction between unit values, tariffs, and quality is positive.

[31] Instead of quality, Irarrazabal et al. (2015) include a dummy variable for high-price firms. Also, they only include a full set of interactions between unit values, distance, and the high-price firms dummy variable.

[32] If we include a full set of interactions between unit values, distance, tariffs, and quality, the coefficients on the interaction terms that involve both distance and tariffs are insignificant and our conclusions remain similar.

Table D1: Elasticity of Demand with Respect to the FOB Price

	(1)	(2)
ln unit value	-15.209^{***}	-11.024^{***}
	(4.328)	(4.105)
quality	-0.124^{**}	-0.065
	(0.061)	(0.073)
ln unit value × quality	0.153^{***}	0.106^{**}
	(0.046)	(0.046)
ln unit value × ln distance (Ψ_2)	2.115^{***}	1.457^{***}
	(0.498)	(0.494)
ln unit value × ln tariffs (Υ_2)	-9.186^{**}	-6.173^{*}
	(3.637)	(3.683)
ln distance × quality	0.019^{***}	0.015^{*}
	(0.007)	(0.009)
ln tariffs × quality	-0.233^{***}	-0.177^{***}
	(0.060)	(0.059)
ln unit value × ln distance × quality (Ψ_4)	-0.023^{***}	-0.016^{***}
	(0.005)	(0.006)
ln unit value × ln tariffs × quality (Υ_4)	0.106^{***}	0.068^{*}
	(0.040)	(0.040)
R-squared	0.566	0.076
Observations	87,078	58,646
Firm-destination-quarter fixed effects	Yes	Yes
Estimation	OLS	IV
Kleibergen-Paap F	–	178.76

Notes: The dependent variable is the (log) FOB export volume (in liters). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. In (2), unit values (and their interactions) are instrumented with mean unit values (and their interactions).

The elasticities of ϵ^{fob} with respect to distance and tariffs are given by:

$$\frac{\partial \epsilon^{fob}}{\partial dist_j}\frac{dist_j}{\epsilon^{fob}} = \frac{1}{\epsilon^{fob}}\left(\Psi_2 + \Psi_4 \times quality_k\right), \tag{D3}$$

$$\frac{\partial \epsilon^{fob}}{\partial tar_{j,t}}\frac{tar_{j,t}}{\epsilon^{fob}} = \frac{1}{\epsilon^{fob}}\left(\Upsilon_2 + \Upsilon_4 \times quality_k\right). \tag{D4}$$

To determine the sign and magnitude of the two expressions, separately for lower and for higher quality exports, we use the estimates reported in Table D1 and we rely on equation (D2) to calculate ϵ^{fob} at the 5^{th} and 95^{th} percentiles of the quality distribution (using the mean values of log distance and tariffs in our sample).

Based on the OLS estimates of column (1), the elasticity of ϵ^{fob} with respect to distance is equal to -0.454, -1.416, and -0.098 at the mean, 5^{th}, and 95^{th} percentiles of the quality distribution. The elasticity of ϵ^{fob} with respect to tariffs is equal to 0.346 at the mean value of quality, and falls from 3.349 at the 5^{th} percentile to -0.761 (and therefore turns negative) at the 95^{th} percentile.

Using the IV estimates of column (2), the elasticity of ϵ^{fob} with respect to distance is equal to -0.137, -0.280, and -0.033 at the mean, 5^{th}, and 95^{th} percentiles of the quality distribution, while the elasticity of ϵ^{fob} with respect to tariffs is equal to 0.445, 1.037, and 0.012, respectively. The elasticity of ϵ^{fob} with respect to distance is therefore negative and increases with quality. Instead, the elasticity of ϵ^{fob} with respect to tariffs is positive and decreases with quality.

E Selection Bias across Firms

To control for selection bias across firms, we implement the three-step estimator of Harrigan et al. (2015). We construct a balanced sample of all firm-wine-destination-quarter combinations that includes positive and zero trade flows, and for each wine we drop the years prior to its vintage year.

In a first step we estimate the probability of entry using a reduced-form probit:

$$pr\left(x_{ijk,t} > 0\right) = \Gamma\left(\delta_1 \ln Y_{j,t} + D_{k,t}\right), \tag{E1}$$

where $x_{ijk,t}$ is the export value, $Y_{j,t}$ includes distance, tariffs, GDP, GDP per capita, and remoteness (distance and tariffs can also be interacted with quality), and $D_{k,t}$ are product-quarter fixed effects. From the estimation of (E1) we obtain the estimated inverse Mills ratio $\widehat{\lambda}_{ijk,t}$. In a second step we estimate by OLS a regression for positive export values with $\widehat{\lambda}_{ijk,t}$ included as an additional regressor:

$$\ln x_{ijk,t} = \gamma_1 \ln Y_{j,t} + \gamma_2 \widehat{\lambda}_{ijk,t} + D_{k,t} + \epsilon_{ijk,t}, \tag{E2}$$

and we calculate the quasi-residuals $\widehat{\kappa}_{ijk,t} = \widehat{\gamma}_2 \widehat{\lambda}_{ijk,t} + \widehat{\epsilon}_{ijk,t} = \ln x_{ijk,t} - \widehat{\gamma}_1 \ln Y_{j,t} - \widehat{D}_{k,t}$. In the final step we add $\widehat{\kappa}_{ijk,t}$ as a selection control in the regression for unit values:

$$\ln uv_{ijk,t} = \zeta_1 \ln Y_{j,t} + \zeta_2 \widehat{\kappa}_{ijk,t} + D_{k,t} + \varrho_{ijk,t}. \tag{E3}$$

Equations (E1) and (E2) are estimated separately for each wine (and, therefore, only include quarter fixed effects), while equation (E3) is regressed on the pooled sample including all wines.[33]

The results of the three-step selection correction procedure, with third-stage standard errors clustered by destination-quarter, are reported in Table E1.[34] The samples are slightly smaller compared to the ones we use for our main regressions because some first-stage probit regressions fail to converge.

In all columns, the positive coefficient on the selection control implies that the correlation between the errors of the regressions for export values and unit values is around four percent. As explained by Harrigan et al. (2015), a positive correlation suggests that destination-specific demand shocks are likely to be more important than supply shocks in explaining which markets firms decide to enter. But most importantly, controlling for selection yields results which are both economically and statistically similar to our benchmark findings.

In column (1), markups increase with bilateral distance, remoteness, and the destination's income per capita, and decrease with tariffs and country size. Column (2) shows that the effects of distance and tariffs on markups are smaller in magnitude for higher quality exports. At the mean, 5^{th}, and

[33] The estimates of the probit regressions (E1) may be biased due to the inclusion of time fixed effects. To address this issue we also estimated equations (E1) and (E2) separately for each wine in each quarter. Our results remain similar.

[34] Due to the firm-destination-quarter fixed effects, controlling for selection in equation (12) is computationally infeasible as this would require us to estimate the first-step probit using our full sample with more than 700,000 fixed effects included.

Table E1: Selection Bias

	(1)	(2)
ln distance	0.033^{***} (0.006)	0.535^{***} (0.070)
ln distance × quality	–	-0.006^{***} (0.001)
ln tariffs	-0.135^{***} (0.035)	-1.494^{***} (0.449)
ln tariffs × quality	–	0.016^{***} (0.005)
ln remoteness	0.046^{***} (0.011)	0.046^{***} (0.011)
ln GDP	-0.017^{***} (0.002)	-0.017^{***} (0.002)
ln GDP/cap	0.019^{***} (0.006)	0.019^{***} (0.006)
selection control	0.044^{***} (0.007)	0.044^{***} (0.007)
R-squared	0.785	0.785
Observations	66,785	66,785
Product-quarter fixed effects	Yes	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** indicates significance at the one percent level. Estimates are obtained using the three-step procedure of Harrigan et al. (2015).

95^{th} percentiles of the quality distribution, the distance elasticity is equal to 0.035, 0.071, and 0.001 (which is insignificant), while the tariff elasticity is equal to −0.140, −0.238, and −0.047 (which is not significant). Our results are therefore robust to controlling for selection bias across firms. Harrigan et al. (2015) find that removing selection bias leads to slightly smaller coefficients on distance, but they also conclude that the difference is negligible.

F Estimation of Quality

We follow Bernini and Tomasi (2015) who adapt the Khandelwal (2010) procedure to estimate the quality of exports at the firm-product-destination-quarter level. The quality of an exported product is the part of its market share in a destination country that is not explained by its price. We estimate:

$$\ln S_{ijk,t} - \ln S_{jK,t} = \beta_1 uv_{ijk,t} + \beta_2 \ln nS_{ijk,t} + D_{j,t} + D_{ik} + \eta_{ijk,t}, \tag{F1}$$

where $S_{ijk,t}$ is the market share of product k exported by firm i to country j in period t, $S_{jK,t}$ is the market share of an "outside variety" K, $nS_{ijk,t}$ is the "nest share," $uv_{ijk,t}$ is the export unit value, and $D_{j,t}$ and D_{ik} are destination-quarter and firm-product fixed effects. Robust standard errors are adjusted for clustering by destination-quarter.

We construct each variable as follows. First, using the export value $x_{ijk,t}$ (in US dollars) and quantity $q_{ijk,t}$ (in kilograms) of each 8-digit MCN-level product k exported by firm i to destination j in quarter t between 2002Q1 and 2009Q4 (from Nosis), we calculate unit values $uv_{ijk,t}$ (in US dollars per kilogram). Second, we use annual frequency data between 2002 and 2009 from the BACI data set to calculate the outside variety share $S_{jK,t}$ as the share of non-Argentinean import quantities (in kilograms) in the total quantities imported by country j in a 6-digit HS-level product category K (Bernini and Tomasi, 2015).[35] We match the outside variety share (at annual frequency) with the quarterly data from Nosis by year to calculate the market share $S_{ijk,t}$ and the nest share $nS_{ijk,t}$ as:

$$S_{ijk,t} = \frac{q_{ijk,t}}{\sum_i q_{ijK,t} / (1 - S_{jK,t})}, \tag{F2}$$

$$nS_{ijk,t} = \frac{q_{ijk,t}}{\sum_i q_{ijk,t} / (1 - S_{jK,t})}, \tag{F3}$$

where $q_{ijk,t}$ and $q_{ijK,t}$ are defined at the 8-digit and 6-digit MCN levels (the denominators of F2 and F3 are proxies for each MCN-level market size).[36]

To address the endogeneity of unit values and of the nest shares, we use the Nosis data to construct the same instruments as Bernini and Tomasi (2015). We instrument unit values with the mean unit value of each 8-digit MCN-level product by destination-quarter, and the nest shares with the number of 8-digit MCN-level products by firm-destination-quarter. We estimate equation (F1) separately for each 2-digit MCN-level category. The quality of product k exported by firm i to country j in period t is obtained as:

$$quality_{ijk,t} = \widehat{D}_{j,t} + \widehat{D}_{ik} + \widehat{\eta}_{ijk,t} = (\ln S_{ijk,t} - \ln S_{jK,t}) - \left(\widehat{\beta}_1 uv_{ijk,t} + \widehat{\beta}_2 \ln nS_{ijk,t}\right). \tag{F4}$$

This procedure allows us to estimate the quality of each 8-digit MCN-level product exported by each firm to each destination country between 2002Q1 and 2009Q4. We also follow the same approach in Section 6 to estimate the quality of wine exports at the 12-digit MCN level.

[35] In the BACI data set, the highest level of disaggregation of the data is at the 6-digit HS level.

[36] Recall that the first six digits of the MCN coincide with the HS while the next two digits are specific to Mercosur.

G Robustness

Table G1: Robustness on Samples and Specifications

	(1)	(2)	(3)	(4)
ln distance × quality	-0.004^{***}	-0.004^{***}	-0.003^{***}	-0.004^{***}
	(0.001)	(0.001)	(0.001)	(0.001)
ln tariffs × quality	0.028^{***}	0.033^{**}	0.025^{***}	0.027^{***}
	(0.004)	(0.013)	(0.004)	(0.005)
Sample	Intermediaries	Baseline	Port of exit	Shipping mode
Observations	67,105	56,605	63,743	40,373
Firm-product-quarter fixed effects	Yes	No	No	No
Product-quarter fixed effects	No	Yes	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes	Yes	Yes
Estimation	OLS	IV	OLS	OLS

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels. In (2), the interaction between tariffs and quality is instrumented with (the log of one plus) each country's total wine production interacted with quality. To save space, the R-squared are not reported but are available upon request.

Table G2: Robustness on Samples and Specifications

	(1)	(2)	(3)	(4)
ln distance × quality	-0.003^{***}	-0.003^{***}	-0.004^{***}	-0.004^{***}
	(0.001)	(0.001)	(0.001)	(0.001)
ln tariffs × quality	0.027^{***}	0.024^{***}	0.026^{***}	0.022^{***}
	(0.004)	(0.004)	(0.004)	(0.005)
ln export volume	–	0.088^{**}	–	–
		(0.040)		
ln export volume × quality	–	-0.001^{**}	–	–
		(0.000)		
Sample	2003–2009	Baseline	Less 4.5 liters	Wines
Observations	64,884	66,941	71,466	69,219
Product-quarter fixed effects	Yes	Yes	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes	Yes	Yes

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels. To save space, the R-squared are not reported but are available upon request.

Table G3: Robustness on Quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln distance × quality	−0.007*** (0.002)	−0.019*** (0.004)	−0.004*** (0.001)	−0.003*** (0.001)	−0.009*** (0.003)	–	−0.003*** (0.001)	–
ln tariffs × quality	0.046*** (0.011)	0.113*** (0.018)	0.027*** (0.004)	0.020*** (0.004)	0.061*** (0.015)	–	0.028*** (0.004)	–
ln distance × estimated quality	–	–	–	–	–	−0.025*** (0.010)	−0.029** (0.014)	–
ln tariffs × estimated quality	–	–	–	–	–	0.119*** (0.037)	0.127* (0.073)	–
estimated quality	–	–	–	–	–	0.200** (0.087)	0.213* (0.111)	–
ln distance × quality (low)	–	–	–	–	–	–	–	−0.003** (0.001)
ln distance × quality (high)	–	–	–	–	–	–	–	−0.003** (0.001)
ln tariffs × quality (low)	–	–	–	–	–	–	–	0.042*** (0.007)
ln tariffs × quality (high)	–	–	–	–	–	–	–	0.040*** (0.006)
Sample	Baseline	Baseline	Excl. "Great"	Excl. US	Baseline	Baseline	Baseline	Baseline
Quality	Parker	WS [1,6]	WS	WS	WS	Estimated	Estimated/WS	WS
Observations	33,448	66,941	66,813	57,113	33,448	125,112	64,713	66,941
Product-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-destination-quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	IV	OLS	OLS	OLS

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. "WS" indicates the Wine Spectator ratings. In (5), the Wine Spectator ratings are instrumented with the Parker ratings (both interacted with distance and tariffs). In (6) and (7), quality is estimated using the Khandelwal (2010) methodology (see Appendix F). To save space, the R-squared are not reported but are available upon request.

Table G4: Robustness on Frequency

	(1)	(2)	(3)	(4)
ln distance × quality	-0.005^{***} (0.001)	-0.002^{***} (0.001)	-0.004^{***} (0.001)	-0.004^{***} (0.001)
ln tariffs × quality	0.023^{***} (0.006)	0.031^{***} (0.004)	0.041^{***} (0.006)	0.031^{***} (0.004)
Frequency	Annual	Monthly	Transaction	Transaction
Observations	53,197	69,796	74,806	161,070
Product-time fixed effects	Yes	Yes	Yes	Yes
Firm-destination-time fixed effects	Yes	Yes	Yes	Yes
Time dimension of fixed effects	Annual	Monthly	Daily	Quarterly

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-time between parentheses (where time is annual in column 1, monthly in column 2, daily in column 3, and quarterly in column 4). *** indicates significance at the one percent level. To save space, the R-squared are not reported but are available upon request.

Table G5: Cross-Sectional Estimates

	ln distance	ln distance × quality	ln tariffs	ln tariffs × quality
Year 2002	0.159 (0.269)	−0.001 (0.003)	1.815 (1.132)	−0.021 (0.014)
Year 2003	0.356 (0.328)	−0.004 (0.004)	−0.605 (2.090)	0.005 (0.025)
Year 2004	0.951^{***} (0.195)	-0.011^{***} (0.002)	-3.812^{***} (0.985)	0.045^{***} (0.012)
Year 2005	0.655^{***} (0.166)	-0.007^{***} (0.002)	-2.866^{***} (0.931)	0.033^{***} (0.011)
Year 2006	0.310^{**} (0.153)	-0.004^{**} (0.002)	-1.943^{***} (0.690)	0.022^{***} (0.008)
Year 2007	0.382^{***} (0.118)	-0.004^{***} (0.001)	-2.069^{**} (0.845)	0.023^{**} (0.010)
Year 2008	0.337^{**} (0.136)	-0.004^{**} (0.002)	-2.202^{**} (0.877)	0.024^{**} (0.010)
Year 2009	0.438^{***} (0.167)	-0.005^{**} (0.002)	-2.378^{**} (0.943)	0.027^{**} (0.011)
Observations		71,952		
Product-quarter fixed effects		Yes		

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Robust standard errors adjusted for clustering by destination-quarter between parentheses. *** and ** indicate significance at the one and five percent levels. GDP, GDP per capita, and remoteness are included but not reported.