Online Appendix

Markups, Quality, and Trade Costs*

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Abstract

This paper examines how trade costs induced by geographic distance or bilateral tariffs impact the markups of exports differentiated by quality. It relies on a data set that combines Argentinean firm-level wine exports with experts' wine ratings as a measure of quality. Exporters price discriminate across destinations by raising markups in more distant markets, and by lowering them in high-tariff countries. However, the response of markups to changes in trade costs is heterogeneous and weaker for higher quality exports. These empirical patterns can be predicted by trade models featuring demand functions more convex than log-concave, but less than superconvex. They 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.

JEL Classification: F12, F14, L11.
Keywords: Distance; export unit values; heterogeneity; markups; quality; tariffs; trade costs; wine.

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A List of Destination Countries

Table A1 lists the 92 destination countries included in our sample and provides the number of observations for each country. The US, followed by Brazil and the UK, have the largest coverages.

Table A1: Destination Countries and Sample Coverage

Country	Observations	Country	Observations	Country	Observations
Albania*	2	Greece	98	Panama	1,085
Angola*	124	Grenada	5	Paraguay	1,167
Antigua and Barbuda	110	Guatemala	468	Peru	2,218
Australia	354	Haiti*	110	Philippines	194
Austria	350	Honduras	203	Poland	836
Bahamas	7	Hong Kong*	970	Portugal	123
Barbados	101	Hungary	44	Qatar	3
Belarus*	21	Iceland*	228	Romania*	8
Belgium	1,372	India	82	Russia	680
Belize*	34	Ireland	846	Saint Lucia*	23
Benin	6	Israel	237	Singapore	706
Bolivia	826	Italy	523	Slovakia	130
Brazil	4,687	Jamaica	36	Slovenia*	7
Bulgaria	126	Japan	1,177	South Africa*	38
Canada	2,949	Jordan*	2	South Korea*	469
Chile	297	Kazakhstan*	27	Spain	876
China*	846	Kenya*	5	Sri Lanka	18
Colombia	1,720	Latvia	337	Suriname	33
Costa Rica	1,022	Lithuania	220	Sweden	631
Croatia*	30	Luxembourg	93	Switzerland	1,217
Cyprus	135	Malaysia	598	Thailand	200
Czech Republic	737	Maldives*	2	Trinidad and Tobago	231
Denmark	1,811	Malta	155	Turkey	79
Dominican Republic*	481	Mauritius*	57	Ukraine*	165
Ecuador	794	Mexico	2,010	United Arab Emirates	256
El Salvador	363	Mongolia*	19	United Kingdom	3,894
Estonia*	69	Netherlands	2,258	United States	7,525
Finland	745	New Zealand	189	Uruguay	1,362
France	1,476	Nicaragua	141	Venezuela	599
Germany	1,816	Nigeria	2	Vietnam	160
Ghana	77	Norway*	384		

Notes: Data from NOSIS. * indicates the countries for which the frequency and coverage ratios of non-tariff measures for food imports are not available (see Section 3.2).

B Extensions

Our estimates may be biased if distance and tariffs are correlated with other country-level characteristics affecting the pricing decisions of exporters in each quality segment. To address this issue, we extend our analysis by controlling for additional country-level variables (depending on data availability, the sample sizes may vary across specifications). We also investigate whether the heterogeneous effects of distance and tariffs on markups vary across different types of exporters.

B.1 Country-Level Controls

In Chen and Juvenal (2016) we 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 estimate equation (1) and control for the real exchange rate between the Argentinean peso and the importer's currency and its interaction with (demeaned) quality. The real exchange rate is defined as the ratio of consumer price indices times the yearly-average nominal exchange rate (International Financial Statistics of the International Monetary Fund), and an increase indicates a real depreciation of the Argentinean peso. Column (1) of Table B1 shows that controlling for the heterogeneous effects of real exchange rates does not substantially modify the size and significance of the coefficients on distance and tariffs and their interactions with quality.

Table B1: Country-Level Controls (1)

	(1)	(2)	(3)	(4)
ln Distance	0.033^{***} (0.009)	0.028^{***} (0.010)	0.039^{***} (0.013)	0.021^{**} (0.009)
ln Distance × Quality	-0.004^{***} (0.001)	-0.005^{***} (0.001)	-0.005^{***} (0.001)	-0.004^{***} (0.001)
ln (1 + Tariffs)	-0.095^{**} (0.044)	-0.077^{*} (0.039)	-0.100^{*} (0.059)	-0.133^{***} (0.044)
ln (1 + Tariffs) × Quality	0.014^{**} (0.007)	0.017^{**} (0.008)	0.019^{*} (0.010)	0.014^{*} (0.007)
ln Real exchange rate	0.023 (0.024)	–	–	–
ln Real exchange rate × Quality	0.011^{**} (0.004)	–	–	–
ln (1 + Wine production/capita)	–	−0.008 (0.011)	–	–
ln (1 + Wine production/capita) × Quality	–	0.000 (0.001)	–	–
ln Wine consumption/capita	–	–	−0.009 (0.009)	–
ln Wine consumption/capita × Quality	–	–	0.000 (0.001)	–
ln (1 + Alcohol tax)	–	–	–	−0.073 (0.047)
ln (1 + Alcohol tax) × Quality	–	–	–	−0.006 (0.007)
R-squared	0.767	0.767	0.764	0.771
Observations	51,970	45,340	36,266	41,608

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

Markups may also depend on each destination country's wine production or consumption patterns. In columns (2) and (3) we control for each country's wine production or consumption per capita (in liters) and their interactions with (demeaned) quality (Anderson and Nelgen, 2011). To include the countries not producing wine in the sample, we use the logarithm of one plus per capita wine production. The coefficients on these additional variables are insignificant, and our results for distance and tariffs continue to hold.

In column (4) we control for each destination country's (logarithm of one plus) value-added taxes on alcohol and their interaction with (demeaned) quality. Some countries charge alcohol taxes on a per-unit basis, but the data (for 2016) are reported in percentage terms only (World Health Organization). Data for the US are not available as alcohol taxes vary across US states. The coefficients on alcohol taxes and their interaction with quality are insignificant, while the coefficients on distance and tariffs and their interactions with quality continue to be significant and with expected signs.

Table B2: Country-Level Controls (2)

	(1)	(2)	(3)	(4)
ln Distance	0.055*** (0.015)	0.031*** (0.009)	0.031*** (0.009)	0.032*** (0.009)
ln Distance × Quality	−0.008*** (0.002)	−0.004*** (0.001)	−0.005*** (0.001)	−0.008*** (0.001)
ln (1 + Tariffs)	−0.057 (0.035)	−0.090** (0.043)	−0.090** (0.043)	−0.091** (0.043)
ln (1 + Tariffs) × Quality	0.014** (0.007)	0.015** (0.007)	0.017** (0.007)	0.011* (0.006)
ln Wine import share	0.030*** (0.011)	–	–	–
ln Wine import share × Quality	−0.002* (0.001)	–	–	–
ln GDP	–	−0.023*** (0.003)	–	–
ln GDP × Quality	–	−0.001 (0.001)	–	–
ln GDP/capita	–	–	0.021*** (0.008)	–
ln GDP/capita × Quality	–	–	−0.001 (0.001)	–
ln Remoteness	–	–	–	0.061*** (0.019)
ln Remoteness × Quality	–	–	–	−0.006*** (0.002)
R-squared	0.768	0.767	0.767	0.768
Observations	52,893	52,894	52,894	52,894

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. GDP, GDP per capita, and remoteness are included in all regressions (but are only reported when interacted with quality).

Markups could also be affected by the intensity of import competition for wine in each country. In column (1) of Table B2 we interact each country's annual share of wine import quantities (HS code 22.04 from the BACI data set, see Gaulier and Zignago, 2010) from Argentina with (demeaned) quality. The effects of distance and tariffs on markups remain heterogeneous across quality levels (the coefficient on tariffs at the mean value of quality is insignificant).

Finally, in columns (2) to (4) we interact the time-varying destination controls that we include in our main regressions (GDP, GDP per capita, and remoteness) with (demeaned) quality (Chen and Juvenal, 2018). In all cases, the results for distance and tariffs continue to hold.

B.2 Heterogeneity across Firms

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 (1) and we multiply the distance and tariff interaction terms with dummy variables for the higher/lower quality firms, the larger/smaller firms, and the exporters with larger/smaller export market shares.

To compare higher with lower quality exporters we divide our sample at the 25^{th} percentile of average firm-level quality. We define a lower quality exporter as one which average quality is below the 25^{th} percentile. As shown in column (1) of Table B3, the interactions of distance and tariffs with quality are significant for the higher quality firms only.

Table B3: Heterogeneity across Firms

	(1)	(2)	(3)
ln Distance	0.034*** (0.009)	0.031*** (0.009)	0.025*** (0.008)
ln Distance × Quality × High quality firms	−0.006*** (0.001)	–	–
ln Distance × Quality × Low quality firms	−0.002 (0.002)	–	–
ln Distance × Quality × Large firms	–	−0.005*** (0.001)	–
ln Distance × Quality × Small firms	–	−0.005** (0.002)	–
ln Distance × Quality × High market share firms	–	–	−0.005*** (0.001)
ln Distance × Quality × Low market share firms	–	–	−0.005*** (0.001)
ln (1 + Tariffs)	−0.105** (0.045)	−0.091** (0.043)	−0.087** (0.041)
ln (1 + Tariffs) × Quality × High quality firms	0.025*** (0.009)	–	–
ln (1 + Tariffs) × Quality × Low quality firms	−0.001 (0.011)	–	–
ln (1 + Tariffs) × Quality × Large firms	–	0.020*** (0.007)	–
ln (1 + Tariffs) × Quality × Small firms	–	0.011 (0.012)	–
ln (1 + Tariffs) × Quality × High market share firms	–	–	0.024*** (0.007)
ln (1 + Tariffs) × Quality × Low market share firms	–	–	0.003 (0.014)
R-squared	0.767	0.767	0.770
Observations	52,894	52,894	52,894

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. *** and ** indicate significance at the one and five percent levels. GDP, GDP per capita, and remoteness are included (not reported). A dummy variable for high market share firms (not reported) is also included in column (3).

As more productive firms tend to charge higher markups (Bellone, Musso, Nesta, and Warzynski, 2014; Berman, Martin, and Mayer, 2012; Melitz and Ottaviano, 2008), we expect these firms to be better able to adjust markups in response to changes in trade costs. Without any data on firm-level productivity, we rely instead on a measure of firm size as it correlates strongly with productivity. We calculate the total volume of exports (in liters) of each firm in each year, and we classify a firm as small if its total exports are below the 25^{th} percentile. Column (2) shows that the effect of distance is equally heterogeneous for all firms while the effect of tariffs is heterogeneous for the bigger firms only.

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 markups. We thus expect the effects of trade costs on markups to be more strongly heterogeneous for high market share firms. We construct market shares as each firm's total exports as a share of the total export value of all firms by destination and year. Relative to the 25^{th} percentile of market shares, we distinguish between high and low market share firms. In column (3), the effect of distance is equally heterogeneous for all firms. Instead, tariffs have heterogeneous effects for the high market share firms only.

C Robustness

In this section, we check the robustness of our findings. We start by controlling for selection bias across firms. We then use different samples and estimate alternative specifications. We rely on different measures of quality, and aggregate unit values at various frequencies. We also allow for the dynamic adjustment of prices, and estimate the cross-sectional variation of our coefficients.

C.1 Selection Bias across Firms

To control for selection bias across firms, we implement the three-step estimator of Harrigan, Ma, and Shlychkov (2015). We construct a balanced sample of all firm-wine-destination-year combinations with 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:

$$pr\left(x_{ijk,t} > 0\right) = \Gamma\left(\delta_1 \ln dist_j + \delta_2 \ln\left(1 + tar_{Kj,t}\right) + \delta_3 z_{j,t} + D_{k,t}\right), \tag{C1}$$

where $x_{ijk,t}$ is the export value and $D_{k,t}$ are wine-year fixed effects (distance and tariffs can also be interacted with demeaned quality). By estimating (C1) 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:

$$\ln x_{ijk,t} = \gamma_1 \ln dist_j + \gamma_2 \ln\left(1 + tar_{Kj,t}\right) + \gamma_3 z_{j,t} + \gamma_4 \widehat{\lambda}_{ijk,t} + D_{k,t} + \epsilon_{ijk,t}, \tag{C2}$$

and we calculate the quasi-residuals $\widehat{\kappa}_{ijk,t} = \widehat{\gamma}_4 \widehat{\lambda}_{ijk,t} + \widehat{\epsilon}_{ijk,t} = \ln x_{ijk,t} - \widehat{\gamma}_1 \ln dist_j - \widehat{\gamma}_2 \ln(1 + tar_{Kj,t}) - \widehat{\gamma}_3 z_{j,t} - \widehat{D}_{k,t}$. In the final step we add $\widehat{\kappa}_{ijk,t}$ as a selection control in the regression for unit values:

$$\ln uv_{ijk,t} = \zeta_1 \ln dist_j + \zeta_2 \ln(1 + tar_{Kj,t}) + \zeta_3 z_{j,t} + \zeta_4 \widehat{\kappa}_{ijk,t} + D_{k,t} + \varrho_{ijk,t}. \tag{C3}$$

Equations (C1) and (C2) are estimated separately for each wine (and, therefore, only include year fixed effects), while equation (C3) is regressed on the pooled sample including all wines.

Table C1: Selection Bias across Firms

	(1)	(2)
ln Distance	0.029^{***} (0.009)	0.029^{***} (0.009)
ln Distance × Quality	–	-0.005^{***} (0.001)
ln (1 + Tariffs)	-0.094^{**} (0.040)	-0.093^{**} (0.041)
ln (1 + Tariffs) × Quality	–	0.018^{**} (0.008)
Selection control	0.048^{***} (0.010)	0.048^{***} (0.010)
R-squared	0.769	0.769
Observations	43,726	43,726

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. *** and ** indicate significance at the one and five percent levels. Estimates are obtained using the three-step procedure of Harrigan et al. (2015). GDP, GDP per capita, and remoteness are included (not reported).

The results of the three-step selection correction procedure, with third-stage standard errors clustered by destination-year, are reported in Table C1. The samples are smaller in size compared to the ones we use for our main regressions because some first-stage probit regressions failed to converge.

The positive coefficients on the selection control imply that the correlation between the errors of the regressions for export values and of the regressions for unit values is around five percent. A positive correlation indicates that destination-specific demand shocks are likely to be more important than supply shocks in explaining which markets firms decide to enter (Harrigan et al., 2015). But most importantly, controlling for selection yields results which are both economically and statistically similar to our benchmark findings.

C.2 Samples and Specifications

Column (1) of Table C2 shows that our results continue to hold when we estimate equation (1) and 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-wine-year fixed effects.

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

Table C2: Samples and Specifications (1)

	(1)	(2)	(3)	(4)	(5)
ln Distance	0.031*** (0.009)	0.042*** (0.010)	0.030*** (0.011)	0.013* (0.007)	0.021 (0.013)
ln Distance × Quality	−0.005*** (0.001)	−0.004*** (0.001)	−0.005*** (0.001)	−0.005*** (0.001)	−0.004*** (0.001)
ln (1 + Tariffs)	−0.088** (0.043)	−0.090** (0.042)	−0.117** (0.057)	−0.027 (0.030)	−0.101 (0.062)
ln (1 + Tariffs) × Quality	0.017** (0.008)	0.015** (0.007)	0.017* (0.009)	0.022*** (0.007)	0.010 (0.007)
Sample	Intermediaries	Port of exit	Shipping mode	Packaging	Less 4.5 liters
R-squared	0.768	0.783	0.791	0.820	0.712
Observations	53,204	52,449	32,871	52,873	57,295
Firm-wine-year fixed effects	Yes	No	No	No	No
Wine-year fixed effects	No	Yes	Yes	Yes	Yes

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

the NOSIS data set reports the port of exit for each export transaction, we construct a new sample and define a wine according to its name, grape, type, vintage year, 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 based on its name, grape, type, vintage year, and shipping mode. As shown in columns (2) and (3), controlling for the port of exit from Argentina or for the shipping mode does not alter our conclusions.

The NOSIS data set reports the type of packaging used for shipping. Wines are predominantly 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 for shipping, in column (4) we define a wine based on its name, grape, type, vintage year, and container type. The effect of tariffs at the mean value of quality is insignificant, but both distance and tariffs have heterogeneous effects on markups. In column (5) we include the shipments containing less than 4.5 liters in the sample. The effect of distance is heterogeneous across quality levels, while tariffs are insignificant.

In December 2001, Argentina was in a crisis. 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 C3 we exclude the year 2002 from the sample. Similarly, to account for the effects of the financial crisis, in column (2) we exclude the year 2009 from the sample (Chen and Juvenal, 2018). In both cases, our results continue to hold.

In column (3) we show that our results remain robust to excluding Islamic countries from the sample (due to their low rates of alcohol consumption).[1] In column (4) we account for export volumes and their interaction with (demeaned) quality. This addresses the possibility that the pricing strategies of exporters depend on shipment size. In column (5) we control for the number of years that have elapsed since each wine was first exported to each destination. This aims to account for the building up of a customer base in each destination market.

Table C3: Samples and Specifications (2)

	(1)	(2)	(3)	(4)	(5)
ln Distance	0.032*** (0.009)	0.030*** (0.009)	0.031*** (0.009)	0.047*** (0.010)	0.030*** (0.009)
ln Distance × Quality	−0.005*** (0.001)	−0.005*** (0.001)	−0.005*** (0.001)	−0.005*** (0.001)	−0.005*** (0.001)
ln (1 + Tariffs)	−0.095** (0.045)	−0.072* (0.042)	−0.089* (0.046)	−0.055 (0.035)	−0.091** (0.043)
ln (1 + Tariffs) × Quality	0.020** (0.008)	0.018** (0.007)	0.018** (0.008)	0.021** (0.008)	0.017** (0.007)
ln Export volume	–	–	–	0.048*** (0.008)	–
ln Export volume × Quality	–	–	–	−0.001 (0.001)	–
Number of years since first export	–	–	–	–	−0.008 (0.008)
Sample	2003–2009	2002–2008	Excl. Islamic	Baseline	Baseline
R-squared	0.768	0.762	0.768	0.777	0.767
Observations	50,861	43,490	51,925	52,894	52,894

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. ***, **, and * indicate significance at the one, five, and ten percent levels. GDP, GDP per capita, and remoteness are included (not reported).

In wine producing countries, wine producers may lobby for protectionism if import competition is strong. Therefore, tariffs may be endogenous. In column (1) of Table C4 we instrument tariffs and their interaction with quality with each country's wine production and consumption (total and per capita, in liters, Anderson and Nelgen, 2011) interacted with (demeaned) quality (again, we use the logarithm of one plus wine production or wine production per capita to account for the countries not producing wine). The Kleibergen-Paap F statistic (equal to 22, Stock and Yogo, 2005) rejects the null of weak correlation between the instruments and the endogenous regressors. The effect of tariffs at the mean value of quality is insignificant, but tariffs have heterogeneous effects on markups across quality levels.

Estimating a log-linear model by OLS is valid only if the variance of the error term is independent from the regressors. Otherwise, the log transformation prevents the error term from having a zero conditional expectation, leading to inconsistent estimates of the true elasticities. Poisson Pseudo-Maximum Likelihood (PPML) instead delivers consistent coefficient estimates, even in the presence of heteroskedasticity (Head and Mayer, 2014; Santos Silva and Tenreyro, 2006). Column (2) reports PPML estimates. The impact of distance at the mean value of quality is insignificant, but distance and tariffs have heterogeneous effects on markups differentiated by quality.

[1] These are Albania, Jordan, Kazakhstan, Malaysia, Maldives, Nigeria, Qatar, Turkey, and the United Arab Emirates.

Finally, in columns (3) and (4) we show that our results remain robust to clustering standard errors by wine-destination, and to multi-level clustering by firm and destination.

Table C4: Samples and Specifications (3)

	(1)	(2)	(3)	(4)
ln Distance	0.056^{***}	0.000	0.031^{***}	0.031^{**}
	(0.014)	(0.009)	(0.004)	(0.014)
ln Distance × Quality	-0.006^{***}	-0.004^{***}	-0.005^{***}	-0.005^{**}
	(0.002)	(0.001)	(0.001)	(0.002)
ln (1 + Tariffs)	-0.252	-0.070^{**}	-0.090^{***}	-0.090^{*}
	(0.153)	(0.031)	(0.014)	(0.046)
ln (1 + Tariffs) × Quality	0.032^{*}	0.032^{***}	0.017^{***}	0.017^{**}
	(0.016)	(0.008)	(0.004)	(0.008)
R-squared	0.013	–	0.767	0.767
Observations	36,266	52,894	52,894	52,894
Clustering	j, t	j, t	k, j	i and j
Estimation	IV	PPML	OLS	OLS

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter) in all columns but the FOB unit value in (2). Quality is demeaned. Wine-year fixed effects are included. ***, **, and * indicate significance at the one, five, and ten percent levels. GDP, GDP per capita, and remoteness are included (not reported). In (1), tariffs and their interaction with quality are instrumented with each country's wine production and consumption (total and per capita) and their interactions with quality.

C.3 Quality

To check the robustness of our findings to the measurement of quality, we first use the time-invariant quality scores published by Robert Parker (Chen and Juvenal, 2016, 2018). Similarly to the Wine Spectator ratings, the Parker ratings are defined on a (50,100) scale according to the wine's name, grape, type, and vintage year, and a higher score indicates a higher quality. Table C5 describes the Parker classification.

Table C5: Robert Parker Quality Ratings

Quality bin	Ratings (50,100)
Extraordinary	96–100
Outstanding	90–95
Above average/very good	80–89
Average	70–79
Below average	60–69
Unacceptable	50–59

Note: Robert Parker classifies the quality scores into six different bins.

When we merge the wines from the customs data set with the Parker ratings by name, grape, type, and vintage year, we observe 151 firms, 3,103 wines, and 89 destination countries. This sample represents 24 percent of the total value of wine exports between 2002 and 2009. The quality scores vary between 72 and 98 (i.e., we only observe four of the six bins listed in Table C5). The mean absolute difference between the Wine Spectator and Parker ratings is equal to 2.02, with a standard deviation of 3.24. 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. Column (1) of Table C6 shows that our results continue to hold when we interact distance and tariffs with the (demeaned) Parker ratings (at the mean value of quality the tariff elasticity is insignificant).

In column (2) we rescale the Wine Spectator ratings between one and six. Each value corresponds to one of 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 as the Wine Spectator is a US-based rating and may therefore not capture taste preferences for quality in other countries (Parker is also US based). Overall, our results continue to hold (only the interaction between tariffs and demeaned quality is insignificant in column 4).

In column (5) we classify the "Very good," "Outstanding," and "Great" wines as high quality, the "Not recommended," "Mediocre," and "Good" ones as low quality, and we let the coefficients on the distance and tariff interaction terms vary between the two quality categories. The effects of distance and tariffs are equally heterogeneous for the higher and for the lower quality categories.

Table C6: Quality (1)

	(1)	(2)	(3)	(4)	(5)
ln Distance	0.033^{***} (0.010)	0.031^{***} (0.009)	0.031^{***} (0.009)	0.031^{***} (0.009)	0.031^{***} (0.009)
ln Distance × Quality	-0.005^{*} (0.003)	-0.024^{***} (0.005)	-0.005^{***} (0.001)	-0.004^{***} (0.001)	–
ln (1 + Tariffs)	-0.065 (0.041)	-0.091^{**} (0.042)	-0.090^{**} (0.043)	-0.100^{**} (0.043)	-0.089^{**} (0.043)
ln (1 + Tariffs) × Quality	0.027^{*} (0.014)	0.092^{***} (0.034)	0.017^{**} (0.007)	0.009 (0.007)	–
ln Distance × Quality (high)	–	–	–	–	-0.004^{***} (0.002)
ln Distance × Quality (low)	–	–	–	–	-0.004^{***} (0.002)
ln (1 + Tariffs) × Quality (high)	–	–	–	–	0.025^{**} (0.011)
ln (1 + Tariffs) × Quality (low)	–	–	–	–	0.026^{**} (0.012)
Sample	Baseline	Baseline	Excl. "Great"	Excl. US	Baseline
Quality	Parker	WS [1,6]	WS	WS	WS
R-squared	0.765	0.767	0.764	0.770	0.767
Observations	26,258	52,894	52,776	46,693	52,894

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. "WS" stands for Wine Spectator. GDP, GDP per capita, and remoteness are included (not reported).

As endogeneity could arise due to measurement error in the quality ratings (Chen and Juvenal, 2016, 2018), in column (1) of Table C7 we use the Parker scores to instrument the Wine Spectator ratings (both demeaned and interacted with distance and tariffs) under the assumption that their measurement errors are uncorrelated. The Kleibergen-Paap F statistic (equal to 1,228, Stock and Yogo, 2005) rejects the null of weak correlation between the instruments and the endogenous regressors.

Table C7: Quality (2)

	(1)	(2)	(3)	(4)
ln Distance	0.035^{***} (0.010)	0.051^{***} (0.011)	0.027^{***} (0.009)	0.004 (0.010)
ln Distance × Quality	-0.006^{*} (0.003)	-0.005^{***} (0.001)	-0.005^{***} (0.001)	-0.003^{**} (0.001)
ln (1 + Tariffs)	-0.071^{*} (0.041)	-0.074^{*} (0.039)	-0.097^{**} (0.047)	-0.116^{**} (0.052)
ln (1 + Tariffs) × Quality	0.032^{*} (0.018)	0.017^{**} (0.007)	0.018^{**} (0.008)	0.018^{*} (0.010)
ln Distance × Estimated quality	–	-0.012^{*} (0.006)	–	–
ln (1 + Tariffs) × Estimated quality	–	0.071 (0.069)	–	–
Estimated quality	–	0.118^{**} (0.047)	–	–
Sample	Baseline	Baseline	Excl. vintage$_t$	Excl. vintage$_{t/t+1}$
Quality	WS	Est./WS	WS	WS
R-squared	0.011	0.768	0.757	0.727
Observations	26,258	51,726	46,452	27,976
Estimation	IV	OLS	OLS	OLS

Notes: The dependent variable is the (log) FOB unit value of exports (in US dollars per liter). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. ***, **, and * indicate significance at the one, five, and ten percent levels. "WS" stands for Wine Spectator. In (1), the Wine Spectator ratings are instrumented with the Parker ratings (both interacted with distance and tariffs). In (2), in addition to accounting for the effects of the Wine Spectator ratings we also control for the effects of quality estimated using Khandelwal's (2010) methodology. GDP, GDP per capita, and remoteness are included (not reported).

Based on Khandelwal's (2010) methodology, we estimate quality for each 6-digit HS-level wine product category by firm-destination-year. In column (2) we interact distance and tariffs with estimated quality but also with the Wine Spectator ratings (both demeaned). The coefficients on the interactions with the Wine Spectator ratings are significant and with expected signs. Instead, the coefficient on the interaction between distance and estimated quality is significant at the 10 percent level only, while the one on the interaction between tariffs and estimated quality is insignificant. This finding most likely reflects that the Khandelwal (2010) measure embodies not only quality but also consumer tastes (the correlation between estimated quality and the Wine Spectator ratings in our sample is only equal to 6.1 percent).

Finally, when building up our sample we match the quality ratings with all the export transactions that we observe for each wine in the customs data set. It might be, however, that the quality ratings are released only after the first shipments take place. To address this issue, for each wine we exclude from the sample the observations in the year of production. Column (3) shows that our results remain robust. In column (4) we further exclude for each wine the observations in the year following the year of production (i.e., for a wine with a vintage year 2004, we exclude the years 2004 and 2005 from the sample). This restriction reduces our sample size by half. The effect of distance at the mean value of quality is insignificant, but distance and tariffs continue to have heterogeneous effects on markups differentiated by quality.

C.4 Data Frequency

In columns (1) and (2) of Table C8 we measure unit values at quarterly and monthly frequency, and we include wine-quarter-year and wine-month-year fixed effects, respectively. In column (3) we use unit values at the transaction level. We control for wine-month-year fixed effects as wine-transaction date fixed effects would otherwise significantly reduce the sample size by restricting the sample to the wines exported to more than one destination on the same day only. Standard errors are clustered at the destination-year level. Markups rise with distance, especially for lower quality exports. The effect of tariffs is insignificant at the mean value of quality, but it is weaker for higher quality exports.

Table C8: Data Frequency

	(1)	(2)	(3)
ln Distance	0.033*** (0.008)	0.040*** (0.008)	0.031*** (0.008)
ln Distance × Quality	−0.005*** (0.001)	−0.005*** (0.001)	−0.006*** (0.001)
ln (1 + Tariffs)	−0.060 (0.037)	−0.028 (0.033)	0.011 (0.032)
ln (1 + Tariffs) × Quality	0.012* (0.006)	0.013** (0.006)	0.012** (0.006)
Frequency	Quarterly	Monthly	Transaction level
R-squared	0.792	0.812	0.741
Observations	71,034	77,605	149,875
Fixed effects	Wine-quarter-year	Wine-month-year	Wine-month-year

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

C.5 Price Dynamics

As wine is a durable good, we account for the dynamic adjustment of prices in three different ways.

Table C9: Price Dynamics

	(1)	(2)	(3)
Lagged unit value	0.343*** (0.027)	0.311*** (0.023)	0.249*** (0.018)
ln Distance	−0.001 (0.007)	−0.002 (0.007)	−0.005 (0.008)
ln Distance × Quality	−0.003** (0.001)	−0.004*** (0.001)	−0.004*** (0.001)
ln (1 + Tariffs)	−0.042 (0.036)	−0.027 (0.036)	−0.037 (0.037)
ln (1 + Tariffs) × Quality	0.018** (0.008)	0.022*** (0.008)	0.021** (0.008)
Lag type	One-year lag	First lag	Oldest lag
R-squared	0.825	0.818	0.813
Observations	12,239	12,814	12,814

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

In column (1) of Table C9 we simply add to equation (1) a one-year lag on export unit values. In column (2), we instead control for the first available lag on export unit values (which can be a one-year lag, a two-year lag, etc.). Lastly, in column (3) we control for the oldest lag available in the sample. The effects of distance and tariffs are insignificant at the mean value of quality, but they continue to be heterogeneous across quality levels. Notice that in all cases, controlling for dynamics significantly reduces the sample size.

C.6 Cross-Sectional Estimates

In Table C10 we estimate the cross-sectional variation of our coefficients. We estimate equation (1) separately for each year in our sample. The coefficients on distance and tariffs and their interactions with quality are not significant in all years, but when they are they indicate that markups rise with distance, fall with tariffs, and these effects are weaker for higher quality exports.

Table C10: Cross-Sectional Estimates

	2002	2003	2004	2005	2006	2007	2008	2009
ln Distance	0.040	0.037	0.028	0.038	0.006	0.047^{**}	0.038^{**}	0.037
	(0.027)	(0.036)	(0.028)	(0.030)	(0.025)	(0.022)	(0.015)	(0.025)
ln Distance × Quality	-0.009^{**}	0.001	-0.009^{**}	-0.007^{***}	-0.006^{**}	-0.004^{**}	-0.004^{**}	-0.007^{***}
	(0.004)	(0.006)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
ln (1 + Tariffs)	0.180	0.018	0.049	-0.326^{*}	−0.016	−0.112	−0.100	-0.227^{*}
	(0.183)	(0.043)	(0.180)	(0.163)	(0.120)	(0.087)	(0.071)	(0.132)
ln (1 + Tariffs) × Quality	−0.027	0.007	0.055^{***}	0.028^{*}	0.032^{*}	0.009	0.037^{**}	0.023
	(0.021)	(0.012)	(0.017)	(0.014)	(0.017)	(0.013)	(0.018)	(0.022)
R-squared	0.732	0.681	0.713	0.728	0.754	0.775	0.823	0.789
Observations	2,033	3,368	4,478	6,144	7,667	9,559	10,241	9,404

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

D Export Volumes

We investigate the heterogeneous effects of distance and tariffs on export volumes across quality levels. As only explaining positive trade flows generates a selection bias, we construct a balanced sample of all firm-wine-destination-year combinations with positive and zero trade flows (and for each wine we drop the years prior to its vintage year). We then estimate the following reduced-form regression by PPML (Head and Mayer, 2014; Santos Silva and Tenreyro, 2006):

$$\begin{aligned} q_{ijk,t} &= \exp(\xi_1 \ln dist_j + \xi_2 \ln dist_j \times quality_k + \xi_3 \ln(1 + tar_{Kj,t}) \\ &\quad + \xi_4 \ln(1 + tar_{Kj,t}) \times quality_k + \xi_5 z_{j,t} + D_{k,t}) + \nu_{ijk,t}, \end{aligned} \quad \text{(D1)}$$

where $q_{ijk,t}$ is the export volume (in liters) and quality is demeaned.

Table D1: Export Volumes

	(1)	(2)
ln Distance	-1.014^{***} (0.115)	-1.013^{***} (0.115)
ln Distance × Quality	–	0.023^{***} (0.006)
ln (1 + Tariffs)	-1.762^{***} (0.647)	-1.798^{***} (0.611)
ln (1 + Tariffs) × Quality	–	-0.187^{***} (0.044)
ln Remoteness	-0.521^{**} (0.217)	-0.529^{**} (0.213)
ln GDP	0.702^{***} (0.035)	0.702^{***} (0.035)
ln GDP/capita	1.090^{***} (0.104)	1.089^{***} (0.103)
Observations	1,012,567	1,012,567

Notes: The dependent variable is the export volume (in liters). Quality is demeaned. Wine-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year between parentheses. *** and ** indicate significance at the one and five percent levels.

As shown in Table D1, 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).[2] 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 -1.013, -1.164, and -0.868, while the tariff elasticity is equal to -1.798, -0.556 (insignificant), and -2.981, respectively.

E Perceived Elasticity of Demand

As explained in Section 5.2.4, we expect ϵ^{fob} to decrease with per-unit trade costs and to increase with ad valorem trade costs. Moreover, these effects should be more modest for higher quality exports. To determine whether these mechanisms are present in our data we estimate (Irarrazabal, Moxnes, and Opromolla, 2015):

$$\begin{aligned} \ln q_{ijk,t} &= \Psi\left[\ln uv_{ijk,t} \times \ln dist_j \times quality_k\right] + \Upsilon\left[\ln uv_{ijk,t} \times \ln\left(1 + tar_{Kj,t}\right) \times quality_k\right] \\ &\quad + D_{ij,t} + \varpi_{ijk,t}, \end{aligned} \tag{E1}$$

where $q_{ijk,t}$ is the export volume (in liters) of wine k exported by firm i to country j in year 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,

[2] Exports fall with the CIF price, and therefore with distance and tariffs. 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.

respectively.[3] We control for firm-destination-year fixed effects $D_{ij,t}$, and robust standard errors are adjusted for clustering at the destination-year level (quality is not demeaned). The demand elasticity ϵ^{fob} is then given by:

$$\epsilon^{fob} = \frac{\partial \ln q_{ijk,t}}{\partial \ln uv_{ijk,t}} = \Psi_1 + \Psi_2 \ln dist_j + \Psi_3 quality_k + \Psi_4 \ln dist_j \times quality_k + \Upsilon_1 \ln(1 + tar_{Kj,t}) + \Upsilon_2 \ln(1 + tar_{Kj,t}) \times quality_k. \quad \text{(E2)}$$

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 $\Upsilon_1 < 0$ such that tariffs decrease the negative ϵ^{fob} (i.e., ϵ^{fob} becomes more negative), while $\Upsilon_2 > 0$ indicates that the effect of tariffs on ϵ^{fob} is smaller for higher quality exports.

Table E1: Perceived Elasticity of Demand

	(1)	(2)
ln Unit value	-15.951^{***} (4.272)	-17.758^{***} (4.542)
Quality	-0.108 (0.079)	-0.293^{***} (0.093)
ln (1 + Tariffs)	8.397 (5.287)	13.324^{**} (6.540)
ln Unit value × Quality	0.160^{***} (0.045)	0.200^{***} (0.051)
ln Unit value × ln Distance (Ψ_2)	2.264^{***} (0.518)	2.232^{***} (0.580)
ln Unit value × ln (1 + Tariffs) (Υ_1)	-6.185^{*} (3.743)	-7.740^{*} (4.118)
ln Distance × Quality	0.018^{*} (0.009)	0.041^{***} (0.012)
ln (1 + Tariffs) × Quality	-0.170^{**} (0.067)	-0.178^{**} (0.075)
ln Unit value × ln Distance × Quality (Ψ_4)	-0.024^{***} (0.006)	-0.027^{***} (0.007)
ln Unit value × ln (1 + Tariffs) × Quality (Υ_2)	0.070^{*} (0.041)	0.088^{*} (0.046)
R-squared	0.521	0.013
Observations	57,987	51,000
Estimation	OLS	IV
Kleibergen-Paap F	–	396.31

Notes: The dependent variable is the (log) export volume (in liters). Firm-destination-year fixed effects are included. Robust standard errors adjusted for clustering by destination-year 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).

We address the endogeneity of unit values in equation (E1) by instrumenting, in each time period, the unit value of each wine exported to a given country with its mean unit value on exports to other destinations (Irarrazabal et al., 2015). 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

[3] Instead of quality, Irarrazabal, Moxnes, and Opromolla (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. 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.

with the same interaction terms but with mean unit values.

The results are reported in Table E1. Column (1) reports OLS estimates, while in column (2) we instrument unit values and their interaction terms. 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_1 on the interaction between unit values and tariffs is negative, while the coefficient Υ_2 on the triple interaction between unit values, tariffs, and quality is positive. These results therefore indicate that the magnitude of ϵ^{fob} decreases with distance and increases with tariffs, but in both cases the effect is weaker for higher quality exports.

References

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

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

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

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.

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.

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

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.

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.

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

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

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

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.