Markups, Quality, and Trade Costs

Natalie Chen

University of Warwick and CEPR

Luciana Juvenal

International Monetary Fund

Motivations

- Firm-level markups are variable (Berman et al., 2012; De Loecker et al., 2016; Simonovska, 2015). But surprisingly, there is no evidence of
  - How the markups of exporters vary across destinations depending on trade costs (bilateral distance or tariffs)
  - How quality shapes the response of markups to changes in trade costs
- Markups rise with distance, fall with tariffs, especially for lower quality exports
- Our findings thus contribute to understanding why prices increase with distance
  - A larger share of higher quality and more expensive goods is exported to more distant countries (a *composition effect* due to per-unit trade costs, Alchian & Allen, 1964; or a *selection effect*)
  - Here: conditional on quality, exporters *price discriminate* (variable markups)

This Paper

Theory

- Builds on Martin (2012) where trade costs are both ad valorem and per unit
  - Ad valorem (iceberg, multiplicative) costs: percentage of the producer price per unit traded
  - Per-unit (additive, specific) costs: constant cost per unit traded
- Monopolistic competition; CES demand; per-unit costs generate variable markups
- For a given quality, export prices and markups depend positively on per-unit trade costs (distance), and negatively on ad valorem trade costs (tariffs)
- The magnitude of the effects of trade costs (distance and tariffs) on prices and markups falls with quality (heterogeneity)

Empirics

- Firm-level exports of Argentinean wines (name, type, grape, vintage year) 2002Q1–2009Q4 combined with two wine ratings (Wine Spectator and Parker)
  - Compare the unit values of individual wines exported by a given producer at a given point in time across destinations, **holding quality constant**
  - Identify **markup variation** by including (firm-)product-time fixed effects
  - **External measure of quality:** explore how firms set unit values and markups across destinations depending on the quality they export
  - **FOB exports**: abstract from transportation and distribution costs

Results

- On average **unit values** rise and fall by 2.74 and 1.37 percent if distance or tariffs double

- These effects can be explained by **variable markups**
  - If distance or tariffs double, markups rise and fall by 1.47 and 1.04 percent
  - Markups explain half (three quarters) of the effect of distance (tariffs) on the variation in within firm unit values across destinations
  - The rest is due to selection/composition effects across products within firms

- The effects of trade costs on markups are smaller for higher quality exports: at the 5^{th} percentile (quality distribution), markups rise and fall by 3.67 and 2.73 percent if distance or tariffs double; no changes at the 95^{th} percentile

Model

- Trade costs t_{ij} are defined as (Martin, 2012)

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

where p_{ij}^{cif} and p_{ij}^{fob} are the CIF and FOB prices of a monopolistically competitive firm i exporting to country j, and $\tau_{ij} \geqslant 1$ and $T_{ij} \geqslant 0$ are ad valorem and per-unit trade costs

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

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

where $c_i\left(\theta\right)$ is the marginal cost of firm i which rises with quality θ (exogenous)

- When firm i maximizes profits subject to a CES demand

$$p_{ij}^{cif} = \frac{\sigma}{\sigma - 1}\left(T_{ij} + \tau_{ij} c_i(\theta)\right) \tag{3}$$

- This yields the FOB price

$$p_{ij}^{fob} = \frac{1}{\sigma - 1}\left(\frac{T_{ij}}{\tau_{ij}} + \sigma c_i(\theta)\right) \tag{4}$$

  - A higher quality θ sells at a higher price
  - If $T_{ij} = 0$, the price is a constant markup over marginal costs $\sigma/(\sigma - 1)$. Prices and markups do not depend on trade costs
  - If $T_{ij} > 0$, for a given θ the price and markup rise with T_{ij}, fall with τ_{ij}
  - If $\tau_{ij} = 1$, the price and markup increase with trade costs

Bilateral Distance

Assume that T_{ij} rises with distance (Hummels and Skiba, 2004; Irarrazabal et al., 2015). The elasticity of the FOB price and markup μ^{fob} with respect to T_{ij} is

$$\epsilon_T^{p^{fob}} = \epsilon_T^{\mu^{fob}} = \frac{1}{\left(1 + \frac{\sigma c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} > 0 \tag{5}$$

The two elasticities are the same as $c_i(\theta)$ does not vary across destinations

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

Empirically, we expect the coefficient on distance to be positive, and the coefficient on the interaction between distance and quality to be negative

Tariffs

The elasticity of the FOB price and markup with respect to ad valorem trade costs τ_{ij}, such as tariffs, is

$$\epsilon_{\tau}^{p^{fob}} = \epsilon_{\tau}^{\mu^{fob}} = \frac{-1}{\left(1 + \frac{\sigma c_i(\theta)}{T_{ij}/\tau_{ij}}\right)} < 0 \tag{6}$$

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

Empirically, we expect the coefficient on tariffs to be negative, and the coefficient on the interaction between tariffs and quality to be positive

Mechanisms

T_{ij} generates an elasticity of demand to the FOB price ϵ^{fob} that depends on trade costs and quality (Crozet et al., 2012; Irarrazabal et al., 2015; Martin, 2012)

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

- If trade costs are ad valorem only ($T_{ij} = 0$), $\epsilon^{cif} = \epsilon^{fob} = -\sigma$
- If $T_{ij} > 0$, the elasticity of ϵ^{fob} with respect to T_{ij} is negative and rises with quality: prices increase with distance, but by less for higher quality exports
- Conversely, the elasticity of ϵ^{fob} with respect to τ_{ij} is positive and falls with quality: prices fall in high-tariff countries, but by less for higher quality exports

Alternative Demand Systems

Our predictions can be derived using non-CES preferences (Irarrazabal et al., 2015)

- Translog preferences (Feenstra, 2003)
- Additively quasi-separable utility (Behrens and Murata, 2007)
- But not with quadratic, non-separable utility (Ottaviano et al., 2002)

Trade Customs Data

- Argentinean firm-level exports (Chen & Juvenal, 2016, 2018)
  - Name of exporter
  - Destination country
  - Date of shipment (2002–2009) but 2002Q1 to 2009Q4
  - Product (wine name, type, grape, vintage year, container type)
- FOB value (US dollars); volume (liters); unit values at firm-product-destination-quarter level
- Exclude the shipments with less than 4.5 liters
- Each wine is exported by one producer only (exclude wholesalers/retailers)
- Unit values can plausibly be interpreted as **prices**

Quality

Two ratings at the name-grape-type-vintage level (Chen & Juvenal, 2016, 2018)

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

- Wine Spectator: 237 exporters, 8,361 wines (quality 55–97), 11,158 products, 95 destinations 2002Q1–2009Q4 (91,810 obs.) – 41% of total exports

- Parker: 2,960 wines (quality 72–98), 4,128 products – 24% of total exports

Markups, Quality, and Trade Costs

We estimate

$$\begin{aligned} \ln uv_{ijk,t} &= \alpha_1 \ln dist_j + \alpha_2 \ln dist_j \times quality_k + \alpha_3 \ln tar_{j,t} \\ &\quad + \alpha_4 \ln tar_{j,t} \times quality_k + \alpha_5 z_{j,t} + D_{k,t} + \varepsilon_{ijk,t} \end{aligned} \tag{8}$$

- $dist_j$ is distance (CEPII); $tar_{j,t}$ is one plus tariff (TRAINS, HS 2204 annual)
- $z_{j,t}$ includes annual (log) GDP, GDP/capita, remoteness (WDI)
- $\alpha_1 + (\alpha_2 \times quality_k) > 0$ with $\alpha_2 < 0$ (Prediction 1)
- $\alpha_3 + (\alpha_4 \times quality_k) < 0$ with $\alpha_4 > 0$ (Prediction 2)

Proceed with

$$\ln uv_{ijk,t} = \phi_1 \ln dist_j \times quality_k + \phi_2 \ln tar_{j,t} \times quality_k + D_{k,t} + D_{ij,t} + \upsilon_{ijk,t} \tag{9}$$

Table 5: Homogeneous Trade Cost Effects

	(1)	(2)	(3)	(4)
ln distance	0.042^{***} (0.008)	0.039^{***} (0.008)	0.021^{***} (0.005)	–
$2,900 \text{ km} \leq \text{distance} < 7,700 \text{ km}$	–	–	–	0.008 (0.008)
$7,700 \text{ km} \leq \text{distance} < 14,200 \text{ km}$	–	–	–	0.040^{***} (0.012)
$\text{distance} \geq 14,200 \text{ km}$	–	–	–	0.054^{***} (0.012)
quality	–	0.032^{***} (0.001)	–	–
ln tariffs	-0.115^{***} (0.040)	-0.113^{***} (0.040)	-0.086^{***} (0.022)	–
$16\% \leq \text{tariffs} < 32\%$	–	–	–	0.005 (0.009)
$32\% \leq \text{tariffs} < 48\%$	–	–	–	-0.022^{**} (0.010)
$\text{tariffs} \geq 48\%$	–	–	–	-0.040^{***} (0.012)
Observations	91,307	91,307	71,952	71,952
Fixed effects	it and p	it and p	kt	kt

*** and ** indicate significance at the one and five percent levels. GDP<0, GDP/cap>0 and rem>0

p indicates grape, type, vintage year, packaging, HS, and province fixed effects

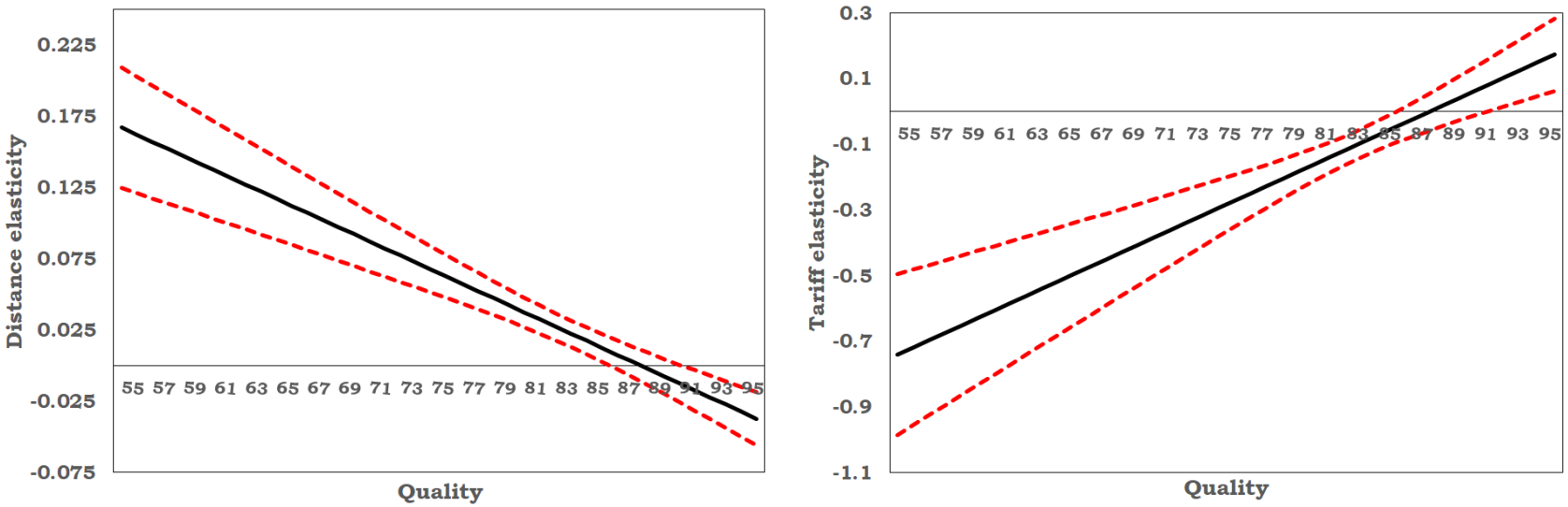
Table 6: Heterogeneous Trade Cost Effects

	(1)	(2)
ln distance	0.446^{***}	–
	(0.061)	
ln distance × quality	-0.005^{***}	-0.003^{***}
	(0.001)	(0.001)
ln tariffs	-1.986^{***}	–
	(0.362)	
ln tariffs × quality	0.022^{***}	0.027^{***}
	(0.004)	(0.004)
Observations	71,952	66,941
Fixed effects	kt	kt and ijt

*** indicates significance at the one percent level

GDP, GDP/cap and remoteness included in (1) but not reported

- In (1), distance elasticity is 0.022 (mean), 0.052 (5^{th}), and -0.007 (95^{th} percentile, insig.)
- Tariff elasticity is -0.094 (mean), -0.227 (5^{th}), and 0.039 (95^{th} percentile, insig.)



(a) Distance elasticity (b) Tariff elasticity

Figure 2: Bilateral distance and tariff elasticities by quality level (based on the estimates reported in column 1 of Table 6). 95 percent confidence intervals reported as dashed lines

Alternative Mechanisms

Foreign Competition

- σ (constant in the model) affects $\epsilon_T^{\mu^{fob}}$ and $\epsilon_\tau^{\mu^{fob}}$
- We estimate σ by destination and quality (Imbs and Méjean, 2015)
  - By quality: σ is 17.71 (*Low*), 11.82 (*Medium*), 8.37 (*High*)
  - By quality/country: σ 1.41–41.73; falls with quality (-16.9 percent)

Country-Level Factors

- Interact US dollar bilateral exchange rate with quality (Chen and Juvenal, 2016)
- Interact foreign real GDP per capita with quality (Chen and Juvenal, 2018)
- Interact quality with each country's wine production/consumption per capita

Extensions

- Heterogeneity is stronger for exports to richer countries
- Heterogeneity is driven by the higher quality firms, the larger firms, and the exporters with larger export market shares
- Other manufacturing industries (markups not identified; we estimate quality)
- Predictions for export volumes

Robustness

- Alternative samples (wholesalers/retailers; exclude 2002; port of exit; shipping mode; annual, monthly, transaction-level frequency; small shipments)
- IV tariffs (in wine producing countries, producers may lobby for protectionism)
- Export volumes interacted with quality (scale economies in transportation)
- Measurement of quality (Parker; 1–6; exclude "Great" wines; exclude the US; endogeneity; Khandelwal, 2010; lower versus higher quality wines)
- Selection bias across firms (Harrigan et al., 2015)
- Cross-sectional variation

Conclusions

- Firm-level markups vary across destinations depending on trade costs
- The effects of trade costs are **heterogeneous**, smaller for higher quality exports
- Our results are important
  - Variation in firm-level export unit values across markets is not only driven by quality differences but also by markup variation conditional on quality
  - Trade costs generate deviations from the LOOP (market segmentation)
  - Results are driven by high performance firms (bulk of aggregate exports)
- Our framework
  - Militates in favor of models featuring markups that vary across countries
  - Stresses the importance of modelling trade costs more flexibly
- Next step: understand the welfare implications of our results