Quality, Trade, and Exchange Rate Pass-Through*†

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Abstract

This paper investigates the heterogeneous response of exporters to real exchange rate fluctuations due to product quality. We model theoretically the effects of real exchange rate changes on the optimal price and quantity responses of firms that export multiple products with heterogeneous levels of quality. The model shows that the elasticity of demand perceived by exporters decreases with a real depreciation and with quality, leading to more pricing-to-market and to a smaller response of export volumes to a real depreciation for higher quality goods. We test empirically the predictions of the model by combining a unique data set of highly disaggregated Argentinean firm-level wine export values and volumes between 2002 and 2009 with experts wine ratings as a measure of quality. In response to a real depreciation, we find that firms significantly increase more their markups and less their export volumes for higher quality products, especially when exporting to higher income destination countries. These findings remain robust to different measures of quality, samples, specifications, and to the potential endogeneity of quality.

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1 Introduction

Exchange rate fluctuations have small effects on the prices of internationally traded goods. Indeed, empirical research typically finds that the pass-through of exchange rate changes to domestic prices is incomplete (or, in other words, import prices do not fully adjust to exchange rate changes).[1,2] A challenge for both economists and policymakers is to understand the reasons for incomplete pass-through as the latter has implications for the implementation of optimal monetary and exchange rate policies.[3] Possible explanations for partial pass-through include short run nominal rigidities combined with pricing in the currency of the destination market (Engel, 2003; Gopinath and Itskhoki, 2010; Gopinath, Itskhoki, and Rigobon, 2010; Gopinath and Rigobon, 2008), pricing-to-market strategies whereby exporting firms differentially adjust their markups across destinations depending on exchange rate changes (Atkeson and Burstein, 2008; Knetter, 1989, 1993), or the presence of local distribution costs in the importing economy (Burstein, Neves, and Rebelo, 2003; Corsetti and Dedola, 2005).[4]

Thanks to the increasing availability of highly disaggregated firm- and product-level trade data, a strand of the literature has started to investigate the heterogeneous pricing response of exporters to exchange rate shocks.[5] However, evidence on the role of product-level characteristics in explaining heterogeneous pass-through remains scarce. In order to fill this gap, this paper explores how incomplete pass-through can be explained by the quality of the goods exported. We model theoretically the effects of real exchange rate shocks on the pricing decisions of multi-product firms that are heterogeneous in the quality of the goods they export, and empirically investigate how such heterogeneity impacts exchange rate pass-through for export prices. Assessing the role of quality in explaining pass-through is a challenge as quality is generally unobserved. To address this issue we focus on the wine industry, which is an agriculture-based manufacturing sector producing differentiated products, and combine a unique data set of Argentinean firm-level destination-specific export values and volumes of highly disaggregated wine products with experts wine ratings as a directly observable measure of quality.[6]

The first contribution of the paper is to develop a theoretical model to guide our empirical specifications. Building on Berman, Martin, and Mayer (2012) and Chatterjee, Dix-Carneiro, and Vichyanond (2013), we extend the model of Corsetti and Dedola (2005) by allowing firms to produce and export multiple products with heterogeneous levels of quality. In the presence of additive (per unit) local distribution costs paid in the currency of the importing country, the model shows that the demand elasticity perceived by the firm falls with a real depreciation and with quality. As a result, following a

[1] For a survey of the literature, see Goldberg and Knetter (1997) and Burstein and Gopinath (2013).

[2] Incomplete pass-through therefore leads to deviations from the Law of One Price.

[3] As incomplete pass-through determines the extent to which currency changes affect domestic inflation in the importing economy, it has implications for the implementation of domestic monetary policy. In addition, as incomplete pass-through determines how currency depreciations can stimulate an economy by substituting foreign by domestic goods, it also has implications for the evolution of the trade balance and exchange rate policy (Knetter, 1989).

[4] In addition, Nakamura and Steinsson (2012) show that price rigidity and product replacements lead aggregate import and export price indices to appear smoother than they actually are, biasing exchange rate pass-through estimates.

[5] Many papers examine the response of import prices (which include transportation costs) or consumer prices (which further include distribution costs) to changes in currency values (e.g., Campa and Goldberg, 2005, 2010). For earlier evidence from the perspective of exporters, see Goldberg and Knetter (1997), Kasa (1992), or Knetter (1989, 1993). For more recent evidence, see Berman, Martin, and Mayer (2012), Chatterjee, Dix-Carneiro, and Vichyanond (2013), or Amiti, Itskhoki, and Konings (2012), among others.

[6] Other papers that focus on specific industries include Goldberg and Verboven (2001) and Auer, Chaney, and Sauré (2012) for the car industry, Hellerstein (2008) for beer, and Nakamura and Zerom (2010) for coffee.

change in the real exchange rate, exporters change their prices (in domestic currency) more, and their export volumes less, for higher quality products. Once we allow for higher income countries to have a stronger preference for higher quality goods, as the evidence from the empirical trade literature tends to suggest (Crinò and Epifani, 2012; Hallak, 2006), the heterogeneous response of prices and quantities to exchange rate changes due to quality is predicted to be stronger for higher income destination countries.

The second contribution of the paper is to bring the predictions of the model to the data. The firm-level trade data we rely on are from the Argentinean customs which provide, for each export flow between 2002 and 2009, the name of the exporting firm, the country of destination, the date of the shipment, the Free on Board (FOB) value of exports (in US dollars), and the volume (in liters) of each wine product exported. This allows us to compute FOB export unit values as a proxy for export prices at the firm-product-destination level. The level of disaggregation of the data is unique because for each wine we have its name, grape (Chardonnay, Malbec, etc.), type (white, red, or rosé), and vintage year. With such detailed information we can define a "product" in a much more precise way compared to the papers that rely on trade classifications such as the Harmonized System (HS) to identify products. As emphasized by Burstein and Jaimovich (2012), defining products at an aggregated level such as the HS is problematic as changes in the prices of these goods may reflect compositional or quality changes rather than changes in the prices of individual goods. In our case, as we define a product according to the name of the wine, its grape, type, and vintage year, compositional or quality changes are unlikely to affect movements in unit values. The sample we use for the estimations includes 6,720 different wines exported by 209 wine producers. The exporters in the sample are therefore multi-product firms.

In order to assess the quality of wines we rely on two well-known experts wine ratings, the Wine Spectator and Robert Parker. In both cases a quality score is assigned to a wine according to its name, grape, type, and vintage year which are characteristics we all observe in the customs data so the trade and quality data sets can directly be merged with each other. Quality is ranked on a (50,100) scale with a larger value indicating a higher quality. Our approach to measuring quality is similar to Crozet, Head, and Mayer (2012) who match French firm-level export data of Champagne with experts quality assessments to investigate the relationship between quality and trade. However, in contrast to our paper, they are unable to distinguish between the different varieties sold by each firm so each firm is assumed to export one type of Champagne only.

We then investigate the pricing strategies of exporters in response to real exchange rate fluctuations between trading partners (i.e., between Argentina and each destination country). Consistent with other firm-level studies, we find that pass-through for export prices is large: in our baseline regression, following a ten percent change in the real exchange rate exporters change their export prices (in domestic currency) by 1.4 percent so pricing-to-market is low and pass-through is high at 86 percent. Also, as expected, we find that higher quality is associated with higher prices. Most interestingly, we show that the response of export prices to real exchange rate changes increases with the quality of the wines exported, or in other words pass-through decreases with quality. A one standard deviation increase in quality from its mean level increases pricing-to-market by four percent. This heterogeneity in the response of export prices to exchange rate changes remains robust to different measures of quality, samples, and specifications. We also examine the heterogeneous response of export volumes to real exchange rate fluctuations. Export volumes increase following a real depreciation, but by less for higher quality goods. Finally, we find that the response of export prices (volumes) to real exchange rate changes increases (decreases) with quality by more for exports to higher income destination countries. Overall, our empirical results find strong support for the predictions of the model.

One concern with our estimations is the potential endogeneity of quality in explaining unit values and export volumes. Although both the Wine Spectator and Parker rating systems are based on blind tastings where the price of each wine is unknown, the tasters are told the region of origin or the vintage year and this might affect in a way or the other the scores they assign to the different wines, leading to an endogeneity bias. In order to overcome this issue, we use appropriate instruments for quality based on geography and weather-related factors, including the total amount of rainfall and the average temperatures during the growing season for each province where the grapes are grown, as well as the altitude of each of the growing regions of Argentina. We show that our main findings remain robust to the instrumentation of quality.

Our paper belongs to two strands of the literature. The first one is the vast literature on incomplete exchange rate pass-through and pricing-to-market. Among the papers that explore the determinants of heterogeneous pass-through from the perspective of exporting firms, Berman et al. (2012) find that highly productive French exporters change significantly more their export prices in response to real exchange rate changes, leading to lower pass-through. Chatterjee et al. (2013) focus on multi-product Brazilian exporters and show that within firms, pricing-to-market is stronger for the products the firm is most efficient at producing. Amiti, Itskhoki, and Konings (2012) find that Belgian exporters with high import shares and high export market shares have a lower exchange rate pass-through.[7]

Our paper is also related to Auer and Chaney (2009) and Auer, Chaney, and Sauré (2012) who explore the relationship between quality and pass-through. As the two papers rely on import and consumer prices data, respectively, their empirical analysis investigates exchange rate pass-through rather than the pricing-to-market behavior of exporting firms. Consistent with our paper, these authors predict that pass-through should be higher for lower quality goods.[8] Auer and Chaney (2009) do not find any evidence for such a relationship using import prices data for the US, where quality is inferred from trade unit values. In contrast, using a data set on the prices and numbers of cars traded in Europe, Auer et al. (2012) find some evidence that pass-through decreases with hedonic quality indices estimated from regressions of car prices on car characteristics such as weight, horse power, and fuel efficiency.

Second, this paper relates to the growing literature on quality and trade, which mostly relies on

[7] Other firm-level studies include Burstein and Jaimovich (2012), Campos (2010), Fitzgerald and Haller (2013), Fosse (2012), Li, Ma, Xu, and Xiong (2012), and Strasser (2013).

[8] Basile, de Nardis, and Girardi (2012) develop a model based on Melitz and Ottaviano (2008) and predict that exchange rate pass-through is lower for higher quality goods. By contrast, using a translog expenditure function to generate endogenous markups in a model where firms are heterogeneous in productivity and product quality, Rodríguez-López (2011) predicts that the response of markups to exchange rate shocks *decreases* with productivity and quality so that exchange rate pass-through *increases* with productivity and quality. In a related study, Yu (2013) shows theoretically that incomplete pass-through results from firms adjusting both their markups and the quality of their products in response to a change in the exchange rate.

trade unit values in order to measure quality.[9] At the country-level, Hummels and Klenow (2005) and Schott (2004) focus on the supply-side and show that export unit values are increasing in exporter per capita income. On the demand-side, Hallak (2006) finds that richer countries have a relatively stronger demand for high unit value exporting countries. More recently, some papers have started to investigate how quality relates to the performance of exporters using firm-level data. Manova and Zhang (2012a) focus on Chinese firm-level export prices and find some evidence of quality sorting in exports. Kugler and Verhoogen (2012), Manova and Zhang (2012b), and Verhoogen (2008) highlight the correlation between the quality of inputs and of outputs focusing on Mexican, Chinese, and Colombian firms, respectively. Closest to our work is Crozet et al. (2012) who explain French firm-level export prices and quantities of Champagne by experts ratings as a measure of quality.[10]

The paper is organized as follows. In section 2 we present our model where firms export multiple products with heterogeneous levels of quality, and show how real exchange rate changes affect the optimal price and quantity responses of exporters. Section 3 describes our firm-level exports customs data, the wine experts quality ratings, and the macroeconomic data we use. Section 4 presents our main empirical results while section 5 addresses endogeneity. Section 6 discusses some extensions while section 7 provides robustness checks. Section 8 concludes.

2 A Model of Pricing-to-Market and Quality

Berman et al. (2012) extend the model with distribution costs of Corsetti and Dedola (2005), allowing for firm heterogeneity where single-product firms differ in their productivity. They show that the elasticity of demand perceived by the exporter falls with a real depreciation and productivity, leading to variable markups which increase with a real depreciation and productivity. This leads to heterogeneous pricing-to-market where more productive exporters change their prices more than others following a change in the real exchange rate.[11] In their appendix, Berman et al. (2012) show that a similar result holds if firms differ in the quality of the (single) good they export: firms that export higher quality goods change their export prices more than others in response to a real exchange rate change.

Chatterjee et al. (2013) extend the model of Berman et al. (2012) to multi-product firms. Inspired by Mayer, Melitz, and Ottaviano (2014), each firm is assumed to be most efficient at producing a key variety which is the firm's "core competency," and the further away a variety is from the core, the relatively less efficient each firm is at producing this variety.[12] In response to a change in the real exchange rate, exporters vary their prices more for the products closer to their core competency, which in turn have a higher efficiency and therefore *smaller marginal costs.*

In what follows, we build on Berman et al. (2012) and Chatterjee et al. (2013) and extend the model of Corsetti and Dedola (2005), allowing for firm heterogeneity in the quality of the goods exported.

[9] This approach is criticized by, among others, Khandelwal (2010) who compares exporters' market shares conditional on price to infer the quality of exports.

[10] For additional evidence on the relationship between quality and trade, see Baldwin and Harrigan (2011), Hallak and Sidivasan (2011), Hummels and Skiba (2004), or Johnson (2012), among others.

[11] Berman et al. (2012) obtain similar predictions when using the models with endogenous and variable markups of Melitz and Ottaviano (2008) and Atkeson and Burstein (2008). In this paper, we only focus on the Corsetti and Dedola (2005) model as our goal is simply to derive a number of predictions that can be tested in the data.

[12] Li et al. (2012) also model multi-product firms by ranking products according to their importance for the firm.

Given that most firms in our data set export multiple products, we model them as multi-product firms which therefore differentiates us from Berman et al. (2012) who focus on single-product firms. In contrast to the multi-product firms model of Chatterjee et al. (2013), we rank the different goods produced by each firm in terms of quality rather than efficiency, where higher quality is associated with *higher marginal costs*.[13] We then look at how changes in real exchange rates affect the optimal price and quantity responses of exporters and derive some testable implications that can be taken to the data.

2.1 The Basic Framework

The Home country (Argentina in our case) exports to multiple destinations in one sector characterized by monopolistic competition. The representative agent in destination country j has preferences over the consumption of a continuum of differentiated varieties given by[14]

$$U(C_j) = \left[\int_{\Psi} [s(\varphi) x_j(\varphi)]^{\frac{\sigma-1}{\sigma}} \, d\varphi \right]^{\frac{\sigma}{\sigma-1}}, \tag{1}$$

where $x_j(\varphi)$ is the consumption of variety φ, $s(\varphi)$ the quality of variety φ, and $\sigma > 1$ the elasticity of substitution between varieties.[15] The set of available varieties is Ψ. 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.

Firms are multi-product and heterogeneous in product quality. The parameter φ, which denotes each variety, indicates how efficient each firm is at producing each variety so φ has both a firm- and a product-specific component. Each firm produces one "core" product, but in contrast to Chatterjee et al. (2013) or Mayer et al. (2014) who consider that a firm's core competency lies in the product it is most efficient at producing – and which therefore has lower marginal costs – we assume that a firm's core competency is in its product of superior quality which entails higher marginal costs (Manova and Zhang, 2012b).

The efficiency associated with the core product is given by a random draw Φ so each firm is indexed by Φ. Let us denote by r the rank of the products in increasing order of distance from the firm's core, with $r = 0$ referring to the core product with the highest quality. Firms then observe a hierarchy of products based on their quality levels. A firm with core efficiency Φ produces a product r with an efficiency level φ given by

$$\varphi(\Phi, r) = \Phi \vartheta^r, \tag{2}$$

where $\vartheta > 1$. Products with smaller r (higher quality) are closer to the core and therefore have a lower

[13] Higher quality goods are typically assumed to have higher marginal costs because they require higher quality – and therefore more expensive – inputs. See Crinò and Epifani (2012), Hallak and Sivadasan (2011), Johnson (2012), Kugler and Verhoogen (2012), Manova and Zhang (2012a), and Verhoogen (2008).

[14] For similar preferences, see Baldwin and Harrigan (2011), Berman et al. (2012), Crozet et al. (2012), Johnson (2012), Kugler and Verhoogen (2012), and Manova and Zhang (2012b).

[15] As in Kugler and Verhoogen (2012), quality is treated as single-dimensional and is therefore only chosen by firms.

efficiency $\varphi(\Phi, r)$. Higher quality goods have a lower efficiency because they have higher marginal costs

$$s(\varphi(\Phi, r)) = \left(\frac{w}{\varphi(\Phi, r)}\right)^{\lambda}, \tag{3}$$

where $\lambda > 1$ implies that markups increase with quality and w is the wage of the Home country (Berman et al., 2012).[16] The closer a product is from the core with the highest quality (i.e., the smaller r), the lower is efficiency $\varphi(\Phi, r)$, and the higher are marginal costs and quality $s(\varphi(\Phi, r))$.

Firms face three types of transaction costs: an iceberg trade cost $\tau_j > 1$ (between Home and destination j), a fixed cost of exporting F_j (which is the same for all firms and products and only depends on destination j), and an additive (per unit) distribution cost in destination j.[17] The latter captures any wholesale and retail costs associated with the selling, storage, marketing, advertising, or transport of the goods that are to be paid in the currency of the destination country. If distribution requires η_j units of labor in country j per unit sold and w_j is the wage rate in country j, distribution costs are given by $\eta_j w_j s(\varphi(\Phi, r))$. As in Berman et al. (2012), we assume that higher quality goods have higher distribution costs.[18] Most importantly, as distribution is outsourced so that distribution costs are paid in the currency of the importing country, they are unaffected by changes in the exchange rate and by the efficiency of the exporter in producing each good.

In units of currency of country j, the consumer price in j of a variety exported from Home to j is

$$p_j^c(\varphi) \equiv \frac{p_j(\varphi(\Phi, r))\tau_j}{\varepsilon_j} + \eta_j w_j s(\varphi(\Phi, r)), \tag{4}$$

where $p_j(\varphi)$ is the export price of the good exported to j, expressed in Home currency, and ε_j is the nominal exchange rate between Home and j. It is straightforward to see that any change in the exchange rate ε_j will lead to a less than proportional change in the consumer price $p_j^c(\varphi)$ (i.e., incomplete pass-through) given that local distribution costs are unaffected by currency fluctuations.[19] The quantity demanded for this variety in country j is

$$x_j(\varphi) = Y_j P_j^{\sigma-1} \left[\frac{p_j(\varphi(\Phi, r)\tau_j}{s(\varphi(\Phi, r))\varepsilon_j} + \eta_j w_j\right]^{-\sigma}, \tag{5}$$

where Y_j and P_j are country j's income and aggregate price index, respectively.[20] The costs, in currency of the Home country, of producing $x_j(\varphi)\tau_j$ units of each good (inclusive of transportation costs) and

[16] See Crinò and Epifani (2012) and Hallak and Sivadasan (2011) for models where marginal costs decrease with firm level productivity and increase with product quality.

[17] We do not model entry and exit in export markets. See Campos (2010) for the implications of entry and exit decisions on exchange rate pass-through.

[18] The assumption that higher quality goods have higher distribution costs is crucial for the predictions of the model. In the empirical analysis we provide evidence suggesting that higher quality wines are subject to higher distribution costs.

[19] The evidence in the literature suggests that local distribution costs are economically important. Burstein et al. (2003) show that distribution costs represent between 40 and 60 percent of the final retail prices across countries. Campa and Goldberg (2010) provide some evidence that local distribution costs, which represent between 30 and 50 percent of the total costs of goods exported by 21 OECD countries in 29 manufacturing industries, decrease the pass-through of exchange rates into import prices. For the beer industry, Hellerstein (2008) shows that incomplete pass-through can be explained by markup adjustments and the presence of local costs in roughly similar proportions.

[20] The aggregate price index in country j is given by $P_j = \left[\int_{\Psi} p_j(\varphi)^{1-\sigma} d\varphi\right]^{\frac{1}{1-\sigma}}$.

selling them to country j are

$$c_j(\varphi) = \frac{wx_j\left(\varphi(\Phi,r)\right)\tau_j}{\varphi(\Phi,r)} + F_j. \tag{6}$$

Expressed in Home currency, the profit maximizing export price for each product the firm exports to country j is

$$p_j(\varphi) = \frac{\sigma}{\sigma-1}\left(1+\frac{\eta_j q_j \varphi(\Phi,r) s\left(\varphi(\Phi,r)\right)}{\sigma\tau_j}\right)\frac{w}{\varphi(\Phi,r)} = m\left(\varphi(\Phi,r)\right)\frac{w}{\varphi(\Phi,r)}, \tag{7}$$

where $q_j \equiv \varepsilon_j w_j/w$ is the real exchange rate between Home and j. In contrast to the standard Dixit-Stiglitz markup (Dixit and Stiglitz, 1977), the presence of local distribution costs leads to variable markups $m\left(\varphi(\Phi,r)\right)$ over marginal costs that are larger than $\frac{\sigma}{\sigma-1}$, increase with quality $s\left(\varphi(\Phi,r)\right)$, the real exchange rate q_j (i.e., a real depreciation), and local distribution costs η_j.[21]

The volume of exports $x_j\left(\varphi\right)$ is given by

$$x_j\left(\varphi\right) = \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} Y_j P_j^{\sigma-1}\left[\frac{w}{\varphi(\Phi,r)s(\varphi(\Phi,r))\varepsilon_j}\tau_j + \eta_j w_j\right]^{-\sigma} \tag{8}$$

so the elasticity (in absolute value) of the exporter's demand $x_j(\varphi)$ with respect to the export price $p_j(\varphi)$ is

$$e_j = \left|\frac{\partial x_j(\varphi)}{\partial p_j(\varphi)}\frac{p_j(\varphi)}{x_j(\varphi)}\right| = \frac{\sigma\tau_j + \eta_j q_j \varphi(\Phi,r)s(\varphi(\Phi,r))}{\tau_j + \eta_j q_j\varphi(\Phi,r)s(\varphi(\Phi,r))}, \tag{9}$$

which is decreasing in quality and with a real depreciation. For a product that is closer to the core, quality is higher, the elasticity of demand is smaller, and the markup is higher. The model leads to two predictions on the effects of exchange rate changes on export prices and quantities that can be tested in the data.

Prediction 1 *The firm- and product-specific elasticity of the export price $p_j(\varphi)$ to a change in the real exchange rate q_j, denoted by e_{p_j} and which captures the degree of pricing-to-market, increases with the quality of the good exported, $s(\varphi(\Phi,r))$:*

$$e_{p_j} = \left|\frac{\partial p_j(\varphi)}{\partial q_j}\frac{q_j}{p_j(\varphi)}\right| = \frac{\eta_j q_j\varphi(\Phi,r)s(\varphi(\Phi,r))}{\sigma\tau_j + \eta_j q_j\varphi(\Phi,r)s(\varphi(\Phi,r))}.$$

Prediction 2 *The firm- and product-specific elasticity of the volume of exports $x_j(\varphi)$ to a change in the real exchange rate q_j, denoted by e_{x_j}, decreases with the quality of the good exported, $s(\varphi(\Phi,r))$:*

$$e_{x_j} = \left|\frac{\partial x_j(\varphi)}{\partial q_j}\frac{q_j}{x_j(\varphi)}\right| = \frac{\sigma\tau_j}{\tau_j + \eta_j q_j\varphi(\Phi,r)s(\varphi(\Phi,r))}.$$

[21] To see how the markup increases with quality, let us rewrite the markup as

$$m\left(\varphi\left(\Phi,r\right)\right) = \frac{\sigma}{\sigma-1}\left(1+\frac{\eta_j q_j\left(\Phi\vartheta^r\right)^{1-\lambda}\left(\omega\right)^{\lambda}}{\sigma\tau_j}\right).$$

As $\lambda > 1$, a smaller r (i.e., a higher quality) increases the markup.

Intuitively, the mechanism is the following. A real depreciation reduces the elasticity of demand perceived by exporters in the destination country, which allows all firms to increase their markups. As higher quality goods have a smaller elasticity of demand, their markups can therefore be increased by more than for lower quality goods. This leads to heterogeneous pricing-to-market which is stronger for higher quality goods (i.e., pass-through is lower). In turn, this implies that the response of export volumes to a real depreciation decreases with quality. This mechanism is similar to Berman et al. (2012) and Chatterjee et al. (2013), although their focus is on productivity differences in driving heterogeneous pricing-to-market across exporters, or exporters and products, respectively.

It is important to note that our model derives a general relation between quality and pass-through that could hold for any market in particular, and is therefore not specific to the wine sector. The reason why we focus on the wine market in the empirical analysis is because it provides us with an observable measure for quality. Appendix A however discusses how the features of the wine industry can be reconciled with the main assumptions of the model, and illustrates that higher quality wines are on average more expensive, and are likely to have higher marginal costs, higher distribution costs, and higher markups, both at the retail and producer-levels. The empirical analysis in section 4.1 also provides evidence suggesting that higher quality wines are subject to higher distribution costs.

2.2 Cross-Country Heterogeneity in the Preference for Quality

In the previous section, we assumed that the preference for quality is homogeneous across destination countries. The evidence in the literature however suggests that consumer preferences for quality may vary from one country to the other as preferences are affected by per capita income. In particular, consumers in richer countries are expected to have stronger preferences for higher quality products so the consumption of higher quality goods is increasing in per capita income.[22] Hallak (2006) finds that rich countries tend to import relatively more from countries that produce higher quality goods. We therefore extend the model to allow for non-homothetic preferences for quality.[23]

The utility function becomes

$$U(C_j) = \left[\int_{\Psi} \left[s(\varphi, y_j) x_j(\varphi) \right]^{\frac{\sigma-1}{\sigma}} d\varphi \right]^{\frac{\sigma}{\sigma-1}}, \tag{10}$$

where we replace $s(\varphi)$ by $s(\varphi, y_j)$ to capture that the intensity of preference for quality can increase in per capita income, y_j (Crinò and Epifani, 2012; Hallak, 2006). Local distribution costs $\eta_j w_j s(\varphi, y_j)$ are thus higher in higher income countries.[24] This allows us to derive two additional predictions that can be tested in the data.

[22] Crinò and Epifani (2012) find that the preference for quality is on average 20 times larger in the richest (the US) than in the poorest location (Africa) in their sample. Verhoogen (2008) assumes that Northern consumers are more willing to pay for quality than Southern consumers. Manova and Zhang (2012a) find that Chinese exporters charge higher FOB prices for the same product when exported to richer destination countries. Fajgelbaum, Grossman, and Helpman (2011) develop a model where consumers have heterogeneous incomes and tastes and predicts that the proportion of consumers who buy higher quality goods is increasing in income.

[23] Differences in consumer preferences across countries could also be due to specific consumer tastes or needs. For instance, US consumers have a preference for fruiter wines with less alcoholic content while Europeans prefer less fruity wines with higher alcohol content (Artopoulos, Friel, and Hallak, 2011).

[24] Using data from the World Bank national income comparison project, Dornbusch (1989) shows that the prices of services are lower in poor than in rich countries, suggesting that local distribution costs are lower in low income countries.

Prediction 3 *The firm- and product-specific elasticity of the export price $p_j(\varphi)$ to a change in the real exchange rate q_j, denoted by e_{p_j}, increases with the quality of the good exported $s(\varphi(\Phi, r), y_j)$, and by more for higher income than for lower income destination countries:*

$$e_{p_j} = \left| \frac{\partial p_j(\varphi)}{\partial q_j} \frac{q_j}{p_j(\varphi)} \right| = \frac{\eta_j q_j \varphi(\Phi, r) \, s(\varphi(\Phi, r), y_j)}{\sigma \tau_j + \eta_j q_j \varphi(\Phi, r) \, s(\varphi(\Phi, r), y_j)}.$$

Prediction 4 *The firm- and product-specific elasticity of the volume of exports $x_j(\varphi)$ to a change in the real exchange rate q_j, denoted by e_{x_j}, decreases with the quality of the good exported $s(\varphi(\Phi, r), y_j)$, and by more for higher income than for lower income destination countries:*

$$e_{x_j} = \left| \frac{\partial x_j(\varphi)}{\partial q_j} \frac{q_j}{x_j(\varphi)} \right| = \frac{\sigma \tau_j}{\tau_j + \eta_j q_j \varphi(\Phi, r) \, s(\varphi(\Phi, r), y_j)}.$$

3 Data and Descriptive Statistics

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

3.1 Firm-Level Exports Customs Data

Before the 1990s, Argentinean wines were rarely exported to international markets. Since then, wine exports started to gain strength thanks to the successful strategies implemented by one of the main wine producers, Nicolás Catena Zapata.[25] Catena played a key role in making Argentinean wines internationally recognized, and the growth in the wine sector that followed was hence spectacular: by the mid-2000s, Argentina was the eighth largest wine exporter and the fifth wine producer in the world.[26] During the 2000s, the sector continued to boom and exports more than tripled between 2002 and 2009.

The firm-level exports data we use are from the Argentinean customs and are provided to us by a private vendor called Nosis. For each export flow we have the name of the exporting firm, the country of destination, the date of declaration, the 12-digit HS classification code, the FOB value of exports (in US dollars), and the volume (in liters) exported between 2002 and 2009.[27] We also have the name

[25] For further insights about the Argentinean wine industry, see Artopoulos et al. (2011). Catena is considered as an "export pioneer" in the Argentinean wine industry as he is the first to have established a stable presence in the markets of developed economies thanks to a strong knowledge about foreign markets and in particular the US. For instance, he promoted Argentinean wines by organizing a "promotional tour that included a sophisticated tango-dance show so as to associate his wines with other recognized symbols of high quality in Argentina" (Artopoulos et al., 2011). He also had his wines reviewed by specialized magazines such as the Wine Spectator, and the positive reviews he received helped him to promote his wines abroad.

[26] For a detailed list of wine production by country, see http://www.wineinstitute.org.

[27] Due to confidentiality reasons imposed by Argentinean law, the customs data cannot make the name of the exporter public. However, after buying the data directly from Argentinean customs, Nosis combines its own market knowledge with an algorithm that compares export transactions in order to generate a "first probable exporter," a "second probable exporter," and a "third probable exporter." To determine the exporter's identity we then proceeded as follows. Using from the Instituto Nacional de Vinticultura (INV) the names of all wines and of the firms authorized to produce and sell them we compared, for each wine name, the name of the first probable exporter with the authorized exporter reported by the INV. If this name coincided we kept the first probable exporter. Otherwise we repeated the same procedure with the second probable exporter, and finally with the third probable exporter. We identified 86 percent of the firms as "first

of the wine exported, its type (red, white, or rosé), grape (Malbec, Chardonnay, etc.), and vintage year. Figure 1 compares the total value of Argentina's wine exports from our customs data set with the value reported in the Commodity Trade Statistics Database (Comtrade) of the United Nations (HS code 2204). The data coincide extremely well.

Given that actual export prices are not available we proxy for them using the unit values of exports in local currency, computed as the ratio of the export value in Argentinean pesos divided by the corresponding export volume in liters.[28] In order to convert the value of exports (in US dollars) into pesos we use the peso to US dollar exchange rate in the month in which the shipment took place. We then aggregate the data at an annual frequency.[29]

We clean up the data in several ways. First, we drop any wine for which either the name, grape, type, or vintage year is missing, cannot be recognized, or is classified as "Undefined." As sparkling wines, dessert wines, and other special varieties do not have any vintage year, they are excluded from the data set. Second, we only keep the export flows recorded as FOB.[30] Third, as we are interested in how product quality affects the pricing and export decisions of wine producers, we restrict our analysis to the manufacturing sector and drop wholesalers and retailers. The Instituto Nacional de Vinticultura's (INV), the government's controlling body for the wine industry, provides us with the names of all the firms authorized to produce and sell wine, as well as their activity classification. We match the exporters names from the customs data with the list of firms provided by the INV and drop wholesalers and retailers. Fourth, due to the rise in inflation in 2007 and increasing worries of capital outflows, the government introduced some barriers to obtain import licenses which culminated in an extreme measure whereby firms were authorized to import if they exported goods for an equivalent value to those they intended to import.[31] As a result, firms unrelated to the wine industry (e.g., chemical manufacturers) ended up exporting wine so we drop them from the sample.[32] Fifth, we drop a number of typos which we are unable to fix. We exclude the very few cases where the vintage year reported is ahead of the year in which the exports took place. We also drop the few observations where the value of exports is positive but the corresponding volume is zero. Finally, we also exclude a few outliers: for each exporter, we drop the observations where unit values are larger or smaller than 100 times the median export unit value charged by the firm.

probable exporters," five percent as "second probable exporters," one percent as "third probable exporters," while the remaining eight percent could not be matched. In the sample we use for the estimations, these proportions become 96.5, three, one half and zero percent, respectively.

[28] In the paper we use the terms unit values and prices interchangeably.

[29] We show in the robustness section that our results hold when measuring unit values, export volumes, and exchange rates at a monthly frequency. The reason why we aggregate the data at an annual frequency for our benchmark regressions is that many of the other variables we use – such as the real effective exchange rate, real GDP, or GDP per capita, to name a few – are not available at a monthly frequency.

[30] Some flows are recorded as Cost, Insurance, and Freight, Delivered Duty Paid or Unpaid, Free Alongside Ship, etc.

[31] See http://www.ustr.gov/sites/default/files/2013%20NTE%20Argentina%20Final.pdf

[32] We discard a total of 157 firms which include wine wholesalers (20), wine retailers (2), unidentified firms (70), as well as firms that belong to the sectors of agriculture (5), soft drinks or malt liquors (6), textiles (6), chemicals (6), metals (1), paints, glass, and paper (3), machinery (1), motorcycles (1), and services industries (25) such as consultancy or book publishing firms. These firms represent 12,376 observations in the raw data set (at the transactions level) or 1.6 percent of the total FOB value of wine exported by Argentina between 2002 and 2009. Of the 157 firms, only 41 of them export wines that can be matched with the quality ratings from the Wine Spectator and these firms represent 0.17 percent of the total FOB value exported over the period (or 1,520 observations). In the final data set aggregated at a yearly frequency, these 41 firms represent 345 observations. In the robustness section, we show that including wholesalers and retailers does not affect our results.

The recent papers on heterogeneous pass-through typically define a "product" according to trade classifications such as the Harmonized System or the Combined Nomenclature (e.g., Amiti et al., 2012; Auer and Chaney, 2009; Berman et al., 2012; Chatterjee et al., 2013). As Table 1 shows, the 6-digit HS classification divides wines into four different categories according to whether they are sparkling or not, and to the capacity of the containers in which they are shipped (i.e., larger or smaller than two liters). Argentina further disaggregates the HS classification at the 12-digit level, but this only enlarges the number of different categories, or "products," to eleven.[33] The problem is that changes in unit values defined at this level may reflect compositional or quality changes rather than price changes as there may be more than one distinct product within a single HS code (Burstein and Jaimovich, 2012). In contrast, the detail provided by our data set allows us to define an individual product as a combination between a wine name, type, grape, vintage year, and the capacity of the container used for shipping (identified using the HS code) so that compositional or quality changes are unlikely to affect unit values.[34] Our cleaned sample includes a total of 21,647 different products/wines of which 6,720 can be matched with quality ratings. The 6,720 wines represent 43 percent of the total FOB value of red, white, and rosé wine exported between 2002 and 2009.[35]

We close this section with descriptive statistics on the sample we use for the estimations. Table 2 summarizes our trade data by year and shows that the exports included in our sample increased threefold between 2002 and 2009. A total of 794 wines were exported by 59 different firms in 2002, while in 2009 this increased to 151 firms exporting 1,833 different wines. Over the whole period, our sample includes 6,720 wines exported by 209 different wine producers.[36] As shown in the upper part of Table 3, these firms exported an average of 139 different wines, ranging from a minimum of one to a maximum of 510 (in the sample, only 15 firms appear as having exported one wine only; in reality, they exported more than one wine but only one could be matched with the quality ratings). Exporters charged between two cents and 381 US dollars per liter of wine exported, with an average of five US dollars per liter.[37] Firms exported to an average number of 40 different destinations, from a minimum of one to a maximum of 88. Table 4 shows that with the exception of Brazil, Argentinean wine exporters mostly sell to developed economies, the United States being the top destination market.

3.2 Quality Ratings

The editors of the Wine Spectator magazine review more than 15,000 wines each year in blind tastings and publish their rankings in several issues throughout the year.[38] The rankings are given on a (50,100) scale according to the name of the wine, its grape, type, and vintage year which are characteristics

[33] As we drop sparkling wines and sweet wines from the sample, the HS codes listed in Table 1, and which are included in our sample, are 22.04.21.00.200.F, 22.04.21.00.900.U, 22.04.29.00.200.B, 22.04.29.00.900.P, and 22.04.30.00.000.X.

[34] Also, in our data set each wine is produced and exported by one firm only while a product defined at the HS level can instead be produced, and therefore exported, by more than one firm.

[35] The issue of sample coverage is addressed in the robustness section.

[36] We observe 882 different wine names, 23 grapes, three types, and 22 vintage years (between 1977 and 2009).

[37] The Trade Unit Values Database developed by the CEPII uses the bilateral trade values and quantities collected by the United Nations to compute "reliable and comparable unit values across countries" (Berthou and Emlinger, 2011, p.3). At the 6-digit level of the HS classification, the FOB unit values of Argentinean wine exports between 2002 and 2009 vary between 7 cents and 16 US dollars per litre exported. Given the much finer disaggregation level of our data, unit values between 2 cents and 381 US dollars per litre exported do not sound unreasonable.

[38] See http://www.winespectator.com.

we all observe in the customs data set. A larger score implies a higher quality. Table 5 lists the six different categories the wines fall in depending on the score they are given.

We match the wines from the customs data set with the ones reviewed by the Wine Spectator by name, type, grape, and vintage year so that each wine is assigned a single quality ranking.[39] We end up with 6,720 wines exported by 209 firms over the 2002-2009 period. As can be seen from Table 3, the mean ranking is 85, the lowest-rated wine receives a score of 55, and the highest receives a score of 97. The distribution across wines is very symmetric as the mean and the median are both equal to 85. Our approach to measuring quality is similar to Crozet et al. (2012) who match French firm-level exports data of Champagne with experts quality assessments in order to investigate the relationship between quality and trade. However, due to data limitations they are unable to distinguish between the different varieties sold by each firm so each firm is assumed to export one type of Champagne only. In addition, their ratings are only measured on a (1,5) scale, where a larger value indicates a higher quality.

We rely on the Wine Spectator for our baseline regressions because it has the largest coverage of Argentinean wines. However, in the robustness section we check the sensitivity of our results using an alternative rating produced by Robert Parker.[40] Parker is a leading US wine critic who assesses wines based on blind tastings and publishes his consumer advice and rankings in a bimonthly publication, the Wine Advocate.[41] His rating system also employs a (50,100) point scale where wines are ranked according to their name, type, grape, and vintage year, and where a larger value indicates a higher quality. Table 5 lists the different categories considered by Parker. Compared to the Wine Spectator, the scores are slightly more generous (for instance, a wine ranked 74 is "Not recommended" by the Wine Spectator, but is "Average" according to Parker).[42] We match the customs data and the Parker ratings, keeping only the wines that are also ranked by the Wine Spectator.[43] Table 3 shows that the scores vary between 81 and 98 with an average of 87. Again, the distribution across wines is very symmetric as the mean and the median are equal. Figure 2 plots the Wine Spectator and Parker rankings. A total of 2,433 wines exported by 135 firms have rankings from both sources. The correlation between the two rankings is 0.53.

Table 6 provides a snapshot of our data. For confidentiality reasons we cannot report the exporter nor the wine names so these are replaced by numbers and letters instead. The table shows that, whether we use the Wine Spectator or the Parker ratings, individual firms export wines with heterogeneous levels of quality (between 76 and 90 for Firm 1 and 83 and 97 for Firm 2). In addition, higher quality wines are, on average, sold at a higher price. Finally, the table illustrates that the Law of One Price fails: in 2006, Firm 1 exported the same wine to two different destinations, but charged 11.98 US dollars per liter to the United States versus 15.07 dollars per liter to Poland. Similarly, in 2008 Firm 2

[39] The quality scores are time-invariant. Variations in quality due to ageing should therefore be captured by the vintage year fixed effects that we include throughout the regressions. Anecdotal evidence however suggests that the quality of Argentinean wines is not much affected by ageing.

[40] See https://www.erobertparker.com.

[41] Both the Wine Spectator and Parker are US-based wine ratings. Unfortunately, we were unable to find alternative rankings with a good coverage of Argentinean wines.

[42] Crozet et al. (2012) also note that Parker is slightly more generous compared to other raters of Champagne.

[43] If we include the wines that are unrated by the Wine Spectator, the customs data and the Parker ratings can be matched for 3,969 wines exported by 181 firms.

charged 18.78 dollars to the United States versus 10.99 dollars to Denmark for the same liter of wine exported to both destinations.

3.3 Macroeconomic Data

The data on GDPs and real GDPs per capita are from the Penn World Tables, and the consumer price indices (CPI) and nominal exchange rates from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). The real exchange rate is defined as the ratio of consumer price indices times the average yearly nominal exchange rate so an increase of the exchange rate captures a real depreciation of the peso. The nominal exchange rates are available for each country relative to the US dollar, which we convert to be relative to the Argentinean peso. The real effective exchange rates are sourced from the IFS and the Bank of International Settlements where an increase indicates a real depreciation. Bilateral distances are from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

During the 2002-2009 period, Argentina witnessed major nominal and real exchange rate fluctuations. Figure 3 illustrates the evolution of the monthly nominal and real exchange rates between the Argentinean peso and the US dollar. After the financial crisis of 2001, the fixed exchange rate system was abandoned and as a result in 2002 the peso depreciated both in nominal and real terms by up to 75 percent. The export boom that followed lead to a massive inflow of US dollars into the economy which helped to appreciate the peso against the dollar. The peso then remained stable – but slightly appreciated in real terms – until 2008 when it depreciated again with the advent of the global financial crisis and the increase in domestic inflation.

4 Empirical Analysis

Prediction 1 states that following a real depreciation, exporters increase their export prices and this increase is larger the higher quality is. In order to check whether this relationship holds in the data, we estimate the following reduced-form regression

$$\begin{aligned} \ln UV_{ij,t}^{k} &= \beta_1 \ln q_{j,t} + \beta_2 s^k + \beta_3 \ln q_{j,t} \times s^k + \xi_{it} + \mu_{ij} + \theta_{grape} + \zeta_{type} \\ &\quad + \gamma_{vintage} + \varrho_{HS} + \kappa_p + \epsilon_{ij,t}^{k} \end{aligned} \quad (11)$$

where $UV_{ij,t}^{k}$ is the export unit value of firm i exporting a product k to destination country j in year t, expressed in pesos per liter of wine exported and is our proxy for export prices. $q_{j,t}$ is the average real exchange rate between Argentina and country j in year t (an increase in $q_{j,t}$ captures a real depreciation). The quality of wine k is denoted by s^k where the Wine Spectator rankings are used in our benchmark specifications. Given the level of disaggregation of the data, changes in real exchange rates are assumed to be exogenous to the pricing (and quantity) decisions of individual firms.

The export price in the exporter's currency is a markup over marginal costs. As a result, in order to identify a pricing-to-market behavior which requires markups to respond to exchange rate changes, the regression needs to control for firm-specific marginal costs (Knetter, 1989, 1993).[44] Without any

[44] Distinguishing between changes in markups and changes in marginal costs is also important from a policy point of view. As noted by Burstein and Jaimovich (2012), changes in costs are efficient while changes in markups are not.

additional information on the characteristics of the exporters, we perform within estimations and control for time-varying firm-specific marginal costs by including firm-year fixed effects, ξ_{it}. Firm-destination fixed effects, μ_{ij}, are also included. As product fixed effects cannot be included (they are perfectly collinear with quality), we instead control for product characteristics by including grape θ_{grape}, type ζ_{type}, vintage year $\gamma_{vintage}$, HS ϱ_{HS}, and province p of origin κ_p fixed effects. Fixed effects for the wine names are not included as they are collinear with the firm fixed effects (because each wine is sold by one firm only). The coefficients to be estimated are β_1, β_2, and β_3, and $\epsilon^k_{ij,t}$ is an error term. Given that all variables are in levels (rather than first differences), the estimated coefficients can be thought of as capturing the long term response of unit values to changes in each of the explanatory variables. Finally, as quality takes on a single value for each product, robust standard errors are adjusted for clustering at the product-level.

Following a real depreciation, exporters are expected to increase their markups and therefore their export prices.[45] According to Prediction 1, this increase should be stronger for higher quality goods in which case β_3, the coefficient on the interaction between the real exchange rate and quality – which captures heterogeneous pricing-to-market – should be positive.

Prediction 2 relates to export volumes. It states that following a real depreciation, exporters increase their exports but by less for higher quality products. To test this prediction we estimate

$$\begin{aligned} \ln X^k_{ij,t} &= \alpha_1 \ln q_{j,t} + \alpha_2 s^k + \alpha_3 \ln q_{j,t} \times s^k + \alpha_4 Z_{j,t} + \xi_{it} + \mu_{ij} + \theta_{grape} + \zeta_{type} \\ &\quad + \gamma_{vintage} + \varrho_{HS} + \kappa_p + \epsilon^k_{ij,t} \end{aligned} \tag{12}$$

where $X^k_{ij,t}$ is the FOB export volume (in liters) of firm i exporting a product k to destination country j in year t.[46] To be consistent with standard gravity models we also include destination-year-specific variables $Z_{j,t}$ such as destination country's real GDP (deflated using each country's CPI), $GDP_{j,t}$, and real effective exchange rate $Q_{j,t}$ as a proxy for country j's price index (Berman et al., 2012). If a real depreciation increases exports and this increase is smaller for higher quality products, the coefficient on the interaction term α_3 should be negative.

4.1 Baseline Results

Panel A of Table 7 reports the results of estimating equation (11) for unit values. Column (1) only includes the exchange rate and quality as regressors and shows that higher quality wines are sold at a higher price, which is consistent with equation (7) and with the empirical findings of Crozet et al. (2012) for Champagne. When the real exchange rate fluctuates, exporters change their export prices: following a ten percent depreciation they raise their prices (in pesos) by 1.4 percent so that on average pricing-to-market is low and pass-through is high at 86 percent. This contrasts with the findings of the literature that focuses on import rather than on export prices, e.g., Gopinath and Rigobon (2008) find

[45] When the interaction term between the real exchange rate and quality is excluded from (11), β_1 is expected to be positive as it captures the degree of pricing-to-market and therefore the extent to which exporters vary their markups following a change in the exchange rate. This assumes that changes in marginal costs for goods produced in a given location do not depend on the destination where the goods are shipped. The degree of exchange rate pass-through for export prices is given by $(1 - \beta_1) \times 100$.

[46] We also tried to use as a dependent variable the value of exports deflated by the Argentinean CPI, as well as the number of export transactions by product for each firm to each destination in each year.

that exchange rate pass-through for import prices in the US is only 22 percent.[47] The large degree of pass-through we find for the wine industry is however consistent with the findings of other papers that use firm-level export data for the whole manufacturing sector. For instance, pass-through for export prices is estimated at 92 percent for French exporters (Berman et al., 2012), 94 percent for Chinese exporters (Li et al., 2012), 77 percent for Brazilian exporters (Chatterjee et al., 2013), 86 percent for Danish exporters (Fosse, 2012), and at 79 percent for Belgian exporters (Amiti et al., 2012).

The estimated coefficient on the exchange rate reported in column (1) however hides a significant amount of heterogeneity in the degree of pass-through across products. To see this, column (2) adds the interaction term between the exchange rate and quality. Its estimated coefficient is positive and significant which is evidence of heterogeneous pass-through, lending support to Prediction 1 in that the elasticity of export prices to a change in the real exchange rate increases with quality. These results are consistent with the theoretical predictions of Auer and Chaney (2009) and the empirical results of Auer et al. (2012).[48]

Both quality and pass-through may vary independently from each other over time. We therefore need to ensure that the negative relationship between quality and pass-through that we find is not due to pass-through being low when quality is high for some unrelated reasons. To address this possibility, column (3) interacts the real exchange rate with year dummies. Reassuringly, the coefficient on the interaction between the exchange rate and quality remains positive and significant.

Recall that the firm-year fixed effects we include in the regressions aim to control, among other factors, for the time-varying marginal costs of each exporter. Marginal costs can however vary across products as well, and as we assume in the model in section 2 – and discuss in appendix A – higher quality wines can be expected to have higher marginal costs. In order to control for time-varying, product-specific marginal costs (which are, as a matter of fact, also firm-specific), column (4) replaces the firm-year fixed effects by product-year fixed effects. The coefficient on quality is not estimated, but pricing-to-market is still stronger for higher than for lower quality wines.

Finally, in column (5) we check if our results hold in a difference-in-difference specification which includes destination-year, firm-destination, firm-year, and product fixed effects. Both the exchange rate and quality drop out from the regression, but the interaction term between the exchange rate and quality can be estimated. Again, the results show that the elasticity of export prices to exchange rates is larger for higher quality wines.

Panel B of Table 7 reports the results of estimating equation (12) for export volumes. From column (1), export volumes react positively to a real depreciation. The elasticity is large and equal to 1.916,

[47] One possible reason for low pricing-to-market and therefore high pass-through for export prices is transfer pricing between multinational firms exporting to foreign subsidiaries. If markups are not adjusted by exporters but by their subsidiaries in the destination country, pass-through could be complete for export prices but incomplete for consumer prices (Knetter, 1992). This scenario is unlikely in our case as our sample includes wine producers only and no multinational firms.

[48] In response to a change in the exchange rate, multi-product firms could also modify the composition of their exports and change the number of products they sell abroad (see Berman et al., 2012, for a discussion, and Chatterjee et al., 2013, for some evidence). One way of addressing this issue is to restrict the sample to firms exporting only one wine to each destination country (Berman et al., 2012). Given the level of disaggregation of our data, this reduces our sample size to 341 observations and the regression coefficients are, as a result, insignificant.

which is consistent with evidence in the literature that the trade elasticities for emerging economies are generally larger than for developed countries.[49] The coefficient on quality is negative and significant while the literature usually uncovers a positive relationship between trade and quality (for example, see Crozet et al., 2012). One crucial difference between our regressions and, for instance, Crozet et al. (2012), however, is that we estimate the *within-firm* effect of quality on export volumes. The negative coefficient on quality therefore indicates that when a firm exports several wines with different levels of quality to a given destination in a given year, the high quality wines are on average exported in smaller quantities than the low quality wines. This is consistent with San Martín, Troncoso, and Brümmer (2008) who observe that more sophisticated, higher quality wines are generally produced in smaller quantities, which in turn suggests that higher quality wines are subject to capacity constraints in production.

The interaction between the exchange rate and quality is included in column (2). Consistent with Prediction 2, it is negative and significant suggesting that the response of export volumes to exchange rates decreases with quality. This finding remains robust to interacting the exchange rate with year dummies (column 3), to controlling for time-varying product-specific marginal costs (column 4), and to a difference-in-difference specification (column 5).

For each regression in Table 7 we report a quantitative evaluation of the economic effects of quality. The lower parts of Panels A and B report the change in the exchange rate elasticities following a one standard deviation increase in quality from its mean level (i.e., a four point increase on the quality scale), as well as the elasticities for the lowest (with a ranking of 55) and highest quality (with a score of 97) wines included in the sample. For our benchmark regression reported in column (2), the unit values elasticity increases from 0.142 to 0.148 following a one standard deviation increase in quality from its mean level, which corresponds to a four percent increase in pricing-to-market. The elasticity for the lowest quality wine is equal to 0.095, indicating a pass-through rate of 90.5 percent. In contrast, for the highest quality wine the elasticity is equal to 0.161 so pass-through drops to 83.9 percent. In column (2) of Panel B, a one standard deviation increase in quality from its mean level reduces the volume elasticity from 1.904 to 1.881. The elasticity for the highest quality wine is equal to 1.831 and increases to 2.085 for the lowest quality wine.

A key ingredient of the model presented in section 2 is that higher quality goods have higher (per unit) distribution costs, where the latter may include any wholesale or retail costs associated with the selling, storage, marketing, advertising, or transport of each good in the destination country. Without this assumption, the model would predict that pricing-to-market *decreases* with quality.[50] In the case of wine, there are actually strong reasons to believe that, consistent with the model, higher quality wines have higher (per unit) distribution costs, especially at the top-end of the quality scale.[51] First of all, top quality wines are more likely to be sold in specialized wine stores than in supermarkets, where the former usually charge a higher margin because of the professional customer service they offer. In

[49] Very few studies estimate the sensitivity of exports to real exchange rate changes for Argentina. Using quarterly data between 1980 and 2010, one exception is Haltmaier (2011) who reports an elasticity of total manufacturing exports to changes in the real trade-weighted exchange rate of six.

[50] In our model, the prediction that pass-through decreases with quality crucially depends on higher quality goods having higher distribution costs. Using models that do not feature this assumption, Auer and Chaney (2009), Auer et al. (2012), and Basile, de Nardis, and Girardi (2012) also predict a negative relationship between pass-through and quality.

[51] See appendix A for additional evidence suggesting that distribution costs increase with the quality of wine.

other words, retail costs should be higher for top quality wines. Second, top quality wines need to be stored in refrigeration units to maintain their temperature, and are therefore subject to higher storage costs. Third, tasting events to promote wines are generally organized by distributors for higher quality wines only, increasing their marketing and advertising costs. Finally, as noted in appendix A, higher quality wines often require heavier bottles and cartons for shipping, and are therefore more costly to transport.[52]

If top quality wines have higher distribution costs, as the evidence above tends to suggest, our model predicts that the response of prices to a change in the exchange rate should be stronger for top quality wines. In order to check this assumption, we estimate equations (11) and (12) for unit values and export volumes, allowing for nonlinearities in the effects of quality on pass-through. We include six variables for quality, i.e., one for each of the six quality bins as defined by the Wine Spectator in Table 5, and the same six quality variables interacted with the exchange rate. For instance, the quality variable s_1^k includes the quality scores of the wines that are "Not recommended" while the variable s_6^k includes the quality scores of the wines that are "Great."

The results are reported in Table 8. For unit values, column (1) shows that the interaction between the exchange rate and quality is statistically significant for the top quality wines only (with a score above 94). In addition, its coefficient is about four times larger than for the lower quality wines. As we cannot reject that the coefficients on the interactions between the exchange rate and quality for the lower quality wines are equal, in column (2) we classify wines according to two quality bins only, one for the wines with a score below 95 and the other for the wines above 94. The coefficient on the interaction between the exchange rate and quality for the lower quality wines is now positive and statistically significant, but remains about four times smaller than for the top quality wines. These findings suggest that, consistent with the model, heterogeneous pass-through due to quality is stronger for the top quality wines because they are likely to have higher distribution costs.

The lower part of Table 8 reports the exchange rate elasticities evaluated at the mean value of quality in each bin. Interestingly, in column (2) the elasticity is equal to 0.144 for the lowest quality wines and jumps to 0.422 for the top quality wines. Following a ten percent depreciation, exporters raise their prices (in pesos) by 1.4 percent for the lowest quality wines and by a much larger 4.2 percent for the top quality wines.

The results for export volumes are reported in columns (3) and (4) of Table 8. In both columns, the coefficient on the interaction between the exchange rate and quality is again larger in magnitude for the top quality wines, although the difference compared to the lower quality wines is less striking than for unit values. Still, the exchange rate elasticity evaluated at the mean level of quality is equal to 1.902 for the lowest quality wines, and drops to 1.679 for the top quality wines (column 4).

4.2 Heterogeneity across Destination Countries

Predictions 3 and 4 state that the effects described by Predictions 1 and 2 for unit values and export volumes, respectively, should be stronger for higher income than for lower income destination countries. This section investigates whether the two predictions can be validated by the data.

[52] Shipping costs can therefore be higher for higher quality wines not only within the destination country but also when exported from Argentina to the country of destination.

We estimate equation (11) for unit values and include interactions between the real exchange rate, quality, and real GDP per capita which we denote by $y_{j,t}$. The results are reported in column (1) of Table 9a. The elasticity of unit values to quality (evaluated at the mean values of the real exchange rate and of income per capita) is positive and significant at 0.031, and does not vary with changes in per capita income.[53] Besides, as shown in the lower part of the table, at the mean value of per capita income the response of unit values to a change in the real exchange rate increases with quality, which is consistent with Prediction 1: the elasticity increases from 0.097 to 0.108 following a one standard deviation increase in quality from its mean level, which represents an eleven percent increase in pricing-to-market. Most importantly, the triple interaction between the exchange rate, quality, and real GDP per capita is positive and significant at a value of 0.002, which indicates that the exchange rate response of unit values to quality further increases with per capita income: at the mean value of quality, this elasticity increases by eight percent from 1.483 to 1.596 following a one standard deviation increase in GDP per capita from its mean level, providing direct support to Prediction 3.

Another way to investigate Prediction 3 is to split the countries included in our sample between high and low income using the World Bank's classification based on GNI per capita in 2011.[54] We then estimate equation (11) and interact all variables with a dummy for high ($High$) and a dummy for low (Low) income countries. The results are reported in column (2) of Table 9a. Higher quality is associated with higher prices, and the elasticity of unit values to quality (evaluated at the mean value of the exchange rate) is again around 0.030 for both groups of countries. Interestingly, the coefficient on the interaction between the real exchange rate and quality is positive and significant for high income destinations only. For these countries, a one standard deviation increase in quality from its mean level increases the exchange rate elasticity from 0.135 to 0.142, or a five percent increase in pricing-to-market. For low income countries, the response of unit values to exchange rate changes does not vary with quality. These findings are consistent with Prediction 3.

According to our model in section 2, the exchange rate elasticity of unit values decreases with τ_j, the trade costs of exporting to destination j. We therefore check that our findings regarding the effects of per capita income are not instead driven by differences in trade costs between high and low income countries. Columns (3) and (4) of Table 9a replicate the regressions reported in columns (1) and (2), but further interact the exchange rate with the bilateral distance between Argentina and each destination country, D_j.[55] Despite being negative, which is consistent with the predictions of the model, these interactions are not statistically significant. Most importantly, their inclusion does not affect our results regarding the effects of per capita income.[56]

[53] Crozet et al. (2012) find that French exporters of Champagne charge higher prices to lower income destination countries. Their interpretation is that lower income countries do not produce much sparkling wine so that French exporters are able to charge higher prices when they enter the markets of these countries. We checked, and confirm, that our results remain robust to controlling for the competition that may arise from the production of wine in destination countries. We estimated equations (11) and (12) and included the total wine production (in tons) of each destination country in each year (Food and Agriculture Organization of the United Nations), together with its interaction with the real exchange rate. The results are not reported due to space constraints but are available upon request.

[54] Low income countries have a GNI per capita of less than \$4,035 while high income countries are above that threshold.

[55] The model does not predict that the exchange rate elasticity of unit values to trade costs τ_j varies with per capita income so we do not interact this elasticity with per capita income in column (3) or with the high and low income dummies in column (4).

[56] Some recent papers argue that the demand for quality is not only determined by income but also by the distribution of income within a country, where richer households typically spend a larger share of their income on higher quality goods.

The results in column (4) show that the elasticity of unit values to changes in the exchange rate (equal to 0.150 at the mean value of quality) is insignificant for low income countries so pass-through for export prices is complete. In contrast, pass-through is incomplete and equal to 87.9 percent (at the mean value of quality) for high income countries. This shows that price discrimination exists across destination countries and that the Law of One Price fails. In addition, this finding is consistent with predictions from the literature that pass-through should be lower for higher income countries. For instance, Devereux, Engel, and Storgaard (2004) predict that a more stable monetary policy in high income destination countries reduces exchange rate pass-through by increasing the probability of invoicing in the currency of the destination country.

Table 9b focuses on export volumes. In columns (1) and (3), which investigate the role of GDP per capita, the response of export volumes to a change in the exchange rate decreases with quality, providing some evidence in favor of Prediction 2 (for instance, in column 1 the elasticity decreases from 0.921 to 0.911 following a one standard deviation increase in quality from its mean level). The triple interactions between the exchange rate, quality, and per capita income are also negative, as Prediction 4 suggests, but are however insignificant. Instead, the results reported in column (2), which split countries between high and low income, provide support for Prediction 4. The interaction between the exchange rate and quality is significantly different from zero for high income countries only, and its negative sign further indicates that the response of export volumes to a change in the real exchange rate is smaller for higher quality wines. For high income countries, the exchange rate elasticity decreases from 1.685 to 1.656 following a one standard deviation increase in quality from its mean level. As before, higher quality wines are exported in smaller quantities, both to high and low income countries (at the mean value of the real exchange rate, the elasticities of export volumes to quality are equal to -0.042 and -0.051 for low and high income countries, respectively, and are not significantly different from each other). These findings remain robust to controlling for the effect of distance on the exchange rate elasticity in column (4).

5 Endogeneity

One concern with our estimations is the potential endogeneity of quality in explaining unit values and export volumes. The Wine Spectator rankings are produced from blind tastings where the "price is not taken into account in scoring." However, the "tasters are told [...] the general type of wine (varietal and/or region) and the vintage" year.[57] Similarly for Parker, "neither the price nor the reputation of the producer/grower affect the rating in any manner" although the "tastings are done in peer-group, single-blind conditions (meaning that the same types of wines are tasted against each other and the

Fajgelbaum, Grossman, and Helpman (2011) derive conditions under which richer, as well as more unequal countries have a larger demand for higher quality goods. Mitra and Trindade (2005) show that more unequal countries import more of higher quality goods. If the demand for quality is indeed stronger for more unequal countries, the response of unit values to changes in the exchange rate may increase with quality by more for more unequal countries, after controlling for differences in income per capita. We estimated equation (11) for unit values and interacted both the exchange rate and quality with the Gini coefficients of each destination country (World Development Indicators, World Bank) while separately controlling for real per capita income. We found that the exchange rate response of unit values to quality increases by more for more *equal* rather than for more *unequal* countries, where the distribution of income tends to be more equal in higher income countries. The results are not reported but are available upon request.

[57] See http://www.winespectator.com/display/show?id=about-our-tastings.

producers names are not known)."[58] In other words, even if the two rankings are unaffected by the price, the tasters do have some basic information about the wines they taste which might in turn affect in a way or the other their scores, leading to an endogeneity bias which direction is, however, unclear. We therefore address the potential endogeneity of quality by using appropriate instruments.

The set of instruments we rely on to explain the variation in wine quality includes geographic and weather-related factors. Indeed, the literature devoted to explaining the quality of wine highlights that the amount of rainfall and the average temperatures during the growing season are strong determinants of quality (Ashenfelter, 2008; Ramirez, 2008). In the Southern hemisphere, the growing period spans the period from September (in the year before the vintage year) to March. In order to allow for the effects of temperature and rainfall to be nonlinear throughout the growing season, we consider as instruments the average temperature and the total amount of rainfall for each growing province in each month between September and March (Ramirez, 2008).[59] Besides, one particularity of Argentina's wine industry is the high altitude at which some of the growing regions are located, and there are strong reasons to believe that altitude contributes to variations in quality because it reduces the problems related to insects or grape diseases that affect quality at a low altitude. We therefore use the altitude of each province as an additional instrument for quality.[60]

The data on monthly average temperatures (in degrees Celsius), total rainfall (in millimeters), and altitude (in meters) are from the National Climatic Data Center of the US Department of Commerce.[61] Gaps in the data are filled using online information, although missing information for some provinces and vintage years results in a slightly reduced sample.[62] Table 3 reports descriptive statistics on the average temperatures and total rainfall across growing regions. On average, temperatures are highest in January and lowest in September. January is also the wettest month and September the driest. Table 3 also shows that the provinces are on average 700 meters high, where altitude varies between 191 meters (province of La Pampa) and 1,238 meters (province of Salta).

As the instruments are only available over a reduced sample, we first replicate our benchmark OLS estimations reported in column (2) of Panels A and B of Table 7 for unit values and export volumes, respectively. The results, reported in columns (1) and (4) of Table 10 for prices and quantities, respectively, show that our main findings go through over the smaller sample.

Column (2) of Table 10 regresses by Instrumental Variables (IV) unit values on the real exchange rate and quality. The coefficient on quality is positive and significant but becomes smaller compared to the OLS estimate in column (1).[63] This positive endogeneity bias suggests that wine tasters tend to

[58] See https://www.erobertparker.com/info/legend.asp.

[59] The average temperatures, total rainfall, and altitude are measured at the following weather stations (province): Catamarca Aero (Catamarca), Paraná Aero (Entre Ríos), Santa Rosa Aero (La Pampa), La Rioja Aero (La Rioja), Mendoza Aero (Mendoza), Neuquén Aero (Neuquen), Bariloche Aero (Río Negro), Salta Aero (Salta), and San Juan Aero (San Juan).

[60] San Martín et al. (2008) also expect the Wine Spectator rankings to be endogenous to the price of Argentinean wines sold in the US. They use the average score of all the wines of the same or older vintages or that belong to the same region of the wine under consideration as instruments for the quality rankings.

[61] This is available at http://www.ncdc.noaa.gov/IPS/mcdw/mcdw.html.

[62] Online information is taken from www.tutiempo.net.

[63] In column (1), the coefficient on quality is still equal to 0.033 if we exclude the interaction between the exchange rate and quality from the regression.

assign higher scores to more expensive wines. Column (5) of Table 10 focuses on export volumes. The instrumented effect of quality on export volumes is negative and significant, and is in turn larger in magnitude than the OLS estimate in column (4). For both regressions, the Kleibergen-Paap F statistic (equal to 93 for both the prices and quantities regressions, where the critical value is equal to 21, Stock and Yogo, 2005) largely rejects the null of weak correlation between the excluded instruments and the endogenous regressors.

We then regress unit values and export volumes on quality which is further interacted with the exchange rate. The set of instruments for quality and for the interaction term includes the monthly temperatures, rainfall, and altitude variables, as well as each of the variables interacted with the exchange rate.[64] The results for unit values are reported in column (3) of Table 10 and show that exchange rate pass-through is larger for lower quality wines. Interestingly, the exchange rate elasticity increases from 0.191 to 0.233 following a one standard deviation increase in quality from its mean level. In addition, pass-through is complete for the lowest quality wine in the sample, and drops to 68.2 percent for the highest quality wine. This suggests that quality is quantitatively important in explaining heterogeneous pass-through. For export volumes in column (6) of Table 10, the coefficient on the interaction term is not statistically significant.

The first-stage regressions for the IV regressions in columns (3) and (6) for unit values and export volumes, respectively, are reported in Table B1 of appendix B (the first-stage regressions for columns 2 and 4 are very similar and are not reported due to space constraints, but are available upon request). They show that climate variation affects wine quality. According to columns (1) and (3) of Table B1, where the dependent variable is quality, the positive coefficients on the January and February temperatures are consistent with the finding in the literature that warmer temperatures during the harvest period are typically associated with higher quality. Also, the positive coefficient on the October rainfall, and the negative coefficients on the January and February precipitations, are consistent with the expectation that precipitation during the earlier part of the growing season is good for quality, while a dry climate during the harvest period is more favorable for crops (Ramirez, 2008).

6 Extensions

This section discusses two extensions to our benchmark model. First we show that, consistent with our model, pricing-to-market increases with local distribution costs in the importing economy. Second, we provide evidence that in addition to increasing with product quality, pricing-to-market also increases with firm-level productivity, as in Berman et al. (2012) and Chatterjee et al. (2013).

6.1 Distribution Costs

Recall that a key prediction of the model of Corsetti and Dedola (2005), and of our extension to their model, is that pricing-to-market increases with local distribution costs in the importing economy. In turn this implies that the difference in pass-through between high and low quality wines should increase

[64] In the regressions reported in columns (2) and (5) that exclude the interaction between the exchange rate and quality, altitude is dropped as an instrument as it is collinear with the province fixed effects. In the regressions reported in columns (3) and (6) that include the interaction term, the interaction between the exchange rate and altitude is used as an instrument.

with distribution costs. Berman et al. (2012) use the data on distribution costs computed by Campa and Goldberg (2010) for 21 countries and 29 industries between 1995 and 2002, and find that the response of unit values to a real depreciation increases with local costs, especially for high productivity firms.

In order to explore this prediction of the model we also rely on Campa and Goldberg's (2010) distribution costs data. Given these are only available between 1995 and 2002, we compute the average distribution costs over time for each destination country and for the "Food products and beverages" industry.[65] Our measure for distribution costs, dc_j, is therefore destination-specific, and given the limited number of countries for which the data are available the resulting sample size is reduced by half. We estimate regressions (11) and (12) and include an interaction term between the real exchange rate and distribution costs. The results are reported in Table 11. For unit values, column (1) shows that the interaction between the real exchange rate and distribution costs is positive and significant, suggesting that pricing-to-market increases with local costs. Column (2) further includes the interaction between the real exchange rate and quality which is positive and significant. Therefore, the difference in pass-through between high and low quality wines increases with the size of local costs. The results for export volumes are reported in columns (3) and (4) of Table 11. The interaction between the exchange rate and local costs is negative, as expected, but is not significant.

6.2 Productivity as a Source of Firm-Level Heterogeneity

This paper focuses on quality as a source of firm and product-level heterogeneity while the literature has so far mostly focused on the role of productivity in explaining heterogeneous pass-through. In this section we explore whether, consistent with the findings of Berman et al. (2012) and Chatterjee et al. (2013), highly productive firms price-to-market more in response to a change in the real exchange rate.

Without any information on the firm-level characteristics that are required to measure productivity (such as value-added or employment), we construct two variables that proxy for firm size as the latter has been shown to correlate strongly with productivity (see, for instance, Bernard, Eaton, Jensen, and Kortum, 2003). First, we use banded data on firms' total sales for 2007 (obtained from Nosis). We classify firms into three categories and create for all years in the sample a firm-specific indicator variable, $sales_i$, that varies between one and three where a larger value indicates a higher value of sales in 2007.[66] Due to missing observations, our sample is slightly reduced. In addition, as sales are only available banded and for a single year, our proxy is likely to suffer from measurement error. Second, we measure firm size using the total volume (in liters) of FOB exports of each firm in each year. Total export volumes are however endogenous to the denominator of unit values in equation (11), and to the dependent variable in equation (12). We therefore divide firms into three categories and create an indicator variable, $size_{i,t}$, which varies between one and three where a larger value indicates a greater volume of exports and therefore a larger firm size in each year.[67] We then interact the real exchange rate with each of our two proxies for firm size, and include them in turn as regressors in equations (11)

[65] In order to minimize measurement error, we only keep the countries for which at least two years of data are available. We therefore drop Estonia and New Zealand from the sample.

[66] The indicator is equal to one if a firm's total sales are less than one million USD, to two if sales are between one and 20 million USD, and to three if sales are greater than 20 million USD.

[67] Firms are assigned a value of three if they export more than the 66^{th} percentile of total FOB sales, two if they export between the 33^{rd} and the 66^{th} percentile, and one if they export less than the 33^{rd} percentile in each year.

and (12). If pricing-to-market increases with firm size and therefore with firm-level productivity, the interactions between the real exchange rate and the proxies for firm size should be positive in equation (11). Conversely, they should be negative in the volumes regression (12).

Panel A of Table 12 focuses on unit values. In column (1), the interaction between the real exchange rate and sales is positive and significant, as expected. A one standard deviation increase in sales from their mean level increases the elasticity of unit values to the real exchange rate from 0.110 to 0.232. Column (2) further includes the interaction between the exchange rate and quality which displays a positive coefficient. Our results therefore show that larger, and therefore more productive firms price-to-market more, especially when exporting higher quality goods.[68] Columns (3) and (4) use total export volumes as a proxy for firm size and the results remain qualitatively comparable. The results for export volumes are reported in Panel B of Table 12. Although the interaction between the real exchange rate and quality is negative in columns (2) and (4), the interactions between the real exchange rate and the two proxies for firm size are not significantly different from zero.

7 Robustness

This section discusses a number of alternative specifications we implement to ensure the robustness of our findings. Overall, the broad similarity of the results supports the paper's main conclusions.

The Measurement of Quality We run a few sensitivity checks on the measurement of quality. Panel A of Table 13 focuses on unit values while Panel B on export volumes. The regressions in column (1) use the log of quality s^k instead of its level. The results remain qualitatively unchanged, and a one standard deviation increase in quality from its mean level increases pricing-to-market by three and a half percent.

In order to minimize possible noise in the measurement of quality when defined on a (50,100) scale, we construct a new variable which takes on values between one and six where each value corresponds to one of the different bins defined by the Wine Spectator (see Table 5). A value of one indicates that the wine is "Not recommended" while a value of six that the wine is "Great" so a larger value captures a higher quality. The results of using this measure are reported in column (2) and remain qualitatively similar, although the magnitude of the estimated coefficients on quality becomes larger.

In column (3), quality is measured using the Parker ratings. Qualitatively, our results largely hold up. Note that the coefficients on the Parker ratings are larger than the ones on the Wine Spectator rankings.

As mentioned earlier, most of the empirical literature on quality and trade relies on trade unit values as a proxy for quality. Indeed, our regressions indicate that on average, unit values increase with quality. We therefore check if our results remain robust to measuring quality using the information contained in unit values. We calculate in each year the mean unit value of each wine exported to all destinations, and for each firm we rank these wines by unit values in decreasing order (see, Berman

[68] In our data set, larger, and therefore more productive firms, do not export higher quality wines only. Quality varies between 55 and 96 when $sales_i = 3$, and between 60 and 96 when $size_{i,t} = 3$. This is consistent with Table 6 which shows that individual firms export wines with heterogeneous levels of quality.

et al., 2012, Chatterjee et al., 2013, or Mayer et al., 2014, for a similar approach). For each firm, the wine with the highest average unit value has a rank equal to one, the second a rank equal to two, etc. We use this rank as an inverted measure for quality so that the interaction between the real exchange rate and product rank is expected to be negative for unit values, and positive for export volumes. This is confirmed by the results reported in column (4) of Table 13, which contrast with Auer and Chaney (2009) who do not find any evidence that pass-through is significantly affected by quality when quality is inferred from trade unit values.

Unrated Wines Recall that due to missing observations on the Wine Spectator rankings, our sample covers 43 percent of the total FOB value of red, white, and rosé wine exported by Argentina between 2002 and 2009. In order to include some of the unrated wines in the sample, we calculate an average Wine Spectator ranking by wine name and type, and assign this average ranking to all wines with the same name and type. This increases our sample coverage to 63 percent of the total FOB value exported over the period. We apply this procedure to compute average quality both on a (50,100) and on a (1,6) scale. The results are respectively reported in columns (5) and (6) of Table 13 and remain qualitatively unaffected (the vintage year and grape fixed effects are omitted from the regressions).

Another way to address the issue of unrated wines is as follows. First, we identify the wines for which the vintage year is missing and assign to each of them the ranking corresponding to the wines with the same name, brand, and type on a (1,6) scale. In general quality does not vary much across vintage years so this assumption sounds reasonable. Second, we assign a value of one to the wines produced by firms which do not have any wine ranked by either the Wine Spectator or Parker. We do this under the assumption that these firms produce wines which could be of a too low quality to be considered by experts for tasting (this approach is similar to Crozet et al., 2012, who assume, as a robustness check, that unrated firms are the lowest quality exporters). This exercise increases our sample coverage to 60 percent of the total FOB value exported between 2002 and 2009. The results using this quality measure are reported in column (7) and remain consistent with our benchmark results (the vintage year fixed effects are omitted from the regression).

The Nature of Wine Our results might be affected by two characteristics that are specific to the nature of wine. First, wine is an exhaustible resource: once a wine with a specific vintage year runs out, the producer can no longer produce, and therefore export, that variety. Second, the production of higher quality wines is likely to be affected by capacity constraints as the availability of high quality grapes is generally limited (San Martín et al., 2008).

In order to control for the exhaustible nature of wine, we construct a new sample and define a product according to the name of the wine, its grape, type, and HS code, but ignore the vintage year.[69] In this sample, the 209 firms export a smaller number of products (2,790 versus 6,720 wines in the original sample) to a larger number of destination countries (78 versus 40 destinations, on average). Quality is computed as the average of the scores assigned to all wines with the same name, type, and grape, and varies between 55 and 96.2.[70] The correlation between average quality (across vintage years)

[69] This exercise allows us to get closer to the CES utility function assumption of a fixed set of varieties as there is no reason for wines to run out once we exclude the vintage year.

[70] The results remain similar if quality is computed as a weighted average of the original quality scores, where the weights are given by the export shares of each wine to each destination country in each year.

and the original quality measure (which varies across vintage years) is equal to 93.7 percent, suggesting that quality does not vary much across vintage years. We estimate equations (11) and (12) for unit values and export volumes and exclude the vintage year fixed effects. For each dependent variable, the results are reported in columns (1) and (3) of Table 14 and show that our findings remain robust to excluding the vintage year as a product characteristic, and therefore to controlling for the exhaustible nature of wine.

To address the issue of capacity constraints, ideally we would need to control for the total production of each of the different wines. Without this information, we rely instead on the total volume (in liters) of FOB exports of each wine to the rest of the world between 2002 and 2009 as a proxy for total output per product. As was the case when we attempted in section 6.2 to proxy for firm size using total exports by firm, the problem is that total exports are endogenous to the denominator of unit values in equation (11) and to the dependent variable in equation (12), especially when measured at the product level. In order to minimize endogeneity issues, we therefore classify products into three categories and create an indicator variable, X^k, which varies between one and three where a larger value indicates a greater volume of total exports.[71] We then include this indicator, together with the indicator interacted with the real exchange rate, in both equations (11) and (12). For unit values and export volumes, the results are reported in columns (2) and (4) of Table 14, respectively, and show that once we control for capacity constraints in wine production, our conclusions still hold.

Sample Periods After the fixed exchange rate regime between the Argentinean peso and the US dollar was abandoned in 2001, the peso depreciated greatly with respect to the US dollar throughout 2002, as can be seen from Figure 3. In column (1) of Table 15a, we check and confirm that our results still hold when restricting the sample to the post-2002 period. A one standard deviation increase in quality from its mean level raises the exchange rate elasticity from 0.151 to 0.157 which represents a four percent increase in pricing-to-market. In turn, in column (1) of Table 15b, the exchange rate elasticity of export volumes drops from 3.589 to 3.568 following a one standard deviation increase in quality from its mean level.

Our results might also be affected by the financial crisis that started in 2008: as Figure 3 shows, the peso started to depreciate with respect to the US dollar. In addition, the crisis might have prompted consumers to substitute towards lower quality imported goods (a "flight from quality effect," see Burstein, Eichenbaum, and Rebelo, 2005). Finally, the crisis might have impacted the financial constraints of some wine exporters. Column (2) of Table 15a therefore restricts the analysis to the pre-2008 sample period. Two comments are in order. First, our main conclusions still hold: the elasticity of export prices to changes in the exchange rate continues to be significantly larger for higher quality wines. Second, pass-through is on average lower than when estimated over the full sample: it is estimated at 73.5 percent at the mean level of quality, and drops to 73.1 percent following a one standard deviation increase in quality from its mean level. This indicates that before the crisis, Argentinean exporters had a stronger tendency to price-to-market. Strasser (2013) shows that financially constrained firms price-to-market less than unconstrained firms. If Argentinean exporters have become more financially constrained with the crisis and as a result price-to-market less, dropping the post-2008

[71] A wine is assigned a value of three if its total exports lie above the 66^{th} percentile of the total exports distribution, two between the 33^{rd} and the 66^{th} percentile, and one below the 33^{rd} percentile.

period from the sample should result in more pricing-to-market and less pass-through (for any given level of quality), as we find (Strasser, 2013, argues that the effect of borrowing constraints has been particularly strong during the recent financial crisis). Regarding export volumes in the pre-2008 sample (column 2 of Table 15b), the coefficient on the interaction term between the real exchange rate and quality remains negative, and the elasticities of export volumes to changes in the real exchange rate are smaller compared to the ones estimated over the whole sample.

Finally, column (3) of Tables 15a and 15b show that, for unit values and export volumes, respectively, our findings remain robust to excluding both the post-2002 and pre-2008 crisis periods.[72]

Extensive Margin Campos (2010) argues that the intensive and extensive margins of adjustment might have opposite effects on pass-through. On the one hand, a depreciation reduces the average price charged by existing exporters (the intensive margin). On the other hand, a depreciation makes exporting a more profitable activity so more firms enter the export market. Given that entrants are generally less productive and therefore charge higher prices, the extensive margin pushes the average export price up, reducing pass-through. As a robustness check, we estimate both equations (11) and (12) on a sample that exclusively captures the intensive margin of adjustment and therefore only includes the firms that export in all years to any destination. The results for prices and quantities are reported in column (4) of Tables 15a and 15b, respectively, and remain robust.

The US Dollar After the large devaluation of the peso in 2002, the peso was allowed to fluctuate within a "crawling band that is narrower than or equal to +/-2 percent" with respect to the US dollar (Reinhart and Rogoff, 2004). This means that variations in the real exchange rate between the peso and the US dollar may have essentially come from movements in domestic prices. We verify that our results still hold after excluding from the sample the US (which is also Argentina's main export destination for wine) as well as the US plus all the other countries which currencies are pegged to the US dollar (Li, Ma, Xu, and Xiong, 2012).[73] The results are reported in columns (5) and (6) of Tables 15a and 15b for prices and quantities, respectively, and remain largely robust.

The Argentinean Consumer Price Index Since 2007, the credibility of the official Argentinean CPI data has been widely questioned by the public. In fact, the IMF has issued a declaration of censure and called on Argentina to adopt remedial measures to address the quality of the official CPI data.[74] Alternative data sources have shown considerably higher inflation rates than the official data since 2007 which makes the real exchange rate used for our estimations in 2008 and 2009 unreliable.[75] Using online data from supermarket chains, Cavallo (2013) constructs an aggregate CPI for Argentina and

[72] We also checked if exporters adopt different pricing strategies depending on whether the Argentinean peso appreciates or depreciates in real terms. We found that, for any level of quality, the response of unit values to changes in exchange rates is significantly larger for appreciations than for depreciations. This asymmetric pattern is consistent with firms trying to maintain export market shares by reducing the domestic currency prices of their exports which become less competitive when the peso appreciates. It is also consistent with Marston (1990) who shows that pricing-to-market by Japanese firms is stronger when the Japanese yen appreciates. The results are not reported but are available upon request.

[73] These countries are Antigua and Barbuda, Aruba, the Bahamas, Barbados, China, Dominica, Ecuador, El Salvador, Grenada, Guyana, Hong Kong, Jordan, the Maldives, the Netherlands Antilles, Panama, Saudi Arabia, Saint Lucia, Saint Vincent, and Venezuela (Reinhart and Rogoff, 2004).

[74] Further information can be found at http://www.imf.org/external/np/sec/pr/2013/pr1333.htm.

[75] See http://www.economist.com/node/21548242.

shows that the corresponding inflation rate is about three times larger than the official estimate. We use the CPI from Cavallo (2013) for 2008 and 2009 to update the official CPI series, and construct a new real exchange rate that we use to estimate both equations (11) and (12). The results are reported in column (7) of Tables 15a and 15b and remain very similar to the ones obtained with the official CPI data.

Monthly Frequency The customs data are provided to us at the transactions level as we have the date of declaration for each shipment. We therefore check whether our results remain robust to aggregating the data at a monthly rather than at a yearly frequency. We estimate equations (11) and (12) where unit values, export volumes, and the real exchange rate are defined at a monthly frequency. Due to data limitations, the real GDPs and real effective exchange rates in the exports regression are measured annually.

Column (8) of Table 15a focuses on unit values. Although the coefficient on quality decreases in magnitude, the results remain highly comparable to the ones obtained at an annual frequency. For export volumes, the results in column (8) of Table 15b also remain qualitatively similar to the annual frequency estimates. Noteworthy is the fact that the coefficient on the real exchange rate is reduced. Still, the regression shows that export volumes increase in response to a real depreciation, and by less for higher quality wines.

Dynamics In order to introduce dynamics in the model, in both equations (11) and (12) we include, in addition to the contemporaneous variables, one lag, and then two lags, on both the exchange rate and the exchange rate interacted with quality. In the volumes regressions, lags on the real effective exchange rate and real GDPs are also included. For unit values and export volumes, the results are reported in columns (9) and (10) of Tables 15a and 15b for the specifications with one and two lags, respectively. In both columns, all reported coefficients (with the exception of the coefficient on quality), as well as the quantitative effects reported at the end of the tables, are the sum of the estimated coefficients on the contemporaneous and the lags of each variable (Gopinath and Itskhoki, 2010, Gopinath, Itskhoki, and Rigobon, 2010). With one lag, the results remain very similar to our benchmark, reported in Table 7. With two lags, the extent of pricing-to-market becomes smaller, but the response of unit values to a change in the exchange rate continues to increase with quality, while the response of export volumes decreases with quality.

Wholesalers and Retailers As explained earlier, we restricted our analysis to wine producers and therefore dropped wholesalers and retailers from the sample. Our results however still hold when including these firms in the sample. The results are reported in column (11) of Tables 15a and 15b for unit values and export volumes, respectively.

Currency of Invoicing A large body of the recent literature is devoted to understanding how the currency of invoicing used for trade affects exchange rate pass-through (Gopinath et al., 2010, show there is a large difference in exchange rate pass-through for US imports priced in US dollars versus non US dollars). In our data set, we do not have any information on the currency in which Argentinean wine exporters price their exports. The Datamyne, a private vendor of international trade data, provides us with the invoicing currency of exports for the wine sector (HS code 2204) between 2005 and 2008.

It shows that over the period, Argentinean firms priced their wine exports mostly in US dollars (88 percent), followed by euros (7.6 percent), Canadian dollars (3 percent), pound sterling (1.2 percent) and in a very few cases in Japanese yen, Swiss francs, Uruguayan pesos, Australian dollars or Danish krones. Due to the predominance of the US dollar as an invoicing currency for exports, the regression in column (12) of Table 15a expresses unit values in US dollars per liter. Remarkably, our results remain largely unaffected once we let exports be invoiced in US dollars.

8 Concluding Remarks

This paper analyzes the heterogeneous reaction of exporting firms to changes in real exchange rates due to differences in product quality. In order to understand the mechanisms through which quality affects the pricing and quantity decisions of firms following a real exchange rate change, the first contribution of the paper is to present a model that builds on Berman et al. (2012) and Chatterjee et al. (2013), and extends the model of Corsetti and Dedola (2005) by allowing firms to export multiple products with heterogeneous levels of quality. In the presence of additive (per unit) local distribution costs paid in the currency of the importing country, the model shows that the demand elasticity perceived by the exporter falls with a real depreciation and with quality. Exporters therefore increase their prices more and their export volumes less in response to a real depreciation for higher than for lower quality goods. Once we allow for higher income countries to have a stronger preference for higher quality goods, as the evidence from the empirical trade literature tends to suggest, the heterogeneous response of prices and quantities to exchange rate changes is predicted to be stronger for exports to higher income destination countries.

The second contribution of the paper is to bring the testable predictions of the model to the data. We combine a unique data set of Argentinean firm-level destination-specific export values and volumes of highly disaggregated wine products between 2002 and 2009 with a data set on two different experts wine ratings to measure quality (the Wine Spectator and Robert Parker). The very rich nature of the data set allows us to define a "product" according to the name of the wine, its grape, type, and vintage year, so the sample we use for our baseline regressions includes 6,720 different wine products exported by 209 wine producers over the period.

Our empirical results find strong support for the predictions of the model. First, pass-through for export prices is large: following a ten percent real depreciation exporters increase their export prices by 1.4 percent so pass-through is 86 percent. Second, higher quality is associated with higher prices. Third, the response of export prices to real exchange rate changes increases with quality and quantitatively, the effect of quality in explaining heterogeneous pass-through is large (from the IV regressions). Fourth, export volumes increase following a real depreciation, but by less for higher quality wines. Finally, the heterogeneous response of prices and quantities to real exchange rate fluctuations is stronger when firms export to higher income destination countries.

To conclude, our findings help to explain incomplete exchange rate pass-through by highlighting the role played by product quality. As we are only focusing on a single industry, we do not know whether the empirical regularities documented in this paper hold more generally, although the results of Auer et al. (2012) for the car industry are consistent with ours. Provided better data to measure quality for other industries become available, future research should test whether our results extend beyond the Argentinean wine industry. Another promising avenue for future research would be to use our data to identify the pricing-to-market behavior of exporters – and relate it to product quality – by assuming that wines with the same name, type, and grape, but produced in different vintage years, are subject to a common marginal cost, so that changes in the prices of these wines sold to multiple destinations reflect changes in markups by individual producers. This is the approach adopted by Burstein and Jaimovich (2012) who study a major retailer selling nondurable consumer goods in the US and Canada, and by Fitzgerald and Haller (2013) who focus on Irish plants that sell the same products to both Ireland and the UK.

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Table 1: Harmonized System (HS) Classification

6-digit	12-digit	Description
22.04.10	10.000.D	Sparkling wine – Champagne variety
	90.000.G	Sparkling wine – Not Champagne variety
	90.100.M	Sparkling wine – Gassified wine (i.e., aerated using CO2)
	90.900.F	Sparkling wine – Other
22.04.21	00.100.A	Sweet wine; $<$ 2 liters
	00.200.F	Fine wine; $<$ 2 liters
	00.900.U	Other wine; $<$ 2 liters
22.04.29	00.100.W	Sweet wine; $>$ 2 liters
	00.200.B	Fine wine; $>$ 2 liters
	00.900.P	Other wine; $>$ 2 liters
22.04.30	00.000.X	Wine; other grape must

Table 2: Summary Statistics on Export Data by Year

Year	Observations	FOB exports (USD)	Firms	Wines
2002	2,067	36,504,644	59	794
2003	3,056	50,664,899	73	933
2004	3,923	69,640,144	107	1,171
2005	5,330	91,261,787	120	1,517
2006	6,793	112,540,681	150	1,731
2007	7,407	131,147,970	148	1,860
2008	6,865	125,851,505	148	1,804
2009	6,135	108,177,602	151	1,833
Total	41,576	725,789,235	209	6,720

Notes: Authors' own calculations.

Table 3: Summary Statistics

	Observations	Min	Max	Mean	Median	Std dev
Unit values (USD/liter)	41,576	0.02	381	5.3	3.6	6.7
Number of wines exported	41,576	1	510	139	120	30
Number of destinations	41,576	1	88	40	37	23
Wine Spectator	41,576	55	97	85	85	3.8
Parker	18,892	81	98	87	87	2.4
Instruments						
Temperature September (Celsius)	37,723	3.4	21.4	14.6	15.2	1.6
Temperature October (Celsius)	37,723	6.4	25.3	18.8	18.9	2.8
Temperature November (Celsius)	37,723	9.2	27.4	22.3	22.2	1.7
Temperature December (Celsius)	37,723	10.5	28.2	24.7	25.3	1.5
Temperature January (Celsius)	37,723	12.7	29.5	25.9	25.8	1.6
Temperature February (Celsius)	37,723	12.6	28.4	23.9	24.0	1.4
Temperature March (Celsius)	37,723	9.8	25.8	21.2	21.2	1.3
Rainfall September (mm)	37,723	0	105	13.4	9	12.5
Rainfall October (mm)	37,723	0	182	23.9	17	25.4
Rainfall November (mm)	37,723	0	195	16.3	8	22.7
Rainfall December (mm)	37,723	0	224	15.4	10	32.9
Rainfall January (mm)	37,723	0	345	49.1	38	47.6
Rainfall February (mm)	37,723	0	581	41.2	39	30.9
Rainfall March (mm)	37,723	0	321	42.9	41	31.6
Altitude (meters)	37,723	191	1,238	716	705	120

Notes: Authors' own calculations.

Table 4: Top Export Destinations 2002-2009

Destinations	% of FOB exports
United States	30.8
Netherlands	10.3
United Kingdom	9.3
Brazil	7.2
Canada	6.4
Denmark	6.0
Finland	3.2
Sweden	3.2
Switzerland	2.8
Germany	2.3
France	1.8

Notes: Authors' own calculations.

Table 5: Experts Ratings

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

Table 6: Snapshot of the Data

Firm	Year	Destination	Name	Type	Grape	Vintage	Quality	Unit value (USD/liter)
Wine Spectator								
1	2006	United States	A	Red	Cabernet Sauvignon	2004	76	2.75
1	2006	United States	B	Red	Malbec	2003	90	11.98
1	2006	Poland	B	Red	Malbec	2003	90	15.07
Parker								
2	2008	United States	C	Red	Merlot	2007	83	4.11
2	2008	United States	D	Red	Malbec	2005	97	18.78
2	2008	Denmark	D	Red	Malbec	2005	97	10.99

Notes: Authors' own calculations.

Table 7: Baseline Results

	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent variable is $\ln UV_{ij,t}^k$					
$\ln q_{j,t}$	0.140^a (3.71)	0.008 (0.14)	–	0.059 (0.95)	–
s^k	0.032^a (11.29)	0.033^a (11.33)	0.033^a (11.34)	–	–
$\ln q_{j,t} \times s^k$	–	0.001^a (2.84)	0.002^a (2.92)	0.002^a (2.90)	0.002^a (3.17)
Quantitative Effects					
Mean(s^k)	–	0.142^a (3.78)	–	0.193^a (4.67)	–
Mean(s^k)+sd(s^k)	–	0.148^a (3.93)	–	0.199^a (4.81)	–
Min(s^k)	–	0.095^b (2.30)	–	0.146^a (3.28)	–
Max(s^k)	–	0.161^a (4.22)	–	0.212^a (5.07)	–
Panel B: Dependent variable is $\ln X_{ij,t}^k$					
$\ln q_{j,t}$	1.916^a (3.64)	2.418^a (4.59)	–	1.880^a (3.02)	–
s^k	-0.050^a (−8.03)	-0.051^a (−8.24)	-0.051^a (−8.20)	–	–
$\ln q_{j,t} \times s^k$	–	-0.006^a (−3.66)	-0.005^a (−2.98)	-0.005^a (−2.72)	-0.005^a (−3.10)
$\ln Q_{j,t}$	0.952^c (1.76)	0.948^c (1.75)	0.825 (1.50)	0.660 (1.04)	–
$\ln GDP_{j,t}$	−0.193 (−1.07)	−0.166 (−0.92)	−0.013 (−0.07)	−0.039 (−0.18)	–
Quantitative Effects					
Mean(s^k)	–	1.904^a (3.63)	–	1.423^b (2.30)	–
Mean(s^k)+sd(s^k)	–	1.881^a (3.58)	–	1.402^b (2.26)	–
Min(s^k)	–	2.085^a (4.00)	–	1.584^a (2.58)	–
Max(s^k)	–	1.831^a (3.47)	–	1.358^b (2.18)	–
N	41,576	41,576	41,576	41,576	41,576

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included in (1)-(3); product-year rather than firm-year fixed effects are included in (4); and firm-destination, firm-year, destination-year, and product fixed effects are included in (5). In (3), the real exchange rate is interacted with year dummies (not reported). Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator.

Table 8: Non-Linearities

	(1)	(2)	(3)	(4)
Dependent variable	$\ln UV^k_{ij,t}$	$\ln UV^k_{ij,t}$	$\ln X^k_{ij,t}$	$\ln X^k_{ij,t}$
$\ln q_{j,t}$	0.049 (0.47)	0.025 (0.42)	2.370^a (4.08)	2.382^a (4.52)
s^k_1	0.028^a (4.79)	–	-0.028^c (−1.81)	–
s^k_2	0.026^a (4.91)	–	-0.031^b (−2.27)	–
s^k_3	0.026^a (5.08)	–	-0.031^b (−2.39)	–
s^k_4	0.025^a (5.11)	–	-0.030^b (−2.41)	–
s^k_5	0.029^a (6.06)	–	-0.036^a (−3.00)	–
s^k_{1-5}	–	0.032^a (11.01)	–	-0.048^a (−7.79)
s^k_6	0.031^a (6.31)	0.035^a (10.34)	-0.048^a (−4.17)	-0.062^a (−9.86)
$\ln q_{j,t} \times s^k_1$	0.002 (1.36)	–	−0.006 (−1.46)	–
$\ln q_{j,t} \times s^k_2$	0.002 (1.19)	–	-0.006^c (−1.67)	–
$\ln q_{j,t} \times s^k_3$	0.001 (1.02)	–	−0.005 (−1.60)	–
$\ln q_{j,t} \times s^k_4$	0.001 (1.05)	–	-0.005^c (−1.67)	–
$\ln q_{j,t} \times s^k_5$	0.001 (1.31)	–	-0.006^c (−1.84)	–
$\ln q_{j,t} \times s^k_{1-5}$	–	0.001^b (2.52)	–	-0.006^a (−3.41)
$\ln q_{j,t} \times s^k_6$	0.004^b (2.17)	0.004^a (2.60)	-0.007^b (−2.03)	-0.007^a (−2.98)
$\ln Q_{j,t}$	–	–	0.977^c (1.81)	0.950^c (1.76)
$\ln GDP_{j,t}$	–	–	−0.146 (−0.81)	−0.168 (−0.93)
Mean Elasticities				
Mean(s^k_1)	0.179^a (4.15)	–	1.972^a (3.75)	–
Mean(s^k_2)	0.166^a (4.28)	–	1.915^a (3.66)	–
Mean(s^k_3)	0.148^a (3.96)	–	1.934^a (3.69)	–
Mean(s^k_4)	0.151^a (4.04)	–	1.911^a (3.64)	–
Mean(s^k_5)	0.178^a (4.75)	–	1.864^a (3.55)	–
Mean(s^k_{1-5})	–	0.144^a (3.83)	–	1.902^a (3.62)
Mean(s^k_6)	0.428^a (2.85)	0.422^a (2.81)	1.700^a (3.05)	1.679^a (3.01)
N	41,576	41,576	41,576	41,576

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator.

Table 9a: Unit Values: Heterogeneity across Destination Countries

	(1)	(2)	(3)	(4)
$\ln q_{j,t}$	2.027^a (3.66)	–	2.114^a (3.47)	–
s^k	0.034^b (2.02)	–	0.034^b (2.02)	–
$\ln y_{j,t}$	-0.004 (-0.02)	–	-0.001 (-0.01)	–
$\ln q_{j,t} \times s^k$	-0.015^b (-2.44)	–	-0.014^b (-2.43)	–
$\ln q_{j,t} \times \ln y_{j,t}$	-0.219^a (-3.67)	–	-0.216^a (-3.57)	–
$\ln y_{j,t} \times s^k$	0.000 (-0.14)	–	0.000 (-0.14)	–
$\ln q_{j,t} \times s^k \times \ln y_{j,t}$	0.002^a (2.72)	–	0.002^a (2.72)	–
$\ln q_{j,t} \times Low$	–	0.222 (1.31)	–	0.629^c (1.81)
$\ln q_{j,t} \times High$	–	-0.028 (-0.44)	–	0.436 (1.29)
$s^k \times Low$	–	0.031^a (5.25)	–	0.031^a (5.27)
$s^k \times High$	–	0.033^a (11.27)	–	0.033^a (11.27)
$\ln q_{j,t} \times s^k \times Low$	–	0.000 (0.01)	–	0.000 (0.04)
$\ln q_{j,t} \times s^k \times High$	–	0.002^a (3.23)	–	0.002^a (3.22)
$\ln q_{j,t} \times \ln D_j$	–	–	-0.014 (-0.35)	-0.054 (-1.41)
Quantitative Effects				
Mean(s^k)	0.097^b (2.34)	–	0.092^b (2.12)	–
Mean(s^k)+sd(s^k)	0.108^a (2.61)	–	0.104^b (2.37)	–
Low : Mean(s^k)	–	0.223^b (1.98)	–	0.150 (1.26)
Low : Mean(s^k)+sd(s^k)	–	0.223^b (1.98)	–	0.150 (1.26)
$High$: Mean(s^k)	–	0.135^a (3.48)	–	0.114^a (2.75)
$High$: Mean(s^k)+sd(s^k)	–	0.142^a (3.66)	–	0.121^a (2.92)
N	41,576	41,576	41,576	41,576

Notes: The dependent variable is $\ln UV^k_{ij,t}$ where unit values are in pesos per liter. Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Quality ratings are from the Wine Spectator. The quantitative effects reported at the end of the table for columns (1) and (3) are evaluated at the mean value of real per capita GDP in the sample.

Table 9b: Export Volumes: Heterogeneity across Destination Countries

	(1)	(2)	(3)	(4)
$\ln q_{j,t}$	-0.016 (-0.01)	–	-1.628 (-0.80)	–
s^k	0.162^a (3.03)	–	0.163^a (3.05)	–
$\ln y_{j,t}$	4.743^a (8.60)	–	4.689^a (8.50)	–
$\ln q_{j,t} \times s^k$	0.010 (0.55)	–	0.010 (0.52)	–
$\ln q_{j,t} \times \ln y_{j,t}$	0.114 (0.61)	–	0.056 (0.29)	–
$\ln y_{j,t} \times s^k$	-0.021^a (-3.92)	–	-0.021^a (-3.93)	–
$\ln q_{j,t} \times s^k \times \ln y_{j,t}$	-0.001 (-0.62)	–	-0.001 (-0.59)	–
$\ln q_{j,t} \times Low$	–	8.096^a (6.70)	–	7.275^a (4.38)
$\ln q_{j,t} \times High$	–	2.337^a (4.32)	–	1.395 (1.05)
$s^k \times Low$	–	-0.031^c (-1.93)	–	-0.031^c (-1.94)
$s^k \times High$	–	-0.050^a (-8.11)	–	-0.050^a (-8.11)
$\ln q_{j,t} \times s^k \times Low$	–	0.003 (0.99)	–	0.003 (0.95)
$\ln q_{j,t} \times s^k \times High$	–	-0.008^a (-4.07)	–	-0.008^a (-4.07)
$\ln Q_{j,t}$	0.474 (0.88)	–	0.378 (0.70)	–
$\ln GDP_{j,t}$	-1.202^a (-5.66)	–	-1.186^a (-5.57)	–
$\ln Q_{j,t} \times Low$	–	8.712^a (6.49)	–	8.670^a (6.43)
$\ln Q_{j,t} \times High$	–	0.711 (1.29)	–	0.659 (1.18)
$\ln GDP_{j,t} \times Low$	–	2.587^a (4.51)	–	2.537^a (4.39)
$\ln GDP_{j,t} \times High$	–	-0.239 (-1.30)	–	-0.243 (-1.33)
$\ln q_{j,t} \times \ln D_j$	–	–	0.242^c (1.85)	0.104 (0.79)
Quantitative Effects				
Mean(s^k)	0.921^c (1.78)	–	0.912^c (1.76)	–
Mean(s^k)+sd(s^k)	0.911^c (1.76)	–	0.903^c (1.74)	–
Low : Mean(s^k)	–	8.353^a (7.20)	–	8.455^a (7.32)
Low : Mean(s^k)+sd(s^k)	–	8.363^a (7.22)	–	8.465^a (7.34)
$High$: Mean(s^k)	–	1.685^a (3.14)	–	1.676^a (3.12)
$High$: Mean(s^k)+sd(s^k)	–	1.656^a (3.08)	–	1.646^a (3.06)
N	41,576	41,576	41,576	41,576

Notes: The dependent variable is $\ln X_{ij,t}^k$ where export volumes are in liters. Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Quality ratings are from the Wine Spectator. The quantitative effects reported at the end of the table for columns (1) and (3) are evaluated at the mean value of real per capita GDP in the sample.

Table 10: The Endogeneity of Quality

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	$\ln UV^k_{ij,t}$	$\ln UV^k_{ij,t}$	$\ln UV^k_{ij,t}$	$\ln X^k_{ij,t}$	$\ln X^k_{ij,t}$	$\ln X^k_{ij,t}$
$\ln q_{j,t}$	0.026 (0.42)	0.158^a (3.93)	-0.997^c (-1.78)	2.147^a (3.95)	1.836^a (3.28)	-0.269 (-0.14)
s^k	0.033^a (11.36)	0.022^b (2.16)	0.021^b (2.07)	-0.050^a (-7.75)	-0.099^b (-2.48)	-0.070^c (-1.82)
$\ln q_{j,t} \times s^k$	0.002^a (2.86)	–	0.014^b (2.06)	-0.004^a (-2.71)	–	0.025 (1.17)
$\ln Q_{j,t}$	–	–	–	0.801 (1.45)	0.853 (1.47)	0.873 (1.49)
$\ln GDP_{j,t}$	–	–	–	0.118 (0.63)	0.096 (0.49)	-0.029 (-0.14)
Quantitative Effects						
Mean(s^k)	0.161^a (3.96)	–	0.191^a (4.27)	1.771^a (3.31)	–	1.902^a (3.35)
Mean(s^k)+sd(s^k)	0.167^a (4.11)	–	0.233^a (4.15)	1.753^a (3.28)	–	1.978^a (3.41)
Min(s^k)	0.113^a (2.58)	–	-0.020 (-0.22)	1.904^a (3.57)	–	1.515^b (2.45)
Max(s^k)	0.180^a (4.38)	–	0.318^a (3.55)	1.717^a (3.20)	–	2.133^a (3.41)
Estimator	OLS	IV	IV	OLS	IV	IV
N	37,723	37,723	37,723	37,723	37,723	37,723

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator. For (2) and (5), the instruments include the monthly average temperatures and total rainfall per province over the growing period (September to March) and the altitude of each province, while for (3) and (6) they include the same variables as well as each variable interacted with the exchange rate.

Table 11: Distribution Costs

	(1)	(2)	(3)	(4)
Dependent variable	$\ln UV^k_{ij,t}$	$\ln UV^k_{ij,t}$	$\ln X^k_{ij,t}$	$\ln X^k_{ij,t}$
$\ln q_{j,t}$	-1.176^a (-2.81)	-1.576^a (-3.55)	4.149^b (2.07)	3.754^c (1.81)
s^k	0.037^a (11.43)	0.033^a (10.33)	-0.058^a (-7.30)	-0.063^a (-6.89)
$\ln q_{j,t} \times s^k$	–	0.005^a (3.37)	–	0.005 (0.88)
$\ln q_{j,t} \times dc_j$	2.165^b (2.20)	2.116^b (2.16)	-1.380 (-0.37)	-1.426 (-0.39)
$\ln Q_{j,t}$	–	–	3.569^b (2.38)	3.569^b (2.38)
$\ln GDP_{j,t}$	–	–	5.801^a (5.56)	5.806^a (5.57)
N	19,573	19,573	19,573	19,573

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator. Destination-specific distribution costs dc_j for the "Food products and beverages" industry are from Campa and Goldberg (2010).

Table 12: **Productivity as a Source of Firm-Level Heterogeneity**

	(1)	(2)	(3)	(4)
Panel A: Dependent variable is $\ln UV_{ij,t}^k$				
$\ln q_{j,t}$	-0.650^c (−1.88)	-0.773^b (−2.21)	0.116^a (2.96)	-0.007 (−0.11)
s^k	0.031^a (10.54)	0.031^a (10.57)	0.032^a (11.29)	0.033^a (11.33)
$\ln q_{j,t} \times s^k$	–	0.002^a (2.80)	–	0.002^a (2.69)
$\ln q_{j,t} \times sales_i$	0.274^b (2.29)	0.273^b (2.28)	–	–
$\ln q_{j,t} \times size_{i,t}$	–	–	0.012^b (1.98)	0.011^c (1.78)
Quantitative Effects				
Mean($sales_i$)	0.110^a (2.70)	0.113^a (2.76)	–	–
Mean($sales_i$)+sd($sales_i$)	0.232^a (4.13)	0.234^a (4.17)	–	–
Mean($size_{i,t}$)	–	–	0.140^a (3.71)	0.142^a (3.77)
Mean($size_{i,t}$)+sd($size_{i,t}$)	–	–	0.150^a (3.92)	0.151^a (3.96)
Panel B: Dependent variable is $\ln X_{ij,t}^k$				
$\ln q_{j,t}$	0.860 (0.62)	1.368 (0.99)	1.947^a (3.69)	2.433^a (4.61)
s^k	-0.048^a (−7.53)	-0.050^a (−7.74)	-0.050^a (−8.03)	-0.051^a (−8.23)
$\ln q_{j,t} \times s^k$	–	-0.006^a (−3.70)	–	-0.006^a (−3.60)
$\ln q_{j,t} \times sales_i$	0.317 (0.74)	0.322 (0.75)	–	–
$\ln q_{j,t} \times size_{i,t}$	–	–	−0.012 (−0.77)	−0.007 (−0.47)
$\ln Q_{j,t}$	0.928^c (1.67)	0.926^c (1.67)	0.959^c (1.77)	0.952^c (1.76)
$\ln GDP_{j,t}$	−0.215 (−1.14)	−0.186 (−0.99)	−0.183 (−1.01)	−0.160 (−0.88)
Quantitative Effects				
Mean($sales_i$)	2.525^b (2.24)	2.526^b (2.25)	–	–
Mean($sales_i$)+sd($sales_i$)	2.859^c (1.86)	2.865^c (1.86)	–	–
Mean($size_{i,t}$)	–	–	1.923^a (3.65)	1.909^a (3.63)
Mean($size_{i,t}$)+sd($size_{i,t}$)	–	–	1.914^a (3.64)	1.903^a (3.62)
N	38,498	38,498	41,576	41,576

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator. The quantitative effects are measured at the mean value of quality in each sample.

Table 13: The Measurement of Quality and Unrated Wines

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Dependent variable is $\ln UV^k_{ij,t}$							
$\ln q_{j,t}$	-0.385^c (-1.75)	0.114^a (2.95)	-0.331^b (-2.39)	0.160^a (4.69)	0.005 (0.09)	0.133^a (4.10)	0.120^a (3.62)
s^k	–	0.144^a (12.11)	0.069^a (9.97)	–	0.073^a (21.63)	0.321^a (22.03)	0.227^a (20.53)
$\ln q_{j,t} \times s^k$	–	0.007^a (2.86)	0.005^a (3.40)	–	0.002^a (3.26)	0.008^a (3.25)	0.010^a (4.99)
$\ln s^k$	2.645^a (10.58)	–	–	–	–	–	–
$\ln q_{j,t} \times \ln s^k$	0.119^b (2.44)	–	–	–	–	–	–
$rank^k$	–	–	–	-0.002^a (-27.79)	–	–	–
$\ln q_{j,t} \times rank^k$	–	–	–	0.001^a (-7.16)	–	–	–
Quantitative Effects							
Mean(s^k)	0.142^a (3.76)	0.140^a (3.73)	0.115^b (2.24)	–	0.160^a (5.23)	0.162^a (5.28)	0.157^a (4.94)
Mean(s^k)+sd(s^k)	0.147^a (3.90)	0.146^a (3.88)	0.128^b (2.46)	–	0.167^a (5.45)	0.169^a (5.50)	0.167^a (5.28)
Mean($rank^k$)	–	–	–	0.147^a (4.33)	–	–	–
Mean($rank^k$)+sd($rank^k$)	–	–	–	0.133^a (3.92)	–	–	–

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: Dependent variable is $\ln X^k_{ij,t}$							
$\ln q_{j,t}$	4.093^a (5.38)	1.999^a (3.83)	3.201^a (3.80)	1.777^a (3.38)	3.996^a (8.72)	3.458^a (7.78)	3.010^a (6.59)
s^k	–	-0.234^a (-8.46)	-0.136^a (-8.78)	–	-0.095^a (-13.46)	-0.438^a (-13.73)	-0.254^a (-9.54)
$\ln q_{j,t} \times s^k$	–	-0.025^a (-3.33)	-0.014^a (-2.72)	–	-0.008^a (-4.56)	-0.036^a (-4.72)	-0.020^a (-3.08)
$\ln s^k$	-4.178^a (-8.11)	–	–	–	–	–	–
$\ln q_{j,t} \times \ln s^k$	-0.493^a (-3.54)	–	–	–	–	–	–
$rank^k$	–	–	–	0.001^a (8.14)	–	–	–
$\ln q_{j,t} \times rank^k$	–	–	–	0.001^a (4.18)	–	–	–
$\ln Q_{j,t}$	0.948^c (1.75)	0.945^c (1.75)	0.991 (1.28)	0.872 (1.62)	2.450^a (5.37)	2.446^a (5.37)	2.041^a (4.35)
$\ln GDP_{j,t}$	-0.167 (-0.93)	-0.170 (-0.95)	-0.338 (-1.29)	-0.148 (-0.81)	-0.344^b (-2.27)	-0.344^b (-2.28)	-0.213 (-1.39)
Quantitative Effects							
Mean(s^k)	1.905^a (3.63)	1.908^a (3.63)	2.005^a (2.63)	–	3.338^a (7.49)	3.334^a (7.49)	2.936^a (6.43)
Mean(s^k)+sd(s^k)	1.883^a (3.58)	1.887^a (3.59)	1.973^a (2.58)	–	3.311^a (7.42)	3.307^a (7.42)	2.916^a (6.38)
Mean($rank^k$)	–	–	–	1.804^a (3.44)	–	–	–
Mean($rank^k$)+sd($rank^k$)	–	–	–	1.833^a (3.50)	–	–	–
Sample	Full	Full	Full	Full	Mean s^k	Mean s^k	Unrated firms
Ratings	WS	WS [1,6]	Parker	Rank	WS	WS [1,6]	WS [1,6]
N	41,576	41,576	18,892	41,576	67,585	67,585	64,280

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Vintage year and grape fixed effects are not included in (5) and (6) and vintage year fixed effects are not included in (7). Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters.

Table 14: The Nature of Wine

	(1)	(2)	(3)	(4)
Dependent variable	$\ln UV_{ij,t}^{k}$	$\ln UV_{ij,t}^{k}$	$\ln X_{ij,t}^{k}$	$\ln X_{ij,t}^{k}$
$\ln q_{j,t}$	0.010 (0.12)	0.035 (0.56)	3.247^{a} (5.40)	1.699^{a} (3.34)
s^k	0.063^{a} (7.69)	0.030^{a} (10.81)	-0.102^{a} (-6.34)	-0.026^{a} (-4.31)
X^k	–	-0.094^{a} (-9.66)	–	0.940^{a} (38.83)
$\ln q_{j,t} \times s^k$	0.002^{b} (2.22)	0.002^{a} (2.80)	-0.005^{c} (-1.93)	-0.004^{a} (-2.73)
$\ln q_{j,t} \times X^k$	–	-0.002 (-0.81)	–	0.080^{a} (10.89)
$\ln Q_{j,t}$	–	–	2.089^{a} (3.53)	0.741 (1.42)
$\ln GDP_{j,t}$	–	–	-0.496^{a} (-2.71)	-0.238 (-1.34)
Quantitative Effects				
Mean(s^k)	0.179^{a} (4.93)	0.162^{a} (4.30)	2.827^{a} (4.86)	1.482^{a} (2.93)
Mean(s^k)+sd(s^k)	0.186^{a} (5.10)	0.168^{a} (4.46)	2.808^{a} (4.82)	1.464^{a} (2.89)
Sample	No vintage	Full	No vintage	Full
N	44,145	41,576	44,145	41,576

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Unit values are in pesos per liter and export volumes are in liters. Quality ratings are from the Wine Spectator. The quantitative effects for columns (2) and (4) are evaluated at the mean value of the total exports indicator X^k for each product in the sample.

Table 15a: Robustness for Unit Values

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln q_{j,t}$	0.007	0.162^{b}	0.171^{b}	−0.004	0.084	0.081	0.008	−0.034	0.007	−0.051	0.010	0.008
	(0.11)	(2.20)	(2.14)	(−0.06)	(1.32)	(1.21)	(0.14)	(−0.69)	(0.12)	(−0.78)	(0.17)	(0.13)
s^k	0.032^{a}	0.033^{a}	0.032^{a}	0.034^{a}	0.032^{a}	0.032^{a}	0.033^{a}	0.027^{a}	0.032^{a}	0.031^{a}	0.033^{a}	0.032^{a}
	(10.90)	(9.93)	(9.42)	(11.64)	(10.86)	(10.78)	(11.34)	(10.24)	(10.91)	(10.21)	(11.32)	(11.31)
$\ln q_{j,t} \times s^k$	0.002^{a}	0.001^{c}	0.001^{c}	0.002^{a}	0.002^{a}	0.002^{a}	0.002^{a}	0.001^{a}	0.001^{a}	0.002^{a}	0.002^{a}	0.002^{a}
	(2.96)	(1.87)	(1.93)	(3.48)	(2.88)	(2.84)	(2.83)	(2.93)	(2.85)	(2.88)	(2.78)	(2.94)
Quantitative Effects												
Mean(s^k)	0.151^{a}	0.265^{a}	0.280^{a}	0.155^{a}	0.220^{a}	0.221^{a}	0.142^{a}	0.078^{a}	0.141^{a}	0.083^{c}	0.141^{a}	0.146^{a}
	(3.73)	(5.15)	(4.92)	(4.09)	(5.26)	(5.18)	(3.78)	(2.61)	(3.63)	(1.87)	(3.74)	(3.93)
Mean(s^k)+sd(s^k)	0.157^{a}	0.269^{a}	0.285^{a}	0.162^{a}	0.226^{a}	0.227^{a}	0.148^{a}	0.083^{a}	0.147^{a}	0.090^{b}	0.147^{a}	0.152^{a}
	(3.89)	(5.23)	(5.00)	(4.27)	(5.41)	(5.33)	(3.93)	(2.78)	(3.79)	(2.00)	(3.89)	(4.09)
Sample	2003-2009	2002-2007	2003-2007	Intensive	No US	No USD peg	Full	Monthly	Full	Full	Wholesalers	Full
Lags	None	None	None	None	None	None	None	None	One	Two	None	None
CPI	Official	Official	Official	Official	Official	Official	Cavallo	Official	Official	Official	Official	Official
Unit values	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	Pesos/liter	USD/liter
N	39,509	28,576	26,509	35,594	36,714	34,372	41,576	72,627	41,576	41,576	41,630	41,576

Notes: The dependent variable is $\ln UV^k_{ij,t}$. Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Quality ratings are from the Wine Spectator.

Table 15b: Robustness for Export Volumes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
$\ln q_{j,t}$	4.062^a	0.889	2.774^a	2.095^a	2.486^a	3.246^a	2.425^a	0.778^a	2.463^a	2.366^a	2.419^a
	(6.05)	(1.47)	(3.20)	(3.97)	(4.63)	(5.76)	(4.61)	(3.53)	(4.58)	(4.22)	(4.59)
s^k	-0.048^a	-0.052^a	-0.048^a	-0.051^a	-0.053^a	-0.055^a	-0.051^a	-0.037^a	-0.049^a	-0.047^a	-0.051^a
	(−7.54)	(−7.80)	(−6.95)	(−7.66)	(−8.43)	(−8.50)	(−8.28)	(−6.65)	(−7.66)	(−7.08)	(−8.24)
$\ln q_{j,t} \times s^k$	-0.005^a	-0.003^c	-0.002	-0.006^a	-0.007^a	-0.008^a	-0.006^a	-0.004^a	-0.006^a	-0.006^a	-0.006^a
	(−3.23)	(−1.92)	(−1.39)	(−3.44)	(−4.14)	(−4.26)	(−3.71)	(−3.04)	(−3.69)	(−3.70)	(−3.62)
$\ln Q_{j,t}$	2.666^a	-0.036	2.117^b	0.534	1.027^c	1.741^a	0.948^c	-0.284	1.166	1.158	0.957^c
	(3.91)	(−0.06)	(2.37)	(0.98)	(1.87)	(3.04)	(1.75)	(−1.22)	(1.60)	(1.60)	(1.77)
$\ln GDP_{j,t}$	-0.095	0.264	0.693^b	0.090	-0.170	0.140	-0.165	-0.284^c	0.055	0.076	-0.171
	(−0.47)	(1.14)	(2.48)	(0.50)	(−0.93)	(0.75)	(−0.92)	(−1.69)	(0.29)	(0.39)	(−0.95)
Quantitative Effects											
Mean(s^k)	3.589^a	0.617	2.567^a	1.596^a	1.887^a	2.591^a	1.904^a	0.455^b	1.942^a	1.843^a	1.910^a
	(5.32)	(1.04)	(2.99)	(3.04)	(3.52)	(4.61)	(3.63)	(2.30)	(3.65)	(3.33)	(3.64)
Mean(s^k)+sd(s^k)	3.568^a	0.605	2.558^a	1.574^a	1.861^a	2.562^a	1.881^a	0.441^b	1.918^a	1.819^a	1.887^a
	(5.28)	(1.01)	(2.98)	(2.99)	(3.47)	(4.55)	(3.58)	(2.23)	(3.60)	(3.28)	(3.59)
Sample	2003-2009	2002-2007	2003-2007	Intensive	No US	No USD peg	Full	Monthly	Full	Full	Wholesalers
Lags	None	None	None	None	None	None	None	None	One	Two	None
CPI	Official	Official	Official	Official	Official	Official	Cavallo	Official	Official	Official	Official
N	39,509	28,576	26,509	35,594	36,714	34,372	41,576	72,627	41,576	41,576	41,630

Notes: The dependent variable is $\ln X^k_{ij,t}$ where export volumes are in liters. Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. Robust standard errors are adjusted for clustering at the product-level. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. Quality ratings are from the Wine Spectator.

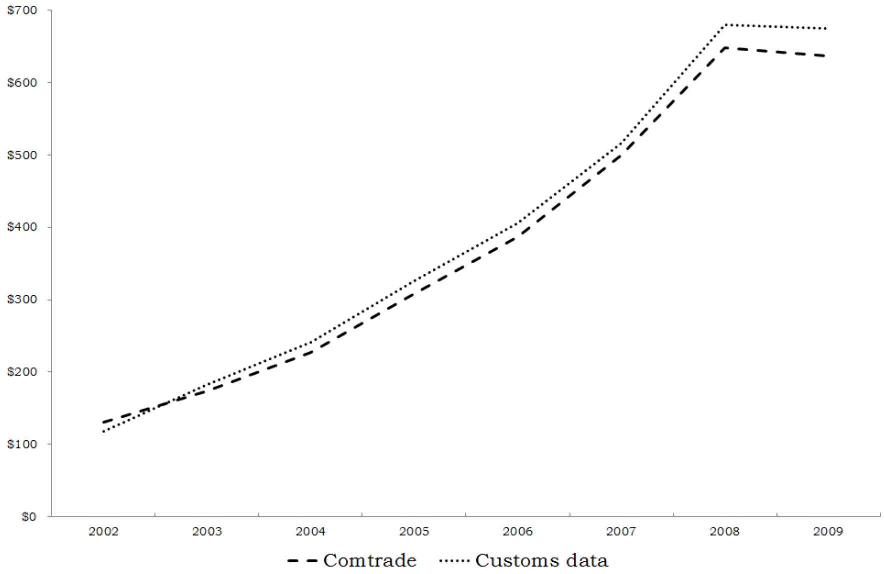

Figure 1: Argentina's Total Wine Exports (million USD)

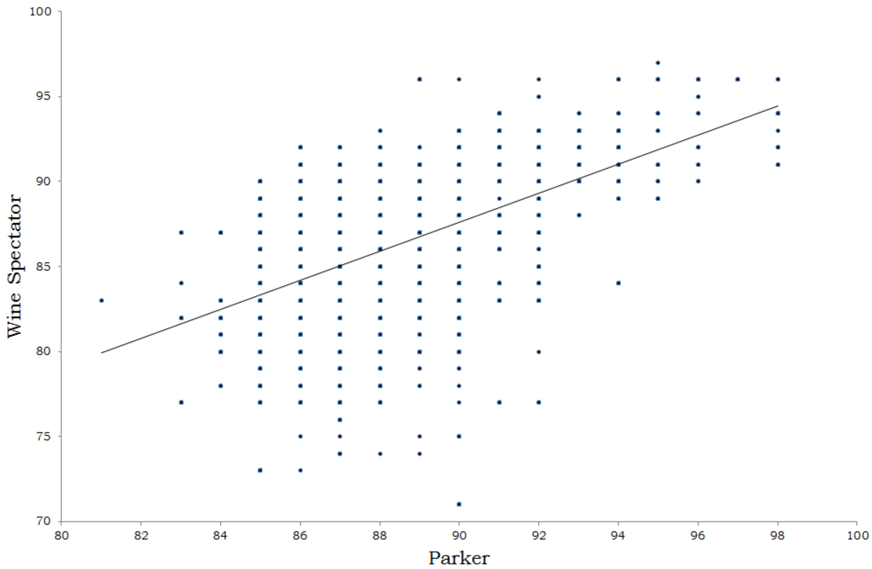

Figure 2: Wine Spectator versus Parker rankings

Figure 3: Argentinean peso per USD, January 2002 to December 2009

Appendix A: Wine and Model Assumptions

We discuss how the features of the wine industry conform with the main assumptions of the model. First, as shown by Table 6 and consistent with equation (7), higher quality wines tend to be exported at a higher price.

Second, the model assumes that higher quality wines have higher marginal costs (equation 3). Although the quality of wine depends predominantly on the quality of grapes which is itself mostly affected by geography and weather-related factors, higher quality wines can be expected to have higher marginal costs (see Crozet et al., 2012, on Champagne). First, higher quality wines may require higher quality and therefore more expensive inputs (Johnson, 2012; Kugler and Verhoogen, 2012; Manova and Zhang, 2012a; Verhoogen, 2008). For instance, wine producers can choose more or less costly additives to be added during the winemaking process (in the various stages of fermentation or as preservatives). Also, higher quality grapes may need to be pruned and trimmed more carefully, requiring more skilled labor (Artopoulos, Friel, and Hallak, 2011). Second, achieving higher quality wines may depend on the production methods chosen by producers. One example is to use oak barrels for the ageing and fermentation of wine. Due to the cost of the oak and to the short lifetime of the barrels (the oak flavors of the barrels last for three or four vintages only), these barrels turn out to be very expensive and are therefore reserved to producing higher quality wines only.[76] "Drip irrigation" also allows producers to limit the yield and therefore increase the potential quality of grapes, but this system is expensive to install.

More direct evidence on the positive relationship between price (quality) and marginal costs can be found in Table A1 which breaks down into several components the price of non-EU wines sold in UK retail outlets (Joseph, 2012).[77] We believe that these figures should provide us with some useful insights on the composition of Argentinean wine prices sold in the UK. The last row of the table shows that the amount that goes to the winemaker, which mainly reflects the costs of producing the wine as well as the costs of the bottle, closure, and carton, clearly increases with the price, and therefore most likely with the quality of the wine.[78]

Third, the model assumes that higher quality wines have higher distribution costs. This is illustrated by the fourth row of Table A1.

Finally, equation (7) predicts that higher quality wines have higher markups. The second row of Table A1 shows indeed that the margin charged by the retailer (40 percent of the pre-VAT tax price) increases with the price of the wine. Unfortunately, the table does not provide any information on the winemaker markup which is the one that is modeled in the theory. However, anecdotal evidence suggests that the producer markup is also likely to increase with the price/quality of the wine: for a £5 wine sold on the UK market, the producer markup is estimated to be approximately £0.40 and to increase to about £10 for a £25 bottle.[79]

The features of the wine industry closely match the assumptions of the model: higher quality wines are more expensive, have higher marginal costs, higher distribution costs, and higher markups.

Table A1: Price Breakdown for Non-EU Wine Sold in Retail Outlets in the UK (Joseph, 2012)

Retail price	£5.76	£7.19	£8.83	£10.09
VAT (20%)	£0.96	£1.20	£1.47	£1.68
Retail margin	£1.92	£2.40	£2.94	£3.36
Duty	£1.90	£1.90	£1.90	£1.90
Distributor margin	£0.11	£0.21	£0.40	£0.51
Common Customs Tariff	£0.11	£0.11	£0.11	£0.11
Transport	£0.13	£0.13	£0.13	£0.13
Winemaker	£0.63	£1.25	£1.88	£2.40

[76] Ageing in oak barrels adds about £0.50 to the cost of a bottle sold in the UK (www.thirtyfifty.co.uk).

[77] UK taxes include a duty of £1.90 per bottle and a VAT sales tax of 20 percent. In the table, shipping costs are stable at around £0.13 per bottle but can increase with the heavier bottles and cartons used for more expensive wines. Non-EU wines are subject to a Common Customs Tariff which does not apply to wines from the EU.

[78] The amount that goes to the winemaker also includes his profit but this cannot be identified from the table.

[79] See www.thirtyfifty.co.uk.

Appendix B

Table B1: First-Stage Instrumental Variables Regressions

	(1)	(2)	(3)	(4)
Regression in Table 10	Column (3)	Column (3)	Column (6)	Column (6)
Dependent Variable	s^k	$\ln q_{j,t} \times s^k$	s^k	$\ln q_{j,t} \times s^k$
Temp Sep	-0.111 (-1.16)	-0.687^a (-3.30)	-0.110 (-1.14)	-0.688^a (-3.30)
Temp Oct	-0.177^a (-3.55)	0.038 (0.32)	-0.177^a (-3.56)	0.039 (0.32)
Temp Nov	0.358^b (2.45)	-0.217 (-0.67)	0.359^b (2.45)	-0.225 (-0.69)
Temp Dec	-0.189^b (-2.10)	-0.327 (-1.51)	-0.191^b (-2.12)	-0.292 (-1.35)
Temp Jan	0.287^a (3.28)	-0.222 (-1.22)	0.286^a (3.27)	-0.201 (-1.11)
Temp Feb	0.183^a (2.79)	0.038 (0.22)	0.184^a (2.79)	0.011 (0.06)
Temp Mar	-0.579^a (-7.50)	-0.334^b (-2.00)	-0.578^a (-7.47)	-0.317^c (-1.90)
Rain Sep	-0.022^a (-5.98)	-0.008 (-0.80)	-0.022^a (-5.98)	-0.008 (-0.79)
Rain Oct	0.014^a (6.15)	-0.008 (-1.32)	0.014^a (6.16)	-0.008 (-1.34)
Rain Nov	0.003 (1.36)	-0.002 (-0.36)	0.003 (1.35)	-0.002 (-0.29)
Rain Dec	0.004 (1.41)	-0.017^a (-3.03)	0.004 (1.41)	-0.017^a (-2.89)
Rain Jan	-0.004^a (-5.80)	-0.003^b (-2.42)	-0.004^a (-5.82)	-0.003^b (-2.25)
Rain Feb	-0.004^a (-3.85)	0.001 (0.46)	-0.004^a (-3.85)	0.001 (0.46)
Rain Mar	-0.003 (-1.61)	0.006 (1.54)	-0.003 (-1.61)	0.005 (1.41)
Temp Sep$\times \ln q_{j,t}$	-0.001 (-0.05)	0.202 (1.41)	-0.001 (-0.07)	0.200 (1.40)
Temp Oct$\times \ln q_{j,t}$	-0.017^c (-1.72)	-0.135^b (-2.41)	-0.017^c (-1.71)	-0.134^b (-2.41)
Temp Nov$\times \ln q_{j,t}$	0.005 (0.21)	0.275 (1.53)	0.005 (0.21)	0.274 (1.53)
Temp Dec$\times \ln q_{j,t}$	-0.007 (-0.44)	0.071 (0.70)	-0.007 (-0.44)	0.069 (0.68)
Temp Jan$\times \ln q_{j,t}$	-0.003 (-0.17)	0.043 (0.35)	-0.004 (-0.18)	0.037 (0.31)
Temp Feb$\times \ln q_{j,t}$	0.009 (0.44)	0.083 (0.61)	0.008 (0.43)	0.084 (0.62)
Temp Mar$\times \ln q_{j,t}$	0.009 (0.42)	-0.160 (-1.23)	0.009 (0.41)	-0.160 (-1.23)
Rain Sep$\times \ln q_{j,t}$	-0.002 (-1.43)	-0.008 (-0.82)	-0.002 (-1.43)	-0.008 (-0.83)
Rain Oct$\times \ln q_{j,t}$	0.000 (0.91)	0.003 (0.93)	0.000 (0.88)	0.003 (0.95)
Rain Nov$\times \ln q_{j,t}$	0.001 (1.34)	0.003 (0.73)	0.001 (1.34)	0.003 (0.66)
Rain Dec$\times \ln q_{j,t}$	-0.002^a (-2.94)	0.003 (0.84)	-0.002^a (-2.96)	0.003 (0.86)
Rain Jan$\times \ln q_{j,t}$	0.000 (-1.11)	-0.003^b (-2.07)	0.000 (-1.11)	-0.003^b (-2.06)
Rain Feb$\times \ln q_{j,t}$	0.000 (0.27)	-0.006^c (-1.70)	0.000 (0.27)	-0.006^c (-1.77)
Rain Mar$\times \ln q_{j,t}$	0.000 (-0.20)	-0.003 (-1.07)	0.000 (-0.20)	-0.003 (-1.01)
Altitude$\times \ln q_{j,t}$	0.000 (1.06)	0.003^b (2.29)	0.000 (1.05)	0.003^b (2.26)
$\ln q_{j,t}$	0.016 (0.01)	72.351^a (9.40)	0.788 (0.55)	70.264^a (8.62)
$\ln Q_{j,t}$	–	–	0.803 (0.97)	-2.797 (-1.25)
$\ln GDP_{j,t}$	–	–	-0.093 (-0.29)	4.915^a (5.45)

Notes: Firm-destination, firm-year, grape, type, vintage year, province, and HS fixed effects are included. t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively.