DISCUSSION PAPER SERIES

No. 9744

QUALITY, TRADE, AND EXCHANGE RATE PASS-THROUGH

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INTERNATIONAL MACROECONOMICS and INTERNATIONAL TRADE AND REGIONAL ECONOMICS

Centre for Economic Policy Research

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Available online at: www.cepr.org/pubs/dps/DP9744.php

ISSN 0265-8003

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Discussion Paper No. 9744
November 2013

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CEPR Discussion Paper No. 9744

November 2013

ABSTRACT

Quality, Trade, and Exchange Rate Pass-Through*

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, but only when exporting to high income destination countries. These findings remain robust to different measures of quality, samples, specifications, and to the potential endogeneity of quality.

JEL Classification: F12, F14 and F31
Keywords: exchange rate pass-through, exports, firms, pricing-to-market, quality, unit values and wine

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*For helpful comments, we thank Illenin Kondo, Logan Lewis, Dennis Novy, Olga Timoshenko, Charles van Marrewijk, Zhihong Yu, and participants at the CAGE Research Meetings 2013, DC Trade Study Group, ETSG Birmingham 2013, Inter-American Development Bank, International Monetary Fund, Midwest International Trade Meetings 2013, LSE, Nottingham, Utrecht School of Economics, and Warwick for comments. We are grateful to Linda Goldberg for sharing the data on distribution costs. Brett Fawley provided excellent research assistance. The views expressed are those of the authors and do not necessarily reflect official positions of the International Monetary Fund.

Submitted 08 November 2013

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. 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 expert 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 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 change

[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.

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 wine exported. 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. For instance, Argentina's 12-digit HS classification only groups wines into eleven different categories or "products." In contrast, as we define a product according to the name of the wine, its grape, type, and vintage year, 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 compute FOB export unit values as a proxy for export prices at the firm-product-destination level, and 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 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 1.1 percent so pass-through is 89 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 five percent. Also, pass-through is complete (i.e., 100 percent) for the wine with the lowest quality in the sample, but drops to 86.5 percent for the highest quality wine. 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 only when firms export to high 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.

The degree of exchange rate pass-through of 89 percent that we find, which magnitude is consistent with the estimates of other firm-level studies, contrasts with the low pass-through that is typically estimated using aggregate or industry-level data. For instance, in a sample of OECD countries, Campa and Goldberg (2005) find an average pass-through of 46 percent in the short run and 64 percent in the long run. We therefore investigate whether pass-through estimates suffer from an aggregation bias. To this aim, we aggregate our data both at the firm and at the country-levels, re-estimate our benchmark specifications, and compare the magnitude of exchange rate pass-through estimated at each level of data aggregation. Interestingly, we find that the more aggregated the data, the lower is estimated pass-through, suggesting that aggregate pass-through estimates suffer from an aggregation bias.

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. However, 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,

[7] Other firm-level studies include 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

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 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 discusses how the features of the wine industry conform with the main assumptions of the theoretical model to be tested. Section 5 presents our main empirical results. Section 6 provides robustness checks, while section 7 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.

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.

[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.

Chatterjee et al. (2013) extend the model of Berman et al. (2012) to multi-product firms. Inspired by Mayer, Melitz, and Ottaviano (2011), 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. 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 however rank the different goods produced by each firm in terms of quality rather than efficiency, where higher quality is associated with *higher marginal costs* (Crinò and Epifani, 2012; Hallak and Sivadasan, 2011; Johnson, 2012; Kugler and Verhoogen, 2012; Manova and Zhang, 2012a; Verhoogen, 2008). 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[13]

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

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. 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 produce goods with different levels of quality. They are heterogeneous in two dimensions: efficiency/productivity and 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. (2011) 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,

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

[13] 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).

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 then 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 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).[14] 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. The latter captures wholesale and retail costs 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. 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.[15] 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.[16] The costs, in

[14] 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.

[15] 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.

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

currency of the Home country, of producing $x_j(\varphi)\tau_j$ units of each good (inclusive of transportation costs) and selling them to country j are

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

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

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

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 $m(\varphi(\Phi,r))$ over marginal costs that are larger than $\frac{\sigma}{\sigma-1}$, increase with quality $s(\varphi(\Phi,r))$, the real exchange rate q_j (i.e., a real depreciation), and local distribution costs η_j.[17]

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

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

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, $s(\varphi(\Phi,r))$:*

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

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

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

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

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, $s(\varphi(\Phi, r))$:*

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

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.

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.[18] 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.[19]

Let us assume that the Home country now exports to only two destinations f, where f is either high or low income. We build on Crinò and Epifani (2012) and assume that the preference for quality is increasing in per capita income. The utility function becomes (also, see Hallak, 2006)

$$U(C_f) = \left[\int_{\Psi} \left[s(\varphi)^{\iota(y_f)} x_f(\varphi) \right]^{\frac{\sigma-1}{\sigma}} d\varphi \right]^{\frac{\sigma}{\sigma-1}}, \tag{10}$$

where $\iota(y_f)$ captures the intensity of preference for quality with respect to per capita income y_f, and $y_{high} > y_{low}$ so countries with higher per capita income have a stronger preference for quality. Local distribution costs are thus higher in high income countries as $\eta_f w_f s(\varphi)^{\iota(y_f)}$ increases in per capita income.[20,21] This allows us to derive two additional predictions that can be tested in the data.

[18] 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.

[19] 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).

[20] If wages are assumed to be the same in high and low income countries, distribution costs increase in per capita income. If, in addition, wages are assumed to be higher in rich than in poor countries, i.e., $w_{high} > w_{low}$, then the gap in distribution costs between high and low income countries becomes even larger.

[21] 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 $p_f(\varphi)$ to a change in the real exchange rate q_f, denoted by e_{p_f}, increases with the quality of the good exported $s(\varphi(\Phi, r))$, and by more for high income than for low income destination countries:*

$$e_{p_f} = \left| \frac{\partial p_f(\varphi)}{\partial q_f} \frac{q_f}{p_f(\varphi)} \right| = \frac{\eta_f q_f \varphi(\Phi, r)\, s(\varphi(\Phi, r))^{\iota(y_f)}}{\sigma\tau_f + \eta_f q_f \varphi(\Phi, r)\, s(\varphi(\Phi, r))^{\iota(y_f)}}.$$

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

$$e_{x_f} = \left| \frac{\partial x_f(\varphi)}{\partial q_f} \frac{q_f}{x_f(\varphi)} \right| = \frac{\sigma\tau_f}{\tau_f + \eta_f q_f \varphi(\Phi, r)\, s(\varphi(\Phi, r))^{\iota(y_f)}}.$$

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.[22] 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.[23] 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.[24] We also have

[22] 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.

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

[24] 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.

the name/brand of the wine exported, its type (red, white, or rosé), grape (Malbec, Chardonnay, etc.), and vintage year.[25] 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.[26] 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.

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." Second, we only keep the export flows recorded as FOB.[27] Third, as the experts rankings we rely on to measure quality are only for red, white, or rosé wines, we drop all sparkling wines, dessert wines, and other special varieties. Fourth, as we are interested in how product quality affects the pricing and export decisions of firms, and in turn need to control for the performance of wine exporters in the regressions, we restrict our analysis to wine producers and therefore to the manufacturing sector only – which requires us to 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 only keep wine producers. Fifth, we drop a number of typos which we are unable to fix. For instance, 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.

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 categorizes 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.[28] The problem is that changes in unit values defined at this level may reflect compositional changes rather than price changes as there may be more than one distinct product within a single HS code. 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)

[25] Wines in Argentina follow the tradition of *New World Wines* which are produced outside the traditional wine regions of Europe. Under Argentinean regulations, a wine must contain at least 80 percent of a grape for the grape name to appear on the label. Otherwise it is classified as a blend.

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

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

[28] 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.

so that compositional changes are unlikely to affect unit values.[29] Our cleaned sample includes a total of 21,647 different products/wines of which 6,720 can be matched with quality rankings. The 6,720 wines only represent 31 percent of all wines, but 58 percent of the total FOB value exported between 2002 and 2009.[30]

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.[31] As shown by 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 rankings). Exporters charged between two cents and 381 US dollars per liter of wine exported, with an average of five US dollars per liter. 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.[32] 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 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.[33] 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. Note that 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

[29] 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.

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

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

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

[33] 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.

alternative rating produced by Robert Parker.[34] 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. 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).[35] We match the customs data and the Parker rankings for 3,969 wines exported by 181 firms. Table 3 shows that the scores vary between 72 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 varying levels of quality (between 68 and 86 for Firm 1 and 74 and 90 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 2009, Firm 1 exported the same wine to two different destinations, but charged 17 US dollars per liter to Norway versus 6.6 dollars per liter to China. Similarly, in 2006 Firm 2 charged 4.4 dollars to the Netherlands versus 3.8 dollars to Brazil for the same liter of wine exported to both destinations.

3.3 Macroeconomic Data

The data on GDPs 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.

During the 2002-2009 period, Argentina witnessed major nominal exchange rate fluctuations. Figure 3 illustrates the evolution of the monthly nominal exchange rate 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 the peso depreciated in 2002 by up to 75 percent. The export boom that followed lead to a massive inflow of US dollars into the economy which helped to depreciate the US dollar compared to the peso. The peso then remained stable until 2008 when it depreciated again with the advent of the global financial crisis and the increase in domestic inflation.

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

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

4 Wine and Model Assumptions

The model described in section 2 intends to capture a general relation between quality and pass-through which could hold for any particular market. The reason why we analyze the wine market is because we have an observable measure for quality. Although the model is general, it is instructive to see how the features of the wine industry conform with its main assumptions. First, as already discussed and illustrated by Table 6, higher quality wines tend to be exported at a higher price which is consistent with equation (7) of the model.

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 the 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). 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.[36] Another example is to use "drip irrigation" which allows producers to limit the yield and therefore increase the potential quality of grapes, but this system is expensive to install. Finally, there is some evidence that in order to produce higher quality wines, Argentinean wineries often produce their own grapes for their best wines (which may need to be pruned and trimmed carefully, requiring more skilled labor), and rely on suppliers for their lower quality wines (Artopoulos, Friel, and Hallak, 2011).

More direct evidence on the positive relationship between price (quality) and marginal costs can be found in Table 7 which breaks down into several components the price of non-EU wines sold in UK retail outlets (Joseph, 2012).[37] 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.[38] We were unable to find a similar breakdown for Argentinean wines, but we believe that these figures for non-EU wines should still provide us with some useful insights on the composition of Argentinean wine prices sold in the UK.

Third, the model assumes that higher quality wines have higher distribution costs (distribution costs $\eta_j w_j s(\varphi(\Phi, r))$ increase with quality $s(\varphi(\Phi, r))$). This is confirmed by the fourth row of Table

[36] Ageing in oak barrels adds about £0.50 to the cost of a bottle sold in the UK (www.thirtyfifty.co.uk/spotlight-wine-pricing.asp).

[37] UK taxes include a duty of £1.90 per bottle and a VAT sales tax of 20 percent which may vary depending on alcohol content. 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.

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

7 that shows that distribution costs amount to £0.11 for a £5.76 bottle, and increase to £0.21 for a £7.19 bottle, £0.40 for a £8.83 bottle, and to £0.51 for a £10.09 bottle.

Finally, equation (7) predicts that higher quality wines have higher markups. The second row of Table 7 shows indeed that the margin charged by the retailer increases systematically with the price of the wine (and, therefore, with quality too).[39] The margin is £1.92 for a £5.76 wine and increases to £3.36 for a £10 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.[40]

We therefore conclude that the features of the wine industry closely satisfy the key assumptions of the model: higher quality wines tend to be exported at a higher price, and are characterized by higher marginal costs, distribution costs, and markups, both at the retail and producer levels.

5 Empirical Framework

Prediction 1 states that following a real depreciation, exporters increase their export price 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

$$\begin{aligned} \ln UV_{ij,t}^k &= \beta_1 \ln q_{j,t} + \beta_2 s_{WS}^k + \beta_3 \ln q_{j,t} \times s_{WS}^k + \beta_4 z_{i,t} + \psi_t + \mu_{ij} + \theta_{grape} + \zeta_{type} \\ &\quad + \gamma_{vintage} + \varrho_{HS} + \kappa_p + \epsilon_{ij,t}^k \end{aligned} \tag{11}$$

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_{WS}^k where the WS index refers to the Wine Spectator rankings. 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 (Knetter, 1989, 1993). 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 which we denote by $z_{i,t}$.[41] Without any additional information on the exporters, we rely on a number of proxies that have been shown in the literature to correlate strongly with productivity/marginal costs. First is the average size of the firm, $size_{i,t}$, measured by the total volume of FOB exports by each firm in each year. Second is the total number of destination countries where each firm exports to in each year,

[39] The reason is that the retail margin represents 40 percent of the pre-VAT tax price. For the wine priced at £5.76, the retail margin is £1.92 which is 40 percent of the pre-VAT tax price equal to £5.76-£0.96=£4.88.

[40] See http://www.thirtyfifty.co.uk/spotlight-wine-pricing.asp.

[41] The approach of distinguishing changes in marginal costs from changes in markups has first been proposed by Knetter (1989, 1993).

$dest_{i,t}$.[42] Besides, we include year fixed effects ψ_t to control for aggregate shocks that are common to all Argentinean exporters. We perform within estimations by including firm-destination μ_{ij} fixed effects. 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/brand are not included as they are collinear with the firm fixed effects (because each brand is sold by one firm only). β_1, β_2, β_3, and β_4 are coefficients to be estimated 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 so β_1 should be positive.[43] Higher quality is expected to increase export prices so β_2 should be positive, too. The coefficient of interest is β_3, the coefficient on the interaction between the real exchange rate and quality which captures heterogeneous pricing-to-market. According to Prediction 1, the response of unit values to a real depreciation should increase with quality in which case β_3 should be positive.

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

$$\begin{aligned}\ln X^k_{ij,t} &= \alpha_1 \ln q_{j,t} + \alpha_2 s^k_{WS} + \alpha_3 \ln q_{j,t} \times s^k_{WS} + \alpha_4 z_{i,t} + \alpha_5 Z_{j,t} + \psi_t + \mu_{ij} + \theta_{grape} + \zeta_{type} \\ &\quad + \gamma_{vintage} + \varrho_{HS} + \kappa_p + \varepsilon^k_{ij,t} \qquad (12)\end{aligned}$$

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.[44] To be consistent with standard gravity models we 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, α_1 should be positive. If this increase is smaller for higher quality products, the coefficient on the interaction term α_3 should be negative.

5.1 Baseline Results

Panel A of Table 8 reports the results of estimating equation (11) for unit values. Column (1) only includes the exchange rate, quality, and firm size 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

[42] Alternatively, we could consider the total number of liters of wine exported by each firm in each year as a proxy for firm size but we do not as this variable appears in the denominator of the unit values ratio.

[43] When the interaction term between the real exchange rate and quality is excluded from (11), β_1 captures the extent to which exporters vary their markups following a change in the exchange rate, and therefore the degree of pricing-to-market. 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 is given by $(1 - \beta_1)$.

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

Crozet et al. (2012) for Champagne.[45] When the real exchange rate fluctuates, exporters significantly change their export prices: following a ten percent depreciation they raise their prices (in pesos) by 1.1 percent so that on average pass-through is 89 percent. The large degree of pass-through we find for the wine industry is therefore consistent with the findings of other papers that use firm-level data for the whole manufacturing sector. For instance, pass-through 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 real depreciation 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).

In column (3) we use the number of export destinations for each firm as an alternative proxy for firm productivity. Its estimated coefficient is not significant, but most importantly our main conclusions regarding heterogeneous pass-through remain unaffected.[46] Column (4) restricts the sample to multi-product firms, where a multi-product firm is defined as a firm-destination-year triplet with strictly more than one wine exported, and the results also remain unchanged.

In column (5) we check if our results hold in a difference-in-difference specification which includes destination-year and product fixed effects instead of the ones specified in equation (11). Both the exchange rate and quality drop from the regression, but the interaction term between the exchange rate and quality can be estimated. Although its estimated coefficient decreases in magnitude and in significance, it still indicates that the elasticity of export prices to exchange rates is larger for higher quality wines.

Panel B of Table 8 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 1.844, which is consistent with evidence in the literature that the trade elasticities for emerging economies are generally larger than for developed countries.[47] The coefficient on quality is negative and significant while the literature usually points to 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, 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, high quality wines are generally produced in smaller quantities.

[45] In (7), higher quality goods have a higher price because they have both a higher markup and higher marginal costs.

[46] Instead, Manova and Zhang (2012a) find that Chinese exporters supplying more countries charge higher prices.

[47] 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.

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 the use of the number of export destinations as a measure of firm performance (column 3) and to restricting the sample to multi-product firms (column 4). The difference-in-difference specification in column (5) does not provide evidence of an heterogeneous response of export volumes to exchange rates driven by quality.[48]

For each regression in Table 8 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). In column (2) of Panel A, the unit values elasticity increases from 0.115 to 0.121 which corresponds to a five percent increase in pricing-to-market. If we calculate the elasticity (not reported) for the lowest quality wine in the sample (with a ranking of 55), the elasticity is equal to 0.065 and is insignificantly different from zero, suggesting full pass-through. In contrast, for the highest quality wine (with a score of 97) the elasticity is positive and equal to 0.135 (significant at the one percent level) so pass-through drops to 86.5 percent. In column (2) of Panel B, a one standard deviation increase in quality reduces the volume elasticity by one and a half percent from 1.833 to 1.808. The elasticity for the highest quality wine is equal to 1.75 and increases to 2.02 for the lowest quality wine. Overall, the effects of quality on the price and volume elasticities remain very similar across all specifications reported in Table 8.

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 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 2001, 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 2001 we compute the average distribution costs over time for each of the 21 destination countries and for the "Food products and beverages" industry. 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 (log) distribution costs. The results are reported in Table 9. For unit values, column (1) shows that the interaction between the real exchange rate and distribution costs is positive and significant at the ten percent level, suggesting that pricing-to-market increases with local costs which is consistent with the findings of Berman et al. (2012) and Campa and Goldberg (2010). Column (2) further includes the interaction between the real exchange rate and quality which

[48] We also estimated the regressions for unit values and export volumes allowing for non-linearities in the effects of quality on pass-through. We included 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 six quality variables interacted with the exchange rate. It turns out that the impact of quality in explaining heterogeneous pass-through is mostly driven by the top quality wines with a score higher than 94. Due to space constraints, the results are not reported but are available upon request.

is positive and significant. Consistent with expectations, this indicates that 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 9. The interaction between the exchange rate and local costs is negative, as expected, but is only significant at the 11 percent level.

5.2 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 high income than for low income destination countries. This section investigates whether the two predictions can be validated by the data.

The destination countries included in our data set are split between high and low income according to the World Bank's classification based on GNI per capita in 2011. Low income countries have a GNI per capita of less than $4,035 while high income countries are above that threshold. We then estimate equations (11) and (12) for unit values and export volumes, and interact the real exchange rate, as well as the real exchange rate interacted with quality, with a dummy for high ($High$) and a dummy for low (Low) income destination countries.[49]

The results for unit values are reported in Panel A of Table 10. According to column (1), higher quality is again associated with higher prices, and the coefficients on the real exchange rate, both for low and high income countries, are of similar magnitude. However, only the coefficient for high income countries is significantly different from zero so while pass-through is estimated as being complete for low income destinations, it decreases to approximately 90 percent for exports to high income countries. This indicates that price discrimination exists across destination countries and that the Law of One Price fails. This finding is also consistent with predictions from the literature that pricing-to-market should be stronger 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.

Column (2) further interacts the exchange rate with quality and interestingly, the coefficient on the interaction term is positive and significant for high income destinations only. As a result, for low income countries, the response of unit values to exchange rate changes does not vary with quality. In contrast, for high income countries, the response of unit values to exchange rate changes increases with quality. A one standard deviation increase in quality increases the exchange rate elasticity from 0.112 to 0.120, i.e., a seven percent increase in pricing-to-market. These findings lend support to Prediction 3.

The finding that pass-through varies with quality for high income destination countries only is robust to the use of the number of destinations as a control for firm productivity (column 3), to restricting the sample to multi-product firms (column 4), and to the inclusion of destination-year and product fixed effects (column 5).

Panel B of Table 10 focuses on export volumes. Overall, the results find strong support for Prediction 4. Column (1) shows that a real depreciation raises export volumes to both low and high

[49] The results remain similar if we also interact quality and firm size with the high and low income dummy variables.

income destination countries. Consistent with the findings in Panel A, column (2) shows that the interaction between the real 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. These findings remain robust in the other columns of the table, except when destination-year and product fixed effects are included in column (5).[50]

5.3 Aggregation Bias

As explained above, the degree of exchange rate pass-through that we find for the wine industry is consistent with the ones reported in other firm-level studies, but is larger than many estimates obtained using aggregate or industry-level data.[51] Therefore, in this section we investigate whether pass-through estimates suffer from an aggregation bias.

To address this issue, we aggregate the data at different levels, re-estimate our benchmark specifications, and compare the magnitude of exchange rate pass-through estimated at each level of data aggregation. The first natural step would be to aggregate the data at the HS level, which classifies wines into five different categories. However, when doing so it turns out that the majority of firms actually export in a single HS code. We therefore instead aggregate the data at the firm-level (so firms become single-product) in which case the unit values capture the average price charged by each firm to each destination in each year, and quality is the average quality of all wines exported by each firm to each destination in each year, denoted by $\overline{s}_{ij,t,WS}$. In a second step, we further aggregate the data across firms in which case the unit values represent the average price of wine exported by all firms in the sample to each destination in each year, and quality is the average quality of all wine exports to each destination in each year and is denoted by $\overline{s}_{j,t,WS}$.

Columns (1) and (2) of Table 11 replicate the benchmark specifications for unit values reported in columns (1) and (2) of Table 8. Whether or not we interact the real exchange rate with quality, average pass-through is estimated at 89 percent. Columns (3) and (4) of Table 11 report our two benchmark specifications estimated on the firm-level sample.[52] As before, higher quality is associated with higher prices. The interaction between the exchange rate and quality in column (4) is however insignificantly different from zero, most likely because the averaging of quality across products at the firm level reduces the variation of quality in the sample substantially. Interestingly, in both columns average pass-through is now estimated at 69 percent, which is 20 percentage points lower than the 89 percent reported in columns (1) and (2). Columns (5) and (6) focus on the aggregate sample.[53] Higher quality still leads to higher unit values although its significance is much reduced. In column (6)

[50] As the local distribution costs data from Campa and Goldberg (2010) are only available for high income countries, we are unable to explore the differential impact of these costs on the pass-through of high versus low income countries.

[51] There are exceptions, however. For instance, Gopinath and Rigobon (2008) use detailed transactions level data on US exports and imports and find that exchange rate pass-through into US import prices is low at 22 percent.

[52] The specification includes year, destination, and firm fixed effects only. We do not include firm-destination fixed effects because a large proportion of the firms included in the sample export to a single destination only. Standard errors are adjusted for clustering at the firm level.

[53] As in Knetter (1989, 1993), the specification only includes time fixed effects to control for marginal costs movements and destination fixed effects to capture time-invariant features that vary across destinations. Standard errors are adjusted for clustering at the destination level.

the interaction between the real exchange rate and quality is again insignificant,[54] but it is interesting to note that average pass-through is low at 47 percent.

To conclude, we show that part of the low exchange rate pass-through estimated using aggregate data appears to result from an aggregation bias: the more aggregated the data, the lower is estimated pass-through. In addition, the more aggregated the data, the more difficult it becomes to identify the impact of quality on heterogeneous pass-through.

6 Robustness

In this section we discuss a number of alternative specifications we implement to ensure the robustness of our findings. Overall, the broad similarity of the resulting patterns is supportive of the paper's main conclusions.[55]

6.1 The Measurement of Quality

We run a few sensitivity checks on the measurement of quality. Column (1) of Table 12 regresses equation (11) using the log of quality s^k_{WS} instead of its level. The results remain qualitatively unchanged, and as before a one standard deviation increase in quality from its mean level increases pricing-to-market by five percent.

In order to minimize possible noise in the measurement of quality when defined on a (50,100) scale, we construct a new variable, denoted by $\widetilde{s}^k_{WS}$, 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 $\widetilde{s}^k_{WS}$ as a regressor in (11) are reported in column (2) and remain qualitatively similar, although the magnitude of the estimated coefficient on quality becomes larger.

In columns (3) and (4), quality is measured using the Parker rankings and is denoted by s^k_P. The regression in column (3) includes all wines for which the Parker rankings are available, while column (4) restricts the sample to the wines for which both the Parker and the Wine Spectator rankings are simultaneously available. Qualitatively, our results largely hold up. The coefficient on s^k_P is however larger than the one on the Wine Spectator rankings.

Recall that due to missing observations on the Wine Spectator rankings, our sample covers 58 percent of the total FOB value exported by Argentina between 2002 and 2009. In order to increase the sample coverage, 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 85 percent of the total FOB value exported over the period. We apply this procedure to

[54] The insignificance of the interaction term is again most likely due to the averaging of quality across products and firms. When splitting the sample between high and low income destination countries, we are still unable to identify any significant effect of quality in explaining pass-through, even for high income destination countries.

[55] We repeated all the robustness checks discussed in this section while allowing for heterogeneous pass-through to differ between high and low income destination countries. Due to space constraints, the results are not reported but are available upon request. The results remain largely robust.

compute average quality on a (50,100) scale, denoted by s^K_{WS}, and on a (1,6) scale, denoted by $\tilde{s}^K_{WS}$ where the K index indicates that quality varies by name and type only. The results of using either s^K_{WS} or $\tilde{s}^K_{WS}$ are respectively reported in columns (5) and (6) of Table 12 and remain qualitatively unaffected.

Table 13 replicates the same specifications as in Table 12 but using export volumes as a dependent variable. Our results remain robust in all cases.

6.2 The Endogeneity of Quality

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.[56] 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 producers names are not known)."[57] 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 $t_{p,m}$ and the total amount of rainfall $r_{p,m}$ for each growing province p in each month m between September and March (Ramirez, 2008).[58] 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 Alt_p of each province p as an additional instrument for quality.[59]

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.[60] Gaps in the data are filled using online information, although missing information for some provinces

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

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

[58] For each province, the average temperatures, total rainfall, and altitude are measured at the following weather stations: 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).

[59] 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.

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

and vintage years results in a slightly reduced sample.[61] 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 8 for unit values and export volumes, respectively. The results, reported in column (7) of Tables 12 and 13 for prices and quantities, show that our main findings go through over the smaller sample.

Column (8) of Table 12 regresses by Instrumental Variables (IV) unit values on the real exchange rate, quality, and firm size. The coefficient on quality is positive and significant but becomes smaller compared to the OLS estimate in column (7). This positive endogeneity bias suggests that wine tasters tend to assign higher scores to more expensive wines. Column (8) of Table 13 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 (7). For both regressions, the Kleibergen-Paap F statistic (equal to 44 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.

The first-stage regressions for the two IV regressions (not reported due to space constraints but available upon request) show that climate variation affects wine quality. The results are somewhat erratic, but the positive coefficient on the February temperature is consistent with the finding in the literature that warmer temperatures during the harvest period (i.e., February/March in the Southern hemisphere) are typically associated with higher quality (the negative coefficient on the March temperature is therefore counterintuitive). Also, the positive coefficients on the October and December 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).

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 now includes the monthly temperatures, monthly rainfall, and altitude variables as well as each of the variables interacted with the exchange rate.[62] The results for unit values are reported in column (9) of Table 12 and show that exchange rate pass-through is larger for lower quality wines. Interestingly, the exchange rate elasticity increases from 0.105 to 0.131 following a one standard deviation increase in quality from its mean level, which corresponds to a 25 percent increase in pricing-to-market. This suggests that quality is quantitatively important in explaining heterogeneous pass-through. For export volumes in column (9) of Table 13, the coefficient on the interaction term is not statistically significant.

[61] Online information is taken from www.tutiempo.net. Missing observations are for Mendoza vintages 1977 and 2001 and Salta vintages 2001 and 2005.

[62] In the regressions that exclude the interaction between the exchange rate and quality, altitude is dropped as an instrument as it is perfectly collinear with the province fixed effects. In the regressions that include the interaction term, the interaction between the exchange rate and altitude is used as an instrument.

6.3 Asymmetries

We check if exporting firms adopt different pricing strategies depending on whether the Argentinean peso appreciates or depreciates in real terms. We estimate equations (11) and (12) for unit values and export volumes and interact the real exchange rate, as well as the real exchange rate interacted with quality, with a dummy for real appreciations (*App*) and a dummy for real depreciations of the peso (*Dep*).

Column (1) of Table 14 shows that the unit values response is larger when the peso appreciates than depreciates in real terms: the exchange rate elasticity evaluated at the mean value of quality is equal to 0.108 for real appreciations versus 0.092 for real depreciations (the two elasticities are statistically different from each other at the one percent level). This asymmetric pattern is consistent with firms trying to maintain export market shares by reducing more the domestic currency prices of their exports, which become less competitive when the peso appreciates. It is also consistent with the findings of Marston (1990) who shows that pricing-to-market by Japanese firms tends to be stronger in periods when the Japanese yen appreciates. Besides, column (1) of Table 14 also shows that a one standard deviation increase in quality from its mean level increases pricing-to-market by 8.3 percent following a real appreciation and by 4.3 percent only following a real depreciation. In turn, column (1) of Table 15 shows that for export volumes, a one standard deviation increase in quality reduces the exchange rate elasticity more during depreciations (decrease of 2.1 percent) than appreciations (decrease of 0.5 percent).

6.4 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 (2) of Table 14, 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 0.099 to 0.106 which represents a seven percent increase in pricing-to-market. The two elasticities are slightly smaller than in the whole sample, suggesting that pricing-to-market tends to be stronger when exchange rates are more variable. This finding is consistent with Martín and Rodríguez (2004) who find more pricing-to-market by Spanish firms over the period 1993-1995 when the domestic currency was quite volatile. In turn, from column (2) of Table 15, the exchange rate elasticity evaluated at the mean level of quality is equal to 3.463 and drops to 3.440 following a one standard deviation increase in quality, where both elasticities are larger than in the whole sample.

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 (3) of Table 14 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: pass-through is estimated at 74 percent at the mean level of quality, and drops to 73.4 percent after a one standard deviation increase in quality. 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 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 3 of Table 15), the coefficient on the interaction term between the real exchange rate and quality is negative but only significant at the ten percent level.

6.5 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 only captures the intensive margin of adjustment and includes the firms that export in all years to any destination between 2002 and 2009. The results for prices and quantities are reported in column (4) of Tables 14 and 15, respectively, and remain robust to the exclusion of the extensive margin.

6.6 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 essentially come from movements in domestic prices. We verify that our results still hold after excluding from the sample the US (which is 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 et al., 2012).[63] The results are reported in columns (5) and (6) of Tables 14 and 15 for prices and quantities, respectively, and remain largely robust.

6.7 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.[64] Alternative data sources have shown considerably higher inflation rates than the official data since 2007 which makes the real exchange

[63] 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).

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

rate used for our estimations in 2008 and 2009 unreliable.[65] Using online data from supermarket chains, Cavallo (2013) constructs an aggregate CPI for Argentina and 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, denoted by $\widetilde{q}_{j,t}$, that we use to estimate both equations (11) and (12). The results are reported in column (7) of Tables 14 and 15 and remain very similar to the ones obtained with the official CPI data.

6.8 Monthly Frequency

The customs data are originally 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 $UV_{ij,m}^{k}$, export volumes $X_{ij,m}^{k}$, and the real exchange rate $q_{j,m}$ are defined at a monthly frequency m, and where month rather than year fixed effects are included. Due to data limitations, the real GDPs and real effective exchange rates in the exports regression are measured annually. For simplicity, average firm size is also defined at a yearly frequency (but in results available upon request we show that the results remain robust to measuring firm size at a monthly frequency).

Column (8) of Table 14 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. Pricing-to-market is significantly stronger for higher quality wines. For export volumes, the results in column (8) of Table 15 also remain qualitatively similar to the annual frequency estimates. Again, the coefficient on quality is smaller. 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.

6.9 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 whole 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 (9) of Table 14 expresses unit values in US dollars per liter. Remarkably, our results remain largely unaffected once we let exports be invoiced in US dollars.

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

7 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 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 high 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 is large: following a ten percent real depreciation exporters increase their export prices by 1.1 percent so pass-through is 89 percent. Second, a 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. Fourth, export volumes increase following a real depreciation, but the increase is smaller for higher quality wines. Finally, the heterogeneous response of prices and quantities to real exchange rate fluctuations is only present when firms export to high income destination countries. The results remain robust to different measures of quality, samples, specifications, and to the potential endogeneity of quality. We also show that part of the low exchange rate pass-through that is estimated using aggregate data appears to result from an aggregation bias.

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 in the future, testing whether our results extend beyond the Argentinean wine industry is a promising avenue for future research.

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Table 1: Harmonized System (HS) Classification Codes

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 Trade 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	41,576	72	98	87	87	2.3
Instruments						
Temperature September (Celsius)	39,146	3.4	21.4	14.6	15.2	1.6
Temperature October (Celsius)	39,146	6.4	25.3	18.8	19.8	2.8
Temperature November (Celsius)	39,146	9.2	27.4	22.3	22.2	1.8
Temperature December (Celsius)	39,146	10.5	28.2	24.6	25.3	1.7
Temperature January (Celsius)	39,146	12.7	29.5	25.8	25.8	1.8
Temperature February (Celsius)	39,146	12.6	28.4	23.6	23.9	1.4
Temperature March (Celsius)	39,146	9.8	25.8	21.1	21.2	1.4
Rainfall September (mm)	39,146	0	105	13.9	9	14.3
Rainfall October (mm)	39,146	0	182	19.3	16	21.7
Rainfall November (mm)	39,146	0	195	17.9	8	22.8
Rainfall December (mm)	39,146	0	224	23.5	6	34.2
Rainfall January (mm)	39,146	0	374	54.4	38	54.8
Rainfall February (mm)	39,146	0	581	42.4	42	33
Rainfall March (mm)	39,146	0	321	43.3	41	33.1
Altitude (meters)	39,146	191	1,238	716	705	134

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	Wine	Type	Grape	Vintage	Quality	Unit value (USD/liter)
Wine Spectator								
1	2006	Poland	A	Red	Cabernet Sauvignon	2005	68	0.67
1	2009	Norway	B	Red	Malbec	2004	86	17.24
1	2009	China	B	Red	Malbec	2004	86	6.64
Parker								
2	2008	Canada	C	Red	Pinot Negro	2007	74	1.33
2	2006	Brazil	D	White	Chardonnay	2005	90	3.84
2	2006	Netherlands	D	White	Chardonnay	2005	90	4.38

Table 7: Price Breakdown for Non-EU Wine sold in Retail Outlets in the UK

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

Source: Joseph (2012).

Table 8: Baseline Results

	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent variable is $\ln UV_{ij,t}^{k}$					
$\ln q_{j,t}$	0.112^{a} (2.947)	-0.026 (-0.436)	-0.031 (-0.528)	-0.026 (-0.435)	–
s_{WS}^{k}	0.032^{a} (12.178)	0.033^{a} (12.231)	0.033^{a} (12.221)	0.033^{a} (12.241)	–
$\ln q_{j,t} \times s_{WS}^{k}$	–	0.002^{a} (3.042)	0.002^{a} (3.058)	0.002^{a} (3.036)	0.001^{b} (1.968)
$\ln size_{i,t}$	0.030^{c} (1.799)	0.030^{c} (1.782)	–	0.027 (1.565)	0.030 (0.841)
$\ln dest_{i,t}$	–	–	-0.024 (-0.814)	–	–
Quantitative Effects					
Mean(s)	–	0.115^{a} (3.02)	0.110^{a} (2.90)	0.114^{a} (3.02)	0.082^{b} (1.97)
Mean(s)+sd(s)	–	0.121^{a} (3.19)	0.116^{a} (3.06)	0.121^{a} (3.18)	0.086^{b} (1.97)
Panel B: Dependent variable is $\ln X_{ij,t}^{k}$					
$\ln q_{j,t}$	1.844^{a} (3.550)	2.371^{a} (4.544)	2.173^{a} (4.180)	2.448^{a} (4.650)	–
s_{WS}^{k}	-0.046^{a} (-7.423)	-0.047^{a} (-7.621)	-0.047^{a} (-7.515)	-0.047^{a} (-7.590)	–
$\ln q_{j,t} \times s_{WS}^{k}$	–	-0.006^{a} (-3.742)	-0.006^{a} (-3.700)	-0.006^{a} (-3.804)	0.000 (0.283)
$\ln size_{i,t}$	0.331^{a} (5.860)	0.333^{a} (5.874)	–	0.345^{a} (5.821)	0.226^{a} (2.605)
$\ln dest_{i,t}$	–	–	0.002 (0.026)	–	–
$\ln Q_{j,t}$	0.841 (1.570)	0.839 (1.570)	0.678 (1.274)	0.914^{c} (1.697)	–
$\ln GDP_{j,t}$	-0.172 (-0.944)	-0.145 (-0.799)	-0.168 (-0.924)	-0.128 (-0.727)	–
Quantitative Effects					
Mean(s)	–	1.833^{a} (3.54)	1.642^{a} (3.18)	1.903^{a} (3.64)	0.039 (0.28)
Mean(s)+sd(s)	–	1.808^{a} (3.48)	1.618^{a} (3.13)	1.878^{a} (3.59)	0.041 (0.28)
Sample	Full	Full	Full	Multi-product	Full
N	41,576	41,576	41,576	41,119	41,576

Notes: Year, province, firm-destination, grape, type, vintage year, and HS fixed effects are included in (1)-(4) while year-destination and product fixed effects are included in (5). 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 9: Local Distribution Costs

	(1)	(2)	(3)	(4)
Dependent variable	$\ln UV^k_{ij,t}$	$\ln UV^k_{ij,t}$	$\ln X^k_{ij,t}$	$\ln X^k_{ij,t}$
$\ln q_{j,t}$	0.478 (1.199)	0.051 (0.124)	2.610 (1.324)	2.349 (1.171)
s^k_{WS}	0.037 [a] (12.394)	0.033 [a] (11.071)	−0.055[a] (−6.974)	−0.057[a] (−6.222)
$\ln q_{j,t} \times s^k_{WS}$	–	0.005[a] (3.462)	–	0.003 (0.507)
$\ln q_{j,t} \times \ln dc_j$	0.511[c] (1.805)	0.488[c] (1.726)	−1.776 (−1.581)	−1.792 (−1.597)
$\ln size_{i,t}$	0.032[c] (1.709)	0.033[c] (1.761)	0.372[a] (5.410)	0.372[a] (5.417)
$\ln Q_{j,t}$	–	–	4.243[a] (3.127)	4.249[a] (3.131)
$\ln GDP_{j,t}$	–	–	2.090[a] (2.632)	2.105[a] (2.654)
N	20,188	20,188	20,188	20,188

Notes: Year, province, firm-destination, grape, type, vintage year, 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. Destination-specific distribution costs dc_j for the "Food products and beverages" industry are from Campa and Goldberg (2010).

Table 10: Heterogeneity across Destination Countries

	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent variable is $\ln UV^k_{ij,t}$					
$\ln q_{j,t} \times Low$	0.119 (1.118)	0.101 (0.733)	0.086 (0.624)	0.097 (0.699)	–
$\ln q_{j,t} \times High$	0.111^a (2.836)	−0.056 (−0.886)	−0.060 (−0.961)	−0.054 (−0.858)	–
s^k_{WS}	0.032^a (12.173)	0.033^a (12.198)	0.033^a (12.189)	0.033^a (12.212)	–
$\ln q_{j,t} \times s^k_{WS} \times Low$	–	0.000 (0.239)	0.000 (0.245)	0.000 (0.333)	−0.001 (−1.230)
$\ln q_{j,t} \times s^k_{WS} \times High$	–	0.002^a (3.375)	0.002^a (3.386)	0.002^a (3.335)	0.001^b (2.467)
$\ln size_{i,t}$	0.030^c (1.800)	0.030^c (1.787)	–	0.027 (1.570)	0.030 (0.831)
$\ln dest_{i,t}$	–	–	−0.024 (−0.812)	–	–
Quantitative Effects					
Low : Mean(s)	–	0.123 (1.17)	0.109 (1.03)	0.128 (1.21)	−0.093 (−1.23)
Low : Mean(s)+sd(s)	–	0.124 (1.18)	0.110 (1.04)	0.129 (1.22)	−0.097 (−1.23)
$High$: Mean(s)	–	0.112^a (2.87)	0.108^a (2.77)	0.112^a (2.86)	0.112^b (2.47)
$High$: Mean(s)+sd(s)	–	0.120^a (3.05)	0.116^a (2.95)	0.119^a (3.04)	0.117^b (2.47)
Panel B: Dependent variable is $\ln X^k_{ij,t}$					
$\ln q_{j,t} \times Low$	1.821^a (3.298)	1.774^a (3.065)	1.531^a (2.651)	1.832^a (3.146)	–
$\ln q_{j,t} \times High$	1.850^a (3.485)	2.551^a (4.756)	2.366^a (4.427)	2.635^a (4.868)	–
s^k_{WS}	-0.046^a (−7.421)	-0.046^a (−7.446)	-0.046^a (−7.342)	-0.046^a (−7.412)	–
$\ln q_{j,t} \times s^k_{WS} \times Low$	–	0.001 (0.418)	0.001 (0.453)	0.001 (0.453)	0.007^a (2.737)
$\ln q_{j,t} \times s^k_{WS} \times High$	–	-0.008^a (−4.150)	-0.008^a (−4.116)	-0.008^a (−4.229)	−0.001 (−0.428)
$\ln size_{i,t}$	0.331^a (5.860)	0.332^a (5.870)	–	0.344^a (5.817)	0.227^a (2.618)
$\ln dest_{i,t}$	–	–	0.002 (0.021)	–	–
$\ln Q_{j,t}$	0.845 (1.560)	0.869 (1.611)	0.716 (1.334)	0.946^c (1.740)	–
$\ln GDP_{j,t}$	−0.173 (−0.944)	−0.151 (−0.824)	−0.175 (−0.960)	−0.134 (−0.756)	–
Quantitative Effects					
Low : Mean(s)	–	1.861^a (3.38)	1.625^a (2.95)	1.926^a (3.47)	0.633^a (2.74)
Low : Mean(s)+sd(s)	–	1.865^a (3.38)	1.629^a (2.96)	1.930^a (3.48)	0.662^a (2.74)
$High$: Mean(s)	–	1.869^a (3.54)	1.690^a (3.21)	1.942^a (3.64)	−0.067 (−0.43)
$High$: Mean(s)+sd(s)	–	1.839^a (3.47)	1.659^a (3.15)	1.911^a (3.58)	−0.070 (−0.43)
Sample	Full	Full	Full	Multi-product	Full
N	41,576	41,576	41,576	41,119	41,576

Notes: Year, province, firm-destination, grape, type, vintage year, and HS fixed effects are included in (1)-(4) while year-destination and product fixed effects are included in (5). 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 11: Aggregation Bias

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln q_{j,t}$	0.112^{a} (2.947)	-0.026 (-0.436)	0.311^{a} (4.449)	0.501^{a} (3.559)	0.530^{a} (3.106)	0.709^{c} (1.799)
s^{k}_{WS}	0.032^{a} (12.178)	0.033^{a} (12.231)	–	–	–	–
$\ln q_{j,t} \times s^{k}_{WS}$	–	0.002^{a} (3.042)	–	–	–	–
$\overline{s}_{ij,t,WS}$	–	–	0.032^{a} (2.956)	0.031^{a} (2.892)	–	–
$\ln q_{j,t} \times \overline{s}_{ij,t,WS}$	–	–	–	-0.002 (-1.434)	–	–
$\overline{s}_{j,t,WS}$	–	–	–	–	0.022^{c} (1.691)	0.019 (1.431)
$\ln q_{j,t} \times \overline{s}_{j,t,WS}$	–	–	–	–	–	-0.002 (-0.460)
$\ln size_{i,t}$	0.030^{c} (1.799)	0.030^{c} (1.782)	0.011 (0.369)	0.011 (0.353)	–	–
Sample	Products	Products	Firms	Firms	Aggregate	Aggregate
$q_{j,t}$ elasticity	0.112	0.115	0.311	0.306	0.530	0.530
Pass-through	89%	89%	69%	69%	47%	47%
N	41,576	41,576	6,505	6,505	510	510

Notes: Year, province, firm-destination, grape, type, vintage year, and HS fixed effects are included in (1) and (2). Year, destination, and firm fixed effects are included in (3) and (4). Year and destination fixed effects are included in (5) and (6). Robust standard errors are adjusted for clustering at the product level in (1) and (2), firm level in (3) and (4), and destination level in (5) and (6). t-statistics in parentheses. ^{a}, ^{b}, and ^{c} indicate significance at 1, 5, and 10 percent levels, respectively. The real exchange rate $q_{j,t}$ elasticity (and therefore the magnitude of exchange rate pass-through) is evaluated at the mean value of quality in (2), (4) and (6).

Table 12: Unit Values: Robustness on Quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln q_{j,t}$	-0.444^{b}	0.085^{b}	-0.206^{c}	-0.292^{b}	0.040	0.136^{a}	−0.050	0.091^{b}	−0.486
	(−2.081)	(2.195)	(−1.779)	(−2.064)	(0.773)	(4.605)	(−0.804)	(2.287)	(−1.632)
s^k_{WS}	–	–	–	–	–	–	0.032^{a}	0.022^{b}	0.021^{b}
							(11.261)	(2.169)	(2.116)
$\ln q_{j,t} \times s^k_{WS}$	–	–	–	–	–	–	0.002^{a}	–	0.007^{c}
							(2.955)		(1.949)
$\ln s^k_{WS}$	2.661^{a}	–	–	–	–	–	–	–	–
	(11.516)								
$\ln q_{j,t} \times \ln s^k_{WS}$	0.126^{a}	–	–	–	–	–	–	–	–
	(2.656)								
$\widetilde{s}^k_{WS}$	–	0.146^{a}	–	–	–	–	–	–	–
		(12.833)							
$\ln q_{j,t} \times \widetilde{s}^k_{WS}$	–	0.008^{a}	–	–	–	–	–	–	–
		(3.090)							
s^k_P	–	–	0.088^{a}	0.066^{a}	–	–	–	–	–
			(14.779)	(9.666)					
$\ln q_{j,t} \times s^k_P$	–	–	0.004^{a}	0.005^{a}	–	–	–	–	–
			(3.631)	(3.253)					
s^K_{WS}	–	–	–	–	0.053^{a}	–	–	–	–
					(21.124)				
$\ln q_{j,t} \times s^K_{WS}$	–	–	–	–	0.001^{a}	–	–	–	–
					(2.798)				
$\widetilde{s}^K_{WS}$	–	–	–	–	–	0.230^{a}	–	–	–
						(21.938)			
$\ln q_{j,t} \times \widetilde{s}^K_{WS}$	–	–	–	–	–	0.007^{a}	–	–	–
						(2.998)			
$\ln size_{i,t}$	0.030^{c}	0.034^{b}	0.099^{a}	0.042	0.045^{a}	0.047^{a}	0.043^{b}	0.045^{a}	0.044^{a}
	(1.799)	(2.035)	(4.514)	(1.370)	(4.486)	(4.611)	(2.405)	(3.399)	(3.320)
Quantitative Effects									
Mean(s)	0.114^{a}	0.113^{a}	0.186^{a}	0.141^{a}	0.158^{a}	0.159^{a}	0.091^{b}	–	0.105^{a}
	(3.01)	(2.98)	(4.38)	(2.69)	(5.61)	(5.65)	(2.25)		(2.57)
Mean(s)+sd(s)	0.120^{a}	0.119^{a}	0.196^{a}	0.152^{a}	0.163^{a}	0.164^{a}	0.097^{b}	–	0.131^{a}
	(3.15)	(3.14)	(4.61)	(2.91)	(5.79)	(5.83)	(2.40)		(2.89)
Sample	Full	Full	Full	Full	Extended	Extended	IV sample	IV sample	IV sample
Experts ratings	WS	WS	Parker	Parker	Extended WS	Extended WS	WS	WS	WS
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS	IV	IV
Kleibergen-Paap F	–	–	–	–	–	–	–	44.15	22.35
N	41,576	41,576	26,669	18,892	67,585	67,585	39,146	39,146	39,146

Notes: The dependent variable is $\ln UV^k_{ij,t}$ where unit values are in pesos per liter. Year, province, firm-destination, grape, type, vintage year, 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. In (8) and (9), 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, and the same variables interacted with the exchange rate, respectively.

Table 13: Export Volumes: Robustness on Quality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln q_{j,t}$	4.117^{a} (5.338)	1.931^{a} (3.742)	4.495^{a} (6.119)	3.256^{a} (3.820)	4.025^{a} (8.948)	3.507^{a} (8.101)	2.393^{a} (4.188)	1.990^{a} (3.366)	1.238 (0.973)
s^k_{WS}	–	–	–	–	–	–	−0.047^{a} (−7.211)	−0.118^{a} (−3.199)	−0.102^{a} (−2.884)
$\ln q_{j,t} \times s^k_{WS}$	–	–	–	–	–	–	−0.007^{a} (−3.785)	–	0.009 (0.640)
$\ln s^k_{WS}$	−3.853^{a} (−7.415)	–	–	–	–	–	–	–	–
$\ln q_{j,t} \times \ln s^k_{WS}$	−0.514^{a} (−3.604)	–	–	–	–	–	–	–	–
$\widetilde{s}^k_{WS}$	–	−0.225^{a} (−8.099)	–	–	–	–	–	–	–
$\ln q_{j,t} \times \widetilde{s}^k_{WS}$	–	−0.026^{a} (−3.293)	–	–	–	–	–	–	–
s^k_P	–	–	−0.136^{a} (−11.261)	−0.135^{a} (−8.904)	–	–	–	–	–
$\ln q_{j,t} \times s^k_P$	–	–	−0.016^{a} (−4.094)	−0.015^{a} (−3.001)	–	–	–	–	–
s^K_{WS}	–	–	–	–	−0.060^{a} (−9.794)	–	–	–	–
$\ln q_{j,t} \times s^K_{WS}$	–	–	–	–	−0.008^{a} (−4.543)	–	–	–	–
$\widetilde{s}^K_{WS}$	–	–	–	–	–	−0.283^{a} (−10.321)	–	–	–
$\ln q_{j,t} \times \widetilde{s}^K_{WS}$	–	–	–	–	–	−0.035^{a} (−4.595)	–	–	–
$\ln size_{i,t}$	0.332^{a} (5.864)	0.327^{a} (5.776)	0.227^{a} (3.450)	0.251^{a} (2.665)	0.301^{a} (8.388)	0.299^{a} (8.317)	0.355^{a} (5.755)	0.368^{a} (7.469)	0.363^{a} (7.372)
$\ln Q_{j,t}$	0.838 (1.568)	0.838 (1.569)	1.875^{a} (2.749)	0.614 (0.788)	2.212^{a} (4.994)	2.222^{a} (5.020)	0.854 (1.457)	0.987 (1.613)	0.968 (1.583)
$\ln GDP_{j,t}$	−0.145 (−0.800)	−0.148 (−0.817)	−0.140 (−0.629)	−0.365 (−1.401)	−0.206 (−1.342)	−0.209 (−1.362)	−0.177 (−0.897)	−0.236 (−1.202)	−0.255 (−1.287)
Quantitative Effects									
Mean(s)	1.832^{a} (3.53)	1.838^{a} (3.55)	3.106^{a} (4.62)	1.915^{b} (2.50)	3.378^{a} (7.80)	3.387^{a} (7.83)	1.827^{a} (3.20)	–	1.982^{a} (3.35)
Mean(s)+sd(s)	1.809^{a} (3.48)	1.817^{a} (3.50)	3.069^{a} (4.56)	1.878^{b} (2.45)	3.350^{a} (7.73)	3.361^{a} (7.76)	1.801^{a} (3.15)	–	2.015^{a} (3.37)
Sample	Full	Full	Full	Full	Extended	Extended	IV sample	IV sample	IV sample
Experts ratings	WS	WS	Parker	Parker	Extended WS	Extended WS	WS	WS	WS
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	OLS	IV	IV
Kleibergen-Paap F	–	–	–	–	–	–	–	44.20	22.33
N	41,576	41,576	26,669	18,892	67,585	67,585	39,146	39,146	39,146

Notes: The dependent variable is $\ln X^k_{ij,t}$ where export volumes are in liters. Year, province, firm-destination, grape, type, vintage year, 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. In (8) and (9), 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, and the same variables interacted with the exchange rate, respectively.

Table 14: Robustness for Unit Values

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln q_{j,t}$	–	−0.050 (−0.796)	0.151^{b} (2.027)	−0.027 (−0.457)	0.026 (0.414)	0.010 (0.146)	–	–	−0.035 (−0.595)
$\ln q_{j,t} \times Dep$	0.003 (0.039)	–	–	–	–	–	–	–	–
$\ln q_{j,t} \times App$	−0.097 (−1.292)	–	–	–	–	–	–	–	–
$\ln \widetilde{q}_{j,t}$	–	–	–	–	–	–	−0.030 (−0.497)	–	–
$\ln q_{j,m}$	–	–	–	–	–	–	–	−0.031 (−0.614)	–
s^k_{WS}	0.033^{a} (12.223)	0.032^{a} (11.558)	0.032^{a} (10.766)	0.034^{a} (12.333)	0.033^{a} (11.664)	0.033^{a} (11.706)	0.033^{a} (12.246)	0.028^{a} (11.597)	0.032^{a} (12.149)
$\ln q_{j,t} \times s^k_{WS}$	–	0.002^{a} (3.130)	0.001^{b} (2.015)	0.002^{a} (3.549)	0.002^{a} (3.109)	0.002^{a} (3.169)	–	–	0.002^{a} (3.143)
$\ln q_{j,t} \times s^k_{WS} \times Dep$	0.001^{c} (1.653)	–	–	–	–	–	–	–	–
$\ln q_{j,t} \times s^k_{WS} \times App$	0.002^{a} (3.162)	–	–	–	–	–	–	–	–
$\ln \widetilde{q}_{j,t} \times s^k_{WS}$	–	–	–	–	–	–	0.002^{a} (3.113)	–	–
$\ln q_{j,m} \times s^k_{WS}$	–	–	–	–	–	–	–	0.001^{a} (2.963)	–
$\ln size_{i,t}$	0.029^{c} (1.751)	0.039^{b} (2.088)	0.003 (0.128)	0.019 (0.918)	0.049^{b} (2.522)	0.061^{a} (3.118)	0.030^{c} (1.794)	0.031^{b} (2.051)	0.037^{b} (2.265)
Quantitative Effects									
Mean(s)	–	0.099^{b} (2.44)	0.261^{a} (4.98)	0.135^{a} (3.50)	0.171^{a} (4.06)	0.163^{a} (3.80)	0.115^{a} (3.02)	0.086^{a} (2.92)	0.109^{a} (2.92)
Mean(s)+sd(s)	–	0.106^{a} (2.60)	0.266^{a} (5.06)	0.142^{a} (3.68)	0.178^{a} (4.21)	0.169^{a} (3.96)	0.121^{a} (3.19)	0.091^{a} (3.09)	0.115^{a} (3.08)
Dep : Mean(s)	0.092^{b} (2.40)	–	–	–	–	–	–	–	–
Dep : Mean(s)+sd(s)	0.096^{b} (2.50)	–	–	–	–	–	–	–	–
App : Mean(s)	0.108^{a} (2.84)	–	–	–	–	–	–	–	–
App : Mean(s)+sd(s)	0.117^{a} (3.08)	–	–	–	–	–	–	–	–
Sample	Full	Post-2002	Pre-2008	Intensive	No US	No USD peg	Full	Monthly	Full
N	41,576	39,509	28,576	35,594	36,714	34,372	41,576	72,627	41,576

Notes: The dependent variable is $\ln UV^k_{ij,t}$ in (1)-(7) and (9) and $\ln UV^k_{ij,m}$ in (7). Unit values are in pesos per liter in (1)-(8) and in USD per liter in (9). Year, province, firm-destination, grape, type, vintage year, and HS fixed effects are included. In (8), the year fixed effects are replaced by month fixed effects. 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.

Table 15: Robustness for Export Volumes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln q_{j,t}$	–	3.951^{a} (5.971)	1.001^{c} (1.676)	2.023^{a} (3.847)	2.298^{a} (4.352)	3.034^{a} (5.487)	–	–
$\ln q_{j,t} \times Dep$	2.635^{a} (5.051)	–	–	–	–	–	–	–
$\ln q_{j,t} \times App$	2.032^{a} (3.726)	–	–	–	–	–	–	–
$\ln \widetilde{q}_{j,t}$	–	–	–	–	–	–	2.374^{a} (4.555)	–
$\ln q_{j,m}$	–	–	–	–	–	–	–	0.962^{a} (4.657)
s^{k}_{WS}	-0.048^{a} (−7.677)	-0.044^{a} (−6.964)	-0.050^{a} (−7.286)	-0.048^{a} (−7.285)	-0.050^{a} (−7.904)	-0.050^{a} (−7.828)	-0.048^{a} (−7.663)	-0.038^{a} (−7.046)
$\ln q_{j,t} \times s^{k}_{WS}$	–	-0.006^{a} (−3.292)	-0.003^{c} (−1.949)	-0.006^{a} (−3.649)	-0.007^{a} (−4.184)	-0.008^{a} (−4.263)	–	–
$\ln q_{j,t} \times s^{k}_{WS} \times Dep$	-0.010^{a} (−4.917)	–	–	–	–	–	–	–
$\ln q_{j,t} \times s^{k}_{WS} \times App$	−0.002 (−1.023)	–	–	–	–	–	–	–
$\ln \widetilde{q}_{j,t} \times s^{k}_{WS}$	–	–	–	–	–	–	-0.006^{a} (−3.767)	–
$\ln q_{j,m} \times s^{k}_{WS}$	–	–	–	–	–	–	–	-0.005^{a} (−3.552)
$\ln size_{i,t}$	0.332^{a} (5.861)	0.398^{a} (6.180)	0.399^{a} (6.010)	0.398^{a} (5.729)	0.312^{a} (5.056)	0.307^{a} (4.936)	0.332^{a} (5.862)	0.244^{a} (4.950)
$\ln Q_{j,t}$	0.840 (1.576)	2.523^{a} (3.743)	0.080 (0.129)	0.429 (0.793)	0.770 (1.431)	1.396^{b} (2.488)	0.840 (1.572)	−0.245 (−1.152)
$\ln GDP_{j,t}$	−0.138 (−0.757)	−0.110 (−0.553)	0.269 (1.126)	0.110 (0.595)	−0.188 (−1.013)	0.081 (0.428)	−0.145 (−0.799)	−0.262 (−1.584)
Quantitative Effects								
Mean(s)	–	3.463^{a} (5.21)	0.721 (1.23)	1.484^{a} (2.84)	1.684^{a} (3.21)	2.370^{a} (4.31)	1.833^{a} (3.54)	0.574^{a} (3.18)
Mean(s)+sd(s)	–	3.440^{a} (5.17)	0.708 (1.21)	1.460^{a} (2.79)	1.657^{a} (3.15)	2.340^{a} (4.25)	1.809^{a} (3.49)	0.557^{a} (3.08)
Dep : Mean(s)	1.820^{a} (3.52)	–	–	–	–	–	–	–
Dep : Mean(s)+sd(s)	1.783^{a} (3.45)	–	–	–	–	–	–	–
App : Mean(s)	1.830^{a} (3.54)	–	–	–	–	–	–	–
App : Mean(s)+sd(s)	1.821^{a} (3.52)	–	–	–	–	–	–	–
Sample	Full	Post-2002	Pre-2008	Intensive	No US	No USD peg	Full	Monthly
N	41,576	39,509	28,576	35,594	36,714	34,372	41,576	72,627

Notes: The dependent variable is $\ln X^{k}_{ij,t}$ in (1)-(7) and $\ln X^{k}_{ij,m}$ in (8). Export volumes are in liters. Year, province, firm-destination, grape, type, vintage year, and HS fixed effects are included. In (8), the year fixed effects are replaced by month fixed effects. 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.

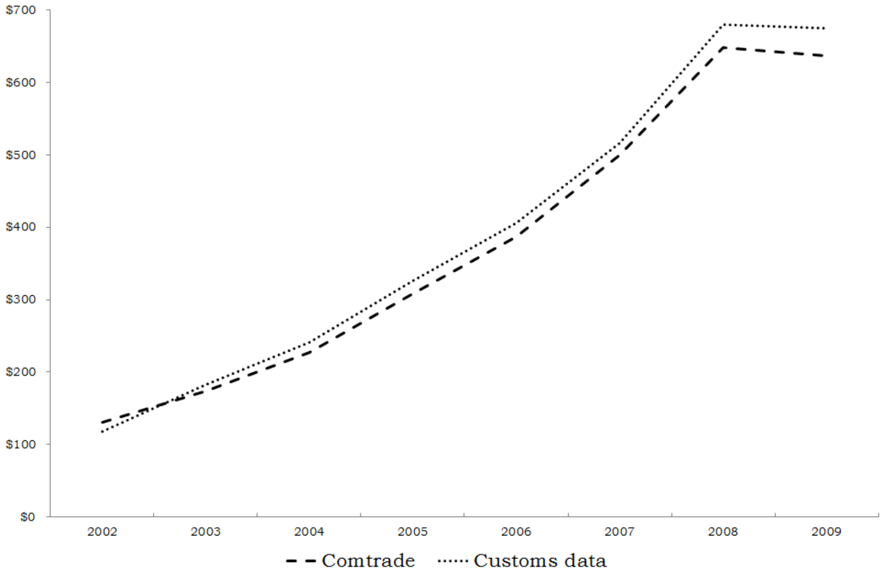

Figure 1: Argentina's Total Wine Exports (million US dollars)

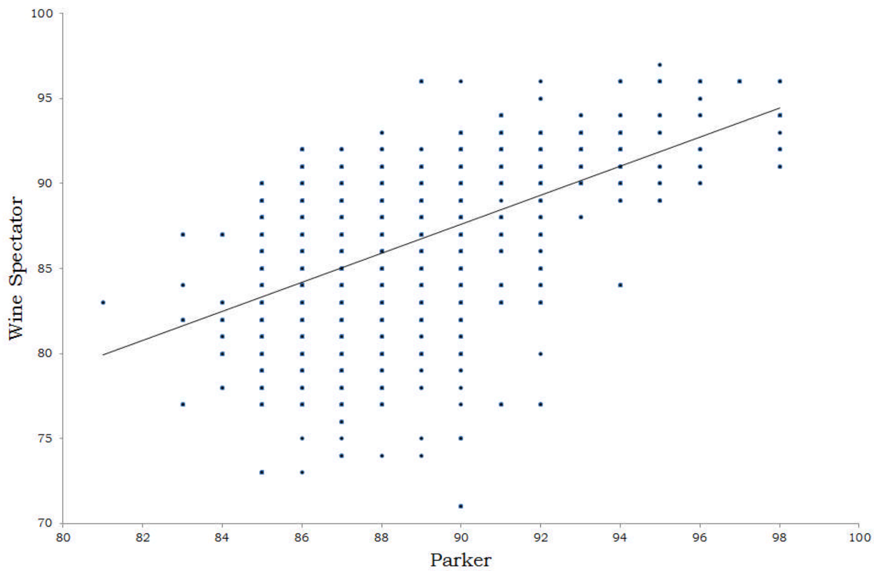

Figure 2: Wine Spectator versus Parker rankings

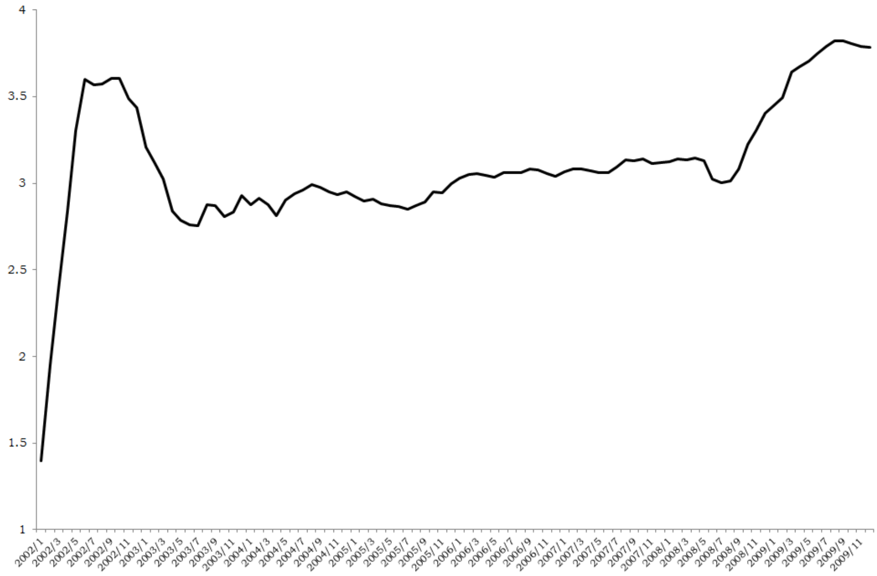

Figure 3: Argentinean peso per US dollar, January 2002 to December 2009