Quality, Trade, and Exchange Rate Pass-Through¤y

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uctua-
tions due to product quality. We model theoretically the e¤ects of real exchange rate changes on the optimal price and quantity responses of …rms 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 …rm-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 …nd that …rms signi…cantly increase more their markups and less their export volumes for higher quality products, but only when exporting to high income destination countries. These …ndings remain robust to di¤erent measures of quality, samples, speci

1 Introduction

Exchange rate ‡uctuations have small e¤ects on the prices of internationally traded goods. Indeed, empirical research typically …nds 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 passcosts paid in the currency of the importing country, the model shows that the demand elasticity perceived by the …rm falls with a real depreciation and with quality. As a result, following a change in the real exchange rate, exporters change their prices (in domestic currency) more, and their export volumes less, for higher quality products. Once we allow for higher income countries to have a stronger preference for higher quality goods, as the evidence from the empirical trade literature tends to suggest (Crinò and Epifani, 2012; Hallak, 2006), the heterogeneous response of prices and quantities to exchange rate changes due to quality is predicted to be stronger for higher income destination countries.

The second contribution of the paper is to bring the predictions of the model to the data. The …

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 trade unit values in order to measure quality.[10] 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 fi 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, where 1

country is

$$(\ ) = \frac{}{¡ \ 1}\left(1 + \frac{(© \ ) \ (\ (© \ ))}{}\right)\frac{}{(© \ )} = \ (\ (© \ ))\frac{}{(© \ )} \qquad (7)$$

where ´ is the real exchange rate between Home and . In contrast to the standard Dixit-Stiglitz markup (Dixit and Stiglitz, 1977), the presence of local distribution costs leads to variable markups ((©)) over marginal costs that are larger than $\frac{}{-1}$, increase with quality ((©)), 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 di¤erences in driving heterogeneous pricing-to-market across exporters, or exporters and products, respectively.

It is important to stress that our model intends to capture a general relation between quality and pass-through that could, as a matter of fact, hold for any market in particular. The only reason why we focus on the wine market in the empirical analysis is because we have an observable measure for quality. Still, appendix A discusses how the features of the wine industry conform with the main assumptions of the model.

by more for high income than for low income destination countries:

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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.[27] 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 classi…ed as "Unde…ned." As sparkling wines, dessert wines, and other special varieties do not have any vintage year, they are excluded from the data set. Second, we only keep the export ‡ows recorded as FOB.[28] Third, as we are interested in how product quality a¤ects the pricing and export decisions of wine producers, we restrict our analysis to the manufacturing sector and therefore 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 …rms authorized to produce and sell wine, as well as their activity classi…cation. We match the exporters names from the customs data with the list of …rms provided by the INV and only keep wine producers. Fourth, we drop a number of typos which we are unable to …x. 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 …rm.

The recent papers on heterogeneous pass-through typically de…ne a "product" according to trade classi…cations 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 classi…cation categorizes wines into four di¤erent 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 classi…cation at the 12-digit level, but this only

based on blind tastings and publishes his consumer advice and rankings in a bimonthly publication, the Wine Advocate.[36] 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 di¤erent 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).[37] We match the customs data and the Parker rankings for 3,969 wines exported by 181 …rms. 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

4 Empirical Framework

which is consistent with evidence in the literature that the trade elasticities for emerging economies are generally larger than for developed countries.[41] The coefficient on quality is negative and significant while the literature usually uncovers a positive relationship between trade and quality (for example, see Crozet et al., 2012). One crucial difference between our regressions and, for instance, Crozet et al. (2012), however, is that we estimate the *within-firm* effect of quality on export volumes. The negative coefficient on quality therefore indicates that when a firm exports several wines with different levels of quality to a given destination in a given year, the high quality wines are on average exported in estimate equations (11) and (12) for unit values and export volumes, and interact the real exchange distribution costs over time for each destination country and for the “Food products and beverages” industry.[44] Our measure for distribution costs, , is therefore destination-speci…c, and given the limited number of countries for which the data are available the resulting sample size is reduced by half. We estimate regressions (11) and (12) and include an interaction term between the real exchange rate and distribution costs. The results are reported in Table 9. For unit values, column (1) shows that the interaction between the real exchange rate and distribution costs is positive and signi…

Panel A of Table 10 focuses on unit values. In column (1), the interaction between the real exchange rate and sales is positive and signi…cant, which is consistent with the …ndings of Berman et al. (2012) and Chatterjee et al. (2013). A one standard deviation increase in sales from their mean level increases the elasticity of unit values to the real exchange rate from 0.110 to 0.232. Column (2) further includes the interaction between the exchange rate and quality which displays a positive coe¢ cient. Our results therefore show that larger, and therefore more productive …rms price-to-market more, especially when exporting higher quality goods.[47] Columns (3) and (4) use total export volumes as a proxy for …rm size and the results remain qualitatively comparable. The results for export volumes are reported in Panel B of Table 10. Although the interaction between the real exchange rate and quality is negative in columns (2) and (4), the interactions between the real exchange rate and the two proxies for …rm size are not signi…cantly di¤erent from zero.

5.3 Asymmetries

Finally we check if exporting …rms adopt di¤ereenin806.2(n)-231(an)3ge ransalr5(w)15ps buin806.28.5(i6)8.5(,4

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 instead of its level. The results remain qualitatively unchanged, and a one standard deviation increase in quality from its mean level increases pricing-to-market by three and a half percent.

In order to minimize possible noise in the measurement of quality when de…ned on a (50,100) scale, we construct a new quality variable which takes on values between one and six where each value corresponds to one of the di¤erent bins de…ned by the Wine Spectator (see Table 5). A value of one indicates that the wine is "Not recommended" while a value of six that the wine is "Great" so a larger value captures a higher quality. The results of using this measure in (11) are reported in column (2) and remain qualitatively similar, although the magnitude of the estimated coe¢cient on quality becomes larger.

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

Recall that due to missing observations on the Wine Spectator rankings, our sample covers 43 percent of the total FOB value of red, white, and rosé wine exported by Argentina between 2002 and 2009. In order to include some of the unrated wines in the sample, we calculate an average Wine Spectator ranking by wine name and type, and assign this average ranking to all wines with the same name and type. This increases our sample coverage to 63 percent of the total FOB value exported over the period. We apply this procedure to compute average quality both on a (50,100) and on a (1,6) scale. The results are respectively reported in columns (4) and (5) of Table 12 and remain qualitatively una¤ected (the vintage year and grape …xed e¤ects are omitted fro.1(,)-47.8(an)11.4(d)-

21ases0 1 61.68 613.341.6(u)1.5(hn)33.1.5(re)9.8(s)2.6(u)11.4(l) 1 0 ts areI Tm (341.6(u)1n)-423.3F1ommia (50.10.6(c)d

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.[49] Similarly for Parker, "neither the price nor the reputation of the producer/grower a¤ect 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)."[50] In other words, even if the two rankings are una¤ected by the price, the tasters do have some basic information about the wines they taste which might in turn a¤ect 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 e¤ects of temperature and rainfall to be nonlinear throughout the growing season, we consider as instruments the average temperature and the total amount of rainfall for each growing province in each month between September and March (Ramirez, 2008).[51] 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 a¤ect quality at a low altitude. We therefore use the altitude of each province as an additional instrument for quality.[52]

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.[53] Gaps in the data are …lled using online information, although missing information for some provinces and vintage years results in a slightly reduced sample.[54] 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 show a O-337[(5)so æein.92 Tm(h)11.47e8(re)-305.4(h)11.4(i)6.2(gh)11.4(e)-1.6(s)13.5(t)]TJ Ep 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 and quality. The coefficient on quality is positive and significant but becomes smaller compared to the OLS estimate in column (7).[55] 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 93 for both the prices and quantities regressions, where the critical value is equal to 21, Stock and Yogo, 2005) largely rejects the null of weak correlation between the excluded instruments and the endogenous regressors.

The first-stage regressions for the two IV regressions (not reported due to space constraints but

6.5 Extensive Margin

Campos (2010) argues that the intensive and extensive margins of adjustment might have opposite e¤ects 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 pro…table activity so more …rms 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 therefore exclusively includes the …rms that export in all years to any destination. The results for prices and quantities are reported in column (3) 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 ‡uctuate within a "crawling band that is narrower than or equal to +/-2 percent" with respect to the US dollar (Reinhart and Rogo¤, 2004). This means that variations in the real exchange rate between the peso and the US dollar may have essentially come from movements in domestic prices. We verify that our results still hold after excluding from the sample the US (which is Argentina's main export destination for wine) as well as the US plus all the other countries which currencies are pegged to the US dollar (Li, Ma, Xu, and Xiong, 2012).[59]

values, export volumes, and the real exchange rate are defined at a monthly frequency. Due to data

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Table 1: Harmonized System (HS) Classi…cation 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 – Gassi…ed wine (i.e., aerated using CO_2)
	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

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 values

Table 9: Distribution Costs

	(1)	(2)	(3)	(4)
Dependent variable	ln n lmaw	ln n lmaw	ln n lmaw	ln n lmaw
	i (−2 81)	i (−3 55)	(2 07)	(1 81)
	(11 43)	(10 33)	i (−7 30)	i (−6 89)
£	–	(3 37)	–	(0 88)
£	(2 20)	(2 16)	i (−0 37)	i (−0 39)
	–	–	(2 38)	(2 38)
	–	–	(5 56)	(5 57)
	19,573	19,573	19,573	19,573

Notes: Firm-destination, …rm-year, grape, type, vintage year, province, and HS …xed e¤ects are included. Robust standard errors are adjusted for clustering at the product-level. -statistics in parentheses. , , and indicate signi…

Table 10: Productivity as a Source of Firm-Level Heterogeneity

	(1)	(2)	(3)	(4)
Panel A: Dependent variable is ln n lmaw				
	i (−1 88)	i (−2 21)	(2 96)	i (−0 11)
	(10 54)	(10 57)	(11 29)	(11 33)
£	–	(2 80)	–	(2 69)
£	(2 29)	(2 28)	–	–
£	–	–	(1 98)	(1 78)
Quantitative E¤ects				
Mean( )	(2 70)	(2 76)	–	–
Mean( )+sd( )	(4 13)	(4 17)	–	–
Mean( )	–	–	(3 71)	(3 77)
Mean( )+sd( )	–	–	(3 92)	(3 96)
Panel B: Dependent variable is ln n lmaw				
	(0 62)	(0 99)	(3 69)	(4 61)
	i (−7 53)	i (−7 74)	i (−8 03)	i (−8 23)
£	–	i (−3 70)	–	i (−3 60)
£	(0 74)	(0 75)	–	–
£	–	–	i (−0 77)	i (−0 47)
	(1 67)	(1 67)	(1 77)	(1 76)
	i (−1 14)	i (−0 99)	i (−1 01)	i (−0 88)
Quantitative E¤ects				
Mean( )	(2 24)	(2 25)	–	–
Mean( )+sd( )	(1 86)	(1 86)	–	–
Mean( )	–	–	(3 65)	(3 63)
Mean( )+sd( )	–	–	(3 64)	(3 62)
	38,498	38,498	41,576	41,576

(

Table 11: Asymmetries

	(1)	(2)
Dependent variable	ln l_{mw}^{n}	ln l_{mw}^{n}
£	(0 21)	(4 97)
£	¡ (−0 56)	(3 77)
	(11 34)	¡ (−8 29)
£ £	(1 88)	¡ (−4 84)
£ £	(2 66)	¡ (−1 02)
	–	(1 72)
	–	¡ (−0 82)
Quantitative E¤ects		
Mean( )	(3 03)	(3 53)
Mean( )+sd( )	(3 14)	(3 46)
Mean( )	(3 53)	(3 57)
Mean( )+sd( )	(3 73)	(3 55)
Sample	Full	Full

Table 13: Export Volumes: Robustness on Quality

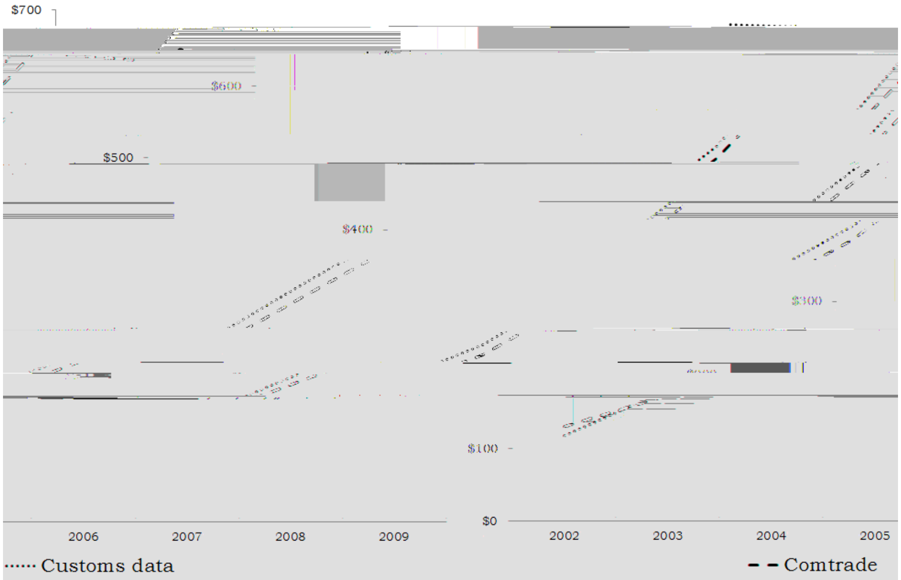

Figure 1: Argentina's Total Wine Exports (million USD)

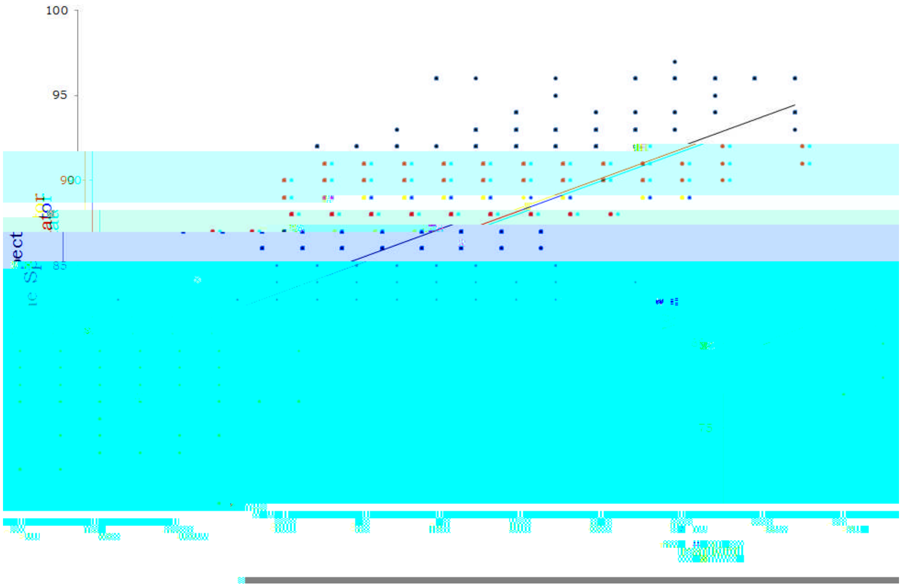

Figure 2: Wine Spectator versus Parker rankings

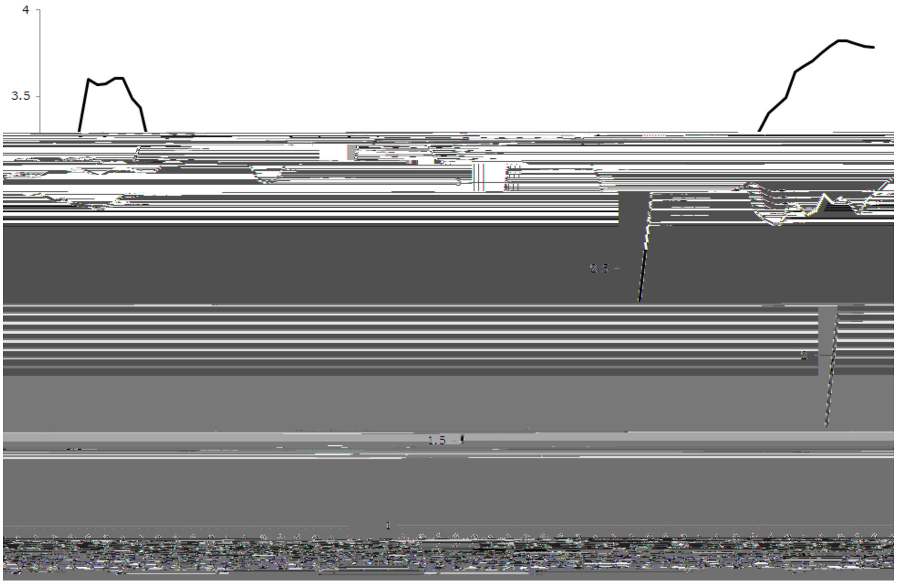

Figure 3: Argentinean peso per USD, January 2002 to December 2009

Appendix A: Wine and Model Assumptions

Although the model we described in section 2 is general and could therefore hold for any market in particular, 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 of the wine (and, therefore, with quality too).[65] 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.[66]

We therefore conclude that the features of the wine industry closely match 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.

Table A1: 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 Tari¤	£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).

[65]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.

[66]See http://www.thirty ..fty.co.uk/spotlight-wine-pricing.asp.