Quality and the Great Trade Collapse*†

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Abstract

We investigate theoretically and empirically the heterogeneous effects of the global financial crisis on international trade flows differentiated by quality. Our model, which identifies the effect of quality on trade that arises on the demand side, through the relationship between income and quality choice, predicts that a negative income shock disproportionately reduces the demand for higher relative to lower quality traded goods (a "flight from quality"). Using a unique dataset of firm-level wine exports for an emerging market economy, Argentina, combined with experts wine ratings as a measure of quality, we find strong evidence of a flight from quality as we show that the values, volumes, unit values, and markups of higher quality exports contracted more sharply during the crisis. Our results imply that the exports of countries producing higher quality goods are likely to collapse more severely during recessions.

JEL Classification: F10, F14, F41
Keywords: Emerging markets, exports, financial crisis, heterogeneity, markups, quality, unit values, wine.

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1 Introduction

The financial crisis, which started in the US and then spread to other developed nations, subsequently turned into a global economic downturn. Consumers in advanced economies suffered a large negative income shock and they thus reduced their consumption and demand for goods from the rest of the world. Between the third quarter of 2008 and the second quarter of 2009, world trade collapsed by 30 percent in nominal terms, and 18 percent in real terms (World Trade Monitor, 2014).[1] This severe contraction of world trade, typically referred to as the "Great Trade Collapse" (Baldwin, 2009), affected advanced countries but also emerging market economies and other developing nations which rely heavily on foreign demand for their exports (Blanchard, Faruqee, and Das, 2010; Didier, Hevia, and Schmukler, 2012; Kose and Prasad, 2010). World trade fell for almost every product category, but to a larger extent for "postponeable" goods such as consumer durables and investment goods (Baldwin, 2009).[2]

Focusing on Argentina, an emerging market economy which exports sharply declined during the crisis, the aim of this paper is to investigate the effects of the crisis on the *composition* of international trade, and in particular to determine whether the effects were heterogeneous across traded goods differentiated by quality. As higher quality goods are more income elastic than lower quality ones (Bils and Klenow, 2001), we expect the adverse income shock induced by the crisis to have resulted in a "flight from quality" (Burstein, Eichenbaum, and Rebelo, 2005; Jaimovich, Rebelo, and Wong, 2015), whereby households in crisis-hit nations reduced not only the quantity, but also the quality of the goods they consume, leading to a sharper contraction in the quantities and in the prices of higher quality imports.[3]

As quality is generally unobserved, evidence that the crisis disproportionately reduced the quantities, but also the prices of higher quality traded goods remains scarce, however.[4] To fill this gap, this paper combines a unique dataset of Argentinean firm-level destination-specific wine exports with experts wine ratings as a directly observable measure of quality. Our approach to measuring quality is therefore similar to Crozet, Head, and Mayer (2012) who match French firm-level exports of Champagne with quality ratings to explore the relationship between quality and trade (see, also, Atkin, Khandelwal, and Osman, 2017, and Chen and Juvenal, 2016). We provide strong evidence of a flight from quality as we show that the values, volumes, prices, but also markups of higher quality wine exports all contracted more sharply during the crisis.

In a first step, to motivate our empirical predictions we sketch a simple theoretical framework

[1] The fall in aggregate demand is considered to be the main culprit for the trade collapse (Baldwin, 2009). Alessandria, Kaboski, and Midrigan (2010) study inventory adjustments, while Freund (2009) argues that the elasticity of trade to GDP is larger during recessions. Supply-side explanations include vertical linkages (Bems, Johnson, and Yi, 2010; Levchenko, Lewis, and Tesar, 2010) or credit constraints (Bricongne, Fontagné, Gaulier, Taglioni, and Vicard, 2012; Chor and Manova, 2012). Also see Behrens, Corcos, and Mion (2013) or Eaton, Kortum, Neiman, and Romalis (2015).

[2] Evidence shows that export performance is negatively affected by macroeconomic crises in trading partners. As crises are typically associated with sharp recessions (Reinhart and Rogoff, 2008; Claessens, Kose, and Terrones, 2009), the fall in income reduces consumption and imports. Bernard, Jensen, Redding, and Schott (2009) show that the Asian crisis reduced US exports. Berman and Martin (2012) find that banking crises in export markets lower African exports.

[3] A fall in demand driven by a negative income shock reduces both the quantities and the prices of imported goods. A negative supply shock would instead lower the quantities and increase the prices of traded goods (Sauré, 2014).

[4] Quality is generally measured using trade unit values (e.g., Hallak, 2006; Hummels and Klenow, 2005; Hummels and Skiba, 2004; Kugler and Verhoogen, 2012; Manova and Zhang, 2012a,b; Schott, 2004; Verhoogen, 2008).

based on Hallak (2006). The model (which we detail in an appendix) assumes that the demand for quality depends on the intensity of the preference for quality, which rises with income. As the supply of quality is considered exogenous, we identify the effect of quality on trade that operates on the demand side, through the relationship between income and quality choice. This partial equilibrium setting departs from the standard CES demand system by introducing non-homothetic preferences such that a higher income implies a larger consumption of higher quality goods. The model predicts that a negative income shock, by lowering the intensity of the preference for quality, disproportionately reduces the demand for higher relative to lower quality imports (i.e., a flight from quality).[5]

In a second step, we use a rich and unique dataset of Argentinean wine exports to determine empirically whether the crisis induced a flight from quality in traded goods. For each export transaction between 2002 and 2009 we observe the name of the exporting firm, the country of destination, the date of shipment, the Free on Board (FOB) value (in US dollars) and the volume (in liters) of each wine exported, where a wine is defined according to its name, grape (Chardonnay, Malbec, etc.), type (white, red, or rosé), and vintage year. Our definition of a "product" is therefore more granular compared to papers that rely on trade classifications such as the Combined Nomenclature (CN) or the Harmonized System (HS) to identify traded goods (Behrens, Corcos, and Mion, 2013; Berthou and Emlinger, 2010; Levchenko, Lewis, and Tesar, 2011).

As a proxy for export prices, we use data on the value and the volume exported to compute FOB unit values. To measure quality, and in contrast to papers that use trade unit values as a proxy, we rely on directly observable measures of product quality (Atkin et al., 2017; Chen and Juvenal, 2016; Crozet et al., 2012), and exploit two well-known experts wine ratings, the Wine Spectator and Robert Parker. This allows us to explore the effects of the crisis not only on the volumes, but also on the prices of exported wines differentiated by quality. When we match the customs data with the quality ratings of the Wine Spectator which has the largest coverage of Argentinean wines, our sample includes 198 multi-product firms shipping 2,214 different wines with heterogeneous levels of quality. We date the collapse of Argentinean wine exports by visually inspecting the data, and assume that the crisis started in the fourth quarter of 2008 and lasted until the third quarter of 2009 (henceforth, 2008Q4 and 2009Q3, respectively).

To understand the dynamics of Argentinean wine exports during the crisis, we perform a decomposition of nominal export growth and find that changes at the intensive margin outweighed changes at the extensive margin. As a result, in our empirical analysis we adopt a difference-in-difference specification which explains changes at the intensive margin only. We compare the growth of export values, volumes, and unit values, before and during the crisis, and across wines with different levels of quality. The growth rates are computed for each firm-product-destination triplet that reports positive exports between two consecutive periods.

The central results of our paper can be summarized as follows. Before the crisis, higher quality wines enjoyed a stronger growth of exports than the lower quality ones, but this trend reversed during

[5] Consistent with our model, Fajgelbaum, Grossman, and Helpman (2011) predict that a higher income increases the share of consumers who buy higher quality goods, while Bils and Klenow (2001) show that richer households buy more expensive, higher quality goods. In a related study, Bertoletti and Etro (2017) show that a higher income leads to specialization in higher quality goods.

the crisis as export growth fell more dramatically for the higher quality wines. On average, a one unit increase on the quality scale raised nominal export growth by 1.5 percentage point before the crisis, and reduced it by two percentage points during the downturn. For export volumes, the effects are equal to 1.7 and -1.4 percentage points, respectively. Besides, a one unit increase in quality was associated with a 0.8 percentage point lower export inflation during the crisis. The collapse of nominal exports for the higher quality wines was therefore driven by a fall in the quantities exported, but also by lower prices (Behrens et al., 2013; Levchenko, Lewis, and Tesar, 2010; Gopinath, Itskhoki, and Neiman, 2012; Sauré, 2014). When we rely on changes in foreign income to measure the intensity of the effects of the crisis across destination countries, we demonstrate that the values, volumes, and unit values of higher quality exports are more sensitive to changes in income, and that the negative income shock induced by the crisis was more detrimental to the higher quality wines. The finding that export inflation fell during the crisis in turn suggests that firms compressed their margins in response to the fall in foreign income, and to a larger extent for the higher quality wines.

To evaluate the contribution of quality in explaining the dynamics of wine export values, volumes, and unit values during the crisis, we use our regression estimates to determine how Argentinean wine exports would have performed if the quality of all exported wines had been as high, or as low, as the highest or as the lowest quality in the sample, respectively. We find that the difference in the growth of export values and volumes between the two alternative scenarios is equal to 5.43 and 5.14 percentage points, respectively, while for export inflation (and, therefore, for markups) the gap is smaller at 0.27 percentage point.

In a next step, we provide extensions to our benchmark results. First, consistent with the premise that richer countries import higher quality goods than poorer countries (Hallak, 2006; Hummels and Skiba, 2004; Manova and Zhang, 2012a; Martin, 2012), we find that the flight from quality was more severe in higher income destination countries. Second, we provide evidence that the flight from quality was more acute in the destination countries which are more distant from Argentina. This can happen if transport costs are proportional to weight rather than value, resulting in quality sorting whereby higher quality goods are shipped to more distant countries (Alchian and Allen, 1964). Third, we find that the growth of exports and prices recovered more strongly for the higher quality wines after the crisis, implying that the trade effects of the recession were only temporary. Fourth, our results remain robust to incorporating changes at the extensive margin in our regressions. At the extensive margin we also find that, during the crisis, higher quality wines were more likely to exit from exports.

Finally, we exploit data on the universe of Argentinean firm-level exports to demonstrate that the flight from quality is a general phenomenon that extends to manufacturing industries other than wine. In contrast to our analysis for wine exports, quality is, however, unobserved. We therefore follow the procedure of Khandelwal (2010) to estimate quality for each 8-digit HS-level product exported by each firm to each destination country in each time period, and also rely on unit values as an alternative proxy for quality. In addition, the level of disaggregation of the data (at the HS level) prevents us from identifying the effect of the crisis on variable markups. Still, our regressions provide evidence that Argentinean manufacturing exports experienced a flight from quality during the crisis as the export values, quantities, and unit values of higher quality goods all contracted more sharply in response to the fall in foreign income. Under the assumption that our results extend beyond Argentina, they

carry macroeconomic implications. In particular, they imply that the exports of countries producing higher quality goods are likely to collapse more severely during recessions.

The flight from quality that we document for Argentinean exports during the crisis is one example of the consequences that adverse shocks to foreign demand can entail for open economies.[6] Negative shocks to external demand have become a major issue for emerging market economies, and in particular for industrializing developing countries such as Brazil, China, or India, among others. These countries have become more vulnerable to foreign shocks because they have pursued export-driven growth strategies which have increased their reliance on external demand. During the crisis, these countries have indeed been hit particularly hard by the fall in demand from advanced economies, which are their dominant destination for exports, as their export growth sharply contracted (Blanchard et al., 2010; Didier et al., 2012; Eichengreen, 2010).[7] And as the composition of these countries' exports has shifted from primary commodities to a diversified range of manufacturing products differentiated by quality (Kose and Prasad, 2010), we speculate that the negative demand shock induced by the crisis is likely to have also reduced the higher quality exports of these nations more severely.[8,9]

Our paper belongs to the literature on quality during the trade collapse. Using scanner-data for products sold domestically, Bems and di Giovanni (2016) document expenditure switching from imported to domestic goods (i.e., a "flight from imports"). Berthou and Emlinger (2010) interpret the fall of HS-level import prices as evidence of a lower demand for quality. Using unit values as a proxy for quality, Esposito and Vicarelli (2011) show that the income elasticity of CN-level imports rises with quality, while Levchenko et al. (2011) conclude that the dynamics of HS-level imports are unrelated to quality. In contrast to these papers we use an observable measure of quality, and simultaneously analyze the values, quantities, and unit values of firm-level exports to provide evidence of a flight from quality in traded goods.

Second, our analysis contributes more broadly to a literature that investigates changes in consumption patterns in the wake of aggregate shocks. Evidence shows that during recessions, households reallocate their expenditures towards cheaper goods by switching to lower price retailers, and purchase more on sale, use more coupons, buy larger sizes, and switch to generic products (Coibion, Gorodnichenko, and Hong, 2015; Jaimovich et al., 2015; Nevo and Wong, 2015). They reduce real expenditures on food, and substitute towards cheaper and less healthy food with lower nutritional contents (Griffith, O'Connell, and Smith, 2013). Burstein et al. (2005) show that the Argentinean devaluation of the early 2000s reduced the market shares of higher quality brands.

[6] When foreign demand falls, export-dependent economies typically suffer a collapse of exports, a contraction in output, a decline in investment, and an increase in unemployment (Eichengreen, 2010; Kose and Prasad, 2010).

[7] For evidence on Brazil, China, India, and Mexico, see Nassif (2010), Yang and Huizenga (2010), Kumar and Alex (2009), and Robertson (2009), respectively. Compared to emerging markets and to industrializing developing economies, other developing countries were less severely affected by the crisis due to their lower level of integration into global trade and finance (Didier, Hevia, and Schmukler, 2012; Kose and Prasad, 2010).

[8] Many scholars view the ability of developing countries to transition from the production of lower to higher quality products as a necessary condition to promote export performance and, in turn, economic development. For instance, the endogenous growth model of Grossman and Helpman (1991) stresses the importance of product quality. Hidalgo, Klinger, Barabási, and Hausmann (2007) and Rodrik (2006) emphasize the role of export quality in improving economic performance. See, also, Verhoogen (2008).

[9] For example, China's capital- and technology-intensive exports were more severely hit during the crisis as consumers switched to more labor-intensive substitutes which are less income elastic (Yang and Huizenga, 2010). In contrast, the poorer developing nations mostly exporting primary commodities are less likely to experience a flight from quality.

Third, our work is related to papers studying the effects of the crisis not only on the quantities, but also on the prices of traded goods. For the US, Gopinath et al. (2012) show that trade prices remained stable for differentiated manufactures while they sharply declined for non-differentiated manufactures. Haddad, Harrison, and Hausman (2010) find that the import prices of differentiated manufactures increased. Sauré (2014) observes a decline in the export and import prices of Switzerland. Behrens et al. (2013) and Levchenko et al. (2010) find that price declines played a minor role in explaining the overall collapse of Belgian and US trade, respectively. These papers, however, do not consider the role of quality in explaining the dynamics of traded quantities and of their prices.

Fourth, our work contributes to a growing, but limited trade literature that exploits direct measures of product quality. Crozet et al. (2012) rely on quality ratings for Champagne, Atkin et al. (2017) use artisan assessments for Egyptian rugs, while Chen and Juvenal (2016) use the same quality ratings for Argentinean wines as in this paper. Other papers derive alternative measures of quality. Khandelwal (2010) compares exporters' market shares conditional on price to infer the quality of exports. Piveteau and Smagghue (2015) develop an instrumental variables strategy to estimate quality using trade data.

Finally, this paper is closely related to Chen and Juvenal (2016) who examine the effects of real exchange rate changes on the exporting behavior of firms. Using the same dataset as in this paper, they show that the response of export prices to changes in real exchange rates increases with the quality of exported wines (i.e., exchange rate pass-through decreases with quality), while the response of export volumes to changes in currency values falls with quality. Although the emphasis of our paper is on the effects of the negative income shock induced by the crisis, the two papers are complementary in several dimensions. First, the mechanisms described by Chen and Juvenal (2016) are relevant for the period that we study as the crisis has been characterized by volatile currency markets. We confirm that our results remain robust to controlling for the heterogeneous effects of real exchange rate changes on exported goods differentiated by quality. Second, in addition to investigating how the quantities and the prices of exported goods respond to aggregate shocks, the two papers also address the behavior of variable markups. Chen and Juvenal (2016) document that a real depreciation increases by more the markups of higher quality exports. Our paper shows that a fall in foreign income induces exporters to compress their margins, and to a larger extent for the higher quality wines.

The paper is organized as follows. Section 2 describes the firm-level exports data, the wine quality ratings, and provides descriptive statistics. Section 3 evaluates the relative contributions of the intensive and extensive margins to the collapse of Argentinean wine exports during the crisis. Section 4 presents the empirical methodology, our main results, and assesses the economic significance of quality in explaining the dynamics of wine exports during the crisis. Section 5 discusses extensions. Section 6 offers robustness checks and Section 7 concludes. The theoretical framework is presented in Appendix A. Evidence on quality sorting is provided in Appendix B. The estimation of quality for manufacturing exports is explained in Appendix C, while the sensitivity tests are reported in Appendix D.

2 Data and Descriptive Statistics

This section presents the firm-level customs data, the wine experts quality ratings, and provides descriptive statistics.

2.1 Firm-Level Customs Data

Firm-level exports are collected by the Argentinean customs and are obtained from a private vendor called Nosis. For each export transaction we observe the name of the exporting firm, the destination country, the shipment date, the 12-digit HS classification code, the FOB value (in US dollars) and the volume (in liters) exported between 2002 and 2009.[10] For each wine exported we have its name, type (red, white, or rosé), grape (Malbec, Chardonnay, etc.), and vintage year. Our sample includes a large range of destination countries that differ in terms of economic development, including OECD and EU countries, but also emerging markets (Brazil, China, India) and Asian countries (Hong Kong, Singapore). The US is the main destination market for Argentinean wine exports.

Given that export prices are not observed, as a proxy we compute FOB unit values by dividing the value by the volume exported. In contrast to papers that define products according to the CN or the HS (Behrens et al., 2013; Berthou and Emlinger, 2010; Levchenko et al., 2011), the granularity of our data ensures that compositional or quality changes do not affect movements in unit values (Gopinath et al., 2012). Missing any data on the currency of invoicing, we measure export values and unit values in US dollars (instead of Argentinean pesos). The Datamyne, a private vendor of international trade data, indeed reports that 88 percent of total Argentinean wine exports (HS code 2204) between 2005 and 2008 were priced in US dollars.

We clean up the raw data in several ways. We exclude any wine for which the name, grape, type, or vintage year is missing, cannot be recognized, or is classified as "Undefined." We only keep the FOB flows, and exclude the wines produced outside of Argentina as well as the shipments containing less than 4.5 liters (the latter corresponds to a carton of six 75cl bottles) to discard commercial samples exported for marketing and promotion. We exclude the few observations where the vintage year reported is ahead of the shipment year, and the cases where the value of exports is positive, but the volume is zero. To eliminate potential outliers, we calculate the median unit value charged by each exporter in each time period, and drop the observations for which the unit value exceeds 100 times the median, or falls below the median divided by 100. Finally, to date the episode of the trade collapse, we aggregate the data at a quarterly frequency. Notice that we only include wine producers in the sample because once the customs data are merged with the quality ratings, wholesalers and retailers, which are very few, drop out. As a result, each wine is exported by one firm only.

One concern is that wine is an exhaustible resource: once a wine with a specific vintage year runs out, it can no longer be produced. To ensure that the fall in exports that we observe during the crisis was not driven by wines which supply was running out, we define a product according to the name of the wine, its type, and grape, but ignore the vintage year (for each wine name, grape, type, destination, and time period, we sum exports across vintage years). This assumption is reasonable as evidence suggests that the quality of Argentinean wines does not vary much across vintage years (although, as we show later, our results remain robust to including vintage information).

[10] Due to confidentiality reasons, the customs cannot make the name of the exporter public. Therefore, Nosis uses its own market knowledge to identify a first, a second, and a third probable exporter. To identify the exporter's identity, for each wine name we collected from the Instituto Nacional de Vitivinicultura the name of its producer and of the wholesaler/retailer authorized to export the wine, and compared them against the probable exporters reported by Nosis.

The literature typically assumes that the Great Trade Collapse started in 2008Q3 (which coincides with the bankruptcy of Lehman Brothers in September 2008) and ended around 2009Q2 (Behrens et al., 2013; Levchenko et al., 2011), with some variation across studies. For Argentina, we date the trade collapse by visually inspecting the data at a monthly frequency. Figure 1 plots Argentina's total and wine exports (in US dollars) from January 2002 to December 2009 (total exports are from the International Financial Statistics of the International Monetary Fund, while total wine exports are from Nosis). Total exports reached a peak in September 2008, fell sharply until February 2009, and began to slowly recover until the end of the year. In September 2009, total exports were, however, still 35 percent lower relative to their value in September 2008.

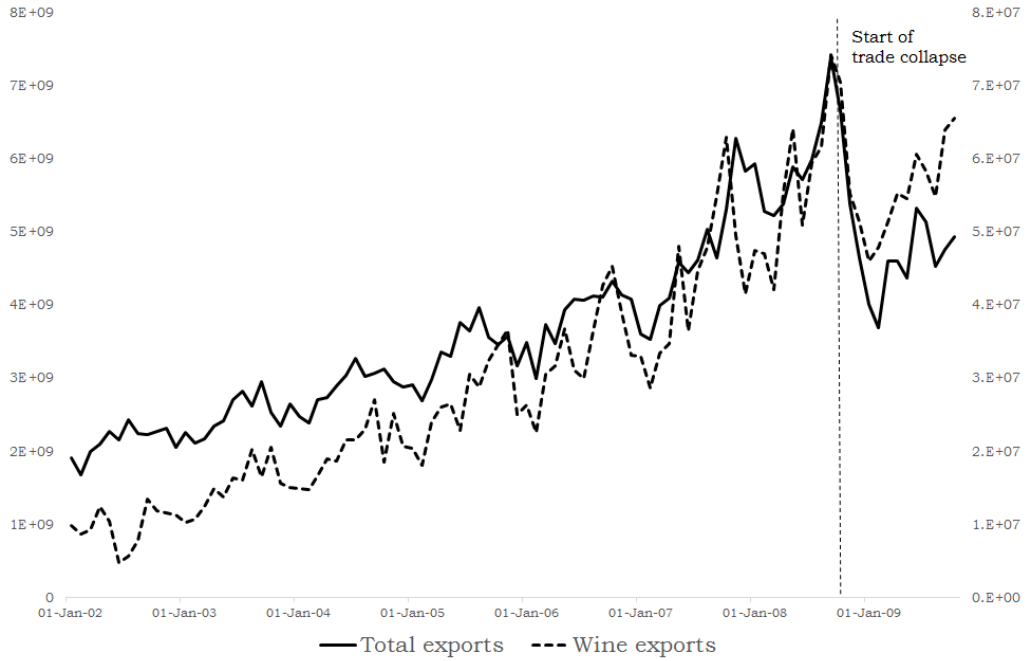

Figure 1: Total exports (left axis) and total wine exports (right axis), in US dollars
Sources: International Financial Statistics of the International Monetary Fund and Nosis

The collapse, and recovery of wine exports occurred approximately in the same months. As shown in Figure 1, wine exports fell from their peak in September 2008 until January 2009, and subsequently started to pick up. In September 2009, wine exports were 14 percent lower compared to their value in September 2008. Relative to total exports, the collapse of wine exports was less severe, consistent with the observation that trade in consumer durables and investment goods fell more sharply than in food and beverages, including wine (Baldwin, 2009; Behrens et al., 2013; Freund, 2009; Levchenko et al., 2010). The dynamics, however, are similar, and the correlation between the two series in Figure 1 is equal to 93 percent.

Given the dynamics depicted in Figure 1, we date the start of the trade collapse in October 2008. As total and wine exports were steadily recovering by the end of the summer of 2009, we designate September 2009 as the last month of the collapse, i.e., one year after its onset (Chor and Manova, 2012). In other words, we assume that the trade collapse started in 2008Q4 and lasted until 2009Q3. As we discuss later, our results remain, however, robust to using alternative starting or ending dates.

For each firm-product-destination triplet, we sum exports over this four-quarter period (henceforth, 2008Q4–2009Q3), which we refer to as the "crisis" period.[11] We then compare the evolution of exports between consecutive four-quarter periods, i.e., 2008Q4–2009Q3 relative to 2007Q4–2008Q3 for the crisis, and 2007Q4–2008Q3 relative to 2006Q4–2007Q3 for the pre-crisis period (Behrens et al., 2013; Iacovone and Zavacka, 2009). Comparing exports between the same quarters enables us to control for seasonal fluctuations, as can be observed in Figure 1. An alternative would be to analyze the drop in trade from the peak to the trough of the recession, but this measure would be contaminated by seasonality (Levchenko et al., 2010).

2.2 Quality

To measure quality, we use the time-invariant quality scores published by the Wine Spectator (Chen and Juvenal, 2016). The wines are assessed in blind tastings, and the ratings are given on a (50,100) scale according to the name of the wine, its grape, type, and vintage year. A larger score indicates a higher quality. Table 1 describes the Wine Spectator rating system. As we define a wine product ignoring its vintage year, we compute, for each wine, the unweighted average of the ratings of all wines with the same name, grape, and type, and round it to its closest integer. As a robustness check, we also calculate a weighted mean using each wine's export volume share as weight. Once we match the wines from the customs dataset with the average quality ratings from the Wine Spectator by name, type, and grape, we end up with 198 firms exporting 2,214 wines with 757 different names, three types, and 23 grapes. The lowest rated wine receives a score of 60, and the highest a score of 96.

Table 1: Quality Ratings

Wine Spectator (50,100)		**Robert 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

Notes: Both the Wine Spectator and Parker rating systems classify wines into six different quality bins.

We check the robustness of our findings using the time-invariant quality scores of Robert Parker (Chen and Juvenal, 2016). As shown in Table 1, the ratings are also given on a (50,100) scale according to the wine's name, grape, type, and vintage year. When we match the customs dataset with the Parker ratings by name, type, and grape (averaged across vintage years), we observe 1,129 wines exported by 165 firms (with 443 different names, three types, and 20 grapes), and the scores vary between 72 and 98 (i.e., we only observe four of the six bins listed in Table 1). A total of 838 wines, exported by 135 firms, are reviewed by both the Wine Spectator and Parker. The mean absolute difference between the two ratings is equal to 2.7, with a standard deviation of 3.2. Still, the two ratings are positively correlated as Pearson's correlation is equal to 0.52, and Kendall's correlation index of concordance is 0.35. We rely on the Wine Spectator for our main specifications because it has the largest coverage of Argentinean wines.

[11] Large Argentinean firms export continuously, while small and medium-sized firms are sporadic exporters (Castagnino, D'Amato, and Sangiácomo, 2013). Aggregating over four quarters increases the coverage for the smaller firms.

2.3 Descriptive Statistics

The primary dataset we use for our empirical analysis spans the 2006Q4 to 2009Q3 time frame, and includes 198 exporters, 2,214 wines, and 86 destination countries (21,433 observations). This sample represents 58 percent of the total value of red, white, and rosé wine exported over the period.

To get a sense of the evolution of wine exports during the crisis, we describe our data between two consecutive four-quarter periods, i.e., 2007Q4–2008Q3 (pre-crisis) and 2008Q4–2009Q3 (crisis). For these two periods, our sample includes 191 firms, 1,966 wines, and 80 destination countries. It is composed of 169 firms, 1,554 wines, and 79 countries in 2007Q4–2008Q3 (7,373 observations), and of 159 firms, 1,559 wines, and 75 export markets in 2008Q4–2009Q3 (6,414 observations). A total of 137 firms exported in both periods, while 32 and 22 firms exported before or during the crisis only. Besides, 1,147 wines were exported continuously, while 407 and 412 wines were exported before or during the crisis only. The mean Wine Spectator rating is equal to 84 for the three groups of wines. Also, the mean quality of all exported wines remained stable at a value of 84 before and during the crisis. Finally, firms exported continuously to 74 export markets, but exited from five countries and entered one new destination during the crisis.

Table 2 describes our data by quality bin of the Wine Spectator. For both the pre-crisis and crisis periods, "Good" and "Very good" wines represent the largest share of the sample (in terms of number of observations, firms, wines, destinations, and export share in the sample). In contrast, "Great" and "Not recommended" wines have the smallest coverages.

Table 2: Summary Statistics by Quality Bin of the Wine Spectator

	Observations		**Firms**		**Wines**		**Destinations**		**Export shares**	
	Pre-crisis	Crisis	Pre-crisis	Crisis	Pre-crisis	Crisis	Pre-crisis	Crisis	Pre-crisis	Crisis
Great	12	22	3	3	5	9	8	8	0.05%	0.05%
Outstanding	732	683	51	54	179	218	57	50	11.39%	9.54%
Very good	2,789	2,386	96	87	472	458	76	73	41.41%	36.64%
Good	3,334	2,896	118	105	701	690	77	72	40.66%	46.28%
Mediocre	401	333	46	45	174	168	39	40	4.79%	5.25%
Not recommended	105	94	12	8	23	16	32	31	1.70%	2.24%
All wines	7,373	6,414	169	159	1,554	1,559	79	75	100%	100%

Notes: The table reports, by quality bin of the Wine Spectator, the number of observations, firms, wines, destinations, and export share in the sample (in %), separately for the pre-crisis (2007Q4–2008Q3) and crisis (2008Q4–2009Q3) periods.

Table 3 describes mean export values, volumes, and unit values by quality bin of the Wine Spectator, as well as mean percentage changes from the pre-crisis to the crisis period. We therefore further restrict our sample to the wines exported continuously in both periods to each destination country. The table shows that the mean export values and volumes are, on average, lower for the higher quality wines. For instance, the mean number of liters exported for "Great" wines before the crisis was equal to 426 (for a mean value of 8,683 US dollars), compared to 6,374 liters for "Not recommended" wines (for a mean value of 16,647 US dollars). Besides, during the crisis the mean export values and volumes collapsed more dramatically for the higher quality wines (by 52.6 and 28.5 percent in value, and by 42.1 and 20.3 percent in volume for "Great" and "Outstanding" wines, respectively). Overall, these numbers are suggestive of a flight from quality during the crisis.

Table 3: Descriptive Statistics by Quality Bin of the Wine Spectator

	Mean export values (US dollars)			Mean export volumes (liters)			Mean unit values (US dollars/liter)		
	Pre-crisis	Crisis	Change	Pre-crisis	Crisis	Change	Pre-crisis	Crisis	Change
Great	8,683	5,130	-52.6%	426	280	-42.1%	20.39	18.34	-10.6%
Outstanding	10,801	8,120	-28.5%	854	697	-20.3%	12.65	11.65	-8.2%
Very good	7,415	6,692	-10.2%	1,961	1,679	-15.5%	3.78	3.98	5.3%
Good	7,102	6,909	-2.7%	2,048	1,887	-8.2%	3.47	3.66	5.5%
Mediocre	5,999	5,772	-3.9%	2,296	1,991	-14.2%	2.61	2.90	10.4%
Not recommended	16,647	14,140	-16.3%	6,374	5,245	-19.5%	2.61	2.70	3.2%

Notes: The table reports, by quality bin of the Wine Spectator, the mean export value (in US dollars), volume (in liters), and unit value (in US dollars per liter) of the wines exported continuously to each destination country in the pre-crisis (2007Q4–2008Q3) and crisis (2008Q4–2009Q3) periods, as well as mean percentage changes.

Table 3 also shows that higher quality wines are, on average, more expensive. Export inflation fell during the crisis for "Great" and "Outstanding" wines (by 10.6 and 8.2 percent), while it increased for the lower quality ones. The fact that the unit value of a given wine with a given quality varies over time cautions against using unit values as a proxy for quality (Khandelwal, 2010). In our sample, the correlation between unit values and the Wine Spectator ratings is equal to 40 percent.

Finally, to understand the dynamics of the relative price of higher to lower quality wines, we broadly classify the "Very good," "Outstanding," and "Great" wines as high quality, and the "Not recommended," "Mediocre," and "Good" ones as low quality. We calculate for each of the two categories its mean unit value, separately for 2007Q4–2008Q3 and 2008Q4–2009Q3. Again, we focus on the wines exported continuously to each destination country in both periods. The mean unit value fell from 6.51 to 6.42 US dollars during the crisis for the higher quality wines (or by 1.36 percent), while it rose from 3.96 to 4.21 US dollars for the lower quality wines (or by 6.12 percent). The relative price of higher to lower quality wines therefore fell during the crisis (by 7.48 percent), consistent with the effect of a negative income shock that predominantly impacted the higher quality wines.

3 Decomposition of Margins

We assess the contributions of the extensive and intensive margins to the dynamics of Argentinean wine exports during the crisis. Similarly to Behrens et al. (2013), Bernard, Jensen, Redding, and Schott (2009), and Haddad et al. (2010), we decompose nominal exports X in a given time period as $X = i \times \overline{j} \times \overline{k} \times \overline{x}$, where i denotes the number of exporting firms, $\overline{j}$ the mean number of countries each firm exports to, $\overline{k}$ the mean number of products each firm exports to each country, and $\overline{x} \equiv X/\left(i \times \overline{j} \times \overline{k}\right)$ the mean sales per firm-destination-product. Defining $\Delta X = \widetilde{X}/X$, where $\widetilde{X}$ are exports in the following period, the change in exports from 2007Q4–2008Q3 to 2008Q4–2009Q3 is:

$$\Delta X = \Delta i \times \Delta \overline{j} \times \Delta \overline{k} \times \Delta \overline{x}, \tag{1}$$

where Δi, $\Delta \overline{j}$, and $\Delta \overline{k}$ capture changes at the extensive margin, $\Delta \overline{x}$ represents changes at the intensive margin, and the latter can be further decomposed into changes in mean quantities $\Delta \overline{q}$ (in liters) and changes in mean unit values $\Delta \overline{uv}$ (in US dollars per liter), i.e., $\Delta \overline{x} \equiv \Delta \overline{q} \times \Delta \overline{uv}$.

Table 4: Decomposition of Margins

		Extensive			Intensive		
	Total exports	Firms	Destinations	Products	Sales	Quantities	Prices
2007Q4–2008Q3	171,582	169	7.34	5.95	23,271	7,018	3.32
2008Q4–2009Q3	124,758	159	6.89	5.85	19,451	5,977	3.25
Growth	-27.29%	-5.92%	-6.05%	-1.58%	-16.42%	-14.83%	-1.87%
Contribution			**39.84%**		**60.16%**		

Notes: Total exports are in thousand US dollars and average sales per exporter-destination-product are in US dollars.

As shown in Table 4, wine exports contracted by 27.29 percent during the crisis. This fall was driven by a 5.92 percent reduction in the number of exporters, and by a 6.05 and 1.58 percent decrease in the mean number of destinations per firm and of wines exported by each firm to each destination country, respectively. Changes at the extensive margin therefore reduced exports by $(0.9408 \times 0.9395 \times 0.9842 - 1) \times 100 = -13.01$ percent. Consistent with findings in the literature (Behrens et al., 2013; Bernard et al., 2009; Haddad et al., 2010), changes at the intensive margin however dominated as the mean value of exports per firm-destination-product fell by 16.42 percent. In other words, the relative contributions of the intensive and extensive margins to the collapse of wine exports amounted to 60.16 and 39.84 percent, respectively. Changes at the intensive margin were primarily driven by a fall (of 14.83 percent) in the mean quantities exported, but also in mean prices (of 1.87 percent).[12,13]

Given that the bulk of the collapse of Argentinean wine exports occurred at the intensive margin, in our empirical analysis we focus on explaining that margin and therefore analyze the growth of export values, volumes, and unit values for the firm-product-destination triplets that report positive exports between two consecutive periods. We then show, in Section 5.3, that our results remain robust to including changes at the extensive margin in our regressions.

4 Quality and Trade During the Crisis

To motivate our empirical predictions, Appendix A.1 presents a simple theoretical framework based on Hallak (2006). We assume that the preferences of a representative consumer in a given sector of a given country depend on the consumption of two goods only, high and low quality. The demand for quality depends on the intensity of the preference for quality, which rises with income. This partial equilibrium setting introduces non-homothetic preferences such that a higher income implies a larger

[12] Considering both margins, the total change in wine exports is equal to $(0.9408 \times 0.9395 \times 0.9842 \times 0.8358 - 1) \times 100 = -27.29$ percent. Further decomposing the intensive margin into changes in mean quantities and changes in mean prices, the total change in wine exports is $(0.9408 \times 0.9395 \times 0.9842 \times 0.8517 \times 0.9813 - 1) \times 100 = -27.29$ percent.

[13] In many countries, wholesalers and retailers, which are excluded from our sample, account for a large share of exports as they assist less productive firms in overcoming barriers to foreign markets. Akerman (2018) shows that higher fixed costs of exporting increase the share of firms selling through intermediaries. As the tightening of credit conditions during the crisis has increased the costs of exporting (Bricongne et al., 2012; Chor and Manova, 2012), the share of trade handled by intermediaries is likely to have soared, potentially biasing our intensive and extensive margin estimates. In Argentina, a very small share of wine exports is, however, handled by intermediaries (see Brevet, Estrella Orrego, and Gennari, 2014, for evidence that Argentinean wine producers tend to export directly), and this share has not risen during the crisis (in our dataset, the share of wine exported by intermediaries is equal to 4.97 percent in 2007Q4–2008Q3, and to 4.14 percent in 2008Q4–2009Q3). If we include wholesalers and retailers (for which quality is unobserved) in our sample, the extensive and intensive margin contributions are equal to 39.43 and 60.57 percent, respectively.

consumption of higher quality goods. The model predicts that a negative income shock, by lowering the intensity of the preference for quality, disproportionately reduces the import demand of higher relative to lower quality goods (i.e., a flight from quality).

To test the prediction of the model, and therefore establish whether the crisis disproportionately reduced the exports of higher relative to lower quality goods, we estimate the following reduced-form regression (Behrens et al., 2013; Bernard et al., 2009; Iacovone and Zavacka, 2009; Sauré, 2014):

$$\Delta \ln X_{ijk,t} = \xi quality_k \times D_{crisis} + D_{ij,t} + D_k + \epsilon_{ijk,t}, \tag{2}$$

where $\Delta \ln X_{ijk,t}$ is the log change of exports (in US dollars) of wine k sold by firm i to country j in period t. The changes are calculated from 2007Q4–2008Q3 to 2008Q4–2009Q3 for the crisis, and from 2006Q4–2007Q3 to 2007Q4–2008Q3 for the pre-crisis period. As computing log changes requires us to observe positive trade flows between two consecutive periods, equation (2) explains changes at the intensive margin. The quality of wine k, $quality_k$, is measured using the Wine Spectator ratings, and $\epsilon_{ijk,t}$ is an error term. We define a dummy variable D_{crisis} which is equal to one for the crisis period, and interact it with quality. The coefficient of interest, ξ, measures the *differential* impact of quality on export growth during the crisis. The prediction of our model requires ξ to be negative. We also estimate equation (2) using the log change of export volumes and of unit values as dependent variables.

We control for an extensive set of fixed effects and perform within estimations. We include firm-destination-time effects, $D_{ij,t}$, that sweep out all aggregate, firm, and destination-specific supply and demand shocks which are common across the goods exported by each firm to each country at each point in time. These include factors that vary by firm-destination-time (e.g., the time-varying demand or taste of a country for a firm's exports, or the presence of long-term contracts between exporters and importers in each destination), time-varying characteristics of the exporters such as productivity, firm size, global value chains, inventories, or credit constraints, and time-varying destination-specific factors such as GDP growth, protectionism, or bilateral exchange rates. The fixed effects also absorb the direct effect of D_{crisis}. We also include product fixed effects, D_k. As product fixed effects are collinear with quality, the direct effect of quality drops out from the regression. Standard errors are clustered by destination to control for idiosyncratic shocks correlated at the importer level.

4.1 Baseline Results

To evaluate the effect of quality on export growth in a "normal" period (i.e., before the crisis), and therefore allow the coefficient on quality to be estimated, we first estimate equation (2) excluding the product fixed effects, and instead control for product characteristics by including grape, type, HS-level, and province of origin of the grapes fixed effects. Controls for the wine names are not included as they are collinear with the firm fixed effects (as each wine is exported by one firm only). Column (1) in Panel A of Table 5 shows that higher quality wines enjoyed a stronger growth of nominal exports before the crisis, but were subsequently more negatively affected. On average, a one unit increase in quality raised nominal export growth by 1.5 percentage point before the crisis, and reduced it by two percentage points during the downturn ($0.015 - 0.036 = -0.021$). For export volumes in Panel B, the effects are equal to 1.7 and -1.4 percentage points, respectively. In Panel C, the negative interaction

between quality and the crisis dummy indicates that a one unit increase in quality lowered export inflation by 0.8 percentage point. The collapse of higher quality exports during the crisis was therefore driven by a fall in the quantities exported, but also by lower prices (Behrens et al., 2013; Levchenko et al., 2010; Gopinath et al., 2012; Sauré, 2014).[14]

Table 5: Baseline Results

	(1)	(2)	(3)	(4)
Panel A: Export values				
quality	0.015^{b} (0.007)	–	–	–
$quality \times D_{crisis}$	-0.036^{a} (0.011)	-0.032^{b} (0.012)	-0.031^{b} (0.013)	-0.227^{a} (0.077)
$\Delta \ln RER \times quality$	–	–	-0.028 (0.072)	–
R-squared	0.480	0.551	0.551	0.551
Panel B: Export volumes				
quality	0.017^{b} (0.007)	–	–	–
$quality \times D_{crisis}$	-0.031^{a} (0.011)	-0.028^{b} (0.012)	-0.027^{b} (0.012)	-0.173^{b} (0.074)
$\Delta \ln RER \times quality$	–	–	-0.040 (0.073)	–
R-squared	0.469	0.543	0.543	0.541
Panel C: Unit values				
quality	-0.002 (0.002)	–	–	–
$quality \times D_{crisis}$	-0.006^{a} (0.002)	-0.004^{b} (0.002)	-0.004^{b} (0.002)	–
$\Delta \ln RER \times quality$	–	–	0.012^{c} (0.007)	–
R-squared	0.473	0.538	0.539	–
Quality	Ratings	Ratings	Ratings	Unit values
Observations	7,569	7,256	7,251	9,590

Notes: Firm-destination-time, grape, type, province, and HS-level fixed effects are included in (1). Firm-destination-time and product fixed effects are included in (2) to (4). Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. Quality is measured using the Wine Spectator ratings except in column (4) where (log) mean unit values (in US dollars per liter) are used instead. An increase in the real exchange rate RER indicates a real depreciation of the exporter's currency.

Column (2) includes product fixed effects, therefore quality drops out from the regression.[15] Quality interacted with the crisis dummy remains negative and significant in all cases, but slightly smaller in magnitude. Column (3) controls for changes in bilateral real exchange rates interacted with quality, with little effect on our estimates.[16] In response to a real depreciation (i.e., an increase in the real exchange rate), exporters increase their export prices by more for higher quality goods (Panel C), while the exchange rate effects on export values and volumes do not vary across quality levels (Panels A and B). These findings are consistent with Chen and Juvenal (2016) who find that, in first

[14] As the mean Wine Spectator rating remained stable before and during the crisis, we rule out that our results are driven by a lower quality reducing the demand for wine exports during the recession.

[15] The number of observations in each column of the table sometimes varies depending on the dimension of the fixed effects included because the observations that are perfectly predicted by the fixed effects (i.e., singletons) are dropped.

[16] The real exchange rate is the ratio of consumer price indices (CPI) times the average nominal exchange rate. Due to poor coverage at a quarterly frequency, the CPIs are measured annually for 2007–2009. Quarterly nominal exchange rates are averaged over each four-quarter period from 2006Q4–2007Q3 to 2008Q4–2009Q3 (International Financial Statistics of the International Monetary Fund).

differences, real exchange rates only have heterogeneous effects on the prices, and not on the values and volumes, of exported goods differentiated by quality.

Finally, we estimate equation (2) using unit values as a measure of quality, as is traditionally done in most of the literature. To ensure comparability with the Wine Spectator ratings which are product specific, we compute the (log) mean unit value of each exported wine across destinations and over time. The main advantage of using unit values as a proxy for quality is to increase data coverage as all unrated wines can be included in the sample. It also allows us to determine whether unit values are a reliable proxy for quality. The drawback is that we cannot assess the effect of quality on export unit values during the crisis. Column (4) therefore reports the results for export values and volumes only. Consistent with our earlier findings, Panels A and B show that, during the crisis, export growth contracted more severely for the higher quality wines. We therefore conclude that, despite being an imperfect proxy for quality (see Section 2.3), unit values do a good job at delivering that wine exports experienced a flight from quality during the crisis.

4.2 Income Shock

According to our story, and as illustrated by our model in Appendix A.1, the flight from quality was driven by a negative income shock, combined with higher quality goods being more income elastic than lower quality ones. To investigate this mechanism in more detail, we rely on a continuous measure of average income and control for the growth of real GDP per capita in each destination country (which, in our sample, fell from 1.6 to -3.9 percent on average during the crisis). In contrast to equation (2), the use of a continuous measure of average income allows us to measure the intensity of the effects of the crisis across destination countries. For nominal exports we estimate:

$$\Delta \ln X_{ijk,t} = \phi \Delta \ln GDP/cap_{j,t} \times quality_k + D_{ij,t} + D_{k,t} + \varrho_{ijk,t}, \tag{3}$$

where the growth of income per capita $GDP/cap_{j,t}$ in destination j is interacted with quality, and firm-destination-time and product-time fixed effects are included (the main effects of quality and of income growth are absorbed by the fixed effects). A positive coefficient for ϕ would imply that higher quality exports are more income elastic, and that the fall in income during the crisis was more detrimental to higher quality exports.[17]

When we estimated equation (2), product-time fixed effects could not be included as they are collinear with the main variable of interest, i.e., quality interacted with the crisis dummy variable. By including product-time fixed effects, equation (3) has two main advantages. First, it controls for the effects of supply-side shocks on the exports of each individual wine. For instance, Argentina's total wine production fell during the crisis (by 19.1 percent) due to severe weather conditions including

[17] Our specification estimates how Argentinean exports are affected by changes in the average income per capita of destination countries. Hummels and Lee (2017) instead consider how shocks to the distribution of income across households within the US drive changes in import demand. Based on a non-homothetic demand system, for each traded good in each time period they construct predicted changes in expenditures arising only from income shocks by combining data on the distribution of income shocks across households with estimates of expenditure shares and income elasticities of demand for each product, income level, and time period. They find that the reduction in income-induced expenditures during the crisis explains the contraction of US import demand within product groups.

Table 6: Income Shock

	(1)	(2)	(3)	(4)
Panel A: Export values				
$\Delta \ln GDP/cap \times quality$	0.358^{a} (0.107)	–	0.347^{a} (0.108)	1.602^{c} (0.932)
$\Delta \ln exports \times quality$	–	0.034^{b} (0.014)	–	–
$\Delta \ln RER \times quality$	–	–	-0.037 (0.063)	–
R-squared	0.593	0.593	0.593	0.607
Panel B: Export volumes				
$\Delta \ln GDP/cap \times quality$	0.290^{a} (0.107)	–	0.274^{b} (0.107)	1.562^{c} (0.922)
$\Delta \ln exports \times quality$	–	0.027^{b} (0.013)	–	–
$\Delta \ln RER \times quality$	–	–	-0.056 (0.063)	–
R-squared	0.585	0.585	0.585	0.596
Panel C: Unit values				
$\Delta \ln GDP/cap \times quality$	0.069^{b} (0.030)	–	0.072^{b} (0.032)	–
$\Delta \ln exports \times quality$	–	0.007^{b} (0.003)	–	–
$\Delta \ln RER \times quality$	–	–	0.019^{b} (0.007)	–
R-squared	0.588	0.588	0.588	–
Quality	Ratings	Ratings	Ratings	Unit values
Observations	6,807	6,807	6,802	8,596

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. Quality is measured using the Wine Spectator ratings except in column (4) where (log) mean unit values (in US dollars per liter) are used instead. An increase in the real exchange rate *RER* indicates a real depreciation of the exporter's currency.

heavy rain and hail.[18] Second, as the export price is a markup over marginal cost, the estimation of equation (3) for unit values allows us to identify the effect of changes in income on markups as the product-time fixed effects control for time-varying product-specific marginal costs.[19]

The results of estimating equation (3) are reported in Table 6. In column (1), for export values, volumes, and unit values the interaction between quality and income growth is positive and significant. In other words, the income elasticity of export demand rises with quality, and the fall in mean income growth during the crisis was more detrimental to the values, volumes, and prices of higher quality exports. The finding that export inflation fell during the crisis in turn suggests that firms compressed their margins, and to a larger extent for the higher quality wines.

To ensure that the fall in foreign income in turn implied a lower demand for Argentinean wines, in column (2) we instead consider as a regressor in equation (3) the growth of total wine export volumes from Argentina to each country (which, in our sample, fell from 10.8 to -19.2 percent on average during the crisis), interacted with quality.[20] Our results continue to hold.

[18] The real GDPs per capita (in US dollars) are from the Penn World Tables, and Argentina's total wine production (in liters) is from Anderson and Nelgen (2011). Both variables are measured annually for the years 2007–2009.

[19] In our raw data, where wines differ by vintage year, marginal costs are time-invariant as each wine is produced in a single year. A change in the price therefore corresponds to a change in the markup. In our sample, marginal costs are time-varying as we merged together the wines with the same name, type, and grape, but with different vintage years.

[20] The bilateral export volumes (in liters), measured annually for 2007–2009, are from UN Comtrade (HS code 2204).

Column (3) controls for changes in bilateral real exchange rates interacted with quality, and the interactions between income growth and quality remain positive and significant. As before, the interaction between real exchange rate changes and quality is significant for unit values only (Panel C). In response to a real depreciation, exporters therefore increase their export prices (and markups) by more for higher quality goods (Chen and Juvenal, 2016). Finally, in column (4) we rely on the (log) mean unit value of each exported wine to measure quality and qualitatively, our results continue to hold.[21]

4.3 Economic Significance of Quality

We assess the contribution of quality in explaining the growth of wine export values, volumes, and unit values during the crisis. Based on our point estimates reported in column (1) of Table 6, we derive the predicted values of each dependent variable and compare them against the predicted values obtained under the assumption that the quality of all wines exported during the crisis was as high, or as low, as the highest or as the lowest quality in the sample (equal to 96 and 60, respectively). These two alternative scenarios provide us with upper and lower bound estimates of the hypothetical performance of trade during the crisis due to differences in the quality composition of exports.

Table 7: Economic Significance

	(1)	(2)	(3)
	Actual change during the crisis	Change if high quality only	Change if low quality only
Export values	-27.29%	-29.05%	-23.62%
Export volumes	-25.90%	-27.57%	-22.43%
Unit values	-1.38%	-1.47%	-1.20%

Notes: Column (1) reports the percentage change of export values, volumes, and unit values during the crisis. Columns (2) and (3) report the corresponding changes if the quality of all exported wines during the crisis had been as high, or as low, as the highest (96) or as the lowest (60) quality in the sample, respectively.

The results are reported in Table 7. Column (1) shows that export values fell by 27.29 percent during the crisis. Columns (2) and (3) show that exports would have fallen by more (by 29.05 percent), and by less (by 23.62 percent), in the high and low quality scenarios, respectively, or a 5.43 percentage points difference in export performance. For export volumes, the gap is equal to 5.14 percentage points, while for unit values (and, therefore, for markups) the difference is smaller at 0.27 percentage point.

5 Extensions

This section discusses extensions to our benchmark specifications. We allow for differences in income per capita across importers, quality sorting, and investigate the post-crisis recovery as well as extensive margin adjustments. We also demonstrate that the flight from quality extends to manufacturing industries other than wine.

[21] In March 2008, the Argentinean government introduced ad-valorem export taxes on most agricultural products, including wine, with the aim of restoring the fiscal surplus to curb domestic inflation. In Table 5, the interaction between quality and the crisis dummy does not allow us to distinguish between the effects of the crisis and the effects of the policy. This policy, however, cannot explain the effects of average income that we report in Table 6.

5.1 Income per Capita and Quality Sorting

Evidence suggests that higher income countries import higher quality goods than lower income countries (Hallak, 2006; Hummels and Skiba, 2004; Manova and Zhang, 2012a; Martin, 2012). At the same time, quality sorting implies that higher quality goods are shipped to more distant destinations (Baldwin and Harrigan, 2011; Hummels and Skiba, 2004; Manova and Zhang, 2012a; Martin, 2012). This can happen if transport costs are proportional to weight rather than value, in which case an increase in transport costs lowers the relative price, and increases the relative demand for higher quality goods (Alchian and Allen, 1964).

We explore the implications of these mechanisms for the flight from quality. As our model shows, if the quality imported is higher in richer countries, the flight from quality should be more severe in wealthier destinations (Appendix A.2). If we allow for quality sorting, and assume that the quality exported increases with bilateral distance, the flight from quality should be more acute in the countries which are more distant from Argentina (Appendix A.3).

To investigate these predictions, we proceed in two steps. First, in Appendix B we replicate estimations from the literature to demonstrate that, in our data, higher quality goods are disproportionately shipped to richer and distant countries. Second, we investigate whether the flight from quality was more severe in wealthier and distant destinations. To do so, we first divide our sample into two groups of richer and poorer countries according to whether their income per capita is above or below the sample mean. Next, we split our sample at the mean value of bilateral distance.[22] We then estimate equation (3) and let the coefficient on quality interacted with income growth vary between the richer and poorer destinations, and between the countries which are distant from or close to Argentina.[23]

Consistent with expectations, columns (1), (4), and (7) of Table 8 show that for export values, volumes, and unit values, the coefficient on the interaction between quality and income growth is larger for the destination countries which are, on average, richer (the effects for richer and poorer destinations are significantly different from each other at the ten percent level). In addition, columns (2) and (8) show that the values and unit values of higher quality exports contracted more sharply during the crisis only in the countries which are farther away from Argentina (the interactions for export volumes in column 5 are insignificant).

One concern is that Argentina's higher income export destinations such as the US and the EU also tend to be farther away (Brambilla, Lederman, and Porto, 2010). In our sample, the correlation between income per capita and bilateral distance is, indeed, equal to 57 percent. We therefore need to ensure that if Argentinean firms disproportionately ship higher quality goods to richer countries, it is not only because these countries are also more distant. To address this issue we further distinguish between the richer and poorer destinations which are distant from or close to Argentina. For export

[22] Bilateral distances are from the Centre d'Etudes Prospectives et d'Informations Internationales.

[23] Income per capita varies between 1,212 (Ghana) and 26,077 US dollars (Israel) for the poorer destinations, and between 27,304 (Greece) and 89,814 US dollars (Luxembourg) for the richer ones. Bilateral distance varies between 529 (Uruguay) and 7,533 kilometers (Mexico) for the countries closer to Argentina, and between 7,701 (Ghana) and 19,146 kilometers (South Korea) for the distant ones. Canada and the US are therefore classified as distant countries.

Table 8: Income Per Capita and Quality Sorting

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Export values			Export volumes			Unit values		
$\Delta \ln GDP/cap \times quality \times rich$	0.707[a] (0.243)	–	–	0.595[b] (0.232)	–	–	0.113[b] (0.045)	–	–
$\Delta \ln GDP/cap \times quality \times poor$	0.207[c] (0.120)	–	–	0.169 (0.125)	–	–	0.038 (0.031)	–	–
$\Delta \ln GDP/cap \times quality \times far$	–	0.337[c] (0.174)	–	–	0.254 (0.173)	–	–	0.084[b] (0.036)	–
$\Delta \ln GDP/cap \times quality \times near$	–	0.120 (0.189)	–	–	0.053 (0.185)	–	–	0.067 (0.059)	–
$\Delta \ln GDP/cap \times quality \times rich/far$	–	–	0.687[b] (0.283)	–	–	0.555[b] (0.270)	–	–	0.132[a] (0.048)
$\Delta \ln GDP/cap \times quality \times rich/near$	–	–	0.302 (0.253)	–	–	0.187 (0.239)	–	–	0.115[c] (0.059)
$\Delta \ln GDP/cap \times quality \times poor/far$	–	–	0.150 (0.154)	–	–	0.109 (0.157)	–	–	0.040 (0.028)
$\Delta \ln GDP/cap \times quality \times poor/near$	–	–	0.122 (0.199)	–	–	0.045 (0.195)	–	–	0.077 (0.062)
R-squared	0.593	0.593	0.593	0.585	0.585	0.585	0.588	0.588	0.588
Observations	6,807	6,807	6,807	6,807	6,807	6,807	6,807	6,807	6,807

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. [a], [b], and [c] indicate significance at the one, five, and ten percent levels. The variables "rich" and "poor," "far" and "near" are dummies for the destination countries which real GDP per capita, and which bilateral distance from Argentina are above or below the sample means, respectively. The variables "rich/far," "rich/near," "poor/far," and "poor/near" are interactions between the "rich," "poor," "far," and "near" dummy variables. Interactions (not reported) are included between quality and "rich" and "poor" in (1), (4), and (7), between quality and "far" and "near" in (2), (5), and (8), and between quality and "rich/far," "rich/near," "poor/far," and "poor/near" in (3), (6), and (9).

values and volumes (columns 3 and 6), the flight from quality is only significant for the richer destinations which are also distant. For unit values (column 9), the coefficient on the interaction between quality and income growth is significant for the richer importers only, but is larger for the distant ones. In terms of magnitude, notice that the coefficients on the interaction for the richer and distant destinations are about twice as large compared to our benchmark estimates reported in column (1) of Table 6. We therefore conclude that the flight from quality during the crisis was mainly driven by the negative income shock in wealthier and distant destinations.[24]

5.2 Post-Crisis Recovery

As shown by our model in Appendix A.1, by increasing the intensity of the preference for quality, a higher income disproportionately increases the demand for higher relative to lower quality goods. We extend our analysis to the aftermath of the crisis, and investigate whether higher quality exports picked up more strongly once the world economy started to recover from the recession. This exercise also helps us to establish whether the trade effects of the crisis were only temporary (Baldwin, 2009).

Unfortunately, due to a glitch in the data collection, the customs data for 2010 report the wine names as missing (while the firm names, grapes, types, vintage years, and destinations are available). As a result, we cannot identify any of the wines exported during that year. Given the constraint of measuring export growth between the same quarters to control for the effects of seasonality, the

[24] If we estimate equation (3) with a full set of interactions, the triple interaction between income growth, quality, and income per capita is positive and significant, while the one between income growth, quality, and distance is insignificant.

earliest post-crisis data which can be used are for the 2011Q4–2012Q3 period. For each firm-product-destination triplet, the growth rates of export values, volumes, and unit values for the post-crisis period are therefore measured from 2008Q4–2009Q3 to 2011Q4–2012Q3 (i.e., with a two-year gap).

Our full sample now spans three different time periods as export growth is calculated for the pre-crisis, crisis, and post-crisis periods. Using this sample, we first re-estimate equation (3). Then, we let the coefficient on income growth interacted with quality vary over time by multiplying the interaction term by D_{pre}, D_{crisis}, and D_{post} which are dummy variables equal to one for the 2007Q4–2008Q3 pre-crisis, 2008Q4–2009Q3 crisis, and 2011Q4–2012Q3 post-crisis periods, respectively.

Table 9: Post-Crisis Recovery

	(1)	(2)	(3)	(4)	(5)	(6)
	Export values	Export volumes	Unit values	Export values	Export volumes	Unit values
$\Delta \ln GDP/cap \times quality$	0.404^{a} (0.121)	0.332^{a} (0.119)	0.071^{a} (0.018)	–	–	–
$\Delta \ln GDP/cap \times quality \times D_{pre}$	–	–	–	0.440^{b} (0.195)	0.307^{c} (0.179)	0.134^{a} (0.043)
$\Delta \ln GDP/cap \times quality \times D_{crisis}$	–	–	–	0.380^{b} (0.163)	0.290^{c} (0.166)	0.090^{b} (0.045)
$\Delta \ln GDP/cap \times quality \times D_{post}$	–	–	–	0.397^{b} (0.184)	0.359^{c} (0.186)	0.038^{c} (0.022)
R-squared	0.585	0.574	0.602	0.585	0.574	0.602
Observations	8,006	8,006	8,006	8,006	8,006	8,006

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. D_{pre}, D_{crisis}, and D_{post} are dummy variables for the 2007Q4–2008Q3 pre-crisis, 2008Q4–2009Q3 crisis, and 2011Q4–2012Q3 post-crisis periods, respectively.

The results are reported in Table 9. The coefficients on the interaction between income growth and quality are positive and significant on average in the full sample (columns 1 to 3), and individually for each of the three sub-periods (columns 4 to 6). The positive coefficients for the post-crisis period indicate that the growth of real GDP per capita from 2009 to 2012 (which, in our sample, is equal to ten percent, on average) increased to a larger extent the values, volumes, prices, and markups of higher quality exports. We therefore conclude that the flight from quality was only temporary.

5.3 Extensive Margin

Given the dominant role of the intensive margin in explaining the collapse of Argentinean wine exports during the crisis, our analysis has so far focused on explaining that margin only. To ensure that our results remain robust to including changes at the extensive margin, we proceed in several ways. First, we use as a dependent variable in equation (3) the mid-point export growth rate $g_{ijk,t}$ of each wine k sold by firm i to country j in period t:

$$g_{ijk,t} = \frac{X_{ijk,t} - X_{ijk,t-1}}{\frac{1}{2}\left(X_{ijk,t} + X_{ijk,t-1}\right)}, \tag{4}$$

where $X_{ijk,t}$ can take on zero values. This measure, which is symmetric around zero and is bounded between -2 and 2, allows us to study entries, exits, and continuing flows simultaneously (Bricongne,

Fontagné, Gaulier, Taglioni, and Vicard, 2012). Second, we use the first difference of $\ln(1+X_{ijk,t})$. For high levels of trade flows, $\ln(1+X_{ijk,t}) \simeq \ln X_{ijk,t}$, and for $X_{ijk,t}=0$, $\ln(1+X_{ijk,t})=0$.

We also estimate specifications in levels. First, we follow Crozet et al. (2012) and regress by tobit the log of exports which are censored at their minimum observed positive value to each destination country. Second, we regress $X_{ijk,t}$ by Poisson Pseudo-Maximum Likelihood (Santos Silva and Tenreyro, 2006). Another way to address sample selection would be to implement Heckman's correction, but this requires a variable that determines a firm's destination-specific fixed costs of exporting, and not its variable trade costs, which is unavailable.

Table 10: Extensive Margin

	(1)	(2)	(3)	(4)	(5)
Panel A: Export values					
$\Delta \ln GDP/cap \times quality$	0.321^{a} (0.121)	0.845^{b} (0.404)	0.246^{a} (0.001)	0.262^{a} (0.001)	–
R-squared (or pseudo)	0.661	0.647	0.270	–	–
Panel B: Export volumes					
$\Delta \ln GDP/cap \times quality$	0.305^{b} (0.118)	0.779^{b} (0.335)	0.263^{a} (0.001)	0.145^{a} (0.002)	–
R-squared (or pseudo)	0.662	0.643	0.273	–	–
Panel C: Probability of exit					
$quality \times \widetilde{D}_{crisis}$	–	–	–	–	0.006^{b} (0.002)
R-squared	–	–	–	–	0.640
Dependent variable	Mid-point	$\Delta \ln(1+X)$	$\ln X$	X	$exit$
Estimation	OLS	OLS	Tobit	PPML	OLS
Observations	10,830	11,784	23,624	20,928	14,044

Notes: Firm-destination-time and product-time fixed effects are included in (1) to (4). Firm-destination-time and product fixed effects are included in (5). Robust standard errors adjusted for clustering by destination between parentheses. ^{a} and ^{b} indicate significance at the one and five percent levels. $\widetilde{D}_{crisis}$ is a dummy equal to one if there was a crisis in the following period.

The results for export values and volumes are reported in Panels A and B of Table 10. Overall, the resulting patterns are supportive of our baseline conclusions. Notice, however, that there is a large variation in the magnitude of the coefficient on the interaction between quality and income growth across specifications. Based on Monte Carlo simulations, Head and Mayer (2014) argue that the tobit and PPML estimators should be preferred.[25] The use of $\ln(1+X_{ijk,t})$ is in general not recommended as the results depend on the units of measurement. In addition, OLS applied to mid-point growth rates is problematic as the latter are doubly censored and often display a bimodal distribution.

A related question is whether the crisis affected differently the propensity of high versus low quality wines to exit from export markets. To investigate this issue, we define an exit dummy variable $exit_{ijk,t}$ which is equal to one if wine k was exported by firm i to country j at time t but not at $t+1$, and zero otherwise. We then regress this exit dummy on a binary variable $\widetilde{D}_{crisis}$ which is equal to one if there was a crisis at time $t+1$, interacted with quality:

$$exit_{ijk,t} = \delta quality_k \times \widetilde{D}_{crisis} + D_{ij,t} + D_k + \rho_{ijk,t}, \tag{5}$$

[25] In Table 10, the magnitude of the tobit and PPML estimates is indeed similar.

where firm-destination-time and product fixed effects are included. Although the dependent variable is dichotomous, we estimate equation (5) by OLS. We prefer the linear probability model to non-linear models such as probit or logit because the former avoids the incidental parameter problem which arises when a large number of fixed effects are included. The coefficient δ measures the differential effect of quality on the propensity of a wine to exit from a given destination during the crisis. In column (5) of Panel C in Table 10, the positive sign on δ indicates that during the crisis, there was more exit for the higher quality wine-destination market pairs.

5.4 Generalization

To demonstrate that the empirical regularities we document for wine exports generalize to other industries, we exploit data on the universe of Argentinean firm-level exports (from Nosis). The dataset reports the name of the exporter, the destination country, the transaction date, the 12-digit HS code, the FOB value (in US dollars) and the mass (in kilograms) of exports. We focus on manufacturing industries (HS codes 16 to 97), and define a product at the 8-digit HS level. For each firm-product-destination triplet we aggregate the data over four-quarter periods from 2006Q4–2007Q3 to 2008Q4–2009Q3, and compute unit values in US dollars per kilogram.[26]

Our full sample between 2006Q4 and 2009Q3 includes 11,073 exporters, 5,809 products, and 157 destination countries (202,967 observations). It is composed of 7,663 firms, 4,514 products, and 153 countries in 2007Q4–2008Q3 (70,623 observations), and of 6,626 firms, 4,294 products, and 147 countries in 2008Q4–2009Q3 (58,803 observations). As quality is unobserved, we follow Bernini and Tomasi (2015) who adapt the Khandelwal (2010) procedure to estimate the quality of exports at the firm-product-destination level. See Appendix C for details. For export values, quantities, and unit values, we then estimate equation (3) and explain changes at the intensive margin. As each product can be exported by more than one firm, we now control for destination-time and firm-product fixed effects. Robust standard errors are adjusted for clustering by destination country.

The results are presented in columns (1) to (3) of Table 11. For export values, quantities, and unit values, the coefficient on the interaction between real GDP per capita growth and quality is positive and significant (quality on its own is positive for export values and quantities only). The income elasticity of exports therefore rises with quality, and the fall in mean income growth during the crisis (from 3.6 to -2.0 percent in our sample) was more damaging to the values, quantities, and prices of higher quality exports. Notice that the level of disaggregation of our data (at the HS level) prevents us from identifying the effect of the crisis on variable markups.

For export values and quantities, we also estimate equation (3) using unit values as a proxy for quality. To ensure that the results remain comparable to the ones we report in columns (1) and (2) where quality varies at the firm-product-destination level, we rely on the (log) mean unit value of each product exported by each firm to each destination over time.[27] In columns (4) and (5), income

[26] We identify the exporter as the first probable exporter reported by Nosis. We drop the observations for which the unit value exceeds 100 times the median unit value per firm-product-time, or falls below the median divided by 100.

[27] By construction, as unit values rise and fall with export values and quantities, respectively, we average the unit values of each product exported by each firm to each destination country over time. Note that our results remain similar if we instead use the (log) mean unit value of each product exported by each firm across destinations and over time.

growth interacted with quality is positive and significant. In contrast to columns (1) and (2), quality on its own is insignificant.

Table 11: Generalization

	(1)	(2)	(3)	(4)	(5)
	Export values	Export quantities	Unit values	Export values	Export quantities
quality	0.109^{a} (0.015)	0.112^{a} (0.015)	-0.003 (0.007)	0.003 (0.027)	-0.031 (0.026)
$\Delta \ln GDP/cap \times quality$	0.451^{a} (0.170)	0.319^{c} (0.188)	0.132^{b} (0.064)	0.332^{c} (0.193)	0.422^{b} (0.184)
R-squared	0.258	0.255	0.254	0.256	0.254
Quality	Estimated	Estimated	Estimated	Unit values	Unit values
Observations	41,056	41,056	41,056	44,711	44,711

Notes: Destination-time and firm-product fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. Quality is estimated using the procedure of Khandelwal (2010) in columns (1) to (3), and is measured using (log) mean unit values (in US dollars per kilogram) in columns (4) and (5).

To conclude, this section provides evidence that Argentinean manufacturing exports experienced a flight from quality during the crisis. Under the assumption that our results extend beyond Argentina, they imply that the exports of countries producing higher quality goods are likely to collapse more severely during recessions. This prediction applies to richer countries which produce higher quality goods, but also to emerging market economies and in particular to industrializing developing countries which have become more specialized in producing manufacturing products with higher levels of quality.

6 Robustness

Tables D1 to D5 in Appendix D report a number of robustness exercises on the estimation of equation (3) for wine exports. Overall, the patterns we find are supportive of our main conclusions.

One factor that determines the performance of Argentinean wine exports is the degree of competition that each quality segment faces in foreign markets. The latter is likely to have changed during the crisis as the tightening of credit conditions forced many small firms to reduce the range of destinations served, or to exit from exports (Bricongne et al., 2012; Chor and Manova, 2012). Without any data on the supply of non-Argentinean wines by quality level in each destination country, we are, however, unable to measure changes in the intensity of competition by quality segment in each export market, resulting in potential omitted variables bias. We address this concern by letting the coefficient on the interaction between income growth and quality in equation (3) vary across the quality bins listed in Table 1. In columns (1) and (2) of Table D1, for export values and volumes the coefficients on the interaction terms are insignificant for the lower quality levels, but are positive and significant for the higher quality bins.[28] This indicates that, within these bins, higher quality exports were more severely affected by the fall in income during the crisis. For unit values in column (3), the coefficients are insignificant.

[28] Although the coefficients across bins are not significantly different from each other, income growth has a larger effect on the higher quality wines as the effect depends on the coefficient on each interaction term, multiplied by quality.

To ensure that the flight from quality that we document for Argentinean wine exports is not instead a "flight from high price," we separately investigate whether the exports of higher quality and the exports of higher-priced wines contracted more sharply during the crisis.[29] For export values and volumes, we estimate equation (3) and further include as regressors the (log) unit value of each wine exported to each destination in each time period and its interaction with income growth. Consistent with a flight from quality, columns (1) and (2) of Table D2 show that the coefficients on the interaction between quality and income growth are positive and significant. Instead, the coefficients on the interaction between unit values and income growth are insignificant. In other words, the fall in income during the crisis has not differently impacted the export performance of higher versus lower-priced wines. We therefore conclude that, during the crisis, Argentinean wine exports experienced a flight from quality and not a flight from high price. Notice that the positive coefficients on unit values indicate that, on average, higher-priced wines experienced a stronger growth of export values and volumes.

To check the robustness of our results to the measurement of quality, we use in column (1) of Table D3 the Parker ratings. In column (2), we compute a weighted average of the Wine Spectator ratings across vintage years using the share of each wine in the total export volume of all wines with the same name, grape, and type, by destination and time period, as weight. In column (3), we calculate a mean Wine Spectator rating by wine name and type, and assign this rating to all wines with the same name and type. In column (4), we exclude the US from the sample because the Wine Spectator (as well as Parker) is a US-based ranking and may therefore not capture taste preferences for quality in other countries.

As measurement error in the quality scores can create an endogeneity bias (Ashenfelter and Quandt, 1999), in column (5) we use the Parker scores to instrument the Wine Spectator ratings (both interacted with income growth) under the assumption that their measurement errors are uncorrelated. For export values, volumes, and unit values, our results continue to hold. The Kleibergen-Paap F statistic (equal to 71.8, Stock and Yogo, 2005) rejects the null of weak correlation between the instrument and the endogenous regressor, and the first-stage regression shows that the Parker and Wine Spectator ratings, interacted with income growth, are positively correlated (the estimated coefficient is equal to 0.503 and is significant at the one percent level).

We also estimate alternative specifications. First, as the exports of higher quality wines grew the most before the crisis, and experienced the largest falls during the recession, we include in column (1) of Table D4 lagged dependent variables. Second, to make sure that our results are not driven by observations which are economically small, in column (2) we weight the observations by the volume of exports in the previous period (Behrens et al., 2013). Finally, columns (3) to (5) show that our results remain robust to clustering standard errors by destination-time, destination and firm, and destination and product-time, respectively.

Finally, in column (1) of Table D5 we extend the pre-crisis sample up to 2003Q4 (we do not include the year 2002 as Argentina was in a recession). We also vary the length of the crisis episode, and exclude 2008Q4 from the crisis period in column (2), while we include 2009Q4 in column (3). To

[29] Equation (A4) in Appendix A.1 shows that the flight from quality obtains holding prices constant.

control for seasonality, the growth rates are again measured between the same quarters. In column (4), we let wine products vary across vintage years (the sample includes 191 firms exporting 3,810 different wines to 90 countries). The original Wine Spectator ratings can therefore be used, but the highly unbalanced nature of this more disaggregated data reduces our sample size threefold. Finally, in column (5) we include the shipments smaller than 4.5 liters in the sample.

7 Concluding Remarks

Using a unique dataset of Argentinean firm-level destination-specific exports of highly disaggregated wine products combined with experts wine ratings to measure quality, this paper shows that the global financial crisis induced a flight from quality in traded goods. Our paper is the first to provide such evidence by simultaneously analyzing the values, volumes, unit values, and markups of firm-level exports.

As we only observe Argentinean exports, our analysis suffers from a number of limitations. First, we are unable to determine whether consumers substituted, for instance, between French or Italian wines and Argentinean varieties. Second, although we provide evidence that the flight from quality generalizes to Argentinean manufacturing industries other than wine, we cannot confirm whether the empirical regularities documented in this paper extend to other countries. Using different data and alternative methodologies, some studies however reach conclusions which are complementary to ours, suggesting that our findings are likely to generalize beyond Argentina. Such papers include Bems and di Giovanni (2016) who document expenditure switching from imports to domestic goods in Latvia, Berthou and Emlinger (2010) who observe declining import prices in the EU during the crisis, and Esposito and Vicarelli (2011) who show that the income elasticity of Italian imports rises with quality.

A number of macroeconomic implications can, therefore, tentatively be drawn from our results. As they provide evidence that the composition of trade matters for the responsiveness of trade flows to downturns, our findings are helpful to infer how different countries are likely to perform in recessions. First, as higher income countries tend to be more specialized in the production of higher quality goods, our results imply that these countries' exports might suffer more in recessions. Second, our findings have implications for emerging market economies, and in particular for industrializing developing countries such as Brazil, China, or India, among others. While these countries have pursued policies to become more integrated into global trade and global financial markets, and have achieved higher growth rates mostly thanks to exports, deeper integration has also made these countries more exposed to external shocks (Blanchard et al., 2010; Didier et al., 2012; Kose and Prasad, 2010). Our results suggest that these countries' exports may have also become more vulnerable to foreign demand shocks as their composition has shifted from primary commodities to a diversified range of manufacturing products with heterogeneous levels of quality.

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A Theoretical Framework

Our theoretical framework is based on Hallak (2006) who assumes that the demand for quality depends on the intensity of the preference for quality, which increases with income. The model identifies the effect of quality on trade that operates on the demand side, through the relationship between income and quality choice. It departs from the standard CES demand system by introducing non-homothetic preferences such that countries with a higher per capita income consume a larger proportion of higher quality goods. This partial equilibrium setting considers that the supply of quality and income are exogenous. It does not model quality formally, nor does it specify a function for how income affects a consumer's allocation of expenditures between goods with different levels of quality.[30]

While Hallak (2006) derives cross-country differences in quality demand which stem from differences in income, we instead consider that a change in income, by impacting the intensity of the preference for quality, affects a country's relative demand for quality over time. For simplicity, we also consider a single sector (i.e., wine), and preferences are defined over the consumption of two goods only, high (H) and low (L) quality.

A.1 Setup

Demand System Define u_j as the utility of a representative consumer in a given sector (i.e., wine) of country j as:

$$u_j = \left[\left(\theta_{jH}^{\gamma_j} q_{jH} + \theta_{jL}^{\gamma_j} q_{jL}\right)^{\rho}\right]^{\frac{1}{\rho}}, \; 0 < \rho, \gamma_j < 1 \; \forall j, \tag{A1}$$

defined with the CES aggregator over the consumption of two goods H and L, and where q_{jH} and q_{jL} denote the quantities of H and L, θ_{jH} and θ_{jL} are the quality levels of goods H and L (where $\theta_{jH} > \theta_{jL}$), and γ_j captures the intensity of the preference for quality. We assume that γ_j increases with income, and it therefore captures, in a reduced form, the effect of income on the sectoral demand for quality of country j.

Defining $\sigma = 1/(1-\rho) > 1$ as the elasticity of substitution, and p_{jk} as the price of good k faced by the consumer in country j, the expenditure on each good $k = H, L$ is given by:

$$p_{jk} q_{jk} = \left(\frac{p_{jk}}{\theta_{jk}^{\gamma_j}}\right)^{1-\sigma}. \tag{A2}$$

Bilateral Imports We now assume that country j imports two different varieties $k = H, L$ from Argentina. As in Hallak (2006), we use equation (A2) to derive country j's import demand:

$$m_{jk} = \left(\frac{\widetilde{p}_{jk}\tau_{jk}}{\widetilde{\theta}_{jk}^{\gamma_j}}\right)^{1-\sigma}, \tag{A3}$$

where we use $p_{jk} = \widetilde{p}_{jk}\tau_{jk}$, i.e., the import price of good k, p_{jk}, is equal to the export price $\widetilde{p}_{jk}$ times the trade cost factor τ_{jk} between j and Argentina for good k. The quality level of good k exported from Argentina to country j is $\widetilde{\theta}_{jk}$ (with $\widetilde{\theta}_{jH} > \widetilde{\theta}_{jL}$).

[30] For other applications of this model, see Bems and di Giovanni (2016) or the general equilibrium model of Feenstra and Romalis (2014) where quality is endogenous (see, also, Chen and Juvenal, 2016, or Crinò and Epifani, 2012).

Income Shock Bilateral imports m_{jk} depend on γ_j, and change with this parameter according to:

$$\frac{\partial \ln(m_{jk})}{\partial \gamma_j} = (\sigma - 1) \ln \widetilde{\theta}_{jk} > 0. \tag{A4}$$

As a negative income shock lowers the intensity of the preference for quality γ_j, it reduces the imports of both higher and lower quality goods. But as $\widetilde{\theta}_{jH} > \widetilde{\theta}_{jL}$, the income shock is more detrimental to higher quality imports (i.e., they are more income elastic), which results in a flight from quality.[31]

Testable Prediction 1 *By lowering the intensity of the preference for quality γ_j, a negative income shock reduces the imports m_{jk} of both higher and lower quality goods as $\partial \ln(m_{jk}) / \partial \gamma_j = (\sigma - 1) \ln \widetilde{\theta}_{jk} > 0$, but by more for higher quality imports as $\widetilde{\theta}_{jH} > \widetilde{\theta}_{jL}$.*

A.2 Income Per Capita

We now compare two countries, rich (R) and poor (P), both importing two varieties H and L from Argentina. Rewriting the model of the previous section separately for $j = R, P$ (where $\gamma_R > \gamma_P$), the import demand for the high quality good H in both countries changes with γ_j according to:

$$\frac{\partial \ln(m_{jH})}{\partial \gamma_j} = (\sigma - 1) \ln \widetilde{\theta}_{jH} > 0. \tag{A5}$$

As richer countries tend to import higher quality goods than poorer countries, we assume that $\widetilde{\theta}_{RH} > \widetilde{\theta}_{PH}$. This implies that, in response to a negative income shock, the collapse of higher quality imports is more severe in the rich than in the poor country.

Testable Prediction 2 *By lowering the intensity of the preference for quality γ_j, a negative income shock reduces the imports of higher quality goods m_{jH} by more in higher than in lower income countries as $\partial \ln(m_{jH}) / \partial \gamma_j = (\sigma - 1) \ln \widetilde{\theta}_{jH} > 0$ and $\widetilde{\theta}_{RH} > \widetilde{\theta}_{PH}$.*

A.3 Quality Sorting

With quality sorting, higher quality goods ship to more distant destinations (Alchian and Allen, 1964). If we consider two importing countries which are respectively distant from (D) or close to (C) Argentina, and assume that the quality exported to country D is higher than to country C, i.e., $\widetilde{\theta}_{DH} > \widetilde{\theta}_{CH}$, equation (A5) for $j = D, C$ shows that the flight from quality is more severe in more distant destinations.

Testable Prediction 3 *By lowering the intensity of the preference for quality γ_j, a negative income shock reduces the imports of higher quality goods m_{jH} by more in the countries which are more distant from Argentina as $\partial \ln(m_{jH}) / \partial \gamma_j = (\sigma - 1) \ln \widetilde{\theta}_{jH} > 0$ and $\widetilde{\theta}_{DH} > \widetilde{\theta}_{CH}$.*

[31] A negative income shock therefore reduces the import demand of higher relative to lower quality goods. The relative import demand is $m_{jH}/m_{jL} = (\widetilde{p}_{jH}\tau_{jH}/\widetilde{p}_{jL}\tau_{jL})^{1-\sigma} \left(\widetilde{\theta}_{jL}^{\gamma_j}/\widetilde{\theta}_{jH}^{\gamma_j}\right)^{1-\sigma}$, and it varies with γ_j according to $\partial \ln(m_{jH}/m_{jL}) / \partial \gamma_j = (1-\sigma)\left[\ln \widetilde{\theta}_{jL} - \ln \widetilde{\theta}_{jH}\right] > 0$.

B Quality Sorting

As higher quality goods are generally more expensive, the literature explains the quality of trade flows by regressing unit values as a dependent variable. Unit values increase with the GDP per capita of the importing country, reflecting that wealthier countries have a stronger preference for quality (Hallak, 2006; Hummels and Skiba, 2004; Manova and Zhang, 2012a; Martin, 2012). Empirical tests of the Alchian and Allen (1964) conjecture, and therefore of the relevance of per-unit trade costs, demonstrate that export prices increase with bilateral distance (Hummels and Skiba, 2004; Manova and Zhang, 2012a; Martin, 2012).[32] We follow the literature and estimate a reduced-form regression:

$$\ln UV_{ijk,t} = \beta_1 \ln dist_j + \beta_2 \ln GDP/cap_{j,t} + \beta_3 \ln GDP_{j,t} + \beta_4 \ln rem_{j,t} + D_{k,t} + \eta_{ijk,t}, \qquad \text{(B1)}$$

where $UV_{ijk,t}$ is the FOB unit value (in US dollars per liter) of wine k exported by firm i to country j in each quarter t between 2006Q4 and 2009Q3 (the results remain similar if we aggregate the data into three four-quarter periods). We expect the bilateral distance $dist_j$ between Argentina and each destination country, and the real GDP per capita $GDP/cap_{j,t}$ of the importer to be associated with higher prices. Consistent with other papers (Baldwin and Harrigan, 2011; Manova and Zhang, 2012a; Martin, 2012), we also control for the importer's real GDP. As competition is tougher in larger countries, prices should be lower. In addition, as unit values depend on average prices in each export market, we control for the relative remoteness $rem_{j,t}$ of each destination.[33] We include product-time fixed effects $D_{k,t}$, and robust standard errors are adjusted for clustering at the destination level.

Table B1: Quality Sorting

	(1)
$\ln distance$	0.031^{b}
	(0.015)
$\ln GDP/cap$	0.041^{b}
	(0.018)
$\ln GDP$	-0.016^{a}
	(0.005)
$\ln remoteness$	-0.091^{b}
	(0.037)
R-squared	0.777
Observations	37,072

Notes: The dependent variable is the (log) unit value (in US dollars per liter). Product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a} and ^{b} indicate significance at the one and five percent levels.

As shown in Table B1, export unit values increase with bilateral distance, consistent with the premise that transport costs are proportional to weight rather than value. Exporters charge higher prices in richer destinations, and lower prices in larger and more remote markets.

[32] In most trade models, exporters either charge the same price to all destinations (Eaton and Kortum, 2002; Melitz, 2003), or reduce it to more distant countries (Melitz and Ottaviano, 2008). With per-unit trade costs, the price increases with bilateral distance (Hummels and Skiba, 2004; Martin, 2012). In Baldwin and Harrigan (2011), quality sorting arises because only high quality firms, setting higher prices, are able to serve more remote destinations.

[33] Remoteness is $\sum_j (GDP_j/dist_j)^{-1}$ (Baldwin and Harrigan, 2011). The real GDPs (in US dollars) for 2006–2009 are from the Penn World Tables.

C Estimation of Quality

We follow Bernini and Tomasi (2015) who adapt the Khandelwal (2010) procedure to estimate the quality of exports at the firm-product-destination level. Intuitively, the quality of an exported product is the part of its market share in a destination country that is not explained by its price (Berry, 1994; Khandelwal, 2010). We estimate the following equation:

$$\ln s_{ijk,t} - \ln s_{jK,t} = \alpha_1 UV_{ijk,t} + \alpha_2 \ln ns_{ijk,t} + D_{j,t} + D_{ik} + \varepsilon_{ijk,t}, \tag{C1}$$

where $s_{ijk,t}$ is the market share of product k exported by firm i to country j in period t which we normalize by the market share $s_{jK,t}$ of an "outside variety" K, $ns_{ijk,t}$ is the "nest share," $UV_{ijk,t}$ is the export unit value, and $D_{j,t}$ and D_{ik} are destination-time and firm-product fixed effects. Robust standard errors are adjusted for clustering by destination country. We explain below our data and the construction of each variable.

First, we rely on the export value $X_{ijk,t}$ (in US dollars) and quantity $Q_{ijk,t}$ (in kilograms) of each 8-digit HS-level product k exported by firm i to destination j in a four-quarter period t from 2006Q4–2007Q3 to 2008Q4–2009Q3 (from Nosis). The unit value $UV_{ijk,t}$ is in US dollars per kilogram. Second, we use annual frequency data between 2006 and 2009 from the BACI dataset to compute a proxy for the outside variety share $s_{jK,t}$ which we define as the share of non-Argentinean import quantities (in kilograms) in the total import quantities of country j in a 6-digit HS-level product category K (Bernini and Tomasi, 2015).[34] We then match the outside variety share measured at an annual frequency with the quarterly data from Nosis by year to compute a proxy for the market share $s_{ijk,t}$:

$$s_{ijk,t} = \frac{Q_{ijk,t}}{\sum_i Q_{ijK,t} / (1 - s_{jK,t})}, \tag{C2}$$

and for the nest share $ns_{ijk,t}$:

$$ns_{ijk,t} = \frac{Q_{ijk,t}}{\sum_i Q_{ijk,t} / (1 - s_{jK,t})}, \tag{C3}$$

where $Q_{ijk,t}$ and $Q_{ijK,t}$ are defined at the 8-digit and 6-digit HS levels, and $\sum_i Q_{ijk,t}$ and $\sum_i Q_{ijK,t}$ are their sums across firms (the denominators of C2 and C3 are proxies for each HS-level market size).

To deal with the endogeneity of unit values and of the nest shares in equation (C1), we use the same instruments as Bernini and Tomasi (2015) which we construct using the data from Nosis. We instrument unit values by the mean unit value of each 8-digit HS-level product by destination-time, and the nest shares by the number of different 8-digit HS-level products by firm-destination-time. The quality of each product k exported by firm i to country j in period t is then obtained as:

$$quality_{ijk,t} = \widehat{D}_{j,t} + \widehat{D}_{ik} + \widehat{\varepsilon}_{ijk,t} = [\ln s_{ijk,t} - \ln s_{jK,t}] - [\widehat{\alpha}_1 UV_{ijk,t} + \widehat{\alpha}_2 \ln ns_{ijk,t}]. \tag{C4}$$

This procedure allows us to estimate the quality of each 8-digit HS-level product exported by each firm to each destination country from 2006Q4–2007Q3 to 2008Q4–2009Q3 which we use in Section 5.4. See Bernini and Tomasi (2015) for more details.

[34] The BACI dataset reconciles the declarations of importers and exporters reported in UN Comtrade (Gaulier and Zignago, 2010). The exports data are disaggregated at the 6-digit HS level.

D Robustness

Table D1: Foreign Competition

	(1)	(2)	(3)
	Export values	Export volumes	Unit values
$\Delta \ln GDP/cap \times quality \times Great$	0.494^{b} (0.206)	0.483^{b} (0.199)	0.011 (0.038)
$\Delta \ln GDP/cap \times quality \times Outstanding$	0.477^{b} (0.232)	0.435^{c} (0.224)	0.042 (0.040)
$\Delta \ln GDP/cap \times quality \times Very\ good$	0.458^{c} (0.248)	0.418^{c} (0.237)	0.040 (0.041)
$\Delta \ln GDP/cap \times quality \times Good$	0.483^{c} (0.260)	0.447^{c} (0.249)	0.036 (0.043)
$\Delta \ln GDP/cap \times quality \times Mediocre$	0.457^{c} (0.274)	0.419 (0.263)	0.038 (0.045)
$\Delta \ln GDP/cap \times quality \times Not\ recommended$	0.444 (0.290)	0.403 (0.278)	0.042 (0.051)
R-squared	0.593	0.585	0.588
Observations	6,807	6,807	6,807

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{b} and ^{c} indicate significance at the five and ten percent levels. The variables "Great," "Outstanding," "Very good," "Good," "Mediocre," and "Not recommended" are dummy variables for each of the Wine Spectator quality bins listed in Table 1.

Table D2: Flight from High Price

	(1)	(2)
	Export values	Export volumes
$\Delta \ln GDP/cap \times quality$	0.335^{a} (0.115)	0.281^{b} (0.117)
$\Delta \ln GDP/cap \times \ln unit\ value$	-1.187 (1.215)	-0.449 (1.033)
$\ln unit\ value$	0.801^{a} (0.140)	0.304^{a} (0.104)
R-squared	0.606	0.587
Observations	6,807	6,807

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a} and ^{b} indicate significance at the one and five percent levels.

Table D3: Robustness on Quality

	(1)	(2)	(3)	(4)	(5)
Panel A: Export values					
quality	–	-0.010^{a} (0.002)	–	–	–
$\Delta \ln GDP/cap \times quality$	0.649^{b} (0.267)	0.073^{b} (0.036)	0.438^{a} (0.133)	0.364^{a} (0.117)	1.199^{b} (0.517)
R-squared	0.626	0.601	0.599	0.582	0.620
Panel B: Export volumes					
quality	–	-0.010^{a} (0.002)	–	–	–
$\Delta \ln GDP/cap \times quality$	0.553^{b} (0.271)	0.065^{c} (0.036)	0.360^{a} (0.134)	0.296^{b} (0.115)	1.009^{c} (0.530)
R-squared	0.613	0.592	0.591	0.570	0.605
Panel C: Unit values					
quality	–	-0.001 (0.001)	–	–	–
$\Delta \ln GDP/cap \times quality$	0.096^{c} (0.049)	0.009 (0.008)	0.077^{c} (0.041)	0.068^{b} (0.031)	0.190^{b} (0.093)
R-squared	0.648	0.566	0.607	0.584	0.644
Quality	Parker	Weighted WS	Mean WS	WS	WS
Sample	Full	Full	Full	Excl. US	Full
Estimator	OLS	OLS	OLS	OLS	IV
Observations	4,347	5,078	7,310	6,057	4,013

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. "WS" indicates the Wine Spectator quality ratings.

Table D4: Robustness on Specifications

	(1)	(2)	(3)	(4)	(5)
Panel A: Export values					
Lagged dep. var.	-0.339^{a} (0.026)	–	–	–	–
$\Delta \ln GDP/cap \times quality$	0.435^{b} (0.180)	0.369^{a} (0.103)	0.358^{a} (0.125)	0.358^{a} (0.108)	0.358^{a} (0.099)
R-squared	0.627	0.576	0.593	0.593	0.593
Panel B: Export volumes					
Lagged dep. var.	-0.370^{a} (0.028)	–	–	–	–
$\Delta \ln GDP/cap \times quality$	0.385^{b} (0.181)	0.317^{a} (0.099)	0.290^{b} (0.115)	0.290^{b} (0.115)	0.290^{a} (0.097)
R-squared	0.638	0.573	0.585	0.585	0.585
Panel C: Unit values					
Lagged dep. var.	-0.272^{a} (0.037)	–	–	–	–
$\Delta \ln GDP/cap \times quality$	0.041 (0.036)	0.053^{c} (0.028)	0.069^{b} (0.034)	0.069^{a} (0.019)	0.069^{b} (0.031)
R-squared	0.582	0.532	0.588	0.588	0.588
Weighted	No	Yes	No	No	No
Clustering	Dest.	Dest.	Dest.-time	Dest., firm	Dest., wine-time
Observations	4,638	6,807	6,807	6,807	6,807

Notes: Firm-destination-time and product-time fixed effects are included. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels. Weighted regression in (2) where the weights are the lagged volumes of exports (in liters).

Table D5: Other Robustness Checks

	(1)	(2)	(3)	(4)	(5)
Panel A: Export values					
$\Delta \ln GDP/cap \times quality$	0.255^{a} (0.093)	0.802^{a} (0.260)	0.391^{c} (0.209)	0.933^{b} (0.441)	0.541^{a} (0.187)
R-squared	0.598	0.563	0.570	0.597	0.662
Panel B: Export volumes					
$\Delta \ln GDP/cap \times quality$	0.173^{b} (0.087)	0.626^{a} (0.211)	0.320 (0.204)	0.828^{c} (0.457)	0.415^{b} (0.186)
R-squared	0.586	0.563	0.570	0.629	0.657
Panel C: Unit values					
$\Delta \ln GDP/cap \times quality$	0.082^{a} (0.021)	0.175^{b} (0.084)	0.070 (0.052)	0.105 (0.093)	0.126^{a} (0.045)
R-squared	0.576	0.547	0.545	0.572	0.632
Sample	From 2003	Crisis 09Q13	Crisis 09Q14	Vintage	Small volumes
Observations	15,895	5,087	6,212	2,323	7,362

Notes: Firm-destination-time and product-time fixed effects are included. Robust standard errors adjusted for clustering by destination between parentheses. ^{a}, ^{b}, and ^{c} indicate significance at the one, five, and ten percent levels.