Financial Constraints and Firm Export Quality: Evidence from France

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Abstract

Do financial constraints hinder the quality of firms' export? The empirical results presented in this paper point to a positive answer to this question. By using French data on firm-level export flows we find that financially healthier exporters sell more expensive varieties on foreign markets and enjoy larger positive revenue elasticity to export prices then more leveraged and illiquid ones. We supplement the analysis on export prices by obtaining an estimator of firms' export quality derived from a discrete choice model of consumer demand (Berry, 1994). This estimator correlates negatively with measures of financial constraints when we analyze French exporters of perfumes and toilet waters. We show that these results are consistent with a simple model of endogenous quality choice in which illiquid and highly leveraged firms face higher cost of credit.

1 Introduction

Recent empirical and theoretical work suggests that product quality is an important determinant of firms' export performances (see for instance Iacovone and Javorcik, 2012; Verhoogen, 2012). Output quality appears to be relevant both to exporters based in developing and in developed countries; while the former need to adapt their products to consumers' tastes in higher-income markets, the latter strive to escape price competition from low-wage economies. Over the last decades, countries have differed in their ability to provide adequate incentives to orient their firms towards higher quality products. For instance, the efforts made by French exporters to increase quality have been considered insufficient to defend their market shares from German competitors (Martin and Mejean, 2011).

In this paper, we look at the impact of financial constraints on the quality of exported goods. Our investigation stems from the hypothesis that financial constraints may prevent some firms from undertaking the necessary investments, such as sourcing of better inputs, innovating or advertising, to improve the actual or the perceived quality of their products. We propose two empirical exercises conducted on a database detailing export flows and financial variables at the firm-level. These exercises are based on alternative strategies to proxy for unobservable export quality. First, we test how price elasticity of export revenue varies across groups of exporters with different financial health. If prices are positively correlated with product quality, demand is expected to be more inelastic to prices for high-quality varieties than for low-quality ones; this allows to infer quality differences across firms with heterogeneous financial conditions by comparing their price elasticity of revenue. Second, we proxy export quality as the market share of individual exporters that is not explained by price variations. Once we obtain this estimator for the quality of exported perfume and toilet waters, we regress it on firms' financial characteristics.

Our paper bridges two recent and expanding strands in the trade literature. The first takes the move from the empirical finding that firms' expansion in foreign markets is often associated with higher export prices (e.g. Kneller and Yu, 2008; Bastos and Silva, 2010; Baldwin and Harrigan, 2011; Manova and Zhang, 2012). Since the positive correlation between prices and performances occurs in industries with greater scope for vertical diversification, this evidence has been interpreted in support of 'quality sorting', whereby foreign market penetration depends on firms' ability to produce higher quality products rather than cheaper ones. On the theoretical ground, these facts have been rationalized by a new generation of models incorporating quality among the dimensions of firm heterogeneity (Kneller and Yu, 2008; Baldwin and Harrigan, 2011; Bernard, Redding, and Schott, 2011). The second strand of literature has produced solid evidence that financial constraints affect firms' behavior in foreign markets. This result has been mainly explained by arguing that international activities entail fixed entry costs, or that exporters face longer lags between shipments of goods and payments from foreign customers, so that they need to finance externally a larger share of their working capital (e.g. Greenaway, Guariglia, and Kneller, 2007; Bellone, Musso, Nesta, and Schiavo, 2010; Minetti and Zhu, 2011).

This paper contributes to the literature by finding supportive evidence that quality helps sustaining export revenue and that financial constraints may cripple firms' ability to compete through quality on foreign markets. We also show that the relationship between financial health and firms' quality can be rationalized by a simple model where investment in quality is relatively more expensive for firms with greater need for external finance and higher risk of default.

The rest of the paper is structured as follows: section 2 describes the dataset, section 3 investigates differences in the revenue elasticity to prices across firms with different financial health, section 4 derives an estimator of quality for exporters of perfumes and toilet waters and investigates its relationship with firms' financial attributes, section 5 presents a simple model of exporters' endogeneous quality choice in the presence of financial constraints, and section 6 concludes.

2 Data

We work on a dataset assembled by merging French Custom data on trade flows with balance sheet data from the FICUS[1] database provided by the French National Statistical Office (INSEE). The Custom database reports export values (euros), quantities (kilograms), and product classes (NC8) relative to the export flows of all French firms (both manufacturers and retailers) engaged in international trade. One limitation of this dataset is that transactions within the Euro area are not recorded if their value is smaller than €1,000. In the empirical section we control for the bias introduced by this threshold by comparing firms exporting to the same destination. Because some product categories are recorded under different NC8 in different years, we use tables provided by Eurostat to concord NC8 product classes over time to the 2007 codification. Although FICUS covers the whole population of French firms, our study is limited to the subset of French exporters. A unique firm identifier (SIREN number) allows to associate each exporter in the Custom database with its balance sheet data from FICUS, and to track the evolution of firms' export and financial condition over time. The final result is a panel dataset with time span 1997-2007, where the panel unit can be set at the firm-product-destination level.

Within each NC8 product class and destination, we identify as a 'variety' the export of a single firm, and we refer to 'quality' as the set of material and immaterial attributes that increase consumers' utility from consuming an additional unit of a particular variety when all varieties are consumed in the same quantity. Because our definition of quality hinges on consumers' utility, we decide to keep only NC8 product categories that are classified 'for household consumption' according to the UN Classification by Broad Economic Categories (BEC).

We clean the dataset by trimming export flows whose unit-values are respectively above or below the 99.5 and the 0.5 percentile within each NC8 product class[2]. In addition, by exploiting the panel dimension of the dataset we eliminate export flows with extreme variations in unit-value over two consecutive years[3]. Lastly, we apply the same cleaning procedure to eliminate outliers in terms of the balance sheet variables from the FICUS dataset. The cleaned dataset includes 6,843,121 observations where rows refer to single export flows. Table 9 in appendix 1 provides additional information by reporting the number of unique firms, their

[1]Fichier complet unifié de Système Unifié de Statistique d'Entreprises.

[2]Unit-values are obtained by dividing flows' values by quantities.

[3]We trim variations that are above or below the 0.5 extreme percentiles.

average number of export flows and destinations by year, the mean values of firms' age, number of employees, and financial attributes.

3 Financial constraints and price elasticity of export revenue

Our first empirical exercise follows closely the methodology of Manova and Zhang (2012). These authors examine the relationship between export prices and revenue across Chinese firms exporting the same product category to the same destination; they interpret the positive correlation between these variables as evidence of quality differentiation. Indeed, if price differences across exporters reflect only heterogeneity in productivity, we would expect firms selling more expensive varieties to realize lower revenue, as consumers substitute away from more expensive toward cheaper varieties when these differ only for horizontal attributes[4]. Instead, a positive correlation between prices and revenue hints at the existence of vertical differentiation among substitutable goods. If prices are positively correlated with quality, and quality is valued by foreign consumers, more expensive varieties might be in greater demand than their cheaper and lower-quality alternatives.

In other words, the sign and the intensity of the correlation between export revenue and price is informative of whether price variations across exporters are related to heterogeneity in quality rather than in productivity. This intuition can be easily transposed to test if firms' financial health matters for the quality of their output. If we observe systematic variations in price elasticity of revenue across firms with different financial health, then we can infer that financial constraints matter for firms' capacity to export better quality output. This hypothesis can be tested by estimating the following multiplicative interaction model:

$$log(rev_{jpdt}) = \alpha + \beta_0 log(UV_{jpdt}) + \beta_1 FC_{jt} + \beta_2 log(UV_{jpdt}) \times FC_{jt} + D_{pdt} + \epsilon_{jdpt} \qquad (1)$$

where j, p, d, t index respectively exporting firms, NC8 product categories, export destinations, and time; rev_{jpdt} is the value of the export flow, FC_{jt} is a firm-level measure of financial constraints, and UV_{jpdt} is the unit value that proxies for export prices. D_{pdt} is a full set of dummies controlling for product-destination-year fixed-effects. The inclusion of these dummies implies that the identification of the coefficients relies exclusively on variations across firms selling the same NC8 product to the same market. By estimating the previous equation we are primarily interested in the t-test of the null hypothesis $H_0 : \beta_1 = 0$. If the test rejects the null, then we find evidence that financial constraints affect the relationship between export prices and revenue.

[4]Horizontal differentiation refers to the set of attributes that change across varieties without making one variety relatively more desirable than the others if these are all consumed in the same quantity.

In bringing this model to the data we substitute FC_{jt} with three measures of financial constraints. Firms' leverage (Lev_{jt}), is widely used in the literature, as high levels of leverage signal deterioration of firms' financial health; highly leveraged firms have been found to be more affected by financial constraints when they invest, and to be exposed to greater risk of failure (Whited, 1992; Bridges and Guariglia, 2008). Because our data do not include the maturity structure of firms' debt, we construct Lev_{jt} as the ratio of firms' total debt over total assets[5]. The coverage ratio $cover_{jt}$ is obtained as the ratio of firms' pre-tax profits over interest rates payments, and it measures firms' availability of internal funds to finance investment and current operations (Guariglia, 2008). Lastly, we use a composite index $M\&Sscore_{jt}$ that measures the financial health of individual firms relative to the other firms operating in the same industry in each given year. This index is constructed as the sum of firms' ranking over five dimensions, according to the methodology developed in Musso and Schiavo (2008). The dimensions we select correspond to firms' attributes most often associated with access to credit (age, tangible assets, leverage), and liquidity (cash flow and coverage)[6].

Because unit values are constructed on revenue, every measurement error in this variable affects both sides of equation (1), hence biasing the estimates of β_0 and β_1. We address this concern by using first lags of all covariates on the right-hand side. In addition, we both estimate the model by pooled OLS (controlling for product-destination-year fixed-effects), and by within-group FE[7]. While product-destination-year fixed-effects control for differences in market structure and demand across countries, within-group transformations control for firm-level time-invariant factors that might correlate both with revenue and prices. Other controls include the log of firms' age ($lage$), a dummy variable for belonging to a business group ($group$), a dummy for foreign ownership ($foreign$), the log of total assets ($lasset$), and the log of firms' physical productivity of labor ($lprod$).

The first two columns of table 1 report the estimates obtained by excluding from the right-hand side of equation (1) the financial constraint variable and the interaction term. This is equivalent to restricting the coefficient of $log(UV_{jpdt})$ to be the same for firms with different financial health. Consistently with the results of Manova and Zhang (2012), we find that estimates obtained exploiting cross-sectional heterogeneity across firms reveal a positive correlation between prices and export revenue. However, our point estimate of the revenue elasticity to price is twice as big as the one found by these authors for Chinese exporters (0.174 vs. 0.081), and this suggests that quality is more important for the performance of French

[5]Since total assets are given by the sum of debt and equities by construction $0 \leq Lev_{jd} \leq 1$.

[6]For simplicity we normalize the index on a scale from 0 to 10 where the highest value is associated with firms ranking in the highest quintile for age, tangible assets, cash flow and coverage and in the lowest one for leverage.

[7]The panel unit is set at the firm-product-destination level.

exporters than it is for Chinese ones. The estimated coefficient on $log(UV_{jpdt})$ changes sign when this model is regressed controlling for firm-level fixed-effects (column 2). This should be expected because in pooled OLS we use varieties' prices as a proxy for their unobservable quality. In other words, we are aware that the positive coefficient on $log(UV_{jpdt})$ is driven by the omission of quality as a relevant factor determining different performances across firms. In FE panel regressions the coefficient on $log(UV_{jpdt})$ turns negative suggesting that the quality differences across firms driving the positive sign of OLS coefficients are mostly explained by firm-level attributes that are stable over time.

The remaining columns of table 1 report estimates obtained including among the covariates each of the three financial variables and their interactions with log prices. The coefficients on the interaction terms are significant and consistent in both pooled OLS and within-group FE[8]. The sign of the coefficients obtained in pooled OLS models suggests that more financially constrained firms enjoy smaller positive correlation between prices and revenue. This implies that demand is more elastic to prices when firms are more financially constrained, and we can infer that quality is less relevant in explaining high prices when we look at more financially constrained exporters. In contrast, in FE estimates an increase in price from one period to the other is associated with smaller reduction in revenues for firms with better financial health. Figure 1 plots the elasticity of revenue to price for different levels of lev and $M\&Sscore$. For firms with leverage below 0.3 the elasticity is greater than -3% while for firms with leverage above 0.3 it is below -5%. We see instead that for firms ranking high in the $M\&Sscore$ revenue elasticity to price is not significantly different from zero, while for those with low scores it is significantly negative.

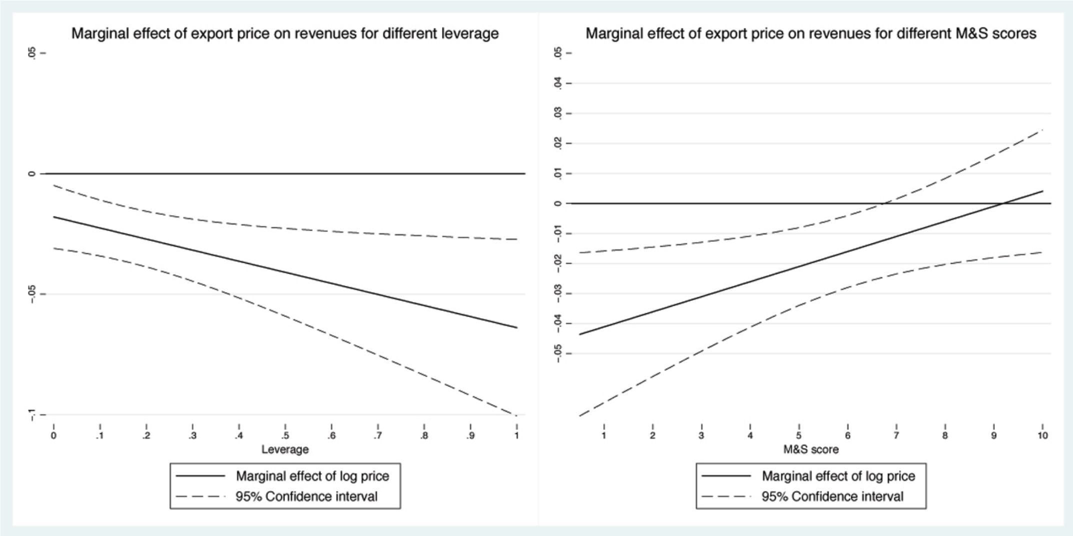
[8]With the exception of *cover* when the model is estimated by FE.

Table 1: Price elasticity of revenues and financial health

Financial var.:			lev		cover		M&Sscore	
Estimator:	OLS	FE	OLS	FE	OLS	FE	OLS	FE
$log(UV_{t-1})$	0.174***	-0.010*	0.185***	-0.018***	0.151***	-0.015**	0.077***	-0.046***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)
$lage_{t-1}$	-0.096***	-0.003	-0.101***	-0.049***	-0.097***	0.003	-0.140***	-0.030***
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
$lassets_{t-1}$	0.090***	0.097***	0.084***	0.052***	0.090***	0.104***	0.089***	0.115***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
$group_{t-1}$	0.025	0.018	-0.018	-0.038**	0.000	0.029	-0.026	0.033
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
$foreign_{t-1}$	0.265***	0.038	0.177***	0.030	0.235***	0.032	0.196***	0.013
	(0.06)	(0.03)	(0.06)	(0.03)	(0.06)	(0.03)	(0.06)	(0.03)
$manuf_{t-1}$	0.391***	-0.026	0.384***	-0.009	0.386***	-0.052	0.383***	-0.058
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
$lprod_{t-1}$	0.171***	0.028***	0.159***	0.028***	0.151***	0.021***	0.142***	0.018***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
lev_{t-1}			0.056	-0.077				
			(0.12)	(0.06)				
$cover_{t-1}$					-0.000	0.001***		
					(0.00)	(0.00)		
$M\&Sscore_{t-1}$							0.008	0.033***
							(0.01)	(0.01)
$(luv \times lev)_{t-1}$			-0.076**	-0.046**				
			(0.03)	(0.02)				
$(luv \times cover)_{t-1}$					0.001***	0.000		
					(0.00)	(0.00)		
$(luv \times M\&Sscore)_{t-1}$							0.012***	0.005**
							(0.00)	(0.00)
Fixed-effects:								
NC8-destination-year	yes	no	yes	no	yes	no	yes	no
NC8-destination-firm	no	yes	no	yes	no	yes	no	yes
year	no	yes	no	yes	no	yes	no	yes
R^2	0.41	0.00	0.40	0.00	0.41	0.00	0.41	0.01
Obs.	1.4e+06	1.4e+06	1.3e+06	1.3e+06	1.2e+06	1.2e+06	1.1e+06	1.1e+06

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. The dependent variable is $log(rev_{jpdt})$, that is the log of the value of each export flow. Cluster robust standard errors are reported in parentheses (clustering unit: firm). FE models apply within-group transformations to the variables where the panel unit is set at the firm-product-destination level. Coefficients on the the dummy $manuf$ are identified in FE models because the sample includes a small group of firms changing industry over time.

Figure 1: Marginal effects plots



Notes. Plots are constructed from the coefficients obtained estimating by FE models on log(revenue).

Table 2: Export prices and financial health

Financial var.:	lev		cover		score	
Estimator:	OLS	FE	OLS	FE	OLS	FE
$lage_{t-1}$	-0.005	-0.007	-0.007	-0.008	-0.034***	-0.011**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
$lasset_{t-1}$	0.021***	0.017***	0.018***	0.020***	0.019***	0.022***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$group_{t-1}$	0.074***	-0.006	0.080***	-0.006	0.073***	-0.008
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
$foreign_{t-1}$	0.056**	-0.003	0.077**	-0.002	0.056**	0.001
	(0.03)	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)
$manuf_{t-1}$	-0.005	0.042**	-0.013	0.034	-0.016	0.034
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$lprod_{t-1}$	-0.153***	-0.023***	-0.156***	-0.024***	-0.161***	-0.025***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
lev_{t-1}	-0.079**	-0.041**				
	(0.04)	(0.02)				
$cover_{t-1}$			0.001***	0.000**		
			(0.00)	(0.00)		
$M\&Sscore_{t-1}$					0.027***	0.003
					(0.00)	(0.00)
Fixed-effects:						
NC8-destination-year	yes	no	yes	no	yes	no
NC8-destination-firm	no	yes	no	yes	no	yes
year	no	yes	no	yes	no	yes
R^2	0.86	0.02	0.86	0.01	0.86	0.01
obs.	1.3e+06	1.3e+06	1.2e+06	1.2e+06	1.1e+06	1.1e+06

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. The dependent variable is $log(UV_{jpdt})$. Cluster robust standard errors in parentheses (clustering unit: firm).

An alternative approach to test if financial constraints matter for export quality consists in regressing FC_{jt} on export prices $log(UV_{jpdt})$ while controlling for firms' productivity $lprod_{jt}$. Results from this exercise can be found in table 2. Consistently with the idea that price differences reflect productivity differences across firms exporting within narrowly defined product categories, we find both in OLS and FE estimates that $lprod_{jt}$ is negatively correlated with the dependent variable $log(UV_{jpdt})$. However, the detrimental impact of financial constraints on quality is supported by the fact that more leveraged, less liquid and firms with smaller $M\&Sscore$ are found setting lower prices relatively to other exporters targeting the same markets.

Our results are in line with the findings of two recent papers supporting the hypothesis that financial constraints hamper the quality of Chinese exports (Manova, Wei, and Zhang, 2011; Fan, Lai, and Li, 2012). These studies find that less financially constrained firms set relatively higher prices in industries with greater reliance on external credit. On the contrary, Secchi, Tamagni, and Tomasi (2011) find that financial constraints correlates positively with the prices of Italian exporters, and they interpret this result according to the efficiency sorting story: "more financially constrained firms set higher prices because they operate at lower efficiency [or they] raise prices in the attempt to offset the negative impact on revenues due to reduced export activity, at least partially exploiting demand rigidities" (p.19).

In the next section we try to overcome the limitations of proxing quality with unit values by adopting an estimator based on the 'revealed' preferences of foreign consumers. Such estimator has the advantage of disentangling the effect of quality and prices on demand, so that we can test more rigorously whether financial constraints reduce exporters' intensive margins by hampering their ability to upgrade the quality of their products. Divergent results obtained in different studies may be also attributed to differences in the export portfolio of the countries they analyze. To rule out that the 'portfolio-composition' effect we will restrict our attention to firms exporting a unique HS6 product category (perfumes and toilet waters) that has a relevant role in French export and significant scope for quality heterogeneity.

4 Financial constraints and the quality of French perfume

4.1 The discrete choice-model of demand

In this section we obtain a proxy for the quality of French exports as the residual from the estimation of a discrete choice model of foreign consumers' demand (Berry, 1994). This theoretical framework is brought to trade data following the empirical strategy of Khandelwal (2010), but instead of estimating the average quality of French products *vis-a-vis* foreign competitors we aim at capturing quality heterogeneity among French exporters, within and across export markets[9]. The discrete choice model described in Berry (1994) assumes that in each period individual consumers choose one among different varieties of substitutable goods available in the market. The variety j chosen by consumer i is simply the one that delivers the greatest utility u_{ij}, such that:

$$u_{ij} > u_{ik} \quad \forall \quad k \in K$$

where K is the set of available varieties. To allow for closer substitutability within subgroups of varieties in K, the utility that consumer i derives from consuming each variety j assumes the nested logit specification (Mcfadden, 1974):

$$u_{ij} = \delta_j + \zeta_{ig} + (1-\sigma)\epsilon_{ij} \quad , \quad 0 \leq \sigma < 1 \tag{2}$$

$$\delta_j = X_j'\beta - \alpha p_j + \zeta_j$$

where δ_j is the expected utility from the consumption of j that depends on a vector of product attributes X_j, on a vector of parameters β that express consumers' average appreciation for each attribute in X_j, on price p_j and on product quality ζ_j. ζ_{ig} is the component of consumer's i utility that is common to all goods belonging to product group g. Finally, ϵ_{ij} is consumer's i individual deviation from the expected utility deriving from the consumption of product j belonging to group g. The within-nest substitutability parameter σ determines the extent to which different consumers agree on the utility deriving from choosing j. If $\sigma = 1$ the correlation of consumers' utilities from consuming each j within group g is equal to one[10]. Hence, we expect more differentiated products to be characterized by smaller values of σ. The probability P_j that a consumer chooses product j among all products in K can be written as:

$$P_j = P_{j/g} \times P_g$$

where P_g is the probability that her choice falls on one of the products in group g:

$$P_g = \frac{[\sum_{k\in g} e^{\delta_k/(1-\sigma)}]^{(1-\sigma)}}{\sum_g [(\sum_{k\in g} e^{\delta_k/(1-\sigma)}]^{(1-\sigma)}} \tag{3}$$

and $P_{j/g}$ is the probability of choosing j conditional on the choice of group g:

$$P_{j/g} = \frac{e^{\delta_j/(1-\sigma)}}{\sum_{k\in g} e^{\delta_k/(1-\sigma)}} \tag{4}$$

[9] A similar application of the discrete choice model to trade data can be found in Gervais (2013).

[10] This implies that all individuals share the same evaluation for the products in product group g (i.e. having the same ζ_{ig}), and they all choose the same product within group g, because there is no consumer-specific deviation in the evaluation of each product.

multiplying the right-hand sides of (3) and (4) we obtain:

$$P_j = \frac{e^{\delta_j/(1-\sigma)}}{[\sum_{k\in g} e^{\delta_k/(1-\sigma)}]^{\sigma} \times \sum_g [\sum_{k\in g} e^{\delta_k/(1-\sigma)}]^{(1-\sigma)}} \tag{5}$$

the expression for P_j can be simplified if we normalize the probability of choosing each j with the probability of choosing an outside variety delivering expected utility $\delta_o = 0$[11]. The probability of choosing the outside variety (hence not choosing any of the inside varieties) is:

$$P_o = \frac{1}{\sum_g [\sum_{k\in g} e^{\delta_k/(1-\sigma)}]^{(1-\sigma)}} \tag{6}$$

taking the log difference of P_j and P_o we obtain:

$$ln(P_j) - ln(P_o) = \frac{\delta_j}{1-\sigma} - \sigma ln(\sum_{k\in g} e^{\delta_k/(1-\sigma)}) \tag{7}$$

using (3) and (6) then $ln(\sum_{k\in g} e^{\delta_k/(1-\sigma)}) = [ln(P_g) - ln(P_o)]/(1-\sigma)$ and substituting in (6) we obtain:

$$ln(P_j) - ln(P_o) = X_j'\beta - \alpha p_j + \sigma(P_{j/g}) + \zeta_j \tag{8}$$

Equation (8) can be estimated using observed market shares as empirical counterparts of probabilities. By applying this theoretical framework to the problem of estimating the parameters of the demand equation of French exported goods we can proxy P_j as the share s_{jpd} of the French exporter j over the total import of market d in a given HS6 product category p:

$$P_j \equiv s_{jpd} = \frac{q_{jpd}}{\sum_{k\in K} q_{kpd}} \tag{9}$$

where q_{jpd} is the physical quantity of export of one French firm j to market d in product category p, and the denominator is the sum of the physical quantities exported in d by the set K of exporters from all origin countries. The probability $P_{j/g}$ is proxied by the nest-share $s_{jpd|F}$, namely the share of the French exporter j over the total import of market m from France in the same HS6 product category:

$$P_j \equiv s_{jpd|F} = \frac{q_{jpd}}{\sum_{k\in F} q_{kpd}} \tag{10}$$

where F is the set of French exporters selling in d the HS6 product p. Hence, by modeling the nest share as the share of an individual exporter over total French exports we assume

[11] The outside variety is a variety for which we do not identify the mean utility. Instead we normalize it to 0 and express the mean utility of all other varieties in relation to the outside variety (Nevo, 2000). In practice we assume that the market share of the outside variety is the total market share minus the share of the inside varieties.

that foreign consumers consider French products as a unique group and each of them assign a value ζ_{iF} to the consumption of a good imported from France[12].

We proxy for the probability of consuming an outside variety P_o with the import share s_o of destination d in product p that does not originate from France:

$$P_o \equiv s_o = \frac{\sum_{k \notin F} q_{kpd}}{\sum_k q_{kpd}} \tag{11}$$

Therefore, the empirical equivalent of (8) becomes:

$$ln(s_{jpd}) - ln(s_{opd}) = -\alpha UV_{jpd} + \sigma ln(s_{jpd|F}) + \epsilon_{jpd} \tag{12}$$

with

$$\epsilon_{jpd} = [\bar{\zeta}_{gpd} + \zeta_{jpd} + X'_{jp}\beta] \tag{13}$$

the error term ϵ_{jpd} captures the market share of exporter j in d that is not explained by prices. It includes the term $\bar{\zeta}_{gpd}$ that expresses the extent to which consumers in d prefer French products over those imported from other countries, the term ζ_{jpd} that is the 'vertical component' of product quality and refers to aspects such as branding, advertisement and quality of materials. Lastly, $X'_{jp}\beta$ represents the extent to which the product fits consumers' tastes on a variety of 'horizontal attributes' (e.g. color, pattern, etc...). Because, we do not observe these attributes we cannot identify the βs[13] . Therefore, the residual term in (13) is a broad measure of quality that encompasses both vertical and horizontal aspects. Indeed, this estimator reflects both the capacity of the firm to improve its products by adopting better materials and more sophisticated production techniques, but also its capacity to meet consumers' preferences by researching tastes in export markets.

Because quality as captured by $\hat{\epsilon}_{jpd}$ involves higher marginal costs for the firm, it should be expected to correlate positively with export unit values UV_{jpd}, and with the nest share $s_{jpd|F}$. Therefore, OLS estimates of α and σ are generally upward biased , and it is necessary to instrument for these endogenous covariates to obtain consistent parameters of the demand curve and consistent residuals (Nevo, 2000).

[12] This assumptions implies that foreign consumers substitute more easily goods imported from the same origin.

[13] An application of the discrete choice model that includes a vector of products' characteristics is Nevo (1998).

4.2 A case study: the export of perfumes and toilet waters

Over the period 1997-2007, perfumes and toilet waters (HS6: 330300) constitute 4% of consumer goods export from France, representing the third most important product class and averaging over 3 millions euros[14]. Although, pharmaceutical and wine have greater economic relevance than perfumes, we choose to focus the following empirical section on perfumes because this product category fits better the assumption of the discrete choice framework. First, there is considerable scope for quality heterogeneity in this product category. Qualitative attributes such as the name of the brand, packaging, and closeness to consumers' tastes are likely to be important determinants of foreign demand for French perfumes. Second, it is plausible that foreign consumers attach value to the French origin of perfumes. Therefore, it is legitimate to assume greater substitutability among different varieties imported from France than among varieties imported from different countries. While a similar argument applies also to wines, it is unlikely that the French origin of pharmaceuticals enter foreign consumers' utility function. Instead, we prefer to investigate perfumes over wines because intermediaries play a much larger role in the export of wines than they do in the export of perfumes[15]. Since intermediarties are more likely to export multiple varieties than manufacturers, the assumption that each exporter coincides with a single variety is less tenable for wines than it is for perfumes. Finally, perfume manufacturing belongs to the chemical industry, that is one of the industrial sectors with higher dependence on external finance[16].

4.3 Estimation

The estimation of (12) requires information on the total quantity of perfume imported by each country served by French exporters to calculate the import share of individual French firms and the import share of the outside variety. We obtain this information from the BACI dataset that reports values and quantities of bilateral export flows for HS6 product categories (Gaulier and Zignago, 2010). The HS6 category for perfumes in BACI (HS6: 330300) is associated with two NC8 product categories in the Custom dataset: distinguishing perfumes (NC8: 33030010) from toilet waters (NC8: 33030090). Because toilet waters are essentially diluted perfumes, then it is possible to assume that substitution across these two categories is sufficiently high to treat them as a unique product group when we estimate the demand

[14] We define consumers' goods according to the BEC classification of economic activities excluding cars. The export share of perfumes is calculated from BACI data.

[15] The wine exporters in our database (HS6: 220241) are 15% manufacturers and 85% retailers, perfume exporters instead are 40% manufacturers and 60% retailers.

[16] Chemicals rank high in terms od dependence on external financing according to the measure developed in Rajan and Zingales (1998).

equation. Therefore, export flows in the Custom dataset are collapsed at the HS6 level by summing export values and quantities of NC8 flows by firm-year-destination. To reduce inconsistencies between BACI and Custom data we drop destination-year observations for which the total sum of the quantities exported by individual firms calculated from Custom is greater or smaller than the 20% of the corresponding aggregate quantity reported in BACI[17]. Summary statistics on the sample are included in Appendix 1.

As previously discussed, OLS regressions would generate inconsistent estimates of the parameters in (12). To solve this problem we instrument for individual varieties' price and nest-share using three different instruments that are expected to be uncorrelated with the quality of the exported variety. We instrument for the price charged by each individual exporter j to a given export market d using the average of the prices of all French exporters of perfumes operating in the same market at time t. We expect this instrument to be mainly driven by demand factors in the destination market, and to correlate through this channel with the price set by individual exporters in each period. Instead this instrument should be uncorrelated with variations in the export shares of individual exporters; *ceteris paribus*, a positive shock in the aggregate demand for imported perfumes in d would increase in the same proportion the total market for imported perfumes and the quantity exported by firm j, hence leaving the market share of j unchanged. Similarly, if a general increase in prices reflects general improvement in the quality of French products exported to d, this would be uncorrelated with changes in market shares explained by idiosyncratic variations in the quality of individual varieties. The second instrument for prices is the physical productivity of the firm, obtained as output quantity per employee[18]. Lastly, we instrument for market shares of individual firms using the Herfindahl index constructed by summing the squares of the market shares of individual exporters in a given export market.

The parameters estimated by OLS and by fixed-effects instrumental variable (IV FE) are reported in table 3, together with test statistics and own-price elasticities calculated using equation (41) in Appendix 2. Consistently with our expectations OLS estimates are greater than those obtained by IV FE, signaling the presence of an upward bias in OLS coefficients. The Sargan test of overidentification does not reject the exogeneity of the instruments and first-stage F statistics show that our instruments are sufficiently correlated with prices and nest-shares. The median own-price elasticity of export market shares (-1.81) is rather low

[17] The following results are robust when we set the threshold at 10%.

[18] Because we observe only the total quantity exported by the firm q_{exp} we obtain quantities produced q_{tot} as: $q_{tot} = \frac{v_{tot}}{v_{exp}} \times q_{exp}$. The implicit assumption is that the ratio of total quantity produced over total quantity exported is equal to the ratio of total revenue over export revenue (these two variables are available in FICUS). We lag this instrument to prevent measurement errors in quantities from driving the correlation between unit-values and the instrument.

consistently with the non-homogeneous nature of this product class[19]. In addition, the low $\hat{\sigma}$ can be interpreted as evidence that heterogeneous preferences across consumers play a large role in determining their choices among different varieties of perfume[20].

Table 3: Perfumes: demand equation estimates

	FE	FE IV
$\hat{\alpha}$	-0.002***	-0.035***
	(0.00)	(0.00)
$\hat{\sigma}$	0.929***	0.475***
	(0.00)	(0.04)
Fixed-effects:		
Year FE	Yes	Yes
Own price elasticities		
High (75th perc.)		-2.98
Median		-1.81
Low (25th perc.)		-1.01
Test statistics		
F stat (uv)		33.88
F stat (sn)		37.50
Sargan p-value		0.47
R^2	0.80	0.45
Obs.	58,531	26,709

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. Cluster robust standard errors in parentheses (cluster unit: firm-product-destination).

We test the quality estimator *qual* obtained as the residual from the IV FE regression by checking its correlation with export market characteristics and with firms' revenue. Table 4 reports the coefficients obtained regressing log prices (column 2) and *qual* (column 3) on the income and distance of different destination markets[21]. By including firms' dummies in both regressions we control for exporters' fixed-effects, and we exploit within-firm price and quality heterogeneity across markets. The negative correlation between distance and prices supports efficiency sorting whereby exporters set lower prices in distant markets to offset

[19] According to the median price elasticity, a 10% increase in price causes a 18% reduction of the share of exporter j over the total import of destination d.

[20] The error term in (2) accounts from difference in the utility different consumers derive from consuming one unit of the same variety.

[21] To measure destination markets' distance from France we use the log of the population weighted distance from the CEPII gravity dataset and to measure income the log of GDP per capita from the same source (Head, Mayer, and Ries, 2010).

higher transport costs and to survive tougher competition (Melitz and Ottaviano, 2008). However, the positive correlation between *qual*, distance and income of destination countries is consistent with the quality sorting hypothesis[22]. These results are contradictory only if we expect higher prices to be a perfect signal of higher quality. However, exporters' pricing policy across markets may not reflect only differences in the quality of the varieties that are shipped toward different destinations. For example, exporters serving multiple destinations might decide to sell higher quality varieties at lower prices in 'tougher' markets. This story is consistent with what we find when we investigate the relationship between quality, prices and export revenue.

Table 4: Perfumes: quality and price across export destinations

	(2)	(3)
Dep. var.	$log(UV)_{jpdt}$	$qual_{jpdt}$
$log(distance)_d$	-0.025***	0.134***
	(0.01)	(0.02)
$log(GDPpc)_{dt}$	-0.004	0.183***
	(0.01)	(0.02)
Fixed-effects:		
Firm FE	Yes	Yes
Year FE	Yes	Yes
R^2	0.67	0.43
Obs.	59,032	57,900

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. Cluster robust standard errors in parentheses (cluster unit: firm).

Table 5 reports the coefficients obtained running FE panel regressions of log prices and quality on log export revenue. Because, we set the panel unit at the firm-product-destination level, coefficients can be interpreted as correlations between changes in prices, quality and revenue at the level of individual export flows. Consistently with the assumption made in Manova and Zhang (2012) that the positive correlation between export prices and revenue reflects quality, we see that both price and *qual* have positive coefficients when they are separately regressed on revenue (column 2 and 3). However, the correlation between prices and revenue turns negative once we control for the quality of the exported varieties. The opposite sign of the coefficients on $qual_{jpdt}$ (positive) and on $log(UV_{jpdt})$ (negative) indicates that export

[22] Two recent papers finding evidence of quality sorting are Crozet, Head, and Mayer (2011) and Bastos and Silva (2010).

revenues can be increased either by lowering prices or by selling higher quality products. In other words, quality and efficiency sorting are not competing theories when it comes to explaining firms' performances in foreign markets.

Table 5: Perfumes: quality, price and revenue

	(2)	(3)	(4)
Dep. var.	$log(rev)_{jpdt}$	$log(rev)_{jpdt}$	$log(rev)_{jpdt}$
$log(UV_{jpdt})$	0.114***		-0.521***
	(0.02)		(0.02)
$qual_{jpdt}$		0.831***	0.906***
		(0.01)	(0.01)
Year FE	Yes	Yes	Yes
Firm-destination FE	Yes	Yes	Yes
R^2	0.01	0.44	0.47
Obs.	60,958	58,012	58,012

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. Cluster robust standard errors in parentheses (cluster unit: firm-product-destination).

4.4 Perfume quality and exporters' characteristics

In this section we investigate the firm-level determinants of export quality. In particular, we test the hypothesis that financial constraints hamper exporters' ability to win market shares by adopting strategies alternative to price competition. Because our proxy for quality is the residual from the estimation of model (12), this can be decomposed into:

$$qual_{jpdt} \equiv \hat{\epsilon}_{jpdt} = u_{jpd} + \eta_{jpdt} \tag{14}$$

where u_{jpd} is a time-invariant and firm-destination specific component, and η_{jpdt} is the idiosyncratic one. The first term captures the 'brand' aspects of quality in individual markets (e.g. consumers' attachment to a particular brand of perfume, the cumulative effect of past advertisement campaigns, consolidated relationships between exporters and domestic distributors), while the term η_{jpdt} is associated with contingent factors (e.g. the introduction of a more appealing packaging, the immediate effect of a recent advertisement campaign, the signature of a contract with a big department store in the destination country). The extent to which variations in $qual$ are explained by each of the two components can be assessed by comparing the adjuster R^2 from regressions of $qual$ and $log(UV)$ on different sets of dummies (table 6). Exporter and year-exporter fixed-effects explain respectively 35% and 38% of quality variations among different export flows, while destination-exporters fixed-effects account for 74%. This implies that the firm-specific time invariant component of quality is more important than the idiosyncratic component, but also that the quality of the products associated with a single exporter varies across export destinations.

Table 6: Sources of quality and price variations

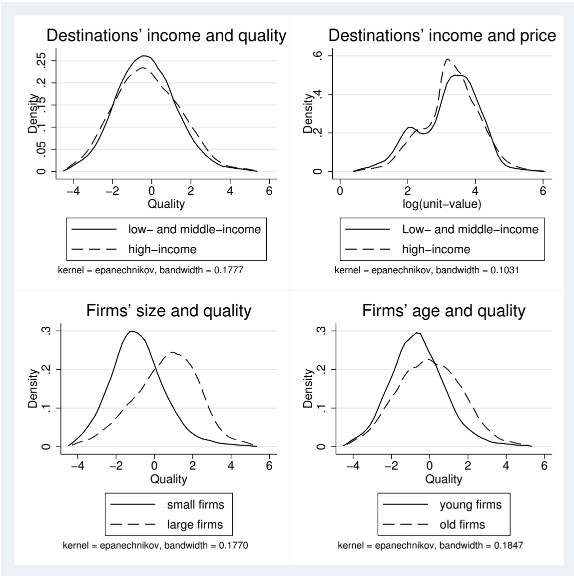
	$qual_{jpdt}$	$log(UV_{jpdt})$
Exporter	.35	.50
Destination-exporter	.74	.70
Year-exporter	.38	.56

Notes. The table reports the adj. R^2 obtained from regressing the dependent variables of different set of dummies.

We start studying the relationship between export quality and firms' characteristics by plotting empirical densities of $qual_{jpdt}$ for groups of firms with different attributes. Kernel densities in figure 3 show that both $qual$ and prices are distributed similarly in high and middle-low income destination markets (upper panels). Instead, $qual$ follows different distributions when we look at export flows generated by firms of different size and different age (lower panels). Specifically, the distribution of $qual$ for larger and older firms stochastically dominates the $qual$ distribution for smaller and younger exporters[23]. Both size and age affect firms' access to credit as firm with more tangible assets and longer track records are found to have easier access to credit and lower costs for external financing (Beck, Demirguc-Kunt, Laeven, and Maksimovic, 2006). Therefore, non-parametric evidence points to the possible relevance of financial factors in explaining quality heterogeneity across exporters.

[23]Larger and older firms are those above the median of the sample in terms of tangible assets and in terms of age. The Kolgomorov-Smirnov test comparing the distribution of $qual$ for large firms and small firms fails to reject the dominance of the large size distribution (p-value=1).

Figure 2: Distributions of *qual* by firm and market characteristics



Notes. Low- and middle-income countries are export destination with income per-capita lower of 12,000 USD. Large and small firms are respectively those above the 4th quartile of the asset distribution and those below the 1st quartile. Old and young firms are respectively those above the 4th quartile and below the 1st quartile of the age distribution.

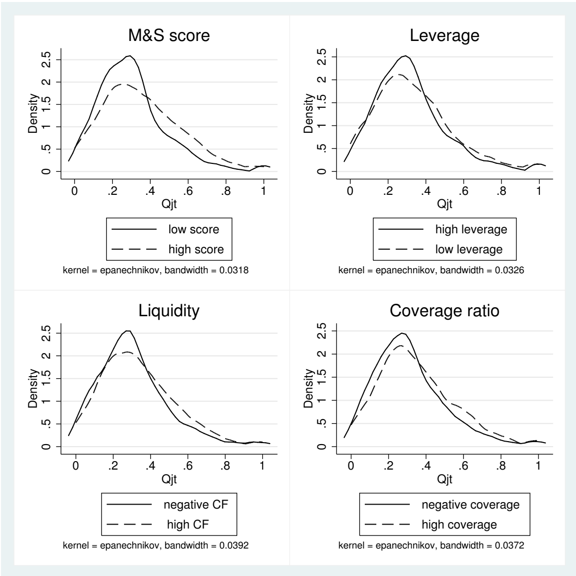
Because financial variables vary at the firm-level while *qual* is a flow-specific estimator of quality, we construct a firm-level measure of quality Q_{jt} by averaging the relative quality of each firm across its export markets:

$$Q_{jt} = \frac{1}{n_{jt}} \sum_{d_{jt}} \frac{qual_{jdt} - min_{dt}}{max_{dt} - min_{dt}} \tag{15}$$

where n_{jt} is the number of foreign markets served by exporter j at time t, min_{dt} and max_{dt} are respectively the lowest and the highest values of *qual* among all exporters serving the same market d at time t. Q_{jt} ranges from 0 to 1, where 0 implies that the firms is exporting the variety with the lowest quality in all markets. On the contrary, when $Q_{jt} = 1$ the exporter is positioned on the 'quality frontier' in all export destinations it serves. In other words, Q_{jt} can be interpreted as the average distance of exporter j from the quality frontier measured within each export destination at time t.

Figure 3 shows the kernel densities of Q_{jt} estimated separately for groups of firms with different measures of financial health. In general we can see that the right-hand tail of the distribution is fatter for firms with better financial health. However, a more formal test of the impact of financial factors on the average distance from the quality frontier requires controlling for other exporters' characteristics that might affect both their financial health and the quality of their products. Hence, we estimate the following model using the dataset

Figure 3: **Distributions of Q_{jt} by firm financial health**



Notes. Low- and high-score firms are respectively those with M&S score below 2.5 and above 7.5. High- and low-leverage firms are respectively those with leverage above the 4th quartile and below the 1st quartile of the leverage distribution. Similarly firms with high CF and high coverage are respectively firms above the 4th quartile of the cash-flow and coverage distributions.

collapsed on the firm dimension:

$$Q_{jt} = \beta_0 + \gamma FC_{jt} + X'_{jt}\beta + v_{jt} \tag{16}$$

where X_{jt} is a vector of firm-level controls and FC_{jt} is the financial variables we use to proxy for internal or external financial constraints. Tables 7 and 8 report respectively the coefficients obtained by estimating (16) on the whole sample and on the sample of manufacturing firms only. For each of the three financial variables introduced on the right-hand side of the estimated equation (leverage, coverage and M&S index), we use three different estimators: pooled OLS, FE within-groups, and GMM System (Blundell and Bond, 1998). All regressors are lagged one period to reduce the risk of endogeneity, and year dummies are always included[24]. The sign of the coefficients of the financial variables estimated on the whole sample are consistent throughout the three different estimators and their significance is generally maintained below the 10% level[25]. The absolute values of $\hat{\gamma}$ from GMM is generally larger and this hints at the presence of attenuation bias from measurement errors when the first lag of the financial variable is not instrumented with previous lags. Among the controls included in X', firms' labor productivity and size correlate positively with Q consistently with

[24]All results are robust to the use of the covariates in level.

[25]With the exception of the insignificant coefficient on $cover_{t-1}$ when the model is estimated with by FE.

the idea that larger and more efficient firms choose to produce higher quality output (Kugler and Verhoogen, 2012). It is more difficult to explain the negative coefficient on the dummy for manufacturing firms. A possible interpretation is that the estimators *qual* and Q overestimate the quality of retailers' ($manuf = 0$). Because retailers are more likely to export a wider range of varieties than manufacturers, their exports fit a larger spectrum of consumers' tastes. Hence our estimator might be capturing horizontal rather than vertical differentiation when it comes to retailers' exports. For this reason table 8 reports the coefficients obtained estimating the model on the restricted sample of manufacturing firms.

Table 7: Export quality and financial constraints (Whole sample)

	lev			cover			M&S score		
	OLS	FE	BB	OLS	FE	BB	OLS	FE	BB
$lasset_{t-1}$	0.015***	0.002	0.014***	0.016***	0.004	0.015***	0.012***	0.002	0.004
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
$group_{t-1}$	0.009	0.025*	0.010	0.012*	0.026*	0.014	0.009	0.026*	0.006
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
$lprod_{t-1}$	0.021***	0.002	0.017***	0.021***	0.001	0.017***	0.021***	0.001	0.017***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$lage_{t-1}$	0.019***	0.002	0.011*	0.015***	0.003	0.011*	0.002	-0.003	-0.030
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
$foreign_{t-1}$	0.021**	-0.006	0.017	0.022**	-0.002	0.020	0.026**	-0.002	0.023
	(0.01)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)
$manuf_{t-1}$	-0.059***		-0.059***	-0.058***		-0.057***	-0.057***		-0.059***
	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)
lev_{t-1}	-0.049***	-0.051**	-0.247**						
	(0.02)	(0.03)	(0.12)						
$cover_{t-1}$				0.004***	0.004***	0.010			
				(0.00)	(0.00)	(0.01)			
$M\&Sscore_{t-1}$							0.015***	0.006**	0.047**
							(0.00)	(0.00)	(0.02)
Fixed-effects:									
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-destination FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
AR2 test (p-value)			0.85			0.96			0.85
Sargan test (p-value)			0.15			0.75			0.79
R^2	0.14	0.01		0.15	0.01		0.16	0.01	
Obs.	3,274	3,274	3,274	3,061	3,061	3,061	2,943	2,943	2,943

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. Cluster robust standard errors in parentheses (cluster unit: firm). *cover* is the decile of the coverage distribution associated with each firm. BB refers to the Bludell-Bond system GMM estimator.

Table 8: **Export quality and financial constraints (Manufacturing)**

	lev			cover			M&S score		
	OLS	FE	BB	OLS	FE	BB	OLS	FE	BB
$lasset_{t-1}$	0.029***	0.015**	0.029***	0.030***	0.017**	0.022***	0.026***	0.016**	0.030***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
$group_{t-1}$	0.043***	0.014	0.043***	0.042***	0.010	0.060**	0.041***	0.010	0.039***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
$lprod_{t-1}$	0.023***	0.004	0.021***	0.024***	0.004	0.020***	0.023***	0.006	0.021***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$lage_{t-1}$	-0.002	-0.002	-0.004	0.002	0.005	-0.002	-0.015***	-0.005	-0.001
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$foreign_{t-1}$	0.034**	-0.001	0.028	0.027*	0.007	0.015	0.035**	0.007	0.024
	(0.01)	(0.04)	(0.03)	(0.01)	(0.04)	(0.02)	(0.01)	(0.04)	(0.02)
lev_{t-1}	-0.107***	-0.062***	-0.136**						
	(0.02)	(0.02)	(0.06)						
$cover_{t-1}$				0.006***	0.004***	0.051			
				(0.00)	(0.00)	(0.03)			
$M\&Sscore_{t-1}$							0.014***	0.003	0.044*
							(0.00)	(0.00)	(0.02)
Fixed-effects:									
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-destination FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
AR2 test (p-value)			1.00			0.29			0.89
Sargan test (p-value)			0.14			0.70			0.20
R^2	0.36	0.02		0.36	0.02		0.37	0.02	
Obs.	1,440	1,440	1,440	1,417	1,417	1,417	1,363	1,363	1,363

Notes. * indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level. Cluster robust standard errors in parentheses (cluster unit: firm). *cover* is the decile of the coverage distribution associated with each firm. BB refers to the Bludell-Bond system GMM estimator.

Results are consistent using the two different samples and they strongly suggest that less financially healthy firms are positioned further away from the quality frontier in the destinations they serve. Because, our estimator of quality captures essentially the demand for firms' export that is not explained by competitively in terms of prices, we find evidence supporting the hypothesis that financial constraints are detrimental to firms' adoption of alternative strategy to expand their presence in international markets.

5 Endogenous quality choice under financial constraints

We now rationalize the empirical results obtained in previous sections by means of a simple model where firms with greater dependence on credit and greater probability of default face higher costs to invest in quality upgrading. For consistency with the methodology we previously used to obtain $qual_{jt}$, we now model demand in destination d by adopting the discrete choice framework, whereby each consumer buys only one unit of output choosing among the varieties available within each product category. Then, each variety available in market d corresponds to a single exporter j operating in that market. Each consumer chooses only the variety j that yields the highest utility u_{ijd}:

$$u_{ijd} = \delta_j + \zeta_{ig} + (i - \sigma)\epsilon_{ij} \tag{17}$$

where

$$\delta_j = \zeta_j^\theta - \alpha p_j \tag{18}$$

for simplicity the expected utility δ_j depends only on price p_j and quality ζ_j, with $\theta < 1$[26]. By modeling individual consumers' probability P_j of choosing variety j according to equation (5), we can write the aggregate demand faced by exporter j in d as:

$$q_{jd} = P_j \times Pop_d \times \mu(y_d) \tag{19}$$

where Pop_d is consumers' population in d and $0 \leq \mu(y_d) \leq 1$ is the proportion of consumers buying a variety belonging to the same product category of j. The parameter $\mu(y_d)$ depends on the income y_d of country d and it is treated as exogenous with respect to individual exporters' prices and quality[27].

Hence, $Pop_d \times \mu(y_d)$ is the size of market d. If there is a large number of exporters marginal changes in p_j and ζ_j affect the demand of product j only through the numerator on the right-hand side of equation (5). Therefore we can write the marginal effects of prices and quality on demand as:

$$\frac{\partial q_{jd}}{\partial p_{jd}} = -\frac{\alpha}{1-\sigma} q_{jd} \tag{20}$$

$$\frac{\partial q_{jd}}{\partial \zeta_{jd}} = \frac{1}{1-\sigma}\left(\theta \zeta_{jd}^{\theta-1} - \alpha \frac{\partial p_j}{\partial \zeta j}\right) q_{jd} \tag{21}$$

equation (20) implies that a marginal change in quality leads to a greater change in demand in more homogeneous classes of products (i.e. for which σ tends to 1). In addition, an upgrade in quality increases proportionally more the sales of exporters that already sell large quantities in market d and have relatively lower quality levels[28].

For what concerns firms' choices, we assume that exporters can increase the quality of their product by making an initial destination-specific investment ζ_{jd}^τ, with $\tau > 1$ implying that the cost of increasing quality in each destination is monotonically increasing and convex in quality. We can justify this formulation by conceptualizing ζ_{jd}^τ as the exporter's cost of adapting its product to consumers' taste in d, or with a destination-specific advertisement campaign aimed

[26]By imposing $\theta < 1$ we assume decreasing return of quality in consumers' utility function.

[27]In a more realistic setting, the exporter that sets the lowest price can expand its market by reaching lower-income individuals through further price reductions.

[28]These are the exporters that achieved a good position in the foreign market thanks to high efficiency and lower prices.

at increasing foreign consumers' appreciation for the brand. The cost function of exporter j relative to its export activities toward destination d is then:

$$c_{jd} = f_d + \frac{q_{jd}}{\varphi_j} + \zeta_{jd}^{\tau} \tag{22}$$

where f_d is a fixed cost of entry in market d, and φ_j are the units of labor required to produce one unit of output[29]. Profits from market d are given by:

$$\pi_{jd} = p_{jd}q_{jd} - f_d - \frac{q_{jd}}{\varphi_j} - \zeta_{jd}^{\tau} \tag{23}$$

and the profit optimizing price is then:

$$p_{jd}^{*} = \frac{1-\sigma}{\alpha} + \frac{1}{\varphi_j} \tag{24}$$

where the fixed markup $\frac{1-\sigma}{\alpha}$ decreases in demand elasticity to price, and in the degree of homogeneity σ of the product category. Because quality does not affect variable costs, then prices are not affected by quality, and in (20) $\frac{\partial p_j}{\partial \zeta j} = 0$. From the FOC, the optimal level of quality that solves exporter's optimization problem is:

$$\zeta_{jd}^{*} = \left(\frac{\theta}{\alpha\tau} q_{jd} \right)^{\frac{1}{\tau-\theta}} \tag{25}$$

equation (25) implies that the optimal level of quality is positively related with firms' *ex-ante* position in market d. On the contrary, the greater is the parameter for the cost of upgrading quality τ and the greater is the parameter α expressing consumers' preferences for cheaper products, the smaller is the optimal quality level ζ^*. This last relationship is determined by the fact that firms' mark-ups are decreasing in α, and the profit margins on each additional unit of products are narrower.

5.1 External credit to improve quality

Assume that the exporter j needs bank credit to finance the proportion $\phi(Liq_j)$ of the investment $\lambda(\zeta_{jd})$, where Liq_j is the liquidity of the firm and $\phi'(Liq_j) < 0$. The bank asks a repayment R for the loan and it evaluates exporter's probability of repaying his loan as $\rho(Lev_j)$, where Lev_j is the proportion of firms' debt over its total assets and $\rho'(Lev_j) < 0$. Bank's profits from financing exporter's investment in quality are:

$$\pi_B = -\phi\zeta_{jd}^{\tau} + \rho(Lev_j)R \tag{26}$$

[29] As it is customary in the theoretical trade literature with heterogeneous firms wages are normalized to 1.

If the banking sector is competitive we can equate (26) to zero and obtain the expression for the repayment R, that increases in the size of the loan and in the probability of exporters' default:

$$R = \frac{\phi \zeta_{jd}^{\tau}}{\rho(Lev_j)} \tag{27}$$

Therefore, the profit function of the externally financed exporter becomes:

$$\pi_{jd} = p_{jd}q_{jd} - f_d - \frac{q_{jd}}{\varphi} - (1 - \phi(Liq_j))\zeta_{jd}^{\tau} - \frac{\phi(Liq_j)\zeta_{jd}^{\tau}}{\rho(Lev_j)} \tag{28}$$

and the optimal quality level solves the following equivalence:

$$\tilde{\zeta}_{jd} = \left[\frac{\theta}{\alpha\tau} q_{jd} \left(1 - \phi + \frac{\phi}{\rho}\right)^{-1}\right]^{\frac{1}{\tau-\theta}} \tag{29}$$

If the exporter commands enough liquidity to self-finance the whole investment in quality ($\phi = 0$) then $\tilde{\zeta}_{jd} = \zeta_{jd}^{*}$. On the contrary if ϕ is positive and $\rho < 1$ (positive probability of firm's default), then $\tilde{\zeta}_{jd} < \zeta_{jd}^{*}$. Intuitively, firms with higher risk of default (i.e. higher Lev_j and lower $\rho(Lev_j)$) must pay a higher risk premium on their loans, and this increases the costs of investing in quality to the extent this investment requires external financing.

The optimal level of quality in (29) is consistent with the negative correlation between *lev* and *qual*, and with the positive correlation between *cover* and *qual* that we find in section 4.4. In addition, because both $\tilde{\zeta}_{jd}$ and ζ_{jd}^{*} increase in q_{jd}, that is a function of market size ($Pop_d \times \mu(y)$) and income, we can also explain the fact that the same producer chooses higher quality when exporting towards larger and richer destinations.

So far we have assumed that the cost of quality does not affect variable costs. Consequently, the optimal price (24) is set independently from the quality choice. We now drop this assumptions by allowing quality to affect firms' marginal costs. If high quality output entails higher unitary input requirements, the profit function of exporter j becomes:

$$\pi_{jd} = p_{jd}q_{jd} - f_d - \frac{q_{jd}\zeta_{jd}^{\tau}}{\varphi_j} \tag{30}$$

and if a fraction $\phi(Liq_j)$ of variable costs must be financed with external credit:

$$\pi_{jd} = p_{jd}q_{jd} - f_d - (1 - \phi)\frac{q_{jd}\zeta_{jd}^{\tau}}{\varphi_j} + \phi\frac{q_{jd}\zeta_{jd}^{\tau}}{\rho\varphi_j} \tag{31}$$

where the last term on the right-hand side is the repayment requested by banks. From the FOC we obtain the optimal price level as:

$$p_{jd}^{*} = \frac{1-\sigma}{\alpha} + \frac{\zeta_{jd}^{\tau}}{\varphi}\left[(1 - \phi) + \frac{\phi}{\rho}\right] \tag{32}$$

hence quality is positively related with prices via its impact on marginal costs. As a consequence, changes in quality affect quantities both positively and directly (i.e. increasing the probability of consuming variety j), and negatively and indirectly (i.e. increasing prices)[30]. Taking the derivative of profits with respect to quality and equating it to zero we obtain the expression for the optimal level of quality:

$$\hat{\zeta}_{jd} = \left[\frac{\theta \varphi_j}{\alpha \tau} \left(1 - \phi + \frac{\phi}{\rho} \right)^{-1} \right]^{\frac{1}{\tau - \theta}} \tag{33}$$

equation (33) differs from (29) because exporters do not base their quality choice on their total sales in d, but rather on their productivity level φ_j. However, exporters' leverage still affects firms' quality by raising the 'risk premium' on the loan[31].

This model can be also used to formalize the relationship between financial constraints and price elasticity of revenue. Holding constant the credit parameters ϕ_j and ρ_j, the demand parameters α and σ, and the cost of inputs, time variations in exporters' prices can be either caused by an increase in quality ζ_{jd} or by a negative shock in productivity φ_j. The total differentials of the optimal prices and quantities are respectively:

$$dp^*_{jd} = \frac{\partial p_{jd}}{\partial \zeta_{jd}} d\zeta_{jd} + \frac{\partial p_{jd}}{\partial \varphi_j} d\varphi_j \tag{34}$$

$$dq_{jd} = \frac{\partial q_{jd}}{\partial \zeta_{jd}} d\zeta_{jd} + \frac{\partial q_{jd}}{\partial p_{jd}} dp^*_{jd} \tag{35}$$

and the total differential of revenue can be written as:

$$d(q_{jd} p_{jd}) = p_{jd} \frac{\partial q_{jd}}{\partial \zeta_{jd}} d\zeta_{jd} + p_{jd} \frac{\partial q_{jd}}{\partial p_{jd}} dp^*_{jd} + q_{jd} \frac{\partial p_{jd}}{\partial \zeta_{jd}} d\zeta_{jd} + q_{jd} \frac{\partial p_{jd}}{\partial \varphi_j} d\varphi_j \tag{36}$$

substituting (34) in (36) we obtain:

$$\begin{aligned} d(q_{jd} p_{jd}) &= d\zeta_{jd} \left(\frac{\partial q_{jd}}{\partial \zeta_{jd}} p_{jd} + \frac{\partial p_{jd}}{\partial \zeta_{jd}} q_{jd} + \frac{\partial p_{jd}}{\partial \zeta_{jd}} \frac{\partial q_{jd}}{\partial p_{jd}} p_{jd} \right) \\ &+ d\varphi_j \left(\frac{\partial \hat{\zeta}_{jd}}{\partial \varphi_j} \frac{\partial q_{jd}}{\partial \zeta_{jd}} p_{jd} + \frac{\partial p_{jd}}{\partial \varphi_j} q_{jd} + \frac{\partial p_{jd}}{\partial \varphi_j} \frac{\partial q_{jd}}{\partial p_{jd}} p_{jd} \right) \end{aligned} \tag{37}$$

From equation (37) we can derive two contrasting channels through which financial constraints affect exporters' revenue elasticity to price. First, (32) implies that price increases faster when quality upgrading is undertaken by more financially constrained firms[32]. In turns, if we observe two exporters in the same market increasing their prices of the same amount (and if we know that the increase is explained by quality improvement), then we should expect

[30] In (21) $\frac{\partial p_{jd}}{\partial \zeta_{jd}} > 0$.

[31] Because $\rho'(Lev_j) < 0$.

[32] From (32) $\frac{\partial^2 p^*_{jd}}{\partial \zeta_{jd} \partial \phi} > 0$ and $\frac{\partial^2 p^*_{jd}}{\partial \zeta_{jd} \partial \rho} < 0$.

the unconstrained exporter to achieve higher quality levels than the constrained one. As a consequence, the constrained exporter would present a less positive price elasticity of revenue. Formally this is captured by a more negative term $\frac{\partial p_{jd}}{\partial \zeta_{jd}} \frac{\partial q_{jd}}{\partial p_{jd}} p_{jd}$ within the first set of brackets in (37).

Second, prices increase faster and quality decreases slower when a negative productivity shock hits a more financially constrained firm[33]. It follows that if we observe two firms increasing their prices equally as a result of negative productivity shocks, we expect that the less constrained one has been suffering a more negative shock in productivity. Because the quality choice of this firm is more sensitive to productivity changes, then we expect it to reduce its quality (and demand) faster than the constrained one. Eventually this would result in a more negative elasticity of revenues for less financially constrained firms. In the second brackets of (37) this implies that the term $\frac{\partial \hat{\zeta}_{jd}}{\partial \varphi_j} \frac{\partial q_{jd}}{\partial \zeta_{jd}} p_{jd}$ is greater for less financially constrained firms.

In section 3 we find positive price elasticity of revenues by exploiting variations across firms (pooled OLS). On the contrary, elasticity is negative when we exploit time variations in prices within the same export flow (FE). In the light of our simple model we can infer that price variations across firms are mostly explained by differences in quality according to the first term on the right-hand side of (37), while productivity shocks prevail as a cause of price changes within the same export flow, as in the second term on the right-hand side of (37). Consistently with model's predictions, we find that less financially constrained exporters have positive and greater price elasticity of revenue. However, our model fails to fit the evidence when it comes to predicting a more negative effect on revenues for less financially constrained firms that increase their price over time. A possible explanation for this discrepancy is that investment in quality might not be sensitive to time-variations in productivity. This is the case when quality investment has to be sustained upfront, or when the effect of investment is persistent over time. If this is the case the term $\frac{\partial \hat{\zeta}_{jd}}{\partial \varphi_j} \frac{\partial q_{jd}}{\partial \zeta_{jd}} p_{jd}$ in (37) is close to 0, and less financially constrained exporters do not suffer more negative reduction in quality as the result of a negative productivity shock.

[33]From (32) $\frac{\partial^2 p^*_{jd}}{\partial \varphi_j \partial \phi} > 0$ and $\frac{\partial^2 p^*_{jd}}{\partial \varphi_j \partial \rho} < 0$, and from (33) $\frac{\partial^2 \hat{\zeta}_{jd}}{\partial \varphi_j \partial \phi} < 0$ and $\frac{\partial^2 \hat{\zeta}_{jd}}{\partial \varphi_j \partial \rho} > 0$.

6 Conclusions

In this paper we investigate to what extent financial factors determine differences in product quality across French exporters. By regressing export revenues on prices as in Manova and Zhang (2012), we find that within narrowly defined product categories better financial health is associated with higher export prices and more positive revenue elasticity. This evidence suggests that financially healthy exporters sell relatively higher quality products than illiquid and highly leveraged ones. We test this hypothesis more rigorously focusing on French exporters of perfumes and toilet waters. By using a firm-destination specific estimator and comparing firms operating in the same export market, we find that firms' financial health correlates positively with quality. This empirical evidence is consistent with the predictions of a simple model in which firms can increase their sales by investing in quality, and where illiquid and financially unhealthy ones face greater costs for obtaining bank credit.

Previous studies have found that financial constraints affect negatively export participation (Bellone, Musso, Nesta, and Schiavo, 2010), export intensity (Minetti and Zhu, 2011; Secchi, Tamagni, and Tomasi, 2011), the number of destinations served and longevity in foreign markets (Askenazy, Caldera, Gaulier, and Irac, 2011). These results have been interpreted in the light of the limited capacity of financially constrained firms to finance the fixed-costs of entering foreign markets or the the iceberg costs of exporting. Our findings point to a novel interpretation of previous results, whereby financially constrained firms find it harder to compete on quality. Indeed, part of the upfront costs for entering foreign markets might be related to quality upgrading, advertisement or the adaptation of products to foreign tastes. The main policy implication of our results is that policy interventions aimed at relaxing exporters' financial constraints might enhance firms' ability to compete on the quality dimension, hence escaping the pressure exerted by low-cost imports from low-wage countries.

We acknowledge that one important question is left unanswered by our investigation: are some financially constrained firms prevented from exporting altogether because they cannot achieve the minimum quality level to enter into the foreign market? Since our dataset does not report quantities sold by non-exporters we cannot proxy for their quality neither through prices nor through domestic market shares[34]. We consider this issue an interesting opportunity for future research on the impact of financial constraints on firms' internationalization.

[34]On the contrary, Kugler and Verhoogen (2012) by using information of quantities and revenue from the domestic market argue that firms tend to upgrade quality before exporting as they find that the domestic price of perspective exporters tend to increase.

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Appendix 1

Table 9: Summary statistics at the firm level

Year	Firms	Flows	Destinations	Leverage	Coverage	M&S score	Age	Employees
1997	41953	14.76	4.70	0.18	9.97	5.48	19.50	96.55
1998	42787	15.02	4.73	0.17	11.35	5.50	21.65	96.87
1999	43349	15.72	4.81	0.17	12.43	5.61	16.16	95.42
2000	44357	15.84	4.84	0.12	13.63	5.63	11.64	94.02
2001	42846	16.16	4.90	0.16	14.08	5.60	16.46	98.47
2002	43584	16.12	4.84	0.16	14.46	5.58	15.05	95.31
2003	41637	16.50	4.89	0.16	14.49	5.52	16.60	86.34
2004	41168	17.70	5.01	0.16	15.60	5.52	16.41	97.50
2005	33349	13.76	4.77	0.15	16.25	5.65	18.38	101.13
2006	34238	12.99	4.63	0.15	17.17	5.71	18.70	107.75
2007	35054	13.71	4.73	0.15	18.30	5.70	19.00	104.65

All statistics refer to means by firm. NEED TO INCLUDE MEAN log(UV) TO INTERPRET FOLLOWING RESULTS

Table 10: Exporters of French perfumes

	Whole sample	Manuf.	Non-manuf.
Export flows (Obs.)	60,958	37,196	23,762
Destinations (unique)	198	190	189
Destinations by firm (median)	2	2	1
Value. flow (median, euros)	25,424	34,677	16,435
Price. flow (median, euros/kg)	27.71	28.36	26,74
French share imp.	.28	-	-
Firms (unique)	2,866	970	1,896
Employees (median)	19	46	9
Leverage (median)	.12	.13	.12
Coverage ratio (median)	4.01	4.41	3.76
M&S score (median)	4.5	5	4

Appendix 2

Derivation of the elasticity of demand (in response to Sarah's perplexity about how to interpret price elasticity of market shares)

By defining $D_g = \sum_{j\in g} e^{\delta_j/1-6}$ equation (5) can be also written as:

$$P_j \equiv s_j = \frac{e^{\delta_j/(1-\sigma)}}{D_g^{\sigma}[\sum_g D_g^{(1-\sigma)}]} \tag{38}$$

then

$$\frac{\partial s_j}{\partial p_j} = \frac{e^{\delta_j/(1-6)}\frac{\partial \delta_j}{\partial p_j}D_g^{\sigma}[\sum_g D_g^{(1-\sigma)}] - e^{\delta_j/(1-\sigma)}[\frac{\partial(D_g^{\sigma})}{\partial p_j}[\sum_g D_g^{1-\sigma}] + D_g^{\sigma}\frac{\partial(D_g^{1-\sigma})}{\partial p_j}}{(D_g^{\sigma}[\sum_g D_g^{(1-\sigma)}])^2} \tag{39}$$

because $\frac{\partial \delta_j}{\partial p_j} = \frac{\alpha}{1-\sigma}$, we can use the definition of s_j in (38) and the definition of $P_{j/g} \equiv s_{j/g}$ in (4) to write (39) as:

$$\frac{\partial s_j}{\partial p_j} = \frac{\alpha}{1-\sigma}s_j(1 - \sigma s_{j|g} - (1-\sigma)s_j) \tag{40}$$

then multiplying (41) by $\frac{p_j}{s_j}$ we obtain the formula for the market share elasticity of demand:

$$\frac{\partial s_j}{\partial p_j} \times \frac{p_j}{s_j} = \frac{\alpha}{1-\sigma}p_j(1 - \sigma s_{j|g} - (1-\sigma)s_j) \tag{41}$$