Insight from the entry-level Bordeaux wines market: vintages as a commodity

Emmanuel Paroissien*†

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Abstract

I provide the first structural modelization of the bulk market for entry-level Bordeaux wines. On this market, the average price paid to the producer is around 1€ per liter, far below the sky-high prices reached by the most prestigious winemakers of Bordeaux. The price for bulk wines also exhibits very different dynamics than the price for the grands crus: the impact of the quantity supplied is much stronger than that of the quality. Original data has been provided by the joint-trade organization of Bordeaux wines. Notably, I observe the stock of wine held by the producers at the end of each marketing year. I use this key information to design a new framework inspired by the literature of commodity storage modelling. I find a counterintuitive result : for the basic regional appellation of Bordeaux, vintage quality actually does not play a major role. The different vintages are well substituable like on a commodity market.

1 Introduction

When it comes to Bordeaux wines, we first think of the premium wines from Médoc, Saint-Emilion or the Graves region. Indeed, those fine wines enjoy a worlwide fame as top-quality wines. Their prices have been largely studied by wine economists as a typical case study of quality signaling for luxury goods. The classical issue is the link between true quality, the imperfect quality signals, and the price. Combris et al. (1997) first addressed this problem showing that prices are mainly driven by the information appearing on the bottle labels, rather than by sensory characteristics such as taste or

*Larefi and Bordeaux Wine Economics, Economics Department, Bordeaux University, Avenue Léon Duguit, 33608 PESSAC cedex, France. Email: emmanuel.paroissien@u-bordeaux.fr.

†CREST-LEI, 15 Boulevard Gabriel Péri, 92245 Malakoff, France. Email: emmanuel.paroissien@ensae.fr

smell. The influence of experts grades on prices has since been largely explored (among others, see Dubois and Nauges (2010), Hadj Ali et al. (2008) or Cardebat et al. (2014). All these studies found that experts significantly affect the prices even after controlling for quality. This literature has built a general framework to understand the formation of Bordeaux wine prices: objective quality signals (weather, rank, vintage, AOC, name of the producer, etc.) are the main determinants of price, but the individual opinions of the experts also play an important role.

However, all these studies only concern a marginal share of the market. As a matter of fact, all the wines that have been primary studied so far only account for 2% to 5% of total Bordeaux wine production in volume. The rest of the Bordeaux market is yet more or less unexplored. Using exclusive data, I hereafter address the question of the determinant of the price for basic Bordeaux red wine sold in bulk. Following the existing literature on Bordeaux fine wine price, I devote a particular attention to the influence of quality.

My specification is theoretically grounded on the literature of the competitive storage model for commodities, first introduced by Gustafson (1958), and more formally refined in Williams and Wright (1991). In that respect, my approach relates to the work of Roberts and Schlenker (2013) who estimate the elasticities of supply and demand for four basic staples. In a similar way, my approach relies on the stock level and the exogenous demand drivers to instrument price of entry-level Bordeaux red wine. In this preliminary work, I only focus on the red wines from the regional designation Bordeaux, which represents one third of total harvest but is representative of all basic red wines from Bordeaux. I show that contrary to what has been exhibited for the fine wine market, quality does not matter much in the formation of entry-level Bordeaux wine price. This market may therefore be viewed as a usual commodity market.

2 Data

I rely on several sources of data in order to control for important drivers of the price. Market information on prices and trade volumes has been provided by the joint-trade organization of Bordeaux wines (CIVB). The volumes harvested, exported and inventories leftovers have been collected by the French customs. I also use the exchange rates against the euro given by the European Central Bank (ECB). The Bordeaux wine quality indexes are available on the website of the Wine Advocate. The substitutes available volumes as measured by the other countries harvests were given by the Food and Agriculture Organization of the United Nations (FAO).

Price and volume traded

The CIVB supplied the series of average prices, but also the total volume sold (in bulk to the wine merchants). My figures concern all vintages taken together, as each vintage is generally sold across three marketing years. The volumes contracted exhibit an important seasonality. This is mainly due to the arrival of the new vintage on the market, which cannot be moved out of the producers warehouses before the 31st of December. Around this date, the number of contracts increases rapidly, reaches a peak around February, and then decreases rapidly around June.

Production and stocks

All the volumes harvested are declared to the customs in December. At the end of July, the inventories left are also declared by every producer. The French customs share this information with the CIVB, which provided me the aggregated data from 1981 to 2013. The market experienced an important expansion phase from 1981 to the late 1990's, with a turning point in 1997. In 1999-2002, we observe a surge of the producers inventories, which more than doubled within five years, conjointly with a collapse of the price. The market stabilized around 2005, with the inventories starting a decreasing trend and prices an increasing trend. In the second half of the observed period, it is striking that the price and the producers inventories exhibit a quasi-symmetrical behavior.

the Wine Advocate data

An evaluation of each vintage quality is publically available on the Wine Advocate website, the former journal of the now retired wine expert Robert Parker. The journal's website gives a score for each vintage from year 1970 on, and for five local designations within the Bordeaux region. All five vintage quality indices for the five Bordeaux regions are highly correlated. It seems therefore reasonable to consider that the fluctuations of quality are well captured by the mean of those five indexes. The tasted wines all belong to the upper-quality segment of Bordeaux wines, so undoubtedly no red wine of AOC Bordeaux were actually tasted. I then rely on the assumption that the fluctuation of top wines quality is a good indicator of the fluctuation of the quality of basic wines. However, as the weather condition is the same for both the top and the basic wines, the two quality indicators should follow the same trend.

Exchange rates and exports data

As an important share of the exports are not paid in euros (about 35% in the last few years) the exchange rates should play an important role in the formation of the production price. The exports are widely spread all around the world, so that many exchange rates should play a role. In order to limit the number of variables, I have computed an effective exchange rate index of the euro for the local market of Bordeaux wines[1]. The data comes from the European Central Bank, and I retained the exchange rates for China, Japan, the United Kingdom (U.K.), the United States of America (USA), and Switzerland.

Competitors outputs

Lastly, the competitors of Bordeaux wines should intervene in the model. I do not observe the prices for these competitors, but I do observe their production. On its website, the FAO provides annual data on wine output, import and export for each country since 1961. Their output is theoretically negatively correlated with their price, so it should have a negative impact on demand for Bordeaux wine. All other things constant, the more substitute wine is available, the lower the demand for Bordeaux red. I have retained the twelve main wine-producing countries and main markets for Bordeaux wines: France (Bordeaux included, it accounts for 18% of world production on average since 2000), Italy (17%), Spain (13%), the USA (9%), South Africa (7%), Argentina (5%), China (5%), Australia (4%), Chile (3%), Germany (3%), Portugal (2%), and Japan (0.3%) which is a major market for Bordeaux wines. Altogether, these twelve countries account for 88% of world total wine production on average since year 2000. As I did for the exchange rate, I have built an index of the total competitor production.

3 Model and estimation strategy

I propose a system of two log-linear equations for quarterly supply and demand. I refer to the storage literature in the design of a supply function driven by the producers stocks. I assume that the quantity supplied at each period is an exponentially increasing function of the producers stocks at the beginning of the period. In that regard, the latter is a natural instrument variable for the price in the demand equation. Conversely, as my demand function includes several drivers (quality, exchange rate and competitors outputs), they provide instrumental variables for the price in the supply equation. I do

[1] It is the mean of the main exchange rates involved in the international market for Bordeaux wines, weighted by their shares in the exports among the non-euro zone.

not consider any supply response regarding the harvest.

For each marketing year t and quarter k, let $p_{t,k}$, $q_{t,k}$, $s_{t,k}$ and $c_{t,k}$ be the logarithms of price, quantity sold, beginning producers stocks and competitors output index. Let $e_{t,k}$ be the quarterly average of the effective exchange rate index, and $\theta_{t,k}$ the quarterly average of the quality index. To limit the number of coefficient to estimate, I build a single series for the competitors harvests. I assume that the harvest of the Northern competitors occurs in the same quarter as the harvest for Bordeaux red, whereas the Southern competitors harvest occurs six months later. I also consider that the effect is diffuse so I smoothed the curve : half of each harvest is added the quarter before actual harvest. This aims at accounting for the incoming news from the competitors harvest. I denote this competitors index as $c_{t,k}$.

My model is the following system:

$$\begin{cases} Supply: & q_{t,k} = \alpha_k^s + \beta^s p_{t,k} + \gamma s_{t,k} + \zeta^s t + \varepsilon_{t,k}^s \\ Demand: & q_{t,k} = \alpha_k^d + \beta^d p_{t,k} + \lambda \theta_{t,k} + \delta e_{t,k} + \eta c_{t,k} + \zeta^d t + \varepsilon_{t,k}^d \end{cases} \tag{1}$$

where α_k^s and α_k^d are the fixed effects for each quarter of respectively the supply and the demand function. I assume that random shocks $\varepsilon_{t,k}^s$ and $\varepsilon_{t,k}^d$ respectively shift the supply function and the demand function. These shocks are supposed time-independent, but can be correlated to each other within the same period. The variance-covariance matrix of $(\varepsilon_{t,k}^s, \varepsilon_{t,k}^d)^t$ is $(\sigma_{i,j})_{(i,j)\in\{s,d\}}$.

As this two equations system can be solved to express $p_{t,k}$ as a function of all covariates and shocks, $p_{t,k}$ is endogenous in both equations. However I dispose of enough instruments to estimate all coefficient without bias. In this framework, $s_{t,k}$ is an instrument for the price in the demand equation, while $\theta_{t,k}$, $e_{t,k}$ and $c_{t,k}$ allow to identify β^s in the supply equation. Intuitively, the inventories held by the producers are unknown of the wine merchants so they are supposed not to be of any influence to the quantity demanded[2]. Similarly, the exchange rates and the competitors harvests influence the equilibrium price only through the demand equation[3], because they alter the world market for wine. In that sense, the hypothesis of independence is theoretically backed. I estimate this equation by 2SLS and 3SLS using the generalized moments methods in order to allow for possible correlation between $\varepsilon_{t,k}^s$ and $\varepsilon_{t,k}^d$.

[2]The declaration of stocks is due to end of July, but is broadcast by the CIVB only in late December.

[3]In order to check that statement, I have interviewed the directors of five main cooperative wineries in Bordeaux. Since they are almost only paid in euro, they are not direcly concerned with the exchange rates variations. Altough they theoretically should, they do not adjust their behavior to the variations of the exchange rates.

Table 1: Variance-covariance matrix of the errors terms estimated in the first stage of 3SLS

	Supply	Demand
Supply	0.063	0.040
Demand	0.040	0.038

Table 2: Estimation of the two equations system (1)

Variable	Supply		Demand	
	2SLS	3SLS	2SLS	3SLS
Price elasticity	0.30	0.30	-1.64*	-1.79**
Stocks	0.68**	0.68**		
Quality			-2.04	-2.47
Exchange rate			-1.72*	-1.58*
Competitors harvest			-0.24	-0.93
Trend	-0.004	-0.004	-0.01***	-0.01***
Quarter 1	0.78	0.78	36.94	50.56**
Quarter 2	0.72	0.72	37.32	50.93**
Quarter 3	1.29	1.29	37.84	51.46**
Quarter 4	1.04	1.04	50.95	37.33**

Legend: The stars account for the level of significance: *: 10% ; **: 5% ; ***: 1%. The others coefficients are not significant at the 10% level.

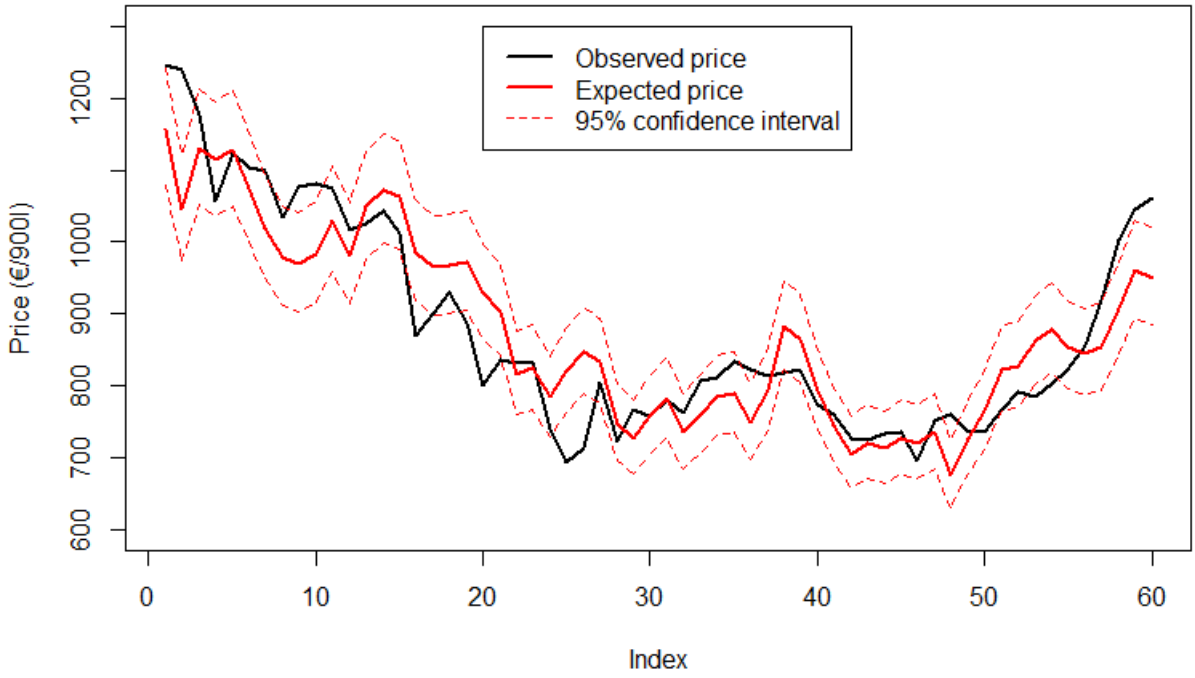
4 Main results

The two estimations schemes lead to very similar results. However, a Hausman test indicates that the 3SLS estimators should be more efficient. Tables 1 and 2 display respectively the estimates of the matrix $(\sigma_{i,j})_{(i,j)\in\{s,d\}}$ and of the coefficients of the model.

The demand shocks are much more volatile than the supply shocks. The demand shocks and the the supply shocks are highly correlated: the Pearson correlation coefficient is 0.77. Most importantly, it indicates that the supply and the demand adjust together to exogenous shocks so as to mitigate the price fluctuations. It must be the result of the instant responses to shocks that are hidden at the quaterly scale. The residuals for each equation show no significant autocorrelation, which ensures that the initial stocks are exogenous for each period.

All the coefficients take the expected sign, except from the one associated with quality. My main result is that quality is not significant. As compared to the influence of a shock on the producers inventories or on the exchange rate, quality does not seem to drive the price. The stocks are of great importance on the supply curve, and significant at the 5% level in both estimation schemes. A Student test fails to reject the equality of the supply price elasticity to zero, but the demand elasticity is significant to the 5% level with the 3SLS estimates. The demand elasticity is strikingly high in

Figure 1: Model fit



absolute value: an increase of 10% in the price imply a demand fall of 16.4% to 17.9%. This is however in line with the wine demand elasticity of -1.65 estimated in Nerlove (1995) in the case of the Sweden consumer market. Moreover, the importance of the price crisis of the early 2000's, seem to advocate for a high level of competition, therefore backing my large estimate for the elasticity of demand. I denote a significant decreasing trend in the demand. It must be the combined result of both the decrease in wine consumption in France and Europe, and of the increasing competition on the world market.

The model provides a rather good fit with a root mean squared error of 0.071. The figure 1 plots the series of observed prices together with the expected price according to the model, and with the two confidence bands at 95%[4].

[4]According to the model, the price is given at each period by the following reduced form formula:

$$p_{t,k} = \frac{\alpha_k^s + \gamma s_{t,k} + \zeta^s t - \alpha_k^d - \lambda\theta_{t,k} - \delta e_{t,k} - \eta c_{t,k} - \zeta^d t}{\beta^d - \beta^s} + \frac{\varepsilon_{t,k}^s - \varepsilon_{t,k}^d}{\beta^d - \beta^s}$$

Let $\varepsilon_{t,k} = \frac{\varepsilon_{t,k}^s - \varepsilon_{t,k}^d}{\beta^d - \beta^s}$, then the variance of $\varepsilon_{t,k}$is given by $\frac{\sigma_{s,s} + \sigma_{d,d} - 2\sigma_{s,d}\sqrt{\sigma_{s,s}}\sqrt{\sigma_{d,d}}}{\beta^d - \beta^s}$ as the two terms are correlated. The confidence bands are obtained under the assumption that $\varepsilon_{t,k}$ follows a distribution $N(0, Var(\varepsilon_{t,k}))$.

5 Perspectives

Although the quality of Bordeaux wines exhibits a high volatility across vintages, the latter actually does not play a role in the formation of the market price. Paradoxically, the market for most Bordeaux wines may be viewed as a commodity market where all vintages are perfectly substituable. This has been confirmed by all my contacts within the wine industry in Bordeaux.

What I still need to do is to apply the method to other appellations of Bordeaux. Quality variations may have more importance in the formation of the price for higher-quality designations like Margaux or Saint-Julien. Anticipation of the harvest (through weather variables measured in the spring and summer) might also be included into the model, as it is done by Osborne (2004) without quantity data. A resolution for the competitive storage equilibrium with multiple state variables could also be conducted, with a fruitful comparison of the predicted optimal quantity variables and the real quantity data, as it is done by Bobenrieth et al. (2013) for the three main staple commodities.

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