

# Reputation and Quality Effects on Wine Prices: A Comparison Between En Primeur and Bottled Bordeaux Wine

Héla Hadj Ali, GREMAQ Toulouse  
and Céline Nauges, LEERNA-INRA, Toulouse

23rd April 2003

## Abstract

## Introduction

The International Office of Vine and Wine reports that the world total viticultural area reached 19.55 millions acres in 2000. Two-thirds of this surface is located in Europe (mainly in France, Greece, Italy, Portugal and Spain) and represent 56% of the overall wine growing. France remains a leading actor in the world wine market despite the sharp competition following the emergence of new-world producers (South Africa, Chile, New Zealand among others) of high quality wine. Even if the market share of France in the global wine production in volume has decreased from 38% in 1990 to 26% today,<sup>1</sup> the most prestigious Bordeaux wines,<sup>2</sup> namely the ones with a long-time established reputation like the *Grands Crus Classés*, remain the most famous and among the most expensive wines worldwide. Could it be that reputation is better valued than quality in the Bordeaux wine region? We propose to address this question by analyzing two distinct Bordeaux wine markets: the ‘en primeur’ market and the more traditional market for bottled

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<sup>1</sup>*La revue du vin de France* n°451, May 2001.

<sup>2</sup>From a total value of sales of 3.1 billion euros in 2001, 1.2 billion come from wine sold on foreign markets corresponding to a volume of 2.5 million of hectolitres (source: Conseil Interprofessionnel du Vin de Bordeaux).

wine.

The en primeur market, which is a kind of ‘future market’ specific to the Bordeaux wine region, occurs every year in spring. En primeur refers to the process of buying new wine several months after the grape harvest while it is still in barrel. This market allows producers to get liquidity before the wine is bottled,<sup>3</sup> but it also allows buyers to get rare wine at potential bargain prices, hence attracting more and more financial speculators (see Hadj Ali and Nauges, 2002). The en primeur market in Bordeaux region may generate up to 600 million euros a year.<sup>4</sup>

The opening of the en primeur market constitutes one of the most important events on the Bordeaux market place. The new vintage is offered for the first time and the prices, set by the producers themselves, are revealed. Little is known about the way producers choose these prices. If prices are expected to vary with objective characteristics such as appellation and ranking,<sup>5</sup> there is however a large uncertainty still attached to future quality as the wine is not yet matured. Indeed, information regarding future quality of the wine mainly come from the observation of the climatic conditions that prevailed during the growing year.<sup>6</sup> When the wine has been bottled and released on the traditional (competitive) market, some additional information regarding quality may be obtained through personal or experts’ tasting. Is there any significant effect of the introduction of competition and the new information on quality?

Using panel data, we show that reputation and quality have very similar impacts on the en primeur price and on the price of bottled wine. Reputation, that we choose to measure by the

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<sup>3</sup>Payment occurs at the time of the en primeur sales and bottled wine is delivered one to two years after.

<sup>4</sup>Le Monde, 2001.

<sup>5</sup>The appellation is a regional designation and the rank is a system of classification specific to the Bordeaux region.

<sup>6</sup>Tasting sessions involving wine experts may also occur before the opening of the en primeur market however we do not observe such judgement or grade in our data set.

classification of wine (both in terms of ranking and appellation), is found highly correlated with the en primeur price chosen by the producers but ranks and appellation are also highly priced by the consumers in their purchase of bottled wine. Reputation is highly valued in particular for the wines belonging to the most famous groups namely the *Premiers Grands Crus Classés* inside both the 1855 and the Saint Emilion classifications. Furthermore, the vintage year (a proxy for climatic conditions of the growing year) is found to be a significant determinant of both prices (en primeur price and the price of bottled wine) while the current quality of each bottled wine as measured by experts' ratings is not highly valued by consumers.

Results about en primeur price are new in this literature, while our results on bottled wine confirm the findings of Ginsburgh, Monzak and Monzak (1994), Combris, Lecocq and Visser (1997) and Landon and Smith (1998), who also analyze price data from the Bordeaux wine region. These three studies agree on the significant impact of objective characteristics (vintage, region etc.) and reputation (as measured by ranking) on wine price on the one hand, and find a moderate influence of current quality (as measured by experts' grades or sensory characteristics) on the other hand.

The paper is organized as follows. In Section 1, we define precisely what we call reputation and quality. In Section 2 we present the data and make some descriptive analysis of wine price on the en primeur market and on the market for bottled wine. Econometric analysis addressing the issue of reputation and quality impacts on wine price for the en primeur market and for the market for bottled wine are detailed respectively in Sections 3 and 4. Section 5 summarizes the main results and concludes.

# 1 Reputation and quality

The impact of the characteristics of a good on its price is commonly addressed through the estimation of a hedonic function. If the good is traded on a competitive market, the estimated coefficients from the regression of price on characteristics can be interpreted as the valuation of the good attributes by the consumers. This interpretation is obviously erroneous in the case of en primeur wine as the price is set by the producers themselves. The estimated parameters will instead measure the correlation between the price set by the château and the characteristics of the wine.

In the Rosen (1974) framework, the characteristics used in the hedonic function should be the ones for which consumers have perfect information. Objective characteristics such as appellation, rank and vintage (or harvest) year are good candidates as they are easily accessible to the consumers through the label.

In the present paper, we call reputation the combination of appellation, ranking and name of the château. We do not follow the approach used by Landon and Smith (1997, 1998) and Oczkowski (2001), who measure reputation through lagged quality scores, because we are primarily interested in measuring the impact of the long-time established fame of Bordeaux châteaux on the price of wine.

Indeed, the first system of ranking in the Bordeaux region dates back to 1855. It was during the Exposition Universelle that Napoléon III, the Emperor of France at the time, invited Bordeaux's wine brokers to rank the region's wines according to price. They eventually agreed upon a five-tier, Classed Growths or *Crus Classés* (CC), classification system ranging from

*Premiers Crus* (1CC, First Growth) to *Cinquièmes Crus* (5CC, Fifth Growth). The final list consisted of 61 leading châteaux. Nearly all the selections came from the Médoc region,<sup>7</sup> with the exception of the most prominent Graves château, Haut-Brion (Pessac Léognan appellation), and the highly rated, sweet wines of Sauternes and Barsac. Sweet wines are classified in *Premiers Crus Classés* (1CC, First Growth) or *Deuxièmes Crus Classés* (2CC, Second Growth), the château Yquem being the only one classified in *Premier Cru Supérieur* (1CS, First Superior Growth). This Classification System of 1855, largely unchanged to this day, is more and more contested because, as explained by Combris, Lecocq and Visser (1997), “Many châteaux have changed ownership, certain châteaux have doubled even tripled their cultivation surface, new vinification methods have been introduced”. The *Crus Bourgeois* (CB), which are the châteaux from the Médoc region that were not originally ranked, were not classified until 1920. By 1932, there were 444 châteaux listed and numbers have fluctuated ever since. A new classification of the *Crus Bourgeois* (CB) of the Médoc and Haut Médoc is currently in process and should be displayed around June 2003.

Saint Emilion wines (Saint Emilion Grand Cru appellation) were not formally classified until 1955 (subsequently revised in 1969, 1985/86 and 1996), with a distinction between *Premiers Grands Crus Classés A* (C1A, First Top Growth A), *Premiers Grands Crus Classés B* (C1B, First Top Growth B) and *Grands Crus Classés* (C, Top Growth). Similarly, some of the wines of Graves (Pessac Léognan appellation) were not officially classified (CC, Classed Growth) until 1953 with others following in 1959. The Pomerol wines always refused being classified. Thus

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<sup>7</sup>Haut Médoc, Margaux, Médoc, Moulis, Pauillac, Saint Estèphe, Saint Julien are the appellation groups found in our sample.

the non-classified (NC) wines in the sample are the Pomerol wines and those wines that are not classified while belonging to classified appellation groups.

Apart from reputation, quality is expected to be another determinant of the price of wine. The debate on the price-quality relationship has always been controversial (see Lecocq and Visser, 2002 for a good survey and some illustrative examples). The quality of a wine depends on many factors. We may distinguish two stages in the wine-making process. First stage would be the growing of grapes until the harvest. It is well known that the quality of the grapes (aromatic intensity, level of acidity and sugar, quantity of tannins, etc.), for a given grape variety, is highly influenced by the climatic conditions of the growing year, but also by decisions taken by the producer such as the clearing of grapes, the date of harvest, the type of harvest (manual or mechanical), the level of investment. The second stage would be the so-called making-process of the wine, which takes place after the harvest. The cellar master (*maitre de chai*) has to take decisions (grape mixing, type of barrels, duration of fermentation and maturation processes, temperature, etc.) during the whole making-process (which lasts often eighteen months in the Bordeaux region) that will be determinant for the future quality of the wine. These decisions are not observable neither by the econometrician, nor by the consumer in general. Only when the wine is bottled some additional information on quality will be publicly known and easily accessible to the consumer through wine guides or magazines. Note that the *en primeur* sales take place before the second stage is completed so the only information available to the consumers (and to the econometrician) at the opening of the *en primeur* market will be the expected overall quality of the wine based on the information on the climatic conditions that prevailed before the

harvest.

Climatic conditions have been included in the hedonic price equation by Ashenfelter, Ashmore and Lalonde (1995), Byron and Ashenfelter (1995) and Ginsburgh, Monzak and Monzak (1994) and have been proved highly significant. In the present study, we will use vintage dummies to control for the climatic conditions of the growing year, both in the model of en primeur price and in the model of the price for bottled wine. The information on the quality of each particular wine, as provided by the experts (*Robert Parker* here) during tasting sessions, will be available only when the wine is in bottle and thus will be included in the hedonic equation for bottled wine only. We argue that it is better to use a single and publicly available measure of quality such as experts' ratings<sup>8</sup> instead of sensory attributes (such as the wine's aroma, body, firmness etc.) or chemical characteristics (such as the wine's sugar and acid level) as done in Combris, Lecocq and Visser (1997, 2000) or Nerlove (1995) because these latter characteristics are not easily observable by the consumer.<sup>9</sup>

## 2 Descriptive analysis

The data record white and red wine produced by 185 châteaux between 1982 and 1998, except for the 1984 vintage,<sup>10</sup> belonging to 15 different appellation groups and to 11 different ranks.

Prices vary considerably across the wines in the data set. En primeur price and the price of bottled wine are known for every wine that we define as the production of one château and one

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<sup>8</sup>Oczkowski (1994, 2001), Gergaud (1998), Jones and Storchmann (2001), and Schamel and Anderson (2001) also use grades as a measure of the quality of the wine.

<sup>9</sup>To some extent, this has been confirmed by Combris, Lecocq and Visser (1997, 2000) who show that sensory traits are statistically insignificant for Bordeaux and Burgundy wine.

<sup>10</sup>This vintage has been removed from the catalogue by the broker.

Table 1: En primeur prices for each rank (prices in 1990 euros equivalent)

	1855 ranking							Saint Emilion GC			Graves	NC
	1CS*	1CC	2CC	3CC	4CC	5CC	CB	C1A	C1B	C	CC	
Mean	96	28	14	10	10	9	7	40	16	11	15	17
Std Dev	20	13	7	2	3	3	2	17	7	5	9	12
Nb obs.	7	127	194	83	103	138	158	28	92	153	166	205

\* comprises Château Yquem only.

vintage. They correspond to the price of a 75cl bottle in euro equivalent (base 1990). The price of the bottled wine is observed every quarter between June 1996 and July 2000, which amounts to 16,586 observations in all. As our data were provided by one of the most famous broker house in Bordeaux they can be considered as fairly representative of the market for Bordeaux wine on the Bordeaux place.<sup>11</sup> For quality measures, we will refer in the present study to the overall vintage judgement as given by *Wine Spectator* (see Appendix), the largest circulation U.S. wine magazine, and the grade attributed to each wine by *Robert Parker's* famous guide.<sup>12</sup>

## 2.1 The en primeur price

We report in Table 1 the average en primeur prices inside each ranking for the whole period covering vintage years from 1982 to 1998 (1,454 observations in all). These statistics show that en primeur prices match the hierarchy of ranking: inside each ranking, the greater the rank, the higher the en primeur price. In the 1855 classification for example, prices of wine belonging to the group of *Premiers Crus Classés* (1CC) lie largely above the price of those being classed from *Deuxièmes Crus Classés* (2CC) to *Cinquièmes Crus Classés* (5CC).

Table 2, which gives some descriptive statistics on en primeur prices as observed for each

<sup>11</sup>The broker's catalogue contains market values for wine computed from the prices proposed by all the wholesale wine merchants on the Bordeaux place.

<sup>12</sup>Both quality indices rise by unit intervals from a minimum of 50 to a maximum of 100.

Table 2: En primeur prices for each vintage year (prices in 1990 euros equivalent)

	82	83	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Mean	15	17	19	15	17	13	16	14	14	9	9	10	13	17	20	17
Std Dev	16	15	15	14	13	7	10	11	15	5	5	7	8	12	15	13
Nb obs.	68	59	68	76	17	87	98	102	33	85	115	118	127	129	145	127

vintage year, shows the fluctuation of en primeur prices between 1982 and 1998. Three sub-periods may be distinguished: in the first sub-period (82-91 vintage) the en primeur price does not vary much from one vintage year to another. Between 1992 and 1994 the average en primeur price decreased and increased after 1995 until 1998. Indeed, the wine of the 1991 to 1994 vintages was not recognized by *Wine Spectator* as a ‘good’ wine, as was also the case for the 1997 vintage. However the latter was sold at the highest en primeur price for the period considered. So if the trend of the en primeur prices matches the tasters judgement (price increases when overall quality of the vintage is much more appreciated) at the beginning of the period, this seems no longer true at the end as illustrated in Figure 1. In addition to the average en primeur price for all wines and the grade attributed by *Wine Spectator*, we graph separately average en primeur prices of the *Premiers Grands Crus Classés* from the Médoc region<sup>13</sup> and from the Saint Emilion region (C1A). We set apart these two groups of châteaux as they are the most famous coming from the Bordeaux wine region and they may be traded at prohibitive prices in auction markets when getting old, as luxuries. Saint Emilion *Premiers Grands Crus Classés A* are sold at the highest price on the en primeur market, followed by the Médoc *Cinq Grands Crus* (5GC). They follow a similar trend all along the period except for the 1998 vintage (the châteaux from Saint

<sup>13</sup>The *Cinq Grands Crus* (5GC) are the five châteaux inside the 1CC group that produce red wine: château Haut-Brion, château Lafite-Rothschild, château Latour, château Margaux and château Mouton-Rothschild.

Figure 1: En primeur prices and *Wine Spectator* ratings for the 1982-1998 vintages

Emilion increased the en primeur price whereas the ones from Médoc lowered it). We clearly see from the picture that a structural change occurred in the mid-nineties. This effect can also be illustrated by computing the correlation coefficients between the overall grade attributed to the vintage by *Wine Spectator* and the average en primeur price (see Table 3).

These simple statistics give interesting insights: on the whole period the correlation coefficient between en primeur price and grade is moderate (0.21 when considering all wines). The results are much different if correlation coefficients are computed before and after 1994. When considering the wine from the 1982 to 1993 vintages, en primeur price and grade are positively correlated, this correlation being quite strong especially for the *Premiers Grands Crus Classés*: 0.84 and 0.86 respectively for the *Cinq Grands Crus* from Médoc and the *Premiers Crus Classés A* from Saint Emilion. However, for the 1994 to 1998 vintages, the correlation coefficient becomes negative,

Table 3: Correlation between price and grade

	Overall	5GC	C1A
82-98	0.21	0.25	0.13
82-93	0.40	0.84	0.86
94-98	-0.41	-0.41	-0.30

showing clearly that the trend of en primeur prices no longer matches the experts' judgement.<sup>14</sup>

## 2.2 The price of bottled wine

Prices of bottled wine from 1982 to 1998 vintages are observed between June 1996 and July 2000. During this period, the market for Bordeaux wine experienced feverish activity following the entry on the market of wealthy buyers, namely multi-millionaires from emerging market economies (Taiwan, Singapore, Brasil, Russia...). The 'French paradox' assessing health benefits of wine consumption also contributed to the success of the wine market. This wealth effect generated an extraordinary inflation which is illustrated by our data (see Table 4). The average price (all wines) per quarter almost doubled between the first quarter (6-7/96) and the sixth quarter (8-10/97). Because of large market fluctuations we consider from now on a detrended price in order to correctly assess the impact of the wine's characteristics on its price. A quarterly price index is built from the regression of the log of price on quarter dummies.

Figures reported in Table 5 show that the price of bottled wine also matches the ranking. We clearly see that the *Premiers Crus Classés* (1CC and C1A groups) are priced significantly above the others. Furthermore, it is shown from Table 6 that prices embody simultaneously an 'age' effect and a 'vintage' effect. On the one hand, quality varies between vintages: 'very good'

<sup>14</sup>The correlation coefficients in the column *Overall* of the table remain almost the same if we exclude the 5GC and C1A wines.

Table 4: Average price of bottled wine for each quarter (prices in 1990 euros equivalent)

	6-7/96	8-10/96	11/96-1/97	2-4/97	5-7/97	8-10/97	11/97-1/98	2-4/98
Mean	28	33	36	43	51	54	54	52
Nb obs.	816	850	832	781	757	972	951	986

  

	5-7/98	8-10/98	11/98-1/99	2-4/99	5-7/99	8-10/99	11/99-1/00	2-4/00	5-7/00
Mean	54	53	49	48	49	51	49	49	47
Nb obs	1,030	1,034	1,146	1,046	1,040	1,079	1,126	1,071	1,069

Table 5: Prices of bottled wine for each rank (detrended prices in 1990 euros equivalent)

	1855 ranking							Saint Emilion GC			Graves	NC
	1CS*	1CC	2CC	3CC	4CC	5CC	CB	C1A	C1B	C	CC	
Mean	90	63	26	19	14	15	9	85	23	12	21	43
St Dev	21	57	20	12	7	11	5	50	13	8	20	87
Nb obs	115	1,632	2,405	965	897	1,506	1,563	380	1,176	1,760	1,709	2,478

\* comprises Château Yquem only.

Table 6: Price of bottled wine for each vintage year (detrended prices in 1990 euros equivalent)

	82	83	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Mean	86	41	45	43	38	31	40	44	23	16	16	16	21	18	14	13
Nb obs.	697	381	686	826	60	1,034	1,341	1,385	286	951	1,825	2,013	2,158	1,557	1,023	363

ones (1982, 1990, 1995) as well as ‘bad’ ones (1987, 1991 to 1994) are easily identifiable. On the other hand, the price gets higher when a bottle gets older: not only the wine gets better (up to a certain limit) but it also becomes even more difficult to find it on the market.

The ‘age’ effect is more emphasized in Figure 2 where we graph the average price of bottled wine at different ages (as measured in quarters).<sup>15</sup> We draw three separate curves: the average price for wines belonging to the *Cinq Grands Crus* group (5GC), the *Premiers Crus Classés A* group (C1A) and average price for all wines. We clearly see that the average price per bottle increases with age. Prices of wines belonging to 5GC and C1A groups are pretty close to each other but lie largely above average price of all wines. Note from the picture that the price starts to increase after the age of five years (20 quarters). The trend in prices of the top growth wines is similar to the trend in prices of the whole average until the age of around 15 years (60 quarters). Later, the price of the *Premiers Grands Crus Classés* (5GC and C1A) experiences a sharper increase, probably due to the scarcity of these most famous bottles.

### 3 Econometric analysis of the en primeur price

The descriptive analysis shows that en primeur price varies with wine ranking and the overall quality of the vintage as assessed by *Wine Spectator*. We propose to measure more precisely the relative impact of reputation and quality by regressing en primeur price on wine’s objective characteristics (ranking, appellation), and its vintage year. The year dummies will act as a proxy for climatic conditions of the growing year and thus for the overall quality of the vintage. These are the only variables that will be used to measure the impact of quality in this model

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<sup>15</sup>The average effect of age is computed with wine from different vintage years and so of different quality.

Figure 2: Price of bottled wine at different ages

as the grades that might be attributed to the wine during tasting sessions are not observed in our data set. We distinguish the group of the *Cinq Grands Crus* (5GC), the five red wines of the *Premiers Crus Classés* (1CC) group, by including a zero-one dummy variable. We take advantage of the panel form of the data by allowing for a random individual effect accounting for an unobserved château effect. Note that this effect might include the unobservable decisions taken by the producer during the growing process.

The model fitting the logarithm of the en primeur price is estimated using Generalized Least Squares. The overall regression is made on 1,454 wines produced by 163 different châteaux. Rank dummies have to be interpreted with respect to the group *Premiers Crus Classés* including white wine from 1CC and 1CS (we will call this group 1CCb from now on);<sup>16</sup> Barsac is chosen as the base case of appellation dummies and 1982 is the base year.

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<sup>16</sup>The *Premier Cru Supérieur* (1CS) group includes the château Yquem only.

Almost all vintage dummies are significant at a 95% confidence level. Note first that estimated coefficients are found negative for those years in which wine was said (see *Wine Spectator* grades) of ‘low’ quality (1987, 1991 to 1994) and positive for ‘good’ years, the only exception being the 1997 vintage (this vintage gets the highest coefficient even if experts disliked it). Thus the vintage dummies partly capture the impact of climatic conditions on the overall quality of the vintage. Second, the coefficients of vintage dummies corresponding to the years 1996 to 1998 are larger than the others in magnitude. As noted earlier, the post-1995 period corresponds to an exceptional boom in the Bordeaux wine market. So it might be the case that, after 1995, producers choose en primeur price considering not only the expected quality of the vintage but also the increased number of (wealthy) buyers on the market.

Note the significant effect of the rank on the en primeur price with respect to the group of *Premiers Crus Classés* (1CCb) (most dummies are significant at a 95% confidence level), even for the old 1855 classification which is today more and more contested: the lower the rank, the lower the en primeur price. We find in particular a large premium for those wines which belong to the top groups: *Cinq Grands Crus* and the best-classified Saint Emilion wines (C1A group).

Any of the appellation dummies are significant at the 95% confidence level.

These results show that reputation (here appellation and above all ranking) has a higher correlation than quality (as measured through vintage effects) with en primeur price. However, quality in this model is measured only by vintage dummies and, as mentioned in the first section, quality might also be determined by some unobservable decisions taken by the producer. These

Table 7: Econometric analysis of en primeur price

	Coef.	p-value		Coef.	p-value
constant	2.5942	0.0000			
<b>Vintage</b>			<b>Appellation</b>		
Vint. 83	0.0377	0.1960	Bordeaux blanc	-0.7063	0.0870
Vint. 85	0.1653	0.0000	Haut Médoc	-0.1957	0.3840
Vint. 86	0.0214	0.4330	Margaux	0.0390	0.8460
Vint. 87	-0.2914	0.0000	Médoc	-0.2241	0.5720
Vint. 88	0.0225	0.3980	Moulis	0.1247	0.6650
Vint. 89	0.2050	0.0000	Pauillac	0.1662	0.4300
Vint. 90	0.0599	0.0200	Pessac Leognan	0.3319	0.1680
Vint. 91	-0.2691	0.0000	Pomerol	0.3630	0.1240
Vint. 92	-0.3695	0.0000	Sauternes	0.3351	0.0800
Vint. 93	-0.2265	0.0000	Saint Emilion Grand Cru	-0.1901	0.6450
Vint. 94	-0.0943	0.0000	Saint Estèphe	0.1332	0.5320
Vint. 95	0.0962	0.0000	Saint Julien	0.2598	0.2000
Vint. 96	0.3662	0.0000			
Vint. 97	0.5215	0.0000			
Vint. 98	0.4196	0.0000			
<b>Rank</b>					
<u>1855 classification</u>					
<i>Cinq Grands Crus</i>	0.6590	0.0090			
2CC	-0.3410	0.0600			
3CC	-0.5419	0.0200			
4CC	-0.6205	0.0060			
5CC	-0.7018	0.0020			
CB	-0.8823	0.0000			
<u>Saint Emilion</u>					
C1A	1.1435	0.0160			
C1B	0.1806	0.6760			
C	-0.2898	0.4900			
<u>Graves</u>					
CC	-0.5837	0.0220			
<u>Non-classified</u>	-0.4738	0.0290			
Total number of observations					1,454
Total number of châteaux					163
R-squared					0.62

unobservable effects have been specified in our model as random château effects and estimations show that they account for 81% of the total unexplained variance.

Another possible approach to weigh the relative impact of reputation and quality is to compare the model fitting the en primeur price using ‘quality’ variables only (i.e. the model that includes as explanatory variables the vintage dummies only) with the overall model including also ‘reputation’ variables (i.e. rank and appellation groups). The R-square of the latter reaches 0.62 whereas the former has an overall fit equal to 0.12 only, which shows that the introduction of ‘reputation’ variables improves to a large extent the explanation of en primeur price variations.

Finally, to get a more precise idea of the impact of reputation and quality we compute the marginal effect of each of the variables in the full model (see Table 8). As the dependent variable has been transformed in logarithm, taking the exponential of each estimated coefficient gives the ‘multiplicative’ marginal effect of the corresponding variable (relative to the base case when looking at dummy variables). As an example the marginal effect of being classified in the *Cinquièmes Crus Classés* (5CC) group is equal to 0.50; it means that, all other characteristics being equal, a wine belonging to this group will be priced 0.50 times the price of a wine classified in the *Premiers Crus Classés* (1CCb) group (the base case). Ranks exhibit marginal effects ranging from 0.41 for the *Crus Bourgeois* (CB) to 3.14 for the *Premiers Grands Crus Classés A* from the Saint Emilion region, which means that a wine classified C1A is priced around eight times a wine ranked CB, all others things equal. The magnitude of reputation effects (as measured by the marginal effects of the rank) is much larger than the magnitude of quality: the marginal effects corresponding to vintage dummies vary from 0.69 (1992 vintage) to 1.69 (1997

Table 8: Marginal effects in the model for en primeur price

Quality effect		Reputation effects	
Vint. 83	1.038	<u>1855 classification</u>	
Vint. 85	1.180	<i>Cinq Grands Crus</i>	1.933
Vint. 86	1.022	2CC	0.711
Vint. 87	0.747	3CC	0.582
Vint. 88	1.023	4CC	0.538
Vint. 89	1.227	5CC	0.496
Vint. 90	1.062	CB	0.414
Vint. 91	0.764	<u>Saint Emilion</u>	
Vint. 92	0.691	C1A	3.138
Vint. 93	0.797	C1B	1.198
Vint. 94	0.910	C	0.748
Vint. 95	1.101	<u>Graves</u>	
Vint. 96	1.442	CC	0.558
Vint. 97	1.685	<u>Non-classified</u>	0.623
Vint. 98	1.521		
		<u>Appellation groups</u>	
		Bordeaux blanc	0.493
		Haut Médoc	0.822
		Margaux	1.040
		Médoc	0.799
		Moulis	1.133
		Pauillac	1.181
		Pessac Léognan	1.394
		Pomerol	1.438
		Sauternes	1.398
		Saint Emilion Grand Cru	0.827
		Saint Estèphe	1.143
		Saint Julien	1.297

vintage).

## 4 The price of bottled wine

On the competitive market for bottled wine, wines of different ages are traded between a high number of sellers and buyers. As already spotted in the descriptive analysis, the impact of age on price is quite complex and as this relationship could be non-linear we include as covariates in the model the age of the wine both in level and in squares.

The model fits the logarithm of the detrended price of bottled wine, using Generalized Least Squares on a panel data set of 185 châteaux. Unobserved heterogeneity is, as in the previous model, accounted for by introducing a random château effect. Estimation results (see Table 9) show that 70% of price variability is explained by the model. The overall quality of the vintage as measured by *Wine Spectator* is highly valued by the consumers. Low quality wines such as the ones from the 1987, 1991, 1992 and more particular the 1997 vintages exhibit large negative estimated parameters. Indeed the vintage dummies capture almost exclusively the vintage ratings attributed by *Wine Spectator* as the correlation coefficient between estimated parameters and grade is equal to 0.81. The quality of the wine in particular, as evaluated by *Robert Parker's* grade, is found a significant but moderate determinant of price. The positive coefficient associated with the variable AGE confirms the intuition that a wine getting older will be higher priced. Furthermore, the significant and negative coefficient associated with the age squared confirms that the relationship between price and age is not linear. It is however difficult to be more precise as age impacts prices simultaneously through a scarcity effect (mainly for the good vintages) and a quality effect. It is important to know that this quality effect is not

Table 9: Hedonic analysis of the price of bottled wine

	Coef.	p-value		Coef.	p-value
constant	1.0409	0.0000			
<b>Vintage dummies</b>			<b>App. dummies</b>		
Vint. 83	-0.5810	0.0000	Bordeaux Blanc	-0.7745	0.0380
Vint. 85	-0.4481	0.0000	Graves Blanc	0.1192	0.7540
Vint. 86	-0.4770	0.0000	Haut Médoc	0.3903	0.0560
Vint. 87	-0.9347	0.0000	Margaux	0.6848	0.0000
Vint. 88	-0.5846	0.0000	Médoc	0.6832	0.0620
Vint. 89	-0.4534	0.0000	Moulis	0.6362	0.0100
Vint. 90	-0.4079	0.0000	Pauillac	0.8404	0.0000
Vint. 91	-1.0737	0.0000	Pessac Léognan	0.7450	0.0010
Vint. 92	-1.2072	0.0000	Pomerol	1.0415	0.0000
Vint. 93	-0.9919	0.0000	Sauternes	0.0376	0.8250
Vint. 94	-0.9533	0.0000	Saint Emilion Grand Cru	0.4946	0.0980
Vint. 95	-0.8449	0.0000	Saint Estèphe	0.6928	0.0000
Vint. 96	-0.9600	0.0000	Saint Julien	0.8149	0.0000
Vint. 97	-1.0518	0.0000	Fronsac	-0.1927	0.6050
Vint. 98	-1.0119	0.0000			
<b>Rank dummies</b>			<i>Parker's rating</i>	0.0255	0.0000
<u>1855 classification</u>					
<i>Cinq Grands Crus</i>	0.7804	0.0010			
2CC	-0.3735	0.0170	AGE	0.0052	0.0000
3CC	-0.4925	0.0160	AGE×AGE	-0.0001	0.0000
4CC	-0.7048	0.0000			
5CC	-0.8245	0.0000			
CB	-1.0248	0.0000			
<u>Saint Emilion</u>					
C1A	1.1122	0.0030			
C1B	-0.0736	0.8150			
C	-0.6026	0.0450			
<u>Graves</u>					
CC	-0.7373	0.0010			
<u>Non-classified</u>	-0.6233	0.0010			
Total number of obs.					16,586
Total number of châteaux					185
R-squared					0.70

Table 10: Marginal effects in the model for bottled wine

<b>Reputation effects</b>		<b>Quality effects</b>	
<b>Appellation effects</b>		<b>Vintage effect</b>	
Bordeaux Blanc	0.461	Vint. 83	0.559
Graves Blancs	1.127	Vint. 85	0.639
Haut Médoc	1.477	Vint. 86	0.621
Margaux	1.983	Vint. 87	0.393
Médoc	1.980	Vint. 88	0.557
Moulis	1.889	Vint. 89	0.635
Pauillac	2.317	Vint. 90	0.665
Pessac Léognan	2.106	Vint. 91	0.342
Pomerol	2.833	Vint. 92	0.299
Sauternes	1.038	Vint. 93	0.371
Saint Emilion Grand Cru	1.640	Vint. 94	0.385
Saint Estèphe	1.999	Vint. 95	0.430
Saint Julien	2.259	Vint. 96	0.383
Fronsac	0.825	Vint. 97	0.349
		Vint. 98	0.364
<b>Ranking effects</b>		<i>Parker's rating</i>	1.026
<u>1855 classification</u>		age	1.005
<i>Cinq Grands Crus</i>	2.182		
2CC	0.688		
3CC	0.611		
4CC	0.494		
5CC	0.438		
CB	0.359		
<u>Saint Emilion</u>			
C1A	3.041		
C1B	0.929		
C	0.547		
<u>Graves</u>			
CC	0.478		
<u>Non-classified</u>	0.536		

straightforward as the time before a wine reaches maturity can vary from a wine to another (it depends among others on the degree of tannin).<sup>17</sup>

Reputation influences the price of bottled wine as was the case for the en primeur price. However, unlike the en primeur model most of the appellation dummies are significant relative to the base case (Barsac). The highest coefficient associated with the Pomerol appellation group could be explained because of the presence of prestigious wines such as Petrus in this non-classified appellation group.

We repeat the same exercises as before, fitting first the model of bottled wine price using variables influencing quality only (vintage year, *Parker's* grade, and age of the wine<sup>18</sup>). The overall R-square is found equal to 0.42 (0.12 in the en primeur price model), that we have to compare to 0.70 which is the R-square obtained when 'reputation' variables are incorporated. Second, we measure that the unobservable château effects represent 71% (88% in the en primeur price model) of total unexplained variance of the whole model. These two results might suggest that there is more information on quality while the wine has been bottled and that quality has a stronger impact on the price of bottled wine than on the en primeur price.

As in the previous section we compute the marginal effect of each variable (see Table 10). This table shows that the marginal effects of the ranking are large, ranging from 0.36 for the *Crus Bourgeois* (CB) group to 3.04 for wines from Saint Emilion belonging to the group of *Premiers Grands Crus Classés A* (C1A). Note that the ordering as well as the magnitude of the marginal effects of the ranks are very similar in both models. As for the en primeur price, there is a large

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<sup>17</sup>The tannin, which is a major component in the structure of red wine, depends on grape variety. A structure involving more tannin will benefit more from a long stay in the cellar.

<sup>18</sup>The R-square of the sub-model is unchanged whether the age of wine is included or not.

Table 11: Marginal effects of cross rates and ranks on the price of bottled wine

	16,586 wines <i>Parker</i>	6,383 wines <i>Parker</i>	6,383 wines <i>Wine Sp.</i>
<u>1855 classification</u>			
<i>Cinq Grands Crus</i> (1CC red)	1.051	1.053	1.037
1CC white	1.035	1.035	1.024
2CC	1.030	1.030	1.023
3CC	1.020	1.028	1.022
4CC	1.022	1.024	1.018
5CC	1.024	1.027	1.019
CB	1.017	1.021	1.015
<u>Saint Emilion</u>			
C1A	1.035	1.054	1.037
C1B	1.017	1.026	1.019
C	1.012	1.031	1.015
<u>Graves</u>			
CC	1.024	1.026	1.020
<u>Non-classified</u>	1.029	1.030	1.020

price premium associated with the groups of the *Premiers Grands Crus Classés* (5GC and C1A). For bottled wine, appellation effects are also quite important as shown by the magnitude of the marginal effects. Relative to Barsac, these effects range from a minimum of 0.46 for Bordeaux Blanc to a maximum of 2.83 for Pomerol. In contrast, age and *Parker's* ratings have a much smaller impact on price. An additional quarter in age increases the price by a factor of 1.01 or, equivalently, an additional one year for a bottle drives the price up by a factor of 1.06. The marginal impact of the quality as announced by *Parker* is the following: five additional points would push the price up by 14%.

Reputation and quality as judged by the experts might not be independent. This may be checked by including the cross-product of *Parker's* rating and wine ranking as explanatory variables in the model. To avoid multicollinearity, we only keep in the model the cross-products

and we remove the rank dummies and *Parker's* rating as variables in level. Marginal effects of variables crossing *Parker's* rating and ranks are reported in column 2 of Table 11. We also propose to compare the ratings attributed by *Robert Parker* to the ones given by the *Wine Spectator* magazine. As we do not observe *Wine Spectator* ratings for each of the wines, we estimate the model and compute the marginal effects on the sub-sample of the 6,383 wines for which we have both *Parker* and *Wine Spectator* grades. Marginal effects are found in columns 3 and 4 of the same table.

The marginal effect is larger for those wines belonging to top ranks (1CC and C1A) which would mean that consumers value more a better judgement for top quality wines than for wines belonging to lower ranks. From columns 3 and 4, we see that marginal effects are always larger when *Parker* is the advisor, which may show the stronger influence of *Robert Parker* on consumers' choices.

## 5 Conclusion

This paper addresses the issue of measuring the relative impact of reputation and quality on the price of wine, where the reputation of a wine is defined through its appellation and its rank. The analysis is made on a panel data set of châteaux from the Bordeaux wine region, covering sixteen vintages and including time-series observations of prices representative of the Bordeaux region. The analysis of reputation is highly relevant as the old system of classification dates back to the nineteenth century. The well-established reputation of the châteaux is found to be determinant in the setting of en primeur price by the producers but also to be highly valued by the consumers when they purchase bottled wine. Reputation is highly priced, in particular when

the wine belongs to the most famous groups namely the *Premiers Grands Crus Classés* inside both the 1855 and the Saint Emilion classifications.

The overall quality of the vintage, as measured in the present study by *Wine Spectator's* grade, is significantly valued by the consumers on the market for bottled wine, but this impact is much smaller than the impact of reputation. On the en primeur market it seems that during the last four years the way the producers choose the en primeur prices have changed. Producers' behaviour might have been influenced by the boom experienced by the wine market during the second part of the decade.

The impact of *Robert Parker's* ratings is found to have a small even if significant impact on the price of bottled wine.

We also show that reputation and quality effects are not independent and that a better grade is more highly valued by the consumers when they consider top quality wines. Furthermore, our results emphasize the dominant influence of *Robert Parker* on consumers' choices.

In addition to pioneering results on en primeur price, this analysis confirms previous findings that reputation is a major determinant of the price of bottled wine and that present quality as measured by experts' ratings has a much smaller impact. Thus despite the criticism that the ranking system should be updated, we show that consumers still highly value the rank of the wine in the Bordeaux region.

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## Appendix: Overall *Wine Spectator* ratings for vintage years

*Wine Spectator* magazine makes a four-tier classification: *Classic*, *Outstanding*, *Good to very good* and *Average*; the *Classic* gathering the best wines.

Vintage year	Ratings
1982	95 (Classic)
1983	86 (Good to very good)
1985	93 (Outstanding)
1986	95 (Classic)
1987	76 (Average)
1988	93 (Outstanding)
1989	98 (Classic)
1990	97 (Classic)
1991	72 (Average)
1992	72 (Average)
1993	82 (Good to very good)
1994	85 (Good to very good)
1995	95 (Classic)
1996	85 (Good to very good)
1997	81 (Good to very good)
1998	90 (Outstanding)