

Wine Price Function and its Variables: The Case of Bordeaux Wines

Abstract

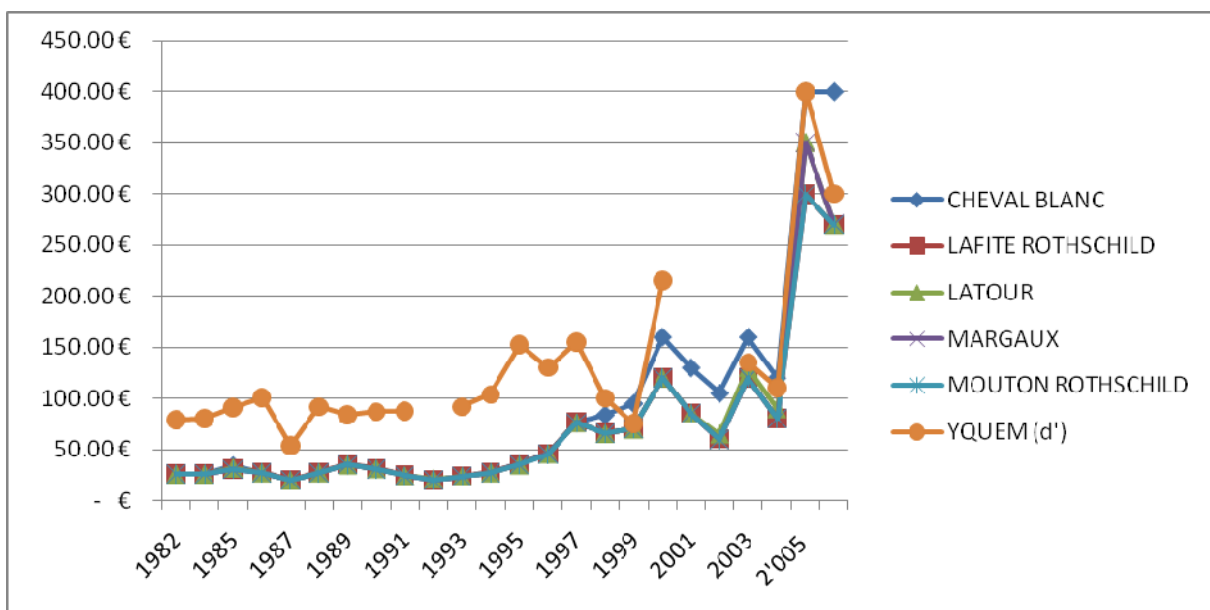
The purpose of this study is to identify the variables that influence wine prices. A large database listing all the prices from retailers and different other variables for each bottle (brand name, vintage, ratings, time-series prices, etc.) has been build. For the moment, we only focus on Bordeaux wines and the matrix size is 29.471 lines of Bordeaux wines X 243 prices of retailers. The findings will be presented during the conference since we are restructuring the database in order to exploit it and not to loose information represented by the huge number of missing values. The model used is hedonic price function where hedonic prices will be estimated by regressing wine prices on wine attributes.

Keywords : hedonic price function, retailers, Bordeaux wines

Introduction

When we talk about wine prices, most consumers think about en-primeur prices where every year, the vintage seem to be better and better and seem to be the best vintage ever made (at least according to some wine critics). In the following chart, we can observe that prices of “en-primeur Grand Cru” wines has increased a lot during the last 25 years, especially for the vintage 2005. Unfortunately, the en-primeur database is very weak in term of variables and we cannot explain the price evolution very well except based on the climate of the vintage or the ratings given by the American wine critics Robert Parker. Thanks to the large database made by the group Vinfox, a huge matrix composed of 29.471 lines of Bordeaux wines and 243 prices of retailers will help us providing a better insight on the influence of different variables on wine price.

Chart 1. Price evolution of en-primeur Grand Cru wines during the last 25 years.



1. Literature Review

In order to identify which variables would influence the wine prices, we mainly went through the wine economic literature and we listed the different independent variables that were influencing the price of wine. The following table shows the variables used by the authors in their study in order to determine the wine prices.

Table 1. Variables influencing wine prices

Variables influencing price of wine	Lecocq & Visser (2006)	Ashenfelter (2008)	Hadj et al (2008)	Jones & Storchmann (2001)	Miler et al. (2007)	Horowitz et al. (2002)
Jury grade	X		X	X	X	X (wine and winery)
Sensory variables	3					
Rating	X		X			
vintages	1989-1998	X		X		X
Vintages (time series analysis)				X		
Appellations	4 (Bordeaux) 0 (Burgundy)					X
Climate		Temperature Rain		X		
grapes				X		
Scarcity (cases produced)				X	X	X
Winery established after 1990						X
Storage (drinkable now or later)					X	

The following articles the authors haven't yet in his possession should also be analysed in order to complete this literature review:

- Benfratello, L., M. Piacenza and S. Sacchetto, 2004, "What Drives Market Prices in the Wine Industry? Estimation of a Hedonic Model for Italian Premium Wines," *Ceris-CNR*, Working Paper no.11.
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- Lockshin L., “Components of wine prices for Australian wine: how winery reputation, wine quality, region, vintage and winery size contribute to the price of varietal wines, *Australian Marketing Journal*, Vol.11, N°3, 2003.

2. Database

The Matrix is composed 29471 lines (Bordeaux wines) X 243 prices of retailers. For each Bordeaux brand, we also have the following information:

- A set of 88 **Bordeaux Châteaux** with 29471 references;
- The price of Châteaux **vintages** from 1945 to 2007 (only bottle from 700-800ml) sold by each retailer;
- Time-series on the price of each vintage for all Bordeaux Châteaux sold by the retailers (from 1997-2009), variable called “**issued**”;
- The **ratings** coming from the main wine critics: Gabriel, Wine Spectator, Bettane, Coates, Parker, Gault & Millau, Tanzer, Hachette and Vinum;
- And of course, the **price** for each bottle sold by more than **243 retailers**

In other words, for each issue of the Vinfox database: 2009, 2008, 2007... 1996, we have the following data:

- Wine brands (all the Bordeaux Chateaux sold in Switzerland)
- And for each brand:
 - o price for different vintages
 - and for each vintage:
 - price per retailer ;
 - ratings of main guides.

3. Identification of main contributions

On the one hand, we have a larger and more complete database in comparison with the ones used in the literature. In other words, next to the wine attributes such as production, ranking and grapes, different ratings can be included in the model. Those ratings come from guides such as: Gault et Millau, Coates, Gabriel, Parker, Tanzer, Wine spectator, Bettane, etc. It will be used to show the price impact of a recommendation system. Furthermore, we also have time-series data for more than 10 years: data in 2009, 2008, 2007, ... 1997.

On the other hand, we will also be able to identify which variables do influence price wine in a very accurate way given the size of the database.

4. Methodology

Based on the hedonic hypothesis that goods are valued for their utility-bearing attributes (Lancaster 1966), hedonic prices are defined as the implicit prices of attributes. The relation between observed prices of differentiated product and their associated attributes is therefore determined by the hedonic prices of the attributes. Consequently hedonic prices can be estimated by regressing product prices on product attributes (Rosen 1974, Horowitz et al.

2002). What is interesting about the current study is that next to the attributes of the product such as production, ranking and grapes, different ratings can be included in the model. Thus from a marketing standpoint it is interesting to show the price impact of a recommendation system.

5. Presentation and selection of the dataset

In order to deal with missing values, we will first describe the whole dataset and then, we will explain which data we will keep for our analysis (reduction of dataset size) and why we choose those data.

A. The whole dataset

The database is composed of 29,471 wines. For each wine, as you can observe in table 2, we have the ratings of the following wine critics. We notice by importance that Gabriel (Swiss critics) has 5900 ratings for the different wines, Wine Spectator 2987 and Parker 2797 ratings.

Table 2. Number of ratings per critics for the database.

Ratings	n
5513-Gabriel	5900
5504-Wine Spectator	2987
5505-Parker	2797
5506-Bettane	2184
5509-Coates	1855
5512-Tanzer	1470
5519-Gault Millau	931
5507-Hachette	67
5514-Vinum	50

In table 3, we can also observe that only 7 retailers (out of 243) got a lot of references (more than 3,000) out of the 29,471 references of wine brands for the different vintages and issues. The most important retailer is B, ZH with 9032 references.

Table 3. References by retailers

Retailers	n
2002-B, zh	9032
71-C. BB, zh	6669
848-G., zh	5477
507-S., lu	4084
475-Luc., lu	3547
1471-Mag., vd	3188
2606-Arc., bs	3163

In the database, we also have 88 different wine brands.

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NB If we run a linear regression with the most representative variables (but there are a lot of missing values...) where the dependent variable is the price of retailer B, ZH and the independent variables are vintage (of the 88 wine brands from 1945), issued (the year the database was issued), ID (the code of the wine and Gabriel (ratings of the Swiss Wine Critics), we observe that all the variables are significant.

Table 4. Linear regression with the most representative variables

Model		Non-Standardized coefficients		Standardized coefficients	t	Sig.
		A	Standard-error	Bêta		
1	(Constante)	-15866.665	4771.620		-3.325	.001
	Vintage	-17.506	.476	-.598	-36.773	.000
	Issued	24.848	2.422	.162	10.260	.000
	Id	3.229E-7	.000	.130	8.336	.000
	5513-Gabriel	52.791	3.005	.281	17.571	.000

a. Dependent variable : 2002-B., zh

B. Reducing the size of the database

We decided to reduce the database size from 29,471 references of wine brands to 9,032 (which represents the retailer with the highest number of wine references: B, ZH). Table 5 shows how many times each of the 88 different wine brands are referenced in the database of 9,032 references.

Table 5. Number of references for each of the 88 Bordeaux wine brands.

Wine brands	Number of references (vintage and issues) per wine brand	Percentage
Arche, Château d' (Sauternes);Sauternes	14	.2
Armailhac, Château d' = Mouton-Baron-Philippe, Château;Pauillac	125	1.4
Batailley, Château;Pauillac	78	.9
Belgrave, Château;Haut-Médoc	26	.3
Beychevelle, Château;Saint-Julien	224	2.5
Boyd-Cantenac, Château;Margaux	53	.6

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Branaire-Ducru, Château;Saint-Julien	145	1.6
Brane-Cantenac, Château;Margaux	195	2.2
Broustet, Château;Barsac	5	.1
Caillou, Château (Barsac);Barsac	5	.1
Calon-Ségur, Château;Saint-Estèphe	120	1.3
Camensac, Château;Haut-Médoc	82	.9
Cantemerle, Château;Haut-Médoc	50	.6
Cantenac-Brown, Château;Margaux	122	1.4
Clerc Milon Rothschild, Château;Pauillac	119	1.3
Climens, Château;Barsac	18	.2
Clos Haut-Peyraguey, Château;Sauternes	8	.1
Cos d'Estournel, Château;Saint-Estèphe	238	2.6
Cos Labory, Château;Saint-Estèphe	40	.4
Coutet, Château (Barsac);Barsac	36	.4
Croizet-Bages, Château;Pauillac	83	.9
Dauzac, Château;Margaux	41	.5
Desmirail, Château;Margaux	10	.1
Doisy-Daëne, Château;Barsac	16	.2
Doisy-Védrières, Château;Barsac	56	.6
Ducru-Beaucaillou, Château;Saint-Julien	240	2.7
Duhart-Milon-Rothschild, Château;Pauillac	107	1.2
Durfort-Vivens, Château;Margaux	19	.2
Ferrière, Château;Margaux	17	.2
Filhot, Château;Sauternes	80	.9
Giscours, Château;Margaux	135	1.5
Grand-Puy Ducasse, Château;Pauillac	123	1.4
Grand-Puy-Lacoste, Château;Pauillac	170	1.9
Gruaud-Larose, Château;Saint-Julien	147	1.6
Guiraud, Château;Sauternes	39	.4
Haut-Bages Libéral, Château;Pauillac	17	.2
Haut-Batailley, Château;Pauillac	108	1.2
Haut-Brion, Château;Pessac-Léognan	378	4.2
Issan, Château d';Margaux	53	.6

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Kirwan, Château;Margaux	49	.5
Lafaurie-Peyraguey, Château;Sauternes	16	.2
Lafite Rothschild, Château;Pauillac	399	4.4
Lafon-Rochet, Château;Saint-Estèphe	84	.9
Lagrange, Château;Saint-Julien	108	1.2
Lagune, Château la;Haut-Médoc	155	1.7
Lamothe Guignard, Château;Sauternes	5	.1
Lamothe, Château;Sauternes	5	.1
Langoa-Barton, Château;Saint-Julien	32	.4
Lascombes, Château;Margaux	104	1.2
Latour, Château;Pauillac	385	4.3
Léoville-Barton, Château;Saint-Julien	139	1.5
Léoville-Las-Cases, Château;Saint-Julien	261	2.9
Léoville-Poyferré, Château;Saint-Julien	197	2.2
Lynch-Bages, Château;Pauillac	235	2.6
Lynch-Moussas, Château;Pauillac	44	.5
Malescot Saint-Exupéry, Château;Margaux	60	.7
Malle, Château de;Sauternes	29	.3
Margaux, Château;Margaux	366	4.1
Marquis d'Alesme Becker, Château;Margaux	15	.2
Marquis de Terme, Château;Margaux	34	.4
Montrose, Château;Saint-Estèphe	240	2.7
Mouton-Rothschild, Château;Pauillac	420	4.7
Nairac, Château;Barsac	3	.0
Palmer, Château;Margaux	224	2.5
Pedesclaux, Château;Pauillac	23	.3
Pichon Longueville Comtesse de Lalande, Château;Pauillac	235	2.6
Pichon-Longueville Baron, Château;Pauillac	256	2.8
Pontet-Canet, Château;Pauillac	138	1.5
Pouget, Château;Margaux	7	.1
Priuré-Lichine, Château;Margaux	86	1.0
Rabaud-Promis, Château;Sauternes	23	.3
Rauzan-Gassies, Château;Margaux	115	1.3

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Rauzan-Ségla, Château de;Margaux	108	1.2
Rayne Vigneau, Château de;Sauternes	81	.9
Rieussec, Château;Sauternes	62	.7
Saint-Pierre, Château (Saint-Julien);Saint-Julien	50	.6
Sigalas Rabaud, Château;Sauternes	24	.3
Suduiraut, Château;Sauternes	74	.8
Talbot, Château;Saint-Julien	153	1.7
Tertre, Château du;Margaux	42	.5
Tour Blanche, Château la (Sauternes);Sauternes	20	.2
Tour Carnet, Château la;Haut-Médoc	105	1.2
Yquem, Château d';Sauternes	279	3.1
Total	9032	100.0

In crossing the data (see table 6), we see the retailer B, Zh has a lot of ratings from Gabriel (2579); the retailer C. BB, ZH gas 1488 ratings from Gabriel. So we must use as reference retailer B, ZH and as critics Gabriel.

Table 6. Cross-data between retailer B,ZH and other variables

	Observations					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
2002-B, zh * Id	9032	100.0%	0	.0%	9032	100.0%
2002-B, zh * Vintage	9032	100.0%	0	.0%	9032	100.0%
2002-B, zh * Issued	9032	100.0%	0	.0%	9032	100.0%
2002-B, zh * 5513-Gabriel	2579	28.6%	6453	71.4%	9032	100.0%
2002-B, zh * 5504-Wine Spectator	1074	11.9%	7958	88.1%	9032	100.0%
2002-B, zh * 5506-Bettane	752	8.3%	8280	91.7%	9032	100.0%
2002-B, zh * 5509-Coates	754	8.3%	8278	91.7%	9032	100.0%
2002-B, zh * 5505-Parker	754	8.3%	8278	91.7%	9032	100.0%
2002-B, zh * 5512-Tanzer	476	5.3%	8556	94.7%	9032	100.0%
2002-B, zh * 848-G, zh	1362	15.1%	7670	84.9%	9032	100.0%
2002-B, zh * 1471-M, vd	1775	19.7%	7257	80.3%	9032	100.0%
2002-B, zh * 2606-Ar, bs	1630	18.0%	7402	82.0%	9032	100.0%
2002-B, zh * 507-Sch, lu	1670	18.5%	7362	81.5%	9032	100.0%
2002-B, zh * 71-C. BB, zh	2960	32.8%	6072	67.2%	9032	100.0%
2002-B, zh * 475-Luc, lu	1390	15.4%	7642	84.6%	9032	100.0%

6. Exploratory results

Extended results will be presented during the conference since we are restructuring the database in order to exploit it and not to lose information represented by the huge number of missing values.

Here are some examples of regression.

In table 7, we run a regression with B, Zh as dependent variable and we use as independent variables: Id (code of the wine), Vintage (of the wine), Issue (price for each year), C. BB (a retailer) and Gabriel (ratings). We observe that ratings made by Parker are significant whereas ratings made by Gabriel are not. So, prices of retailer B, ZH are influenced by Parker. We can also notice the vintage and the year of editing the catalogue (issue) are influencing the price (they are significant). Finally, id or the brand name is not influencing the price, which seem to be abnormal.

Table 7. Regression 1

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Model		Non-Standardized coefficients		Standardized coefficients	t	Sig.
		A	Standard-Error	Bêta		
1	(Constante)	-4148.736	14191.574		-.292	.770
	Id	9.800E-8	.000	.046	.850	.397
	Vintage	-26.236	2.624	-.658	-10.000	.000
	Issued	27.518	7.909	.211	3.479	.001
	5513-Gabriel	4.440	10.975	.025	.405	.686
	5505-Parker	16.080	4.660	.234	3.451	.001

a. Dependent variable : 2002-B, zh

In regression 2, we can observe the prices of retailer B, ZH are influenced by the wine brand name (id), the vintage, the issue and the rating of Gabriel is not significant. Finally, there is a relationship between the price of B, ZH and “C. BB”, ZH,

Table 8. Regression 2.

Model		Non-Standardized coefficients		Standardized coefficients	t	Sig.
		A	Standard error	Bêta		
1	(Constante)	-20805.334	1840.361		-11.305	.000
	Id	5.499E-8	.000	.036	3.367	.001
	Vintage	-1.113	.292	-.055	-3.812	.000
	Issued	11.484	.971	.129	11.825	.000
	5513-Gabriel	2.107	1.298	.019	1.623	.105
	71-C BB, zh	.989	.015	.914	67.230	.000

a. Dependent variable : 2002-Badaracco, zh

6. Further research and limits

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For the moment, we decided to focus only on Bordeaux wines since they are used in most studies as benchmark; perhaps because of the availability of database proposed by the effective Bordeaux distribution system (wine merchants/négociants).

In the future, we would like to extend our research to one or two regions where Vinfox has a lot of data especially ratings such as Burgundy, Champagne, California or/and Italy. We could compare Bordeaux region with those regions.

The main concern we have is to avoid deleting missing values that could give us a lot of information on scarcity phenomenon for example. So, we must test a lot of alternatives that will be done within the conference. So, we can compare, Wine per Wine, segment of wine per segment (price segmentation) or issue per issue (e.g comparison between issue 1998 and issue 2008).

We could also incorporate different variables easy to collect for each region except sensory ones (due to the lack of references):

- climate of the vintage or quality of the vintage (source: official unions of producers)
- chateaux' production: number of bottles and ha (source: Bettane)
- potential of the bottle (source: Bradfer (2008))
- average price of auctions (source: Bradfer (2008) and choko (2008))
- kinds of grapes (source: Bettane)
- Price of "En-primeur"
- Ranking of 1855

In the model, we will build, we can introduce measurement error for price fluctuation

Finally, some price correction should be made because of the exchange rate fluctuation between currencies.

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