# A market-based pricing model for wines: Test over the period 1988-2007

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**Abstract**

Contrary to the estimation of an hedonic price equation which include all factors explaining prices, this paper suggest a model to explain the price of a specific wine by the market price for wines. In this simplified relationship, all factors explaining the price of a wine are summarized by two factors: the market and the price of a basic wine. The research is based on data collected in the review of the Savour Club for wines for sale over the period 1988-2007. It is found that the price of wine is significantly explained by its covariance with a market portfolio and that this relation can be used to classify wine appellations in segregated markets.

**JEL classification**: C5, D4, L66, Q11.
**Keywords**: Wine, pricing models, price segmentation, wine markets.

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## 1 Introduction

What determines wine prices? The question is obviously not new but the most recent papers dealing with this subject tend to go beyond a simple competitive market where the prices are the result of supply and demand (Chiffoleau and Laporte 2004). Many papers look at the determinants of prices by using hedonic price functions. Wine prices are determined by climate influences and by their reputation or perceived quality (Jones and Storchmann 2001). In an application to the wines of Bordeaux and Burgundy, Combris et al. (1997, 2000) come to the conclusion that the market price of wine can be explained by the objective characteristics appearing on the label of the bottle. Most of the recent literature (Landon and Smith 1998; Oczkowski 2001; Schamel and Anderson 2003; Benfratello et al. 2004) demonstrates the importance to consider the reputation to explain the formation of a price on the market.[2]

The price of the wine can also be the subject of a financial evaluation to determine the evolution of prices and the possible financial return on a purchase. The expected price of a wine and its variance depend at the same time on the characteristics of the wine and on the characteristics of the market. Hadj Ali and Nauges (2003) show that the purchase of Bordeaux wines could be more profitable than the traditional investment in financial securities. This result however is not supported by earlier studies (Krasker 1979; Weil 1993; Mougeot and Pérignon 2000; Burton and Jacobsen 2001).

This paper suggests a simple model to explain the price of a specific wine in relation to the market. In this simplified relationship, all factors explaining the price of a wine are summarized by its relationship to the market as it is the case in asset pricing models.

The analysis is based on the definition of a market portfolio of wines, but the comparison with the portfolio theory is limited to the estimation of the sensitivity of the prices compared to the average price of the market. The existence of a market guarantees the convergence of prices according to the perceived quality of the wines. As in the financial analysis, the price of a wine is conditioned by a whole set of variables (year, climate, inflation) which are fully reflected by the market and the sensitivity of the price of a particular wine compared to the market is revealing characteristics specific to the wine.

The model is tested with data collected in the review of the Savour Club and takes into account a panel of wines available for sale over the period 1988-2007.

[2]For a review of the literature see Lecocq and Visser (2006). They confirm that the prices of the wines of Bordeaux and Burgundy are primarily determined by objective characteristics.

The article is organized as follows. Part one presents the market-based pricing model for wines. In part two the data which are used to test the model are presented. The third part explains the main results and the last part discusses the limits and possible extensions of the analysis.

## 2 The market-based pricing model

Market pricing is a result of rational, utility maximizing agents acting under information constraints. An efficient market is one in which prices fully reflect available information. An implication is that no excess prices can remain because new information is quickly incorporated into prices and those prices in turn reflect that information back to all other market participants.

The model that we propose is directly inspired by the capital asset pricing model used for the valuation of financial assets.[3] Using the terminology of modern portfolio theory, if all agents have homogeneous beliefs, then they all have the same linear efficient set of decisions related to the market. There is a fixed number of products for a known quantity and all the individuals have access to the same potential portfolio of wines which represents the market. According to usual assumptions there are no information costs and no market imperfections. These assumptions applied to the market for wines are not easily acceptable for the average consumer but perfectly realistic for a market of wine professionals.

There is always an element of risk in buying wine. However, risk is lower for inexpensive, low-quality wines, and perceived risk increases as the price of wine increases. The expected price of any wine E[Pj] is equal to the price of a basic/standard wine PB (called risk-free price) plus a risk premium to take into account the volatility of the price due to expected higher quality. In this terminology, the price of risk (the measure of volatility) is the slope of the line between the expected price on the market portfolio PM and the risk-free price. This measure of volatility can be calculated for each wine, it is the covariance between the expected price of a wine and the market.

$$E[Priceofwinej] = \alpha_j PB + \beta_j (E[PM] - PB) \quad (1)$$

The model is a one period model and supposes that any combination of the basic wine and the market portfolio is available to market players. E[PM]-PB represents the surplus of price required by the market and accepted because the wine is perceived as having a higher quality than the basic wine.

[3] Haugen (2001).

The market portfolio is defined as the portfolio which contains all the products available on the market and the proportion of each wine in the portfolio is equal to the ratio of the total value of all the units of this product on the total value of all the products available on the market, i.e. each wine is weighted in the portfolio in proportion to its weight in the market. This portfolio is not readily available and the theoretical basis of the model rests on the assumption that there is a price for a portfolio that replicates the market.

$\beta$ is the measure of the volatility of the price compared to market that is, it shows how much the price of a particular wine jumps up and down compared with how much the market as a whole jumps up and down. It is equal to the covariance between the price of the wine j and the price of the market divided by the variance of the price of the market. The surplus price of a wine does not depend on its variance which is an intuitive measurement of the risk related to the evaluation of the price (evaluation of quality for example) but of its covariance with the market.

If $\beta = 1$ volatility is equal to that of the market and the price moves exactly in line with the market. If $\beta > 1$ there is amplification of the variations of the market and on the other hand, if $\beta < 1$ there is a dampened response to market price moves. Since the price of a wine should be at least equal to the price of the basic wine (PB), $\alpha$ should be close to the unit.

What are the expected results? The market portfolio collects the effects which affect on average all wines. On the other hand $\beta$ reflects the quality associated with a particular wine and should discriminate reputable AOC from others. Finally, this variable must allow a segmentation of the wine market based on volatility rather than price as investigated in a different context by Livat (2002) and Costanigro et al. (2007).

## 3 The data

The Savour Club selects ordinary wines and high-quality wines and regularly publishes the price of these wines in its review.[4] It behaves as a trader who proposes a whole range of wines, from table wines to the most famous AOC. It also sells generic AOC without reference to a domain name. The selection of generic AOC avoids having to consider the reputation of the producer in the pricing of the wine and only the reputation of the AOC is taken into account. The other advantage is that the same wines are regularly proposed in the review and make it possible to build indices of prices from 1988 to 2007.

[4]The Savour Club created in 1964 is one of the leaders in France of the marketing of wines by mail.

To validate the model it is necessary that the index of the selected market portfolio be close enough to the theoretical portfolio representing the market. Instead of considering all the wines available each year we can build an index of the market based on 26 wines selected according to their geographical origin and the availability of price series over the period of the study.[5] Prices for all the wines were collected in the review published during the summer (June to August) in order to avoid the overlapping of years at the beginning or at the end of the year.

In addition the club proposes a table wine (Cuvée des Graviers) which can be regarded as a product representing the basic/standard wine whose price evolves without fluctuations related to the reputation or the year. This basic wine is assembled by the Savour Club under his own label. The price must be relatively stable over time to keep the confidence of the customers.

Figure 1 below compares the evolution of the price index of the basic wine with the market portfolio over the period 1988-2007. It is noteworthy looking at the depression in the early nineties, when the price of the market portfolio became lower than the price of the basic wine, followed by a strong increase of the prices since 1996. Hadj Ali and Nauges (2003) observe the same tendency for the best Bordeaux wines and suggest that improvement of the global quality during these years explains this recovery at least partly. In 2000, the price index of the market portfolio decreases compared to the price of the basic wine and thereafter increases relatively regularly and at a higher rate than the index of the basic wine.

## 4 The results

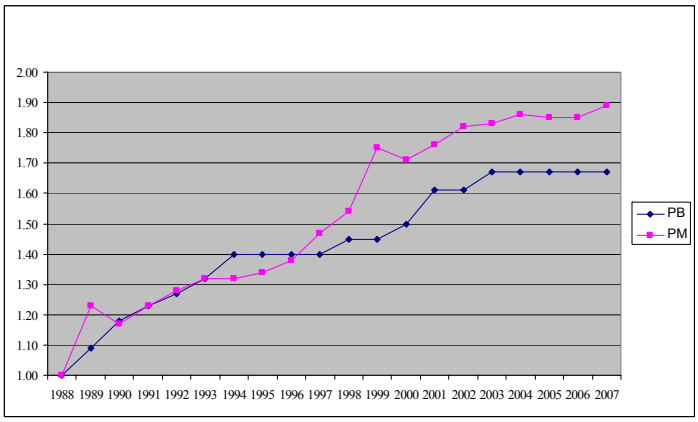
The market-based pricing model of wines (equation 1) is estimated by ordinary least squares over the period 1988-2007 for a selection of wines representative of the data available. The results are presented in table 1. Estimation coefficients are all significant (student-t statistics) and the overall adjusted R2 is relatively high as expected by construction of the model.

As expected $\beta$ghows a significant relationship between the price of a wine and the market. The value of the coefficient $\alpha$ is also close to 1.0, which indicates that the price of the wine incorporates the price of the basic/standard wine.

The most interesting result is that the reputation of the AOC of the wine has a considerable impact on the value of $\beta$u This result differs somewhat from the results presented by Lecocq and Visser (2006) which suggest that the system of

[5]The market price index is based on 26 AOCs: Bordeaux (2 whites and 4 reds), Burgundy (4 whites and 2 reds), Loire (2 whites and 1 red), Beaujolais (2 reds), Provence (1 rosé and 1 red), Rhone (1 rosé and 3 reds) and Alsace (3 whites).

Figure 1: Price indices (100 in 1988)




classification in Burgundy is less rigid than the historical classification of Bordeaux wines and appears to be a more significant factor related to prices. This result is however not confirmed if we test the model on the rates of increase of prices. In this case only the AOC of Burgundy has a value significantly larger than 1.0 (Appendix 1).

The heterogeneity of prices is strongly related to the system of AOC set up in France and which partly removed the asymmetry of information on the quality of the wines (Chiffoleau and Laporte 2004). But this heterogeneity is not random and depends largely on the relationship with the market. One can consider that the wines having the same sensitivity compared to the market portfolio belong to the same market. As in Livat (2002) or Costanigro et al. (2007), we endorse the idea that markets are segmented. In our study, wines having the same $\beta$ belong to the same market. The results show that wines of the Côtes de Castillon and the Côte Chalonnaise are in the same market. In the same way the wines of Sancerre and Saint-Véran are very similar from a marketing point of view. It is also interesting to note that the Sylvaner is considered in the same market as the local wines (Vins de Pays).

However, these associations could be questioned especially if we note that white wines and red wines could be regarded as substitutable. The same remark is made by Livat (2002).

Table 1: Estimation and results

| Wine | α | t | β | t | Adjusted R2 |
|---|---|---|---|---|---|
| Chassagne-Montrachet | 1.11 | 27.2 | 2.51 | 6.11 | 0.87 |
| St Emilion GC | 0.86 | 11.4 | 1.86 | 2.46 | 0.56 |
| Tavel | 1.00 | 47.9 | 1.37 | 6.59 | 0.94 |
| Côtes de Castillon | 0.97 | 40.7 | 1.02 | 4.27 | 0.89 |
| Sancerre blanc | 1.02 | 25.5 | 1.19 | 2.97 | 0.76 |
| St Véran | 0.81 | 32.7 | 1.08 | 4.39 | 0.82 |
| Côte Chalonnaise rouge | 0.87 | 36.5 | 0.94 | 3.94 | 0.86 |
| Brouilly | 0.91 | 41.1 | 0.82 | 3.68 | 0.87 |
| Sylvaner | 0.95 | 55.2 | 0.25 | 1.44 | 0.90 |
| Vin de Pays | 0.93 | 43.7 | 0.35 | 1.66 | 0.85 |

## 5 Conclusion, limits and possible extensions

This paper aimed at providing a new empirical approach on factors affecting wine prices. It presents a model establishing a relationship between the price of a wine determined by its individual characteristics and the market defined by a market portfolio. This market-based pricing model allows for a classification of wines based on a measure of volatility in comparison with the market portfolio. The empirical analysis is based on data collected in the review of the Savour Club over the period 1988-2007.

The measure of volatility $\beta$ reflects the reputation of the AOC and makes it possible to classify wines. Two products belong to the same market if their relative prices maintain a ratio stable. Livat (2002) tests this methodology to identify the substitutable or complementary wines in the case of Bordeaux wines. Our approach is much simpler since the market-based pricing model determines a value $\beta$ for each wine and allows for a classification of wine having the same value.

This methodology has its own limits which are related to the assumptions of the model and the existence of a market portfolio which replicates the overall market. Further tests are needed to validate this methodology with a broader market portfolio and over a longer period of time. Our data base for example does not contain wines of the Languedoc-Roussillon area which creates an obvious error of measurement.

In spite of these limits, the demonstration remains relevant. In addition, this model is an easy tool since all the explanatory factors of the price of a wine are represented by two factors: the market and the price of the basic wine. Moreover

it provides an easy way to evaluate the expected price of a wine.

Graphically, we can represent the expected price-beta relationship through a market line. At ß = 0 the line will intersect the y-axis at the risk free price of the basic wine PB. At ß = 1 the line will be at E(PM). Also, it can be shown that the slope of the market line is equal to the expected excess price to the market E(PM)-PB. In equilibrium, all prices will lie on the market line, however, if a wine is overpriced (underpriced) it will lie above (below) the market line since it will provide an expected price that differs from the price given by its beta (figure in appendix 2).

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## Appendix 1

Table 2: Estimation results based on price increases

| Selected wine | $\alpha$ | t | | $\beta$ | t |
|---|---|---|---|---|---|
| | | | | | |
| Chassagne-Montrachet | 1.02 | 41.2 | | 1.83 | 4.44 |
| St Emilion GC | 1.03 | 22.6 | | 0.43 | 0.56 |

## Appendix 2

Figure 2: The Market Line