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AN INVESTIGATION INTO DIFFERENCES  
BETWEEN POSTED AND MARKET PRICE

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**Does the bottle size matter?**  
**An investigation into differences between posted and market prices**

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**Abstract:**

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. There is more than the price of wine in a bottle. The decision to market wine in a different bottle size is considered to have more to do with the judgment of taste and the feeling of pleasure than other factors. Does size matter? In this short paper we investigate the relationship between price and the size of the bottle for the same wine. We find that in the case of Champagne, the posted price of wine increases more than proportionally with the size of the bottle. However, this result does not fully hold for Bordeaux wines when we consider auction prices for large bottles.

**Keywords:** Price-size relation, scarcity, wine

**JEL classification:** D40, L66

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# Does the bottle size matter?

## 1. Introduction

What's behind the bottle price? Weather, vintage, geographic area, bottling, marketing, recipe are all important factors in the cost of the wine. Production costs vary enormously based on the type of wine, the size of the winery and its location. Wine prices are also determined by their reputation, their perceived quality or sensory characteristics. Many papers look at the determinants of prices by using hedonic price functions. Most of the recent literature (Combris et al. 1997 and 2000; Landon and Smith 1998; Oczkowski 2001; Jones and Storchmann 2001; Horowitz and Lockshin 2002; Schamel and Anderson 2003; Benfratello et al. 2004; Cardebat and Figuet, 2004; Lecocq and Visser, 2006) demonstrates the importance to consider all these factors to explain the formation of a price on the market.

Wineries may use many tools to convince consumers that their wines are worth more - fancy bottles, designer labels, sophisticated advertising (Boudreaux and Palmer 2007; De Mello and Gonçalves de Borochia 2008). The decision to market wine in a different bottle size is considered to have more to do with the feeling of pleasure than other factors. To our knowledge, no investigation of the possible effects of bottle size on supply or demand has ever been made with the exception of Di Vittorio and Ginsburgh (1996) and Brunke et al. (2009). In their empirical analysis, based on wines offered at auction markets in Germany, they find a negative correlation between price and bottle size. When controlling for vintage and quality, they find that the bottle size generally does have very little or no effect on the price sold at auction. However the sample of prices in their dataset is mainly relevant for 1.5l (magnums) but very limited for bigger sizes (only 9 cases for 3.0l and one case for a 6.0l bottle). The purpose of this paper is to investigate the price effect with bigger bottles for Champagne and Bordeaux wines.

The results of our investigation show a major difference between prices posted for bottles of champagne and auction prices for Bordeaux wines. In the case of Champagne, the price of wine increases more than proportionally with the size of the bottle. We show that the relative

scaled price of the marketed bottle may vary from 1.0 for a standard bottle (0.75l) to a factor of 2.1 when the size of the bottle increases whatever the type of wine or region of production. However, this result does not fully hold for Bordeaux wines when we consider auction prices for large bottles.

The paper is organized as follows. First we provide some background on bottle sizes and implications. In the next section, we suggest a measure of the relative scaled price index to compare the price of different bottle sizes on the same scale, i.e. a standard bottle of 0.75l and then we show that its value is an increasing function of the size of bottles. We suggest that the hypothesis of scarcity, defined by Walras, may be explaining this increasing relationship. In the following section we verify this hypothesis with a sample of wines for which auction “hammer prices” are available. The last section discusses the results and concludes the paper.

## **2. Does the bottle matter?**

Whereas it isn't really necessary to have any knowledge of wine bottles in order to appreciate wine, the bottles are vitally important. A glass bottle, sealed with a cork or other device, is preferable for the storage and transport of wine. The size and the color of the bottle may also have important implications. Shape of bottles also evolved according to traditions and customs of the people which made them and has proved to be a reliable container, including other essential environmental factors, ideal for the keeping and the aging of wine.<sup>1</sup>

As well as the traditional (in many cases, legally required) 750ml bottle (the standard size), and the useful half-bottle (containing 375ml of wine), there are a number of legally permitted 'large format' bottles. Bottle sizes permitted by the EU, but only applied to still wine, range from 0.1 liter to 10 liter (Robinson 2006).

Magnums, the next size up from the standard bottle, are probably the most popular choice. Wine bottles, however, come in many different sizes, and all of them serve a purpose. The list of all formats is presented in appendix 1 of this paper. Many of the big bottles are biblical

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<sup>1</sup> See Brunke et al. (2009) for a short historical background.

names (Jeroboam, Rehoboam, Methusalem, Salmanazar, Balthazar, Nebuchodonosor and Melchior to name the most famous). There are a few other bottle sizes permitted in some regions, like the Clavelin (62ml) in Jura or in some countries, like the commonly encountered size of 500ml bottle, used for some Ports designed for drinking young, and Tokay, the famous sweet wine of Hungary.

The price of an empty bottle (including or not the label and cork) should be almost identical among providers in a same region or even in different regions whatever the quality of the wine in the bottle. It is usually estimated that the price is less than 10% of the final price of a standard bottle and may significantly decrease when the number of bottles produced increases.

More expensive wines tend to have more expensive packaging. A flat-bottom, generic Burgundy-style bottle (at 50 cents per) may do just fine for a less expensive wine. But if a producer wants to target a different market with higher-priced wines, he or she may select a more expensive bottle style. Although the notion that high prices may convey quality is well established in the behavioral marketing literature (Rao and Monroe 1989), the signaling effect of a high price related to the size of a bottle is less clear.

Wineries produce very few large format bottles because they require manual processing. Once they choose to release a bottling that is larger than a magnum, it no longer fits on a standard bottling line. Each step means higher labor costs and higher risk of poor closure. Nevertheless, large format bottles are popular and limited supply may put a premium on large formats.<sup>2</sup> The scarcity of supply has been shown to affect product attractiveness and desirability (Brock 1968; Lynn 1991) which, in turn, affect purchase decisions (Lynn and Bogert 1996) and product diffusion patterns (Swami and Khairnar 2003).<sup>3</sup> This would certainly also apply to wine because consumers are willing to pay for the prestige associated with small-production bottling from renowned appellations.

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<sup>2</sup> At this stage it could be useful to distinguish between the tangible value of a bottle which refers to the fact that wines in larger formats ripen slower, and the intangible value which refers to the collector's value of the bottle.

<sup>3</sup> It must be noted that whether consumers overestimate or underestimate the levels of supply is actually a very difficult question to tackle since quantities produced are usually unknown.

In reality, there is a high correlation between value and scarcity (see appendix 2). Research in marketing and psychology has shown that consumers usually apply this correlation in their value judgments; they judge what is scarcer as more valuable (Lynn 1992; Verhallen and Robben 1994).

### 3. A measure of the relative scaled price index

The value of the wine is hypothesized to be the same whatever the quantity sold. The basis for the observed price of wine is the standard bottle (750ml). Everything else being equal, the price of a larger bottle of wine should be a simple multiplier of the quantity of wine in the bottle. The relative scaled price index is the ratio of the observed price of the bottle to the normalized price relative to the price of the standard bottle for the same wine.

For example, if the price of a standard bottle is \$15 then the normalized price of a magnum should be \$30 (15x2) or the price of a Methusalem \$120 (15x8). We assume there are no economies of scale.<sup>4</sup> The ratio of the real price of the Methusalem bottle (\$216) to the normalized price (\$120), gives an index equal to 1.8 (the index is always equal to 1.0 for the standard bottle).

Data for Champagne are posted prices found on company's websites. For each producer, the data set is limited to prices available for the same vintage and the same wine for the full range of bottle sizes. Only seven producers are posting the relevant prices.

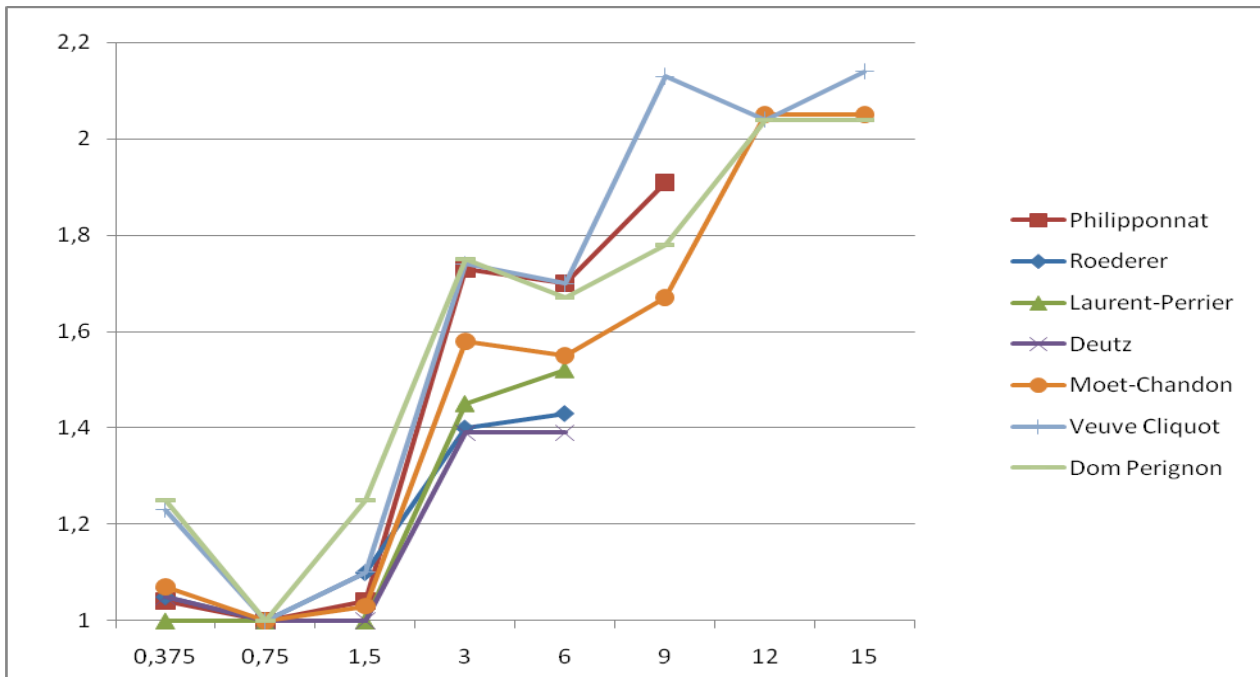
*Is price is a function of perceived quality (producer, vintage)?*

Figure 1 presents the relationship between the sizes of the bottles measured in liters and the price index. The relationship is calculated for the seven producers. For each producer the price is for the same vintage whatever the size of the bottle and the curve looks similar whatever the perceived quality of the producer. The index also increases for smaller bottles (375ml) to a value of 1.2 and the larger the size of the bottle is, the higher is the index, up to a value of 2.1.

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<sup>4</sup> This hypothesis is not true for water as shown in appendix 3.

**Figure 1: Relationship between bottle size (number of liters) and the scaled price index for Seven Champagne producers.**



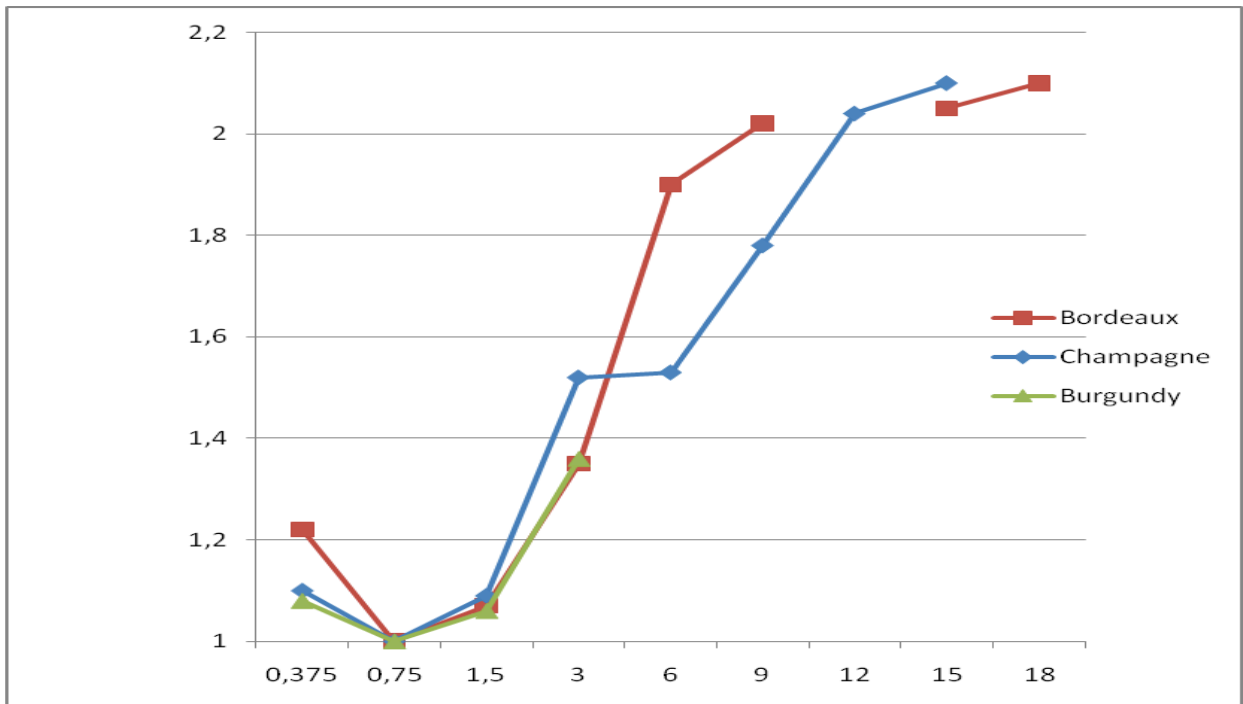
*Is this relationship related to other factors?*

Bigger bottles are also supposed to be the ideal medium for ageing wine. The larger the bottle the less air space per milliliter of wine, resulting in better storage conditions. Collectors attracted by the rarity of such bottles (the intangible value) are also attracted by the fact that wine ages much more slowly and gracefully in larger bottles (the tangible value). Unfortunately this hypothesis does not hold for large format bottles if, as it is often the case in Champagne, they are filled using wine poured from single 750ml bottles prior to sale.

The shape of the relationship may be a regional phenomenon. Some data for Bordeaux and Burgundy have been collected on company's websites and averaged by region when possible.<sup>5</sup> Figure 2 presents the average price index for three regions in France. The relationship exhibits the same curve whatever the region of production.

<sup>5</sup> Only one producer in Bordeaux (Chateau Le Puy) and three producers in Burgundy. Data is available from the author.

**Figure 2: Relationship between bottle size (number of liters) and the average price index by region of production**



*What about the price of empty bottles?*

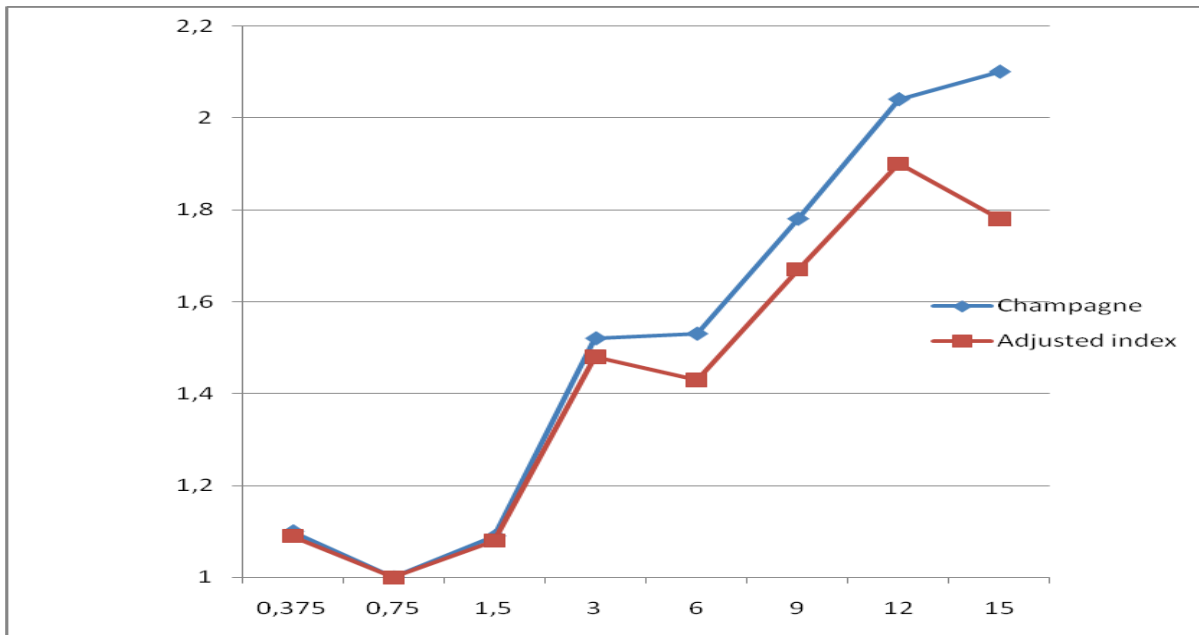
It could be also argued that the higher index may only reflect the higher cost of producing bigger bottles. The price of the empty bottle may also explain this relationship. We collected the price without taxes of empty bottles of champagne. Whereas a standard 0.75 liter champagne bottle costs €0.53, a magnum bottle sells for €1.6, a 3 liter bottle for €10.0, a Methusalem (6.0l) for €42 and up till the Nebuchodonosor (15.0l) which sells for €305.<sup>6</sup>

For all bottle sizes we calculated an adjusted price index taking into account the price of the empty bottle. It is clear from figure 3 that the relationship remains the same with the exception of the largest bottle (a Nebuchodonosor), the price of which is so high that it has a significant effect on the index.

<sup>6</sup> Prices were provided by Champagne Emballage, Reims



**Figure 3: Relationship between bottle size and the adjusted price index for Champagne compared to the non-adjusted price index.**



*Is this relationship an illustration of scarcity?*

According to Walras, value is an increasing function of scarcity. This hypothesis of scarcity may be explaining the increasing relationship between the price and the size of a bottle independently of the perceived quality of the wine or the region of production. However, posted prices may not reflect actual transactions and may not represent the actual willingness-to-pay. Actually, it could also be suggested that these bottles are not physically for sale and may only be in the catalogue of the producers for prestige or marketing purpose.<sup>7</sup> Unfortunately this kind of information is not readily available.

#### **4. The market price of large bottles at auctions**

Further investigation of the possible effects of bottle size on the price of wine products need to be performed with prices resulting from real transactions at auction markets. Most

<sup>7</sup> Research in information economics has focused on signals as mechanisms to solve problems that arise under asymmetric information (see a review of the literature on signaling by Karmini and Rao, 2000). This hypothesis is not considered in this paper.

wines are traded on the basis of posted prices or according to private terms and conditions. Auctions are, however, used for buying and selling some high quality wines or rare wines.<sup>8</sup> The prices used in our sample are obtained from one year period of monthly auction “hammer price” data (from July 2009 to June 2010) from the Chicago Wine Company (TCWC).<sup>9</sup> TCWC represents one of the largest trading markets for wine and conducts one live auction per month.<sup>10</sup>

Among all transactions reported over a one year period only a few are relevant for our analysis. The transactions should be realized for one producer, for the same vintage, during the same month and for bottles ranging from 0.375l to 6.0l (some transactions for smaller sizes (0.375ml) are missing in our sample and there is not a single transaction for sizes larger than 6.0l). Transactions for these large bottles reflect only Bordeaux wines (not any single transaction in another region) and 8 producers corresponding to 12 sets of transactions for vintages 1999 to 2006 (table 1).

**Table 1: Sample of companies, transactions realized during July 2009 to June 2010**

|                           | July-Dec 2009 | Jan-June 2010 |
|---------------------------|---------------|---------------|
| Producer                  | Vintages      | Vintages      |
| Château Quinault L'enclos | 1999, 2001    |               |
| Château Monbousquet       | 2001          | 2006          |
| Château Pavie             | 2004, 2005    | 2005          |
| La Mission Haut-Brion     | 2005          |               |
| Château Pape-Clement      | 2005          |               |
| Château Branaire-Ducru    | 2006          |               |
| Cos d'Estournel           |               | 2005          |
| Château Ducru-Beaucaillou |               | 2005          |

For each producer and set of transactions the relative scales price index (relative to 0.75l) has been calculated. The average value is presented in figure 4, as well as the maximum and minimum values, for each bottle size. On average, larger bottles fetched a higher price than

<sup>8</sup> On auctions for wine, see Ashenfelter (1989).

<sup>9</sup> These data are available at [www.twcw.com](http://www.twcw.com)

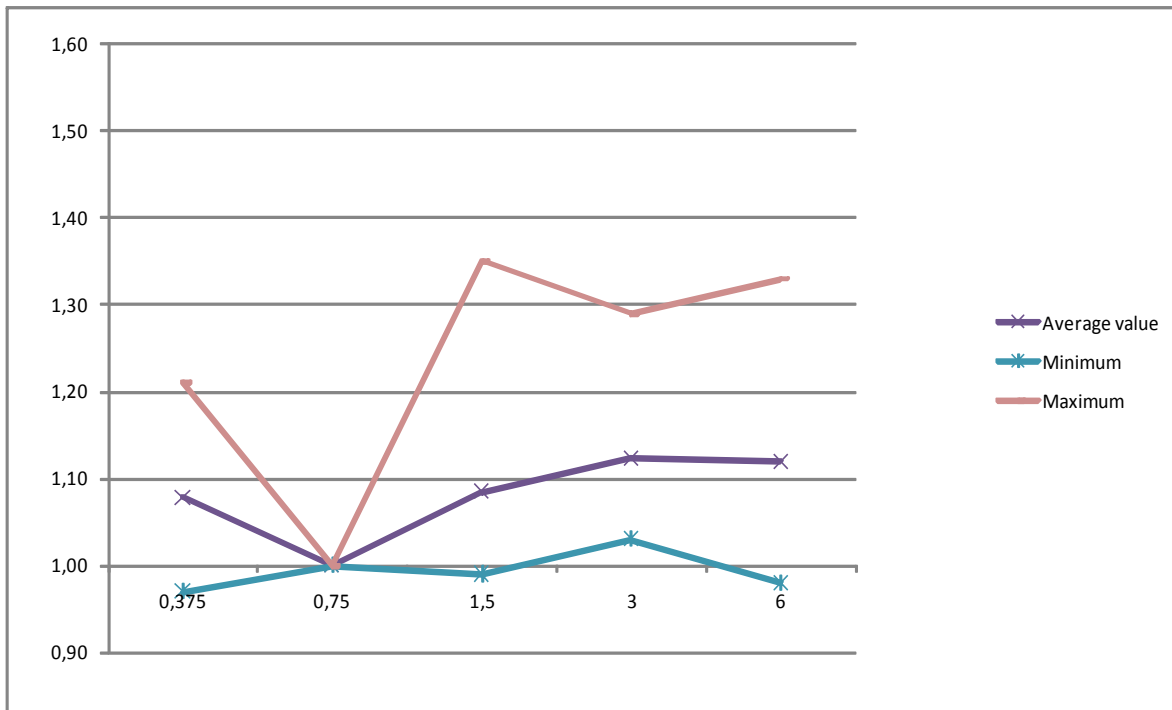
<sup>10</sup> See Sanning et al. (2008) for more details.

regular bottles for the same wine. This is also true for half-bottles and therefore it is difficult to conclude that bottle size could capture wine quality.

Analyzing Bordeaux wines in the Medoc region priced at Christie's auctions, Di Vittorio and Ginsburgh (1996) found that wines sold in bottles larger than magnums tend to be more expensive than those in regular bottles reflecting the effect of rarity, for which collectors are willing to pay more. They calculate a price increase as large as 42% for imperials (6 liters) compared to the maximum value of 33% in our study.

When comparing the results for posted prices for bottles of Champagne and market prices for bottles of Bordeaux, it is true that the effect is much smaller, but nevertheless, this result is very different to the results of Brunke et al. (2009) for German wines that show no effect of size on price.

**Figure 4: Relationship between bottle size and the adjusted price index for Bordeaux wines at auctions.**



## 5. Conclusion and suggestions for further research

We show in this paper that the hypothesis of scarcity may be explaining the increasing relationship between the posted prices of larger bottles of Champagne and the size of a bottle independently of the perceived quality of the wine or the region of production. However, further investigation based on prices determined at auctions for Bordeaux wines mitigates these results as the premium for larger bottles is much smaller than for posted prices.

Further investigation of the possible effects of bottle size on supply or demand of wine products would need access to larger databases on this subject. Does this relationship vary significantly with more expensive wines or wines perceived as being of long standing high quality? Also, supplied quantities are well known when the wine is sold for the first time, but over the years, quantities are likely to decrease with consumption. If quantities available on the market over time become a matter of scarcity, then the relative price should increase. Unfortunately, information on quantities is not available and the effect on price could eventually be tested only if data for the same wine would be available over a long period of time.

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## Appendix 1: Wine Bottle Size

| Bottle Name    | Volume in liters | Equivalent standard bottles | Name's Origin                          | Comment  |
|----------------|------------------|-----------------------------|--|--|
| Mignonette     | 0.05 to 0.15     | ..                          |  | Used as a sample                                     |
| Piccolo        | 0.1875           | 1/4                         | "Small" in Italian                     |  |
| <i>No name</i> | 0.200            | ..                          |  | Used frequently for Ice-wine in Québec               |
| Chopine        | 0.250            | 1/3                         | Traditional French unit                | Known as Quarter bottle                              |
| Demi           | 0.375            | 1/2                         | "Half" in French                       | Fillette in Loire Valley                             |
| Jennie         | 0.5              | 2/3                         | 50cl bottle<br>"White Spirit" in Welsh | Used in Tokay, and several sweet wines               |
| Clavelin       | 0.620            | ..                          | Jura « Vin Jaune »                     | Exist also a half-clavelin                           |
| Bottle         | 0.750            | 1                           | Standard bottle                        |  |
| Fifth          | 0.757            | ..                          | One-fifth of a U.S. gallon             | In 1979, the U.S. adopted the metric                 |
| Liter          | 1.0              | ..                          |  | Used for low-quality wine                            |
| Magnum         | 1.5              | 2                           |  |  |
| Marie Jeanne   | 2.25             | 3                           |  | Tregnum for Port Wine                                |
| Double Magnum  | 3.0              | 4                           |  |  |
| Jeroboam       | 3.0/4.5          | 4/6                         | Biblical, First king of Israel         | 3.0 l. in Champagne & Burgundy<br>4.5 l. in Bordeaux |
| Franzia        | 5.0              | ..                          |  |  |
| Rehoboam       | 4.5              | 6                           | Biblical, First king of Judea          |  |
| Imperial       | 6.0              | 8                           |  | In Bordeaux  |
| Methusalem     | 6.0              | 8                           | Biblical, Oldest Man                   | Or Methuselah  |
| Salmanazar     | 9.0              | 12                          | Biblical, Assyrian King                |  |
| Balthazar      | 12.0             | 16                          | Biblical, one of the Wise              |  |
| Nebuchodonosor | 15.0             | 20                          | Biblical, King of Babylon              | Or Nebuchadnezzar                                    |
| Melchior       | 18.0             | 24                          | Biblical, one of the Wise              |  |
| Solomon        | 20.0             | 26 2/3                      | Biblical, King of Israel,              |  |
| Sovereign      | 25.0             | 33 1/3                      |  |  |
| Primat         | 27.0             | 36                          |  |  |
| Melchizedek    | 30.0             | 40                          | Biblical, middle-east religions        |  |

## Appendix 2: Price or value as a function of scarcity

Walras argued that value is a function of scarcity. It is generally agreed that the value of any product satisfies the following properties (Chen 2005):

- (a) The value of two products should be higher than the value of each of them.
- (b) If two products are independent, that is, if the two products are not substitutes or partial substitutes of each other, then the total value of the two products should be the sum of two products.
- (c) The value of any product is non-negative.

The only mathematical functions that satisfy all of the above properties are of the form

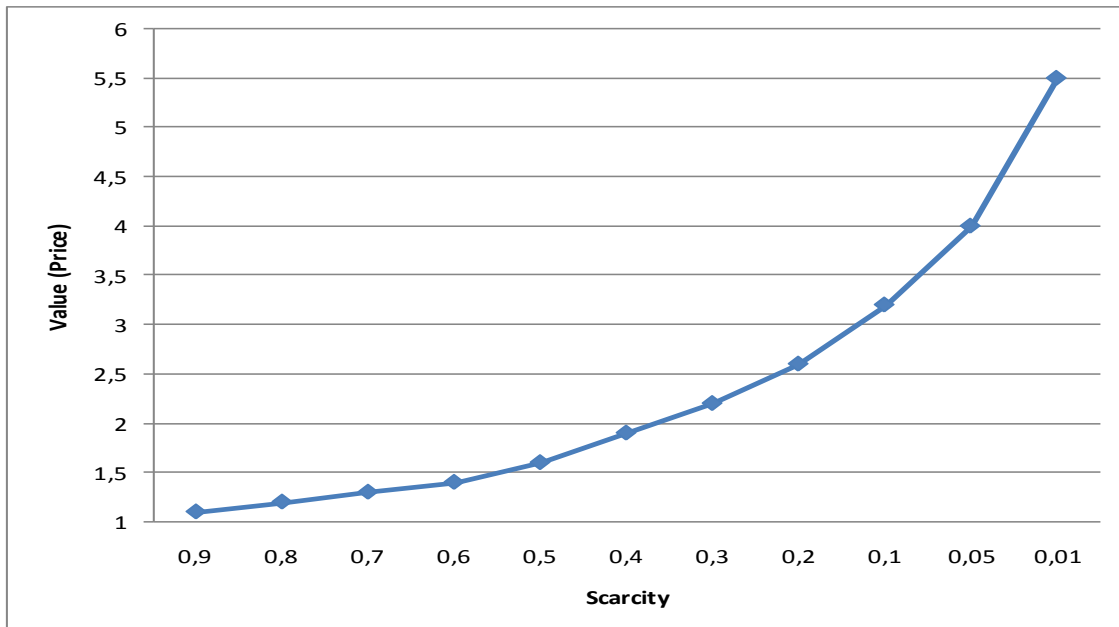
(E1)  $V(P) = -\log_b P$  where  $b$  is a positive constant. The base  $b$  can be understood as the number of unit produced.

In general, if the scarcity of a service or product,  $X$ , can be estimated by the probability measure  $\{p_1, p_2, \dots, p_n\}$ . The expected value or price of this product is the average of the value of each possibility, that is

$$V(X) = \sum_{i=1}^n p_i (-\log_b p_i)$$

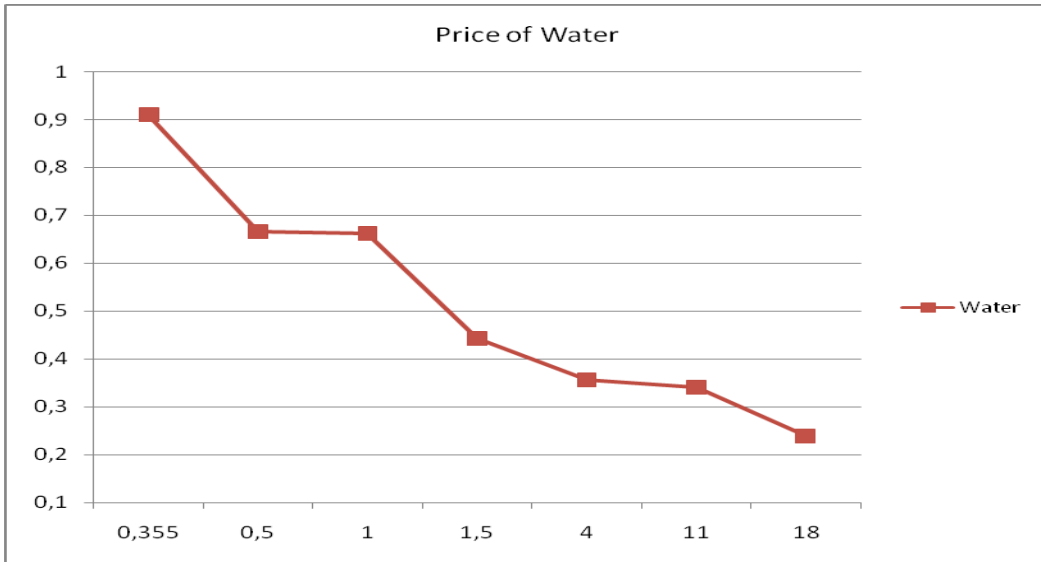
Therefore, value, just as information, in its general form can be defined as entropy, a measure of the unavailability. The concept was introduced by Claude E. Shannon (1948). The figure below is a graph of (E1), which shows that value (price) is an increasing function of scarcity measured by the decreasing probability of availability.

**Figure: Value (Price) and scarcity**





**Appendix 3: Relationship between price and size of the bottle of water**



Source : [www.amaro.ca/](http://www.amaro.ca/)