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### IS THE SECOND-CHEAPEST WINE A RIP-OFF? ECONOMICS VS. PSYCHOLOGY IN PRODUCT-LINE PRICING

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# **Is the Second-Cheapest Wine a Rip-Off?**

## **Economics vs. Psychology in Product-Line Pricing\***

David de Meza <sup>a</sup> and Vikram Pathania <sup>b</sup>

### **Abstract:**

*The standard economic analysis of product-line pricing by Mussa and Rosen (1978) implies that higher-quality varieties command higher absolute mark-ups. It is widely claimed that this property does not apply to wine lists. Restaurateurs are believed to overprice the second-cheapest wine to exploit naïve diners embarrassed to choose the cheapest option. This paper investigates which view is correct. We find that the mark-up on the second cheapest wine is significantly below that on the four next more expensive wines. It is an urban myth that the second-cheapest wine is an especially bad buy. Percentage mark-ups are highest on mid-range wines. This is consistent with the profit-maximising pricing of a vertically differentiated product line with no behavioral elements, although other factors may contribute to the price pattern.*

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## **Introduction**

Many firms offer a range of vertically differentiated products. Examples are airlines, laptop sellers, car firms and software providers. The economic principles determining product-line selection and pricing are derived by Mussa and Rosen (1978).<sup>1</sup> The only readily testable implication is that absolute profit is monotonically increasing in quality. In deriving the result, potential psychological confounders, often emphasised in marketing, are ignored. One setting where such considerations are widely considered to apply is the wine list. Former Wall Street Journal wine columnists, Frank Brecher and Dorothy Gaiter explain; "...the cheapest wine on the list is often a fine value, while the second-cheapest wine on the list is almost always the worst value, since people don't want to appear penurious by ordering the least expensive wine on the list."<sup>2</sup> Conspicuous consumption theories of this sort are widespread on the internet.<sup>3</sup> The advice that follows is exemplified by a Daily Telegraph article, "Why you should never order the second-cheapest wine" (24/04/2014), a conclusion that is also endorsed by Ariely (2016).

Systematic evidence that the second-cheapest wine on the list is priced differently to other wines does not seem to have been collected. Telling a plausible story why the second-cheapest wine may be overpriced seems enough to conclude that it is overpriced. Nevertheless, the implicit assumptions are strong. Most diners may not be embarrassed to order the cheapest wine. The wide circulation of the theory may make the second-cheapest wine even less attractive than the cheapest since it is not only believed to be a bad buy, but signals a pathetic effort to appear affluent. Even if diners do behave as naïve behavioral types, restaurateurs may choose not to

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<sup>1</sup> Mussa and Rosen examine monopoly and perfect competition. They find that the range of qualities offered is narrower under monopoly, but this does not seem easily testable. Champsaur and Rochet (1989) look at duopoly. Sellers specialise in quality ranges, but for each seller mark-up patterns seem to be similar to monopoly. Complications for wine lists include that restaurants sell a complementary good, food. Also, home consumption of wine may be a relevant alternative to restaurant consumption. For example, if a high- and low-quality wine are to be consumed, one at home, which way round should it be?

<sup>2</sup> Facebook, March 2, 2016,

<https://www.facebook.com/winecouple/photos/a.168541269860041.33458.167910653256436/957853967595430/?type=3>

<sup>3</sup> These ideas are most associated with Veblen (1899), but Adam Smith (1759) expressed similar views: "...we constantly pay more regard to the sentiments of the spectator, than to those of the person principally concerned, and consider rather how his situation will appear to other people, than how it will appear to himself." (Book IV Part 1).

exploit them, perhaps because doing so makes the more sophisticated types distrustful or a desire to behave morally.

This paper examines empirically whether the pricing of the second-cheapest wine on the menu is exceptional. We find that mean absolute mark-ups steadily increase in rank. Moreover, percentage mark-ups peak around the median wine on the menu, well above the second-cheapest wine. It is therefore an urban myth that the second-cheapest wine is especially exploitative. Nevertheless, stigma may play a role in pricing decisions. Suppose ordering the cheapest wine carries the most shame whilst buying the second-cheapest wine, though embarrassing, is less so. Moving up the ranks, stigma may even turn into swagger. These preferences impart a tendency for mark-ups to increase in rank, so do not explain why the highest ranks have lower mark-ups. It is therefore worth looking carefully at the implications of the non-behavioral Mussa-Rosen model. Contrary to the claims of some papers, we show that implausible functional forms are not required to generate the highest mark-ups on mid-range wines. Mark-ups are low at the bottom to encourage wine consumption of some sort. At the top as there is an asymmetry in substitution effects. A lower mark-up on the most expensive wines leads to upgrading but no downgrading in diner choice so is profitable.

In the remainder of the paper the data is described and mark-ups by menu price-rank are reported. It is then examined whether the patterns are due to rank rather than mark-ups varying with wine quality. Finally, potential explanations for the findings are considered and brief conclusions drawn.

## **The Data**

We sampled 249 London-based restaurants on Tripadvisor.co.uk in July 2015. All restaurants had online wine menus no longer than 3 pages. The median Tripadvisor ranking of the sampled restaurants was 600. The information on the wine menus was "read in" by a customized computer program (validated by human spot checks.) Of the sampled restaurants, 235 had "readable" wine menus, one each of red and white. These 470 menus had 6335 wines listed. The menu information coded included name of the wine, description if any, vintage year(s), position on the menu (or submenu), and price per bottle (or large or small glass).

Tables 1 provides summary descriptive statistics for the menus and the mark-ups.

The red wine menus had on average close to 15 different wines while white wine menus were slightly shorter with an average of little more than 12 wines. The average price of a red wine bottle was £42 while the white wines were cheaper with an average price of £32. The most expensive red was priced at £7630 while the most expensive white came in at £520. Most wines were much cheaper with about 46% priced below £30, and 79% priced below £50.

There was considerable variation in the length of the menu and wine price across restaurants. In general, pricier restaurants had longer wine menus. The cheapest wine was more expensive and the average wine price higher. For a subset of 126 restaurants, we had estimates of the cost of a typical meal. The mean wine price rose by 2% for every £1 increase in the cost of a meal.

Tables 2 and 3 provide information on how buying wine by the glass compares to buying by the bottle. Unsurprisingly, cheaper wines were more likely to be offered with a choice of glass vs. bottle than the expensive wines. For instance, about 53% of the wines priced under £15 were also offered in glass as compared to under 5% of the wines priced above £100. The most common glass size was the standard 175ml. Buying wine by the glass is not substantially more expensive than wine by the bottle, contrary to the common perception. On average, the price of wine in the 175ml glass was 13.1% more than that of equivalent volume of wine if bought as a bottle.

The name, description, and vintage year of the wines were run through Wine-searcher.com that gives the cheapest available retail prices. An exact match was found for 66% of the wines. Table 4 reports on mark-ups. The mean % mark-up over retail (margin/cost) was about 303% - very similar for both red and white wines. In choosing restaurant wine, the relevant comparison for diners is probably with the retail option. Knowing that the menu price of a wine is unusually high relative to its supermarket price would likely be regarded as a rip-off and discourage its choice. Wholesale price is the relevant input cost for both the menu price and the retail price but is difficult to obtain. Retail and menu prices are highly correlated with  $r^2$  of over 0.92, suggesting that retail price is a good proxy for

wholesale price.<sup>4</sup> Most importantly though, the effect of menu rank on mark-up over retail and wholesale should be similar.<sup>5</sup>

### **Is the second-cheapest wine special?**

According to the embarrassment view, restaurateurs exploit the enhanced willingness to pay of naïve diners for whatever wine is the second cheapest. The test is therefore whether this wine commands a mark-up above that of its neighbours.

Figure 1 plots the absolute mark-up (menu price minus retail price). The point estimates are derived from regressions of mark-ups on rank dummies.<sup>6</sup> Plotting mark-ups relative to the cheapest wine controlling for menu fixed effects where a menu is a unique restaurant and wine type (red or white wine) combination yields a similar pattern. The absolute mark-up increases in rank, slowly for the first 5 ranks then more rapidly as price differences become greater but the second-cheapest wine does not stand out as anomalous. Percentage mark-ups, shown in Figure 2, are lower on the two cheapest wines, then flatten, and fall beyond about rank 10. Where the peak mark-up occurs naturally depends on menu length. Regressing the rank of the peak percentage mark-up on menu length, the relationship is increasing but not proportionately. On menus with fewer than eleven wines peak mark-up tends to be below the median rank but on longer menus the highest % mark-up is below the median rank. Figure 3 plots the result.

Table 5 provides more formal tests for these properties. The first column shows that the mean mark-up of the second-cheapest wine is significantly below the mean of ranks 3-6. Column 2 shows that mark-ups are rising over the first 6 ranks with the second-cheapest wine not standing out from the significant trend. Beyond rank 6, mark-ups fall, as shown by the significant slope coefficient of column 3. The evidence is that there is a turning point in mark-ups. Column 4 shows how the location of the peak mark-up varies with menu length. The longer the menu the

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<sup>4</sup> Jaeger and Storchmann (2011) find a (weak) positive correlation between retail price and price dispersion. It is therefore possible that use of the lowest retail price may generate a tendency for our mark-up measure to increase with price, contrary to the findings.

<sup>5</sup> Suppose the mark-up of retail over wholesale is  $p_r = g(p_w)$  and the mark-up of menu price over wholesale is  $p_m = f(p_w, R)$  where  $R$  is menu rank. Mark-up of menu over retail is then  $p_m/p_r = f(p_w, R)/g(p_w)$ . Our measure may not accurately capture mark-up on wholesale, but it will show how the mark-up varies with rank.

<sup>6</sup> We estimate regressions without the intercept so that we do not have to omit any rank.

higher the peak a little below the median rank on longer menus and above on shorter.<sup>7</sup>

### **Do mark-ups vary with rank or with price?**

According to the embarrassment view, the mark-up on the second cheapest wine is high by virtue of its rank. Although the evidence so far does not support this claim, there is a pattern to mark-ups, a relatively smooth inverse U shape with respect to rank. As rank and retail price are bound to be positively correlated, it is open whether rank *per se* has an independent influence. At first sight, this issue can be addressed by including retail price in the mark-up regressions. This is not the case. Adding retail price mechanically generates rank effects even if rank is not an element in pricing. Two wines with the same retail price need not have the same menu price, perhaps because retail price is mismeasured, or because their wholesale prices are not identical, or for other reasons. The wine with the lower menu price then has lower rank and lower observed mark-up even though rank does not influence menu price.

To avoid this problem, we compare the menu price of the exact same wines appearing on different menus at different price ranks. This procedure eliminates the need to measure retail price and limits the effect of variations in wholesale price. The lower the rank at which a given wine appears, the more upmarket the restaurant tends to be. Since more upmarket restaurants tend to have higher average mark-ups, the tendency is for price (mark-up) to be higher when rank is low. Thus, if the same wine is significantly cheaper when it appears at rank  $n$  than at rank  $n+1$ , it is reasonable to conclude that a rank effect is involved. Alternatively, including restaurant fixed-effects controls for differences in average mark-ups across restaurants.

For this test, it is necessary to find wines that appear on multiple menus. They were identified by a Freelancer worker. Only wines that seemed in all respects identical were retained. For example, same grape, vintage, region but different winery would not be considered identical. This yielded 176 observations comprising 85

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<sup>7</sup> The median, mean and standard deviation of the peak mark-up rank for red are 5, 7.36, 8.76 and for white, 6, 6.77, 5.48.



distinct wines appearing on 81 menus from 70 restaurants. The full sample and the wines selected as identical are in the online appendix.

Column 1 of Table 6 is a regression of (log) menu price on price rank without wine or menu fixed effects. When a specific wine is the cheapest on the menu it is priced significantly lower than at higher ranks. The remaining columns add both sets of fixed effects to provide an estimate of true rank effects. Again, when a wine is the cheapest on the menu, columns 2 and 3 indicate it is priced significantly lower than on menus on which it appears at a higher price rank.

Comparing identical wines on different menus eliminates some issues in determining whether rank matters, but it is still possible there are confounding effects. Some restaurants may have paid less for a given wine than have others and as a result charge less for it. Alternatively, there may be random effects in menu price setting. For these reasons, menu price may increase in rank even though rank is not a basis for menu pricing. These effects would though apply comparing any two ranks. The final three columns of Table 6 include menu-price rank as a continuous variable, but it is not significant. The significant discount on the cheapest wine is therefore likely to be a strategic choice.

### **Explaining mark-ups**

There are several possible explanations why percentage mark-ups rise then fall with rank.

#### *1) Vertical price discrimination*

A natural starting point is whether mark-ups following an inverse U in rank is consistent with profit-maximization in the presence of well-informed consumers whose utility only depends on the wine consumed. This is the Mussa and Rosen (1978) model of a monopoly selling a vertically differentiated product line.<sup>8</sup> Consumers have unit demand but differ in their valuation of (unidimensional) quality. Those insensitive to quality buy mediocre items at prices that do not much affect the willingness to pay for better quality by the more discerning.<sup>9</sup> The only

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<sup>8</sup> Restaurants are seldom reasonably viewed as monopolies, but once entered, diners will not go elsewhere for their wine. Whether diners fully factor the wine list in when choosing a restaurant is an open question. Champsaur and Rochet (1989) analyse a price-setting duopoly. Results are not fundamentally different to monopoly as subsequently discussed.

<sup>9</sup> Even if higher quality is no more costly than lower, a variety of qualities will be offered as in Gabszewicz et al (1986) and Denekere and McAfee (1996).

definite result in Mussa and Rosen is that the absolute mark-up over wholesale price is increasing in quality.<sup>10</sup> This property strongly holds for absolute mark-up over retail price in our data, as illustrated in Figure 1, suggesting that it also does for mark-up over wholesale.<sup>11</sup>

Although Mussa and Rosen (1978) do not investigate percentage mark-ups, Maskin and Riley (1984) show that with a continuous taste distribution and every possible quality available to the seller, the relative mark-up must locally decline in quality in the vicinity of the best variety offered.<sup>12</sup> In addition, conditions are found, described as “mild restrictions” (p185), for mark-ups to monotonically decline with quality. For example, sufficient conditions include that the hazard rate of consumer valuations is non decreasing. If theory does yield a strong presumption of monotonically declining mark-ups, our empirical finding that mark-ups initially rise implies rejection of the standard model. However, increasing mark-ups are compatible with seemingly reasonable specifications. To identify the issues, we first examine a two-type setting then provide simulations with a continuous type distribution and multiple varieties.

As in Mussa and Rosen, let the valuation of a wine of quality  $q$  by a consumer with taste parameter  $\theta$  be  $v = k_0 + k_1\theta q$ . For simplicity, the convex cost of quality function is  $C(q) = c_0 + aq + bq^2$ . Figure 4 presents the analysis when there are just two consumer types. The functions show marginal benefits and costs of quality. Two qualities are offered,  $q_1$  bought by low types and  $q_2$  by the high. Willingness to pay by the low types is  $ADq_10$ . It is optimal to charge this as not only does it maximise revenue from the low quality but lowers the surplus the high types obtain from buying the low quality to  $EFDA$  and therefore maximises what can be charged for  $q_2$  to  $EGq_20$ - $EFDA$ . The mark-up on  $q_1$  is therefore  $EFDA/OBCq_1$  and on  $q_2$  is  $(EGB-EFDA)/BGq_20$ . Given  $q_1$ , the profit maximising choice of high quality is the efficient  $q_2$  as the seller can extract all the social surplus from quality upgrades. The profit maximising  $q_1$  given  $q_2$  is more delicate. A marginal increase in  $q_1$  raises profit on each low item sold by FC but by increasing the surplus from high types buying low quality by FD lowers the profit

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<sup>10</sup> Suppose the highest quality wine had a lower mark-up than the second highest. Marginally increasing its price not only causes some substitution to the more profitable wine but more profit is also made from diners that remain with the best wine.

<sup>11</sup> Suppose that the relation between retail and wholesale price is a fixed proportion.

<sup>12</sup> Their Proposition 6 is the relevant one. This concerns whether a monopolist selling its homogeneous output in packages of various sizes will choose quantity discounts. As Maskin and Riley point out, this can be reinterpreted as a quality choice problem with larger packages regarded as higher-quality goods.

on each high-quality item by FD. If there are  $n$  times as many low types as high, the optimal  $q_1$  is where  $nDC=FD$ .

The question is whether the percentage mark-up on high and low quality can be ordered. In particular, can the lowest mark-up be on the lowest quality wine? Let the valuation of quality by the low types be low, with  $A$  just above  $B$ . If  $n$  is high, it will be worth selling the low-quality wine but the mark-up of  $AB/B_0$  will be low and well below that on the high quality which will be close to  $EGB/BGq_20$ .

**Proposition** *If enough diners put low value on quality, high quality wine carries the greatest mark-up.*

The requirements for the cheapest wine to have the lowest mark-up seem quite plausible.<sup>13</sup>

As there are only two wines in this analysis, it is not possible to determine whether the quality-mark-up relationship is monotone, but the forces identified make it unlikely that this generally holds when there are many wines. First, an asymmetry applies to the pricing of the most expensive wine that is not present for other ranks. Cutting the price of the top of the range wine induces some diners to upgrade but none to downgrade. For every other wine, a price cut induces two-way substitution. This is true even for the cheapest wine. Cutting the price of the cheapest wine will induce some diners to start buying wine, augmenting profit. This is offset by unprofitable down grading from the second-cheapest wine. Still, the mark-up on the cheapest wine is likely to exceed the extra absolute mark-up on the second cheapest, making it profitable to draw in extra drinkers through a low price. There are therefore reasons why mark ups are low at the quality extremes . Obtaining analytical solutions is difficult, so to investigate further, numerical methods are adopted.

The model involves some generalisation of functional forms Diners value a wine of quality  $q$  at  $v = k_0 + k_1\theta q^\rho$  where  $k_0, k_1, \rho, \theta > 0$  with taste parameter  $\theta$  distributed according to the Beta distribution  $B(\alpha_0, \beta_0)$ . This distribution is flexible including uniform as a special case but allowing the density to be greater for lower qualities, as is plausible. If there is decreasing marginal utility to quality,  $\rho < 0$ .

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<sup>13</sup> This does not invalidate the Maskin and Riley result of declining margins at the top as the two wines offered are discretely different.

The wholesale cost of a wine of quality  $q$  is  $C(q) = c_0 + q^\gamma$  with  $\gamma > 1$  for convex costs.

The procedure is to specify values for all parameters including the number of diners,  $N$ , and the number of wines,  $n$ . Tastes are drawn from the Beta distribution so  $\theta \in [0,1]$ , whilst the available qualities have end points at 0 and 1.

Partly for computational reasons, the number of wines available to the restaurant is set exogenously, though it is allowed that the restaurant chooses not to sell all the wines in the market. In the Mussa and Rosen formulation in most cases there is no bunching with every consumer buying a different wine. This is obviously excessive variety relative to actual wine lists. The most obvious explanation is fixed costs in adding a wine and perhaps diner cognitive capacity. It is therefore to be expected that there will be a finite number of wines on the list. Whatever number of wines and quality distribution assumed, it is likely it can be justified by some fixed-cost specification.

Only a finite number of prices can be considered in the search for the optimal menu. For each wine, possible prices are restricted to  $p_i = k_0 + m\delta$  where  $\delta$  is a price increment and  $m$  an integer. A feasible price list,  $p_1 \dots p_n$ , is further restricted to have  $p_n < k_0 + k_1$  or else the best wine will certainly not be bought. The collection of menus satisfying these conditions is denoted the feasible set,  $P$ . For each of these menus, demand for every wine on the list is calculated enabling its profitability to be evaluated.

For each diner,  $j$ , their surplus from wine  $i$  is  $z_{ij} = v_{ij} - p_i$ . Define  $z_{max}^j \equiv \max z_{ij}$ , then if  $z_{max}^j > 0$ ,  $j$  buys wine  $i$ . Indicator variable  $D_{ij}$  equals 1 if  $z_{max}^j > 0$  and zero otherwise. The profitability of price configuration  $p$  is therefore

$$\pi_p = \sum_j^N \sum_i^n D_{ij}(p_i - C_i)$$

The menu with the highest expected  $\pi_p$  is found following an exhaustive search routine.

Table 4 reports the optimal mark-up for four runs differing in taste distributions and the number of wines available for the restaurateur to offer. All have the property that the percentage mark-up is highest for mid-ranked wines.<sup>14</sup>

In case A, there is a uniform distribution of tastes with three wines available, all selected to be sold. At the optimal prices, all 1000 diners choose to order wine, as is true of all cases. Case B adds a lower quality wine to the restaurateur's choice set, but is otherwise the same as case A. As a result, the previously cheapest wine is no longer sold.<sup>15</sup> The new wine caters to the low-end of the market, so if a wine just a little better is also sold, it does not expand the market but simply diverts diners from more profitable up-market wines. Case C is the same as case A, except the taste distribution is skewed towards lower quality wine. Not surprisingly, sales are now concentrated on the cheapest wine. The price of the cheapest wine is the same as under the uniform distribution as the corner solution remains optimal and willingness to pay for the lowest quality is always  $k_0$ .<sup>16</sup> The price of the top wine is somewhat reduced, essentially because demand for it is more elastic. That is, sales are lower, but substitutability with the next most expensive wine (the pdf of the taste distribution) not so much changed. Comparison of the uniform case B and skewed case D has the same pattern.<sup>17</sup>

What is most important is that in all these cases is that it is the middle wine that has the highest mark-up.

## 2) *You get what you pay for*

This well-established adage is often claimed to apply to all kinds of goods and services. If the belief is widely held, the issue is what stops sellers of low-quality products setting a high price so to profitably pass them off as high quality? Bagwell and Riordan (1991) study the case of a firm selling a single good that may be of high or low quality. Many consumers cannot tell product type at time of

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<sup>14</sup> In all runs  $p_{i+1} - C_{i+1} > p_i - C_i$ , the property that absolute mark-ups rise with quality, an implication of optimization..

<sup>15</sup> There is thus partial optimisation of the wines that appear on the menu. In principle the choice set should be broadened, but computational requirements become excessive.

<sup>16</sup> In the Table the coarseness of the price grid means the cheapest wine is priced a little below  $k_0$ .

<sup>17</sup> Champsaur and Rochet (1989) consider the product-line choice by duopolists as a two-stage game. First, the product lines are selected then prices are set. The main result is that to soften competition, product lines may be chosen so as not to overlap. At the qualities that differ least between sellers, there is bunching. For the up market restaurant the pricing problem is similar to our simulations whereas the best wine at the down market restaurant competes with the worst at the up market restaurant.

purchase. It is shown that price can serve as a quality signal if low-quality products are cheaper to produce, as loss of volume at a high price may make it the less profitable choice for a low-quality seller, even though consumers then believe the item is of high quality.

A wine list offers multiple items, so this is a different set-up. Consider the case of two wines and start from the profit-maximising prices if all consumers are informed. Now suppose that a fraction of consumers is uninformed concerning quality but know population distributions and costs and draw rational inferences. The seller now has an incentive to offer the low-quality wine at the high price. Informed sellers would switch to the low-quality wine, a loss in profit but there would be more profit from the cost saving on the high price wine. If there are few informed sellers, this strategy would be unprofitable, making price a valid signal of quality. With more uninformed consumers, it would pay to sell a low-quality wine at the high price if the uninformed believe it is high quality. This would not be a rational belief, so only the low-quality wine could be sold.<sup>18</sup>

In this analysis formidable cognitive demands are placed on the uninformed. Moreover, the uninformed (concerning wine quality) require considerable information about taste distributions and costs. Perhaps more realistic is that the uninformed simply believe quality increases with price, imposing no consistency between consumer beliefs and seller behavior. Even repeat diners may not engage in much experimentation to challenge their beliefs concerning quality and price. If they do, diners may be subject to autosuggestion to confirm their initial beliefs. Plassman et al (2008) find in an fMRI experiment that the same wine priced more highly is not only expected to be better but is actually enjoyed more.<sup>19</sup> To exploit a naïve belief that quality increases in price, restaurateurs can therefore offer essentially the same low-quality wine at increasing prices. The implication is that it is not just the second-cheapest wine that is overpriced due to non-standard beliefs. Margins are even higher further up the list as a wine does not actually have to be better to be believed to be better.

More explicitly, initially suppose all diners are uninformed about wine quality, have the same income but take price as a quality signal. Anticipated utility is  $U = v(p) + u(M - p)$  with  $u' > 0, u'' < 0$ . There is unit demand for wine and irrespective of its true quality, a bottle is valued at  $v(p), v'(p) > 0, v'' < 0$ .

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<sup>18</sup> Measures such as cutting the price of the cheapest wine or offering both a high and low quality wine at the high price will not generally work either.

<sup>19</sup> Shiv, Carmon and Ariely (2006) find that the same energy drink is more efficacious when priced higher.

Although it is believed that a higher price implies a better wine, this effect is insufficient to prevent anticipated surplus falling with price,  $\partial U / \partial p = v'(p) - u'(M - p) < 0$ . In this situation there is no point in selling anything but wines of the lowest presentable quality. Price is set to eliminate anticipated consumer surplus, so satisfies  $v(p) + u(M - p) = u(M)$ .

Now let there be two income levels,  $M_l < M_h$ . The solution is a standard separating equilibrium. Low-income diners buy the cheapest wine at a price that leaves them with zero surplus, that is  $u(M_l - p_l) + v(p_l) = u(M_l)$ . High-income types buy at a price that gives them the same surplus as if they bought the cheapest offer,  $u(M_h - p_l) + v(p_l) = u(M_h - p_h) + v(p_h) = 0$ . The mark-up percentage therefore rises with price as both wines cost the same wholesale.

Now introduce some low-income informed diners. Faced by the offers when there are only uninformed diners, the informed would only contemplate buying the cheapest wine. As the uninformed overvalue even the cheapest wine due to its relatively high price, informed low-income types do not order wine at all. High-income types might buy the cheapest wine as the utility cost of the price is low for them, but provisionally assume this does not happen.

Finally, add a genuinely higher quality wine to the list. It costs more wholesale than the other wines. The new wine is priced an epsilon above  $p_h$  so it will not be bought by the uninformed high-income types as the higher price is not compensated by sufficiently higher perceived value. For high-income informed types, the new wine can be a good buy because, recognising its quality, the cheapest wine delivers negative surplus. The highest priced wine therefore carries a lower mark-up than the second most expensive.

### Loss leaders

Cheap wines may be a kind of “loss leader”. They are presented at the top of the menu, are likely to be the most familiar to customers who judge how reasonable the restaurant’s overall pricing is based on whether the cheapest wine is a good deal. If it is, customers may be encouraged to buy more expensive “exotic” wines thinking they are equally keenly priced.

### Pass through

Restaurants may pay different wholesale prices for the same wine. Those that buy for less may charge less. Suppose the unobserved wholesale price paid by a

restaurant for a particular wine is random, independent of the price paid for other wines and by the other restaurants. Menu price is determined mechanically as the wholesale price plus a percentage common to all wines. Consider a collection of wines with the same mean wholesale price. On a given menu the wines with bad draws on the wholesale price will be higher priced implying measured mark-up on retail increases in rank. Across menus the same wine is cheaper when at a lower rank. Rank effects emerge, although for purely mechanical reasons.<sup>20</sup> The pattern does not entirely fit the empirics though. Within menus mark-ups peak around the median rank and comparing the same wine on different menus the tendency for menu price to increase with rank is primarily for the first two ranks. Pricing patterns are not fully accounted for by mechanical effects.

### Compromise theory

According to the compromise theory of Simonson (1989), when choosing from a list, people tend to go for an option close to the median. In our data, the peak mark-up varies with menu length occurring close to the median rank. This is consistent with compromise theory (but also with vertical price discrimination).

The compromise effect may be enhanced by the strategic incentives arising from decoy theory as developed by Huber, Payne and Puto (1982). The idea is that introducing an expensive but minimally superior item to a product line makes the less expensive items seem more attractive. This leads Ariely (2016) to expect the most expensive wines to be disproportionately expensive as they are priced to make other wines look cheap. We find the opposite to be the case as judged by percentage mark-up over retail. Nevertheless, this strategy may be of relevance. Most diners do not seriously consider the very top-end wines. A more salient comparison may be with the middle-ranked wines, so these may be the ones overpriced to make wines around positions two and three seem attractive.

### Conclusion

The second-cheapest wine on the menu is widely claimed to be an exceptionally bad buy. It is argued that gouging restaurateurs exploit naive diners who don't

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<sup>20</sup> Introducing wines that differ by mean wholesale price does not affect the tendencies.



really care what they drink, as long they are not exposed as stingy. This sounds a plausible story, but as far as we know the claim has never been investigated empirically. Our data refutes the behavioural hypothesis in its narrowest form. The mark-up on the second-cheapest wine is below that on the immediately succeeding wines.

A further finding is that absolute mark-ups increase in rank whilst percentage mark-ups peak on mid-range wines. This latter feature had been thought to be inconsistent with the standard utility and profit maximising model under reasonable assumptions, but we show this is not the case. Keeping prices low at the bottom encourages diners who would not otherwise order wine to do so. At the top end, a low mark-up induces connoisseurs to trade-up to wines with higher absolute mark-ups with no offsetting trading-down. Behavioural elements such as unvalidated beliefs that you get what you pay for and compromise effects may also contribute to higher mark-ups on middle-range wines.

In the standard model diners optimize, so there is no reason for them to change behaviour by substituting away from high-mark-up wines. Behavioural factors imply either the cheapest wine or top end wines are the best buys, in which case the appropriate maxim is, don't get stuck in the middle!

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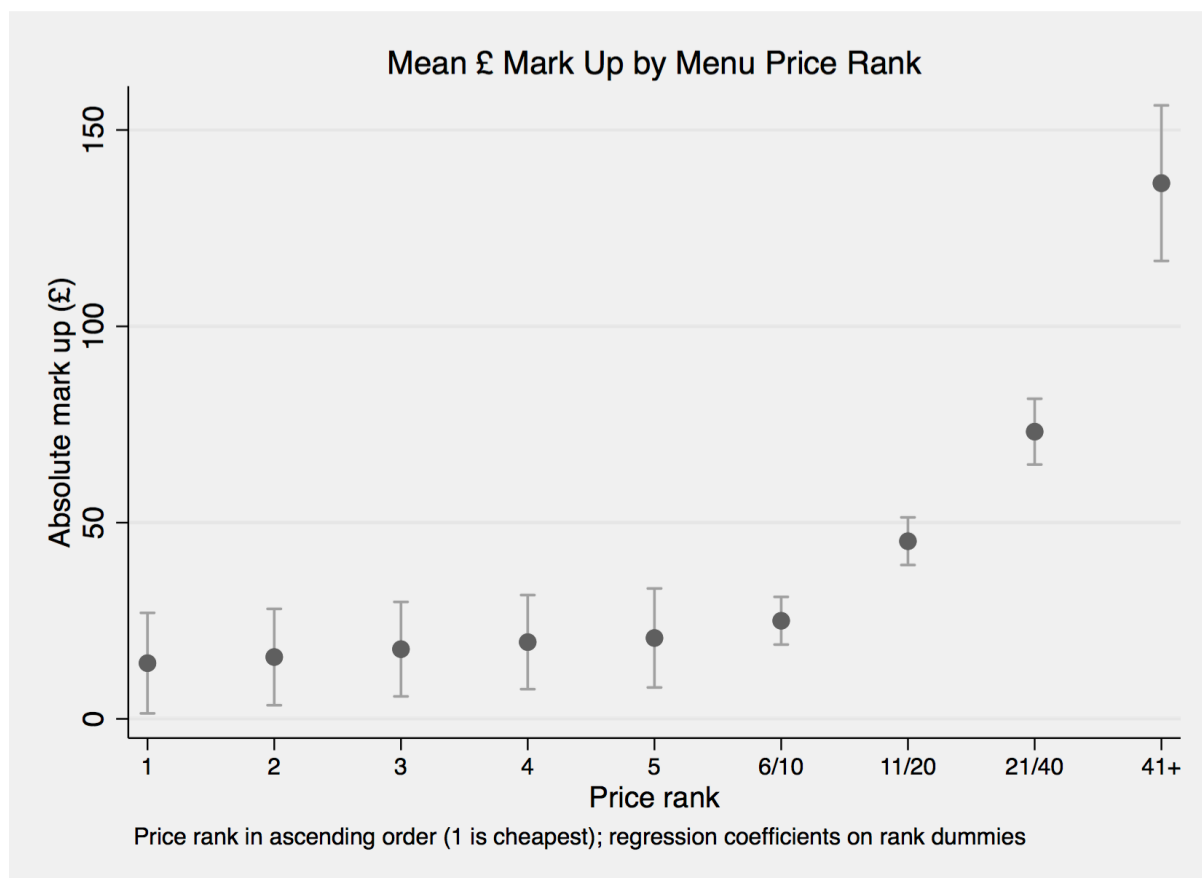
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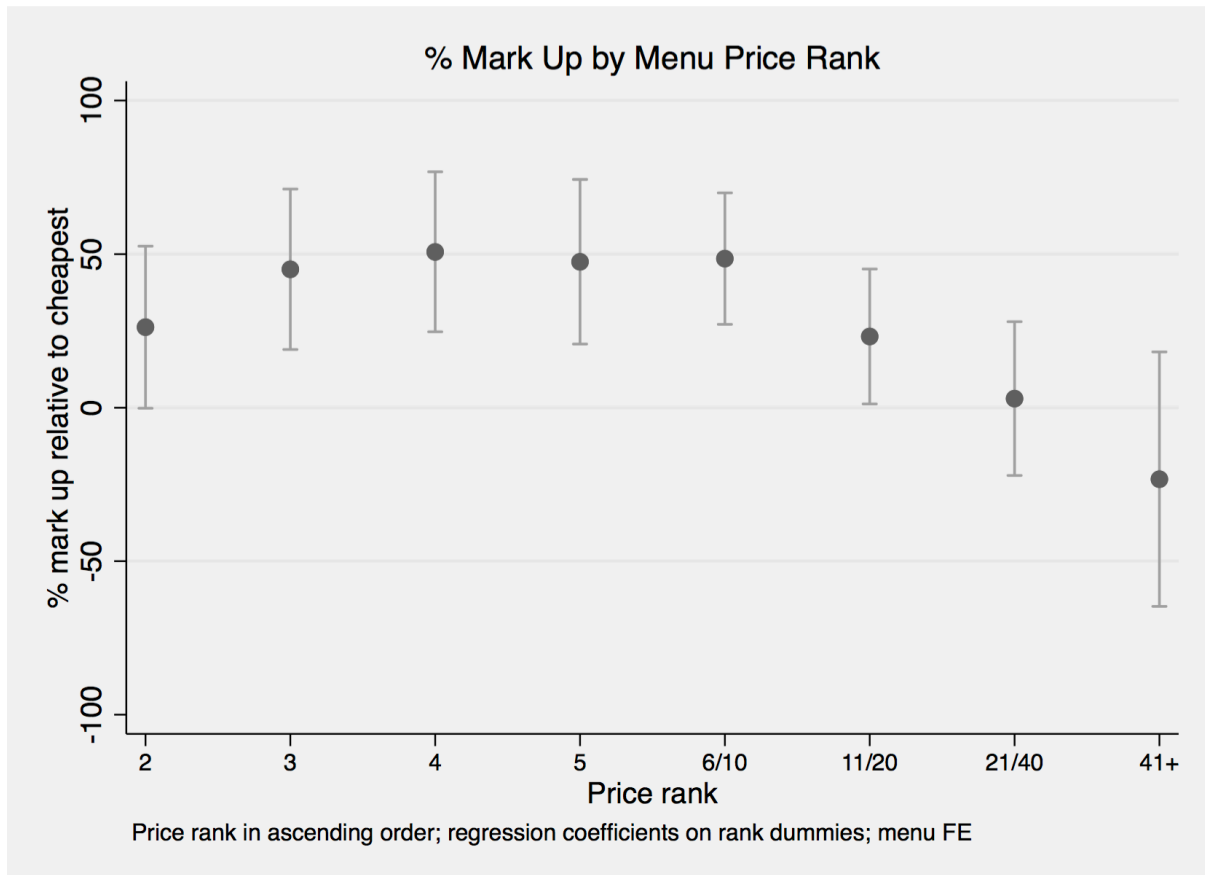
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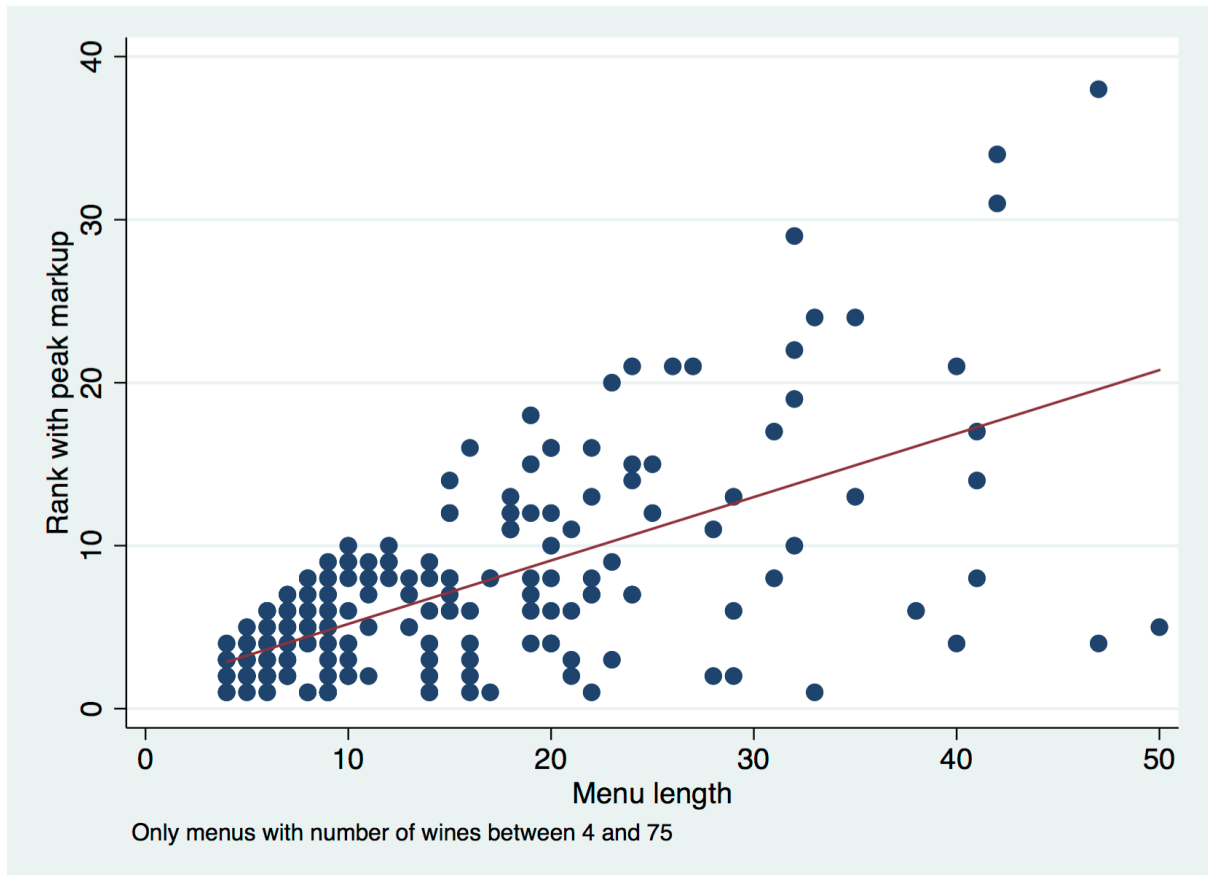
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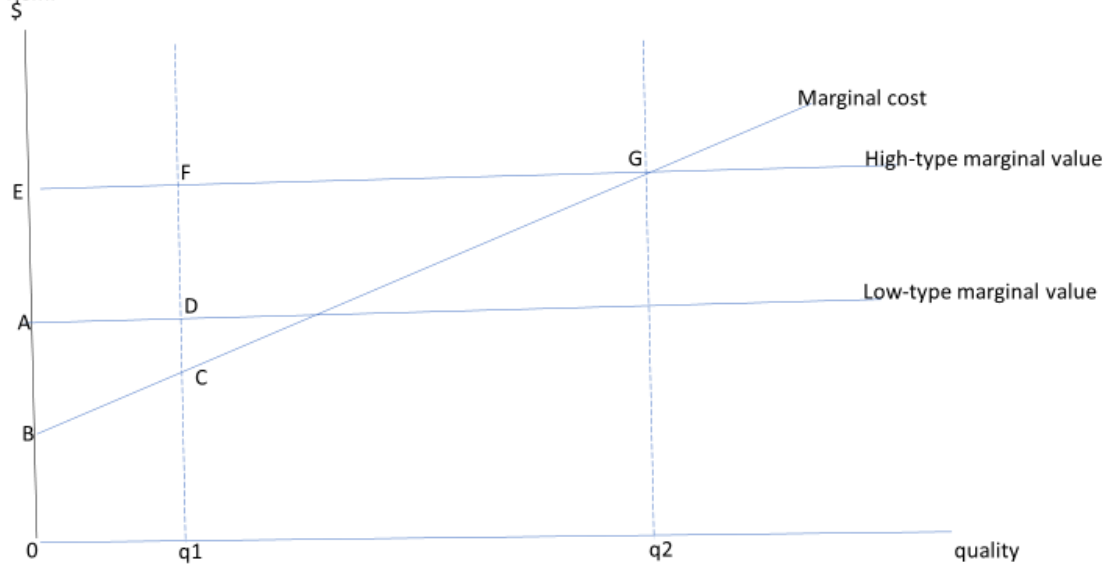
**Figure 1 Absolute mark-up over retail price by menu price rank**



**Figure 2: % absolute mark-up over retail price by menu price rank**



Mark up on low  $ABCD/0BCq_1$ . On high  $(EGB-EFDA)/0BGq_2$ . In limit  $AB/BD$  and  $EGB/0BGq_2$  so can be lower on low quality item.



**Figure 4: Mark-ups rise with quality**

## TABLES

**Table 1**  
**Menu-level summary statistics**  
**(full set of 6335 wines listed on the 470 wine menus)**

		<b>Mean</b>	<b>Min.</b>	<b>Max.</b>
<b>Red</b>	Number of wines	14.65	1	98
	Mean price (£)	42.17	12.95	751.6
	Cheapest wine (£)	19.35	8.5	59
	Priciest wine (£)	152.22	12.95	7630
<b>White</b>	Number of wines	12.31	1	70
	Mean price (£)	31.84	13.95	100.47
	Cheapest wine (£)	19.15	8.5	45
	Priciest wine (£)	65.31	13.95	520

**Table 2: % wines offered by glass**

<b>Bottle price (£)</b>	<b>% offering glass</b>	<b>N</b>
<15	53.0%	134
15-30	39.8%	2558
30-50	19.6%	1959
50-100	7.0%	935
100-200	5.1%	237
200-500	0.0%	83
>500	0.0%	20

Note: 26% of all listed wines offered by glass.

**Table 3: Relative price of wine by glass vs. bottle.**

Glass Size (ml)	Mean f	Std. dev	Median f	N
125	1.182	0.205	1.131	294
175	1.131	0.136	1.108	1141
250	1.065	0.051	1.07	342
375	1.079	0.138	1.054	207
500	1.057	0.066	1.056	362

Relative measure f = (Glass price/ml )/(Bottle price/ml )

**Table 4 Mark-up summary statistics**

	Mean	SD	Median	5th pct.	95th pct.	Number
<b><u>% markup (margin/retail)</u></b>						
<b>Red</b>	298.8	151.5	267.1	107.7	596.2	2289
<b>White</b>	300.7	154.1	268.9	108.2	592.8	1884
<b>All</b>	299.7	152.7	267.7	108.0	592.8	4173
<b><u>Absolute markup (£ margin)</u></b>						
<b>Red</b>	46.5	130.8	27.1	11.4	113.6	2289
<b>White</b>	28.5	23.1	23.0	10.9	61.8	1884
<b>All</b>	38.4	98.5	25.1	11.1	90.5	4173

(Note: Computed at wine-level for subset of wines that were matched to Wine-searcher.com. There was a higher match rate for the more expensive wines. Only includes % markups >0 or < 1000%.)



**Table 5: % mark-up on the 2<sup>nd</sup> cheapest wine and peak mark-up rank**

	% mark-up			Peak mark-up rank
	(1)	(2)	(3)	(4)
Rank 2 dummy	-26.1853* [14.6221]	5.2684 [13.9859]		
Rank (continuous)		10.9068*** [3.2876]	-2.3226*** [0.4964]	
Menu length				0.4303*** [0.0688]
Constant				1.0540 [0.7878]
Observations	1,251	1,502	2,597	401
R-squared	0.3945	0.3769	0.2722	0.4604

**Note:** Column (1) includes wines on ranks 2 to 6; column (2) includes wines on ranks 1 to 6; and column (3) includes wines ranked 6 and higher. Wines with mark-ups below 0 or above 1000% are dropped. The regressions (1)-(3) include menu FE. Robust standard errors are clustered on restaurant. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 6**  
**Menu price for identical wines at different ranks.**  
**(Table 3 from the latest version of the paper)**

	<u>Ln(Menu price)</u>				
	(1)	(2)	(3)	(4)	(5)
Cheapest	-0.652*** [0.092]	-0.107*** [0.023]	-0.120*** [0.020]		
2 <sup>nd</sup> cheapest	-0.488*** [0.091]	-0.004 [0.023]		0.025 [0.078]	
3 <sup>rd</sup> cheapest	-0.231*** [0.083]	0.024*** [0.000]			0.025 [0.022]
Rank			0.009 [0.010]	0.007 [0.010]	0.006 [0.010]
Constant	3.686*** [0.055]	4.020*** [0.011]	3.759*** [0.308]	3.801*** [0.307]	3.823*** [0.309]
Wine FE	N	Y	Y	Y	Y
Restaurant FE	N	Y	Y	Y	Y
Observations	176	176	176	176	176
R-squared	0.224	0.999	0.999	0.999	0.999

**Table 7**  
**Optimal markups from numerical analysis**

<b>Q</b>	<b>0.05</b>	<b>0.1</b>	<b>0.2</b>	<b>0.8</b>
<u>A. Uniform taste distribution (3 wines)</u>				
<b>Price</b>		2.491	2.558	3.092
<b>Mark-up (p/c)</b>		1.383	1.14	1.11
<b>Demand</b>		593	369	38
<u>B. Uniform taste distribution (4 wines)</u>				
<b>Price</b>	2.490	2.551	2.588	3.122
<b>Mark-up (p/c)</b>	1.383	1.416	1.431	1.350
<b>Demand</b>	549	0	396	55
<u>C. Left-skewed taste distribution (3 wines)</u>				
<b>Price</b>		2.491	2.528	3.032
<b>Mark-up (p/c)</b>		1.383	1.398	1.311
<b>Demand</b>		746	249	5
<u>D. Left-skewed taste distribution (4 wines)</u>				
<b>Price</b>	2.490	2.521	2.558	3.062
<b>Mark-up (p/c)</b>	1.383	1.400	1.415	1.324
<b>Demand</b>	800	0	199	1

Notes: Optimal (profit-maximising) price, and the resulting relative mark-up and quantity demanded for each wine quality (q), computed using the numerical algorithm described in the text. The cost function is  $c = 1.8 + q^3$ . The value function is  $v = 2.5 + \theta q^{0.8}$  with 1000 i.i.d. draws of the taste parameter ( $\theta$ ) from the Beta(1,1) distribution for panels A & B, and the Beta(0.5,2) distribution for panels C & D. Please see text for further details on the numerical algorithm.