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Determinants of Demand for Wine

– price sensitivity and perceived quality in a monopoly setting

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Abstract:

The purpose of this paper is to characterise the demand for wine. In contrast to the majority of current research efforts this paper treats wine as a heterogeneous good with a range of inherent characteristics. Each wine included in the study is described by twelve variables including, among others, price, quality, sensory attributes and country of origin. Using unique data that cover 90 percent of all wines sold in Sweden we conclude that consumers do recognise quality in wine, that price elasticity is non-constant and decreasing with price and that consumers put a great deal of weight on the country of origin of the wine.

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1 Introduction

In this paper we investigate whether or not consumers can identify quality in wine. More specifically if they choose a higher quality wine when all else, including price, is equal. Using sales figures from the Swedish alcohol monopoly stores, Systembolaget (SB), combined with reviews from professional wine critics we construct a unique data set to estimate this and other effects. We differ from many recent studies on the demand for wine in that we treat wine as a heterogeneous good. For the individual consumer we assume that both observed and unobserved heterogeneity is present. Observed heterogeneity includes objective features of the wine such as variety, country of origin and price. Arguably, the most important unobserved characteristic of a wine is its quality. One might argue that quality is not always unobserved and this is an issue that we will return to later.

Understanding how consumers perceive and assess quality in wine is a new, but rather vibrant, research topic. Many of the tools necessary for such an analysis come from the so called new consumer theory, credited first and foremost to Lancaster (1966) who showed how one might divide demand for a good into demand for specific characteristics of the same good[2]. More recently Gergaud & Livat (2007) investigate a sample of 6000 European wine consumers to see how they use various signals to assess quality. They divide the sample into connoisseurs and non-connoisseurs and ask them questions on previous and present experience with wines from Bordeaux. Their main conclusion is that connoisseurs use price as signal of quality to a less degree than do non-connoisseurs. Combris et al. (1997) generally criticize the method of using data acquired from wine guides which they deem unreliable. They perform a hedonic price study on a sample of 519 Bordeaux wines that were tested in a unique French experiment by a jury of twelve professional oenologists and sommeliers. Besides sensory attributes each wine is assigned a grade between 0 and 20 to reflect overall quality. In line with Rosen (1974) they however opt not to include this grade as an explanatory variable, claiming that overall quality is not an intrinsic character of the wine. Further they argue that since the wine was bought prior to the grading of it, the quality grade can logically have no influence on its price. Their main findings are that market prices of Bordeaux are almost wholly explained by the objective features displayed on the label of the bottle. When they however let quality as measured by the jury grade be the dependent variable they find that this is first and foremost explained by the sensory

[2] As Morishima (1959) correctly points out a similar analysis of demand was performed already in the 1930's by Hicks and others.

characteristics of the wine. One offered explanation is that the preferences of the average consumer may very well differ from that of a professional jury.

In this paper we wish to discern, first of all, if consumers are able to recognize quality in wine and secondly if this is reflected in their consumption behavior.

The rest of this paper is outlined as follows; a review is given to previous studies that treat wine as a heterogeneous good. A short background to the Swedish system of alcohol sales is then provided, this is followed by a segment on the quality grading of wine. We go on to state our model, present our data and the estimated results. Finally we discuss our findings and propose some further research.

2 Previous studies

Most earlier studies on the price elasticity of wine has treated wine as an homogenous good. While this may be appropriate from a policy perspective regarding maximisation of tax revenues (Heien and Pompelli, 1989) or reduction of overall consumption (Ornstein and Hanssens, 1985, Eakins and Gallagher, 2003, Johnson et al., 1992), it is not so from the perspective of an individual wine producer. This has been stressed by Anderson et al. (2003) who argue for differentiation with regards to country of origin and quality. The meta analysis of elasticities of alcoholic beverages by Wagenaar et al. (2009) finds that the median estimated price elasticity of wine is around 0,69. However, an individual producer of wine can hardly expect this to apply for his or her own production. Too many substitutes, in form of other wines, will exist, especially at lower price intervals. We estimate the price elasticity of wine by treating it as a heterogeneous good using a non-linear demand function, hence allowing for non-constant price elasticity. We use Swedish retail data, covering roughly 90% of the total value and volume of Swedish wine sales. In addition to price and quantity data we also utilize sensory data as well as a quality measurement for all wines included in the data set. Our findings indicate that elasticity is indeed non-constant and decreasing with price. We further find that for most price levels, wine is much more elastic than what has been estimated when wine has been treated as a homogenous good. For low price levels our estimates point to an elasticity of around 2.5 for red wine and 2.8 for white wine. Not surprisingly, this is much higher than when wine is treated as a homogenous good.

As previously noted, most earlier studies treat wine as a homogenous good, and when differentiation is done it is most often done so with regard to origin. A small review on studies that have treated wine as a heterogeneous good is presented below.

Table 1 Review of studies on wine as a heterogeneous good

Author	Area	Differentiation	Non-constant price elasticity	Quality
Carew et al., (2004)	Canada	Variety, origin	Yes (AIDS)	No
Davis et al., (2008)	United States	Origin, grape	No (Multinomial logit)	No
Seale et al., (2003)	United States	Origin	Yes (AIDS)	No
Nerlove (1995)	Sweden	Variety, origin, sensory attributes	No	Yes
Present paper	Sweden	Variety, origin, sensory attributes, information, etc.	Yes	Yes

Note: AIDS denotes Almost Identical Demand System

Our study controls for product heterogeneity through inclusion of variety (red or dry white), quality, three sensory measures, bottle or bag in box, ecological as well as country of origin for each individual product included. We also employ regional data allowing us to control for the elasticity of demand with regard to income.

Nerlove (1995) is the study closest resembling the present one in that he uses Swedish data, treats wine as a heterogeneous good and differentiate with respect to quality. He however performs a more traditional hedonic study, in the sense that implicit prices are assigned to the objective attributes of the wines. He does however, much like the present study, use volume sold as the dependent variable rather than product prices. His data covers 235 wines, while ours include close to 1000 different wines. Total Swedish consumption increased by 77% between Nerlove's and the present study (Sorad, 2006) and this development seems to be mirrored in many western countries (Thompson & Sam, 2008). This increase does not imply increased consumption of all alcoholic beverages in general but rather a shift in preferences to higher quality wines. We will return to this issue later. Further, we control for possibilities of cross border purchasing, income and perhaps most importantly we allow elasticity to be a function of price and not constant. We

also differ in our view on how sensory characteristics of a wine enter into the consumers demand function.

3 History of the Swedish alcohol monopoly

In this section we give a short review of the development of rules and regulations with regards to alcohol in Sweden. Early development as well as the present situation is discussed.

3.1 Early development of alcohol regulation policy

Due to wide spread alcoholism and alcohol misuse during the earlier part of the 19th century many of the Swedish cities formed liquor monopolies and banned all household production of distilled alcohol to curb this development[3]. These bans seem to have had little impact on the consumer demand as these monopolies turned out to be highly successful. The Swedish government on their part decided to tax these profits at twenty percent, a decision that proved vastly disliked and induced wide spread tax evasion. This in turn led the government to tax one hundred percent of the profits, or in effect overtake the monopolies.

It was felt that even though the state was now the sole provider of alcohol the consumption was far too high. Based on a referendum in 1922, although consultative in nature, the government instated the alcohol rationing system ("Motboken") stating exactly how much any one person could purchase during a certain time period. It turned out to be a highly unpopular system even among the ranks of the sobriety movement and was finally ousted in 1955. During this process the monopoly also took on its new name Systembolaget.[4]

Not willing to throw out the baby with the bath water, a new but less restrictive set of rules for the selling of alcohol was instated. It stated that to purchase alcohol you must be over 21 years of age, you cannot be noticeably under the influence of alcohol and you may not purchase in the purpose of selling the goods to minors. These are in effect the rules that still govern alcohol sales in Sweden today, with the exception that the legal age is now 20 years. The initial effect of the new rules were dramatic with sales soaring 25% and alcohol related crimes doubling.

[3] This section builds upon the historical overview that can be found on www.systembolaget.se
[4] Meaning *System Corporation* named after the *Stockholm System* of alcohol rationing.

3.2 Systembolaget today

So far, the only dramatic change to the monopolistic structure came in 1995 when Sweden joined the European Union. It was at first questioned whether Sweden would be able to keep its monopoly under the EU's stricter competition laws. In 1997 it was however ruled that SB could keep their monopoly of the sales of alcohol to consumers. The monopolies on production, import, export and sales to restaurants were however banned and subsequently dissolved.

Today SB is a corporation wholly owned by the state with close to 500 branches, a revenue of $2.5 bill., and a profit margin of around 25% (SB yearly report 2007). Its board of directors is politically appointed and the company has strict guidelines as to what their strategies and values should be.[5] The long term profitability goal is set at 4% above the nominal interest rate on a Swedish ten year t-bond, but SB clearly states that they are not a profit maximizing business. A recent example of this is the decision to lower consumer prices when profitability became "too high" in recent years (ibid). Not changing, and highly criticized, are the opening hours that have SB closing at six pm on weekdays and two pm on Saturdays. Sunday is closed.[6] To our knowledge, Sweden shares the system of a alcohol monopoly only with two countries, neighboring Norway and Finland. Certain provinces of Canada, including Ontario, employ a similar, but less restrictive system of government run stores.

4 Swedish consumption patterns

This section has two main purposes; to give a general overview of how alcohol consumption patterns have developed into their present state and secondly a short note on how we can expect consumer preferences to be shaped by the actual purchasing experience. The occurrence of cross-border purchasing is also dealt with in brief.

4.1 Development of consumption patterns and the role of Systembolaget

As was previously stated, the Swedish alcohol monopoly was instated as a reaction to soaring alcohol consumption. It may therefore seem a bit surprising that alcohol consumption per capita today is higher than it was 100 years ago. Some claim that the explanation is cultural (SB 2008).

[5] SB states that their core values are "Caring, Knowledge and Inspiration"
[6] Recently some stores have extended their opening hours to seven or eight pm on weekdays and four pm on Saturdays.

Traditionally Swedes would concentrate their drinking activities to Saturdays, and make up for daily drinking with Viking-like perseverance during the weekends. Today there are indications of a pattern of adopting the continental European habit of drinking wine and beer with food on a daily basis and combining, not substituting, this with binge drinking over the weekends. It is however hard to discern if this is an effect of higher aggregated consumption or if individual consumers are actually adopting this type of behavior.

Looking in more detail at where the growth in consumption lies, reveals a pattern of increased sales for wine, especially the more expensive segment, and decreased sales of liquor, especially the less expensive white liquor varieties (ibid). This would to some degree confirm the cultural hypothesis, but we will also show that this changing pattern of consumption to some extent can be explained by the more liberal policies on bringing alcohol into Sweden from foreign countries.

The local branches of SB are adjusted in size and variety of products depending on their location. In the metropolitan regions of Stockholm, Goteborg and Malmo you find the *wine cellar stores* that carry all available articles, meaning close to 3100 bottles, cans and boxes. In contrast, the smallest stores carry only 540 articles, but have all other available upon request at no additional charge, but a waiting period of up to two weeks.

To further clarify how Swedes buy alcohol a word on store design is in order. Almost every SB store is now organized in much the same way as an ordinary self service store, rather than the over-the-counter system that was prevalent earlier. Wine, beer and liquor are placed in different areas of the store in shelf systems. Important to note is that wine is organized first after price range. Three main ranges exist in most SB stores; under $7, $7-$13 and above $13[7]. Wines are then sorted by country in their respective price ranges. This can be taken to imply that a consumer is more likely to choose between two different types of wine within the same price range rather than trying similar wines from different price ranges. This is unfortunately an effect that is hard to control for when modeling since we cannot discern what each individual "puts in his or her basket".

[7] Approximate figures. In stores with a larger range of varieties more price ranges exist.

4.2 Cross border purchasing

Important to patterns of Swedish wine consumption is also geography. Sweden has three directly neighboring countries; Denmark, Norway and Finland. Norway and Finland share Sweden's system of alcohol monopoly with the same implications for price and availability thus giving little incentives for cross border purchasing by Swedes. Noteworthy however is that Swedish prices are relatively low compared to those of Norway giving rise to intense cross border purchasing by Norwegians, especially along the northern west coast of Sweden. Our data are in this respect unfortunately rather crude so this is not an effect we can control for. The third neighboring country, Denmark, has no state monopoly on the sale of alcohol and significantly lower taxes on alcohol giving rise to lower prices and has long been a popular destination for Swedes wanting to buy beer and wine. We control for this effect by including the distance from the county capitals to the Danish capital, Copenhagen, in the regressions and even this, rather crude, variable proves significant and positive. Denmark is furthermore the most important gateway to continental Europe with its even lower prices of alcohol and very liberal alcohol policies. Since Sweden's entry into the EU, Swedes are now allowed to bring in an unlimited amount of alcohol from any other EU country as long as it can reasonably be thought to be for personal consumption. For more on the economics of Nordic cross-border shopping, see Asplund et al (2007).

4.3 How do consumers assess information?

Assuming that the consumer does not already know what he or she will buy when entering the store, all information received there should be of crucial importance for how we form our preferences. Two occurrences are noteworthy in this respect. For each bottle in store there is a shelf note with some information on the product. This includes such basics as country of origin and alcohol level. More importantly, it also contains information on sensory characteristics and suitable food pairings. The sensory characteristics are given through pie diagrams that reflect tannins, acidity, fullness and sweetness. We control for these characteristics through their numerical representation. The suitable food combinations are represented by illustrations such as a shrimp, a lamb or a cake. This is thus information that the consumer can take into account when making his decision.

Conversations with store managers further confirm the non-profit maximizing behavior of SB in that they ask their stores to re-arrange the order of the wines with the purpose of making sure that all wines receive equal shelf exposure and thus opportunity of being sold.

5 Grading of wine

This section is devoted to the quality grading of wine as performed by various professionals such as critics and journalists. We discuss why such grading is popular among so called *experience goods.* Further, a short discussion is held on the reliability of such grading and a presentation is done of Swedish wine grading in general and our chosen quality measure specifically.

5.1 Theoretical foundations and previous work

Few would argue against the notion that wine is a highly differentiated good. Even the least discriminating among us can without hesitation separate a sweet white wine from a dry red wine. This type of differentiation can be done for any number of goods, but we will here argue that wine also has another feature that sets it apart from many others; it has an inherent *experiential* quality to it (Castriota & Delmastro 2008). This should be taken to imply that wine is not consumed simply as any other beverage to quench thirst, it is consumed to experience the specific features inherent in wine and this experience is not readily substitutable with any amount of a lesser or different good. This element of intangibility is the core in considering wine to be an experience good (Andersson & Andersson 2006). The general assumption is that this holds for all classes of wines, but a reasonable addition to this is that this experience factor increases with the quality or price of the wine. One can for example assume that the wine aficionado finally consuming his 1982 Chateau Cheval Blanc will take this wine consumption experience into his utility function in a completely different manner than the not so wine savvy person ordering a glass of generic California Chardonnay at his local pub. Of importance here is another prominent feature of experience goods; you can usually not sample them before consumption. This is of course not strictly true for wine as anyone who has visited a vineyard or a wine fair can attest. It is plausible however, that most rational consumers will only choose to consume their Bordeaux Premier Cru's once they have reached their optimal *drinking window* after years of ageing, and not be caught by their curiosity at earlier stages only to find a much too young wine. This line of reasoning will most likely not hold for the previously mentioned Chardonnay consumer who can simply buy another bottle, or a close substitute, when the bottle is empty. He can also choose to buy another variety if the first one did not suit his taste. Naturally, no limit as

to where wines become an experience good can be set as this depends entirely on the individuals preferences and budget constraint.

5.2 Grading of wine in practice and consumer response

One can assume that consumers wish to reduce the inherent uncertainty of buying a wine. One strategy is to continue to buy wines that you have sampled before and know that you like. We assume that this is a common occurrence but we can unfortunately not control for it in our data. Another strategy is to turn to those who can be assumed to have a valuable opinion about the good in question. To be sure, this can include recommendations from family and friends but generally we will assume that this type of information is gathered from professional critics appearing in various media. As can be easily observed, the critic holds an important *gatekeeper* role for almost all experience goods such as movies, art and literature (see for example Caves 2000 and Andersson & Andersson 2006). For wine almost all daily newspapers have their own critics while others work for specialized international magazines such as *Wine Advocate* and *Wine Spectator*.

The most prevalent method of grading wine is on a scale from 0-100 (see for example erobertparker.com). This scale is however a bit deceiving since most critics agree that it in fact starts at 50. *Wine Advocate* deems wine scoring 50-59 as *unacceptable* (ibid.) While *Wine Spectator* sees any wine scoring less than 75 as *not recommended* for consumption. This scale is said not to take any account of price of the wine and tasting is usually done fully blind with no room for changing grades after the identity has been disclosed. A general objection to such a closed end scale is that if one assumes that wine making is constantly getting easier with the help of technological progress, then wines should accordingly become better, not taking variations such as weather into account, and eventually we will have wines that are simply better than those that previously scored 100. This would then force a down scaling of massive proportions to take place, or alternatively for the scale to become open ended.

A recent paper by Hodgson (2008) examines how reliable wine judges are. He uses a sample from the California State Fair where each year almost all California-produced wine is tested and graded. In order to test reliability, three identical wines are presented to the judges in a flight of thirty wines without the judges having any knowledge of this. The general conclusions are not encouraging for wine judges. Only around 18% of judges were consistent in their grading, and the highest precision was seen in wines of low to very low quality. One could imagine that this

holds also for more average consumers that can easily distinguish "what they like" or "dislike" in a wine but might be unable to identify which wine has a higher objective quality.

Almost all Swedish media differ from specialized wine magazines in that they grade their wines on a *value for money* basis[8]. The scales differ to some degree, but usually range from 1 to 5 or 6. Some opt to replace the numerical grades with statements such as *Bargain!* or *Good value for money*. We have chosen to use the grades given by food and wine magazine *Allt om Mat* (AOM), primarily because they each year test all wines available at SB. The usual procedure is that they purchase one bottle of all available wines, around 1300 varieties, and then a panel of four or five professional wine critics test each of the wines, non-blind, and set a grade on a four point scale. The result of this grading process is compiled in a book that is released in November of each year. This allows us to say that the grading done by AOM does not have any direct influence on the Swedish consumers, and can thus be used as a more objective measure of quality. By running the regressions excluding the last two months of the year we can control for this effect.

Even though these grades reflect not only quality but also value for money there is no significant correlation between this measure and price per liter. This is well in line with other authors who have also found a less than perfect correlation between price and quality (see for example Combris et al 1995 and Morton Scott & Podolny 2002) A transformation of this measure to reflect absolute quality is nevertheless done and can be found below.

6 Data and estimation

This section describes the data collection process and presents the final data set. Further, a short discussion is held on estimation of quality, price and product heterogeneity as an introduction to the presentation of our explanatory variables in the next section.

[8] This includes the four largest daily newspapers *Svenska Dagbladet, Dagens Nyheter, Göteborgs Posten* and *Sydsvenska dagbladet.*

6.1 Description of data

We have collected data on sales volume for all articles available at SB during 2007. This data is available for each of Sweden's twenty counties and for all twelve months of 2007. We have limited our study to two categories of wine, dry white wine and dry red wine simply because they represent the most purchased varieties of wine. Further, we have excluded wines that have not sold at least 10 liters for at least three months during the year. The reason for this is that SB does a monthly release of new wines in limited quantities. These are often in high demand and customers will typically stand in lines at opening to obtain bottles. If we were to include these wines in our model our estimates of price elasticity would be biased since these are clearly goods that consumers do demand and would even be willing to pay a premium for but they cannot obtain them since supply is entirely fixed.

The data set is furthermore limited to the wines that have been graded by AOM. In total we have grades for 924 wines, this represent 39% of all red and dry white wines available at SB. This represents 89.4% of total sold volume in liters of red and white wines and 88.9% of total value of red and white wines sold. As can be observed, quite a large portion of the available wines are excluded, but very little of the volume. The wines that are excluded were either released in very small quantities, are very expensive or of very low quality. Exclusion of these wines does not lead us to question the results we obtain. This leaves us with two unique data sets of 99665 observations for red wine and 51176 for white wine.

6.2 On estimating quality, product heterogeneity and price elasticity

As was previously mentioned, one of the aims of this paper is to discern how consumers assess quality when making consumption decisions. The key issue here is how the consumers form their opinions about quality. If we wish to make statements about whether consumers can recognize quality then the quality, as described by professional wine critics, must be unobserved by the consumers at the time of consumption. This would in theory imply that the consumer through repeated sampling forms an opinion about the quality of the good and makes purchases in accordance with this opinion. The measure of quality that we employ, allows us to test such an assumption based on the fact that the grades were published in late October of 2007 for wines available in 2007. Thus, the consumer cannot have been directly influenced by these grades and has therefore made his purchase decision on some other ground.

Quality is also at the heart of one of our other core issues, product heterogeneity. To assume that wines have different qualities and inherent characteristics is to assume that not all wines are equal and that consumers presumably recognize this. Allowing for heterogeneity gives a superior representation of reality when compared to treating consumer goods as homogenous. It further means that we are able to make not only traditional policy recommendations but also specific recommendations to the individual producer who cannot benefit from simply knowing the price elasticity of alcoholic beverages in general. In the next section you will find a presentation of the various measures of product heterogeneity we have included. We separate between those that are observed by the individual consumer and those who are not.

A logical step from assuming product heterogeneity is to assume individual heterogeneity. There is no logical or empirical reason to believe that consumers have identical, or even similar, willingness's to pay. This is however a weak statement simply suggesting that some consumers will purchase cheap wine and some will purchase expensive wine. What we allow for is that not only may some individuals wish to purchase more expensive wine, they may also be less price sensitive in doing so. In some sense this is a quite intuitive result, but one that to our knowledge has been somewhat overlooked in recent research efforts. The non-constant price elasticity specification is presented below.

We assume the following demand function of wine, which is estimated in a log-log specification.

$$Q_{ijt} = P_{ijt}^{\beta_0} e^{\beta_2 (\ln P_{ijt})^2} Z_i^{\delta} \prod_{m=1}^{M} W_{im}^{\theta_m} \prod_{k=1}^{K} Y_{jk}^{\gamma_k} \prod_{h=1}^{H} e^{\nu_h V_{ih}} \prod_{n=1}^{N} e^{\lambda_n O_{in}} \prod_{t=1}^{T} e^{\eta_t R_t} \quad (1)$$

Where Q_{ijt} is quantity of wine *i* bought in region *j* at time *t*, P_{ijt} is the price of wine *i* at time *t* in region *j*, Z_i is the quality of wine *i*. We then have five additional vectors of variables, the vector Y contains k variables that measure regional heterogeneity such as income, the vector W contains m variables that accounts for further heterogeneity of the individual wines such as sensory attributes and type of packaging. All variables in this vector are observable at the time of purchase, for each wine, by consumers at SB. Further, a vector V of h variables captures the possibility of previous knowledge of the wine such as time in store and coverage in Swedish newspapers. Finally a vector O of dummy variables takes into account the wines' Country of Origin (COO) and a vector R time dummies. All variables used except the dummies for COO and time are displayed in table 2 and discussed further in the next section.

7 Presentation of variables

Variable	Explanation	Observable	Expected sign
ln_Price	Ln of price per liter	Yes	-
Quality	AOM-grade + ln_Price	No	+
ln_Price^2	Polynomial interaction term	(Yes)	-
Ln_Income	Ln of county wage sum, income	No	+
Ln Avg_Income	Ln of income/population	No	+
Distance_CPH	Distance to Copenhagen from county capital	Yes	+
Coverage	Dummy for mention in review	Yes	+
First_appearance	1 if month of release	No	+
Time_in_stores	Number of months in stores	No	+
Sweetness_W	Sweetness in white wine	Yes	+/-
Tannins_R	Tannins in red wine	Yes	+/-
Fullness	Fullness in red and white wine	Yes	+/-
Acidity	Acidity in red and white wine	Yes	+/-
Dummy_Eco	Dummy for ecologically produced wine	Yes	+
Country of origin	Dummy variable for all countries of origin	Yes	+/-
BiB	Dummy for bag in box wine	Yes	+
Month	Dummy variable for all months of the year	Yes	+/-

Table 2 Explanatory variables

The explanatory variables used in our model can be subdivided into four broad categories. The first category contains the primary explanatory variables, price and quality, where price is always observable by the individual consumer while quality normally is not. The second category is control variables for regional heterogeneity. Since we are employing regional panel data we must control for differences among counties, such as income. Included in this category is also the distance to Copenhagen, to control for regional differences in cross border shopping. The third category includes variables that control for the consumers previous knowledge and familiarity with the products, such as media coverage and time in stores. The fourth category includes control variables for all the wine's characteristics that are directly observable by the consumer, for example whether the wine has been ecologically produced and it's COO. For all included countries of origin, please see the appendix and table A.4.

7.1 Price and quality

The measure of quality reported by AOM is a relative quality measure i.e. how a particular wine compares with other wines of the same price. There is no reason to believe relative quality to be correlated with price. Absolute quality however, should be at least partly correlated with price. The exact definition of absolute quality is impossible to identify, let us however assume the following relationship.

$$Z = pe^{r} \tag{2}$$

Where *r* is a relative quality measure taking value for money into account and *p* is price. Thus if a producer increases p without increasing quality, *r* should decrease correspondingly so that Z is held constant. If a log-log version of equation (1) is estimated using *r* instead of Z, i.e. relative au-lieu the absolute quality, this will cause the estimated price parameter to be biased even if *p* and *r* are uncorrelated even as the other parameters remain unaffected.

The exact relationship between quality, price and an index of relative quality is due to the characteristics of judging quality not possible to estimate. We opt to use (2), however in the appendix the result using other specifications such as $Z = \ln(p) * r$, $Z = p * r$ and $Z = r$ are presented. The only difference concerns the slope parameter of price and the difference in this parameter estimate is relatively small. Using equation (2) to transform relative into absolute quality also yields a correlation between the logarithm of price and absolute quality that are roughly the same as what has been found in other studies as can be seen in table A.3 in the appendix (regarding the relationship between quality and price see Combris et al., 1997). As an aside it can be noted that the correlation coefficient between relative quality and price is not significantly different from 0.

The log-log version of equation (1) allows for a simple estimation of non-constant price elasticity, ε.

$$\varepsilon = \frac{\partial \ln(q)}{\partial \ln(p)} = \beta_1 + 2\beta_2 \ln(p) \tag{3}$$

If price elasticity is constant then β_2 should not be significantly different from zero.

When we estimate the log-log version of equation (1) it is straight forward to calculate the price sensitivity. However, the expression of elasticity above needs to be given its own confidence interval. Since (3) is a linear combination we can use the fact that a linear combination $U = w'b$, of T different variables, b, each with the individual weight w_i, has variance σ_b^2 which is equal to $\sigma_b^2 = w'\Sigma_b w$, where Σ_b is the variance covariance matrix of b. In our case this signifies

$$Var(\varepsilon) = \begin{bmatrix} 1 & 2\ln(p) \end{bmatrix} \begin{bmatrix} s_{11} & s_{12} \\ s_{21} & s_{22} \end{bmatrix} \begin{bmatrix} 1 \\ 2\ln(p) \end{bmatrix} = s_{11} + 4\ln(p)\, s_{21} + 4(\ln(p))^2 s_{22} \quad (4)$$

Moreover since we estimate the variance-covariance matrix equation (4) can easily be calculated and displayed as graphs, with the marginal effect on the y-axis and $\ln p$ on the x-axis[9]. As has been noted by Brambor, Clark and Golder (2006) in non-linear models marginal effects are often interpreted in an erroneous way. The marginal effect, which in our case amounts to the price elasticity has to be calculated as in (5) and not by only looking at β_1. Further, it is important to supply the marginal effect with its proper confidence interval as to be able to conduct hypothesis testing.

When (3) is graphically displayed along with its confidence interval we choose to do this for the whole sample range of $\ln(p)$. Another option is to, as suggested by Cohen and Cohen (1983) and Jaccard et al. (1990), numerically display the results for a limited number of values of $\ln(p)$, such as the mean, and one standard deviation above and one below the mean.

As can be seen in table A.1 in the appendix the average price in the sample is SEK 133/liter and the median is SEK 104/liter.

[9] For such a graphical representation, see the result section.

7.2 Regional heterogeneity

We include total wages which should be considered a measure on the market capacity of a county. One should be aware however that this is a rather crude measure that could signal more general regional heterogeneity and should not be considered a pure income elasticity. For this reason we have also included average wages that has the more straightforward interpretation of an income elasticity. Regional income heterogeneity is not however a focus of this paper. The distance to Copenhagen is a control measure for the wine that Swedes buy from Denmark and continental Europe. A number of supermarket type shops are located along the German-Danish border that caters almost exclusively to this clientele, many of them including, the notably higher, SB prices as a part of their advertisements. We expect this variable to be positive, meaning that those who live further from Denmark will to a higher degree buy their wine at SB due to less available alternatives in the form of cross border purchases.

7.3 Previous product knowledge

Coverage, first appearance and time in stores are all meant to control for consumer knowledge and information. As has been mentioned before consumers most likely use media sources when forming their consumption decisions with regard to wine. Coverage is a dummy variable with value 1 if the wine has been reviewed in *Svenska Dagbladet*[10] during the month in hand. We expect this to be positive. One could of course include dummy variables for mention in other papers as well, but since the date of publication coincides rather well across news papers due to centralized samplings and this is not the focus of the paper we opt not to pursue this path. First appearance is a dummy variable with value 1 if the wine was sold during its first month in stores. This variable is included to be able to properly interpret the coverage variable. The reason for this is that most wine reviews are published as a result of new releases and thus increased sales of these goods could simply be a result of availability if not controlled for. Time in store gives the number of months during the year the wine has been sold, providing both a measure of availability and a measure of how consumers get "acquainted" with new products. We expect this to be positive but it should be noted that the mean for number of months sold is 10.3, as can be seen in table A.3 in the appendix and the majority of wines (70%) are sold during all months

[10] Grade given by professional wine critic Jens Dolk for daily newspaper *Svenska Dagbladet*.

7.4 Observable product heterogeneity

The fourth category of variables include those who can be directly observed by the consumer. This can occur in several ways but we assume that studying the information signs attached to shelf fronts and the actual bottles are most common. Sweden was one of the first countries to embrace the Bag in Box (BiB) packaging and it continues to grow as a market segment. In our sample almost 8% of the wines are packaged in BiB. There is normally a discount for buying BiB as compared to the same wine in a bottle. This effect should be controlled for by price per liter in our model but consumers might not necessarily be perfectly informed on this matter. There is also an element of convenience to the consumer, especially in the possibility of being able to consume a single glass of wine without having to finish an entire bottle within a day or two. For these reasons we expect a positive sign on this variable. We include a dummy variable for ecologically produced wine. The effect of this is not certain due to the rather dubious quality of some of the first ecological wines that were released. When quality is controlled for the effect should however be positive, especially in the light of recent heightened awareness of environmental issues. Only around 3% of the wines in our sample are however noted as being ecological. We also include the sensory characteristics that are displayed on the shelves in SB stores. These are pie diagrams indicating the sweetness, fullness and acidity of each wine. Very little inference can in our opinion be drawn from these variables as they most likely do not enter linearly into the consumers demand function but rather as combinations of tastes and sensations that can hardly be measured on a scale. It is however important to control for these characteristics as consumers may be highly averse to extreme values of some features.

Previous studies have shown a clear effect of country of origin on consumer preferences (see Verlegh & Steenkamp 1999 for a review). We have no reason to believe that this is not true for wine also. If anything, the effect should be clearer as the country of origin is usually on prominent display and there are likely many consumers who base their consumption decisions on beliefs such as "I like Australian wine" without any further discrimination. Furthermore, wine is a product with very strict regulations as to how you may market its origin (EU 2008). Generally, the more precise a geographical indication is, the more exclusive the wine is. Indications generally range from country specific down to single vineyard parcels. As has been shown by van der Lans et al. (2001) consumers are quite aware of these types indications of origin and are also able to link them to quality and willingness to purchase. Specifications ran without controlling for the country of origin confirms its importance in that it radically alteres the parameters of most variables.

For these reasons we include dummy variables for all countries of origin of the wines in the sample. Without any strong theoretical foundations very little can be said *ex post* about country specific effects. For countries with smaller market shares we should expect results to be driven by single wines that have been successful or unsuccessful in the Swedish market. Beyond this we leave further discussion to the section on results. It can be noted however that the five biggest COO in the Swedish market for our sample are Australia, Spain, France, Italy and South Africa, together they represent over 75% of total volume. Additional descriptive statistics regarding COO is presented in table A.2 in the appendix.

7.5 Seasonal effects

In addition to the above mentioned variables all months of the year are also controlled for with dummy variables to discern any seasonal characteristics. The sign here is expected to vary, but to be positive for the summer months, Christmas season and national holidays.

8 Model and results

We estimate the log transformed version of equation (1) separately for red and white wine.

$$Q_{i,t} = \alpha + \beta_1 \ln(P_i) + \beta_2 (\ln P_i)^2 + \delta \ln(Z_i) + \sum_{m=1}^{M} \theta_m W_m + \sum_{k=1}^{K} \gamma_k Y_{tk} + \sum_{h=1}^{H} \nu_h V_{ih} + \sum_{n=1}^{N} \lambda_n O_{in} + \sum_{r=1}^{T} \eta_r R_r + \mu \quad (5)$$

The error term μ is assumed to have the usual characteristics. We also estimate a version using a specification without the $(\ln P_i)^2$ term, i.e. imposing constant elasticity. The results are displayed in table 3, table 4 (Country of Origin dummies) and table 5 (time dummies) below and the price elasticities along with the confidence intervals of red and white wine are plotted in figure 1. Each of the four groups of variables are discussed in turn in the next section. Each of the four groups of variables are discussed in turn in the next section. For regressions using alternative measures of quality consult table A.5-A.10 in the appendix.

Table 3 Regression results, explanatory variables

Variables		(1) White	(2) White constant elasticity	(3) Red	(4) Red constant elasticity
Ln price		-7.7544***	-2.2481***	-7.0278***	-1.8292***
		(0.2723)	(0.0234)	(0.1656)	(0.0135)
Ln price^2		0.5717***		0.5248***	
		(0.0277)		(0.0164)	
Quality		0.0887***	0.0870***	0.1250***	0.1176***
		(0.0057)	(0.0058)	(0.0038)	(0.0038)
Control variable	**Vector**				
BIB	W	1.0634***	1.2913***	1.0677***	1.2876***
		(0.0221)	(0.0182)	(0.0181)	(0.0159)
Ecological	W	-0.1219***	-0.1532***	-0.0304**	-0.0298**
		(0.0211)	(0.0211)	(0.0146)	(0.0148)
Sweetness	W	0.0255***	0.0147*		
		(0.0080)	(0.0080)		
Tannins	W			-0.0322***	-0.0479***
				(0.0056)	(0.0056)
Fullness	W	0.0486***	0.0375***	0.0276***	0.0198***
		(0.0050)	(0.0049)	(0.0063)	(0.0063)
Acidity	W	0.0051	-0.0021	-0.1137***	-0.1716***
		(0.0087)	(0.0088)	(0.0094)	(0.0093)
Ln Income	Y	0.7923***	0.7973***	0.7973***	0.8022***
		(0.0082)	(0.0082)	(0.0063)	(0.0064)
Ln Avg Income	Y	2.3105***	2.3395***	1.4298***	1.4496***
		(0.1134)	(0.1134)	(0.0886)	(0.0887)
Distance Cph k	Y	0.0392***	0.0372***	0.1515***	0.1498***
		(0.0102)	(0.0102)	(0.0082)	(0.0082)
Coverage	V	1.0796***	1.0574***	1.3680***	1.3008***
		(0.0521)	(0.0544)	(0.0432)	(0.0450)
First time	V	-0.2002***	-0.1725***	-0.2781***	-0.2080***
		(0.0510)	(0.0540)	(0.0460)	(0.0482)
Time in stores	V	0.0892***	0.0903***	0.0602***	0.0593***
		(0.0033)	(0.0033)	(0.0026)	(0.0026)
Constant		-1.0997	-14.4048***	3.5095***	-8.7071***
		(0.8453)	(0.5258)	(0.5679)	(0.4128)
Observations		51176	51176	99655	99655
R-squared		0.6255	0.6230	0.5633	0.5590
Adj. R-squared		0.6258	0.6233	0.5634	0.5592

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Vector W: Additional wine heterogeneity, Vector Y: Regional heterogeneity, Vector V: Possibility of previous knowledge

As we can see in table 3 it is clear that elasticity of wine is non-constant since the interaction term is significant, however imposing constant price elasticity does not greatly change the qualitative results of the other variables. So, it seems that if there is some advantage of simplifying the model

by restricting elasticity to be constant and the focus is not on the price elasticity then it may be ok to do so. From the single producers perspective however, it is of course of great importance to know that consumers are much more price sensitive for wines of lower price. Further, the main focus on many previous papers on wine has been to estimate the price elasticity. As was stated above, we need to plot the price elasticity to be able to facilitate examination; this is done below in figure 1.

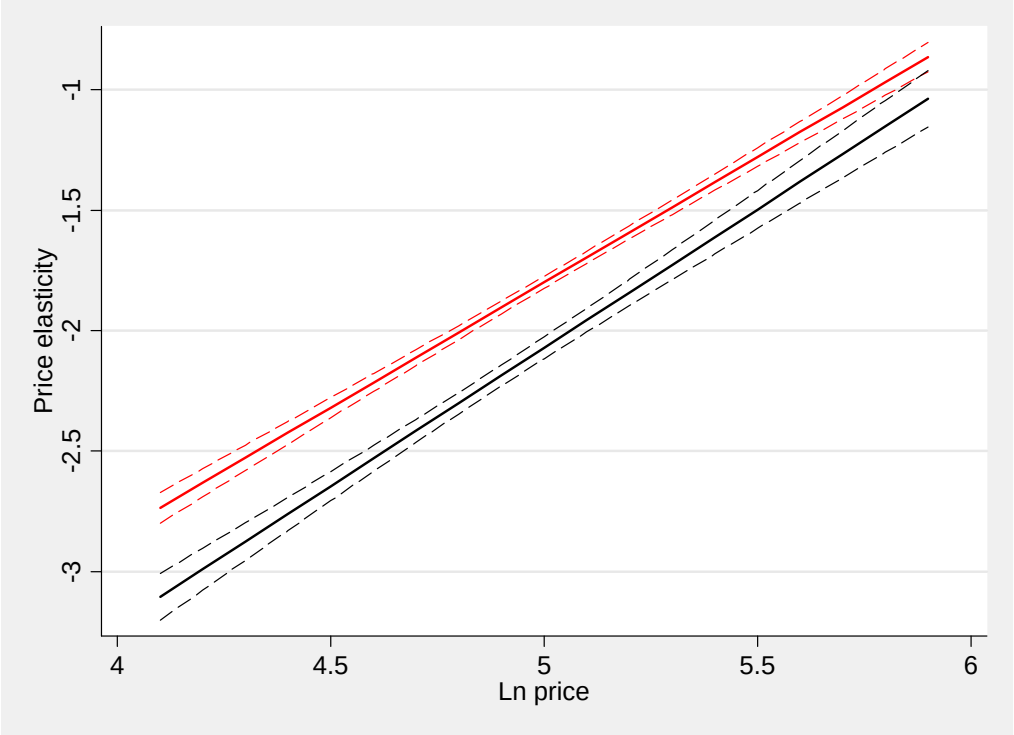
Table 4 Regression results, country of origin effects using Spain as baseline country

	(1)	(2)	(3)	(4)
Country of Origin	**White**	**White constant elasticity**	**Red**	**Red constant elasticity**
Other			-1.3584***	-1.4449***
			(0.0797)	(0.0819)
Argentine	0.3716***	0.4004***	0.0294*	0.0103
	(0.0295)	(0.0296)	(0.0171)	(0.0171)
Austria	0.2723***	0.2302***		
	(0.0334)	(0.0337)		
Australia	0.8133***	0.8005***	0.5401***	0.5199***
	(0.0261)	(0.0264)	(0.0140)	(0.0141)
Bulgaria	0.2457***	0.3381***	-0.6309***	-0.4825***
	(0.0362)	(0.0353)	(0.0224)	(0.0221)
Chile	0.0938***	0.0938***	-0.0447***	-0.0488***
	(0.0284)	(0.0287)	(0.0139)	(0.0140)
Germany	0.0655**	0.0716**		
	(0.0309)	(0.0313)		
France	0.4027***	0.3866***	-0.4780***	-0.4815***
	(0.0261)	(0.0264)	(0.0123)	(0.0122)
Greece	-0.8576***	-0.7605***	-1.8658***	-1.9118***
	(0.0408)	(0.0406)	(0.0510)	(0.0508)
India	-0.1267*	-0.1878**	-1.2147***	-1.2826***
	(0.0763)	(0.0766)	(0.1058)	(0.1061)
Israel	-0.8878***	-0.9107***		
	(0.0969)	(0.0967)		
Italy	0.1639***	0.1792***	0.0720***	0.1036***
	(0.0263)	(0.0265)	(0.0103)	(0.0102)
Lebanon			-0.5141***	-0.5335***
			(0.0308)	(0.0328)
New Zeeland	0.8757***	0.8135***	-0.3736***	-0.5054***
	(0.0392)	(0.0392)	(0.0304)	(0.0298)
Portugal	-0.2676***	-0.1447***	-0.5238***	-0.4943***
	(0.0330)	(0.0328)	(0.0266)	(0.0263)
South Africa	0.6188***	0.6210***	0.0081	-0.0296**
	(0.0262)	(0.0265)	(0.0124)	(0.0123)
Hungary	0.4492***	0.5517***		
	(0.0337)	(0.0334)		
Uruguay			-0.9930***	-1.0235***
			(0.0538)	(0.0526)
USA	0.1741***	0.1786***	-0.3039***	-0.3675***
	(0.0278)	(0.0280)	(0.0146)	(0.0143)

Note: White's robust standard errors have been used, significance at 10/5/1 % level are denoted by *//*****

In table 4 we can see that the COO that receives the highest premium for white wine is New Zeeland and Australia, the point estimate of New Zeeland is slightly higher but a Wald test cannot reject that they are equal. For red wine Australia receives the highest premium with Italy coming second. Comparing this with a ranking based only on the volume sold should not necessarily yield the same order since all the other variables included also influence volume sold. In fact the COO with the highest volume of white wine sold is South Africa and for red wine it is Spain (see table A.2 in the appendix). The seasonal effects are displayed in table A.11.

Figure 1 Price elasticity for red and white wine over entire price range with 95% confidence interval



Note: Upper full drawn line depicts red and lower full drawn line depicts white wine. Graph covers entire range of prices, no interpolation is done.

In figure 1 we have used equation (4) to plot the price elasticity for red and white wine over the sample price range. Red wine is slightly less elastic than white wine, although the difference becomes smaller as price increases. Comparing these elasticities with those that has been estimated on wine when it has been treated as a homogenous good shows that the elasticity for a single producer of wine is much higher. For the lower end of the price range the elasticity is above 2.5 to be compared with the median price elasticity of 0.69 from Wagenaar et al's (2009) metastudy.

9 Discussion

Here the results of our estimated model are presented and discussed. We do this separately for the categories of variables introduced earlier.

9.1 Price and quality

Our estimates indicate that consumers do purchase higher quantities of higher quality wines. This effect is slightly stronger for red wine than it is for white wine. A crucial questions is of course how the preferences for quality are formed. Two basic scenarios seem plausible. The consumer could be interested enough to search out information about the wine before the actual purchase. This could be in the form of a critics review, a friends recommendation or guidance from the staff at SB. One could however also imagine that the consumer is a repeat customer and that he or she has sampled a number of wines, independently identified the wine of higher quality and continued to purchase that variety.

From Figure 1 we observe that as prices increase the price sensitivity decreases. This is true for both red and white wine, with red having a lower overall price elasticity over the entire price range. One explanation for why the price elasticity decreases with price is that at lower price levels there might be more substitutes. At higher prices there are fewer comparable wines and hence demand gets less elastic. It is important to remember that elasticity is dependent on whether the consumers *perceive* the goods to be close substitutes, not if they actually *are* so. We could thus be observing consumer heterogeneity. If consumers of low price wines have less developed, or less trained, palates they will all else equal be more likely to perceive two different wines as being similar than if they had more trained, or refined, palates. Hence, wines could in reality be equally differentiated at all price levels but the consumers purchasing the lower priced wines cannot make this distinction. They are thus more likely to buy another variety if the price of their first choice was to increase. Most likely, it is more expensive for a producer to make a complex wine and thus a higher priced wine should be more complex, we argue however that this might not be the dominating effect.

More farfetched explanations could include that purchasing expensive wine is a form of conspicuous consumption (see Veblen in Lerner 1948) , meaning that consumers are less price sensitive in higher price ranges because they believe that purchasing these wines signals wealth and thus derive utility from higher prices. This is doubtful however since your consumption, or holding, of the wine will generally only be witnessed by individuals who already have a general

idea about your financial wealth, such as family or friends. A Veblen-effect is more likely to be found in a restaurant or nightclub setting where purchasing an expensive bottle of champagne may fill the intended purpose of signaling wealth to your peers. Another explanation might be that wine is a luxury good for a certain range of prices (Kemp, 1998). In actuality what we would observe is a *luxury segment* for a class of goods, an occurrence that can be witnessed in many markets such as cars or clothes where a lower price segment may be thought of as necessities but the more expensive options as luxuries.

9.2 Regional heterogeneity

As was previously mentioned the parameter of ln income is more of a market size effect than anything else. The ln income per capita parameter however, is more in line with a normal income elasticity, this is markedly higher for white wine, 2.3 compared with 1.4 for red wine. So an increase in total income of 10% that is coupled with a 10% increase in population (worker migration) would increase consumption with 8%, however if there is an income increase of 10% but no migration the total increase would be 22%. So individuals increase their spending more than proportional to the increase *i* in personal income. Hence, our estimates do show that wine is luxury good in Sweden for certain price ranges. As was mentioned in the introduction it is noteworthy that these estimated price elasticities differ from estimates in studies where wine, or alcohol, is treated as a homogenous good. Estimates there typically range from 0.7 to 1.3 (FHI, 2005). This alone should be a sufficient reason to study wine as a heterogeneous good.

A previous study on Canadian data found that white wine tends to have a higher expenditure elasticity (Carew et al., 2004). In Sweden one reason for the difference in price sensitivity between white and red varieties could be changes in food consumption as income increases. It has been shown that fish and seafood have a higher income elasticity than do meat and other food products. Thus, when income increases consumers may tend to switch their consumption toward fish and seafood and this likely coincides with a higher consumption of white wines.

As expected the distance to Copenhagen positively influences demand. This was to be expected since a longer distance reduces the likelihood that the consumer will make his purchases in Denmark or Germany, who have significantly lower prices on alcoholic beverages. In practice this effect means that any given wine will sell 10% less in Malmo, the third largest city, located thirty minutes from Denmark than in the capital, Stockholm, located four hours north. This

effect will likely vary with transportation costs such as gasoline prices, ferry ticket prices and toll road fees.

9.3 Previous product knowledge

We observe a clear effect from media coverage in our results. All else equal, being mentioned in a newspaper review increases quantity sold for a red wine by almost 300%. Compare this with an increase in relative quality from *Poor value for money* to *Bargain!* (lowest to highest grade) for a red wine that costs SEK 70 per bottle, that would result in a 45% sales volume increase. It should be noted however that the quantity increase from quality is persistent over time while the coverage effect only appears in the month of publication for the review. Not included in our results are the grades given in the aforementioned newspaper review. In specifications where this was included, the actual grade given had no significant effect on sales volume. This counterintuitive result requires further study but one explanation might be that consumers merely remember the wine being mentioned, and not whether it was applauded or dismissed as undrinkable. Time in stores is also positive and significant, suggesting that consumers do need some time to get acquainted with products they purchase.

9.4 Observed product heterogeneity

There is a clear effect of the country of origin on demand. Sweden is an interesting case in this respect as there is no possible home country bias as Sweden has no wine production, which would most likely be the case for a wine producing country.[11] Our findings on country specific effects clearly diverge from studies on for example the US market. Whereas US-consumers put premiums on French red wines (Brooks, 2008), Swedish consumers do the opposite. A reversed relationship applies with the respect to Spanish red wines that are popular among Swedish consumers while they seem to be less so among American consumers. However, there are also similarities such as the premium attached to Italian red wines. Table 12 in the appendix displays a ranking of all countries by their respective country of origin premium. For red wine Australia is the clear winner followed by Italy and Argentina whereas New Zeeland takes the trophy for white wine followed by Australia and South Africa. Wines from the new world have been prevalent in the world markets only in the last twenty years. This has given them the possibility of making wines that are very direct and likeable as they do not to the same extent have a burden of tradition or strict wine laws to uphold. They have also been alert in adopting new techniques

[11] There are actually a number of vineyards that produce wine in Sweden and sell it at SB. Their commercial importance is however negligible.

such as screw caps and bag-in-box packaging providing practicality to the average consumer. The old world countries on the other hand often adhere to strict laws governing in detail how their wines are to be produced. Especially important in this respect are regulations with regard to allowed grape varieties and residual sugar which are strictly governed within the European Union (EU, 2008) and quite liberal in countries such as the United States, South Africa and Australia. Anecdotal evidence suggests a conscious marketing and diversification strategy by SB and various wine importers in the 1990´s but this cannot be verified. Others claim that Swedes are simply attracted by the "fruit bomb" wines of the warmer climates. One could also imagine that wines from the new world would provide a higher value for money due to lower land rents and other factors and that consumers recognize this. Since we control for quality and price this is not however true in reality. It seems however that consumers *perceive* these wines to give higher value for money. This is a highly interesting finding that is somewhat puzzling and that requires more research, likely involving both insights on both marketing and psychology.

A further note on French wine is due. During the early 1990's, France performed nuclear tests on the Muroroa atoll in the Pacific Ocean. This gave rise to a wide spread boycott of French goods and especially wine. Some claim that this shifted the Swedish consumers' taste towards the wines of such countries as Spain, Australia and South Africa and that this effect lingers long after the actual boycott has ended.[12]

It has been hypothesized that one reason for the increase in Swedish wine consumption over the last years is due to the introduction of Bag in Box wines (Sorad, 2003). The positive and significant coefficient can verify that all else equal more of a bag in box wine will be bought. There are several reasons for a consumer to favor BiB packaging;, it is easier to carry and when opened it keeps better than a bottle wine. Clearly, there can also be an effect from the fact that these wines are only sold in larger volume packaging compared to bottled wine. Thirdly one can certainly imagine that consumers are willing to pay a premium for the possibility of having a single glass of wine per night over an extended time period which the longer keeping capability of these wines enable.

The variable for ecological wines is negative and significant for all specifications. This is somewhat surprising given that we control for quality. As was previously mentioned this might be an effect of bad reputation from early ecological wines of low quality that persists. One should

[12] Statement given by Mats Burnert, chairman of Munskänkarna, Gothenburg chapter. Munskänkarna is the oldest and largest association for wine sampling and education in Sweden.

also be aware that the signaling system in this respect is far from perfect. Many prestigious producers such as Nicolas Joly from the Loire valley employ entirely organic or biodynamic growing techniques but have no wish to display this on their labels (Livets Goda, 2009). This applies also for many producers in Piedmont and Rhone, that do in fact produce ecological wines but choose not to employ this in their marketing.

10 Suggestions for future research

A possible shortcoming of this paper is that we are not able to control for the appearance of the bottle. There is solid reason to believe that in the absence of knowledge of the actual quality of the wine a consumer may well choose to purchase a "novelty" bottle. Examples from SB include *Happy Cat* with its kitten-shaped bottle in blue tinted glass or the frosted glass of *Dreams*. Generally we can assume that these sorts of gimmicks are attractive to the consumer with little or no interest in wine, and repellent to the consumer with a high knowledge of wine who can be assumed to prefer the classic label styling of for example the French *Chateaux*. A possible corollary can be found in the fashion industry where the younger and less knowledgeable consumers are generally more drawn to clothing with the label on prominent display, whereas a more sophisticated consumer will choose clothing with no obvious label attached to them, thus attracting envy only from others *in the know* (Bianchi, 2002).

Another variable that likely has an influence on the sales of wine is marketing. This may sound overly obvious but one has to understand that in Sweden, marketing of wine is highly restricted. The only type of advertisement allowed in newspapers for example is a simple picture of the bottle and excerpts from critics reviews. Still it would by highly interesting to see what influence this limited marketing has on sold volumes of wine. On the same note it would be interesting to see how in-store marketing affects sales figures. Given the Swedish regulations this marketing is decidedly subtle but in is not implausible that one, as has been previously mentioned, would see effects from for example how and where wines are displayed in the stores. More research should also be devoted to investigate how consumers are influenced by expert opinions. We control for this effect, but more research is sorely needed. One should also include new media influence, such as wine blogs, in such an investigation.

A deeper investigation into the country of origin preferences of wine consumers would be highly interesting. We have shown that this is a strong and important effect but we are not able to

explicitly explain it using this framework. One would most likely base such a study, at least in part, on interviews and surveys with consumers, producers and importers.

Since the deregulation of the wine imports market in Sweden, hundreds of wine importers have established themselves. They are allowed to sell their products directly to restaurants but to consumers only through SB. Thus SB can be said to exert not only a monopoly of sales but also a monopsony of purchase. This is certainly true for Sweden, but anecdotal evidence suggests that SB might approximate a monopsonist in certain international markets as well due to its high volume purchases through the Swedish importers. In the light of this, it would be interesting to compare prices in the Swedish market to those in the producing country and other countries.

Lastly, there are some indications that wine might be used as an intoxicant. For the consumers that demand wine for this purpose the level of alcohol is likely of interest. This is an effect that we have not been able to control for and that further studies might take into consideration.

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Appendix

Table A.1 Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Quantity (liters)	924	51,75	2378715,00	94896,6224	230636,14053
Price	924	46,33	798,67	133,6356	89,88410
Quality	924	4,84	10,04	7,0540	1,06074
Months sold	924	3,00	12,00	10,1797	3,23312

Table A.2 Descriptive statistics for country of origin

Country	Articles	%	Total liter (k)	%	Total value (k)	%	Red liter (k)	%	Red value (k)	%	White liter (k)	%	White value (k)	%
Other	2	0,2	7	0,01	749	0,01	7	0,01	749	0,02	0	0	0	0
Argentine	36	3,9	2659	3,03	217748	3,21	1881	3,05	157097	3,25	778	2,98	60652	3,1
Austria	10	1,1	189	0,22	20231	0,3	0	0	0	0	189	0,72	20231	1,03
Australia	97	11	16104	18,4	1222487	18	12750	20,7	939782	19,5	3354	12,9	282706	14,5
Bulgaria	13	1,4	1817	2,07	109650	1,62	498	0,81	32850	0,68	1319	5,06	76801	3,93
Chile	66	7,1	6064	6,92	471131	6,94	4361	7,08	346552	7,17	1703	6,54	124579	6,37
Germany	19	2,1	1591	1,81	101485	1,5	516	0,84	27889	0,58	1076	4,13	73596	3,76
Spain	120	13	14147	16,1	995614	14,7	13623	22,1	952848	19,7	524	2,01	42765	2,19
France	188	20	6980	7,96	673899	9,93	4261	6,92	369906	7,66	2718	10,4	303993	15,5
Greece	3	0,3	83	0,09	6017	0,09	16	0,03	1279	0,03	67	0,26	4739	0,24
India	2	0,2	6	0,01	613	0,01	2	0	278	0,01	3	0,01	335	0,02
Israel	1	0,1	2	0	358	0,01	0	0	0	0	2	0,01	358	0,02
Italy	171	19	16290	18,6	1365096	20,1	13515	21,9	1166688	24,2	2775	10,7	198407	10,1
Lebanon	4	0,4	88	0,1	11918	0,18	88	0,14	11918	0,25	0	0	0	0
New	9	1	352	0,4	46795	0,69	51	0,08	7894	0,16	302	1,16	38901	1,99
Portugal	25	2,7	1208	1,38	99511	1,47	877	1,42	77718	1,61	332	1,27	21794	1,11
South	91	9,8	14661	16,7	1036041	15,3	5693	9,24	470813	9,75	8968	34,4	565228	28,9
Hungary	5	0,5	592	0,67	40355	0,59	0	0	0	0	592	2,27	40355	2,06
Uruguay	2	0,2	13	0,01	1416	0,02	13	0,02	1416	0,03	0	0	0	0
USA	60	6,5	4832	5,51	366048	5,39	3469	5,63	265462	5,49	1363	5,23	100586	5,14
Total	924	100	87684	100	6787162	100	61621	100	4831139	100	26064	100	1956023	100

Note that this is for the sample used in the regression and not the complete Swedish market. The sample represents roughly 90% of value and volume of the complete Swedish market.

Table A.3 Bivariate correlation for explanatory variables of the wine's characteristics

Variable	ln_liter	ln_Price	lnQuality	BIB	Dummy_eko	N_BREAK
ln_liter	1,000	-,478**	-,205**	,408**	-,019**	,070**
ln_pris	-,478**	1,000	,470**	-,405**	-,020**	-,137**
Quality	-,205**	,470**	1,000	-,185**	-,022**	-,039**
BIB	,408**	-,405**	-,185**	1,000	,007**	-,027**
Dummy_eko	-,019**	-,020**	-,022**	,007**	1,000	,028**
N_BREAK	,070**	-,137**	-,039**	-,027**	,028**	1,000

Table A.4 Dummy variables for Month and Country of origin

Dummy	Explanation
Jan	1 if month 2
Mar	1 if month 3
Apr	1 if month 4
May	1 if month 5
Jun	1 if month 6
Jul	1 if month 7
Aug	1 if month 8
Sep	1 if month 9
Oct	1 if month 10
Nov	1 if month 11
Dec	1 if month 12
Argentine	1 if country=Argentine
Austria	1 if country=Austria
Australia	1 if country=Australia
Brazil	1 if country=Brazil
Bulgaria	1 if country=Bulgaria
Chile	1 if country=Chile
Germany	1 if country=Germany
Spain	1 if country=Spain
France	1 if country=France
Greece	1 if country=Greece
India	1 if country=India
Israel	1 if country=Israel
Italy	1 if country=Italy
Lebanon	1 if country=Lebanon

New Zeeland	1 if country=New Zeeland
Portugal	1 if country=Portugal
South Africa	1 if country=South Africa
Hungary	1 if country=Hungary
Uruguay	1 if country=Uruguay
USA	1 if country=USA

Table A.5 Regression results for white wines using different quality measures

Variables		(1) White	(2) White	(3) White	(4) White
Ln price		-7.7544***	-7.8651***	-7.7515***	-7.6658***
		(0.2723)	(0.2729)	(0.2722)	(0.2718)
Ln price^2		0.5717***	0.5732***	0.5772***	0.5717***
		(0.0277)	(0.0277)	(0.0277)	(0.0277)
Ln Quality		0.0887***			
		(0.0057)			
Ln Quality2			0.1925***		
			(0.0129)		
Ln Quality3				0.1925***	
				(0.0129)	
Ln Quality4					0.0887***
					(0.0057)
Control variables	**Vector**				
BIB	W	1.0634***	1.0638***	1.0639***	1.0634***
		(0.0221)	(0.0222)	(0.0222)	(0.0221)
Ecological	W	-0.1219***	-0.1058***	-0.1059***	-0.1219***
		(0.0211)	(0.0211)	(0.0211)	(0.0211)
Fullness	W	0.0486***	0.0478***	0.0478***	0.0486***
		(0.0050)	(0.0050)	(0.0050)	(0.0050)
Sweetness	W	0.0255***	0.0264***	0.0264***	0.0255***
		(0.0080)	(0.0080)	(0.0080)	(0.0080)
Acidity	W	0.0051	0.0084	0.0084	0.0051
		(0.0087)	(0.0086)	(0.0086)	(0.0087)
Ln Income	Y	0.7923***	0.7922***	0.7922***	0.7923***
		(0.0082)	(0.0082)	(0.0082)	(0.0082)
Ln Avg Income	Y	2.3105***	2.3102***	2.3102***	2.3105***
		(0.1134)	(0.1134)	(0.1134)	(0.1134)
Distance Cph k	Y	0.0392***	0.0391***	0.0391***	0.0392***
		(0.0102)	(0.0102)	(0.0102)	(0.0102)
Coverage	V	1.0796***	1.0789***	1.0790***	1.0796***
		(0.0521)	(0.0521)	(0.0521)	(0.0521)
First time	V	-0.2002***	-0.2025***	-0.2025***	-0.2002***
		(0.0510)	(0.0511)	(0.0511)	(0.0510)
Time in stores	V	0.0892***	0.0893***	0.0893***	0.0892***
		(0.0033)	(0.0033)	(0.0033)	(0.0033)
Constant		-1.0997	-1.0536	-1.0694	-1.0997
		(0.8453)	(0.8452)	(0.8451)	(0.8453)
Observations		51176	51176	51176	51176

R-squared	0.6258	0.6257	0.6257	0.6258
Adj. R-squared	0.6255	0.6254	0.6254	0.6255

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Vector W: Additional wine heterogeneity, Vector Y: Regional heterogeneity, Vector V: Possibility of previous knowledge

Table A.6 Country of Origin results for white wine using different quality measures

Country of Origin	(1) White	(2) White	(3) White	(4) White
Other	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Argentine	0.3716***	0.3487***	0.3487***	0.3716***
	(0.0295)	(0.0293)	(0.0293)	(0.0295)
Austria	0.2723***	0.2841***	0.2841***	0.2723***
	(0.0334)	(0.0334)	(0.0334)	(0.0334)
Australia	0.8133***	0.8011***	0.8011***	0.8133***
	(0.0261)	(0.0261)	(0.0261)	(0.0261)
Bulgaria	0.2457***	0.2377***	0.2378***	0.2457***
	(0.0362)	(0.0361)	(0.0361)	(0.0362)
Chile	0.0938***	0.0816***	0.0816***	0.0938***
	(0.0284)	(0.0284)	(0.0284)	(0.0284)
Germany	0.0655**	0.0556*	0.0556*	0.0655**
	(0.0309)	(0.0309)	(0.0309)	(0.0309)
France	0.4027***	0.3931***	0.3931***	0.4027***
	(0.0261)	(0.0260)	(0.0260)	(0.0261)
Greece	-0.8576***	-0.8722***	-0.8722***	-0.8576***
	(0.0408)	(0.0408)	(0.0408)	(0.0408)
India	-0.1267*	-0.1551**	-0.1551**	-0.1267*
	(0.0763)	(0.0762)	(0.0762)	(0.0763)
Israel	-0.8878***	-0.8664***	-0.8663***	-0.8878***
	(0.0969)	(0.0972)	(0.0972)	(0.0969)
Italy	0.1639***	0.1495***	0.1495***	0.1639***
	(0.0263)	(0.0263)	(0.0263)	(0.0263)
Lebanon	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
New Zeeland	0.8757***	0.8519***	0.8519***	0.8757***
	(0.0392)	(0.0389)	(0.0389)	(0.0392)
Portugal	-0.2676***	-0.2875***	-0.2874***	-0.2676***
	(0.0330)	(0.0329)	(0.0329)	(0.0330)
South Africa	0.6188***	0.6095***	0.6095***	0.6188***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)
Hungary	0.4492***	0.4332***	0.4333***	0.4492***
	(0.0337)	(0.0336)	(0.0336)	(0.0337)
Uruguay	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
USA	0.1741***	0.1630***	0.1630***	0.1741***
	(0.0278)	(0.0277)	(0.0277)	(0.0278)

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.7 Time dummy results for white wine using different quality measures

Month	(1) White	(2) White	(3) White	(4) White
January	0.1843***	0.1865***	0.1865***	0.1843***
	(0.0541)	(0.0541)	(0.0541)	(0.0541)
March	0.1769***	0.1770***	0.1770***	0.1769***
	(0.0185)	(0.0185)	(0.0185)	(0.0185)
April	0.2080***	0.2084***	0.2084***	0.2080***
	(0.0193)	(0.0193)	(0.0193)	(0.0193)
May	0.3559***	0.3559***	0.3559***	0.3559***
	(0.0196)	(0.0196)	(0.0196)	(0.0196)
June	0.1690***	0.1690***	0.1690***	0.1690***
	(0.0193)	(0.0193)	(0.0193)	(0.0193)
July	0.3683***	0.3683***	0.3683***	0.3683***
	(0.0200)	(0.0200)	(0.0200)	(0.0200)
August	0.3272***	0.3270***	0.3270***	0.3272***
	(0.0192)	(0.0192)	(0.0192)	(0.0192)
September	0.0602***	0.0597***	0.0597***	0.0602***
	(0.0184)	(0.0184)	(0.0184)	(0.0184)
October	0.0926***	0.0919***	0.0919***	0.0926***
	(0.0187)	(0.0187)	(0.0187)	(0.0187)
November	0.1507***	0.1499***	0.1499***	0.1507***
	(0.0192)	(0.0191)	(0.0191)	(0.0192)
December	0.3790***	0.3783***	0.3783***	0.3790***
	(0.0193)	(0.0193)	(0.0193)	(0.0193)

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.8 Regression results for red wines using different quality measures

Variables		(5) Red	(6) Red	(7) Red	(8) Red
Ln price		-7.0278***	-7.2367***	-7.0821***	-6.9028***
		(0.1656)	(0.1658)	(0.1656)	(0.1655)
Ln price^2		0.5248***	0.5316***	0.5370***	0.5248***
		(0.0164)	(0.0164)	(0.0164)	(0.0164)
Quality	$Z_1 = \text{per}$	0.1250***			
		(0.0038)			
Quality2	$Z_2 = \text{per}$		0.2623***		
			(0.0078)		
Quality3	$Z_3 = \ln(\text{per})$			0.2623***	
				(0.0078)	
Quality4	$Z_4 = 1$				0.1250***
					(0.0038)
Control variable	**Vector**				
BIB	W	1.0677***	1.0749***	1.0751***	1.0677***
		(0.0181)	(0.0181)	(0.0181)	(0.0181)
Ecological	W	-0.0304**	-0.0345**	-0.0345**	-0.0304**
		(0.0146)	(0.0147)	(0.0147)	(0.0146)
Fullness	W	0.0276***	0.0244***	0.0244***	0.0276***
		(0.0063)	(0.0063)	(0.0063)	(0.0063)
Tannins	W	-0.0322***	-0.0277***	-0.0277***	-0.0322***
		(0.0056)	(0.0056)	(0.0056)	(0.0056)
Acidity	W	-0.1137***	-0.1149***	-0.1150***	-0.1137***
		(0.0094)	(0.0094)	(0.0094)	(0.0094)
Ln Income	Y	0.7973***	0.7973***	0.7973***	0.7973***
		(0.0063)	(0.0063)	(0.0063)	(0.0063)
Ln Avg Income	Y	1.4298***	1.4286***	1.4286***	1.4298***
		(0.0886)	(0.0886)	(0.0886)	(0.0886)
Distance Cph k	Y	0.1515***	0.1516***	0.1516***	0.1515***
		(0.0082)	(0.0082)	(0.0082)	(0.0082)
Coverage	V	1.3680***	1.3737***	1.3737***	1.3680***
		(0.0432)	(0.0435)	(0.0435)	(0.0432)
First time	V	-0.2781***	-0.2869***	-0.2869***	-0.2781***
		(0.0460)	(0.0463)	(0.0463)	(0.0460)
Time in stores	V	0.0602***	0.0611***	0.0611***	0.0602***
		(0.0026)	(0.0026)	(0.0026)	(0.0026)
Constant		3.5095***	3.7882***	3.7677***	3.5095***
		(0.5679)	(0.5681)	(0.5681)	(0.5679)
Observations		99655	99655	99655	99655
R-squared		0.5633	0.5636	0.5636	0.5633
Adj. R-squared		0.5634	0.5638	0.5638	0.5634

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Vector W: Additional wine heterogeneity, Vector Y: Regional heterogeneity, Vector V: Possibility of previous knowledge

Table A.9 Country of Origin results for red wines using different quality measures

Country of Origin	(5) Red	(6) Red	(7) Red	(8) Red
Other	0.5401***	0.5452***	0.5452***	0.5401***
	(0.0140)	(0.0139)	(0.0139)	(0.0140)
Argentine	-0.6309***	-0.6261***	-0.6261***	-0.6309***
	(0.0224)	(0.0223)	(0.0223)	(0.0224)
Austria	-0.0447***	-0.0496***	-0.0497***	-0.0447***
	(0.0139)	(0.0139)	(0.0139)	(0.0139)
Australia	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Bulgaria	-0.4780***	-0.4699***	-0.4699***	-0.4780***
	(0.0123)	(0.0121)	(0.0121)	(0.0123)
Chile	-1.8658***	-1.8927***	-1.8928***	-1.8658***
	(0.0510)	(0.0510)	(0.0510)	(0.0510)
Germany	-1.2147***	-1.2323***	-1.2323***	-1.2147***
	(0.1058)	(0.1057)	(0.1057)	(0.1058)
France	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Greece	0.0720***	0.0703***	0.0703***	0.0720***
	(0.0103)	(0.0103)	(0.0103)	(0.0103)
India	-0.5141***	-0.5092***	-0.5093***	-0.5141***
	(0.0308)	(0.0312)	(0.0312)	(0.0308)
Israel	-0.3736***	-0.3838***	-0.3838***	-0.3736***
	(0.0304)	(0.0304)	(0.0304)	(0.0304)
Italy	-0.5238***	-0.5140***	-0.5140***	-0.5238***
	(0.0266)	(0.0263)	(0.0263)	(0.0266)
Lebanon	0.0081	0.0038	0.0038	0.0081
	(0.0124)	(0.0124)	(0.0124)	(0.0124)
New Zeeland	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Portugal	-0.9930***	-0.9793***	-0.9793***	-0.9930***
	(0.0538)	(0.0529)	(0.0529)	(0.0538)
South Africa	-0.3039***	-0.2917***	-0.2917***	-0.3039***
	(0.0146)	(0.0146)	(0.0146)	(0.0146)
Hungary	0.5401***	0.5452***	0.5452***	0.5401***
	(0.0140)	(0.0139)	(0.0139)	(0.0140)
Uruguay	-0.6309***	-0.6261***	-0.6261***	-0.6309***
	(0.0224)	(0.0223)	(0.0223)	(0.0224)
USA	-0.0447***	-0.0496***	-0.0497***	-0.0447***
	(0.0139)	(0.0139)	(0.0139)	(0.0139)

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.10 Time Dummy results for red wines using different quality measures

Time dummy	(5) Red	(6) Red	(7) Red	(8) Red
January	0.2126***	0.2214***	0.2215***	0.2126***
	(0.0483)	(0.0486)	(0.0486)	(0.0483)
March	0.0869***	0.0869***	0.0869***	0.0869***
	(0.0149)	(0.0149)	(0.0149)	(0.0149)
April	-0.0265*	-0.0258*	-0.0258*	-0.0265*
	(0.0152)	(0.0152)	(0.0152)	(0.0152)
May	-0.0457***	-0.0452***	-0.0452***	-0.0457***
	(0.0153)	(0.0153)	(0.0153)	(0.0153)
June	-0.0586***	-0.0581***	-0.0581***	-0.0586***
	(0.0151)	(0.0151)	(0.0151)	(0.0151)
July	0.0567***	0.0570***	0.0570***	0.0567***
	(0.0157)	(0.0157)	(0.0157)	(0.0157)
August	-0.0250*	-0.0245	-0.0245	-0.0250*
	(0.0152)	(0.0152)	(0.0152)	(0.0152)
September	-0.1155***	-0.1156***	-0.1156***	-0.1155***
	(0.0148)	(0.0148)	(0.0148)	(0.0148)
October	-0.0478***	-0.0478***	-0.0478***	-0.0478***
	(0.0153)	(0.0153)	(0.0153)	(0.0153)
November	0.0860***	0.0859***	0.0859***	0.0860***
	(0.0156)	(0.0156)	(0.0156)	(0.0156)
December	0.3187***	0.3188***	0.3188***	0.3187***
	(0.0157)	(0.0157)	(0.0157)	(0.0157)

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A.11 Regression results, seasonal effects using February as baseline month

	White b	t	White b	t	Red b	t	Red b	t
Month dummies								
January	0.184***	3.406	0.157***	2.754	0.213***	4.402	0.142***	2.809
March	0.177***	9.545	0.178***	9.579	0.087***	5.842	0.086***	5.768
April	0.208***	10.759	0.206***	10.627	-0.026*	-1.744	-0.029*	-1.901
May	0.356***	18.172	0.353***	17.990	-0.046***	-2.990	-0.048***	-3.097
June	0.169***	8.766	0.167***	8.655	-0.059***	-3.886	-0.061***	-4.043
July	0.368***	18.406	0.365***	18.230	0.057***	3.614	0.054***	3.447
August	0.327***	17.035	0.328***	17.021	-0.025*	-1.646	-0.025*	-1.657
September	0.060***	3.268	0.059***	3.217	-0.116***	-7.796	-0.114***	-7.662
October	0.093***	4.954	0.087***	4.640	-0.048***	-3.127	-0.048***	-3.128
November	0.151***	7.869	0.147***	7.651	0.086***	5.517	0.085***	5.405
December	0.379***	19.598	0.376***	19.380	0.319***	20.346	0.320***	20.335

Note: White's robust standard errors have been used, significance at 10/5/1 % level are denoted by *//*****