Do expert reviews affect the demand for wine?

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Abstract

We examine the demand for wines in Sweden using five years of weekly data on sales, advertising and expert reviews. The effect of a favorable review peaks in the week after publication with an increase in demand of six percent and the effect remains significant for more than 20 weeks. We find small demand-enhancing effects of neutral reviews and no evidence of important negative effects from unfavorable reviews. Restrictions on the state-owned monopoly retailer, and the exogenous timing of a subset of the reviews, support a causal interpretation of the effects of reviews on demand.

Keywords: Experience goods, expert reviews, effects of advertising.

JEL: L15, L66.

The regular assortment at the Swedish state liquor stores consists of more than 500 different wines. Such a wealth of choice is ubiquitous to consumers in rich countries and evidence abounds that many people find the range of choice bewildering.[1] Expert reviewers might thus fulfill a potentially important role in helping consumers make well-informed decisions. Indeed, casual observation suggests that many people follow and sometimes act upon on the renowned critic Robert Parker's wine reviews or the *Guide Michelin*'s restaurant recommendations. To provide an assessment of the quantitative impact of expert reviews this paper utilizes rich data on the Swedish market for wine. While the Swedish wine market is perhaps of limited interest

[1] In an often cited experiment, Sheena S. Iyengar and Mark R. Lepper (2000) find that consumers are more likely to purchase at least one product when they have been exposed to a smaller choice set. In an article with the indicative title "The Tyranny of Choice", *The Economist* (December 18, 2010) provides a thought-provoking introduction to some of the issues, for instance noting that the average American supermarket carries 48 750 items. Richard H. Thaler and Cass Sunstein (2009) give an overview of the difficulties of choice in the cluttered environment faced by many consumers.

by itself, we argue below that the institutional setting, and detailed data, provide an unusually clear-cut case for examining the effects of expert reviews on demand. We use the grade and timing of all wine reviews in six leading print media in Sweden between 2002 and 2007. These are then combined with weekly sales volumes of wines and weekly advertising expenditures during the same period. Quantifying the effects of a review on demand requires comparison with a counterfactual sales volume; that is, what would sales have been had the wine not been reviewed? We rely on two sets of fixed effects to generate counterfactual sales. First, every wine, vintage and price combination is associated with a separate fixed effect. We also include weekly fixed effects that differ by 10 different segments defined by price, color (red/white/sparkling) and type of container (bottle or bag-in-box) to account for separate trends and demand shocks in the different segments of the wine market.

We find substantial increases in demand from favorable critique. A positive review raises demand by more than six percent in the week after the review appears. Effects gradually fade and it is only after more than 20 weeks that we can no longer reject the *null* that the effect is zero. We find small demand-enhancing effects of neutral reviews and no evidence of important negative effects from unfavorable reviews.

Reviews by experts are, of course, only one possible source for guiding consumer choice. Certifying agencies (such as local health authorities), retailers (through advertising or in store information) as well as other consumers are other possible sources of information about the availability and characteristics of products. We first discuss some differences between the various sources of information. We then relate our findings to previous work that specifically examines expert reviews.

Note that the impact of information on consumer choice may depend on both the *content* of the information and the *identity of the sender*. Certifying agencies typically provide information on product characteristics that are observable or verifiable, for instance whether a restaurant adheres to hygiene regulations or whether a wine is produced in Burgundy according to local standards (see David Dranove and Ginger Zhe Jin (2010) for an overview). However, consumers may also value information on aspects of quality that are harder to assess objectively – such as whether a movie is funny or a wine enjoyable. For some types of goods, such "soft" information is likely to be particularly relevant. When choosing what restaurant to go to, what movie to watch, what book to read or what wine to buy, observable product characteristics are unlikely to provide a complete picture of what to expect. These products may be regarded as

examples of what Philip Nelson (1970) termed experience goods; quality is learned only after consumption. Nelson (1974) hypothesized that the identity of the sender matters for the impact of information on demand for experience goods. For example, when a retailer advertises, consumers are aware that the information is given by an interested party. This should lower the effect on demand as compared to information provided by a neutral party. Similarly, favorable reviews on internet forums may be discounted if prospective buyers believe that the authors of recommendations are a selected sample.[2] Experts, who are purportedly authorities, with a reputation to uphold and with no economic interests in the sales of the products reviewed, may well have a greater impact than other channels. On the other hand, reviewers may be corrupt, reviews may largely exist for entertainment value and experts' tastes may correlate poorly with consumers' tastes, which would contribute to reducing the impact of reviews.[3]

There is substantial evidence that advertising increases sales of advertised products; Kyle Bagwell (2007). Accumulating evidence also shows that customer-to-customer information transmission affects demand for experience goods. For instance, Judith Chevalier and Dina Mayzlin (2006) use sales rank data for books from Amazon's and Barnes and Noble's web stores to establish that the addition of a new favorable customer review raises the sales rank. Hongbing Cai, Yuyu Chen and Hanming Fang (2009) show that when customers are given information about the most popular dishes in a restaurant, demand for those dishes increases by up to 20 percent.[4] Such evidence suggests that expert reviews also create an effect, but this conclusion does not follow automatically.

Documenting the effects of expert reviews on demand may be particularly pertinent in the sense that various sources of information differ in their implications regarding how markets function. Advertising can have a positive effect on consumer welfare by informing consumers about the existence of products and by helping them find the product that best fits their tastes and budget. This is known as the informative view of advertising, often attributed to George J. Stigler (1961). On the other hand, advertising can create customer loyalty and act as an entry barrier. This is known as the persuasive view of advertising; see Bagwell (2007) for an

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[2] See Abhijit Banerjee and Drew Fudenberg (2004) for a model of links between word-of-mouth learning and sampling rules, such as over-reporting by agents with high or low payoffs.
[3] A related question is whether critics' selections stand the "test of time"; see Victor Ginsburgh (2003) for an overview.
[4] Raghuram Iyengar, Crisptophe Van den Bulte and Thomas W. Valente (2010) show that physicians who increase their prescriptions of a new drug have a strong effect on the decision of other physicians to prescribe the same drug. There is also considerable evidence that social learning has strong effects; see, for instance, Esther Duflo and Emmanuel Saez (2002) on the decision to join a retirement savings plan or Charles Manski (1993) for an analysis of identification.

overview. Note that expert reviews can have an effect on demand similar to that of informative advertising and do so with few direct costs. Information transmission among consumers may be sensitive to herding behavior, such that products which have been chosen by many others will also tend to be chosen by subsequent consumers, even if they had a private signal that another product would better match their tastes. An important possibility in models of consumer-to-consumer information transmission is thus that society gets locked into the "wrong" products: lack of information prompts consumers to choose what others have chosen; see Banerjee (1992) and Sushil Bikhchandani, David Hirshleifer and Ivo Welch (1992) for seminal contributions. Expert critics who act with integrity can therefore have an important role to fill for well-functioning markets, in particular by informing consumers about high-quality products from credit-constrained producers with limited resources to advertise.

To our knowledge, four papers have attempted to study whether there is a causal effect of expert reviews on sales or demand.[5] Jehoshua Eliashberg and Steven M. Shugan (1997) are frequently credited with being the first to tackle this question. They find no significant relation between the share of positive or negative reviews and revenue during the first weeks after a movie is screened. They interpret this as evidence against the presence of a causal effect. David A. Reinstein and Christopher M. Snyder (2005) compare the box-office revenue of movies reviewed by two U.S. film critics, Gene Siskel and Roger Ebert on the opening weekend to box-office revenue of movies that are reviewed after the opening weekend. When examining all movies, they find a marginally significant positive effect of reviews. The effects for "art" movies are found to be somewhat more pronounced. Two recent papers find stronger evidence of effects. In a field experiment, James Hilger, Greg Rafert and Sofia Berto Villas-Boas (2010) posted quality ratings on the shelf next to a random selection of wines in a store and found that good reviews increase sales. Similar to our strategy, Jonah Berger, Scott Rasmussen and Alan Sorensen (2010) use a difference-in-differences approach to establish that favorable book reviews in the *New York Times* raise sales.

Our findings thus reinforce the evidence that favorable expert reviews increase sales. Restrictions on the retailer imply that we can rule out stimuli at the time of purchase and retailer sales efforts as mechanisms for an increase in sales. As regards unfavorable reviews, Hilger, Rafert and Villas-Boas (2010) find a negative effect of a bad review on sales whereas Berger,

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[5] Many previous studies have found a positive correlation between favorable reviews and sales, which may or may not reflect a causal effect. Caroline Elliot and Rob Simmons (2008) summarize a number of studies and conclude that the evidence supports a positive correlation between favorable reviews and box-office revenue for movies.

Rasmussen and Sorensen (2010) find a *positive* effect of bad reviews for lesser-known authors. While a negative review is also associated with increased demand in our data, the effect is sufficiently small that it may best be described as approximately zero.

To relate these different results to each other consider a setting where consumer choice is potentially affected by information from reviews and by stimuli that occur at the time of purchase. Product differentiation may have vertical (actual quality differences) as well as horizontal aspects (consumers have different tastes). Holding other factors constant, an increase in the (perceived) quality of one product would raise demand for that product in any standard model of vertical product differentiation, such as in Avner Shaked and John Sutton (1982).[6] Conversely an unfavorable review should have a negative impact if vertical differentiation is important.[7] In contrast, if differentiation is mainly horizontal, the grade in reviews should matter less. Neutral or negative reviews can increase demand of horizontally differentiated products since they inform consumers that a product with certain characteristics exists. The logic is similar to that underlying models of informative advertising such those in Gerard Butters (1977) or Gene Grossman and Carl Shapiro (1984). Horizontal product differentiation is arguably dominant for many cultural goods like books. We would therefore venture to say that the difference between our results and those of Berger, Rasmussen and Sorensen (2010) may be explained by a greater importance of horizontal product differentiation in the markets for books.

We further conjecture that an important difference with respect to Hilger, Rafert and Villas-Boas (2010) is that their information is given at the time of purchase. When there are many products to choose among, a bad review in the print media may not be a sufficiently strong signal to discourage consumers from buying a wine that they would have bought absent that signal. Consumers may take note of which wines to buy among an assortment of several hundred products, but are less likely to make a note of which wines not to buy, even if those wines might capture their attention in the store. Raj Chetty, Adam Looney and Kory Kroft (2009) provide an example of how purchasing decisions are affected by sales tax information made conspicuous at the time of purchase.

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[6] See Yenbo Chen and Jinhong Xie (2008) for a model that includes both vertical and horizontal product differentiation as well as third party reviews.

[7] A negative effect may also be posited if public information about a wine interacts with consumers' utility function such that they are less inclined to offer their guests a wine that has received negative reviews, or to consume it themselves. The mechanism would be similar to Stigler and Gary S. Becker's (1977) arguments for the "prestige" effects of advertising.

In the next section we describe our data and the institutional setting. Our empirical model is introduced in Section II and the results are examined in Section III. We offer some concluding remarks in Section IV.

I. Retail sales of wine and reviews in Sweden

We use weekly data on retail sales of wine in Sweden between January 2002 and the first two weeks of 2007. The data cover all red, white and sparkling wine sold in 750 ml bottles or in (three-liter) bag-in-box packages that are part of the regular assortment of Systembolaget, the Swedish state-owned monopoly retailer.[8] These package sizes account for more than 96 percent of volume in the retail market.

The terms we use are specified as follows. We define a *wine* according to producer, grape varietal, container size and any other indication on the label (such as "Reserva" or a specific cuvée). An example of a wine is Turning Leaf Zinfandel in a 750 ml bottle. In some instances, wines with the same name and grape varietal are available as both a bag-in-box and in a bottle; Gato Negro, for instance, is available in both containers. In such cases we treat these different containers as separate wines and refer to Gato Negro as the *brand*. In our regression framework, we allow standard errors to be correlated at the brand level. Further, in the regressions, a wine is the unit of observation, but we allow a new vintage and a new nominal price to affect demand via the inclusion of fixed effects for each combination of wine×vintage×price. To control for demand shocks, we use fixed effects for each week×segment. We define 10 such *segments*: four segments of red wine (bag-in-box/ low-priced bottles/ medium-priced bottles/ high-priced bottles), four segments of white wine (defined analogously as for red wine) and two segments of sparkling wine (low-priced and high- priced bottles).[9] In some robustness checks, reported in the online appendix, we also used a finer categorization that we term *taste-segment*. This applies a finer classification of the colors into 16 taste categories. Red wine is split into four, white into eight and sparkling into four taste categories. Systembolaget uses these taste categories in their catalogs to describe wines. We combine the taste categories with the same container and price cutoffs as for the *segments* to

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[8] The data set thus includes all retail sales in Sweden. Sales through restaurants and bars account for 11 percent of total wine sales in 2004 (Source: Swedish National Institute of Public Health).
[9] The cutoffs for the groups are SEK 75 per bottle (USD 10.2 as of January 2004) and SEK 110 per bottle (USD 14.9). Since there are fewer sparkling wines in our data, we only have weekly dummies for high- and low-priced sparkling wines. No sparkling wines are sold in bag-in-box.

create *taste-segments.* An example of a taste-segment is "crisp and fruity, dry white wine" sold in a medium-priced bottle.

Systembolaget is the sole retail outlet in Sweden for wine, spirits and beer with an alcohol content above 3.5 percent by volume. Its stated purpose is to minimize alcohol-related health problems and support a responsible relation to alcohol, and it is not instructed to maximize profits.[10] It is monitored by the Swedish competition authority twice yearly on behalf of the European Commission to ensure that it provides a level playing field for manufacturers from different countries. Hence, there is no role for sales-enhancing activities by the monopoly retailer that may be correlated with the appearance of reviews. For instance, results of reviews are not allowed to be posted anywhere in the stores. Positioning products at eye-level, giving a product more shelf space and in-aisle displays are examples of sales-enhancing tactics frequently used in supermarkets.[11] At Systembolaget, shelf display is organized according to color, price and country of origin only. Wines that are located at eye level in a particular store are likely to sell more than those located closer to the floor, but the display cannot respond to temporary demand shocks. Sales staff may answer questions from customers, but are instructed not to promote sales.

Systembolaget has six distribution levels for the wines that are part of their regular assortment. One set of wines is distributed in all 420 stores and a second tier is distributed in 325 stores. Together, these two categories make up 77.4 percent of the volume. Other wines have distribution in 195, 95 and 45 stores, respectively. The share of stores carrying a wine clearly has the potential to affect sales. We thus confine our attention to wines distributed in most or all stores (distribution in 325 or 420 stores). Store coverage for a wine can change only twice a year in connection with new catalogs that appear in spring and fall.

Overall volumes are rather stable over the period under study, but there are cyclical patterns that differ across types of wine.[12] For instance, sparkling wines sell more around New Years Eve whereas white wines sell the most in summer. Moreover, within each color, the cyclical patterns in sales differ across price segments. For example red bag-in-box wines are sold more during summer than during winter. These facts motivate our definitions of segments as described above. Table 1 reports some key descriptive statistics across the wines that are

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[10] See www.systembolaget.se for a further description; links are available in English.
[11] See Herb Sorenson (2009) for an overview of how store layout and product display affect consumer choice.
[12] See the online appendix for graphs of volume over the period.

included in our sample. There are 293 different red wines in our data, and the average volume is 9609 liters per week. Sales of white wine are lower, with fewer wines (198 white wines) and lower average volume (7987 liters per week per wine). There are 35 sparkling wines and the average volume per week is 2969 liters.

Table 1 about here

The average price for both red and white wine is around 90 Swedish kronor (SEK) per liter, approximately corresponding to USD 12.2. Sparkling prices are higher, mostly reflecting the large number of sparkling wines from Champagne. For all three types of wine, the median price is lower than the mean price, reflecting a tail of wines with high prices. The highest priced wine over this period is a Champagne, *Veuve Clicquot Brut*. In comparison with wine retailing in many other countries, the lower cutoff in terms of price is higher. The cheapest wine is a German white wine, Johann Bihn Liebfraumilch at SEK 49, approximately USD 6.1.

Estimation of the effects of reviews on demand is simplified by the limited possibility to adjust prices.[13] Systembolaget is required to apply the *same* markup rule to all wines. The markup is determined by the Swedish Parliament and was changed twice during the period under study.[14] The prices that consumers face are thus fully determined by the wholesale prices charged by profit-maximizing importers acting as wholesalers to Systembolaget. Presumably, these profit maximizing wholesalers would want to change prices in response to demand shocks. However prices are the same across the whole country and there is no leeway to respond to local demand shocks by changing price. In the time series dimension as well there is little scope to change price. New catalogs appear in April and late September or the first week in October (with an additional catalog in December or in summer during some years). There are no more than three catalogs in any of the years under study and prices can change only when a new catalogue appears. Prices change even less frequently than this, however. Figure 1 below shows the number of price changes for the wines in our sample. The median wine changed price twice during this period, the same number of times as Systembolaget's markup changes.

[Figure 1 about here]

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[13] Indeed Héla Hadj Ali, Sébastien Lecocq and Michael Visser (2008) show that the grades assigned by the leading wine critic Robert Parker affect the prices of "*en primeur*" wines from Bordeaux.

[14] In April 2004, the fixed component of markup was lowered from SEK 4 to SEK 3.5 and the percentage markup increased from 17 to 23 percent. In August 2006, the percentage markup was lowered from 23 to 19 percent. The price of 64 percent of the wines offered changed at the first of these dates and 93 percent at the second.

We also use information on advertising expenditures per wine per week.[15] These expenditures are quite concentrated and in the median week, the typical wine is not advertised. In Sweden, wines are advertised by the importer, i.e. the retailer does not engage in wine advertising.[16] Prior to May 15 2003, advertising of wine in Sweden was prohibited.[17] A standard measure of advertising expenditure is to set advertising expenditures in relation to sales revenue at the retail level. In 2006, this ratio is 0.74 percent. As a comparison, the same ratio for the U.S. wine industry in 2006 was 3.3 percent.[18]

We now turn to data on reviews. We compiled the date of publication and grade for all reviews of wine that appeared in six major Swedish print media. We regard these as including the most influential wine reviews in Sweden during the time period. Arguably the target group for these reviews is the general consumer market, that is, people looking for a nice wine for their weekend dinner, rather than someone interested in learning about the latest vintage of a prestige cru.[19]

We used reviews from the two leading tabloids with nationwide distribution – *Aftonbladet* and *Expressen*. In 2004 the average daily circulation of *Aftonbladet* was 452 300 and of *Expressen* 363 000. Thus, they reach a substantial share of Sweden's nine million inhabitants. We also used the reviews from two leading morning papers, *Dagens Nyheter* (circulation 368 200) and *Svenska Dagbladet* (circulation 180 800). Both have nationwide distribution even though their sales are concentrated to greater Stockholm. The population of Stockholm County is two million. Further, we used reviews from *Dagens Industri* which is the main business daily with nationwide distribution and a circulation of 116 700. Finally we used reviews from *Allt om Mat* (AoM), the leading food and beverage magazine in Sweden. It publishes 20 issues/year, with a circulation of 129 300. All six sources publish a numerical

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[15] Source: Research International/SIFO. Advertising expenditure is an estimate of the total cost of advertising for a given brand in a given week in magazines and newspapers, as well as on television and billboards.

[16] Systembolaget only provides statements about its mandate and policy, including its rules regarding ID checks of persons who are under 25 (the legal purchasing age is 20).

[17] Prior to this, magazines were not allowed to advertise unless they were only distributed in premises where underage consumers were denied access. Some advertising would also reach Sweden via satellite TV channels broadcasting in Swedish but not based in Sweden. The advertising to sales ratio was 0.03 percent in 2002. The lifting of advertising bans has been used in several studies as an identification tool; see Jeffrey Milyo and Joel Waldfogel (1999).

[18] Source: *Advertising Age*. Other alcoholic beverages frequently have higher marketing intensity. In the U.S., in 2006, the advertising to sales ratio was 8 percent for beer and 16.8 percent for liquor.

[19] Note that this is in contrast to some previous work on wine markets. Orley Ashenfelter (2008), for instance, examines the very high end of the market.

grade that sets quality in relation to price; that is, designating which wines are a "good buy"[20]. To generate a consistent measure of quality for the different sources and across time, we converted the grades into a 0-10 scale. *Aftonbladet*, for instance, ranks wines on a scale from 0 to 5, so a grade of 4 in *Aftonbladet* is then associated with a value of 8 in our review variable.

Table 2 about here

As seen in Table 2, there is considerable dispersion of the grades in all the sources. To facilitate the analysis, we created the variable Grade that takes the value of the review if there is at least one review in the given week.[21] If the same wine is reviewed in several sources in the same week, Grade is the circulation-weighted average of these reviews. Summing the first six rows yields 5 570 reviews which, compared with the number of observations of Grade (5 093), shows that in the vast majority of cases a wine is just reviewed in one source in a given week. In the regressions reported below, we also added separate dummies for reviews that give a good grade (8 or above) and reviews that give bad grade (4 or below).

There are cases where a wine receives conflicting reviews from different sources. Nevertheless, the correlation between the grades of reviews given to a specific wine across the different sources is positive and significant at the 95 percent level for all bilateral comparisons. The median wine in our sample was reviewed in seven different weeks (mean: 9.9 weeks, standard deviation 9.8, 10th percentile 1 week, 90th percentile 25 weeks). In Figure 2, we graph the number of reviews published each week. The main conclusion is that reviews are broadly spread across time. The highest spikes are due to the wine-tasting issue of *AoM* that appears in October every year. In this issue, nearly all red and white wines in the regular assortment are reviewed. In 2004, for instance, 95 percent of the red wines and 94 percent of the white wines available at that time were reviewed. The timing of these reviews is thus exogenous from the perspective of the sales for individual wines. The issue appears during the same week or somewhat after publication of the fall catalog by Systembolaget. There is thus no possibility in the short run for wholesalers to change their prices in response to information in the catalog.[22]

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[20] *Expressen* did not begin this practice until March 2006 and *Svenska Dagbladet* ceased publishing such grades in November 2004. In these cases we rely instead on their reported measures of absolute quality.
[21] In the online appendix we also report regression results from specifications with other aggregation schemes for reviews. There are only minor differences between these results and those in the benchmark below.
[22] We cannot rule out information leaks from *AoM* sufficiently in advance to affect prices charged by wholesalers. Note however that new prices are determined several weeks before the distribution of the new catalog and the next opportunity to change price would typically arise in April.

[Figure 2 about here]

II. The empirical model

Equation (1) below is our baseline estimating equation. The dependent variable is the natural log of liters sold of wine i, with vintage and price combination j, sold in segment k during week t. We include a fixed effect α, which is defined by wine×vintage×price. Thus, a new vintage or a new price is associated with a new fixed effect. To accommodate different time trends in sales, we allow for separate fixed effects (δ) by week×segment (as described in the second paragraph of Section I). For instance, one fixed effect captures bottled red wines sold at a price above SEK 110 per bottle in week 128.

$$(1) \quad \ln Q_{ijkt} = \alpha_j + \delta_{kt} + \sum_{l=-4}^{25} \alpha_{t-l}^{good} R_{it-l}^{good} + \sum_{l=-4}^{25} \alpha_{t-l} R_{it-l} + \sum_{l=-4}^{25} \alpha_{t-l}^{bad} R_{it-l}^{bad} + \sum_{l=-4}^{25} \gamma_{t-l} ADVERT_{it-l} + \eta_{ijkt}$$

Our main variables of interest are the review variables. R_{it} takes the value 1 if wine i is reviewed in week t and 0 otherwise. Additional dummy variables R^{good} (Grade≥8) and R^{bad} (Grade ≤4) are used to denote good and bad reviews. We use a finite distributed lag model to allow for the possibility that not all the effects of a review are simultaneous, thereby allowing effects to last up to 25 weeks. We also include advertising expenditures (in thousands of SEK) for wine i in week t, as defined above. We estimated (1) by ordinary least squares (OLS). To account for possible correlation in the error term over time and across vintages, prices and container types, we clustered standard errors at the brand level.

In order for OLS to deliver unbiased estimates, we require that $E(\eta_{ijkt}|\alpha,\delta,R,R^{good},R^{bad},ADVERT)=0$. This condition would fail to hold if reviews were simultaneously correlated with demand shocks that we fail to capture with our time effects. As indicated in Figure 2, there are cyclical patterns to reviews; for instance, champagnes are more likely to be reviewed in the week before New Year whereas bag-in-box red wines suitable for a a barbeque are more likely to be reviewed in summer. The market-segment specific time effects capture such demand shocks.

Positive idiosyncratic demand shocks may also trigger a review. We addressed this concern in two ways.[23] First, we included four leads on all time-varying explanatory variables

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[23] Specification (1) also allows reviews of a wine to have an effect after a new price or a new vintage has appeared. In the sense that a price decrease or a new vintage may coincide with a new review, we risk spuriously assigning a

in our regressions. If a wine is gaining popularity, and a review appears in response to this tendency, we expect leads to be significantly positive. Second, we redid the analysis using only reviews from the annual wine-tasting special issue of *AoM*. Since essentially all red and white wines sold by Systembolaget are included in these special issues with predetermined publication dates, the timing of these reviews is exogenous to any temporary demand shock.

Our estimates would also be biased if retailers or wholesalers reacted rapidly to reviews, by changing location on the shelf or sales efforts by staff. Even without any direct effect of reviews on customers' propensity to buy a particular wine, an endogenous response by retailers could lead to a significant coefficient on reviews in our model. As discussed in the preceding section, there is no scope for such actions in the present setting.

It should also be noted that advertising is a choice variable for the importer. Wines that have high sales are also likely to have high advertising expenditures. Two features of our data limit the concern for the potential endogeneity to influence our estimation results. First, we controlled for wine×vintage×price fixed effects as well as for demand shocks using weekly data. At this high frequency, we expect a low correlation between advertising and idiosyncratic demand shocks. Second, our main interest is in the effects of reviews. We therefore also estimated our model on the period before advertising was allowed (this robustness check is reported in the online appendix). During this period, there is no possibility for endogeneity of advertising to bias the coefficients on reviews.[24]

III. Results

We start by presenting our baseline results for the full sample of wines and reviews. This is followed by results based solely on the reviews published in the annual wine-tasting special issues of *AoM*, as well as heterogeneous effects across types of wines and market segments. Given the large number of lags, we report estimated effects from model (1) graphically along with the 95 percent confidence intervals in Figure 3.[25]

[Figure 3 about here]

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demand increase to the review. As a further check on robustness, we therefore also estimated the equivalent of equation (1) exclusively at the product/price/vintage level. Results are reported in the online appendix.

[24] Another alternative would be to find a good instrument for advertising. Despite the efforts represented by a large literature, fully satisfactory solutions for instruments for advertising have not been reached; see Bagwell (2007) for an overview. Randall Lewis and David Reiley (2009) use a field experiment and document a positive effect of advertising on demand.

[25] As regards robustness to different specifications, we refer to the online appendix.

A review raises sales by 1.2 percent in the same week that the review appears. During the following four weeks, sales are significantly higher than if the wine had not been reviewed. From the fifth week after the review, we cannot reject that the effect is zero. Turning next to a good review, we see a substantial impact. In the same week that the review appears, the point estimate indicates that a favorable review increases sales by an additional 2 percent over and above the effect of a review. The effect peaks in the week after a good review, with a point estimate of 5.2 percent higher sales. The effect remains positive and continuously significant up to 22 weeks after the review. A bad review, on the other hand, is associated with a negative coefficient, but the effect is weak and counterbalanced by the positive coefficients of being reviewed at all. The effect of advertising on sales is significant, but appears to be short-lived. Every SEK 1 000 (approximately USD 136) spent on advertising is associated with 0.025 percent higher sales the same week, and a slightly lower effect the week after the advertisement. The point estimates on leads are generally close to zero and not significant, thus suggesting that the segment-specific period fixed effects successfully capture temporary demand shocks and seasonal variation. That is, we find no indication that wines are reviewed as a response to idiosyncratic trends.

The full impact of a good review is given by adding the coefficients for review and good review. Taking the significant (at 5 percent) point estimates of current and lagged responses from the regression and evaluating them at the mean volume (8 218 liters per week) implies that a good review increases volume by 4 418 liters, roughly equivalent to half a week of sales. At the mean price of SEK 99.6, this raises sales revenue by SEK 440 000, approximately USD 60 000. The corresponding calculation for a neutral review generates a modest increase in sales of around 555 liters. Adding the coefficients for review and bad review, we find that a negative review has an impact close to zero. The positive impact of a review per se is sufficient to just barely outweigh the negative effect of the review being unfavorable; in fact, a negative review is actually associated with a slight *increase* in volume of 170 liters.

Our main interest is in the effects of a review, with advertising included as a control variable. Before turning to a discussion of the estimated effects of advertising we would like to emphasize two caveats. First, our identification of advertising is less compelling than for reviews. As discussed in Section II, we expect that endogeneity of advertising is a limited concern at the weekly frequency, after controlling for the segment effects, but caution is

warranted. Second, given our interest in lags, we introduced advertising in levels in a parsimonious fashion. The estimates may mask threshold effects and decreasing returns to advertising that we fail to capture with our simple formulation. With these provisos, let us note that the demand-enhancing effects of advertising expenditures are minor. At the mean advertising levels, a week of advertising would raise demand by only 320 liters. The average weekly advertising expenditure, however, is also very low at SEK 6 900. The wine with the highest average advertising expenditure (Gato Negro) spends on average SEK 96 000 per week when it advertises (around USD 13 000). A week of advertising at that level generates a volume increase of 525 liters, approximately the same as a review does.

Research on the effects of advertising outlays has increasingly stressed that the impact of advertising on demand is not merely a matter of how much is spent, but also on how the finer details interact; see, for instance Demetrios Vakratsas and Tim Ambler (1999) or Gerard J. Tellis; Rajesh K. Chandy and Pattana Thaivanich (2000). The permissible content of wine advertisements in Sweden is tightly regulated.[26] As a result advertising is arguably informative rather than persuasive. It is therefore perhaps not surprising that we do not see large short-run effects of informative advertising for wines in the regular assortment at a monopoly retailer. Interestingly, good reviews raise demand for a longer period of time than advertising does. A possible interpretation is that advertising on this market largely serves to alert consumers to the existence of a product and thus fulfills a role similar to a short-lived neutral review. A good review on the other hand appears to shape perceptions of quality in a more persistent way.

Our identification strategy rests on the premise that wine-specific demand shocks in a given week are not correlated with whether that wine is reviewed the same week. We used the annual reviews in *AoM*'s wine-tasting special issue to examine whether we capture the causal influence of reviews. The publication dates of these annual reviews are exogenous at the level of an individual wine. In the specification in the lower left-hand panel in Figure 3, we therefore ran the baseline regression using only the reviews that appear in *AoM*'s annual issue. The lower right-hand panel reports the results from the complement, that is, applying the baseline specification but only using the reviews that do not appear during the week of the annual issue.

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[26]It is stipulated that advertising of alcohol should show "particular moderation". In the print media, an ad may contain a picture of the product and some printed text; see http://www.alkoholgranskningsmannen.se.

We take the similarity of coefficients across these different specifications as support for the notion that the regressions capture a causal effect of reviews on demand.

Another issue of potential interest is the effect of reviews on sales of competing wines. Therefore, we also estimated an extension of equation (1) where, apart from retaining all the explanatory variables of (1), we included the number of competing good reviews, the number of competing bad reviews, the number of competing reviews as well as the sum of advertising expenditures for competing wines. These variables, which capture competing wines, were calculated at the weekly level and included with four leads and 25 lags. We define a competing wine as one in the same taste-segment, as defined in Section II.

As shown in the online appendix, there is a tendency for good reviews of competing wines to decrease demand and for bad reviews of competing wines to increase demand. We expect the effect of reviews to be stronger on own demand than on competitors and, indeed, the cross effects are of an order of magnitude lower than the own effects and frequently not significant. Admittedly, this specification introduces competing reviews in a rather crude way. Therefore, we did not use this as our main specification; instead, we let competing reviews be absorbed in the error term in equation (1).[27] Note that there are more good reviews than bad. It is conceivable that the increase in demand from a good review partly stems from market expansion, and not just from business stealing from competitors. A back-of-the-envelope calculation of the effects of reviews can be made by using the predicted values from the specification with competitor reviews and setting all reviews to zero. If we do so, we find that weekly volume is on average 1.02 percent higher with reviews than without. This exercise is therefore suggestive of a small market-expanding impact of expert reviews.

Different theories of the role of information for demand, such as the informative and persuasive views of advertising, raise the possibility of varying responses for different types of wines. In the informative role of advertising, information matters because it provides quality information as well as alerting the consumer to the availability of a product. The significant effect of a review that we established above suggests that information about availability has some effect on demand, but a more important effect is due to quality information conveyed by the review. To provide a test of whether effects vary across different categories of wine we

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[27] The difficulties inherent in estimating effects of reviews on competitors are similar to those in estimating cross-price elasticities. See Steve Berry, James Levinsohn and Ariel Pakes (1995) for seminal work on the use of a structural model of demand to measure own and cross-price elasticities in an oligopolistic industry with many products.

estimated specifications that include interaction effects. Specifically, we tested whether there are significant differences in the impact of reviews during the first 10 weeks.[28] This was done by interacting the review indicators, *R*, with the categories of interest, for example if the wine is in the medium- or high-price category. This allows the effect for the category of interest to be systematically larger or smaller.[29] We thus estimated equation (2), where we introduce the super index *m=good review, bad review, review* (to save on notation we do not include the summations over *m*) and D_g is an indicator that captures the different groups that we are interested in comparing. We thus examined

$$(2) \quad \ln Q_{ijkt} = \alpha_j + \delta_{kt} + \sum_{l=-4}^{25} \alpha_{t-l}^m R_{it-l}^m + \sum_{l=0}^{10} D_g \alpha_{t-l}^m R_{it-l}^m + \sum_{l=-4}^{25} \gamma_{t-l} ADVERT_{it-l} + \vartheta_{ijkt}$$

[Table 3 about here]

In column (1) of Table 3 we see that wines with a medium or high price show a greater response to good reviews. This is consistent with a setting where quality information matters more in the higher price classes. It is also consistent with a view of information similar to that in the complementary, or "prestige", view of advertising associated with Stigler and Becker (1977). According to that view, advertising enters utility directly and is complementary to consumption of the final good. In the current setting, this may imply that greater pleasure is associated with offering guests a wine that received a good review. In column (2) we establish that good reviews published in a tabloid matter less than those in the other sources. While admittedly speculative, this is also consistent with a "prestige" view of reviews, as it may appear less prestigious to take one's wine cues from tabloids. The lack of significant differences for a neutral review in column (2) rhymes well with a view that the identity of the sender matters little for the quantitative impact of bringing a product to the attention of consumers.

Informative views of advertising suggest larger effects on demand for a product if consumers are unaware of its existence, or if there is uncertainty about quality. Observers of the wine industry have noted that wine producers in the Americas, South Africa and Australia/New Zealand market by brand name rather than relying on regional affiliation and aim at a more

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[28] The estimated effect of reviews is transitory in all cases. Including a very large number of lags would thus point to us not finding any significant differences, even if there are important differences in the short run.
[29] We were inspired by Ken Hendricks and Sorensen (2009) in choosing this form of testing for significant differences in the response.

consistent quality over the years than European producers.[30] The test in column (3) suggests that there is a systematic difference in the effects of reviews between European and other wines. A review per se matters less if it concerns a non-European wine, but there is no significant difference with respect to a good review. This may indicate that non-European wines are better known by their brands and that informing consumers of their existence therefore matters less. This finding is consistent with an informative view of reviews. Wines that are advertised should also be better known. However, as seen in column (4), the estimated differences in the response to reviews are essentially zero and not significant. In column (5) we explore whether the impact of reviews is different for the period when advertising was allowed than when it was not. If advertising in this market were strongly persuasive and effective in creating brand loyalty, we would expect weaker effects of reviews after advertising is allowed, an implication that is not supported.

The longer a wine has been established on the market, the more consumers are likely to have tried it themselves or have an opinion based on word of mouth or previous reviews. Reviews may therefore be expected to have their greatest impact on wines that are relatively new to the market. The set of wines in these top tiers of distribution is quite stable. Thus, in order to generate a sufficient number of observations of "new" wines we regarded wines that were introduced not more than two years before a review as new. Using this definition of a new wine, there is no significant difference in the impact of a review, as seen in column (6). Reviews are likely to have a greater effect for wines where there is more uncertainty about their quality. Based on this motivation, we compared the effects of reviews on demand for wines that come in vintages (where quality variation across years should be greater) with non-vintage wines in column (7). In column (8) we interacted reviews with a dummy that indicates if a wine comes from a region that exhibits high quality variation, as measured by the reviews. Interactions in both cases are close to zero and insignificant.

IV. Concluding remarks

In summary, we found that a good review generates a transitory, but quantitatively important, increase in demand for a given product. In fact, just being reviewed has a small positive effect on demand. The effect of a bad review on demand is approximately zero. The results overall are

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[30] We thank a referee for suggesting the possibility of heterogeneous responses to reviews in this dimension. For a discussion of different strategies and production methods across the different origins, see, for instance, Gwyn Campbell and Nathalie Guibert (2006).

consistent with a view that good reviews provide information about quality which consumers act on. The minor and short-lived effects of neutral reviews and advertising suggest that these information channels serve mainly to bring a wine to the attention of consumers.

We also found that the effects of good reviews are greater for higher-priced products. The impact of a review is also stronger if a review appears in the morning press or targeted press, rather than in tabloids. This is consistent with a "prestige" view of reviews similar to the "prestige" view of advertising. Economic logic also suggests heterogeneous responses in some other dimensions where most comparisons yielded differences that were small and not significant. Without observing consumer-level wine choices and linking them to the media consumption of consumers (such as in Daniel Ackerberg (2003)), an explanation for the (lack of) patterns of heterogeneity remains speculative, however. We hope to be able to address the effects of reviews with consumer-level data in the future.

Most of us are likely to see a particular movie only once and to buy only one copy of a book. In contrast, many of us will reward a wine that we like with future purchases. It could be conjectured that reviews of experience goods that have been on the market for a long time should have little effect on demand.[31] Clearly this hypothesis does not hold in our data. There is no statistically significant difference in the impact of reviews on the demand for newer versus older wines. A possible interpretation is that at least some of the effect of reviews is due to consumers "discovering" a wine that has been on the market for a long time.

To what extent can the quantitative effects of reviews that we estimated be expected to hold in other markets? We can ascertain mechanisms that point at both weaker and stronger effects of reviews on sales. It may be that it is precisely a lack of persuasive advertising, and a lack of retailer sales promotion, that gives rise to the large impact of information from expert reviewers on demand. Alternatively, in other markets, there can be important complementarities between expert reviews on the one hand, and retailer or advertising behavior on the other hand, that augment the sales-increasing effect of a good review. We hope to have convincingly established that at least in one clean setting, there is a positive effect of favorable reviews on demand.

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[31] Michael H. Riordan (1986) examines how the number of purchases per consumer affects the equilibrium in a "competition-on-the-circle" model with experience goods. He shows that as the share of repeat purchases increases, the market converges to the full-information equilibrium outcome.

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Table 1. Descriptive statistics across wines, Sweden, Jan 2002-Jan 2007.

Segment	Variable	Mean	Standard deviation	Min	Median	Max	Observations
Red	Liters per week	9609.29	12874.32	9.75	5155.60	96367.66	293
	Price per liter	96.46	37.41	49.37	90.14	324.97	293
	Advertising expenditure	7.92	13.55	0.05	3.25	96.34	160
White	Liters per week	7087.37	8177.93	183.11	3651.92	46679.42	198
	Price per liter	86.96	30.68	48.96	80.02	267.63	198
	Advertising expenditure	3.52	5.53	0.03	1.82	42.10	91
Sparkling	Liters per week	2968.80	3802.02	285.03	1707.27	19686.05	35
	Price per liter	197.82	136.14	66.41	126.57	450.24	35
	Advertising expenditure	2.97	3.17	0.02	1.31	9.34	19
Total	Liters per week	8218.12	11028.08	9.75	4167.19	96367.66	526
	Price per liter	99.63	55.14	48.96	86.37	450.24	526
	Advertising expenditure	6.09	11.15	0.02	2.55	96.34	270

Note: The table shows mean price, volume per week and advertising expenditure (means of means across brands). Prices and advertising expenditure in real January 2004 terms. Advertising per wine is in thousands of SEK and is the mean of the mean per wine advertising expenditure over weeks with positive advertising expenditure for the respective wine. The relatively lower number of observations for advertising expenditure is due to that some wines were not advertised.

Table 2. Wine reviews in Swedish print media, Jan 2002-Jan 2007.

Media	Mean	Standard deviation	Min	Median	Max	Observations
Aftonbladet	7.46	1.83	0.00	7.50	10.00	675
Dagens Nyheter	6.64	3.57	0.00	7.50	10.00	1160
Dagens Industri	7.93	1.69	0.00	7.50	10.00	676
Expressen	8.13	1.92	0.00	8.00	10.00	500
Svenska Dagbladet	6.89	1.17	4.00	6.00	10.00	271
Allt om Mat	5.13	3.16	0.00	6.67	10.00	2288
Grade	6.38	3.04	0.00	6.67	10.00	5093
Grade|Grade≥8	9.49	0.80	8.00	10.00	10.00	1637
Grade|Grade≤4	2.00	1.60	0.00	3.33	4.00	1315

Note: Reviews of wines included in our sample. The 5570 reviews in the individual print media are on a scale from 0 to 10, where 10 is the best. Grade is a circulation-weighted average of all reviews for a given wine in a given week. Reviews are stated in a "value-for-money" dimension, rather than in terms of absolute quality.

Table 3. Differential impact of reviews on demand for wine

	(1) Different prices	(2) Different media	(3) Wines from the new vs old world	(4) Wines with vs without advertising expenditures	(5) Reviews when advertising is legal vs non-legal	(6) New vs older wines on the market	(7) Standard vs vintage wines	(8) Regions with high quality variation
				Interaction term:				
	× Medium & High Price	× Tabloid	× New world	× Wines with advertising	× Advertising legal	× New	× Vintage wines	× High quality variation
Review	0.0018	-0.0006	-0.0205**	0.0056	-0.0039	-0.0150	-0.0049	-0.0046
	(0.0061)	(0.0056)	(0.0080)	(0.0050)	(0.0047)	(0.0120)	(0.0050)	(0.0064)
Good Review	0.0219***	-0.0191**	-0.0026	-0.0049	0.0038	0.0130	0.0009	0.0028
	(0.0083)	(0.0083)	(0.0084)	(0.0059)	(0.0065)	(0.0139)	(0.0057)	(0.0080)
Bad Review	-0.0064	-0.0062	0.0098	-0.0025	-0.0087	-0.0013	0.0028	0.0048
	(0.0087)	(0.0186)	(0.0105)	(0.0073)	(0.0082)	(0.0139)	(0.0094)	(0.0083)
Observations	64863	64863	64863	64863	64863	64863	64863	64863
# Wines	526	526	526	526	526	526	526	526
# Reviews	5093	5093	5093	5093	5093	5093	5093	5093
Adj. R-squared	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Note: Reported coefficients are interaction effects from estimating Equation (2), allowing for a differential effect for 10 weeks following the review. The interaction terms dummy variables take the value 1 as follows: *Medium & high price* are bottled wines priced above SEK 75 per bottle (approx USD 10.2); *Tabloid* refers to reviews that appear in tabloids; *New world* wines are from North America, South America, Africa and Oceania; *Wines with advertising* have advertising expenditures in at least one period; *Advertising legal* corresponds to reviews after May 15, 2003 when wine advertising become legal in Sweden; *New* are wines that were introduced at most two years before the review; *Vintage wines* have a labeled vintage; *High quality variation* indicates that the wine comes from a region (by year) with the 10 percent highest standard deviation in terms of price worthiness among the wines retailed on the Swedish market. The dependent variable is wine sales in log liters. All models estimate effects for all reviews in all wine segments, and include fixed effects for each wine×vintage×price combination and separate week×segment effects. They also include 25 week lags and 4 week leads of the effect of a review, a good review, a bad review, and of advertising expenditures. Robust standard errors clustered on brand are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
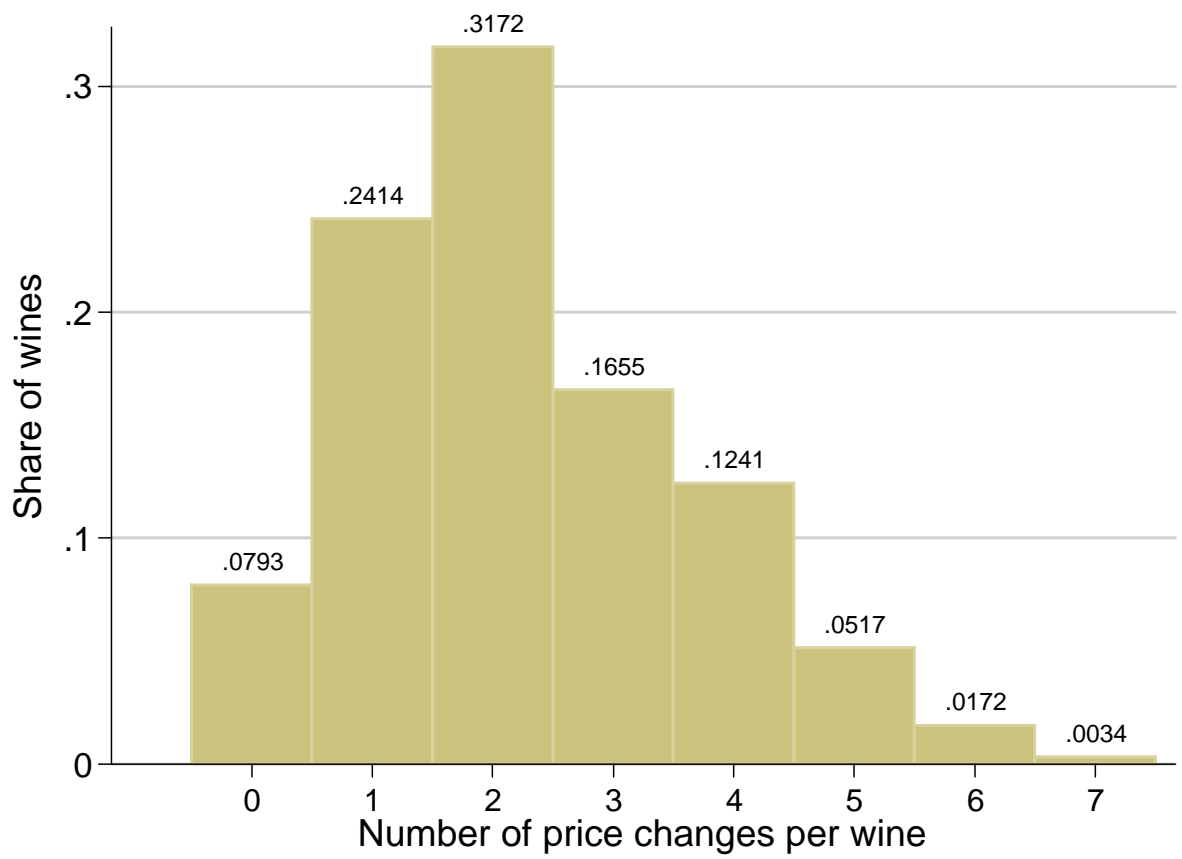
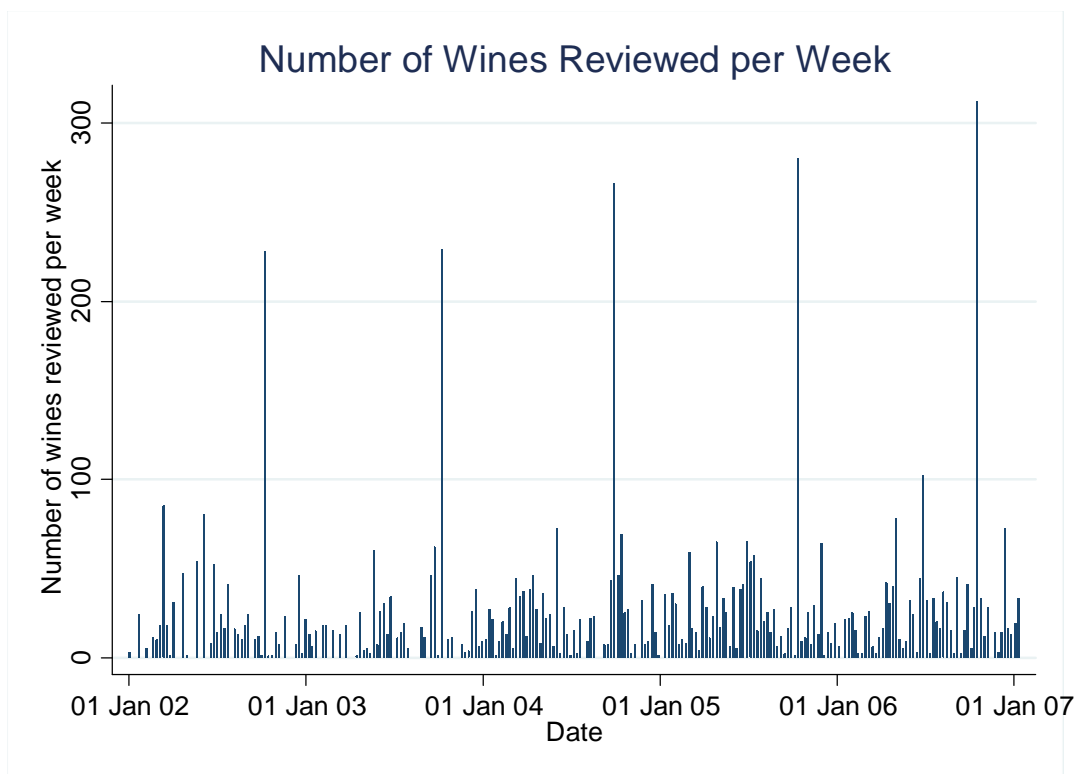Figure 1. Number of price changes per wine in the sample, Jan 2002 – Jan 2007.

Figure 2. The number of wines reviewed per week, Jan 2002 – Jan 2007.

Note: The figure shows the number of wine reviews (of the wines included in our sample) in six Swedish print media.
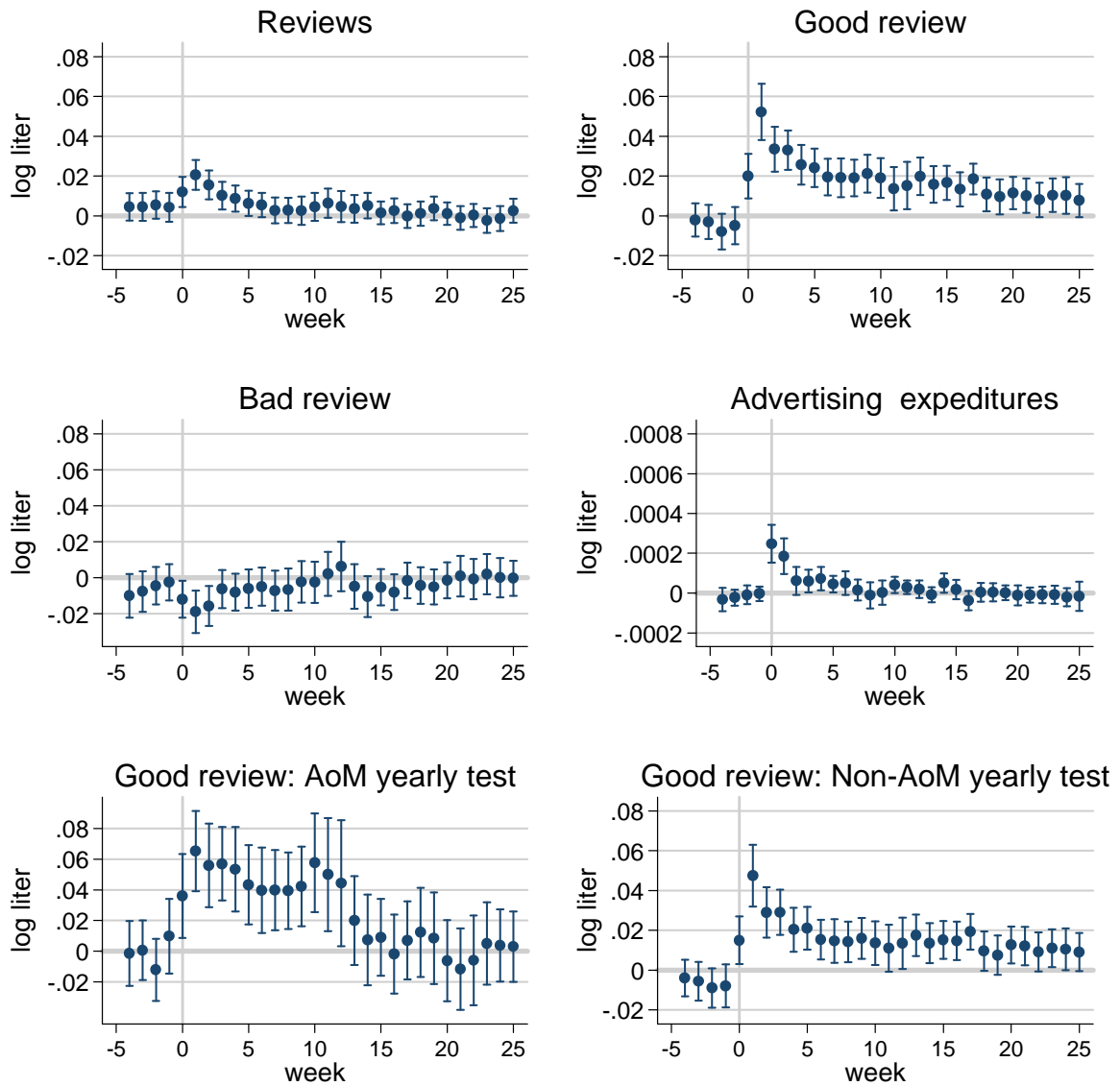
Figure 3. Effects of reviews and advertising on demand for wine, benchmark results.

Note: The figures display estimated coefficients (and 95 percent confidence intervals) from Equation 1, and include fixed effects for each wine×vintage×price and for each week×segment. Number of observations 64 683, number of wines 526 and adjusted R-square is 0.99 in all panels. The top four panels show coefficients of interest for the baseline specification using all reviews, in total 5 093. The lower left panel presents the effect of a good review using the 1 218 *AoM* yearly reviews only, number of observations, number of wines and adjusted R-squared as in the baseline. The lower right-hand panel uses the 3 869 reviews published in weeks when the *AoM* yearly reviews did not appear, number of observations, number of wines and adjusted R-squared as in the baseline. Standard errors are robust and clustered on brand.