



# The wine headache: Consumer perceptions of sulfites and willingness to pay for non-sulfited wines



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## ABSTRACT

A panel of 223 alcohol consumers recruited in a liquor store participated in a survey/best–worst experiment investigating perceptions on sulfites and willingness to pay for non-sulfited wines. We find that 34% of our sample experiences headaches after consuming moderate amounts of wine, and sulfites are the most frequently attributed cause. Based on a rank ordered logit estimation of best–worst choices, headache syndrome sufferers are willing to pay a *ceteris paribus* premium of \$1.23 per bottle to avoid added sulfites. However, results from a (logit) model of purchase intentions suggest that quality and price are most important, with differentiating labels (no sulfite added, organic) playing only a marginal role. Marketing implications for the wine industry are offered, and negative perceptions toward sulfites are contextualized within the hypothesis of a “lightning rod” effect induced by the “contains sulfites” warning label.

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## 1. Introduction

### 1.1. Motivation and objectives

Added as sulfur dioxide (SO<sub>2</sub>) or other forms, sulfites are commonly used as an antioxidant and antimicrobial agent and, since 1985, the U.S. Food and Drug Administration (FDA) imposes mandatory labeling of the use of sulfites as an additive for most foods and beverages.

Regulatory action in the Eighties was prompted by an FDA-commissioned study finding that “sulfites, while safe for most people, could pose a hazard of unpredictable severity to a small (about 1%) population of “sulfite sensitive” consumers (see Papazian, 1996, for a chronology of the events leading to mandatory labeling). Reported symptoms associated with sulfite sensitivity range widely in intensity and severity and include trouble breathing, skin rashes, and stomach pain (Grotheer, Marshall, & Simonne, 2005; Vally & Thompson, 2001). As a direct result of the FDA regulation, all wines sold in the United States via interstate commerce include a warning statement if they contain more than 10 ppm of sulfites (see also Alcohol & Trade Bureau., 2012).

Even though the population of sulfite-sensitive consumers is relatively small, the perception that sulfites may cause negative health effects appears to be more common. Anecdotal evidence

and articles in the popular press suggest that some consumers report experiencing headaches and migraines after consuming small amounts of certain wines, particularly the red varieties (Gaiter & Brecher, 2000; Robin, 2010). Even though the scientific debate regarding what exactly may cause these adverse effects is ongoing (several chemicals have been identified as plausible triggers, see Mauskop & Sun-Edelstein, 2009 and Millichap & Yee, 2003), consumers have been reported to associate migraines and headaches to the presence of sulfites (Gaiter, 2000). Despite the widespread use of sulfites in the food and beverage industry, we are not aware of any study formally investigating consumers’ beliefs and perceptions regarding sulfites, the central theme of this article.

Small amounts of sulfites may form naturally in wine during fermentation (Chengchu, Ruiying, & Yi-Cheng, 2006), but vintners commonly add around 30–90 ppm of additional sulfites throughout production (Burgstahler & Robinson, 1997) to prevent spoilage and enhance aging potential (Goode & Harrop, 2011). While historically uncommon, winemaking without added sulfites is becoming increasingly feasible due to better hygiene in the production process and technological improvements, such as refrigerated fermentation in climate-controlled facilities (Goode & Harrop, 2011) or pasteurization via ultraviolet irradiation (see Fredericks, Du Toit, & Krügel, 2011).

Low-sulfite winemaking in the United States has been so far predominantly synonymous with organic production, as sulfites are forbidden by the organic wine production protocol (Alcohol &

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Tobacco Tax & Trade Bureau, 2012). Unfortunately, the few studies examining consumers' attitudes toward organic wines (e.g. Olsen, Thach, & Hemphill, 2012) provide scarce information regarding perceptions of sulfites, mainly because consumers attribute to organic production several other important properties (e.g. better health, taste, nutritional, environmental and social outcomes, which may confound more specific considerations regarding sulfites; see Fotopoulos, Krystallis, & Ness, 2003 or Chryssohoidis & Krystallis, 2005).

If consumers do in fact worry about sulfites, a key aspect for entrepreneurs and winemakers is how much consumers value a minimized sulfite level (independently of the other standards imposed by organic production), and what share of consumers would consider such a trait important in their buying decisions. In this article we therefore use a survey and best–worst choice experiment to (1) formally assess consumers' perceptions and beliefs toward sulfites in wine; (2) quantify willingness to pay (WTP) for non-sulfited wines; and (3) identify consumer segments receptive to low-sulfite wine marketing.

### 1.2. Background on choice experiments

The basic idea underlying choice experiments is that the process of choosing between alternatives is an obvious and familiar way for consumers to manifest their preferences. When several possible product formulations exist, observing which product profiles are preferred implicitly reveals consumers' preferences for specific product attributes. Thus, a common approach in choice experiments requires participants to select the best option out of a small number of alternatives listed in several choice sets.

By including price as one of the varying product attributes, choice experiments allow estimating the rate at which participants are willing to trade money for the inclusion of one or more attributes (i.e. WTP). The hypothetical nature of discrete choice experiments has limitations (see Lusk & Schroeder, 2004 on hypothetical bias), but the major advantage is allowing the study of products or attributes not yet available in the market. The adoption of specific experimental designs can ensure that the effect of each attribute on preferences can be identified, while simultaneously minimizing the sample size needed to obtain acceptable (i.e., low variance) estimates. This experimental approach also allows researchers to control for exogenous factors that may otherwise invalidate or weaken results (Kroes & Sheldon, 1988), as is often the case for studies using real-world observational data.

Both discrete choice experiments and conjoint analyses have been used in studies evaluating the relative importance of product attributes (e.g. Gil & Sánchez, 1997; Hu, Batte, Woods, & Ernst, 2012; Mtimet & Albisu, 2006; Onozaka & Thilmany McFadden, 2011), but, as Louviere, Flynn, and Carson (2010) point out, choice experiments have their foundation within the economic random utility framework, while classical conjoint analysis lacks a behaviorally meaningful error term, and is generally inconsistent with economic demand theory.

Best–worst methods (Finn & Louviere, 1992), another class of choice experiments, request participants to indicate the most and least preferred items within each choice set, thereby providing a more efficient mean for recovering preferences than a traditional “pick one” choice experiment (Flynn, Louviere, Peters, & Coast, 2007). In best–worst experiments, researchers can either ask participants to rank products attributes (to study how attributes are ranked and which ones are most important, as in Flynn et al., 2007); or rank multi-attribute options/product profiles (to recover the contribution of each individual attribute to the overall utility and WTP for a multi-attribute profile, as in this article and Scarpa, Notaro, Louviere, & Raffaelli, 2011). The interested reader is referred to Marley, Flynn, and Louviere (2008) and Marley and

Pihlens (2012) for an exhaustive treatment of the theoretical and probabilistic properties of the two approaches.

### 1.3. Wine marketing studies

The United States is the largest wine market by sales revenue in the world, representing nearly \$32 billion in total retail value (Wine Institute., 2012). In the last 15 years, American wine production has increased 55%, and both total and per-capita wine consumption has expanded every year since 2001 (Wine Institute., 2011a; Wine Institute., 2011b). Though wine remains a highly diversified product, the growing domestic demand for U.S. wines has incentivized industry consolidation (Goodhue, Hein, Green, & Martin, 2008) and a greater degree of uniform production practices within well-known geographical areas (e.g. Napa Valley). Countering this trend, some producers have begun differentiating their products by focusing on more natural and sustainable production practices (see Goode & Harrop, 2011, on organic and biodynamic wines).

Consumer preferences for various intrinsic and extrinsic wine attributes have been investigated in several previous marketing studies, often using choice experiments. For example, Gil and Sánchez (1997) varied price, age, and origin and found that, in the absence of other quality cues, origin is the most important wine attribute. Lockshin, Jarvis, d'Hauteville, and Perrouy (2006) and Mtimet and Albisu (2006) examined how market involvement influences the valuation of wine attributes such as brand, region of production, quality medals, and aging. In addition to variety and region of production, Jarvis, Mueller, and Chiong (2010) studied the effect of label images and slogans.

Experiments considering health-related claims are particularly relevant to our research objectives. This literature generally supports the hypothesis that consumers will pay a premium for wines perceived as being healthier than others. For example, Barreiro-Hurlé, Colombo, and Cantos-Villar (2008) estimate a positive valuation for resveratrol-enriched wine, a health-promoting ingredient. Organic wines are also often perceived as being health-promoting (Barreiro-Hurlé et al., 2008; Fotopoulos et al., 2003), and health-conscious consumers are particularly receptive to marketing campaigns promoting natural (and organic) wines (Goode & Harrop, 2011). However, higher valuation for organic wines also comes from environmental concerns, and, as Olsen et al. (2012) argue, the premium for organic wine may be viewed as the financial “self-sacrifice” made in order to protect the environment. In summary, “organic” is a multifaceted attribute encompassing numerous consumer values, and consumers may even have difficulty explaining why they value organic wine over other varieties (e.g., Barreiro-Hurlé et al., 2008).

## 2. Methods and data

### 2.1. Sample characteristics

Subscribers (older than 21 years of age) to the email list of a large beer, wine and spirits retailer in northern Colorado were contacted via email and offered a \$20 wine voucher to be redeemed at the collaborating wine retail store in exchange for their participation in an online survey. The online, anonymous survey was conducted between March 8, 2012 and March 31, 2012, and a total of 223 participants completed the survey.

Demographic characteristics of the sample and participants' involvement in the wine market are reported in the first column of Table 1. While the sample may not be representative of the entire U.S. population (participants have higher incomes and education than the national average, which is typical of U.S. college towns), the recruiting strategy was highly successful in targeting

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