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# **Wine Economics**

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# 2

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## Consumption, Quality, and Prices

Life is too short to drink bad wine.

—A phrase attributed to Johann Wolfgang von Goethe (1749–1832)

This chapter will first discuss the variables affecting the consumption and abuse of alcohol and secondly those that affect the quality and price of wine. Before reviewing the literature, a premise is necessary. Most consumers drink alcohol moderately, and this produces positive effects on people's physical and mental health. Alcohol abuse, however, generates a series of negative consequences for the consumers themselves and for others (see chapter 7), but fortunately this involves only a minority of individuals. It is important, therefore, to understand what influences people's behavior by distinguishing between moderate consumption and abuse, the latter being further differentiated into consumption exceeding the World Health Organization's (WHO's) recommended number of alcohol units, binge drinking, and alcoholism.

### 2.1 The Consumption of Alcoholic Beverages

The variables that determine the consumption of alcohol have been classified in four groups (ICAP, 2009):

1. genetic predisposition;
2. individual characteristics;
3. social and economic factors; and
4. environmental factors.

The following discussion starts from the specific and moves to the general, instead of the other way around. Genetic predisposition is unique and subjective for every individual as are a good part of an individual's characteristics. On the other hand, social, economic, and environmental factors influence entire categories of people (if not peoples). The decision to proceed from the specific to the general is based on the consideration that the variables conditioning the consumption of an individual tend to be constant in time, whereas the general can change substantially.

### 2.1.1 Genetic Predisposition

Genetics influences the consumption and, above all, the abuse of alcohol and drugs. There is a strong element of hereditariness in alcohol dependence. A study conducted on a sample of people adopted at a young age showed that 18.2 percent of those with biological parents with alcohol problems developed forms of dependence, against 6 percent of those who had normal parents (Hawkins, Catalano, and Miller, 1992). As dopamine is the main neurotransmitter influencing the pleasure experienced during the consumption of alcohol, genetic differences that can affect the functioning of dopamine pathways are considered important determinants of alcoholism.

Gene polymorphism, in which genetic variations occur with an incidence of at least 1 percent in the population, is believed to influence the consumption of and dependence on alcohol. Choi et al. (2005) analyzed polymorphism in a sample of 352 individuals, 106 of them with alcohol dependence and 246 without. They found genetic abnormalities only among those who showed alcohol dependence, and when they analyzed subgroups, they identified a gene that would appear to be most responsible for this risk. Other genes have been identified by Edenberg and Foroud (2006) in a study of families with more than one member suffering from alcoholism. Although an increasing amount of medical research is being carried out on this subject, much remains to be discovered. However, 50–60 percent of the risk of developing life-threatening behaviors depends on the hereditary genetic predisposition and the remaining proportion on other environmental factors (Le Strat et al., 2008).

### 2.1.2 Individual Characteristics

#### *Gender*

The consumption of alcoholic beverages differs considerably between men and women. In a large-scale study done between 1997 and 2007, questionnaires were submitted to a sample of citizens in thirty-five countries. Wilsnack et al. (2009) found a prevalence of regular drinkers among men and teetotalers among women. The lower levels of consumption recorded for women are due to both social and physiological factors. In many cultures it is not socially acceptable for a woman to consume alcohol or, in any case, to drink heavily.<sup>1</sup> The task of child rearing is also predominantly or exclusively entrusted to women and requires clear-headedness and self-control, and so motherhood greatly reduces alcohol consumption (Little et al., 2009). Further, the female body is composed of a higher percentage of lipids and a lower quantity of water than the male body, so the same amount of alcohol per kilogram of weight produces a greater amount of alcohol per liter of blood (Ramchandani, Bosron, and Li, 2001).<sup>2</sup>

The harmful effects of alcohol on the body are also inversely proportional to an individual's weight. This has two important consequences (Ely et al., 1999). First, the negative consequences of alcohol on health and self-control are greater for women than for men, even with the same level of consumption, because women have a lower

body weight. Second, women tend to consume less alcohol since a smaller amount of alcohol has the same negative effect on their nervous system.

### *Age*

A vast amount of literature has shown that age influences both total consumption and patterns of consumption significantly. Consumption levels and the frequency of binge drinking are inversely correlated with age (Wilsnack et al., 2009), with notable differences between countries. After administering questionnaires to a sample of 13,553 people living in twenty urban areas in the United States, Johnson et al. (1998) found higher levels and frequency of consumption among men, young people, and whites. The peak is reached around the age of twenty-one for both men and women; after that age, total consumption tends to decline while the frequency tends to remain stable. When people enter adulthood, they must take on a range of responsibilities, both in the family (e.g., married life, relationships, care of children and elderly parents) and at work, and these responsibilities are often incompatible with irresponsible behavior (Little et al., 2009).

Aristei, Perali, and Pieroni (2008) studied expenditure on the purchase of alcoholic beverages in Italy using Italian National Institute of Statistics (ISTAT) data for the period 1997–2002. According to their purely descriptive analysis, total consumption reaches a peak between the ages of forty and fifty. The authors separated the effect of age at the time of the interview from that of the birth year (cohort) and the general trend in the country (time trend). In line with the literature, the study confirmed the negative correlation between the interviewee's age and the level of consumption. Moreover, net of other sociodemographic variables and the age of the respondent, the generations born around the mid-twentieth century present greater participation and consumption levels than the later ones. In recent decades, radical changes in lifestyles and the rhythms and types of work and greater awareness about the harm caused by bad habits have led to a sharp decrease in the purchase of alcoholic beverages.

For the elderly, the consumption of alcoholic beverages, especially in European Mediterranean countries, follows a traditional pattern as it takes place daily at meal-times and rarely with more than six glasses. Despite this, those most likely to have nonmoderate daily consumption levels are often the elderly, especially among males.<sup>3</sup> This is probably due to a lack of knowledge about the correct amount of alcohol that should be consumed. WHO, in fact, recommends that, during meal consumption, men should not exceed two to three alcohol units per day; women should not exceed one to two; and elderly people should not exceed one. It is most likely that the elderly will maintain the habits they have acquired during their lifetime, unaware of the increased health risks in advancing age (ISTAT, 2013, p. 9).

Age also strongly influences the frequency of episodes of alcohol *abuse* (ICAP, 2009), which is significantly higher in adolescents and twenty-year-olds. These excesses

are particularly dangerous for young people who are less able to metabolize alcohol properly and are inexperienced in managing states of drunkenness. Alcohol abuse is the cause of serious accidents in the home and on the roads and damages health in the long run. In adulthood, alcohol abuse decreases, consumption becomes more regular, and the reasons for consumption change. In the past, wine and beer were considered more than just a drink. They were part of the meal—rich in carbohydrates, sugars, vitamins, proteins, and minerals.<sup>4</sup> Today, however, the reasons for drinking alcoholic beverages have very little to do with enriching our diet; such reasons include the following items (Agrawal et al., 2008):<sup>5</sup>

1. To socialize: drinking to facilitate interaction with other people or to celebrate an event or a person
2. To feel good: people drink so that alcohol can act on their central nervous system and alter their state of mind and perception of reality
3. To console oneself and to reduce stress: some people “drink to forget” (e.g., to forget personal or economic problems)
4. To conform: people drink because others do

The reasons for drinking vary from one person to another, but what is of greater interest is that they tend to change with age (Peterson and Hektner, 2008). Adults usually drink in moderation and mainly to socialize, or when they are going through a difficult time, they may exceed consumption to combat stress (the first and third reasons). In contrast, consumption among adolescents is usually concentrated during the weekends, with frequent episodes of alcohol abuse for the deliberate intention of losing control and imitating peer behavior (the second and fourth reasons).

Contrary to what is often believed, the age at which a person begins to consume alcohol does not in itself affect the likelihood of having problems with alcoholism. It is the *abuse*, not the mere consumption, of alcoholic beverages at a young age that produces harmful effects (Bonomo et al., 2004). In any case, people who start drinking heavily at an early age often have a series of deviant behaviors that characterizes them as being more at risk (Clark and Bukstein, 1998). It is therefore very difficult to attribute any responsibility to the age at which alcohol is approached, especially as the risk of dependence decreases when it is the family that introduces children to the alcohol (Warner and White, 2003), as is the case for most people (Coleman and Cater, 2003).

### *Personality traits*

Consumption and alcohol abuse are also correlated with personality traits, such as risk aversion, impulsiveness and strong emotion seeking. Risk aversion has been widely studied by both psychologists and economists, but the definitions for classifying an individual as having a propensity or an aversion to risk differ in the two disciplines. Psychologist C.R. Cloninger (1987), for example, developed a tridimensional personality questionnaire to assess three elements—namely, harm avoidance, novelty

seeking, and reward dependence. These three features are considered by psychologists as the signs of a personality that loves, or at least does not fear, risk.

Economists, on the other hand, evaluate risk aversion based on preferences for risk-return combinations expected in a number of possible investments. Although they rest on different logical bases, the definitions provided by psychologists and economists lead to rather similar classifications of individuals. Moreover, various studies in both disciplines have found a strong negative correlation between risk aversion and alcohol consumption.<sup>6</sup> The negative correlation between risk aversion and the consumption of alcohol is generally accepted, although in Howard, Kivlahan, and Walker (1997), only the link between seeking new stimuli and alcohol consumption is positive while the other two components of the Cloninger test have only a marginal role. As for economists, Dave and Saffer (2008) included risk aversion in the demand function and, using two different American databases (Panel Study of Income Dynamics [PSID] and Health and Retirement Study [HRS], both from the University of Michigan), found a 6 to 8 percent prevalence of alcohol consumption in less cautious people.

Consumption and alcohol abuse levels are also 50 percent higher among people with mental health problems (Cleary et al., 2009), while the abuse of psychoactive substances among the very young affects individuals with psychological problems, such as anxiety, depression, and low self-esteem, in 60 percent of cases (ICAP, 2009).<sup>7</sup> Although it is sometimes difficult to clearly identify the direction of causality and isolate the effect of one variable net of other confounding elements from a methodological point of view, genetic variables and individual personality characteristics obviously play a key role in determining consumption habits of alcoholic beverages.

### 2.1.3 Social and Economic Factors

Levels and patterns of alcohol consumption are influenced by social environment, socioeconomic status, and the absolute and relative prices of beverages.

The social environment—formed by family, friends, and work contacts—affects the development of drinking patterns over time. The influence of the family will last into adulthood, but it is stronger in adolescence (Halebsky, 1987) and can be positive when parents' consumption is moderate or negative in the opposite case. People with strong ties to their family are less influenced by the behavior of their peers, which is a protective factor when parents consume alcohol moderately. Nash, McQueen, and Bray (2005) administered questionnaires to 2,573 American high school students and showed that disapproval of alcohol abuse by parents reduces the influence of friends and is a strong deterrent to excess. Conversely, individuals whose parents have alcohol problems tend to assimilate their behaviors and say that they feel unloved and socially excluded and are left to themselves (Burke, Schmied, and Montrose, 2006).

Older siblings (McGue, Sharma, and Benson, 1996) as well as friends (Valliant, 1995; Ali and Dwyer, 2010) are also very important in forming the consumption

habits of young people.<sup>8</sup> Wrong friendships can lead to increased alcohol consumption with a fall in school and university performance (Kremer and Levy, 2008). Personal relationships are another important determinant; alcohol consumption is, in fact, more moderate among people in a stable relationship (Prescott and Kendler, 2001) but tends to grow when a relationship breaks down.

Socioeconomic status indicators generally focus on (1) education, (2) income, and (3) unemployment. These variables are correlated with each other, though each one centers on different aspects. Education and income, in fact, influence access to intangible and material assets respectively while employment reflects prestige and the power associated with a certain type of job (Van Oers et al., 1999).

From a theoretical point of view there are valid reasons to believe that these three variables can be correlated both positively and negatively with consumption and alcohol abuse. Education can be negatively correlated with consumption and, above all, with the abuse of alcoholic beverages because it improves risk perception and awareness of its negative effects on health.<sup>9</sup> However, most educated people have a greater sense of self-control and often work in environments where the consumption of alcohol is not only tolerated but also expected (Huerta and Borgonovi, 2010).<sup>10</sup>

As for the question of income, the economic models based on the maximization of consumer welfare include a budget constraint so that an increase in spending capacity should also increase, *inter alia*, the consumption of alcoholic beverages. This point becomes even more relevant if greater economic means correspond to a more intense social life. However, the opportunity cost of reducing time spent at work to consume alcohol (the cost of leisure time) and the potential damage to one's reputation as a result of a state of intoxication are greater for people with a high income. For obvious reasons this problem is felt more by those who have a job as alcohol consumption decreases job performance, thus increasing the risk of dismissal, and during an economic crisis when the probability of finding a new job decreases. Yet people on a low-income and the unemployed "have little to lose" when they drink heavily for consolation and for the release of tension, using alcohol as "self-medication" (see Hill and Angel, 2005). The effect of income on alcohol consumption is, therefore, uncertain.

Similarly, the economic and psychological costs of unemployment affect both the unemployed and the employed.<sup>11</sup> Those who have lost their job suffer a drastic drop in income while the community as a whole has to bear an increase in tax burden to cope with increased social spending (e.g., unemployment benefits). Adverse economic conditions should encourage the purchase of necessary goods rather than alcoholic beverages (Ruhm, 1995), especially in those countries where health care is largely private and health insurance is suspended in the event of dismissal.

However, psychological costs connected to the state of anguish for current and future economic situations concern, to a greater extent but not exclusively, those who have lost their job and are responsible for the upkeep of a family. As alcohol can be

consumed to alleviate stress and for comfort, it is reasonable to expect an increase in consumption among the unemployed. This may also be true, though to a lesser extent, for those in employment, especially in times of economic crisis. We can, therefore, find the opposite effect of a fall in income. Further, unemployment is like a virus; those who suffer most are the direct victims, but as the disease spreads, there is a greater risk of contagion. Individuals whose jobs are in jeopardy may be encouraged to increase consumption because of stress or conversely, given the increasing difficulties in finding a new job, reduce consumption and increase effort at work (Catalano et al., 1993). Lastly, unemployment increases the free time that can be dedicated to enjoyable pastimes during which alcohol is usually consumed (television, parties with friends, etc.), even though there are fewer economic resources and opportunities to meet people (Devalos, Fang, and French, 2012), so the net effect is ambiguous.

Economic theory, therefore, has worked out valid arguments for both a positive and a negative effect of socioeconomic status on the consumption and abuse of alcohol. The question at this point becomes merely empirical. From an econometric point of view, however, it is very difficult to measure the contribution of socioeconomic status to consumption and alcohol abuse since the variables considered—income, education, and employment—are strongly correlated with each other, generating collinearity that may affect the results.<sup>12</sup> Another problem, which is always present in econometric analyses, is the risk of omitting some important regressors (omitted variable bias). This is not a minor point in models of alcohol consumption that are applied to existing databases as it can lead to a distorted estimate of the parameters.<sup>13</sup> A third issue is reverse causality; for example, if we agree that there is a link between unemployment and alcohol consumption, which one influences which? The loss of a job could induce an individual to seek consolation in alcohol, but it is also true that alcohol abuse negatively affects productivity and increases the risk of dismissal. Hence, it is often rather difficult to identify and measure the direction of causality that can be two-way. The differences that have emerged in various studies may, therefore, depend on the quality of the databases and the econometric techniques and instrumental variables used as well as the peculiarities of some countries or historical periods.

### *Empirical studies on the effect of education*

In some studies the level of education increases alcohol consumption and the frequency of abuse, while in others it reduces them. Examples of the first kind are the Los Angeles County Department of Public Health (2001) that interviewed a sample of 8,354 adults in the county in 1999 and Schoenborn and Adams (2010) using National Health Interview Survey (NHIS) data on a sample of American families in the period 2005–2007. They both recorded with purely descriptive evidence greater consumption by people with higher educational qualifications. Similarly, the ISTAT (2013) annual survey showed that in Italy graduates presented higher levels of alcohol consumption

and drank less on a daily basis but more frequently outside of meals, which is dangerous for health. Comparable results can also be found in econometric studies: Dawson et al. (1995), Moore et al. (2005), and Dave and Saffer (2008) (all using American data) and Strand and Steiro (2003) (using Norwegian data) found a greater percentage of drinkers among highly educated people. Huerta and Borgonovi (2010) applied a two-stage model to longitudinal British data for a sample of people born in 1970 (in the British Cohort Study) and found a positive relationship between school results on the one hand and consumption and alcohol problems on the other.

The list of studies that have shown the negative relationship between education and alcohol consumption is, however, equally long. Crum, Helzer, and Anthony (1993) used data on a sample of households between 1980 and 1984 and found a higher risk of developing disorders related to alcohol abuse in individuals who had dropped out of school or university compared with those who had a degree. Droomers et al. (1999) (using Dutch data for 1991) and Casswell, Pledger, and Hooper (2003) (using longitudinal data on American individuals aged eighteen, twenty-one, and twenty-six) found higher levels of consumption among people with lower education. Parry et al. (2005) using 1998 South African data detected a strong association between symptoms of alcohol problems and lack of schooling. Karlamangla et al. (2006); Aristei, Perali, and Pieroni (2008); Kestilä et al. (2008); Lee et al. (2009); and Schnohr et al. (2009) came to the same conclusions using American and European databases. The effect of education on consumption and alcohol abuse is not, therefore, unequivocal.

### *Empirical studies on the effect of income*

The elasticity of alcohol consumption to income is important for both firms (in a monopolistic or competitive market) and legislators. In fact, demand which is inelastic to changes in income reacts weakly to economic cycles. This is good during economic downturns. However, in the long term consumption patterns are going to be flatter because demand is not very responsive to an increase in gross domestic product (GDP) and buyers' purchasing power.

The study of the effects of income on consumption and alcohol abuse has also produced conflicting results. When the consumption of alcohol was considered without distinguishing the types of drinks, positive correlations were reported by Gottlieb and Baker (1986), Dawson et al. (1995), Moore et al. (2005), and Kerr et al. (2009) (using American data); Pietilä, Rantakallio, and Läärä (1995) (using Finnish data); Strand and Steiro (2003) (using Norwegian data); and Aristei, Perali, and Pieroni (2008) (using Italian data). Opposite results were obtained by Karlamangla et al. (2006) (using American data), Batty et al. (2008) (using Scottish data), Caldwell et al. (2008) (using British data), and Kestilä et al. (2008) (using Finnish data).

However, there is a much larger number of analyses examining the three main types of alcoholic beverages—beer, wine, and spirits—separately. These results are less

controversial and the effect of income almost always appears to be positive. Fogarty (2010a) reviewed 141 studies that analyzed the elasticity of consumption with respect to income and to price. Elasticity is defined as the ratio between percentage variations of two variables—in our case the percentage variation in consumption divided by the percentage variation in income or the price of the drink. If elasticity to income is positive, the good is considered normal as the increase in economic means corresponds to an increase in the demand for the good; whereas if it is negative, it is called an inferior good because cheaper, low-quality goods can be replaced with other more expensive ones.<sup>14</sup> When elasticity is positive and between zero and one, the good is considered necessary since the reduction in consumption is less than proportional to the reduction in income (“inelastic” demand), whereas if it is higher than one it is considered a luxury good (demand adapts more easily to economic circumstances).

Fogarty (2010a) reported summary statistics and distributions of the elasticity of demand with respect to income and the price of the three alcoholic beverages—beer, wine, and spirits—found in the 141 studies reviewed. A series of interesting points emerged from this analysis. First, the distribution of the elasticities in the six histograms shows a certain dispersion; if the data, countries, years, and econometric methodologies change, different results are obtained.<sup>15</sup> Second, despite this variability in the estimates, very few studies (less than 8 percent for wine, beer, and spirits) showed income elasticity to be negative (or an inferior good), in line with what economic theory and common sense says. Third, income elasticity is on average higher for spirits (1.15) and lower for beer (0.64), with wine in an intermediate position (1.10). The demand for beer is more rigid than wine, and the demand for wine is in turn more rigid than for spirits. Beer is a necessary good while wine and spirits are luxury commodities. The reason for this is probably the average price, which is lower for beer than wine, whereas spirits are the most expensive.

### *Empirical studies on the effect of unemployment and economic cycles*

The effect of unemployment on consumption and alcohol abuse is uncertain. Ruhm (1995) used data on American states and found that alcohol consumption is procyclical; when unemployment falls, liquor consumption increases, together with road accidents. Similar results were obtained by Freeman (1999) with an analysis of logarithmic differences. The problem of these two databases is that they did not include individual characteristics that may have important implications for the study in question, which is why Ettner (1997) used longitudinal NHIS data from 1988. With the use of instrumental variables, he showed that unemployment increases alcohol consumption but reduces the symptoms of addiction. Dee (2001), using longitudinal BRFSS data for the period 1984–1995, found the opposite. In periods of economic crisis alcohol consumption decreases, but the cases of binge drinking increase by 1.5 percent in the presence of a 1 percent increase in unemployment.

Ruhm and Black (2002) extended Dee's (2001) study using very similar data (the US Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System surveys [BRFSS], 1987–1999). The authors confirmed the pro-cyclical relationship of alcohol consumption and showed that changes are driven by the behavior of heavy drinkers (those who drink more than one hundred alcohol units a month). However, two other studies found a countercyclical relationship. Devalos, Fang, and French (2012), with the US National Epidemiologic Survey on Alcohol and Related Conditions data for the period 2001–2005 and fixed effects panel models, found a positive relationship between the unemployment rate on the one hand and abuse, drunk driving, and alcohol dependence on the other. Mossakowski (2008), with data from the US National Longitudinal Survey of Youth from 1979 to 1992, showed that the duration of poverty and involuntary unemployment affect alcohol abuse in people between the ages of twenty-seven and thirty-five years. Lastly, Charles and DeCicca (2008), with NHIS data for the period 1997–2001, found the effects of unemployment on consumption and heavy drinking are not statistically significant. Similar conclusions were also reached by Jiménez-Martín, Labeaga, and Vilaplana Prieto (2006) who used BRFSS data for the period 1987–2003 and a similar methodology to Dee (2001). The problem of reverse causality was addressed by Mullahy and Sindelar (1996) who applied instrumental variables to US data from the 1988 NHIS Alcohol Supplement and showed how alcohol abuse has a negative impact on employment.

In summary, most of these studies found a pro-cyclical effect of income on alcohol consumption, while the effects of unemployment are more controversial. At the aggregate level Helble and Sato (2011), using data on fifty-nine countries in the period between 1961 and 2004, analyzed the relationship between per capita change in GDP and per capita variation in alcohol consumption. Overall, the authors found a robust pro-cyclical relationship; taking into consideration income effect, unemployment, and all the other mechanisms illustrated above, the positive effects prevail over the negative when the economy grows, and vice versa.

There is, however, a general consensus on the deleterious effect of economic and social marginalization on consumption habits. Numerous studies in Europe and in the United States have shown how the rates of alcohol dependence are much higher among the homeless and the destitute than in the rest of the population (FEANTSA, 2009; Fazel et al., 2008), although there is some variation between countries due to demographic differences, unequal access to health systems, and sampling quality. Alcoholism rates among the homeless in urban areas stand at 72.7 percent in Munich, 62.9 percent in Los Angeles, 46 percent in Melbourne, and 24.9 percent in Paris while in Brazil over 70 percent of street children consume large quantities of alcohol (ICAP, 2009). In the study of a random sample of 621 Swedish citizens born in 1914 in Malmö, Hanson (1994) found a strong correlation between various indices of social isolation and alcohol consumption/abuse. Although the study failed

to identify the causal direction, the author supported the need to promote policies that encourage social inclusion in order to reduce alcohol consumption and protect public health.

### *Empirical studies on the effect of price*

After this review of the socioeconomic variables, the discussion now moves on to deal briefly with the relationship between prices and consumption. Unlike income, it is normal to expect an inverse relationship between the two variables (negative elasticity). Price elasticity may be lower, higher, or equal to  $-1$ . In the first case, the variation in demand is more than proportionate to that in price (of the opposite sign) and demand is said to be elastic, whereas it is inelastic or rigid in the second case and unitary in the third.

The elasticity of demand is important for both a monopolist entrepreneur and the government (see Thornton, 2013, pp. 225–235; Marks, 2015, pp. 143–144; Towse, 2010, pp. 146–147). In fact, with monopoly the demand curve of the firm and that of the market coincide. Therefore, it is essential to know how consumers will react to a price increase to maximize profits. If the demand is inelastic, the firm can increase the price without losing many customers, and the overall impact on revenues will be positive. If the marginal revenue is greater than the marginal cost, the best strategy is to raise the price.

The wine market is, however, very competitive. Consumers can easily find valid alternatives; therefore, wineries are not free to raise their prices whenever they want. The elasticity of demand is, instead, much more relevant for legislators. To implement effective public policies to discourage alcohol abuse and its negative consequences on risky and criminal behaviors, they have to know to what extent consumers will react to tax and price increases. If the demand is inelastic, a larger tax increase is necessary to produce significant results.

The three main factors that affect the price elasticity of demand are

1. the degree of substitutability with other goods (the greater the substitutability, the greater the elasticity);
2. the time horizon considered (demand is generally more inelastic in the short than in the long run since it is more difficult to change and adapt habits to new prices); and
3. the type of product, given that necessity goods have more inelastic demand and luxury goods more elastic.

Fogarty (2010a) shows that only a few studies (far less than 5 percent and close to zero) report positive price elasticity of a good. As in the case of income elasticity, price elasticity is on average higher for spirits ( $-0.73$ ) and lower for beer ( $-0.45$ ), with wine in an intermediate position ( $-0.65$ ). The consumption of beer is less elastic than wine, which in turn is less elastic than spirits.<sup>16</sup> The lower income and price

elasticity of beer is attributable to price and is much lower than that of other alcoholic drinks. In other words, faced with a fall in income or an increase in price, it is much more likely that the consumption of the cheaper drinks will remain unchanged (Helble and Sato, 2011). Another possible explanation is that, as a consequence of a decrease in income, part of the consumption of alcoholic beverages (mostly spirits) in bars and restaurants is replaced by wine and beer at home (Ruhm, 1995).

Most scientific studies have focused on estimating the price elasticity of alcoholic beverages at an aggregate level without making a distinction among low, medium, or high levels of consumption. Manning, Blumberg, and Moulton (1995) used 1983 data from the NHIS to check whether a price increase has the same impact on alcohol consumption in all three categories. The results demonstrated that price elasticity is much lower among people with low and high levels of consumption, probably for very opposite reasons. For light drinkers the impact of a price increase is irrelevant in absolute terms, whereas heavy drinkers often develop forms of addiction that make it difficult to reduce consumption. This has important implications since price elasticity can seriously undermine the effectiveness of a policy aimed at reducing alcohol abuse based on an increase in taxation and, consequently, prices.

The consumption of a specific alcoholic beverage, however, is also affected by changes in the prices of other drinks since they can represent valid alternatives to the preferred drink if it becomes too expensive (for a simple constrained maximum utility model with a Cobb-Douglas function and two goods—wine and beer—see box 2.1). If the cross elasticity of a good is positive at a certain price of another good, then the two products are called “substitutes” (when the price of good X increases, the consumption of good Y increases). If, instead, it is negative, they are said to be “complements.”

Empirical studies have shown limited substitutability for alcoholic beverages. Clements and Johnson (1983) (using Australian data for the period 1955–1956 to 1976–1977); Nelson (1997) (using quarterly US data from 1974 to 1990); and Angulo, Gil, and Gracia (2001) (using Spanish data on domestic consumption) found positive cross elasticity for wine, beer, and spirits, even if the results of the first study were not always statistically significant. In contrast, Australian data for the period from 1975–1979 to 1988–1989 in Chang and Bettington (2001) indicated that wine and beer are complements while in Ornstein and Levy (1983) and Wohlgenant (2009) the cross elasticities were not statistically different from zero. The evidence, therefore, seems to point toward a rather limited substitutability of alcoholic beverages while price elasticity, as shown above, is generally significant and inverse to the starting price.<sup>17</sup>

#### 2.1.4 Environmental Factors

Alcohol consumption is significantly influenced by the environment in which a person grows up and lives. The dominant culture, understood as the social acceptance of consumption and tolerance toward alcohol abuse, influences people’s behavior and reflects on the regulations that govern the marketing and supply of alcoholic

**Box 2.1**

A simple model of constrained utility maximization applied to the consumption of alcoholic beverages.

To show the typically expected relationship between the price of alcoholic beverages and consumption, let us imagine that we want to maximize a Cobb-Douglas utility function  $U(w, b) = w^\alpha \cdot b^\beta$  in which  $\alpha + \beta = 1$  (i.e.,  $\beta = 1 - \alpha$ ) and that consumer satisfaction depends on the quantity of wine  $w$  and beer  $b$  consumed (one could, alternatively, consider the categories of wine and other alcoholic beverages) and on preferences for the first ( $\alpha$ ) and second ( $1 - \alpha$ ) drink. This must be done within a budget  $y$  so that the value of the wine and beer purchased ( $p_w \cdot w + p_b \cdot b$ ), in which  $p_w$  and  $p_b$  are the prices of the two goods, must not exceed a preestablished amount of money. If it is assumed that this sum is a constant share of income, it would follow that as income increases, the consumption of both drinks will increase according to the preferences expressed for each of them.

In formal terms the problem of maximization looks like this:

$$\text{Max}_{w,b} U(w, b),$$

so that:

$$p_w w + p_b b = y,$$

with  $w$  and  $b \geq 0$ ,  $p_w$  and  $p_b > 0$  and  $0 < \alpha < 1$ . The Lagrangian is given by:

$$L = w^\alpha b^{1-\alpha} - \lambda(p_w w + p_b b - y),$$

with  $\lambda$ , which is the Lagrange multiplier. First-order conditions are obtained deriving the Lagrangian with respect to the two goods  $w$  and  $b$ :

$$\frac{\partial L}{\partial w} = 0 \Rightarrow \alpha w^{\alpha-1} b^{1-\alpha} = \lambda p_w \Rightarrow \lambda = \frac{\alpha \left(\frac{b}{w}\right)^{1-\alpha}}{p_w} \quad (1)$$

$$\frac{\partial L}{\partial b} = 0 \Rightarrow w^\alpha (1 - \alpha) b^{-\alpha} = \lambda p_b \Rightarrow \lambda = \frac{(1 - \alpha) \left(\frac{w}{b}\right)^\alpha}{p_b} \quad (2)$$

Then putting the two equations in the system we obtain

$$\frac{\alpha \left(\frac{b}{w}\right)^{1-\alpha}}{p_w} = \frac{(1 - \alpha) \left(\frac{w}{b}\right)^\alpha}{p_b}.$$

The equation indicates that equilibrium occurs when the relationship between marginal utility and price is the same for wine and beer. If these two relationships were different, the consumer could increment his utility by increasing the consumption of one good

(continued)

## Box 2.1 (continued)

and reducing that of the other, thus achieving the optimum. With some adjustments the following relationship between beer and wine consumption is reached:

$$\frac{b}{w} = \frac{1 - \alpha}{\alpha} \frac{p_w}{p_b}.$$

The relationship between beer and wine consumption depends on the preferences of each consumer toward the first ( $1 - \alpha$ ) or the second ( $\alpha$ ) beverage and their relative prices. If the preference for one or the other product changes in the course of their life, the consumer will modify the share of the consumption of the two goods to maximize their utility. Similarly, the relationship between the consumption of beer and wine is a direct function of the price of wine and an inverse function of the price of beer: if the price of beer increases, more wine and less beer will be consumed, and if the price of wine increases, the opposite will happen. This is valid, however, only under the conditions imposed in the model, such as the utility function of the Cobb-Douglas type; while it does not apply to perfect substitutes and perfect complements, if income were to increase, the consumption of both drinks would increase.

beverages. There are, however, marked differences between countries in this respect. European Mediterranean countries are characterized by high alcohol consumption generally distributed throughout the week and at mealtimes and by a firm condemnation of abuse (Naboum-Grappe, 1995). Nordic countries, on the contrary, are less permissive toward the levels of total consumption, which is discouraged with high taxes and restrictive regulations, while the intake of alcohol takes place mostly at the weekend and outside of mealtimes. This leads to frequent cases of loss of control and excesses which are, nevertheless, socially tolerated (Heath, 1995).

The culture of a country is formed in the course of centuries and is the result of a series of elements such as climate, foreign domination and religion. In most countries, however, women drink less than men even before motherhood, since consumption and above all alcohol abuse are socially less acceptable for women than men (Cottino, 1995).

Finally, alcohol consumption is also influenced by catastrophic events and wars that cause serious psychological damage to the populations involved. About 4–5 percent of survivors of natural disasters tend to develop post-traumatic stress disorder (PTSD), as for example in the case of Hurricane Katrina in New Orleans where there was a very high incidence of PTSD among survivors (Coker et al., 2006). Vetter et al. (2008) studied the impact of the 2004 tsunami in Asia on Swiss tourists who survived the disaster and found an increase in symptoms of depression and the use of drugs, cannabis, and alcohol.

Vlahov et al. (2002), Stein et al. (2004), and Schiff (2006) all focused on terrorist attacks. Vlahov et al. (2002) analyzed data on telephone interviews made with New Yorkers five to eight weeks after the attack on the World Trade Center. Of the 988 people considered, 9.7 percent reported an increase in cigarette consumption, 24.6 percent reported an increase in alcohol consumption, and 3.2 percent in marijuana. Similar results were found by Stein et al. (2004) in a sample of Americans residing outside the city of New York and showed how anxiety spread simply through a passive involvement with the media during the dramatic events. Schiff (2006) examined the effect of prolonged exposure to terrorism in six hundred adolescent Jews, religious or otherwise, living in Jerusalem. Exposure to the risk of attack—particularly intense between September 2000 and August 2005 with 889 episodes, 1,064 Israeli victims, and 7,441 wounded—caused an increase in post-traumatic stress symptoms, depression, and alcohol consumption, though they were restrained by their religious faith.

## 2.2 The Quality of Wine

The previous section discussed the main micro- and macroeconomic variables that influence the choice and level of alcohol consumption. When a decision has been made, the individual generally sets an amount to spend and looks for the best quality based on the information in their possession. Therefore, consumers position themselves in a certain segment of the market at the time of purchase depending on how much they want to spend. Product differentiation can be horizontal or vertical. In the first case we refer to the type (white, red, rosé, sparkling wine, liqueur, etc.) while in the second case we refer to the quality of the drink. Two types of viticulture and enology have always coexisted: an ordinary level with wines for the masses (“jug” or “basic wine”) and a top-quality level with fine wines (“premium wine”), historically intended for nobles and clergymen and then later intended for the upper middle class (Mariani, Boccia, and Napolitano, 2006).

In the past, the production of top-quality wines was very limited, but now it has grown together with purchasing power so that a classification based on a mere dichotomous distinction of basic premium wines is no longer sufficient. Over the years various classifications based on the price have been made that implicitly assumes a strong positive correlation between the price and quality of the product. Rabobank, for example, considers “basic” wines to be priced at \$5; “premium” wines range from \$5 to \$7.99; “super premium” wines range from \$8 to \$13.99; “ultra-premium” wines from \$14 to \$49.99; and “icon” wines are over \$50 (see Schirmer, 2012).<sup>18</sup>

Some wineries specialize in just one segment—for example, mass wines or those of the highest level—but more and more companies differentiate production both horizontally and vertically to attract new buyers, to diversify risk, and (partially) to help

guard against the consequences of changes in tastes and consumption. Although the current exploitation of vineyards has shortened their duration (AIS, 2005a, p. 12), the life cycle of a vine can last seventy years. Given the amount of investment needed to plant a vineyard, having to reconvert the entire production halfway or one-third of the way through its life cycle can jeopardize the financial stability of a company.

Although quality and price are positively correlated, investing in quality is not necessarily profitable. As reported by Rust, Zahorik, and Keiningham (1995),

1. quality is an investment;
2. economic efforts to pursue quality need to be calculated;
3. there is a risk of making too many investments in quality; and
4. not all investments in quality are the same.

Before deciding whether to aim for excellence, a company should evaluate carefully the costs and benefits of this type of investment and calculate the net present value. Unfortunately, apart from Castriota (2018), there is little or no scientific literature on the profitability of quality investments in the wine sector (see chapter 3). In any case, since quality is one of the key elements in the selection of wines, it is important to understand the variables that influence it. Studies on the subject mainly rely on the opinions of experts in the wine guides of famous tasters such as Robert Parker, Hugh Johnson, and Luigi Veronelli. Further, studies on the determinants of wine quality have to solve a number of methodological issues that are discussed in box 2.2.

The variables affecting wine quality can be grouped into three main categories: (1) the terroir, (2) agronomic and wine-making techniques, and (3) company characteristics.

### 2.2.1 Terroir

In the Old World the deep-rooted conviction that “quality was linked to *terroir*, the almost mystical combination of soil, aspect, microclimate, rainfall and cultivation that the French passionately believed gave the wine from each region—and indeed, each vineyard—its unique character” (Bartlett, 2009) still holds true.<sup>19</sup>

As any wine maker knows, soil plays a fundamental role because its chemical composition influences the sensorial characteristics of wine. The same vine planted in two different parts of the world can, in fact, give completely different results even with the same climate and production techniques. The influence of the composition and chemical-physical-microbiological structure of the soil as well as the genetics of the rootstock have been widely studied by agronomists and wine makers.<sup>20</sup>

Another fundamental element of the terroir is the climate, which can influence the quality of wine temporarily or structurally. In fact, some areas have a very stable climate while others generally guarantee the production of quality wines even though uncertain atmospheric conditions, especially during the harvest period, mean the

**Box 2.2**

Methodological issues in empirical studies on wine quality.

When reviewing the literature on the determinants of wine quality six points need to be clarified. First of all, the samples that are analyzed in the wine guides are not representative of the real world of wine: the ordinary wines sold in supermarkets and bulk wines tend to be excluded. There is, therefore, a strong imbalance in favor of medium-high range products purchased mainly in the Horeca. However, there is no reason, except for a few exceptions, why the variables influencing the superior quality wines should not influence also those in the lower ranges in a similar way.

A second point concerns the reliability of the ratings given in guides whose aim is to reduce information asymmetries (Cardebat, 2017, pp. 53–55). Hodgson (2009) analyzed over four thousand wines entered in thirteen US wine competitions and showed that 84 percent of wines that received an award in one competition were not awarded in another. Morrot, Brochet, and Dubordieu (2001) made an experiment with fifty-four experts; they tasted a real red and a real white wine. A few days later they tasted the same wines again, but some of the white wines were colored red with a neutral-tasting food colorant. Results show that the experts described the red wines in a similar way even though some red wines were actually white. Opinions can also be influenced by personal tastes and preferences. Using data from the Guida dei Vini di Veronelli from 2004 to 2009, Castriota, Delmastro, and Curzi (2013) showed that the evaluators' opinions are conditioned by two types of subjective distortions—namely, generosity and preferences for some characteristics of the product.<sup>a</sup> Nevertheless, sommeliers' evaluations follow the rules that are well established at an international level and in time have proven their validity. Castriota and Delmastro (2012), for example, studied what determines the reputation of Italian wineries by using the ratings awarded by Hugh Johnson's international guide and L'Espresso's national guide and found the results were extremely similar since there was a very strong correlation (0.62) between the two values.

Third, as written in bold by Robert Parker in his website when explaining his rating system: “Scores, however, do not reveal the important facts about a wine. The written commentary that accompanies the ratings is a better source of information regarding the wine's style and personality, its relative quality vis-à-vis its peers, and its value and aging potential than any score could ever indicate” (Parker, n.d.). The scientific literature on the usefulness of tasting notes is reviewed by Storchmann (2012, p. 25) who showed that the ability among nonexperts to identify wines after reading the notes is random.

Fourth, the methodology of tastings can affect the results. As pointed out by Colman (2008, pp. 120–121) with respect to Parker's ratings, tasting tens or even hundreds of wines within a few hours favors big, concentrated wines which can “shout louder” than their rivals. These types of wine—sometimes named “fruit bombs”—perform well when tasted in isolation but are not necessarily the best choice for a dinner. Further, some observers are skeptic about Robert Parker's ability to evaluate thousands of wines each year and wonder whether the 0–100 scores he assigns are expressed in relative (within vintage and region) or absolute terms. Next, experiments have shown that the sound and lighting conditions during wine tastings can strongly influence the description and the scores awarded (Goode, 2016, p. 66).

*(continued)*

## Box 2.2 (continued)

Fifth, experts do not necessarily experience wine like untrained drinkers. Castriota-Scanderbeg et al. (2005) made an experiment with seven professional sommeliers and seven untrained people matched by gender and age. They made them taste three wines and a glucose solution as a control while having their brain scanned with neuroimaging technologies. Results show that during the tasting different areas of the brain of sommeliers and of nonexperts are activated. This study suggests that learning changes the way of thinking and of tasting wine.

A last point concerns the use of sensory evaluations (e.g., persistence of taste or level of acidity) as determinants of quality ratings in econometric regressions: the relationship between the tasters' ratings and sensory variables is tautological (Delmastro, 2007) and of no interest from an economic point of view. For this reason, the discussion in section 2.2 focuses mainly on inherent variables such as (1) the terroir, (2) agronomic and wine-making techniques, and (3) company characteristics.<sup>b</sup>

*Notes:* <sup>a</sup>The wines were reviewed by two tasters, the first of whom systematically awarded—all other things being equal—more generous votes than the second taster, showing a preference for red wines, sweet wines, and those from the northeast of Italy. This is particularly important because the random assignment to one or another taster can influence the rating given to the wine in a statistically significant way, with consequences for sales and the price that can be applied.

<sup>b</sup>For an econometric analysis of the ratings on the quality of wine that includes sensory variables, see Combris, Lecocq, and Visser (1997).

results can vary from one year to the next. Yet other areas are not very suitable and have no hope of excelling. Corsi and Ashenfelter (2000) used data on a sample of Barolo and Barbaresco wines and concluded that only rainfall in the months of August and September exerts a significant (and negative) influence on the quality while other variables are irrelevant. Grifoni et al. (2006), using data on six prestigious appellations of central and northern Italy, showed that the best wines are obtained in the years with scarce rainfall and high temperatures. Jones and Storchmann (2001) reached the same results with data on twenty-one French Crus Classés châteaux. Even within the same area, there are plots of land with exposures and altitudes that guarantee optimal sun, temperature, humidity, and ventilation.

Gergaud and Ginsburgh (2008) showed the role played by exposure with French data: land facing the south and east is protected from winds that come from the west and is more exposed to the sun that dries the grapes, reducing the risk of mold. Given the importance of the sun in determining the quality of wine and considering the sudden climatic changes of the last decades, some cold and rainy regions in northern Europe could benefit considerably from a rise in temperature and a reduction in

rainfall. Ashenfelter and Storchmann (2010) applied a hedonic model of sunlight to the Moselle area in Germany and came to the conclusion that a rise of three degrees in the temperature would double wine prices and an increase of one degree would lead to an increase of 20 percent.<sup>21</sup>

### 2.2.2 Agronomic and Wine-Making Techniques

Investments in vineyards and cellars are expensive, but they generate substantial improvements in the quality of the wine produced. There is a long list of potentially important techniques and innovations, but literature has reviewed only a part of them. In a study made with Italian data from the Istituto Agrario di San Michele all'Adige (now known as the Edmund Mach Foundation), Zago (2009) demonstrated the relevance of agronomic variables, such as the number of vines per hectare, the number of bunches per vine, the depth of the roots, and yield per hectare on Chardonnay and Merlot wines produced from 1994 to 1996. In particular, there emerged a trade-off between quantities and quality: as the wine yield per hectare increased, the wine quality decreased unrelentingly.

Wine-making techniques are equally important. Delmastro (2007), using Italian data from Piedmont, proved the contribution of variables such as the length of the aging process, the use of barrels or *barrisques* (225-liter),<sup>22</sup> an increase in the alcohol content (“superior” wine), and an increase in production standards (“reserve” wine). Alston et al. (2015) analyzed the alcohol content of more than one hundred thousand wines from eleven countries from 1992 to 2009 and showed that it has increased from 12.7 to 13.7 percent. However, the cause of this rise in wine alcohol was not global warming but rather the rational decision of wine makers to use over-ripe grapes to produce more mature, flavored, and intense wines (Thornton, 2013, pp. 120–121). Investments in technology, when they do not distort the product,<sup>23</sup> can be expected to lead to qualitative improvements; what remains to be seen is whether the costs exceed the revenues. In other words, it is not clear whether the companies that produce quality wines, sustaining large investments in the long run, are more or less profitable than the average company.

But how important is the *terroir* and how important is technology? Gergaud and Ginsburgh (2008) analyzed the determinants of the quality of Bordeaux wines using data for the period 1980–1992. Quality is strongly influenced by both the *terroir* (e.g., the chemical and organic characteristics of the soil and the exposure of vineyards) and technology (from the initial choice of the vine to the final bottling stage).<sup>24</sup> The results of the study showed, in fact, that technology matters far more than *terroir*, whose role is negligible. In Ginsburgh, Monzak, and Monzak (2013), using French data from the *Médoc*, once again the importance of technology proved to be far superior to land.<sup>25</sup>

These studies consider relatively small areas, but if the results were to be confirmed by new surveys with data on other countries and years, this would strengthen

the conviction of many operators (including the famous wine maker Michel Rolland) that good wine can be produced anywhere in the world; all that would be necessary are the right techniques.<sup>26</sup> In turn, this leads to important implications for industrial policy: if the terroir matters little and adopting technology is expensive, then the Old World is at a disadvantage compared with new competitors. European Community regulations, in fact, strongly limit or even prohibit the use of many innovations while the small size of companies often prevents big investments.

Lastly, any discussion of the role played by wine-making techniques has to consider the wine classification system, which will be discussed in more detail in chapter 6. In Italy, like in the other EU countries, there are five hierarchically ordered levels: at the bottom we find the *ex-table* wines (*Vino da Tavola*, or *VdT*); then the varietal wines, the typical geographic indication (*Indicazione Geografica Tipica*, or *IGT*); *Controlled Designation of Origin* (*Denominazione di Origine Controllata*, or *DOC*); and finally, the *Controlled and Guaranteed Designation of Origin* (*Denominazione di Origine Controllata e Garantita*, or *DOCG*). The production of *IGT*, *DOC*, and *DOCG* wines is possible only within clearly defined geographical borders and requires compliance with a set of rules established by law concerning production techniques, such as the vines to be used, the maximum yield per hectare, and minimum aging. This is to guarantee the particularity of the wine—linked to the tradition and characteristics of the terroir—and a minimum level of quality. The closer to the top of the pyramid (*DOCG*), the more stringent the rules become and the higher the quality expected.

A positive correlation between *DOCG* and wine quality was found by Delmastro (2007), although there is a certain variability in the ratings given to wines that have different appellations but are of the same level (*Barolo* and *Barbaresco* stand out among the Piedmontese *DOCG*) or that belong to the same designation (with some particularly distinguished and historic vineyards—for example, *crus*). Corrado and Oderici (2008), using 1997–2006 data from the *Guida dei Vini di Veronelli*, documented that a *DOC* or *DOCG* designation has become progressively less important for determining the quality of the wine while the role of some wine-making practices has increased. This is explained partly by the fact that the sample analyzed by a guide is, as mentioned previously, biased in favor of high-end wines. Many companies that aim for excellence, in fact, have started to produce table wines or *IGT* to avoid the strict rules of the law and to experiment with new vines and agronomic and wine-making techniques. The companies that can afford to produce successful and expensive wines theoretically classified as “low end” are those that over the years have built a solid business reputation and therefore do not have to resort to the collective brand.

It is a completely different story for table wines sold through large-scale retail trade channels. In this case it is not a question of excellence but of cheap wines. Therefore, there is a stronger correlation between quality and belonging to a particular quality segment in wines purchased in large-scale retail trade channels than in the hotel and

catering industry (or Horeca in Europe, as in hotel, restaurant, and catering). In other words, table wines and IGTs sold in wine shops are of a much higher quality than products sold in supermarkets, and sometimes they can reach very high levels.

### 2.2.3 Business Characteristics

This group of variables includes the age, size, and ownership structure of wineries. The age of the company can have a positive effect on quality if it is related to the age of the vines because older vines—those over thirty or forty years old—decrease in productivity and increase in quality. In addition, agronomists and wine makers experiment with techniques and products, and they learn from their mistakes (“learning by doing”).

Company size, measured by the number of bottles produced or hectares owned or cultivated, can exert a positive effect on the average quality of wine, given that large companies have greater financial resources and can adopt large-scale technological innovations to cut costs or increase quality.<sup>27</sup> However, the opposite is also true: there can be a negative relationship between company size and average quality because of the growing difficulty of placing high-end products on the market at prices that are beyond the reach of most people. In other words, it is one thing to be able to place 250,000 bottles of precious wine per year on the market and another to sell 250 million bottles. Therefore, while a small cellar can focus exclusively on excellence, large companies must necessarily diversify by focusing largely, if not totally, on consumer goods. The empirical result depends on the sample considered; it can change radically depending on if all kinds of companies are reviewed by guides or if only the high-end ones are reviewed. Unfortunately, the existing studies consider mainly or exclusively this last segment of the market and do not come to conclusive results. Frick (2004) found company size had a positive effect on the average quality of wine while Delmastro (2007) did not record any statistically significant effect.

As for the ownership structure, companies can be privately owned or state-owned companies, cooperatives, or foundations or be part of a group of companies or conglomerate. In private companies the control of the entire production chain and, therefore, of quality lies in the hands of the owner, who can pursue a certain quality according to the chosen market segment and degree of vertical integration. In fact, wine firms can produce (1) both the grapes and the wine, (2) only the wine, with grapes purchased from suppliers, or (3) neither of them, in which case these “bottlers” sell the wine produced by other wineries with their own label. Usually, the higher the degree of vertical integration, the higher the quality (see chapter 4). As mentioned above, some wineries belong to conglomerates with multibillion revenues and diversified portfolios of products ranging from food to alcoholic beverages and so on. Belonging to a conglomerate can have a negative impact on quality, especially if wine is the core business, in which case selling millions of bottles to the mass market requires competitive prices.<sup>28</sup>

An important aspect that can affect the quality of wine is the separation of ownership and management since the owner has every interest in managing the company as best as they can, but they do not necessarily have the ability (or, at least, may not be the most suitable person to do so). In state-owned companies the control of the production chain is in the hands of managers, but often there are no incentives to pursue results in qualitative and quantitative terms as in private companies.

Cooperatives only have full control of production in the winery during vinification since the decision about techniques and machinery for wine making is a prerogative of the management. However, the actual production of grapes—the upstream phase—is decentralized and delegated to individual landowners who have to comply with a set of instructions and rules issued by the cooperatives. There is a strong incentive here to behave in an opportunistic way since the cost of growing the grapes falls entirely on the individual while the gains from a superior quality of grape are divided equally between all the members, regardless of the merits of each one (Pennerstorfer and Weiss, 2013).

It is reasonable to assume that this incentive becomes stronger as the number of members increases, and this also makes peer control more difficult. In the absence of effective control mechanisms or economic incentives, the cooperative becomes a place to unload the grapes produced at the lowest possible cost. The situation is even worse if the cooperatives attract grape producers who are less motivated or have poor land so that they cannot produce good wine on their own or sell their grapes to a private winery.

Cooperatives, on the other hand, are nonprofit companies. When members deliver their grapes to the winery, they receive not only payment for the raw material but also any profit from the production and sale of the wine, which is then distributed proportionally among members. Well-managed cooperatives that make a capital gain and adopt a differentiated payment system according to the quality of the raw material can attract small owners with the best land and contrast or even reverse unfavorable selection.

Foundations are legal entities created through irrevocable donations; they do not have an owner and are managed by a committee that establishes the internal regulations in accordance with the goals set by the donor. Foundations are nonprofit organizations that may define social objectives in their statute and are exempt from the strict controls to which private companies are subject. The effect of this type of company on the quality of wine could be negative as managers are not rewarded on the basis of business results or positive as they can have a longer time horizon and greater patience in investment strategies. Lastly, companies that are part of a group can exploit economies of scale and adopt technologies, distribution, and marketing.

From an empirical point of view Frick (2004), using panel data on over 3,200 bottles produced by 305 German wineries in the period 1996–1999, demonstrated how companies run by external managers produce better wines. The opposite, however, is true

for private companies managed by their owners, state-owned companies, cooperatives, and foundations. Delmastro (2007), with data on 2,046 wines from 414 wineries in Piedmont, confirmed the results of Frick (2004) for private companies and cooperatives. It demonstrated that the average quality of wines increases when the enterprise is administered by the owner who carries out the function of wine maker. When the management, therefore, is entrusted to an expert, be this an external manager or the wine-maker owner, the company benefits, but the opposite happens when it is administered by the owner who does not have specific skills. This occurs frequently in some countries in the Old World where the small size of companies and the family corporate culture perpetuate the “do-it-yourself” approach. Similar conclusions were reached in a qualitative analysis by Mediobanca (2014, table 17); this analysis showed that private companies tended toward “great wines” (with a price above €25) and wines with an appellation. The same study (table 18) also revealed a greater propensity for these companies to sell directly and through Horeca (hotel, restaurant, and catering industries) and wine shops while cooperatives rely heavily on large retailers.

The question of the supply of grapes produced by third parties or on rented land also deserves consideration. Many wineries buy a certain percentage of raw material from external producers and therefore do not have any control over the growing of the grapes. In this case, however, the temptation of the farmer to adopt opportunistic behavior could be neutralized by incentive mechanisms that are more effective than those in cooperatives. Removing a member from a cooperative can prove to be much more complicated than changing a supplier.

Relations between grape producers and wineries can—but do not necessarily have to—be formalized with contracts, which generally provide for a series of instruments to guarantee a minimum level of quality, such as the definition and monitoring of agronomic practices and a system of rewards and penalties that vary according to the characteristics of the goods produced.<sup>29</sup> Goodhue et al. (2003) analyzed the type of sales agreements used by Californian companies distinguishing between written contracts, verbal agreements, and the absence of any formal contract. The study showed that larger companies and companies that produce premium grapes are more likely to protect themselves through the signing of formal contracts. Given the high perishability of the raw material, in fact, wine makers can try to increase their own profit margin to the detriment of agricultural firms by forcing them to accept significant price reductions given the short time in which they can sell their goods.

Zylbergsztain and Miele (2005) analyzed 139 Brazilian farmers and found a greater stability in contracts among producers of quality grapes, given the larger potential damage from a missed or delayed sale of the raw material. Indeed, large companies find it more economical to sign formal contracts. As transaction costs are generally fixed, they decrease in unitary terms as production and the price of grapes rise. Long-term relationships can increase trust between parties, making the use of formal contracts superfluous,

and they are often replaced by oral agreements (Allen and Lueck, 2002).<sup>30</sup> The empirical evidence from Californian companies provided by Goodhue et al. (2003), however, contrasts with this principle that is well established in agricultural economics. Mutual knowledge and trust built in the course of time do not seem to replace written contracts.

Fernández-Olmos, Rosell-Martínez, and Espitia-Escuer (2009) analyzed the factors that influence the decision of Rioja wineries to either produce their own grapes or buy them from external producers and found a positive correlation between wine quality and vertical integration. These results confirm the importance of control over the production chain. The size of the company, however, is negatively correlated with vertical integration. Given the very high cost of land in the most famous and prestigious wine-growing areas, the investment required to buy tens, hundreds, or thousands of acres often becomes unsustainable. Further, it is difficult to find land for sale in the most prized areas, a problem that is exacerbated in Europe by EU regulations on appellations and on planting rights that hinder the growth of companies even where there are still plots available.

The question of renting land is more complex. In this case the winery directly controls the cultivation of the vine, but if the lease contract does not have an adequate time horizon, it may be discouraged from making agronomic investments. Unfortunately, there is not sufficient documentation on this last point. Malorgio, Hertzberg, and Grazia (2008) did demonstrate with Italian data that wineries that do not own land produce a much greater share of table wines than those who do (68 percent and 19 percent respectively) while the share of cooperatives is in an intermediate position. This study, therefore, clearly proves the importance of vertical integration.

### 2.3 The Price of Wine

After reviewing the determinants of the quality of wine we will now look at how prices are established. Empirical models, commonly called “hedonic regressions,” link the price of an asset (in the case of wine that is usually a 75 centiliter [a little over 25 ounces] bottle) with a number of characteristics of the product, the production structure, and the market. Hedonic models were first proposed by Court (1939) and later perfected by Griliches (1961) and Rosen (1974). The methodological issues arising in studies on the determinants of wine price are discussed in box 2.3.

Empirical studies<sup>31</sup> have shown that wine prices are determined essentially through five channels: quality, consumer preferences, production costs, scarcity, and reputation (see table 2.1). The factors that affect the price of wine are

- product quality,
- type of wine,
- vine,
- vintage,

**Box 2.3**

Methodological issues in empirical studies on wine price.

It is of utmost importance to specify the model used to study the determinants of wine prices. The most commonly adopted are the linear, log-linear, log-log, and the Box-Cox (1964) transformation.

In the first, all the dependent and independent variables are used without being transformed, which means they can be easily interpreted from an economic point of view. Sometimes, however, the relationship between dependent and independent variables is nonlinear. In this case, if the variables are transformed appropriately, it is possible to return to the linear relations. The model can be estimated with the ordinary least squares method, though the interpretation of the coefficients changes from one model to another. The variables can be modified in many ways, but the most interesting for the wine sector are those that use logarithmic and Box-Cox transformations. In the log-linear model, only the dependent variable is transformed into a logarithm; in the lin-logarithmic model, only the independent variables get converted; and in the log-log model both dependent and independent variables are modified. With the Box-Cox methodology, a variable is transformed by means of an iterative procedure to normalize the original data:<sup>a</sup> the new variable becomes  $X_\lambda = (X^\lambda - 1)/\lambda$ . In the wine sector the log-linear model is the most frequently used, even if there are applications that make use of the Box-Cox transformation (see the study by Nerlove, 1995, with data on Swedish consumers). The choice of the functional form, therefore, is fundamental because it can lead to biased conclusions if incorrect.

The choice of the sample is equally important. Costanigro, McCluskey, and Mittelhammer (2007)—using data for 13,024 wines from California and the state of Washington reviewed by the Wine Spectator guide between 1991 and 2000—showed how wine is a strongly differentiated product even within the white and red categories. Hedonic model estimations by product categories and price ranges strongly improve the ability to explain data variability and produce more accurate results. On the other hand, it is wrong to hypothesize that a certain variable has the same effect on the price of the goods considered as a whole.

Another relevant methodological aspect concerns the inclusion or otherwise of quality in the set of regressors. Indeed, some studies consider price as a proxy for wine quality (see, for example, Ginsburgh et al., 2013), arguing that the two variables are strongly correlated. In the long run a good cannot be systematically priced more than it is worth. Prices and quality are not, however, the same thing. In the first place, although many consumers are influenced by the ratings expressed in wine guides, their own opinions may differ greatly because of their different knowledge and experience. Using 6,175 observations from seventeen blind tastings organized in the United States between 2007 and 2008, Goldstein et al. (2008) found that only experts prefer the most expensive wines while the correlation between price and quality is fairly negative for nonexperts. Secondly, several studies have shown that quality is only one of the various elements affecting the determination of wine prices and that there are many others that explain a relevant part of the variance of regression. In some studies, the quality was even of little or no importance at all. Combris, Lecocq, and Visser (1997), for example, studied the price determinants of a sample of Bordeaux wines and found that sensory characteristics influence the quality

(continued)

## Box 2.3 (continued)

expressed by judges but not the price, which instead reflects the objective characteristics shown on the label (e.g., type of wine, vintage, classification system, designation, etc.).

The correlation between sensory quality and price is not, therefore, necessarily strong. Various elements, such as production costs, past quality/reputation, and marketing campaigns, can all influence the willingness of buyers to pay (demand side) and the prices charged by producers (supply side). It is therefore appropriate to analyze the price determinants net of quality. While the identification of the variables that affect the quality reflected in the opinions of experts and consumers is more relevant for agronomists and wine makers, what is most interesting from an economic point of view are the variables that increase or decrease the price of products of equal quality.

Methodological aspects are, therefore, of fundamental importance because they strongly influence the results of the econometric investigations.

*Note:* <sup>a</sup>The Ramsey Regression Equation Specification Error Test (RESET) test, where the null hypothesis is that the best specification uses all the variables expressed (see Oczkowski, 2001), can be used to choose the most suitable functional form from the various possible transformations.

**Table 2.1**  
Determinants of wine price.

Variable	Channel				
	Quality	Consumer preferences	Production costs	Scarcity	Reputation
Quality of product	X		X	X	X
Type of wine	X	X	X		
Vine	X	X	X		
Year	X			X	X
Aging	X		X		
Aging potential	X		X	X	
Technology	X		X		
Famous external oenologist	X				X
Firm reputation	X		X		X
Collective reputation (belonging to an appellation)	X		X		X
Institutional reputation (public classification system)	X		X		X
Biological/biodynamic production	X	X	X	X	
Firm size	X		X		

- aging,
- aging potential,
- technology,
- the hiring of a famous external oenologist,
- expectations about quality,
- belonging to an appellation/geographic area,
- official classification system,
- organic/biodynamic production, and
- firm size.<sup>32</sup>

Product quality has been widely discussed and, apart from the findings of the study by Combris, Lecocq, and Visser (1997), has been shown to influence both the willingness of consumers to pay (see Bombrun and Sumner, 2003; San Martín, Brümmer, and Troncoso, 2008; Crozet, Head, and Mayer, 2012) and production costs. Paroissien and Visser (2018) showed that producers of medaled wines can increase their price by 13 percent. Further, as quality improves, wine production falls, which leads to rationing that, in turn, raises the price. The production of quality wines is the first step toward building a solid business reputation.

The type of wine (white, red, sparkling wine, etc.) and grapes (Pinot Noir, Sangiovese, etc.) reflect the quality, the preferences of the consumers, and production costs (see Bombrun and Sumner, 2003; Costanigro, McCluskey, and Mittelhammer, 2007; San Martín, Brümmer, and Troncoso, 2008). Red wines, sparkling wines (above all the *metodo Classico* or *Champenoise* method), and straw wines (*passiti*) cost more than the others on average. The first two, in fact, require more complex technologies and aging while straw wines have a lower yield. All these factors affect production costs.

Consumer preferences for product types can also differ from one country to another, depending on the climate, and they may change in time according to trends. The same holds for vines, which have different yields and production costs and can fall in or out of favor with consumers. Cuellar, Karnowsky, and Acosta (2009), for example, examined the effect of the film *Sideways* on the American consumption of wine. The film, shown in theaters from October 2004 to May 2005, received five Academy Awards and grossed \$100 million at the box office, with \$70 million of that in the United States alone. In a memorable scene from the film the protagonist belittles and refuses to drink merlot but exalts Pinot Noir. The authors of the study showed that the film had positive effects on the sales of Pinot Noir, whereas sales of merlot had slowed down, though not as much as expected.

Vintage influences quality since the best years are produced after summers with little rainfall (Jones and Storchmann, 2001; Ashenfelter, 2008). Moreover, low rainfall negatively affects the quantities produced so that scarcity rations the supply and increases the average production cost, which, in turn, drives prices upward. Finally, some vintages enjoy a “reputational reward” that increases the willingness of

consumers to pay beyond what is justified by the volume and quality levels achieved (Oczkowski, 1994; Combris, Lecocq, and Visser, 1997; Costanigro, McCluskey, and Mittelhammer, 2007).

It is well known that aging improves the sensory characteristics of wine, especially red and some sparkling wine, but it is expensive (purchase and maintenance of barrels, storage of wine, deferred gains), so corporate decisions must be based on careful cost-benefit analysis. Dimson, Rousseau, and Spaenjers (2015) found that the aging of young fine wines has a positive effect on the return of the financial investment. As noticed by Cardebat (2017, pp. 12–13), we have to distinguish the enological from the rarity value of aging. In fact, aging increases the quality of certain types of wine up to a certain number of years, but then it decreases while over time the number of available bottles decreases. Therefore, in the first years the higher value from aging is due to better quality, but after the peak it is due to rarity.

Aging *potential* is another element that can positively affect the price of wine (Jones and Storchmann, 2001), but it involves just the niche of high-end products that lend themselves to long aging. The use of technology in a broad sense, such as the use of wooden barrels mentioned above, includes all those agronomic and enological techniques that affect not only quality but also costs of production. Ginsburgh et al. (2013) found that technology and climate change can explain more than two-thirds of price variance. Once again, companies need to make a careful evaluation of the real benefits of expensive investments, bearing in mind the market and segment of interest.

It is difficult and expensive to build up a company's reputation, which may be understood as the buyers' expectations about the average quality of the current product based on the quality provided in the past. It requires significant investments both in production and marketing policies, but in time it can repay the expense and efforts of producers. A study by Ali and Nauges (2007) about Bordeaux wines showed that individual reputation influences the prices of en primeur wines more than variations in the short-term ratings expressed by critics.<sup>33</sup> To increase their reputation and charge higher prices, some firms hire famous external oenologists as consultants. Using data on Californian red and white wines, Roberts, Khaire, and Rider (2011) compared prices before and after hiring the new oenologist. Since the old wine depended on the previous oenologist, the positive price difference found is due solely to the reputation of the new oenologist.

Membership of an appellation (e.g., Aglianico del Vulture) or a certain segment of the classifications established by authorities (e.g., DOCG) influences quality since the minimum standards (e.g., maximum yield per hectare, alcohol content, etc.) differ significantly, which will as a consequence affect the willingness of buyers to pay.<sup>34</sup> Numerous studies have found positive effects for appellations (Oczkowski, 1994; Combris, Lecocq, and Visser, 1997; Costanigro, McCluskey, and Mittelhammer, 2007; San

Martín, Brümmer, and Troncoso, 2008; Cross, Plantinga, and Stavins, 2011) and for official classifications (Combris, Lecocq, and Visser, 1997; Corsi and Strøm, 2013).<sup>35</sup>

The production of organic or biodynamic wines<sup>36</sup> increases the willingness to pay of those consumers who are more sensitive to quality issues (Barber, Taylor, and Strick, 2009), intended above all as product wholesomeness and respect for the environment (Mollá-Bauza et al., 2005).<sup>37</sup> Positive price differentials in favor of organic wines were discovered by Corsi and Strøm (2013) with questionnaires administered to 171 Piedmont wineries. Schmit, Rickard, and Taber (2013) measured the willingness to pay for wines produced with environmentally friendly techniques by using experiments. The authors confirmed the idea that promoting these techniques leads to an increase in demand and consequently in price increases but only if the sensory characteristics meet the expectations of consumers.

Kallas, Serra, and Gil (2010) analyzed what determines the decision to adopt organic techniques of production by working with data on a sample of Catalan wineries. Older producers, those who are mainly driven by short-term economic motivations and those that run large companies, are all less likely to adopt organic practices. As highlighted by Vastola and Tanyeri-Abur (2009), the price strategies of organic producers must take into account the fact that these practices involve lower soil yields and high labor and certification costs that increase total unit costs by at least 30 percent. Again, costs and benefits must be weighed up, bearing in mind that the return on investment is realized in the long run by building a reputation as a fair and sustainable producer.

Finally, company size affects the ability to make large-scale investments to cut average production costs, which will have some repercussions on consumer prices (Oczkowski, 1994; Corsi and Strøm, 2013). This price containment effect is amplified if larger companies place large quantities of wine in the medium-low range of the market.

Companies have an interest in communicating all the characteristics of the wine that reflect its quality to the consumer. Reputation and signals are particularly relevant because wine quality is discovered only at the time of consumption. A buyer can rely on an abundance of information to find the best product, but it is expensive to obtain and process. This is why consumers rely on signals such as price, label information, and expert opinions. A good part of economic theory considers price to reflect the market structure, but price can also be used as a marketing tool as, for example, when it influences consumers' perceptions of quality. This has been shown in experiments where people were told the retail prices of the wines they were going to taste (Goode, 2016, pp. 79–80). Participants tasted the same wines more than once but, even if the wine was the same, the price displayed was changed. Results show that there is a strong correlation between the declared price and the subjective evaluation. In their evaluation process people are influenced by the price which is perceived as a signal of quality.

In a study on the use of signals by over six thousand European consumers, Gergaud and Livat (2007) showed that price is used as a quality signal, especially by nonexperts.

**Table 2.A.1**  
Quality determinants of wine, Veronelli Guide 2004–2009.

Variable	Description	(1)	(2)	(3)	(4)
New entrant	DV = 1 if the wine has been reviewed for the first time	-0.889*** (0.0247)	-0.788*** (0.0402)	-0.753*** (0.0404)	-0.755*** (0.0404)
Red	DV = 1 if the wine is red	0.837*** (0.0223)	0.396*** (0.037)	0.444*** (0.0376)	0.378*** (0.0416)
Rosé	DV = 1 if the wine is rosé	-0.523*** (0.0717)	-0.337*** (0.0988)	-0.305*** (0.101)	-0.322*** (0.113)
Sweet	DV = 1 if the wine is sweet	0.406*** (0.0491)	0.370*** (0.0753)	0.462*** (0.0749)	0.217*** (0.0809)
Age	Age of wine in years	3.228*** (0.094)	3.667*** (0.146)	3.545*** (0.147)	3.545*** (0.147)
(ln) Bottles	Ln of number of bottles produced by the firm	-0.264*** (0.00952)	-0.125*** (0.0152)	-0.139*** (0.0154)	-0.144*** (0.0155)
(ln) Hectares	Ln of number of hectares in vineyard	0.169*** (0.00968)	0.124*** (0.0153)	0.131*** (0.0154)	0.134*** (0.0155)
Cooperative	DV = 1 if the wine is produced by a cooperative	0.291 (0.198)	0.0228 (0.27)	-0.0222 (0.269)	-0.0561 (0.269)
(ln) Hectares * Cooperative	Slope DV	-0.137*** (0.0341)	-0.101** (0.0464)	-0.0915** (0.0465)	-0.0863* (0.0463)
Barrels	DV = 1 if the wine is aged in barrels		0.529*** (0.0385)	0.553*** (0.0391)	0.556*** (0.0392)

Barriques	DV = 1 if the wine is aged in barriques	1.388*** (0.0361)	1.369*** (0.0363)	1.373*** (0.0364)
IGT	DV = 1 if the wine is IGT	0.138* (0.0714)	0.0788 (0.118)	0.0914 (0.119)
DOC	DV = 1 if the wine is DOC	-0.349*** (0.0684)	-0.263** (0.114)	-0.255** (0.114)
DOCG	DV = 1 if the wine is DOCG	0.218*** (0.0734)	0.00578 (0.121)	0.0206 (0.121)
N		47,227	21,103	21,103
Pseudo R2		0.119	0.174	0.206

*Note:* Results come from ordered logit regressions with robust standard errors (in brackets). Regressions are run with the `ologit` Stata command, which estimates the proportional odds/parallel lines model. DV (dummy variable) is a binary (1/0) variable. Regressors with \*\*\* are significant at 1 percent level, with \*\* at 5 percent, and with \* at 10 percent. All the specifications include region, year, and denomination (IGT, DOC, and DOCG) dummy variables. Results come from table 2 of Castriota, Delmastro, and Curzi (2013).

**Table 2.A.2**  
Price determinants of wine, Veronelli Guide 2004–2009.

Regressors	Description	(1)	(2)	(3)	(4)
Quality	Number of stars	1.384*** (0.0142)	1.232*** (0.0228)	1.238*** (0.0235)	1.242*** (0.0236)
New entrant	DV = 1 if the wine has been reviewed for the first time	-0.412*** (0.0225)	-0.258*** (0.0359)	-0.259*** (0.0359)	-0.261*** (0.0359)
Red	DV = 1 if the wine is red	0.695*** (0.0202)	0.0456 (0.0331)	0.0442 (0.0332)	0.00612 (0.0361)
Rosé	DV = 1 if the wine is rosé	-0.745*** (0.0695)	-0.636*** (0.0965)	-0.636*** (0.0965)	-0.657*** (0.106)
Sweet	DV = 1 if the wine is sweet	0.922*** (0.0495)	0.777*** (0.0676)	0.774*** (0.0676)	0.899*** (0.0717)
Age	Age of wine in years	1.681*** (0.0724)	1.817*** (0.115)	1.816*** (0.115)	1.806*** (0.115)
(ln) Bottles	Ln of number of bottles produced by the firm	-0.527*** (0.00946)	-0.412*** (0.0144)	-0.411*** (0.0144)	-0.413*** (0.0144)
(ln) Hectares	Ln of number of hectares in vineyard	0.276*** (0.00892)	0.207*** (0.0135)	0.207*** (0.0135)	0.211*** (0.0135)
Cooperative	DV = 1 if the wine is produced by a cooperative	1.102*** (0.173)	0.34 (0.234)	0.339 (0.234)	0.317 (0.233)

(ln) Hectares * Cooperative	Slope DV				
Barrels	DV = 1 if the wine is aged in barrels	-0.346*** (0.0307)	-0.197*** (0.0413)	-0.197*** (0.0413)	-0.195*** (0.0412)
Barriques	DV = 1 if the wine is aged in barriques	0.840*** (0.0359)	0.839*** (0.0359)	0.839*** (0.0359)	0.841*** (0.0358)
IGT	DV = 1 if the wine is IGT	1.416*** (0.033)	1.415*** (0.033)	1.415*** (0.033)	1.410*** (0.0331)
DOC	DV = 1 if the wine is DOC	-0.585*** (0.0715)	-0.977*** (0.11)	-0.976*** (0.11)	-0.988*** (0.109)
DOCG	DV = 1 if the wine is DOCG	-0.852*** (0.0692)	-1.066*** (0.106)	-1.065*** (0.106)	-1.076*** (0.106)
N		47,052	21,099	21,099	21,099
Pseudo R2		0.1847	0.1991	0.1991	0.2

Notes: Results come from ordered logit regressions with robust standard errors (in brackets). Regressions are run with the ologit Stata command, which estimates the proportional odds/parallel lines model. DV (dummy variable) is a binary (1/0) variable. Regressors with \*\*\* are significant at 1 percent level, with \*\* at 5 percent, and with \* at 10 percent. All the specifications include region, year, and denomination (IGT, DOC, and DOCG) dummy variables.

Almenberg and Dreber (2011), with an experiment on 135 people conducted in Boston in 2008–2009, demonstrated that the price of wine strongly influences the judgment of quality, especially if this information precedes tasting, which happens whenever it is not a repeat purchase. Heffetz and Shayo (2009), however, found that high prices used as a quality signal work only in laboratory experiments and not in everyday life. The use of high prices seems, therefore, to influence the willingness to pay when declared in experiments or possibly when consumers have limited knowledge.

The opinions of experts and wine guides are another signal used by a large number of enthusiasts; proof of this lies in the proliferation of guides and websites evaluating bottles of wine all over the world. Ali, Lecocq, and Visser (2008) showed that gurus like Robert Parker are able to influence the price of en primeur wines from Bordeaux. His ratings are generally published in spring of each year before prices are established. In 2003, however, the ratings were published in autumn, after pricing. This “natural experiment” allowed them to isolate the impact of the expert’s opinion on the price of wine. Dubois and Nauges (2010) came to similar conclusions and, using panel data on 108 châteaux of the Bordeaux region, distinguished the effect of the experts’ ratings from the unobservable quality of the product. Using Swedish sales data, Friberg and Grönqvist (2012) found that favorable expert reviews increase prices by around 6 percent for more than twenty weeks, whereas negative ones do not have any effect.

While signals are important, the information on the label is strategic. Lecocq et al. (2005) demonstrated with experiments that, if participants first read the labels in wine auctions, then sensorial information becomes irrelevant, whereas if they taste the wine first, then the information on the labels increases the willingness to pay. San Martín, Brümmer, and Troncoso (2008) found, using data on Argentine wines sold in the United States and judged by *Wine Spectator*, that labeling practices are more influential than the opinions of experts. This is probably due to the fact that more people read the label than consult a guide before proceeding with a purchase.

In conclusion, the price of wine is influenced by a set of variables. Some of these concern the quality of the wine and therefore mainly interest agronomists and wine makers while others (choice of the type of wine that attracts demand, information on the label, etc.) are strictly the responsibility of those who manage the company. However, as shown by Jaeger and Storchmann (2011), there is a certain degree of dispersion in wine prices that is higher for expensive bottles that are purchased infrequently.

## Appendix 2.1

Tables 2.A.1 and 2.A.2 show the results of regression analyses with robust standard errors in which the dependent variables are, respectively, the quality and the price of wine. The database, used also in Castriota, Delmastro, and Curzi (2013) and Castriota (2018), contains information on approximately fifty thousand wines produced

by more than four thousand companies and reviewed by the Veronelli Guide from 2004 to 2009. For each wine tasted the guide reports the year and the region of production; if it has been judged for the first time; the type (white/rosé/red, sweet/dry); if it has been aged using wooden barrels or barriques; and the size and legal nature of the company. The information on the use of barrels and barriques is not so complete so that their use as regressors reduces the number of observations available. The analyses of table 2.A.1 and 2.A.2 show that the variables influencing prices are the same as those that determine the quality, net of use of quality as a regressor (see table 2 of Castriota, Delmastro, and Curzi, 2013).

