Journal of Wine Economics, Volume 7, Number 1, 2012, Pages 1–33
doi:10.1017/jwe.2012.8

Wine Economics*

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Abstract

Fine wine has a few characteristics that differentiate it from other agricultural commodities and beverages, rendering it an interesting topic for economists. Fine wine can regularly fetch bottle prices that exceed several thousand dollars. It can be stored a long time and can increase in value with age. Fine-wine quality and prices are extraordinarily sensitive to fluctuations in the weather the year in which the grapes were grown. Wine is an experience good, that is, its quality cannot be ascertained before consumption. As a result, consumers often rely on "expert opinion" regarding quality and maturation prospects. This article describes the emergence and the unparalleled rise of wine economics from the 1980s to the present and sheds light on its three main topics: finance, climate change, and the role of expert opinion. (JEL Classification: Q1, G11, Q54, L15)

I. Introduction

Humans have cultivated vines for the production of wine for thousands of years. According to Unwin (1991), the origins of viticulture lie in the region between the Black Sea and the Caspian Sea and date back to 4000 B.C.E., possibly even 6000 B.C.E. Only a few products have such a long history with a production process that has remained more or less unchanged.

Accordingly, over the past millennia, a large body of viticultural and enological literature has accumulated. Early examples date back more than 2,000 years (Robinson, 2006). The Roman statesman Marcus Cato, also known as Cato the Elder (234–149 B.C.E.), in his book *De agri cultura* provides detailed practical advice on how to profitably run a wine farm. Among other topics, he stresses that grapes should be fully ripe when harvested and that all vats need to be perfectly clean to

*This paper is based on the Simon Brandt Memorial Address I presented at the joint Annual Conference of the African Association of Agricultural Economists and the Agricultural Economics Association of South Africa, Cape Town, September 20, 2010. I am grateful to Nick Vink, University of Stellenbosch, and Orley Ashenfelter, Princeton University, for many helpful comments. A shorter version of this paper appeared in *Agrekon* (Storchmann, 2011).

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prevent wine from turning into vinegar. Another Roman, Lucius Columella, discusses many technical aspects of Roman viticulture in his treatise on farming, *De re rustica* (60 C.E.). In two books, he elaborates on topics such as which grape variety grows best on which soil type. He lays out many elements of modern vine training and trellising. For instance, he recommends a vine spacing of a double pace (about 1.50 m), vines to be trained on chestnut stakes as high as a man, and willow shoots to fasten the vines (a natural fastener that is still being used in the Mosel Valley).

Economists have taken notice of wine and the vine as well. Adam Smith, David Ricardo, John Stuart Mill, Karl Marx and Leon Walras all wrote, to some extent, about wine (see, e.g., Chaikind, 2010). Although these early writings are on topics such as the value of vineyard land or trade, they mostly touch on wine only in passing or refer to it as an example. In addition, these references are too scattered over more than a century for them to constitute wine economics as an independent economic discipline.

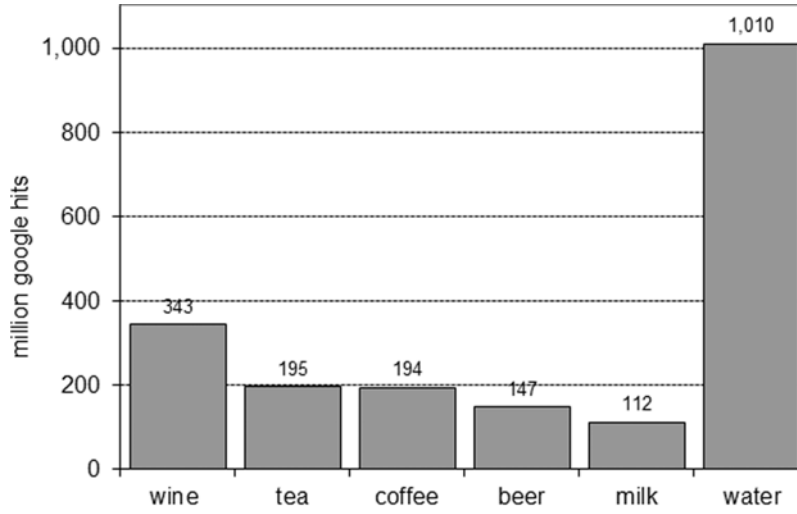
Wine economics as a discipline that analyses wine-related issues as its main focus entered the scene much later. Over the past two decades, wine economics has emerged as a growing field, not only within agricultural economics but in adjacent fields such as finance, trade, growth, and environmental economics as well. Several academic associations are devoted to furthering the economics of wine. At the annual conferences of the largest one, namely, the American Association of Wine Economists (AAWE), more than 200 wine economists from all over the world regularly meet and present the results of their research. For example, at the 2011 annual AAWE meetings in Bolzano, Italy, 130 papers were presented on wine economics . Since 2006, and in addition to the agricultural economics journals, one academic journal is devoted to wine and economics, the *Journal of Wine Economics*.[1] Furthermore, wine economics research has been increasingly recognized by general economics journals.

In what respect is wine different from milk, coffee, tea, or beer? This article aims to sketch the emergence of wine economics and recent developments in the economics literature. Furthermore, I want to shed some light on the three main research issues of wine economics, namely: wine as an investment, environmental issues, and the role of experts. The remainder of the article is organized as follows: section II provides some data on the development of wine in the scholarly literature over the past few decades; section III describes the emergence of wine economics;

[1] Apart from the *Journal of Wine Economics* of the AAWE, there are several journals that, although not purely economics-oriented, also publish economic wine-related analyses; these journals are the *International Journal of Wine Business Research* of the Academy of Wine Business Research, the *Journal of Wine Research* of the Institute of the Masters of Wine and the *International Journal of Wine Research*.

Figure 1

Google Hits for Selected Beverages (million hits, September 2010)



the central topics of wine economics are introduced in sections IV, V, and VI; and section VII concludes and provides an outlook.

II. Developments

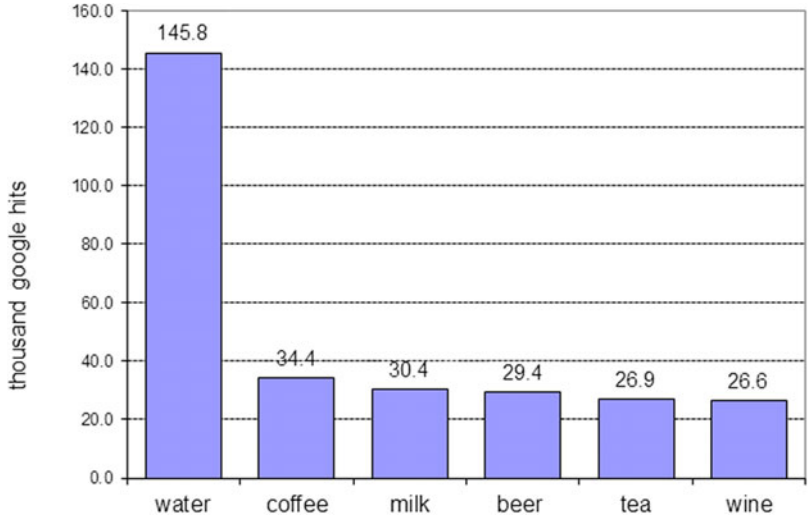
Although wine is not the most talked-about subject in the world, it may still be important compared to other beverages. In order to get an idea of the general relevance of a topic, I conducted a simple Google search for words such as "wine" or "beer." Certainly, counting Google hits as a measure of general relevance is not without problems. First, some topics might be discussed on the Internet a lot while others are more offline topics, that is, online publications and bloggers focus their Internet chatter on some topics more than others. Second, counting Google hits of single words can result in an exaggerated count when unrelated terms contain this word. For instance, all searches for "tea" will also contain references to "tea party," which has little relation to the beverage. Third, the search is confined to the English language, which can disadvantage certain topics. For instance, "wine" might have resulted in relatively more results if the French word (*vin*) had been included. Notwithstanding these issues, a Google search can still lead to insightful results.

Figure 1 reports the results of this Google search, done on September 5, 2010, for beverage words, such as "coffee," "milk," "tea," "water," and "wine." At 343 million results, the word "wine" yields more hits than any other beverage, except for water. However, compared to words, such as "bread" (450 million), "sport" (548 million), "sex" (586 million), "apple" (705 million), "money" (4.7 billion)

Figure 2

Google Scholar Hits for Selected Beverages in *Business, Administration Finance and Economics*, 1940–2010

on September 5, 2010



or "car" (5.57 billion), the number of Google results for "wine" appears to be rather small.

Figure 2 provides the number of Google Scholar hits, that is, hits in scholarly publications, for the same subjects from 1940 to 2010. Because Google Scholar allows users to search by discipline, I confined the search to "business," "administration," "finance," and "economics." Surprisingly, the general Internet chatter by online publications, bloggers, and so on is inadequately reflected in scholarly relevance. First, of the considered beverages, "wine," with 26,600 hits, has the least scholarly coverage while—apart from "water"—"coffee" exhibits the highest coverage (34,000 hits). Second, and unsurprisingly, scholarly hits amount to only a very small fraction of all general hits. However, the range of the ratio "all Google hits to Google Scholar hits" is astoundingly high. Although "milk" generates less than 3,700 general Google hits per Google Scholar hit, the same metric is almost 13,000 for wine (Table 1). In fact, of all beverages, wine has by far the most nonscholarly hits per scholarly hit. Clearly, more people have opinions about wine and write about them than they do about milk. This appears to square with Richard Quandt's statement in his article "On Wine Bullshit" in the *Journal of Wine Economics*: "I think the wine trade is intrinsically bullshit-prone and therefore attracts bullshit artists" (2007, p. 135).

These results are apparently not in line with the emergence of a new academic field called *wine economics*. However, two facts change the picture again: the scholarly growth rate and the quality of the publications.

Table 1
Scholarly Ratio of Selected Beverages

Beverage	*All Google hits (in million)*	*Google Scholar hits*	*All Google hits per Google Scholar hit*
Wine	343	26,600	12,895
Tea	195	26,900	7,249
Water	1,010	145,800	6,927
Coffee	194	34,000	5,706
Beer	147	29,400	5,000
Milk	112	30,400	3,684

Note: Google hits and Google Scholar hits from 1940–2010 as of September 5, 2010.

Figure 3
Growth Rates of Google Scholar Hits in *Business, Economics and Finance*
for selected beverages by decade, 1950–2010

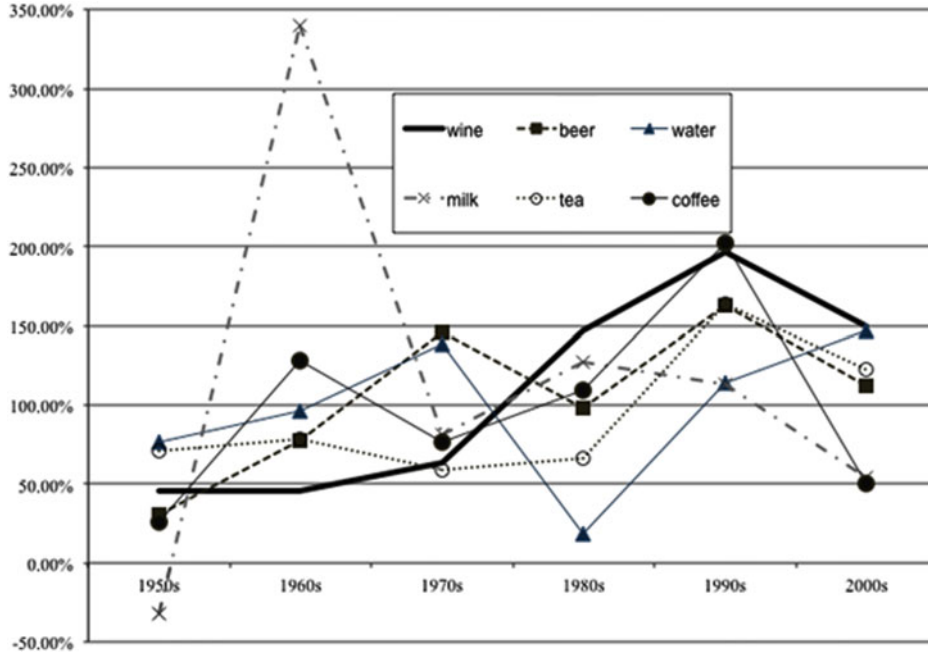
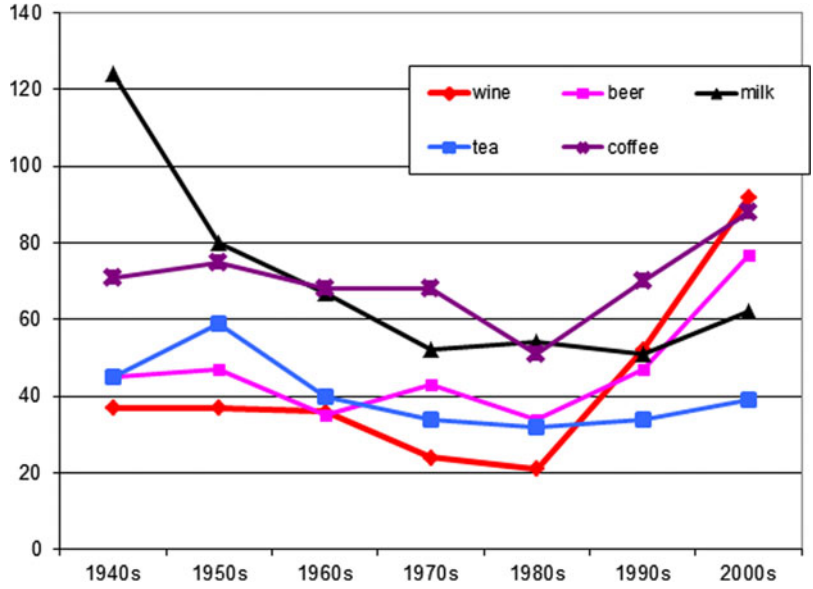


Figure 3 depicts the decennial changes in Google Scholar hits. Compared to the other beverages, "wine" has consistently exhibited the largest scholarly growth rates since the 1980. In contrast, "milk," the beverage with the highest scholarly ratio (see Table 1), has experienced its largest growth rates in the 1960s and has lagged behind ever since.

Figure 4

Google Scholar Hits in Top General Economics Journals*
by decade from the 1940s to the 2000s



* *American Economic Review, Economic Journal, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics*

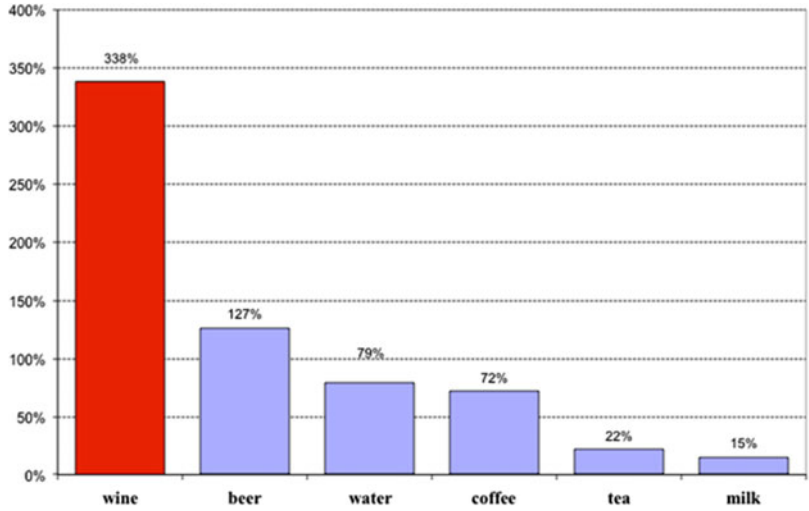
In addition, when considering the scholarly hits in the top (applied) economics journals only,[2] "Wine" exhibits the fewest hits for the 1980s but is first in the 2000s (Figure 4).[3] Figure 5 shows the corresponding growth rate from the 1980s to the present. Among the six beverages, the growth rate of "wine" citations in top general economic journals is second to none. In fact, the growth rate of "wine" is higher than all the other five beverages combined.

The findings of the Google analysis can be summarized as follows: (i) Compared to other beverages, "wine" exhibits a lively online presence, suggesting that wine is a topic that people want to talk about. (ii) However, not all of this Internet chatter is scholarly. Of all beverages, "wine" has the highest "nonscholarly rate" (general Google hits per Google Scholar hit). (iii) Despite (or because of) the fact that "wine" is prone to attract nonscholarly Internet hits, "wine" has experienced extraordinary growth in the scholarly literature over the past two decades. (iv) When considering

[2] These figures refer to *American Economic Review, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics,* and *The Economic Journal.*
[3] The word "wine" must be mentioned in either the title or the abstract of the article.

Figure 5

Growth Rates of Google Scholar Hits in Top General Economics Journals*
from the 1980s to the 2000s



* *American Economic Review, Economic Journal, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics*

the journal quality of scholarly hits, "wine" has risen from the bottom in the 1980s to the top in the 2000s. Its citation growth rate over this period is higher than for all the other beverages combined.

What has caused this enormous interest in wine over the past two decades, especially in the high-end general economic literature?

III. The Emergence

Fine wine has a few characteristics that differentiate it from other agricultural commodities and beverages, rendering it an interesting topic for economists. First, fine wine can regularly fetch bottle prices that exceed several thousand dollars. In fact, the world's most expensive bottle, a 1787 Château Lafite, purportedly formerly owned by Thomas Jefferson, was auctioned off by Christie's of London in 1985 and sold for £105,000, which was equivalent to approximately $322,000 in 2011. Second, fine wine can be stored a long time and can increase in value with age. Third, fine-wine quality and prices are extraordinarily sensitive to fluctuations in the weather the year in which the grapes were grown. Fourth, wine is an experience good, that is, a good for which it is difficult to ascertain its quality before consumption. As a result, consumers often rely heavily on "expert opinion" regarding quality and maturation prospects.

In 1986, Princeton economics professor Orley Ashenfelter launched a newsletter called *Liquid Assets—The International Guide to Fine Wines*. As the first publication of its kind and in stark contrast to the prevailing glossy wine literature, *Liquid Assets* was devoted to the quantitative analysis of the fine-wine market. Ashenfelter published auction prices and provided numerous economic analyses, such as an updated "new objective ranking of the chateaux of Bordeaux." Like the original classification of 1855, Ashenfelter's ranking was completely empirical and based on wine auction prices and not—as might be thought—on "expert opinion" (1988, 1997).[4] Other articles have tackled issues such as the impact of wine critics on wine prices (Ashenfelter, 1992). *Liquid Assets* ran a successful campaign to allow wine drinkers to bring their own wine to New York City restaurants (e.g., Ashenfelter, 1991). Another campaign focused on fine wine auctions and their legality in some states (Ashenfelter, 1987b).

However, the central theme of Ashenfelter's research published in *Liquid Assets* has always been the assessment of vintage quality for wines from various regions (e.g., Ashenfelter, 1986, 1987c, 1987d). Essentially, Ashenfelter devised an econometric model that explains auction prices of mature wines by referring to the wine's age and the weather in the year during which the grapes were grown. This model has proven surprisingly effective at assessing the quality of Bordeaux vintages and predicting prices of mature wines.

Given that Ashenfelter was the editor of the prestigious *American Economic Review*,[5] his wine-related works received considerable attention from economists and the general public alike. The *New York Times* has published numerous articles on Ashenfelter's wine economics research in its Wine and Food Section, in the Business Section, and on the front page (e.g., Goldberg, 1987; Passell, 1990a, 1990b; Prial, 1990). TV channels, such as ABC, CNN, CNBC, and Bloomberg, have aired special reports on his econometric wine models. The wine trade and wine critics, however, have been less intrigued. The New York wine merchant William Sokolin calls Ashenfelter's equation "somewhere between violent and hysterical" (Ayres, 2007). Robert Parker, the world's most influential wine critic, deems Ashenfelter's empirical approach "really a Neanderthal way of looking at wine. It is so absurd as to be laughable," in short, "an absolute total sham" (Ayres, 2007).

Why is the wine world up in arms against an empirical approach to wine? Frank Prial of the *New York Times* writes:

> Two reasons. Some elements of the wine trade are angry because the Ashenfelter equation could be helpful in identifying lesser vintages they have promoted. For example, he is down on 1986, a year praised by more conventional commentators. Mr. Ashenfelter, or at least his

[4] Historically, all vineyard classifications were based on wine prices, land prices, or land profits. The existence of professional "wine critics" is a fairly recent phenomenon from no earlier than the 1970s.
[5] In fact, he edited the *AER* from 1985 to 2001, having had the longest tenure of all editors, second only to the founding editor, Davis Dewey (1911–1940).

Table 2
Bordeaux Wine Prices and the Weather

	Dependent variable logarithm of London auction prices for mature red Bordeaux wines		
Independent variable	*(1)*	*(2)*	*(3)*
Age of vintage	0.0354 (0.0137)	0.0238 (0.00717)	0.240 (0.00747)
Average temperature over growing season (April–September)		0.616 (0.0952)	0.608 (0.116)
Rain in August		–0.00386 (0.00081)	–0.00380 (0.000950)
Rain in the months preceding the vintage (October–March)		0.001173 (0.000482)	0.00115 (0.000505)
Average temperature in September			0.00765 (0.0565)
R-squared	0.212	0.828	0.828
Root mean squared error	0.575	0.287	0.293

Source: Ashenfelter (2008). All regressions are of the (natural logarithm of) the price of different vintages of a portfolio of Bordeaux chateau wines on climate variables, using as data the vintages of 1952–1980, excluding the 1954 and 1956 vintages, which are now rarely sold; all regressions contain an intercept, which is not reported. Standard errors are in parentheses.

> numbers, say the vintage will be the worst of the 1980's. Secondly, and more seriously, he is accused of relegating the whole wine- tasting mystique to a minor role. Supposedly, the sipping, spitting, sniffing and note-taking so dear to wine romantics have all been rendered obsolete by mathematics. (1990)

Ashenfelter et al. published an updated version of the "Bordeaux equation" in 1995 (Ashenfelter et al., 1995) and later, in 2008, in *The Economic Journal* (Ashenfelter, 2008). The Bordeaux model is a cross-sectional model with the (natural logarithm of) price index of a Bordeaux wine portfolio as dependent variable and the wine's age and various weather data as independent variables. Table 2 shows the results of three different variants. Column (1) reports the results when only age is used as explanatory variable, and columns (2) and (3) also include weather variables. The equation in column (2) is most commonly referred to as the "Bordeaux equation." It contains the main seeds of wine economics and its major research topics: (1) the value of wine as an alternative financial asset, (2) wine and climate change, and (3) wine and expert opinion.

First, the Bordeaux equation laid the foundation for a large body of research in wine's role as an alternative financial asset. The age coefficient of 0.0238 (Table 2, column (2)) represents the real rate of return to holding Bordeaux wine.[6] One more year of age adds 2.38% to the wine portfolio's value. Does that justify holding wine as an alternative asset in lieu of stock?

[6] Note that "real" does not refer to the CPI basket of consumer goods but, rather, to wine only.

In addition to storing wine, consumers might also invest in Bordeaux wine futures one year after the harvest. The future prices are set by the producers and might not reflect the true market value of the wine. The true market is not known before the wine is finally released and traded, which normally happens three years after the harvest. Young Bordeaux *grands crus* are typically very tannic and need a maturation period of eight to 10 years to be drinkable. Ashenfelter shows that, as the wines approach their drinkable age, the auction prices slowly converge toward their predicted price. Therefore, consumers can arbitrage if the initial future price is sufficiently lower than the expected market price from the Bordeaux equation. (However, this is almost never the case.) In this way, the Ashenfelter equation has paved the way for a new strain of research in wine and finance.

Second, Ashenfelter finds that weather is crucial in producing a good vintage. In particular, a warm growing season, a dry harvest, and plenty of rainfall in the winter preceding the growing season create ideal conditions for high-quality wine in the Bordeaux region. Of course, the relationship between wine quality and weather has been known to wine producers for thousands of years, but consumers seem to have forgotten this and prefer to listen to "experts." The Ashenfelter equation does not only repeat already known facts, but exactly quantifies the relationship between wine prices and weather. In addition, and this has become increasingly important, it can assess the effect of global warming on wine prices (and thus on land values). The equations in Table 2 show the positive effect of warming on Bordeaux wine prices, a result that has been confirmed for several northern European wine-growing regions. The opposite might be true for wine regions that are already at their optimal growing-season temperature. The Bordeaux equation, therefore, also contains the seeds for many future articles on wine and climate change.

Third, the Bordeaux equation shows that wine experts are less reliable than quantitative methods in predicting a wine's quality. Because Bordeaux wines are not ready to be consumed before an age of about eight to 10 years, vintage assessments need to forecast a vintage's quality. Although the Bordeaux equation's predictions with an R^2 of 0.828 are fairly accurate, experts steadily adjust their ratings as more information about a wine's drinkability becomes available. Particularly mediocre vintages are often rated too highly. For instance, in 1983, Parker deemed the 1975 vintage in Pomerol and St. Emilion (subappellations within the Bordeaux wine-growing region) outstanding and awarded it 95 out of 100 points. He also added that the wines were too tannic to be drunk and should be stored for a long time (a sign of a great vintage). However, as these wines matured, Parker dramatically adjusted his rating. In 1989, he awarded this very vintage only 88 points and recommended that the wines be consumed immediately rather than stored. That is, within six years, Parker's 1975 vintage rating dropped from outstanding to below average. In contrast, the Bordeaux equation had already predicted the mediocre quality of this vintage in 1975, immediately after the harvest. In addition, expert opinion is not free. In order to obtain vintage ratings, consumers must subscribe to Parker's

Table 3
Annualized Nominal Rates of Return for Various Wine Portfolios, 1986–1996

Aggregate	7.9%
First growth	6.7%
1961 vintage	
All	8.3%
First growths	9.6%
1982 vintage	13.9%
Parker's top 15	
All vintages	7.8%
1961 vintage	9.9%
1982 vintage	16.2%
Sokolin's 1985 investment grades	
Grade one	7.7%
Grade two	7.2%
Grade three	5.3%
Sokolin's 1985 portfolio	
Average prices	9.4%
Maximum prices	11.8%
Dow Jones	13.5%
T-Bills (1 year)	5.8%

Source: Burton and Jacobson (2001).

newsletter or buy similar wine magazines. Weather data, by contrast, are freely available online.[7]

IV. Wine and Finance

Only a very small minority of wines will gain in quality and price when properly stored. The overwhelming majority of wines produced will not benefit from being stored for more than two or three years. Wine investors concentrate mainly on the finest growths from Bordeaux and Burgundy and selected wines from California and Australia. In the past 25 years, these wines have become the focus of an increasing number of investors and a large "wine-investing industry" has evolved around this phenomenon. Like stock market indices, such as the Dow Jones Industrial Average, the London International Vintners Exchange (Liv-ex), a market for wine merchants established in 1999, tracks wine prices and reports the development of several wine price indices.[8]

[7] The Royal Netherlands Meteorological Institute provides numerous long time-series data from weather stations all over the world at no charge (Koninklijk Nederlands Meteorologisch Instituut, 2011).
[8] The Liv-ex indices are Liv-ex Fine Wine 50, Liv-ex Fine Wine 100, Liv-ex Fine Claret Chip, Liv-ex Wine Investible Index, and Liv-ex Fine Wine 500 (Liv-ex, 2012).

Table 4
Nominal Annual Rates of Return for Wine and Other Assets, 1986–1996

	All	*First growths*	*1961*	*1982*	*Dow Jones*	*T-bills*
Annual return	7.9%	6.7%	8.3%	13.9%	13.5%	5.8%
Standard deviation	0.133	0.261	0.290	0.134	0.079	0.008

Source: Burton and Jacobson (2001).

Expectedly, the wine trade declares wine the ultimate asset. Wine generates above-average returns, helps to diversity an investor's portfolio, and thus lowers the risk and—if all fails—they can still drink it. Zachy's, a major New York wine retailer and wine auction house, states that "top Bordeaux prices have increased in the auction market 25 to 50 per cent per year for the last several years" (Burton and Jacobsen, 2001, p. 338). In 1998, Peter Meltzer, the auction correspondent of the *Wine Spectator*, the world's largest wine magazine, wrote that "throughout the 1990s, the wine market has outpaced the Dow Jones" (Burton and Jacobsen, 2001, p. 338). More spectacular profit margins for selected wines were reported by Sokolin (1998).

The rapid increase in public attention has been accompanied by a growing body of economic literature that assesses the return as well as the risk of investing in wine. Broadly, cross-section models can be distinguished from time-series models.

The studies by Ashenfelter (Ashenfelter, 2008; Ashenfelter et al., 1995) mentioned in section 3 are based on prior work published in *Liquid Assets* (e.g., Ashenfelter, 1987a) and are cross-section analyses. Therefore, the coefficient of the age variable of the Bordeaux equation in Table 2 reflects the effect of age at one point in time and reports the real, rather than the nominal, rate of return. Given that the Dow Jones index grew by 30.2% (nominal) in 1991 (see Table 5), a 2.4% real wine return is fairly low. It should be noted that equities would also have yielded dividends while the only financial returns to wine are due to capital gains and also incur storage cost.

In a similar fashion, Haeger and Storchmann (2006) and Jones and Storchmann (2001) report cross-sectional real rate of returns for selected châteaux of Bordeaux wines and California pinot noirs, respectively, that are significantly below those for common stock (see Table 5).

In a pooled **SUR** model for Australian Grange, one of Australia's icon wines, traded in 1991–1993 auctions, Ashenfelter and Byron (1995) find nominal annual returns of between 12% and 18%. They find market inefficiencies, with many young wines being significantly underpriced.

Similarly, Wood and Anderson analyzed three Australian icon wines, Grange, St. Henri, and Hill of Grace. They also employed an SUR approach but modeled age as a cubic function; prices rise "when the wine is young, plateauing out around optimal drinking time, before increasing again in value as the wine becomes an

Table 5
Rate of Return to Holding Wine: Selected Empirical Results

Source	*Wine (model)*[a]	*Period*	*Rate of return (nominal p.a.)*	*Comparison (nominal p.a.)*[b]
Krasker (1979)	Bordeaux and California (TS)	1973–1977	No statistical difference from T-bills	Dow Jones: –0.8% T-bills: 6.9%
Jaeger (1981)	Bordeaux and California (TS)	1969–1977	8.5–16.6% above T-bills (depending on storage cost)	Dow Jones: 0.3% T-bills: 6.5%
Weil (1993)	Bordeaux, Burgundy, Rhone (TS)	1976–1992	6.5% (portfolio of a particular investor)	Dow Jones: 19.3% T-bills: 8.6%
Ashenfelter et al. (1995)	Bordeaux (CS)	1990–1991	2.4% (real rate of return)	Dow Jones: 30.2% T-Bills: 5.9%
Ashenfelter and Byron (1995)	Australian Grange (Pooled)	1991–1994	12.0–18.0%	Dow Jones: 6.2% T-bills: 4.4%
Burton and Jacobson (2001)	Bordeaux (TS)	1986–1996	Average 7.9% (range from 5.3% to 16.2%)	Dow Jones: 13.5% T-bills: 6.1%
Jones and Storchmann (2001)	Bordeaux (CS)	1996–1997	1.2–9.6% (real rate of return, varies by chateau)	Dow Jones: 31.9% T-bills: 5.1%
Haeger and Storchmann (2006)	U.S. Pinot Noir (CS)	1998–2003	8.0% (real rate of return)	Dow Jones: 13.3% T-bills: 3.6%
Wood and Anderson (2006)	Australian icon wines (Pooled)	1992–2000	Dependent on age, for first 20 years 2.2–4.3% (real rate)	Dow Jones: 14.4% T-bills: 5.1%
Sanning et al. (2008)	Bordeaux (TS)	1996–2003	Wide range depending on wine/vintage Avg. first growths: 8.4% (SD 7.8%)	Dow Jones: 8.6% (SD 18.7%), T-bills: 4.3%
Masset and Henderson (2010)	Bordeaux (TS)	1996–2007	4.1–6.0% (SD 5.3–9.4%) depending on portfolio	Dow Jones: 7.8% (SD 19.7%), T-bills: 4.1%; [reference portfolio: 7.4% (SD 14.1%)]
Masset and Weisskopf (2010)	Bordeaux (TS)	1996–2009	Various wines and periods, e.g., Bordeaux 1996–2009: 8.1% (SD 10.3%)	Dow Jones: 4.8% (SD 19.4%) T-bills: 3.7%
Fogarty (2010)	Australian wine (TS)	1990–2000	8.2% (SD 3.9%)	Australian shares: 10.7% (SD 5.8%), U.S. shares: 19.2% (SD 8.7%). T-bills: 5.6%

Notes: a. TS = time series, CS = cross section, b. T-bills = Treasury bills with a one-year maturity (Federal Reserve Bank, 2011), c. SD = standard deviation in %.

'antique' wine" (Wood and Anderson, 2006, p. 146). Due to the cubic specification, the real rate of return is dependent on the wine's age. For instance, Hill of Grace yielded a real return of 14.8% in its second year, 0% in year 20, and 10.4% in year 30. In the first 20 years of the wine's age, the average annual return equaled 4.3%, which was significantly below the annualized 14.4% growth rate of the Dow Jones (Table 5).

Krasker (1979) conducted the first economic time-series analyses of the rate of return on storing wine. Drawing on 137 observations of red Bordeaux and California Cabernet Sauvignon for the period from 1973 to 1977, he found that the rate of return on holding wine was not significantly different from that for risk-free U.S. Treasury bills. In contrast, Jaeger (1981) found that, for a wine portfolio similar to Krasker's (1979), wine outperformed Treasury bills by 16.6%. Although Krasker's (1979) storage cost was endogenous and was estimated at $16.60 per case and year, Jaeger assumed a substantially lower exogenous annual storage cost of **$0.45**. In addition, she used a longer time period, from 1969 to 1977—potentially lowering the dampening effect of the 1973–1975 recession. As Jaeger has shown in several variants of her model (Jaeger, 1981, p. 589), the higher returns compared to Krasker's (1979) result were equally due to the different time period (+8.5%) and the lower storage cost (+8.1%).

Weil (1993) analyzed the actual portfolio of a specific wine investor and tracked each of his purchases and sales from 1976 to 1992. The portfolio consisted of various Bordeaux, Burgundy, and Northern Rhône wines. Overall, Weil (1993) analyzed 68 transactions and accounts for actual storage costs and all clearing fees and sales commissions. For each transaction, he compared the rate of return with a hypothetical return if the investor had invested in the **Dow Jones** during the same time period. As a result, although an investment in stock would have yielded an annualized rate of return of 19.3% (Table 5), the actual wine transactions resulted in only 6.5% (all nominal and before tax).

Burton and Jacobsen (2001) analyzed the returns from storing Bordeaux wines for the time period from 1986 to 1996, using repeat-sales regressions. They compared the semiannual returns of various wine portfolios against those of financial assets. As reported in Table 3, Burton and Jacobsen found that a portfolio of first growths (6.7% p.a.) barely outperformed Treasury bills (5.8%), let alone the Dow Jones index (13.2%). Even a portfolio of Sokolin's (1998) first investment-grade wines did not yield more than 9.4% at average auction prices or 11.4% at maximum prices.[9] In fact, only top Parker-rated wines of the 1982 vintage outperformed the Dow Jones during the observed time frame. When sales commission, insurance, and storage were subtracted, however, the returns on 1982

[9] When considering sales commission, insurance and storage these return rates fall to 5.7% for average prices and 8.4% for maximum prices, respectively (Burton and Jacobsen, 2001).

wines were not different from those on equities (which, in addition, provided dividends).

As Burton and Jacobsen (2001) reported in Table 4, not only does wine generally yield lower returns than stock but wine investment is also riskier. The standard deviation of a portfolio consisting of all *grands crus* is more than twice as high as that of the Dow Jones. Portfolios that focus on First Growths or the 1961 vintage only exhibit an even larger price variation.

More recently, Sanning et al. (2008) analyzed Bordeaux auction prices from 1996 to 2003 using the Fama-French-Three-Factor Model and the capital asset pricing model (CAPM). They found a wide range of annualized risk-adjusted returns averaging at approximately 8.5%; the standard deviations were similar to those found by Burton and Jacobsen (2001). However, Sanning et al. (2008) also found that the covariance between wine and equity market returns was close to zero, rendering wine a potential hedging asset that might offset or protect against stock market risks. Similarly, in a recent analysis of Australian wines, Fogarty found "that despite the return to Australian wine being lower than the return to standard financial assets, wine does provide a modest diversification benefit" (2010, p. 119).

These findings found additional support from Masset and Henderson (2010), who analyzed a 1996–2007 sample of Bordeaux wine prices. They found that wine can provide diversification risk-reduction benefits and calculate optimal portfolio shares for equity, wine, and art for investors with different preferences with respect to expected returns, variance, skewness, and kurtosis. Although it may be advisable for investors to hold a fraction of their portfolio in wine, Masset and Henderson (2010) also call for caution. First, wine is less liquid than stock. Second, diversification advantages may change over time. They computed a moving 24-month window correlation between the Standard & Poor's 500 Index and two wine indices and showed that the correlation between equities and wine varies. Although there was no correlation from 2000 until the financial crisis began in October 2008, that changed significantly thereafter. Masset and Henderson (2010) suspected the flight to more liquid assets to be the likely cause. Positive correlations between equities and wine will, however, potentially thwart any diversification strategy.

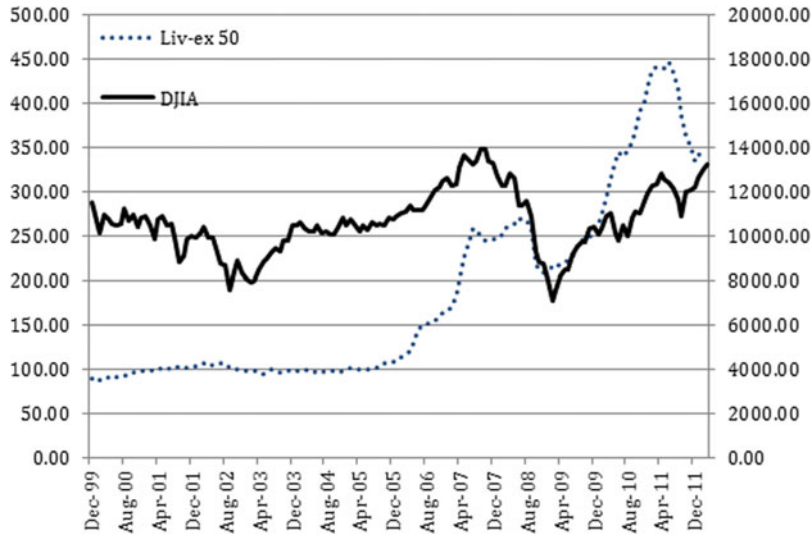
Masset and Weisskopf (2010) studied the profitability of wine investments during the financial crisis of 2008. Analyzing different portfolios for five investor types (from conservative to aggressive) and taking risk aversion, different financial assets, and various wine indices into consideration, they showed that the addition of wine to a portfolio is beneficial for private investors. Adding wine to a portfolio improves returns as well as skewness and kurtosis. Employing a conditional CAPM, Masset and Weisskopf (2010) found that both alphas and betas vary over time.[10]

[10] Alpha is a risk-adjusted measure of the so-called active return on an investment. Beta describes the relation of an asset's return compared to the whole market.

Figure 6

Liv-ex 50 and Dow Jones Industrial Index

December 1999 to March 2012



Wine returns appear to be unrelated to market risk but behave cyclically with the economy and the dollar-to-euro exchange rate. Di Vittorio and Ginsburgh (1996) reported similar findings for Medoc wine auctions at Christie's.

Figure 6 shows the developments of the Liv-ex 50 and the Dow Jones Industrial Average from December 1999 to March 2012. First, the graph depicts the covariance between wine market and stock market since 2008 (betas). The wine market follows the stock market. Second, the figure also displays the extraordinary growth in wine prices since about 2005 (alphas). This trend was temporarily interrupted by the financial crisis. However, since the spring of 2011, the Liv-ex 50 index has experienced a major correction. From June 2001 to March 2012, the wine index declined by more than 22% while the Dow Jones increased by 6%.

Jovanovic (2008) studied the prices of selected older Bordeaux wines (e.g., Lafite 1865, 1875, 1900; Margaux 1900; Yquem 1900) at auctions, on restaurant wine lists and at retail outlets over the past 100 years. Based on the works of Hotelling (1931), Jovanovic shows theoretically how bubble equilibria can form for exhaustible resources, such as wine. In most equilibria, the price of a resource rises at the rate of interest. "In a bubble equilibrium, however, the consumption of the resource peters out, and a positive fraction of the original stock continues to be traded forever. And that may well be happening in the market for high-end Bordeaux wines" (Jovanovic, 2008, p. 1).

V. Wine and Climate Change

It has been known for more than 2,000 years that the quality of any fruit, and wine grapes in particular, depends on the weather during its growing season. For instance, the Roman naturalist Pliny the Elder (23–79 C.E.) noticed that grape quality varies across vineyards due to (micro)climatic factors (Pliny, 77/2007). Some of the earliest work that evaluates the relationship between wine and climate dates back to the pioneering University of California at Davis viticulturalists Amerine and Winkler (1944), who mapped the nascent grape-growing regions of California. More recently, Gladstones (1992) provides a detailed reference of environmental factors that affect viticulture. The close relationship between weather and wine has also been exploited for reverse inferences. Historical climatologists use data on harvest dates and phenological stages to generate medieval weather data (see, e.g., Brázdil et al., 2005; Garcia de Cortázar-Atauri et al., 2010).

Given that fine-wine quality and prices are very responsive to weather variables, such as temperature and rainfall, any variation in weather results in equivalent price variations. Although some regions, such as California, exhibit little year-to-year weather variation, most European wine-growing regions, including the Bordeaux region, have experienced substantially higher annual weather volatility. Accordingly, vintage-related price variations for Bordeaux wines are significantly higher than those for Napa wines. Ashenfelter (2008) reports that, depending on the vintage, auction prices for Bordeaux grand cru wines can differ by a factor 10 or more.

The first empirical evaluations of the effect of weather on wine prices were carried out by Ashenfelter and were published in *Liquid Asset* in the late 1980s (e.g., Ashenfelter, 1986, 1987c, 1987d, 1990). The Bordeaux equation in column 2 of Table 2 reports a growing season temperature coefficient of 0.616, that is, a growing-season temperature increase of 1 °C results in a 61.6% price increase. Given that, since 1945, average Bordeaux growing-season temperatures have ranged between 14.98 °C (1972) and 19.83 °C (2003) large price variations are hardly surprising. Predicted temperature increases for the European wine-growing regions for this century are between 1.5 °C and 5 °C (e.g., European Commission, 2009; IPCC, 2007), that is, an extent of variation that is within the already experienced range of regular annual weather fluctuations. Predictions for precipitation are less reliable and generally conclude that precipitation will increase in Scandinavia and decrease in Southern Europe; the direction of changes and their extent in the heart of Europe, including France, are uncertain (European Commission, 2009). Assuming future temperature increases and no changes in precipitation, Ashenfelter's Bordeaux equation, therefore, predicts substantial price increases for Bordeaux *grands crus*.

Jones and Storchmann (2001) confirmed the positive effect of global warming on the Bordeaux wine region. They modeled the effect of weather by estimating cross-sectional equations for each of 21 selected *premiers crus* châteaux. Given that each château's wine is a unique blend that is either dominated by Cabernet Sauvignon or

Merlot or is a blend of both,[11] Jones and Storchmann (2001) first computed the weather's impact on the sugar and acid level of each of these grape varieties. Taking into account the respective blend proportions, they then proceeded with a price equation. They found that Merlot is more responsive to weather than Cabernet Sauvignon. That is, in a scenario of global warming, Merlot-dominated wines, such as Château Petrus, would disproportionally benefit.

Ashenfelter and Storchmann (2010b) employed three different models to evaluate the effect of warming on Mosel vineyards in Germany. In the first model, they explained the Prussian vineyard classification from 1868. Based on land profits for the period from 1837 to 1860,[12] the Prussian government assigned one of eight ranks to each vineyard; rank 1 vineyards commanded the highest wine prices and were highly profitable, while rank 8 vineyards yielded the lowest profits (if any). This vineyard classification was not carried out as an orientation guide for wine aficionados but, rather, as a basis for fair and just taxes; high-profit land was taxed more than low-profit land. Using an ordered-probit model, Ashenfelter and Storchmann (2010b) showed that the Prussian ranking (and thus the willingness to pay for wine) could be explained by referring to the main vineyard characteristics, namely, soil type and the land's potential ability to capture incoming solar radiation, that is, energy. The darker the soil (mainly dark slate that can store the heat) and the higher the potential solar energy of a vineyard, the better is its rank. The amount of solar radiation that a plot of land can capture can be calculated in a fashion similar to that of a solar panel and depends on its latitude, slope, and orientation. For the German Mosel, which is located at the northern frontier of professional viticulture, energy is a scarce resource and the best vineyards are south-facing and exhibit a 45-degree slope. In the next step, Ashenfelter and Storchmann (2010b) employed the Boltzmann equation to link solar radiation to temperature. Higher temperatures require more solar radiation. Higher solar radiation, in turn, will change the likelihood that a certain vineyard will have a high-quality rank. As a result, further warming will shift the rank distribution of all Mosel vineyards from low to high quality and will thus increase land prices. Under a warming scenario of 3 °C, the value of vineyards in the Mosel might double.

Ashenfelter and Storchmann (2010b) compared these results with two different time-series models. In one model, they regressed the accountancy data of wineries from various West German wine-growing regions on weather. Table 6 shows that the marginal effect of temperature on winery profits (excluding subsidies, column 1) is approximately 0.309. A growing-season temperature increase of 3 °C might raise profits by about 150%. Interestingly, temperatures do not alter production costs;

[11] Many châteaux add smaller quantities of Cabernet Franc, Petit Verdot, Malbec, or Carménère. For Château Cheval Blanc, however, Cabernet Franc is the dominant variety.

[12] The profit was calculated as the product of wine price and crop yield minus cost of growing. A detailed description is provided by Beck (1869). Karl Marx (1843) published some critical comments about the calculation method in 1843.

Table 6
Weather and Real per Hectare Profits and Costs

	(1) *ln(profits – subsidies)*	*(2)* *ln(profits incl. subsidies)*	*(3)* *ln(costs)*
Temperature growing season[a]	0.309***	0.305***	0.026
	(5.17)[5.25]	(4.71)[5.11]	(0.18)[0.19]
Rainfall winter[b]	–0.0034***	–0.0031***	–0.0003
	(–9.77)[–9.90]	(–3.23)[–8.51]	(–0.29)[–0.29]
Rainfall growing season[c]	– 0.0009***	–0.0009***	–0.0001
	(–4.62)[–4.68]	(–1.75)[–5.67]	(–0.51)[–0.52]
Trend	–0.074***	–0.072***	–0.029
	(–8.79)[–8.91]	(–8.37)[–7.98]	(–1.40)[–1.42]
Fixed effects			
Mosel	8.09	8.14	10.33
Rheinhessen	7.55	7.52	10.14
Rheingau	8.28	8.14	10.35
Pfalz	7.79	7.75	9.86
Baden-Württemberg	8.48	8.43	10.18
Franken	8.11	8.10	10.41
R^2	0.663	0.644	0.538
F statistic	9.17	11.25	8.26
N	52	52	57

Source: Ashenfelter and Storchmann (2010a). a. February to October, in degrees Celsius. b. December to February prior to growing season, in milliliters. c. April to October, in milliliters. d. weather data are from the station in Trier (Mosel); *** significance level of 1%; ** 2%; * 5%; + 6.6%; Newey-West robust *t*-values in parentheses; *t*-values based on year clustered standard errors in brackets.

column (3) of Table 6 reports only insignificant effects, that is, profit increases are virtually identical to revenue increases.

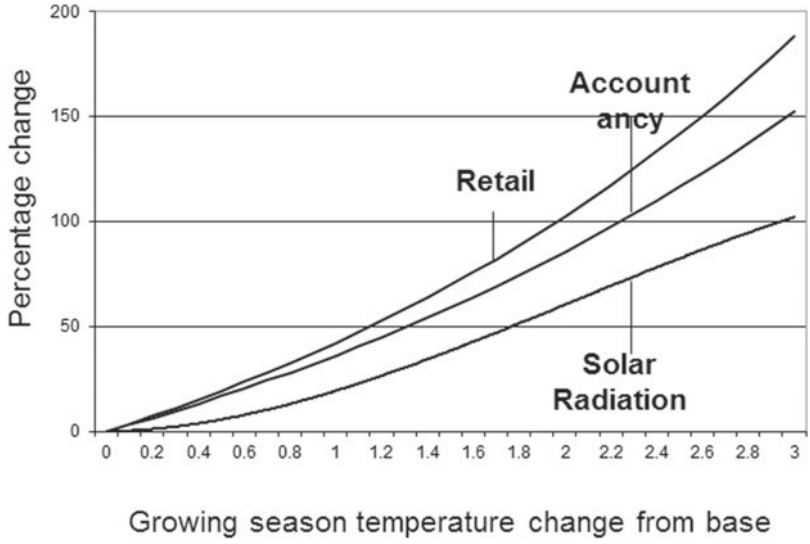
In their third model, Ashenfelter and Storchmann (2010b) regressed Mosel wine revenue on temperatures. They showed that crop yields as well as prices respond positively to higher growing-season temperatures. This model suggests that a warming of 3 °C might raise revenue by approximately 180%. Figure 7 depicts the suggested temperature impact of all three models, which all show a positive relationship between growing-season temperatures and profits, revenues, or land values. Given the entirely different nature of the models, the results are remarkably consistent.

In a different article, Ashenfelter and Storchmann (2010a) showed that, depending on the wine sample considered, regressing price on temperature might result in biased results. Comparing auction, retail, and wholesale prices yielded the strongest positive temperature effects for wines sold at auction and much smaller effects for the wholesale sample. Given that only a tiny fraction of the wines produced are sold at auction (e.g., only those of the highest quality) referring to auction prices can overstate the effect of warming.

In a long-run time-series analysis covering the period from 1800 to 2009, Chevet et al. (2011) studied prices and yields of a *premier cru* château in the

Figure 7

Temperature Changes and Percentage Changes in Land Value



Source: Ashenfelter and Storchmann (2010a).

Bordeaux region. They found a positive impact of temperature on both yields and prices. However, while the temperature responsiveness of crop yields has fallen dramatically over time, prices have become substantially more sensitive to growing-season temperature changes.[13] Apparently, technological improvements have helped wine growers to lower the weather's impact on crop levels. However, the findings also suggest that prices are not driven by quantity produced alone. Quality effects and growing market demand must more than offset the price declining effect of yield increases due to warmer growing seasons.

All the articles mentioned above employ linear temperature specifications, that is, the marginal effect of temperature on wine prices is implicitly assumed to be constant. That might be justified for regions in cooler climates, such as Bordeaux and Germany, or when drawing on data from colder periods such as the "Little Ice Age" of the early and mid-nineteenth century. For warmer regions, especially in the New World, nonlinear specifications might be more appropriate. Byron and Ashenfelter (1995), in their analysis of Australian Grange (see section 4), regressed a squared function in which wine prices grow with increasing temperatures

[13] While the yield coefficient has fallen from 0.31 (1847–1900) to 0.08 (1961–2009), the price coefficient has increased from 0.004 (1839–1900) to 0.45 (1961–2009) (Chevet et al., 2011).

but at a decreasing rate. Wood and Anderson (2006) also employed a squared temperature specification for Australian icon-wine prices. Similarly, Haeger and Storchmann (2006) estimated a squared function for U.S. pinot noirs that have their price-maximizing peak at a growing-season temperature of 22.2 °C (from April to September). Many U.S. growing regions are already above the optimal temperature (Salem, Oregon: 23.2 °C; Napa, California: 26.2 °C; Paso Robles, California: 30.3 °C). Further warming might thus have detrimental effects on Pinot Noir prices. In contrast, Burgundy (Dijon: 22.0 °C) as well as German wine regions (Karlsruhe, Pfalz: 21.3 °C) are still benefiting from further warming.

Some studies focused on wine quality rather than on wine prices or winery profits. Jones et al. (2005) analyzed the effect of temperature on Sotheby's vintage ratings from 1950 to 1999 for all major wine regions worldwide. They employed nonlinear squared time-series models for each region and show that there are winners and losers in global warming. In general, although wine-growing regions in northern France and Germany will produce better wine quality with increasing temperatures, wine-growing regions in Spain (Rioja), California, and South Australia (Barossa Valley) might suffer from any further warming.

Storchmann (2005) examined the weather determinants of the quality of Schloss Johannisberg wine in the German Rheingau region from 1700 to 2003 employing an ordered-probit model. He drew on documented vintage classifications (such as "top wine," "sour," "lesser vintage") in historical harvest books, grouped them into five quality ranks, and regressed these ranks on various weather data. Because instrumental weather data for the covered period are available only from weather stations in England and, with some restrictions, in the Netherlands, he also referred to monthly index data. The results showed that (1) English weather data are a good proxy variable for the actual weather conditions in the Johannisberg vineyards;[14] and (2) that moderate warming will improve the quality of Rheingau wines.

It is clear from these analyses that, in the wine industry as in many other industries, there are winners and losers in global warming. Changing climate requires many technological adjustments and varietal substitutions. In addition, in order to mitigate the deteriorating effects of temperature increases, viticultural regions tend to move toward the poles, to higher elevations or, for example, in California, closer to the coast.

[14] This squares with the results of an analysis by Lecocq and Visser (2006), who analyzed Bordeaux wine prices. They compared the results when drawing on data from only one weather station to those from numerous local stations. They conclude that using localized data does not improve the models' explanatory power.

Table 7
Subscriptions to Selected U.S. Wine Magazines in 2010

Magazine title	*Founded*	*Subscriptions*	*Single copies sold*	*Subscription price[a] ($)*	*Single-copy price ($)*	*Sales revenue ($1,000)*
California Grapevine	1973	3,000[b]	n.a.	32.00		96.0
Connoisseurs' Guide to California Wine	1974	7,000[b]	n.a.	90.00		630.0
Wine Spectator	1976	368,522	32,030	49.95	4.95	18,887.0
Wine Advocate	1978	50,000	0	75.00		3,750.0
Wine Enthusiast	1979	108,000	4,653	29.95	4.95	3,257.6
Wine and Spirits	1981	23,000	48,000	29.95	5.99	976.4
The Wine News[d]	1985	30,250[b]	24,750	25.00	5.00	880.0

Sources: Association of Magazine Media (2011), Pitcher (2003), and the websites of the respective magazines. a. for 2010. b. as of 1999. c. online only, a hardcopy subscription costs $120/year. d. discontinued in 2010.

VI. Wine and Expert Opinion

A. *Expert Ratings and Price Impact*

Because wine is an experience good, and its characteristics are not known to most wine drinkers before consumption, experts and their critical reviews can help to fill an information void.

Accordingly, the market for expert opinion on wine is large. The seven major U.S. wine magazines have a combined subscribership of more than 500,000 (Table 7), with 350,000 alone for the *Wine Spectator*; wine magazine sales total more than $25 million. In addition, there are a few foreign magazines (e.g., *Decanter*) and numerous smaller publications, online services (e.g., JancisRobinson.com), and wine blogs.

Another remarkable fact shown in Table 7 is the sudden and rapidly growing interest in expert opinion. The first U.S. wine magazines started in California in the mid-1970s. Even *Wine Spectator* was originally launched in San Diego and moved to New York only after Marvin Shanken bought the publication from founder Bob Morrisey in 1981. Considering that there was no national wine magazine before the mid-1970s, this sudden and rapidly growing demand for expert opinion is fairly amazing.

Wine consumers and investors rely on experts in many ways. Experts predict the quality of particular (especially Bordeaux) vintages that have not been traded yet in order to help wine investors and connoisseurs to decide whether to buy futures. They describe a wine's taste and smell and rate wines or award gold medals to help consumers make a choice.

Ashenfelter (e.g., 1987d, 1990, 1992, 2008; Ashenfelter et al., 1995) has shown that expert opinion regarding Bordeaux vintage qualities can be seriously flawed.

Relying on publicly available information, such as weather data, yields more reliable results. Furthermore, weather data about a certain vintage are available directly after the harvest, that is, about half a year before the first experts have tasted and rated the vintage. In addition, weather information is available at no cost.

Ashenfelter (2008) has also shown that the Bordeaux wine market exhibits considerable inefficiencies. Directly after their release, many young wines have prices that deviate substantially from the predicted price based on weather. In fact, most vintages are overpriced. However, after about 10 years, when the wines enter the drinkable stage, wine prices converge on the predicted price based on the weather. According to Ashenfelter (2008), the overpricing during the wines' early life is especially pronounced for vintages that are predicted to be the worst. For instance, prices for the 1969 vintage decreased by 76% within the first 15 years after its release: "This suggests that, in large measure, the ability of the weather to predict the quality of the wines is either unknown or ignored by the early purchasers and sellers of the wines" (Ashenfelter, 2008, p. F183).

One reverse anomaly is the 1982 Bordeaux vintage whose prices soared above the weather-predicted price and even 30 years after its release have not converged at the expected price (Ashenfelter, 2008). The main reason for this phenomenon could be the high praise for this vintage by wine critics, in particular by Parker, who is widely considered the most influential wine critic. For the 1982 vintage, Parker awarded a perfect score of 100 points to seven Bordeaux *grands crus*, more than for any vintage before.[15]

This raises the question of whether and to what extent wine critics influence wine prices. Based on prior analyses by Ashenfelter (1990), Ashenfelter and Jones (2012) examined the efficiency and the price influence of expert ratings for Bordeaux wines. They contrasted the explanatory value of ordered vintage quality indicators by well-known experts, namely, the University of Bordeaux enology professors Riberau-Gayon and Guimberteau, with publicly available weather data to examine whether the experts' opinion contains any private information beyond what is already publicly known. In two models, they regressed wine prices first on expert ratings only and then on weather data only and found that both kind of variables are good price predictors. In the following step, they added the experts' ratings to the weather data equation. As a result, expert ratings become inconsistent and insignificant, suggesting that they do not contain any private information. This result finds further support from the fact that weather data are excellent predictors of the experts' ratings. Haeger and Storchmann (2006) pursued a similar sequential approach and found that *Wine Spectator* points only marginally improve weather-based models of U.S. pinot noir wine prices. Jones and Storchmann (2001) differentiated this approach by château and reported that prices of smaller châteaux, those that make

[15] Other outstanding Parker-rated Bordeaux vintages are (number of 100-point wines in parenthesis): 2000 (7), 1961 (4), 1945 (3), 1989 (3) and 1990 (3).

Cabernet Sauvignon-dominated wines and those that have been rated highly in the past, are more sensitive to Parker points than others.

Hadj Ali and Nauges (2007) examined Bordeaux *en primeur* prices, that is, wine future prices that are set by the châteaux in the spring after the harvest. Using a hedonic approach, they found a statistically significant but small effect of critical points by *Wine Spectator* as well as by Parker in addition to fundamentals. Hadj Ali and Nauges (2007) found that Parker's impact on future prices is fairly small: one additional Parker point results in an average price increase of 1.01%.

Hadj Ali et al. (2008) referred to a natural experiment in order to disentangle the public and the private information content of expert ratings. They analyzed the influence of Parker ratings on Bordeaux *en primeur* prices by drawing on a natural experiment. Normally, the Bordeaux châteaux set their *en primeur* prices in the spring following the harvest—after Parker has tasted and rated the wines. The châteaux, therefore, have the opportunity to incorporate any possible private information contained in Parker's rating into the price. However, in the spring of 2003, Parker did not visit the region and did not publish his assessment of the 2002 vintage before the fall of 2003. Thus, the châteaux set their 2002 *en primeur* prices without Parker's rating. The authors confirmed the small price relevance of critical points already found by Hadj Ali and Nauges (2007). The fact that Parker visits the Bordeaux region and tastes and rates *en primeur* wines has an average value of approximately €2.80 per bottle, that is, less than 2% of the average *en primeur* price for *premier cru*.

B. *Experts and Wine Words*

Wine critics and experts not only convey private information about a wine's quality by assigning grades or points but also provide verbal descriptions of the smell and taste. Parker alone has evaluated and described the appearance, smell, and taste of more than 180,000 wines in his newsletter *The Wine Advocate; Wine Spectator* lists over 240,000 wine reviews on its website. Over the past 40 years, a rich wine vocabulary has evolved.

According to Parker's *A Glossary of Wine Terms*, wine descriptors include terms such as "angular," "austere," "backward," "chewy," "decadent," "dumb," "precocious," and "unctuous" (Parker, 2011). For instance, Parker describes a Rhône wine as follows: "Deep ruby color includes purpose nuances. Closed aromatically, hints of crème de cassis and black cherries. Cuts broad swath across the palate with considerable depth and concentration. Tannic as well as broodingly backward" (Weil, 2007, p. 140).

What is the informational value of wine words? In one of the first studies, the linguist Adrienne Lehrer (1975) examined the function and value of the wine language. She ran several experiments to assess the degree of useful communication about wine flavors. In one experiment, she let people first describe three distinctly

different wines. In subsequent blind tastings, she then asked the subjects to match the description with the wine. Surprisingly, the subjects were unable to produce a better than chance match, thus casting doubts on the informational value of wine words.

Lawless (1984) compared the matching ability of wine experts and nonexperts when drawing on descriptions by either group. In his experiments, only expert tasters using expert descriptions performed slightly better than random. All other combinations, such as *expert descriptions and amateur tasters* or *amateur descriptions and amateur tasters*, resulted in outcomes that were no better than chance.

More recently, Weil (2007) analyzed the value of wine words. He drew on published wine descriptions in *Wine Spectator* and Parker's *Wine Advocate* and asked subjects to match three wines with the corresponding description. The overall matching performance was random.

Why do wine consumers rely on expert opinion if they do not provide any practical use?

Quandt (2007) analyzed the wine market by referring to a book by Princeton philosophy professor Harry G. Frankfurt called *On Bullshit* (2005). He concluded: "I think the wine trade is intrinsically bullshit-prone and therefore attracts bullshit artists" (Quandt, 2007, p. 135). This seems to be confirmed by the relatively high nonscholarly Google hit ratio reported in Table 1.

However, according to Ramirez (2010), wine descriptions appear to exert influence not only on wine critics but also on producers. Analyzing 2,700 *Wine Spectator* reviews of recent Napa Cabernet Sauvignon and employing a dynamic price model, Ramirez found that the length of the review (measured by the number of characters) has a significant positive price effect—even after controlling for quality. In addition, he found that the price effect does not result from "purely analytical" words but, rather, from metaphorical language. This suggests that consumers find prose more persuasive than neutral descriptions, that is, wine descriptions might meet needs other than the mere transmission of information.

C. *Expert Failure*

Not only can expert opinion be of little informational value, but it can also be downright flawed. Hodgson (2008) analyzed the performance of wine judges at a major U.S. wine competition from 2005 to 2008. At these wine competitions, panels of four wine judges assess samples of 30 wines and award medals (Gold, Silver, Bronze) to excellent wines. Unknown to the judges, Hodgson inserted triplet pourings of one bottle into the sample, that is, three of the 30 wines within one flight were identical. Only 10% of the judges were able to rank these wines within the same medal rank; another 10% assessed the triplet wines within a two-medal range, that

is, 80% of the examined judges ranked identical wine more than two medal ranks apart. In addition, even the 10% of judges who assigned the same quality rank to identical wines were unable to repeat this performance the following year. These results suggest that experts award medals at random.

This conclusion finds further support in a second study by Hodgson (2009). Hodgson, a wine maker himself, observed that wines entered into several competitions rarely received identical evaluations in each of them. A wine might obtain a Gold medal in one competition and nothing in another. If a Gold medal were a good predictor for quality, then the probability of receiving a Gold medal at competition B should *not* be independent of whether this wine already obtained a Gold at competition A. In fact, a wine that receives a Gold at competition A should have a higher than random chance of obtaining a Gold at competition B.

However, Hodgson (2009) found that this is not the case. The probability of obtaining a Gold medal at competition B is stochastically independent and follows the binomial probability distribution. For instance, if the chance of receiving a Gold at any competition were 10% and if the distribution of Gold medals were random (i.e., independent of quality) the chance of receiving two Gold medals would equal 0.1 * 0.1 = 0.01. Hodgson found that this is the case for wine competitions and states "that chance alone may account for the number of Gold medals that a wine receives" (2009, p. 8).

Expert opinion does not suffer only from a lack of expertise, however. Sometimes conflicts of interest can result in biased outcomes. Reuter (2009) examined whether wineries that advertise in *Wine Spectator* receive better critical evaluations of their wines. He exploited the fact that the other large wine magazine, *Wine Advocate*, does not accept winery advertising. Although advertisers and nonadvertisers obtain similar ratings, when he controlled for quality by referring to *Wine Advocate* ratings, Reuter (2009) found that advertisers receive almost one more critical point than do nonadvertisers. The effect seems largely due to a higher chance of being "retasted." When a blind tasting yields unexpected results, *Wine Spectator* allows a retasting, that is, the wine will be added to the next flight and thus "gets a second chance." It appears that advertisers obtain this opportunity more frequently than non-advertisers.

But, even worse, Robin Goldstein (2008) reported that, in addition to being flawed or biased, expert opinion can be entirely made up. Goldstein applied for the Wine Spectator Award of Excellence, that is regularly given to restaurants with an outstanding wine list. However, Goldstein has never owned nor managed a restaurant. Instead, he launched a website for a fictitious restaurant in Milan, Italy; he posted menus and two wine lists—a regular list and a reserve list. For the expensive reserve list, he mostly selected wines that received only between 50 and 70 *Wine Spectator* points. *Wine Spectator* deems wines in the 50–74-point range "not recommended" and wines in the 75–79-point rage "mediocre: a drinkable wine that may have minor flaws." In order to add some credibility to his made-up restaurant,

Goldstein also obtained an Italian telephone and fax number. He submitted his application, a letter and a $250 fee—and after an evaluation phase of a few weeks, he indeed received the Wine Spectator Award of Excellence.

This means that *Wine Spectator* granted an award of distinction to a nonexistent restaurant. The expert's service, namely, conveying information about an experience good, has become an experience good (or even a credence good) itself. Ashenfelter et al. (2011) showed in a theoretical and empirical model that earning a *Wine Spectator* Award of Excellence is meaningless for the quality of the wine list. Only restaurants that can charge their customers for the cost incurred will apply for the award. Thus, after controlling for the quality of food, service and décor, Ashenfelter et al. (2011) found that applying for (and receiving) a *Wine Spectator* Award of Excellence only results in higher prices.

However, the issue of flawed or even fraudulent expert opinion is not unique to the wine industry. A recent *ABC News* report on the Better Business Bureau (BBB), an institution that evaluates and rates businesses in the United States, showed that numerous nonexistent businesses, such as a fictitious firm named Hamas, received impeccable ratings as long as they paid the evaluation fee. Others that declined to pay, such as Disneyland or some of Wolfgang Puck's restaurants, received an F (Rhee and Ross, 2010). Clearly, inherent issues arise when the evaluatee pays the expert who evaluates him. There has long been a suspicion that the evaluations of business rating companies such as Moody's, Fitch, or Standard & Poor's may be equally flawed.

VII. Summary

Compared to other beverages, wine enjoys a lively Internet presence; wine writers, critics, bloggers, consumers, winegrowers, and merchants all write about wine. In contrast, significantly less scholarly work has been conducted on wine than on any other beverage. As a result, a Google search shows that the general Internet chatter on wine per Google Scholar hit is second to none among all beverages. Although milk generates less than 4,000 general Google hits per scholarly citation, wine generates almost 13,000. Clearly, more people have opinions about wine and write about them than they do about milk.

However, the scholarly economics work on wine has grown substantially since the mid-1980s. Meanwhile, wine has become the leading beverage cited particularly in high-end general economics journals. In 2006, the AAWE was founded and the association's publication, the *Journal of Wine Economics*, is entirely devoted to economic issues related to wine.

The origins of wine economics can be found in the newsletter *Liquid Assets*, which was launched by Ashenfelter in 1986. *Liquid Assets* has been devoted to a quantitative way of looking at the wine market. Although Ashenfelter has published

many ground-breaking wine papers in his newsletter, the most influential one was arguably his analysis of Bordeaux wine prices and the weather, for it contains the seeds of the three major research topics in wine economics: finance, climate, and experts.

More than 25 years after the launch of *Liquid Assets*, consumers can look back on a substantial and increasing body of high-end economic literature in all three fields. It appears to be typical for wine economics that the findings of many analyses have implications that go beyond the wine market. Financial wine studies not only analyze the effects of portfolio diversification and risk control but also contribute to general research on the development of asset bubbles. Analyses of wine and weather provide a complex picture of winners and losers from climate change. Wine-related research on the role and value of expert opinion can be applied to seemingly wine-distant issues such as business rating agencies like Standard & Poor's or Moody's.

In the past decade, the research into wine economics has diversified and gone beyond finance, climate, and experts. In particular, research interest has grown on issues related to market regulation, quality signaling and consumer search.

The repeal of Prohibition in the United States in 1933 granted states the authority to regulate the production, distribution, and consumption of alcohol, resulting in a wide range of rules and standards across the country; for instance, many states prohibited direct interstate wine shipping. Riekhof and Sykuta (2005) analyzed the political economy of interstate shipment regulations and showed that wine distributors are the driving force behind shipping restrictions; the higher the distributors' market concentration within a given state, the more likely it is that this state will prohibit direct shipments. In addition, Gokcekus and Nottebaum (2012) find that states with little tax revenue, proxied by the fraction of federal aid received, tend to prohibit direct wine shipments.

Wiseman and Ellig (2004) investigated wine prices in Virginia and concluded that the prohibition of out-of-state online sales has resulted in a 10% increase in prices. When the state of Virginia legalized direct wine shipping to consumers from out-of-state sellers in 2003, not only the price level but also the retail price variance among retail outlets decreased dramatically (Wiseman and Ellig, 2007). Sharma (2010) analyzed whether direct shipping restrictions impair smaller firms more than larger ones. Jaeger and Storchmann (2011) examined the impact of various wine market regulations in the United States on consumer search and retail price variations.

The available literature on asymmetric information and quality signaling is especially rich. Various articles have analyzed the effect of reputation on wine prices and decomposed the effect into the components product, firm, and regional reputation (e.g., Costanigro et al., 2010; Frick et al., 2011; Landon and Smith, 1998; Schamel, 2009). Cross et al. (2011) analyzed the impact of regional reputation on Oregon vineyard prices. Schnabel and Storchmann (2010) assessed the role of prices as quality signals in the German wine market. Roberts et al. (2011) examined

whether a winery can signal quality and command higher prices by hiring a well-known winemaker from a prominent competitor.

Certainly, wine economics research has reached well beyond the issues described and will not stop here. In addition to further analyses of the topics mentioned above, wine economists will open new research avenues. One apparent new impetus might come from the rise of Asian wine markets and the resulting dramatic increase in fine wine prices. On the one hand, wine can provide valuable insights in the forming of bubbles. On the other hand, and given that soaring wine prices have been accompanied by a soaring number of counterfeits, wine economics can give forensic economics new impetus.

References

Amerine, M., and Winkler, M. (1944). Composition and quality of musts and wines of California grapes. *Hilgardia*, 15, 493–675.

Ashenfelter, O. (1986). Why we do it. *Liquid Assets*, 1, 1–7.

Ashenfelter, O. (1987a). Fine wine trading tips: California Cabernet wine-aging mutual find. *Liquid Assets*, 2, 11–14.

Ashenfelter, O. (1987b). How to sell your wines easily and legally in the U.S. (Why didn't anybody tell us this before?). *Liquid Assets*, 3, 1–7.

Ashenfelter, O. (1987c). Objective vintage charts: Red Bordeaux and California Cabernet Sauvignon. *Liquid Assets*, 3, 8–13.

Ashenfelter, O. (1987d). Vintage advice: Is 1986 another outstanding Bordeaux vintage? (No! And you heard it here first). *Liquid Assets*, 2, 1–7.

Ashenfelter, O. (1988). A new objective ranking of the chateaux of Bordeaux (Based on auction prices, of course!). *Liquid Assets*, 5, 1–6.

Ashenfelter, O. (1990). Just how good are wine writers' predictions? (Surprise! The recent vintages are rated highest!). *Liquid Assets*, 7, 1–9.

Ashenfelter, O. (1991). Restaurants: New York and suburbs, things are changing. (The best restaurants where you can bring your own wine—No. 2 of a series). *Liquid Assets*, 8, 1–11.

Ashenfelter, O. (1992). Critiquing the wine critics: Broadbent versus Parker (A review of two most influential books on Bordeaux wines). *Liquid Assets*, 9, 1–11.

Ashenfelter, O. (1997). A new objective ranking of the chateaux of Bordeaux. *Liquid Assets*, 13, 1–6.

Ashenfelter, O. (2008). Predicting the prices and quality of Bordeaux wines. *Economic Journal*, 118, 40–53.

Ashenfelter, O., and Jones, G. (2012). The demand for expert opinion: Bordeaux wine. *Journal of Wine Economics*, forthcoming.

Ashenfelter, O., and Storchmann, K. (2010a). Measuring the economic effect of global warming on viticulture using auction, retail and wholesale prices. *Review of Industrial Organization*, 37, 51–64.

Ashenfelter, O., and Storchmann, K. (2010b). Using a hedonic model of solar radiation to assess the economic effect of climate change: the case of Mosel valley vineyards. *Review of Economics and Statistics*, 92(2), 333–349.

Ashenfelter, O., Ashmore, D., and Lalonde, R. (1995). Bordeaux wine vintage quality and the weather. *Chance*, 8, 7–13.

Ashenfelter, O., Goldstein, R., and Riddell, C. (2011). Do expert ratings measure quality? The case of restaurant wine lists. Paper presented at the 4th Annual AAWE Conference at the University of California at Davis, June 2010.

Association of Magazine Media. (2011). Facts and figures. http://magazine.org/consumer_marketing/circ_trends/index.aspx (accessed June 20, 2011).

Ayres, I. (2007). *Super Crunchers: Why thinking–by–numbers is the new way to be smart*. New York: Bantam Books.

Beck, O. (1869). *Der Weinbau an der Mosel und Saar. Nebst einer vom königlichen Katasterinspekteur Steuerrath Clotten zu Trier angefertigten Weinbaukarte*. Trier: Selbstverlag der königlichen Regierung zu Trier.

Brázdil, R., Pfister, C., Wanner, H., Storch, H. von., and Luterbacher, J. (2005). Historical climatology in Europe: state of the art. *Climatic Change*, 70(3), 363–430.

Burton, B.J., and Jacobsen, J.P. (2001). The rate of return on investment in wine. *Economic Inquiry*, 39, 337–350.

Byron, R.P., and Ashenfelter, O. (1995). Predicting the quality of an unborn Grange. *Economic Record*, 71, 40–53.

Chaikind, S. (2010). The role of viticulture and enology in the development of economic thought. How wine contributed to modern economic theory. American Association of Wine Economists AAWE, Working Paper, No. 74.

Chevet, J.-M., Lecocq, S., and Visser, M. (2011). Climate, grapevine phenology, wine production, and prices: Pauillac (1800–2009). *American Economic Review: Papers and Proceedings*, 101, 142–146.

Costanigro, M., McCluskey, J.J., and Goemans, C. (2010). The economics of nested names: name specificity, reputations, and price premia. *American Journal of Agricultural Economics*, 92, 1339–1350.

Cross, R., Plantinga, A.J., and Stavins, R.N. (2011). What is the value of terroir? *American Economic Review: Papers and Proceedings*, 101, 152–156.

Di Vittorio, A., and Ginsburgh, V. (1996). Pricing red wines of Medoc vintages from 1949 to 1989 at Christie's auctions. *Journal de la Société Statistique de Paris*, 137, 19–49.

European Commission (2009). Regions 2020. The climate change challenge for European regions. Directorate General for Regional Policy. Background document to commission staff working document SEC (2008) 2868 Final, Brussels: European Commission.

Federal Reserve Bank (2011). Selected interest rates: historical data. www.federalreserve.gov/releases/h15/data.htm (accessed June 20, 2011).

Fogarty, J.J. (2010). Wine investment and portfolio diversification gains. *Journal of Wine Economics*, 5(1), 119–131.

Frankfurt, H.G. (2005). *On Bullshit*. Princeton: Princeton University Press.

Frick, B., Eggert, A., and Hogreve, A. (2011). The returns to reputation: empirical evidence from German wine auctions. Paper presented at the 4th Annual AAWE Conference at the University of California at Davis, June 2010.

Garcia de Cortázar-Atauri, I., Daux, V., Garnier, E., Yiou, P., Viovy, N., Seguin, B., Boursiquot, J.M., Parker, A.K., Van Leeuwen, C., and Chuine, I. (2010). Climate reconstructions from grape harvest dates: Methodology and uncertainties. *The Holocene*, 20, 599–608.

Gladstones, J. (1992). *Viticulture and environment*. Adelaide, South Australia: Winetitles.

Goldberg, H.G. (1987). Wine talk. *New York Times*, October 28.

Gokcekus, O., and Nottebaum, D. (2012). Public finance, special interests, and direct wine shipping laws in the United States. *Journal of Wine Economics*, 7(1), this issue.

Goldstein, R. (2008). What does it take to get a Wine Spectator Award of Excellence? Blindtaste, August 15. http://blindtaste.com/2008/08/15/what-does-it-take-to-get-a-wine-spectator-award-of-excellence/ (accessed June 20, 2011).

Hadj Ali, H., and Nauges, C. (2007). Reputation and quality effects in the pricing of experience goods: the case of *en primeur* wine. *American Journal of Agricultural Economics*, 89, 91–103.

Hadj Ali, H., Lecocq, S., and Visser, M. (2008). The impact of gurus: Parker grades and *en primeur* wine prices. *Economic Journal*, 118, F158–173.

Haeger, J.W., and Storchmann, K. (2006). Prices of American pinot noir wines: climate, craftsmanship, critics. *Agricultural Economics*, 35, 67–78.

Hodgson, R.T. (2008). An examination of judge reliability at a major U.S. wine competition. *Journal of Wine Economics*, 3, 105–113.

Hodgson, R.T. (2009). An analysis of the concordance among 13 U.S. wine competitions. *Journal of Wine Economics*, 4, 1–9.

Hotelling, H. (1931). The economics of exhaustible resources. *Journal of Political Economy*, 39, 137–175.

Intergovernmental Panel on Climate Change (IPCC) (2007). *Climatic change 2007: impacts, adaptation and vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, edited by M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson. Cambridge: Cambridge University Press.

Jaeger, D.A., and Storchmann, K. (2011). Wine retail price dispersion in the United States: searching for expensive wines? *American Economic Review: Papers and Proceedings*, 101(3), 136–141.

Jaeger, E. (1981). To save or savor: the rate of return to storing wine. *Journal of Political Economy*, 89(3), 584–592.

Jones, G.V., and Storchmann, K. (2001). Wine market prices and investment under uncertainty: An econometric model for Bordeaux *crus classés*. *Agricultural Economics*, 26(2), 115–133.

Jones, G.V., White, M.A., Cooper, O.R., and Storchmann, K. (2005). Climate change and global wine quality. *Climatic Change*, 73(3), 319–343.

Jovanovic, B. (2008). Bubbles in the prices of exhaustible resources. American Association of Wine Economists, AAWE Working Paper No. 32.

Koninklijk Nederlands Meteorologisch Instituut (2011). KNMI Climate Explorer. De Bilt, Netherlands. http://climexp.knmi.nl/start.cgi?someone@somewhere/ (accessed June 20, 2011).

Krasker, W.S. (1979). The rate of return to storing wines. *Journal of Political Economy*, 87(6), 1363–1367.

Landon, S., and Smith, C.E. (1998). Quality expectations, reputation, and price. *Southern Economic Journal*, 64(3), 628–647.

Lawless, H. (1984). Flavor description of white wine by "expert" and nonexpert wine consumers. *Journal of Food Science*, 49(1), 120–123.

Lecocq, S., and Visser, M. (2006). Spatial variations in weather conditions and wine prices in Bordeaux. *Journal of Wine Economics*, 1(2), 114–124.

Lehrer, A. (1975). Talking about wine. *Language*, 51(4), 901–923.

Liv-ex (2012). www.liv–ex.com (accessed April 13, 2012).

Marx, K. (1843). Rechtfertigung des ++–Korrespondenten von der Mosel. *Rheinische Zeitung*, No. 15, 17, 18, 19 and 20 (of January 15, 17, 18, 19, and 20, 1843). (English translation: Justification of the Correspondent from the Mosel. www.marxists.org/archive/marx/works/1843/01/15.htm (accessed June 20, 2011).

Masset, P., and Henderson, C. (2010). Wine as an alternative asset class. *Journal of Wine Economics*, 5(1), 87–118.
Masset, P., and Weisskopf, J.-P. (2010). Raise your glass: wine investment and the financial crisis. American Association of Wine Economists, AAWE Working Paper No. 57.
Parker, R. (2011). A glossary of wine terms. https://www.erobertparker.com/info/glossary.asp (accessed June 20, 2011).
Passell, P. (1990a). Economic scene; more great wine before its time. *New York Times*, December 12.
Passell, P. (1990b). Wine equation puts some noses out of joint. *New York Times*, March 4.
Pitcher, S. (2003). A critical survey of major wine review publications. www.winepros.org/aftertaste/pub-survey.htm (accessed June 20, 2011).
Pliny the Elder (77/2007). *Pliny's Natural History in Thirty–Seven Books*. Whitefish, MT: Kessinger.
Prial, F. (1990). Wine talk. *New York Times*, May 23.
Quandt, R.E. (2007). On wine bullshit: some new software. *Journal of Wine Economics*, 2(2), 129–135.
Ramirez, C. (2010). Do tasting notes add value? Evidence from Napa wines. *Journal of Wine Economics*, 5(1), 143–163.
Reuter, J. (2009). Does advertising bias product reviews? An analysis of wine ratings. *Journal of Wine Economics*, 4(2), 125–151.
Rhee, J., and Ross, B. (2010). Terror group gets 'A' rating from Better Business Bureau. *ABC News*, November 12. http://abcnews.go.com/Blotter/business–bureau–best–ratings–money–buy/story?id=12123843/ (accessed June 20, 2011).
Riekhof, G.M., and Sykuta, M.E. (2005). Politics, economics, and the regulation of direct interstate shipment in the wine industry. *American Journal of Agricultural Economics*, 87(2), 439–452.
Roberts, P.W., Khaire, M., and Rider, C. (2011). Isolating the symbolic implications of employee mobility: price increases after hiring winemakers from prominent wineries. *American Economic Review: Papers and Proceedings*, 101(3), 147–151.
Robinson, J. (2006). *The Oxford Companion to Wine*. 2nd ed. Oxford: Oxford University Press.
Sanning, L.W., Shaffer, S., and Sharratt, J.M. (2008). Bordeaux wine as a financial investment. *Journal of Wine Economics*, 3(1), 51–71.
Schamel, G. (2009). Dynamic analysis of brand and regional reputation: the case of wine. *Journal of Wine Economics*, 4(1), 62–80.
Schnabel, H. and Storchmann, K. (2010). Prices as quality signals: evidence from the wine market. *Journal of Agricultural and Food Industrial Organization* 8, Article 2.
Sharma, R. (2010). Stock market reaction to court decisions related to differential treatment of in–state and out–of–state internet wine sales. *Journal of Wine Economics*, 5(1), 69–86.
Sokolin, W. (1998). *The Complete Wine Investor. Collecting Wine for Pleasure and Profit*. Rocklin, CA: Prima.
Storchmann, K. (2005). English weather and Rhine wine quality: An ordered probit model. *Journal of Wine Research*, 16(2), 105–119.
Storchmann, K. (2011). Wine Economics: emergence, developments, topics. *Agrekon*, 50(3), 1–28.
Unwin, T. (1991). *Wine and the Vine. A Historical Geography of Viticulture and the Wine Trade*. London and New York: Routledge.
Weil, R. (1993). Do not invest in wine, at least in the U.S., unless you plan to drink it, and maybe not even then. Or: as an investment wine is a no corker. Mimeo, University of Chicago.

Weil, R. (2007). Debunking critics' wine words: can amateurs distinguish the smell of asphalt from the taste of cherries? *Journal of Wine Economics*, 2(2), 136–144.
Wiseman, A.E., and Ellig, J. (2004). Market and nonmarket barriers to internet wine sales: the case of Virginia. *Business and Politics*, 6(2), Article 4.
Wiseman, A.E., and Ellig, J. (2007). The politics of wine: trade barriers, interest groups, and the Commerce Clause. *Journal of Politics*, 69(3), 859–875.
Wood, D., and Anderson, K. (2006). What determines the future value of an icon wine? New evidence from Australia. *Journal of Wine Economics*, 1(2), 141–161.