

What Is the Value of Terroir?

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Wine producers and enthusiasts use the term “terroir,” from the French *terre* (meaning land), to refer to the special characteristics of a place that impart unique qualities to the wine produced. The Appellation d’Origine Contrôlée (AOC) system in France, and similar systems adopted in other wine-producing countries, are based upon the geographic location of grape production, predicated on this notion of terroir. Under the US system, production regions are designated as American Viticultural Areas (AVAs), with finer geographical designations known as sub-AVAs. Such designations allow wineries to identify the geographical origin of the grapes used in producing their wines, and—equally important—seek to prevent producers outside an AVA from making false claims about the nature and origin of their wines.

What is the value of terroir in the American context? Does the “reality of terroir”—the location-specific geology and geography—predominate in determining the quality of wine? Does the “concept of terroir”—the location within an officially named appellation—impart additional value to grapes and wine? Does location within such an appellation impart additional value to vineyards?

The central question we address is whether measurable site attributes—such as slope, aspect, elevation, and soil type—or appellation designations are more important determinants

of vineyard prices.¹ We do this by conducting a hedonic price analysis to investigate sales of vineyards in Oregon’s Willamette Valley, one of the most important wine-producing regions in the United States.²

How should site attributes and sub-AVA designations influence vineyard prices? If site attributes significantly affect wine quality and if consumers are able to discriminate such quality, then vineyard prices would depend on site attributes,³ and AVA designations might be redundant. Alternatively, consumers might not be able to discriminate among wines perfectly and might use AVA designations as signals of average quality of wines from respective areas, and/or might derive utility directly from drinking wines which they know to be of particular pedigree. In this case, site attributes and AVA designations would influence vineyard prices, with parameters for site attributes indicating how producers value intra-AVA differences in vineyard characteristics. Presumably, producers attach premiums to site attributes that enhance wine quality, provided that consumers can perceive and are willing to pay for such quality differences.

What if, at the extreme, variation in vineyard prices is explained completely by AVA designations (that is, site attributes are irrelevant)? This would indicate that terroir matters economically—as a concept, though not as a fundamental reality. In other words, producers recognize the value of the AVA designation because they

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¹ The notion of terroir is sometimes extended beyond natural endowments to encompass the history and culture of a place, but we employ a narrower and more common definition of terroir focused on physical attributes of the location (Olivier Gergaud and Victor Ginsburgh 2008).

² The Willamette Valley is designated as an AVA. Within the valley, there are six sub-AVAs: Chehalem Mountains, Yamhill-Carlton District, Ribbon Ridge, Dundee Hills, McMinnville, and Eola-Amity Hills.

³ Wine quality is affected not only by site attributes, but also by the quality of growing stock, as well as vineyard management, and the skills and resources of the wine maker.

know that consumers will pay more for the experience of drinking wine from designated areas.⁴ However, if site attributes known to affect wine quality have no impact on vineyard prices, this suggests that consumers cannot discern quality differences. Any appreciation they might express for an area's terroir would essentially be founded on reputation, not reality.

In the next part of the paper, we discuss some related research from the wine economics literature. Then, in Section II, we describe the data we employ, as well as our estimation strategy. In Section III, we present our results plus some robustness checks. Section IV concludes.

I. Previous Literature

Our analysis is related to and builds upon previous work by others. In one recent study, Gergaud and Ginsburgh (2008) find that site attributes of vineyards in the Haut-Médoc appellation in Bordeaux have no effect on wine prices or ratings. Our study builds on this work by examining—in addition to site characteristics—the value assigned to appellation designations. Further, we are able to measure site characteristics more precisely by using GIS-based information to develop detailed physiographic profiles of parcels.

In another recent study, Orley Ashenfelter and Karl Storchmann (2010) investigate the effects of climate on vineyards in the Mosel Valley. As in our study, the authors have fine-scale data on vineyard characteristics. They find that site characteristics—including slope, orientation, soil types, soil depth, and altitude—as well as solar radiation are significant determinants of vineyard quality. We do not include climate variables in our analysis, because of trivial variation in rainfall, humidity, and wind across the Willamette Valley, but our site attribute variables proxy for the amount of solar radiation received by vineyards.

An important similarity and difference with our study concerns respective dependent variables. Gergaud and Ginsburgh (2008) and Ashenfelter and Storchmann (2010) employ measures that are based on wine prices or ratings.

Our dependent variable, vineyard sale prices, is preferable in the context of our investigation into the value of terroir. Provided that non-vineyard inputs into wine production (labor, wine-making techniques, etc.) are variable and reproducible, profit maximization implies that the optimal levels of these inputs are implicit functions of vineyard attributes and input and output prices that are constant across the vineyards in our sample. As such, we can estimate the implicit prices of vineyard attributes using the simple hedonic equation presented below.

As we suggest above, if consumers have limited information about specific vineyards or are unable to judge differences in quality among wines, they might use appellation designations as signals of quality. In fact, the results of many blind taste tests indicate that consumers have very limited ability to distinguish intrinsic qualities of wine (sweetness, acidity, tannins, etc.), and instead judge quality by relying on extrinsic signals, such as price, origin, and wine-maker reputation. Roberta Veale and Pascale Quester (2008) found that tasters' perceptions of quality were strongly correlated with price and country of origin, but not with intrinsic qualities related to taste. Similarly, Robin Goldstein et al. (2008) found that when price information is withheld, nonexpert tasters show no preference for more expensive wines and even show a slight preference for less expensive wines.

II. Data and Estimation Strategy

We employ a new dataset on vineyard sales provided by Northwest Farm Credit Services, a lending institution specializing in agriculture. This database includes the universe of 104 sales of properties in the Willamette Valley between 1995 and 2007 that included vineyards and vine-lands (land that can be developed for vineyards). In addition to the total sale price, the size, and the location of the property, each sale record includes an appraiser's estimate of the value of non-vineyard assets, such as dwellings and other buildings, winery equipment, and non-vineyard land. We subtract the estimated values of these non-vineyard assets from the total sale price to obtain the value of vineyards in each sale. Because terroir relates exclusively to nontransferable attributes of vineyards, we also subtract from the vineyard value the appraiser's estimate of the value of all vineyard enhancements,

⁴ Likewise, producers might bid up the value of vineyards located in designated appellations because there is prestige associated with owning vineyards in these areas.

TABLE 1—ESTIMATION RESULTS

	Parameter estimate	Standard error
Constant	8.582	0.333
Eola-Amity Hills sub-AVA	0.438	0.138
McMinnville sub-AVA	0.154	0.230
Yamhill-Carlton sub-AVA	0.529	0.135
Dundee Hills sub-AVA	0.852	0.143
Chehalem Mountains sub-AVA	0.482	0.125
Vineyard acreage	−0.005	0.002
Vineyard acreage squared	0.000014	0.000006
Share of parcel with best elevation	0.157	0.154
Share of parcel with other elevation	0.130	0.164
Share of parcel with south aspect	0.202	0.268
Share of parcel with southeast/west aspect	−0.088	0.267
Share of parcel with east or west aspect	0.270	0.471
Share of parcel with best soil	−0.030	0.157
Share of parcel with good soil	0.048	0.137
Share of parcel with best slope	0.075	0.286

Dependent variable = log of vineyard price per acre
Observations = 104
Adjusted R^2 = 0.422

leaving the estimated price of land for vineyards. Our dependent variable is the logarithm of this “vineyard price” per acre for each property (in 2007 dollars).

The sales records include information about average characteristics of vineyards included in each sale, but we develop more precise measures, using GIS-based information on slope, aspect, elevation, and soils, with location of each parcel determined from tax lot boundaries and matched to GIS maps of physiographic variables. Parcels are divided into ten-meter pixels, and each pixel is classified according to 14 slope, 16 aspect, 86 elevation, and 8 soil group categories. Because the number of categories exceeds the number of observed sales, we combine the categories based on accepted knowledge about which vineyard attributes are most favorable or unfavorable, compute the percentages of each parcel in each of the aggregated categories, and use these as independent variables in our hedonic regressions.

In addition to site attribute variables, we include the vineyard area, the square of area, and indicator variables for the location of a parcel within a sub-AVA.⁵ Parcels outside of sub-AVAs

are demarcated as being in the Willamette Valley AVA. The average price for vineyards is about \$10,000 per acre, with prices ranging from \$2,500 to \$42,000 per acre. Given that our sample includes only parcels with vineyards, we must have within-sample variation in site attributes if we hope to measure effects of terroir. Fortunately, our sample reflects a significant range of physiographic conditions.

III. Results and Robustness

We regress the log of vineyard price on the variables discussed above, and a constant term. Variables are defined such that we expect the coefficients on the included site attributes and sub-AVA designations to be positive. The results reveal that most of the estimated coefficients on site attributes are positive, but none is significantly different from zero (Table 1).⁶ However, four of the five estimated coefficients for sub-AVA are significantly different from zero at better than the 99 percent confidence level.

Pairwise *F*-tests indicate that the coefficient on Dundee Hills is different from those on Eola-Amity Hills, Yamhill-Carlton, and Chehalem

⁵ Note that the sub-AVA designations were not officially adopted until the end of the period covered by our data. However, prior to that time, the areas that would later be designated as sub-AVAs were well recognized by wine

producers, and it was common practice to label the origin of wines using the same geographical terms.

⁶ The results do not change appreciably if we use robust standard error estimates.

TABLE 2—VINEYARD PRICE PREMIUMS AND BOTTLE PRICES

Vineyard prices		Average bottle prices	
Appellation designation	Vineyard price premium	Wine spectator	Wine advocate
McMinnville	\$ 0	\$ 40	\$ 43
Willamette Valley	\$ 0	\$ 46	\$ 47
Eola-Amity Hills	\$ 2,933	\$ 51	\$ 50
Chehalem Mountains	\$ 3,306	\$ 52	\$ 55
Yamhill-Carlton	\$ 3,721	\$ 49	\$ 48
Dundee Hills	\$ 7,163	\$ 59	\$ 54

Note: Vineyard premium is the increment in sale price (2007 dollars per acre) due to location inside a sub-AVA.

Mountains, but that the latter three coefficients are statistically equivalent. The coefficients on parcel size indicate that the per-acre price falls as the parcel size increases, but at a diminishing rate. The adjusted R^2 , 0.422, is reasonable for cross-sectional data.

Why are the impacts of site attributes on sales price insignificant? One potential problem is that the site attributes are measured over the entire parcel, not just the vineyard portion. We therefore restrict the sample to parcels that are at least 50 percent vineyards, leaving 83 observations with which to estimate the model. The results show little change from the basic model.⁷ Qualitatively, the findings remain the same for cut-off values of 68 percent and 75 percent.

Another possible explanation for the insignificance of site attributes is that their effects could be masked by the sub-AVA designations. When we drop the sub-AVA variables, the variable for best soils becomes significant. However, further investigation shows that this variable is highly correlated with the Dundee Hills sub-AVA variable and that it is the Dundee Hills location, not better soils, that raises vineyard prices. A further check is to see if there is variation in the site attributes within sub-AVAs. In fact, we find similar variation in site attributes within and across sub-AVAs.

Finally, if the fundamentals of terroir—as opposed to the reputation associated with an appellation designation—have important influences on wine quality, then parcels that are outside, but close to, sub-AVAs should be valued more than parcels that are farther away. We therefore reestimate the basic model with a variable

for the distance of a vineyard from a sub-AVA included. We find that its influence is insignificant.

The significant premiums we find to be associated with sub-AVA designations are not related to observable site attributes. One possible explanation is that bottle prices for wines from sub-AVAs command higher prices (for reputational reasons), which in turn bids up the prices of sub-AVA vineyards. To investigate this possibility, we examined data on 2006 pinot noir bottle prices for the Willamette Valley AVA and for each sub-AVA. From the database of *Wine Spectator* magazine, we obtained 243 observations, and from the *Wine Advocate* database, 310 observations. Rated wines from the most highly valued appellation, Dundee Hills, command an average premium of some \$13 per bottle in the *Wine Spectator* data and about \$7 per bottle in the *Wine Advocate* data (Table 2). Likewise, from the results reported in Table 1, we can estimate the price premiums associated with vineyards in various appellations. The Dundee Hills sub-AVA commands a premium of more than \$7,000 per acre.

The rankings of vineyard price premiums are roughly consistent with the bottle price premiums. Dundee Hills ranks first in vineyard price premiums and first in both of the estimates of bottle price premiums, whereas McMinnville and Willamette Valley fall at the bottom of all three sets of rankings. Of course, bottle prices are also affected by the skills and reputations of wine makers, and so these results are only suggestive of correlation.⁸ That said, the results are consistent with the notion that consumer demand

⁷ Econometric results of this and all other robustness checks are found in Cross, Plantinga, and Stavins (2011).

⁸ Because there is considerable variation in bottle prices within sub-AVAs, we cannot reject the null hypothesis that average bottle prices are the same across sub-AVAs.

for wines of better pedigree drives higher valuation of respective vineyards.

IV. Conclusions

We have estimated a hedonic model of vineyard prices in Oregon to examine whether such prices vary systematically with designated appellation, after controlling for site attributes. Despite using precise measures of site attributes, we do not find evidence of significant effects on vineyard prices, and a series of robustness tests does not alter this finding. However, we do find that vineyard prices are strongly determined by location within specific sub-AVAs. These appellations are supposed to reflect the area's terroir, but our finding that the physical characteristics of vineyards are not priced implicitly in land markets raises questions about whether sub-AVA designations have a fundamental connection with terroir.

Nevertheless, our results make clear that the concept of terroir matters economically, both to consumers and to wine producers. Buyers and sellers of vineyard parcels in the Willamette Valley of Oregon attach a significant premium to sub-AVA designations. One possibility is that buyers are less informed than sellers about how the attributes of a vineyard will affect wine quality and, therefore, rely on sub-AVA designations as quality signals. Either way, consumers are evidently willing to pay more for the experience of drinking wines from these areas. While they may not discriminate among wines in terms of

their intrinsic qualities, consumers are apparently responding to extrinsic qualities of wines, such as price and area of origin.

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