Archives of Business Research – Vol. 13, No. 05
Publication Date: May 25, 2025
DOI:10.14738/abr.1305.18757.
Murova, O. I., Boonsaeng, T., & Williams, K. (2025). Investigating Factors Affecting the Prices of Texas Wine Grapes. Archives of Business Research, 13(05). 35-45.

Investigating Factors Affecting the Prices of Texas Wine Grapes

Olga I. Murova*
Associate Professor, Dept. of Agricultural & Applied Economics, Texas Tech University, Lubbock, TX 79409

Tullaya Boonsaeng
Research Scientist, Dept. of Agricultural Economics and Agricultural Business, New Mexico State University Las Cruces, NM 88003

Kirk Williams
Lecturer of Viticulture, Viticulture & Enology, Dept. of Plant & Soil Science, Texas Tech University, Lubbock, TX 79409

ABSTRACT

This paper examines the factors affecting wine grape prices in Texas. It also investigates price differentials of grapes based on the type of wine produced – red, white, dry, or sweet. Surveys from the National Agricultural Statistical Surveys for five grape-producing regions of Texas in 2015, 2017, 2019, and 2020 are utilized. Findings reveal that increased grape production and the increased yields in the state lead to decreasing grape prices. Low temperatures result in reduced yields and, consequently, an increase in the prices of white and red grapes. High summer temperatures drive up the prices of white grapes, but not those of red grapes. Models with fixed time effects show that producers received higher grape prices in 2017 and 2020. Drought was the reason for lower grape prices in 2019. An interesting result indicates that grapes used in white wine production, regardless of whether they are dry or sweet, contribute to higher prices received by producers compared to red grapes.

Keywords: white and red grapes, price of wine grapes, yield, acreage, max and min temperatures.

INTRODUCTION

Grapes are among the most important commodities in the state of Texas. All grapes produced in the state are utilized by the local wine industry, which has been growing at an incredible pace. The total number of wineries increased from 100 to nearly 1000 over the last 20 years, making Texas the fourth-largest wine producer in 2022 (IOVW, 2022). The growth of the wine industry in the state has been bolstered by the increase in acreage dedicated to grape production. However, the expansion of the wine industry has outpaced the growth in grape production. Consequently, additional wine grapes needed by producers have been sourced from neighboring states and even California.

There are five wine grape-growing regions in Texas: High Plains & Panhandle, North Texas, Gulf Coast, West Texas, and Hill Country. In 2020, Texas wine grape growers produced a total of 7,100 tons of grapes from 5,140 bearing acres (NASS, 2020). The Texas High Plains & Panhandle region produces 73% of the wine grapes grown in the state (Cristal G., 2024). This region's geographic location and climatic conditions make it ideal for wine grape production. It is situated 3,400 feet above sea level and experiences hot, dry summers. The Hill Country region ranks second in grape growing and wine production. This region is known for its natural beauty and is the top tourist destination in Texas.

The soil map of Texas is divided into 15 major land resource areas, grouping similar soils, vegetation, and topography. Each wine-growing region in Texas is described by at least two or more land resource areas.[1]

Natural hazards in Texas's primary grape-growing regions pose a significant challenge to effective viticulture and meeting the state's demand for grapes. A research study surveyed grape producers in the area, revealing that most crop losses in Texas arise from biological and geophysical hazards, despite the growers' extensive professional experience, crop insurance, and hazard mitigation techniques (Townsend & Hellman, 2014). Growers in all regions, except the High Plains, identified biological hazards as the primary threat. Researchers ranked animal-related damage, fungal disease, Pierce's Disease, and insects among biological hazards from most to least damaging. Geophysical hazards, including late spring freeze, hail, wind, drought, and severe winter temperatures, were also recognized as particularly troublesome by growers across all areas of Texas. Wines labeled as originating from a specific American Viticultural Area (AVA) must consist of at least 85% grapes grown in that region (Texas Wine Grape Varieties, 2023). However, many producers in the state are pursuing a goal to produce Texas wine using 100% Texas-grown grapes. Therefore, grape production in the state must increase to meet this goal.

While working with state grape producers, Texas Tech University viticulturists were requested by the producers to identify the attributes and characteristics of grapes, along with other factors that influence wine grape prices. In response, this study aims to address this question and investigate whether the type of wine produced affects the price of grapes in Texas. To explore these issues, the research examines the grape varieties grown in the state, considering yields, production areas, location, climate variables, and time to address these questions.

Therefore, the two primary objectives of this research are: 1) to identify factors that significantly influence the price of wine grapes, and 2) to examine the variations in grape prices based on the type of wine produced in the state.

[1]Link to the map of Texas soil:
https://maps.lib.utexas.edu/maps/texas/texas_general_soil_map-2008.pdf

LITERATURE REVIEW

Currently, no literature has been found that identifies varietal characteristics and other factors of wine grapes that influence the price of grapes in the state of Texas. One possible reason for the lack of research findings in Texas is the limited availability of data related to this topic.

In general, numerous research studies have examined consumer attitudes toward quality attributes and characteristics of products. Agbola et al. explored how consumer attitudes are influenced by the quality characteristics of chickpeas in India. The authors utilized a linear hedonic price model and quality data from two varieties of chickpeas, based on 180 samples obtained from major markets in India. Empirical results indicate that physical quality characteristics and purity standards significantly influence consumption decisions in the Indian chickpea market (2002). Another study investigated the attributes and characteristics that affect the price of hotel rooms in Cyprus (Mitsis, 2022). Following a hedonic price analysis approach, the findings reveal that hotel rating, spa facilities, playgrounds, table tennis activities, and proximity to the bus station significantly affect hotel room prices.

Researchers use hedonic price models to estimate the marginal contribution of the individual characteristics of goods to the final price of a house as a product (Sirmans, Macpherson, and Zietz, 2005). They identify a set of factors – slanted roof, sprinkler system, double oven, and gated community- that positively affect the selling price of a house. On the other hand, their research shows that no attic space, proximity to a landfill or hog farm, or high voltage lines negatively affect the selling price.

Grapes as a product are described by characteristics such as color, texture, and nutritional content, including sugar, calcium, phosphorus, and vitamin A. Additional characteristics used to describe grapes include growth, form, and their suitability for cultivation in various regions and climate zones. Grapes used in wine production may be valued based on factors like berry color, acid profiles, phenolic content, sugar content, harvest time, and more. Recent research investigated how certain grape and wine characteristics affect the price of grapes (Cadot et al., 2010; Lee and Sumner, 2006; Golan and Shalit, 2008; Obreque-Slier et al., 2024).

There are numerous grape varieties, each with unique characteristics. Aroma is one of wine's most important sensory attributes and plays a crucial role in influencing wine quality (Cadot et al., 2010). Other studies indicate that, in addition to aroma, chemical and sensory attributes significantly contribute to evaluating the quality of grapes and wines (Gao et al., 2024). This study compared physicochemical parameters, organic acids, phenolic compounds, and aroma profiles of grapes and wines from six cultivars in China. Sensory evaluation of wine is performed using quantitative descriptive analysis. This analysis revealed that varieties with reduced sugar content are preferred by consumers. These varieties historically had lower yields. Additionally, the analysis allowed for the identification of varieties with varying phenolic content, ethyl decanoate, coumaric acid, and methyl decanoate, all of which contribute to the sensory characteristics of wine. The findings provide valuable knowledge for viticulturists and winemakers in selecting grape varieties.

A study by Golan and Shalit identifies and evaluates the quality characteristics of wine produced from grapes (2008). The authors use a hedonic price function expressed as a regression of price on its quality characteristics, considering the marginal contribution of each characteristic to the price. The data for the first-stage analysis includes the physical and chemical characteristics of wine – color, chemical composition, acidity, and residual sugar, along with a subjective blind-tasting evaluation by a panel of experts, which reflects consumer preferences. The tasting measurement uses the Davis scale (from 1 to 20) developed by enologists at the University of

California, Davis. This scale is designed with four main subjective characteristics in mind: visual appearance, aroma, taste, and overall balance. Results show wide variation in the marginal contribution of each characteristic to the quality of different wine varieties. The results for red wine reveal the importance of total acidity, sugar content, and harvest date. In the case of white wines, the distribution of acidity was the dominant attribute. In the second stage of analysis, the authors relate quality to price.

The question of how variety contributes to the observed variation in wine grape prices has been investigated in the past. Market prices of wine grapes were explained using location, variety, market power, and contracted quality by Lee and Sumner (2006). The authors use 10 years of data for 15 major varieties in California with 51,073 observations. They found that Pinot Noir has the highest price effect across varieties, followed by Merlot and Cabernet Sauvignon, compared to Zinfandel. Analyses offer a ranking of varieties across this sample. Thompson Seedless came out as the low-priced variety among 15 varieties considered. The market power effects model includes the number of buyers variable and keeps year, district, and variety variables as fixed effects.

Many recent studies identify a set of intrinsic characteristics that might affect the price of a product. Moreover, it is possible to specify extrinsic characteristics that would lead to the identification of credence cues. Recent literature suggests using credence as a class of quality properties. Credence may include nutritional value, health, ethics, or trust (Fernqvist and Ekelund, 2014).

Chilean researchers investigate the impact of topography and cultivation location on the polyphenolic profiles and sensory attributes of “Pais” heritage wines (Obreque-Slier et al., 2024). They found that the sensory characteristics of wines are related to the soil and climate of the localities. A close relationship is found between edaphoclimatic conditions of wine-growing areas and certain sensory properties of wine, such as color and mouthfeel (not aroma).

As seen from the literature review, hedonic modeling relates the price of a good to its various quality or cost attributes. Another study by Bombrun and Sumner (2003) examines a dataset of 8460 observations on prices of five premium varietal wines and 12 vintages from all regions of California. The results of the hedonic analysis indicate that variables such as variety, grape vintage, age at release, appellation of origin, and label designations like vineyard, estate, and reserve explain 72 percent of the variation in wine prices when weighted by the number of produced cases of each wine. This suggests that a price premium for a particular wine variety or appellation translates to a price premium for the corresponding wine grape variety and grape location.

Haeger and Storchmann used a hedonic price model to explain the retail prices of Pinot Noir wines from California and Oregon (2006). This study analyzes the determinants of wine prices, such as climate, wine scores based on expert knowledge, and variables related to the winemaker, in explaining the price of Pinot Noir. The findings show that temperature and precipitation, as well as the reputation of a winemaker, impact the price of wine. However, expert knowledge does not show a significant impact on the price of Pinot Noir.

Some researchers focus on investigating how environmental factors control grape wine quality (Fayolle et al., 2019). In addition to environmental factors, soil is a well-known variable affecting the production of wine grapes, as it provides water and nutrients to the grapevines. This research studies soil characteristics, root system development, and environmental factors as an integrated system. Results indicate that chemical soil characteristics, along with the dynamics of the water table, significantly impact the root development patterns of vines and, consequently, the quality of grape wine.

Relations between climate, wine grape price, and wine grape quality have been studied by many (Esteves & Orgaz, 2001; Resseguier et al., 2020; Webb et al., 2008). Their findings reveal a significant relation between wine grape quality and precipitation and temperatures in May. Webb et al. also examine the relationship between climate and the quality of grapes for different varieties (2008). Some varieties demonstrate a linear reduction in quality as a response to a warmer climate, while others show a quadratic relationship between the quality of grapes and increasing temperatures. The literature review reveals a set of variables that are found to be significant in explaining the price of grapes and shows that the hedonic price model can be selected and used as an appropriate model for the analysis.

DATA

Texas wine grape surveys collected by the National Agricultural Statistical Services (NASS) of the USDA for the years 2015, 2017, 2019, and 2020 are used in this research. These surveys provide detailed information on grape varieties, which we use to classify each variety into one of the following wine categories: red, white, or other. Additionally, the surveys provide information for the five regions on acreage, yield, grape price, and production. Based on the data, we have constructed two balanced panel datasets for analysis. The first one is a Regional Panel, based on five wine growing regions in Texas: Texas High Plains and Panhandle, North Texas, South Texas and Gulf Coast, West Texas, and Hill Country. The second one is a Wine Type Panel, based on five wine categories produced in Texas: dry red, sweet red, dry white, sweet white, and other.

The maximum and minimum temperatures for five regions were obtained from the National Climatic Data Center (CDO, 2024). Minimum temperature is estimated as the lowest average January temperature across five regions, and Max temperature is calculated as the highest average temperature in August across five regions of Texas. The average price of red and white wines in Texas is obtained from the currently published prices (Beauchamp and Novak, 2023). The prices of red and white wine are adjusted for inflation using the US Consumer Price Index, and the price of grapes is adjusted for inflation using the US Producer Price Index found at the Bureau of Labor Statistics site. Table 1 presents a summary of the descriptive statistics for the variables used in this study. Due to its size descriptive statistics table is presented in the appendix.

MODEL AND RESULTS

Regional Panel Data

The empirical hedonic price model is used to explain the prices of grapes used in wine production in Texas for regions $i = 1, \ldots, N$ which are observed over multiple time periods $t = 1, \ldots, T$. The model is specified as follows:

$$lnPGD_{it} = \alpha + \alpha_1 Prod_{it} + \alpha_2 MaxTemp_{it} + \alpha_3 MinTemp_{it} + \alpha_4 2017_i + \alpha_5 2019_i + \alpha_6 2020_i + \varepsilon_{it}, \quad (1)$$

Where $lnPGD_{it}$ is the natural log of average deflated price of grapes per ton used in producing red or white wine, $Yield_{it}$ is the yield in tons per acres for each wine type, $Prod_{it}$ is the production in tons for each wine type, $MaxTemp_{it}$ is the average highest temperature in August in Texas, $MinTemp_{it}$ is the average lowest temperature in January in Texas, 2017_i, 2019_i, and 2020_i are year specific dummy variables, and ε_{it} is the error term. Model coefficients were estimated using the panel data regression with random effects in SAS (**proc panel**).

Two separate models were estimated using identical variables: one for grapes used in white wine production and the other for grapes used in red wine production. The time dummy variable for the year 2015 was excluded. The results from these two regressions are reported in Table 2. Both models exhibited good explanatory power: the first model explained 73 percent of the variation in the price of white wine, and the second model explained 63 percent of the variation in the price of red wine.

The impact of time on grape prices showed mixed results. In Model 1, which analyzes white wine grape prices, the years 2017 and 2020 were associated with significantly higher prices compared to the base year 2015. Conversely, the dummy variable for 2019 indicated a significant negative effect on grape prices relative to 2015. Model 2 shows significant and positive differences in the price of grapes used in red wine production in the year 2020. Minimum temperature had a significant negative effect on grape prices in both models, while Maximum temperature positively influenced grape prices in the white wine model. The production variable had a negative impact on prices in the white wine model, but this effect was not statistically significant in the red wine model.

Table 2. Results for two models: Model 1 represents grapes used in white wine production, and Model 2 represents grapes used in red wine production.

	Model 1		Model 2	
Variable	Estimate	P-value	Estimate	P-value
Intercept	6.20416**	<.0001	7.73532**	<.0001
Production	-0.00004**	0.0074	-0.00001	0.2324
Min Temp	-0.01789**	0.0018	-0.00942**	0.0275
Max Temp	0.01927**	0.006	-0.00018	0.9776
2017	0.09810**	0.0076	0.028424	0.3995
2019	-0.12644**	0.0106	0.021004	0.7886
2020	0.08841	0.1047	0.18534**	0.003
R^2	0.73		0.63	

**, * indicate significance at the 5% and 10%, respectively

Wine Type Panel

The following regression, referred to as Model 3, explains the prices of grapes used in wine production for the entire state of Texas based on the type of wine produced from the grape varieties $j = 1, \dots, N$, which are observed over multiple time periods $t = 1, \dots, T$. The model is specified as follows:

$$lnPGD_{jt} = \alpha + \alpha_1 Acres_{jt} + \alpha_2 Yield_{jt} + \alpha_3 lnPWD_{jt} + \alpha_4 MinTemp_t + \alpha_5 DRD_t + \alpha_6 DRS_t + \alpha_7 DWD_t + \alpha_8 DWS_t + \varepsilon_{jt}, \quad (2)$$

where $lnPGD_{jt}$ is the natural log of average deflated price of grapes, used in the production of j types of wine in Texas, $Acres_{jt}$ is the total number of acres used in the j type wine production in tons, $Yield_{it}$ is the average yield for wine type j, $lnPWD_{jt}$ is the natural log of average wine prices for wine type j, $MinTemp_t$ is the lowest average temperature in January in Texas, four dummies in the regression represent four types of wine – red/dry (DRD), red/sweet(DRS), white/dry(DWD), and white/sweet(DWS) wine, and ε_k is the error term.

Model 4 is a modified version of Model 3, where the dummy variables for red/dry (DRD) and red/sweet (DRS) are combined into a single category representing all red wines. Similarly, the dummy variables for white/dry (DWD) and white/sweet (DWS) are merged into one category representing all white wines. Hence, the equation for Model 4 is specified as follows:

$$lnPGD_{jt} = \alpha + \alpha_1 Acres_{jt} + \alpha_2 Yield_{jt} + \alpha_3 lnPWD_{jt} + \alpha_4 MinTemp_t + \alpha_5 DR_t + \alpha_6 DW_t + \varepsilon_{jt}, \quad (3)$$

where DR is the dummy that represents the effect of grapes used in red wine production on the price of grapes, and DW is the dummy that measures the effect of grapes used in white wine production on the price of grapes. The goal of this model is to investigate whether the type of wine (red or white) has a significant effect on the price of Texas wine.

The coefficients in Model 3 and Model 4 were estimated using panel data regression with random effects in SAS (**PROC PANEL**). In both models, acreage is positively and significantly associated with grape prices, whereas yield exhibits a significant negative relationship. The logarithm of the deflated wine price ($lnPWD$) has a positive and significant effect on grape prices in Model 4, indicating that grape prices tend to rise as wine prices increase. The coefficients for the dummy variables representing white wine types (dry and sweet) are positive and significant in both models, indicating that grape prices are higher for white wine varieties relative to other types. Additionally, Model 4 also shows a negative and significant effect of red wine production on grape prices. The two overall Texas models exhibited good explanatory power of 64 and 63 percent, respectively.

Table 3: Results for the overall Texas models.

Model 3			Model 4		
Variable	Estimate	p-value	Variable	Estimate	p-value
Intercept	8.34465**	<.0001	Intercept	8.11399**	<.0001
Acres	0.00011**	0.0425	Acres	0.00013**	0.0059
Yield	-0.11057**	0.0219	Yield	-0.11477**	0.0002
lnPWD	0.22515	0.4355	*lnPWD*	0.32352**	<.0001
Min Temp	-0.04008**	0.0381	Min Temp	-0.04073**	0.0232
DRD	-0.17125	0.3795	DR	-0.26394**	0.0392
DRS	0.03864	0.7652	DW	0.13836**	<.0001
DWD	0.15964**	0.0092	R^2	0.63	

URL: http://doi.org/10.14738/abr.1305.18757

DWS	0.11445**	0.0375			
R^2	0.64				

**, * indicate significance at the 5% and 10%, respectively

DISCUSSION

This study employed four hedonic price models to investigate the factors influencing the price of grapes used in wine production. Our findings resonate with the earlier research findings related to wine grapes.

The first two models demonstrate that the increased production of white and red grapes leads to a greater supply in the market and a decrease in grape prices. The prices of white grapes were significantly higher in 2017 and 2020 compared to the year 2015, while the prices of red grapes were significantly higher in 2020 compared to 2015. The actual Texas data indicates that in 2020, grape production in Texas increased by 22%, the number of bearing acres rose by 11%, and the total value of wine grapes produced increased by 20% since 2017 (Wilfong, 2020).

Low temperatures in January throughout all productive regions result in a decrease in yields due to plant damage, a reduction in grape yield, and consequently, an increase in grape prices. The freezes of 2019 impacted the High Plains region, which accounts for 73 % of Texas's grape production. High temperatures in August significantly drive up the prices of white grapes, while maximum temperatures do not substantially affect the prices of grapes used for red wine. Increased temperatures speed the phenological development of the grapevines causing them to ripen in warmer parts of the growing season, which may impact red grape quality more than white grape quality (Delelee, 2024). In late summer and early fall of 2019, Texas faced severe drought conditions across Central, Southern, and Eastern West Texas. This led to a poor overall grape harvest in 2019 owing to the drought, which adversely affected the price of white grapes only.

The two later models, Models 3 and 4, produced consistent results. These results demonstrate that an increase in planned acres of grapes contributed to a more stable and competitive wine market. The rise in acreage leads to improvements in the quality and quantity of Texas grapes, which in turn enhances competitiveness in the Texas wine market and makes it less reliant on out-of-state grapes. The price of wine in the state is positively and significantly related to the price of grapes in the last model, as grapes represent a significant cost in wine production.

Grape yield exhibits an inverse relationship with grape prices in models 3 and 4. This is an expected result, even though there has been a lot of uncertainty in the grape market in Texas, which has led to annual fluctuations in grape prices. Higher yield increases overall output, leading to a more competitive market and reduction in price, but factors like grape quality, weather, and demand from wineries have an additional effect on the grape price.

Model 3 demonstrates that growing white grapes contributes to higher grape prices, while red grape varieties generally offer lower prices to producers. Further categorization of grapes by dry, sweet, and rosé/bubbly indicates that grapes used in white wine production, regardless of being dry or sweet, lead to increased grape prices. Red grape varieties show a significant negative contribution to the price of grapes in the last model. It is a well-established fact that red wine is priced higher than white wine due to the greater costs associated with its production. Why do our results suggest otherwise? An examination of our dataset reveals that the average price of red grapes was $ 2,081 per ton in 2015 but declined to $ 1,869.50 per ton in 2020, while the average price of white grapes was $ 1,536.40 per ton in 2015, increasing to $ 1,635.80 per ton by 2020. The price of red grapes fell by 10.2 percent during this period, whereas the price of white grapes increased by 6.5 percent. The decline in red grape prices is attributed to uncertainty and variability in weather patterns across the main grape-producing regions, including the High Plains and Panhandle region.

Another factor contributing to the rise in white grape prices is the changing attitudes and preferences of wine consumers across Texas, the US, and the world. According to the International Organization of Vine and Wine, the focus of consumers and producers is shifting from red wine to white wine (IOVW, 2023). In the US, overall white wine production holds the largest market share, accounting for 50 to 60% of the total output during the 2000-2021 period (IOVW, 2023). The same report states that worldwide red wine consumption has decreased by more than 15 percent since 2007. This national trend toward white wine consumption, particularly among young consumers, is driving the shift. Additionally, there is a growing preference for lower-alcohol wines favored by young and more mature consumers. The significant growth in the number of new wineries, which produce a larger share of white wine, contributes to the increased demand for white grapes and subsequently drives up white grape prices. According to the Texas Alcoholic Beverage Commission, the number of Texas winery permits increased by over 63 percent between 2015 and 2020 (TABC, 2024).

All four models in the study explained between 63 percent and 73 percent of the variation in grape prices.

Future research will examine whether grape variety influences grape prices. Alongside varying grape varieties, other significant factors affecting grape prices will be integrated into a random effects model. Expanding the current dataset will also improve the estimation of quantitative relationships among variables. A few additional factors could be included: precipitation, soil characteristics, and attributes of grapes such as flavor, body, tannin level, and acidity. Researchers are searching for additional years of survey data for 75 grape varieties grown in Texas. This would expand the current dataset and yield more efficient results.

References

Agbola, F.W., T. G. Kelley, M. J. Bent and P. P. Rao, 2002. “A Hedonic Price Analysis of Quality Characteristics of Chickpea in India,” paper presented at the 46th Annual Conference of Australian Agricultural and Resource Economics Society, 13-15 February 2002, Canberra, Australia.

Beauchamp, E. and L. Novak, 2023. “This is How Much a Bottle of Wine Costs in Your State,” Today’s Homeowner, todayshomeowner.com, accessed 03/08/2024.

Bombrun, H. and D. A. Sumner, 2003. “What Determines the Price of Wine? The Value of Grape Characteristics and Wine Quality Assessments”, Agricultural Issues Center, Issues Brief, University of California, No. 18, January 2003.

Cadot, Y., S. Caille, A. Samson, G. Barbeau, and V. Cheynier, 2010. Sensory dimension of wine typically related to a terroir by Quantitative Descriptive Analysis, Just About Right Analysis, and typicality assessment. Analytica Chimica Acta, Volume 660, Issues 1-2.

Climate Data Online, National Centers for Environmental Information, https://www.ncdc.noaa.gov/cdo-web/, visited on April 4, 2024.

Cristal G., 2024. "Unveiling the Unexpected: A Guide to Texas Wine Regions." Grape and Barrel, https://grapeandbarrel.com/texas_wine-regions/

Delelee L.M., A. J. Woodill, and P. A. Skinkis, 2024. "Climate Change Projections Indicate Shifts in Phenology for Willamette Valley Pinot Noir," American Journal of Enology and Viticulture, 76:0760003, DOI: 10.5344/ajev.2024.24033.

Esteves, M. A., and M.D. Orgaz, 2001. The influence of climatic variability on the quality of wine. International Journal Biometeorology 45 (1), 13–21. doi:10.1007/s004840000075

Fayolle, E., Follain, S., Marchal, P., Chéry, P., and Colin, F. 2019. Identification of environmental factors controlling wine quality: A case study in Saint-Emilion Grand Cru appellation, France. Science of the Total Environment. 694 133718 doi:10.1016/j.scitotenv.2019.133718

Fernqvist, F. and L. Ekelund, 2014. "Credence and the effect on consumer liking of food – A review", Food Quality and Preference, Vol. 32, pp. 340-353. (www.elsevier.com/locate/foodqual)

Gao, F., Guan, L., Zeng, G., Hao, X., Li H., and H. Wang, 2024. "Preliminary characterization of chemical and sensory attributes for grapes and wines of different cultivars from the Weibei Plateau region in China." Food Chemistry: X. Vol. 21, March 30, 101091, https://doi.org/10.1016/j.fochx.2023.101091

Golan, A. and H. Shalit, 2008. "Wine Quality Differentials in Hedonic Grape Pricing," Journal of Agricultural Economics, Vol 44. Issue 2, pp.311-321, https://onlinelibrary.wiley.com/doi/10.1111/j.1477-9552.1993.tb00274.x

Haeger, J. W., and Storchmann, K. 2006. Prices of American pinot noir wines: Climate, craftsmanship. Critics. Agric. Econ. 35 (1), 67–78. doi:10.1111/j.1574-0862.2006.00140.x

International Organization of Vine and Wine, 2024. Focus OIV 2023: Evolution of world wine production and consumption by colour. https://www.oiv.int/sites/default/files/documents/OIV-FOCUS-2023_Evolution_of_the_world_wine_production_and_consumption_by_colour_4.pdf

Lee, H. and D. A. Sumner, 2006. "Explaining Market Prices for Grapes: Location, Variety, Market Power and Contracted Quality," 3rd International Wine Business Research Conference, Montpellier, 6-8 July, http://academyofwinebusiness.com/wp-content/uploads/2010/05/Lee.pdf

Mitsis, P. 2022. "Hedonic Price Analysis of Hotel Rooms in Cyprus." The Journal of Hospitality Financial Management, Vol. 30, No. 1, pp.41-50.

National Agricultural Statistical Service, USDA. Census of Agriculture 2015, 2017, 2019, and 2020. https://nass.usda.gov/Statistics_by_Subject/

Natural Resources Conservation Service, USDA. 2008. General Soil Map of Texas. https://maps.lib.utexas.edu/maps/texas/texas-general_soil_map-2008.pdf

Obreque-Slier, E., Lopez-Solis, R., Medina, F., Seguel, O., Valentin, D., Parr, W., and M. Medel-Maraboli, 2024. "Diverse impact of topography and cultivation location on the polyphenolic profiles and certain sensory attributes of 'País' heritage wines from the Maule dryland region (Chile)," Food Research International, Vol. 197, Part 1., December, 115195, https://doi.org/10.1016/j.foodres.2024.115195

Rességuier, L., Mary, S., Le Roux, R., Petitjean, T., Quénol, H., and van Leeuwen, C. 2020. Temperature variability at local scale in the Bordeaux area. Relations with environmental factors and impact on vine phenology. Front. Plant Sci. 11, 515. doi:10.3389/fpls.2020.00515

Sirmans, G.S., D. A. Macpherson, and E. N. Zietz, 2005. The Composition of Hedonic Pricing Model, Journal of Real Estate Literature, Vol. 13, No. 1, pp. 3-43.

Texas Alcoholic Beverage Commission, 2024. https://tabc.texas.gov

Texas Wine Grape Varieties, 2023. Texas Wine & Grape Growers Association, August 7, https://www.txwines.org, accessed November 12, 2024.

Townsend C.G. and E. W. Hellman, 2014. "Viticulture in Texas: the challenge of natural hazards Viticulture in Texas: the challenge of natural hazards," Journal of Wine Research, Vol. 25, Issue 4, pp.211-228, https://www.tandfonline.com/doi/full/10.1080/09571264.2014.967338#d1e315

Webb, L.B., P. H. Whetton , and E. W. R. Barlow. 2008. Modelling the relationship between climate, winegrape price and winegrape quality in Australia, Climate Research, Vol. 36: 89–98, 2008 doi: 10.3354/cr00739

Wilfong, S. 2020. Texas grapevines by the number: what's trending up, what's trending down, and what it means for Texas wine. Texas Wine Lover, online journal, https://txwinelover.com/2020/04/texas-grapevines-by-the-numbers-whats-trending-up-whats-trending-down-and-what-it-means-for-texas-wine/.