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Article

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Analysis of structural changes on grape grower's return per ton: A case study of developing American Viticultural Areas

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Abstract

As of 2012 the United States has become the world's leading consumer of wine (Wine Institute, 2011). In Illinois alone this industry has created an economic impact around \$320 million (MKF, 2009). The presence of a distinguishing terroir is one of the prerequisites for the establishment of a federally recognized American Viticultural Area (AVA). Wineries in the U.S. are using these geographic designations and labels to differentiate their wines and increase the consumers' confidence (Love, 1997). The TTB granted the Shawnee Hills, located in southern Illinois, this designation at their request in 2006. The goal of this research is to determine the economic impact of a regional designation on a wine-producing region. The next step in the discovery of this goal is to examine less recognized wine-producing regions with an established AVA designation and a wine culture in place. We have chosen two California AVAs, Lodi and the Central Coast AVAs. Using a regression model we have attempted to discover the source of these regions' growth in grower return. Our results show the significance of achieving an AVA status, and the formation of regional quality wine standards program for that AVA.

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Keywords: Economic return; Grape production; American Viticultural Areas

1. Introduction

Since the end of Prohibition in the USA, wine consumption has grown by a noticeable 751 million gallons a year. United States wine consumption per resident increased by over 900% from 1934 to 2012 from 0.26 to 2.73 gallons and is trending up (Wine Institute, 2011). Grapes are now the highest value crop in the country and the grape crop in the United States has more than tripled over the last two decades. In Illinois alone there are over 90 wineries (MKF Research LLC, 2009). About 85% of these wineries have been established within the last fifteen years. The average annual production of Illinois wine is 357,000 gallons.

The industry provides over 2,000 full-time employment positions. With total revenues of \$247,513,000 and total wages paid of \$71,466,000, the full economic impact is almost \$319 million (MKF Research LLC, 2009).

Many reasons have been identified as to why this resurgence of winegrape and wine production has occurred in Illinois. These include the new crop appeal, a growing understanding of which grape varieties are best suited to its *terroir*, a more fluid procurement process of out of state grapes and juice, and the rising demand for wine (MKF Research LLC, 2006).

From the grower's perspective, the most important reason for the growing grape and wine production might be the product's profitability. When compared to the staple crops of Illinois, corn and soybeans, winegrapes are considerably more profitable per acre. Revenue from soybeans or corn can fall in the range of \$300 to \$400 an acre. Winegrape revenue can fall in the range of \$4,000 to \$6,000 an acre. This allows many vineyards to make a profit even after including labor costs (MKF Research LLC, 2006).

The wineries and vineyards of Southern Illinois and specifically those within the Shawnee Hills American Viticultural Area

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(AVA) are leading the way in the resurgence of wine in Illinois. Five of the top 17 counties that contain 54% of Illinois' vineyards are in part within the boundaries of the Shawnee Hills AVA including the top two grape producing counties, Jackson and Union counties, with 32% of all grapes planted within the southern region of the state. Of the top 17 counties that contain 62% of Illinois' wineries, five are again within the boundaries of the Shawnee Hills AVA, including the top two, Union and Jackson (Shoemaker, 2005). Furthermore the *terroir* of Southern Illinois is the most conducive to the growth of vinifera grapes that currently sell for higher prices than both natives and hybrids. Expanding the growth of vinifera grapes is of great importance to the maturation of the wine industry in the state (MKF Research LLC, 2006).

The *terroir* of Southern Illinois is characterized by rolling hills with sandy and clay loam soils, which are both very favorable conditions for the growth of grapes. *Terroir* is a concept relating the sensory attributes of the wine to the environmental conditions in which the grapes are grown. The word “*terroir*”, from the French, can be translated as a “sense of place” and describes a wine's geographic, geological, and climate based characteristics as they relate to the grape's genetic character. The climate of Southern Illinois is more temperate; with low levels of frost. Its consistent summer breezes help to keep the grapes dry even with frequent showers. The favorable *terroir* elements supported wineries and vineyards, which began opening in the area in 1984 with Alto Vineyards. In 1995 enough wineries existed for the establishment of the Shawnee Hills Wine Trail, and in only seven years it had catered to over 100,000 visitors and grossed over \$2 million. All of these factors contribute to Shawnee Hills' unique *terroir*, and are part of what encouraged the decision to petition the Alcohol and Tobacco Tax and Trade Bureau to become an American Viticulture Area, a petition was granted in December 2006 (MKF Research LLC, 2006). An AVA designation allows wineries to identify the geographical origin of the grapes used in their wine production, and prevents producers from outside the AVA from making false claims about the nature and origin of their own wines (Cross et al., 2011).

Despite the rising revenues, job growth, and tax dollars that the wine industry of the Shawnee Hills AVA produces, it is struggling to develop the consumer interest that many industry experts feel its unique *terroir* could provide and its wines deserve. For example, the *terroir* of the wine industry in California accounted for over 199.6 million cases of wine with a retail value of \$18.5 billion. Many experts see the continued growth of the wine industry throughout all of the 50 U.S. states, as Americans are increasingly interested in lifestyles with food and wine and its current per capita consumption is only about 5% of that of France or Italy (Wine Institute, 2011). The *terroir* of Southern Illinois is unlike any other in the world and has resulted in the production of high quality wines, many of which that have won awards at international wine competitions. The Shawnee Hills AVA is an area that has the foundations present for the capture of some of the growing American market share. Illinois is the fifth largest wine market in the United States

and the city of Chicago is the third largest US metropolitan wine market (MKF Research LLC, 2006).

Furthermore Americans are not only demanding more wine, they are demanding better wine, and there is potential for growth in the wine quality reputation of the Shawnee Hills where theoretically the best grapes in Illinois can be grown. However thus far this has not translated into national consumer recognition for the wines of the Shawnee Hills AVA as 70% of all cases of wine are sold in winery tasting rooms (Ward, 2012), and 60% of all visitors to the tasting rooms are local (defined as coming within 50 miles). The present research is important because it will potentially help to find a way to bring broader consumer recognition to the 20 wineries in the Shawnee AVA and their wines. Furthermore as wine consumption and wine awareness continue to rise in the United States, the industry has the potential to facilitate overall economic growth.

The specific objective of the present research is to determine the most substantial method of improving the reputation of wine quality in the Shawnee Hills AVA. To accomplish the objective, American Viticultural Areas similar to the Shawnee Hills that possess a unique and advantageous *terroir*, while also exhibiting a similar trend of growth in wine production were selected for analysis. The areas chosen are the Lodi and the Central Coast AVAs, both located in California. These areas were chosen because only relatively recently did many consumers associate quality with their wines. Furthermore both the Lodi and the Central Coast areas were recommended by industry professionals based on common structural changes that led to increased price for grapes and mutual data availability. In examining these areas, we asked two primary questions: What were the structural changes in production or marketing that best explain or predict the change in grower's return per ton (price)? Are these effects greater than zero and statistically significant?

The present research will help to identify events or strategies that helped improve the price of the winegrapes in the Lodi and Central Coast AVAs. It is widely understood that higher winegrape prices should be found in regions of higher quality winegrape production. Furthermore the Regulatory Flexibility Act provision within any U.S. Alcohol and Tobacco Tax and Trade Bureau (TTB) approved AVA petition states:

The proposed regulation imposes no new reporting, recordkeeping, or other administrative requirement. Any benefit derived from the use of a viticultural area name would be the result of a proprietor's efforts and consumer acceptance of wines from that area.

AVA are much less detailed and proscriptive when compared to geographic appellation designations granted in many European wine regions which can dictate what grapes may be grown, maximum grape yields, alcohol level, irrigation, and other quality factors, before an appellation name may legally appear on a wine bottle label (Love, 1997). The only requirement to use the AVA name on the wine label is that 85% of the wine must have come from grapes grown within the geographical AVA boundaries. Since AVAs were first

introduced in 1982 many wineries in the U.S. are turning to more geographic designations to distinguish their wines and today there are well over 100 in the U.S. (Love, 1997). Therefore this research should produce an introductory blueprint of growth from which the grape growers and wine producers in the Shawnee Hills AVA can learn. Using the knowledge from the present research analysis, efforts and investment dollars can be allocated to actions of economic impact, and the Shawnee Hills AVA can benefit growers, producers, and consumers.

2. Previous work

Cross et al., 2011 attempted to place an economic value on *terroir* by conducting a hedonic pricing analysis of the sales of vineyards in Oregon's Willamette Valley, using data on vineyard value per acre, "vinevalue," provided by the Northwest Farm Credit Services. The results of their study showed no evidence of significant effects of a designated appellation on vineyard prices; however they did find that vineyard prices are strongly determined by a location within specific sub-AVAs. Furthermore they found the physical characteristics of vineyards are not priced implicitly in land markets, which could imply that large AVA designations do not have a direct connection to *terroir*. Still their results did show that *terroir* makes an economic difference to both consumers and producers. A premium was placed on all parcels sold within the sub AVAs and the bottle prices were relatively high which showed to the researchers that the consumers were willing to pay more for the chance to drink these AVA's wines (Cross et al., 2011).

Consumers were willing to pay more for the chance to drink *terroir* influenced AVA wines (Cross et al., 2011). The Lodi Rules Sustainable Winegrowing Program (SWP), was established in 1995 by the Lodi Winegrape Commission (LWC) with the goal of consistently transferring the *terroir* influences to their wines and effectively translating this to consumers. Hillis et al. (2010) researched the winegrower perceptions of the LWC and its Lodi Rules Sustainable Winegrowing Program. Discovering the grower perceptions of this program was deemed important because similar programs have been already begun to be established at the California state level or soon will be established in other winegrape growing regions and other agricultural commodities. Both surveys and semi-structured interviews were used to gather information on the perception of the program's success from the grower's perspective. Survey respondents were asked whether or not they participate in various LWC outreach and education activities, how successful they think the LWC has been across a range of objectives, and the degree to which they support local and statewide programs (Hillis et al., 2010).

The results of the research showed participation in LWC activities ranges from over 90% of growers (reading the LWC newsletter) to less than 40% (completion of Lodi Rules third-party certification program), with lower participation in more resource intensive activities. Seventy percent of growers think the LWC has improved consumer perception of the region. They also rated the LWC's achievement of environmental

objectives more highly than they did economic objectives, particularly reducing input costs and streamlining operations. Survey respondents were mostly supportive of the statewide California Sustainable Winegrowing Alliance, as well as their certification programs, but they did prefer the use of local programs (Hillis et al., 2010).

The researchers thus concluded that growers are heavily influenced by economic factors, and therefore are more likely to avoid apparently costly program participation activities. Even with the improving consumer perception of the region, growers are struggling to associate financial success with the LWC and its SWP program. If the programs were able to more visibly reduce the cost of participation and more importantly demonstrate that an initial investment in time, money, or commitment can yield a benefit to growers in the long-term, then grower's perceptions may change (Hillis et al., 2010).

Growers surveyed in Hillis, Luebell, and Hoffman's research are an important part of the wine industry community in the Lodi AVA, but they are not alone. Shaw et al. (2011) conducted a study on the community aspect of regional regulations. The article analyzed the evolution and effectiveness of the Sustainable Winegrowing Program in Lodi, California. They sought to specifically discover the complementary effects of three different theories of wine-grape grower behavior; diffusion of innovation, cultural change, and social capital. The researchers hypothesized that participation in sustainable partnerships creates more positive attitudes toward such sustainable partnerships and increases adoption of such practices. In order to discover whether the relationship between program participation and sustainable practice adoption exists, the researchers created a regression model based on the findings of two separate surveys in 1998 and 2003 conducted by the Lodi Winegrape Commission. These surveys assessed grower's impressions of quality, timeliness, and usefulness of the Lodi Winegrape Commission's educational outreach programs (Shaw et al., 2011).

The results of Shaw, Luebell, and Ohmart's regression analysis confirmed that participation in the Sustainable Winegrowing Program was positively associated with the adoption of sustainable practices. Although the results of the analysis were not sufficient to claim that partnerships are guaranteed to reach longer-term goals of sustainability, they do provide evidence of the necessary short-term goal of adoption. Furthermore, grape growers anticipate strong emergence of a green market for wine. This is important, as there exists a strong link between consumer perceptions of regional reputation and economic success those wine regions (Shaw et al., 2011). This is consistent with the findings of Cross et al. (2011) regarding consumer's willingness to pay more for wines based upon their geographic designation.

2.1. World wide quality studies

International studies have been conducted analyzing quality control systems as well. Foti et al. (2011) conducted a specific assessment of the result of quality control systems in the Sicilian winemaking industry. They conducted a multi-variable

analysis of information collected using ad hoc gathering instruments of principal components. They specifically looked at the implementation process of each quality program and the level of satisfaction reached by each company. They found that quality is an integral tool in the optimization of the management and production process. Furthermore, the reputation and the value of production of wine are increased. These effects accomplish a number of significant benefits such as breaking into new markets, guaranteeing product quality and safety, traceability, environmental protection, and the improvement of overall performance. They concluded that heightened consumer demand for higher quality and standardized products was a primary driver of this shift (Foti et al., 2011). This is consistent with the findings of both Cross et al. (2011) and Shaw et al. (2011), highlighting the importance of quality production and regional reputation across the global wine market.

Chiodo et al. (2011) published a paper analyzing how different aspects related to regulations can influence a consumer's quality perception and what value is attributed to those wine products. Unlike previous studies, which examined the effects of single quality factors, they sought to examine the product as a whole. They therefore utilized an economic methodology of conjoint analysis that considered both the combination of all characteristics of the wine, and the contribution of every factor to the creation of value for the consumer. Conjoint analysis allows researchers to determine the importance of specific attributes or aspects of a product (Chiodo et al., 2011).

They hypothesized that consumers' preference for higher quality would allow for wineries to institute more restrictive rules and incur higher costs in order to differentiate their wines and achieve that higher quality. Specifically provisions in wine labeling and presentation, origin and quality identification would permit the consumer to separate higher quality products from lower quality products and differentiate their willingness to pay. However, this would only be possible if consumers were able to recognize these differences and assign a higher value to certain quality aspects. They felt that this was substantial as wine labeling and presentation can modify consumers' perceptions and preferences. Therefore they considered the following aspects related to regulation provisions that are often used by wineries to differentiate their products in labeling and presentation: organic farming, using additional producer organization brands (PDOs), specific indications about production methods such as name of producer and bottler, and the content of sulphur dioxide in the wines (Chiodo et al., 2011).

The results of Chiodo, Casolani, and Fantini confirmed that aspects of wine labeling and presentation directly linked to regulatory policies affect Italian consumer perception, especially when linked to quality control, naturalness, and safety aspects. Furthermore, attributes such as the membership of a Protected Designations of Origin Consortium (DOC) and the indication of production methods, exhibit higher importance than the organic certification. In addition, the differentiated attribution of quality to brand DOC versus PDO accentuates the need for government policymakers to inform consumers in more efficient ways. Confusion needs to be reduced. This

answers a portion of the question posed by grape growers in Hillis et al. (2010) study regarding whether the investment in time, money, and commitment can yield a benefit to growers long-term, as it shows that more restrictive rules and the incurring of higher costs is sometimes necessary in order to differentiate wines and achieve higher quality.

2.2. Regional domestic impacts

Rendleman et al. (2002) used an IMPLAN impact analysis to measure the contribution of the grape and wine sectors of the Illinois economy. They then divided the areas of impact into sections: effect of Illinois grown grapes, the effect of wine sales using only Illinois grown grapes, and the total effect of Illinois wine sales. They then established a regional purchase coefficient (RPC) of the ratio of local to total purchases of grapes. The RPC is the portion of total input used that was either produced by a local winery or grape grower. They then studied the economic contributions of Illinois grapes alone and discovered that in 2000, 530 t of grapes were produced resulting in \$477,000 in sales, with the price per ton falling in the range of \$600 to \$1600 per ton. These results represent \$333,839 in value added. As previously mentioned, the grape sector is connected to the rest of the economy through the purchasing of inputs and the additional income produced by sales that is spent. Thus with these factors included, the total economic impact of grapes was \$876,370 (a combination of sales (direct), input purchases (indirect), and the induced impact (sales revenue spent) (Rendleman et al., 2002).

Next the researchers examined the impact of wine produced from Illinois grown grapes. They discovered that the 530 t of Illinois grapes produced in 2000 went on to make approximately 74,000 gallons of wine resulting in a total impact of \$6,516,405. This total impact includes \$3,353,395 of direct winery sales, plus \$1,076,152 of indirect sales, and \$2,086,858 of induced impact (Rendleman et al., 2002).

Only 31% of all Illinois wines in 2000 were produced using nothing but Illinois grapes. The total output effect is \$18,998,366, with the indirect portion equaling \$2,209,771 and the induced effect equaling \$6,013,443 (Rendleman et al., 2002).

The researchers concluded through their IMPLAN analysis that if the existing trends in Illinois wine continued, by 2005 Illinois grape production would equal the amount of 857 ac, a necessary amount to meet current winery needs, thus eliminating most out of state grape importation. They hypothesized that if wine production continued to grow at the rate of 6% per year there would be 31 wineries by 2002 (Rendleman et al., 2002).

Through the information provided by NASS conducted in 2011 we now know that these estimates have been easily surpassed as there were 1066 grape producing acres, and 105 wineries (Ward, 2012). However this has not eliminated the need to import a majority of grapes used in production as Rendleman et al. hypothesized. As of 2011 only 44% of total gallons produced of Illinois wine is the result of Illinois grapes. However in the southern region of the state 83% of total gallons produced is the result of Illinois grapes (Ward, 2012). This is a favorable percentage as many midwest wine quality

programs rely on the use of regional fruit as a source of differentiation (Edwards, 2011).

3. Model & data

In order to investigate the relationship between the dependent variable, weighted average price per ton, and the identified structural change explanatory variables, a regression model was created. To determine if any of these events had a substantial impact on the region's grower return per ton we use an inverse demand function, with dummy variables linked to particular structural changes in Lodi and the Central Coast. The structural events identified as potentially being most influential are (1) the approval of each region's AVA designation, (2) the formation of the regional wine industry groups, and (3) the creation of a regional wine quality program.

Model:

$$\text{Price} = \beta_0 + \beta_1 \text{Crush} + \beta_2 \text{IPM} + \beta_3 \text{SWP} + \beta_4 \text{LRW} + \beta_5 \text{PHC} \\ + \beta_6 \text{SEAL} + \beta_7 \text{ACRES} + \beta_8 \text{Trend} + \varepsilon$$

where:

Price = price per ton.

Crush = total production in tons.

IPM = implementation of integrated pest management program.

SWP = creation of a sustainable winegrowing program.

LRW = printing of the Lodi Rules Workbook.

PCH = beginning of Protected Harvest certification.

SEAL = use of the Lodi Rules label seal.

ACRES = the achievement of almost 25 percent of all vineyard acres certified sustainable.

Trend = trend variable for the years 1976 through 2012.

A strong link exists between consumer perceptions of regional reputations and the economic success of that region (Shaw et al., 2011). Each of the independent variables represents a source of regional identification. Furthermore each is an example of TTB approved AVA efforts to derive benefits from the use of the viticultural area name and increase consumer acceptance of their wines ("American Appellation America", 2011).

The model was run separately for each AVA in order to discover possible correlation. The dependent variable in the model, weighted average grower return per ton (price), is used as a proxy to represent quality. The β_0 variable is the weighted average price per ton if none of the structural changes or trend variable effects existed.

Since our data include nominal prices, a trend variable, 1 to 36 for each year of the data, was tested. The effects of all other price influencing factors are captured by the trend variable, specifically inflation, consumer preferences and environmental changes (Cameron, 2005).

These data used were extracted from California grape crush report tables, which include all winegrapes crushed, and the weighted average grower returns per ton of grapes sold (NASS, 2012). The structural events identified as potentially

being most influential are (1) the approval of each region's AVA designation, (2) the formation of the regional wine industry groups, and (3) the creation of a regional wine quality program. To determine if any of these events had a substantial impact on the region's grower return per ton a regression model was developed, specifically an inverse demand function, using dummy variables that linked particular structural changes in Lodi and the Central Coast in the crush reports to the prices paid to growers for the grapes harvested.

The β_1 variable represents the California Crush Report production totals or amount of grapes harvested and crushed each year. We expect β_1 to have a minimal or negative effect because of the negative correlation between yield and quality. (Johnson, 1989, p. 121–122). In the 18th century when the Cistercian monks developed many viticultural practices in Europe including the concept of pruning for quality over quantity. Around this time the concept of *terroir* emerged too, as wines from particular places began to develop a reputation for uniqueness. Varietals were studied more closely to see which grape varieties were the most suitable for a particular *terroir* (Johnson, 1989, p. 121–122).

The β_2 variable represents the first structural change, the approval of the Lodi AVA in 1986, and the Central Coast AVA in 1985 ("American Viticultural Areas" 2011). An approval may be granted by the Department of the Treasury's Alcohol and Tobacco Tax and Trade Bureau once a formal petition, review, comment, and occasionally a hearing process is completed. It is important to achieve this distinction because it regulates the labeling of wine to specify the area of origin of the wine for the consumer. Thus AVA designation provides the consumer with accurate information regarding the product's identity and prohibits the use of misleading information by producers from outside the AVA. The geographical uniqueness of each place is critical to the approval of each AVA. These AVA designations allow wine producers and consumers to attribute a given quality, reputation, or other characteristic of the wines produced from grapes to a specific AVA. It is the uniqueness of the region and the potential to produce quality wines from it that is one of the core drivers behind heightened consumer interest in a region (Elliott-Fisk, 2012). The Lodi AVA is located in the Central Valley of California, at the northern edge of the San Joaquin Valley east of San Francisco Bay. It includes 551,000 ac (223,000 ha) of which 90,000 acres (36,000 ha) are currently planted with wine grapes. The Central Coast AVA is a California American Viticultural Area that spans from Santa Barbara County in the south to the San Francisco Bay Area in the north. It includes around 4,000,000 acres of which 100,000 acres (400 km²) are currently planted with winegrapes (Appellation America, 2012).

In the analysis of the Lodi AVA, the β_2 variable represents the formation of the regional Winegrape Commission (LWWC), in 1991 by the Lodi winegrape growers.

The Lodi growers set forth three primary goals for the LWWC:

- (1) Differentiate Lodi in the marketplace as a producer of premium winegrapes and wine.

- (2) Fund research on local viticulture issues assisting Lodi growers to produce higher quality winegrapes.
- (3) Create and implement an area-wide integrated pest management program.

The LWWC is funded based on an assessment on the annual value of growers' winegrape crops (Cliff Ohmart, Lodi Winegrape Commission mailing list message, January, 2005).

In the analysis of the Central Coast AVA, the β_2 variable represents the formation of the Central Coast Vineyard Team (CCVT), in 1994. The founders of the CCVT recognized a need for more progressive and regionally based research and education. They wanted to guide growers towards environmentally and economically sustainable farming practices, practices they theorized would result in higher quality wines. The CCVT programs are funded through private membership dollars, events, donations, and grants/contracts (Central Coast Vineyard Team, 2012).

The β_3 variable represents the establishment of the Lodi Rules Sustainable Winegrowing Program (SWP) by the LWWC. The SWP goals were centered on promoting grower adoption of the best management practices via informational meetings, workshops, vineyard demonstrations and research, the Lodi Winegrower's Workbook for sustainability self-assessment, and the Lodi Rules for Sustainable Winegrowing third-party certification program. The LWWC thinking was that developing a sustainable vision for one's farm is important because it provides a template for sustainability (Hillis et al., 2010). The researchers sought to increase the time scale of grower goal development.

In our Central Coast regression model the β_3 variable represents the establishment of the Sustainable in Practice Certification Standards (SIP) by the CCVT. The CCVT formed the foundation for what would later become the SIP program in 1996 with the award-winning Positive Points System. The SIP Certification's goals start with a quality commitment to protecting both natural and human resources. Growers and winemakers recognize that attentive fruit production and care for workers' well-being are important components of quality wine. Habitat conservation, energy efficiency, pest management, water conservation, economic stability, and human resources are some of the key elements of the program. The standards look at the farm in its entirety: the worker, soil fertility, cover crops,

wildlife, native plants, irrigation, and more (Central Coast Vineyard Team, 2012).

The coefficients of all structural change variables in the present analysis were hypothesized to be positive. Since each structural event change had a regional economic development rationale motivating their approval, then each program should exhibit a significant impact on price. It is our hypothesis that the regional quality wine standards programs will exhibit the most substantial impact from zero. We believe the Regulatory Flexibility Act within each TTB petition will prevent the most substantial effect to be associated with the AVA variable. There are no accompanying regulations to AVA after approval, and the quality reputation is then left to the opinion of the consumer ("American Viticultural Areas" 2011). Quality reputation in the uncertain wine buying process is important as it helps to reduce the risk associated with the potential purchase of a low quality wine. This increases the buyer's confidence in the wine's consistency too (Elliott-Fisk, 2012).

This proposition is supported by the literature. Specifically work by Cross, Plantinga, and Stavins; Foti, Pilato, and Timpanaro; and Chiodo, Casolani, and Fantini which detail the comprehensiveness of standards, and the effects of regional quality reputation on consumers. Also the results of several other studies conducted by Hillis, Luebell, and Hoffman and Shaw, Luebell, and Ohmart that analyzed the impacts and effects of the Lodi Rules Sustainable Winegrowing Program. The assumption made in this analysis was to rely on a price dependent model because of the assumed connection between quality and price in the winegrape market. This is again due to the pruning off of excess fruit prior to harvest in an attempt to boost quality. We also make the assumption that this will result in a negative coefficient on the crush or production variable. Both models were run using SPSS statistical software using OLS.

4. Results

4.1. Lodi AVA

The Lodi AVA analysis shows the approval of the AVA designation had the most substantial impact, \$173.73 per ton, on the weighted average grower return per ton (price) (Table 1).

Although this result does not confirm our hypothesis that the most substantial impact would be the result of the regional quality wine program, it clearly shows the value of achieving AVA status for a wine region. The regression constant, \$229.248, is not

Table 1
Regression Model Output for Lodi Model: 1976–2011.

<i>LODI MODEL</i>	<i>Unstandardized Beta</i>	<i>Standard Error</i>	<i>Standardized Beta</i>	<i>T-value</i>	<i>Significance</i>
(Constant)	229.248*	28.078		8.165	0.000
Production (Crush)	0.000	0.000	-0.629	-2.424	0.022
AVA	\$173.73***	45.049	0.537	3.856**	0.001
Industry Group	\$98.41	45.451	0.335	2.165	0.038
Quality Program	\$165.81***	52.038	0.568	3.186***	0.003
TREND	\$2.13	4.463	0.153	0.478	0.636

determined by the value of the structural changes in the industry; it represents the amount of total price change per ton not determined by our structural change variables.

Although the AVA variable exhibited the most substantial effect on price (Table 1), the creation of the regional quality wine program also exhibited a very substantial effect, \$165.81, on the weighted average grower return per ton (price). This substantial impact on price shows the importance of expanding and improving a region after it has achieved an AVA status.

The formation of the LWWC, \$98.41 per ton, had a smaller impact compared to the AVA and regional quality wine program variables (Table 1). But the trend variable had no impact. Furthermore the impact of the total tons crushed (CRUSH) was found to be negative. This confirms our choice of a price dependent model due to the negative effect of quantity on price in the winegrape market.

4.2. California central coast AVA

The creation of the regional quality wine program in the California Central Coast AVA exhibited the most substantial impact, \$372.88 per ton (Table 2), on the weighted average grower return per ton and confirms the hypothesis that the regional quality wine program variable would exhibit the most substantial impact. Although the creation of the regional quality wine standards program variable exhibited the greatest effect, the establishment of the Central Coast AVA, \$179.60 per ton, also exhibited a very substantial effect on the weighted average grower return per ton. This suggests the importance of achieving the American Viticultural Area status as it may have acted as a facilitator for each of the events that followed (Love, 1997). In both cases it appears important to achieve an AVA status and develop a regional quality wine standards program. However in the case of the Central Coast the regional wine quality standards program was considerably greater.

The formation of the CCVT, \$138.13 per ton, had a smaller impact compared to the AVA and regional wine quality program variables (Table 2). But the Trend variable had no impact. The impact of the total tons crushed (CRUSH) was found to be negative confirming our assumption to use a price dependent model.

5. Conclusions and discussion

Therefore, it is our conclusion based on the results of these analyses that it is necessary for a developing wine

region to both achieve AVA designation status and to implement a regional quality wine program. To establish a sequence of events, it would appear helpful for a region to first achieve AVA status. It differs from earlier research conducted by Cross et al. (2011) which stated that large AVA designations do not affect prices, the present analysis suggests that it has a substantial effect. Next, because the AVA designation does not carry any quality regulatory features and each AVA's reputation is then based on perceptions, each region would be best served by creating its own quality wine standards program. This confirms earlier research conducted by Shaw et al. (2011) that cited the importance of establishing a link between consumer perceptions of regional reputation as it directly affects the economic success of the region. In both the Lodi and Central Coast AVA models the impact of the regional quality wine standards programs were both statistically significant, and in the case of the Central Coast model it proved to be the overwhelming economic driver behind the growth in its weighted average return per ton. Furthermore the analysis spans a 35 year period and suggests that grower investment in time, money, and commitment can yield a long term benefit answering the question posed by Lodi growers (Hillis et al., 2010). Grape growers in the Shawnee Hills are of a similar mindset in that they too are heavily influenced by perceived economic factors in their decision-making.

It should be noted that each of these programs included a sustainable agriculture component. Sustainable agriculture involves using site-specific principles of ecology, the study of relationships between organisms and their environment, in order to sustain farming long term. However, it is our interpretation that at least in the short-term this component appears to offer mainly marketing benefits as it serves as a source of product differentiation. As previously noted, in the wine industry, regional reputations exhibit a strong link to economic returns. In the Lodi AVA, the creators aimed to build a regional reputation for both wine quality and sustainability as a strategy for competing against more recognized California wine regions (Shaw et al., 2011).

In the Midwest wineries have continually battled a long-held perception that the best U.S. wines come from California, and in an attempt to develop a market differentiation strategy several Midwestern states, beginning in Ohio, developed, or are developing, regional quality wines programs that recognize state-grown wines and promote them as

Table 2
Regression Model Output for Central Coast Model: 1976–2011.

<i>Central Coast MODEL</i>	<i>Unstandardized Beta</i>	<i>Standard Error</i>	<i>Standardized Beta</i>	<i>T-value</i>	<i>Significance</i>
(Constant)	479.643*	54.165		8.855	0.000
Production (Crush)	−0.001	0.000	−0.327	−2.274	0.030
AVA	\$179.60**	79.275	0.235	2.266**	0.031
Industry Organization	\$138.13	100.381	0.209	1.376	0.179
Quality Program	\$372.88***	104.541	0.559	3.567***	0.001
TREND	\$10.35	7.379	0.325	1.402	0.171

an alternative to California (Edwards, 2011). Furthermore in California, winegrowing regions anticipate a stronger emergence of a new market for sustainable products. In the long term higher quality should result, but in the short term they are competing to establish regional reputations that will capture this market share and increase economic returns (Shaw et al., 2011).

After completing the study of the Lodi and Central Coast AVAs in California, two things are clear. The presence and recognition of an area's possession of a distinct geography as referenced by an American Viticultural Area distinction has a significant effect on price. However, the implementation of regional quality wine-making and grape growing standards, e.g., the Lodi Rules Sustainable Winegrowing Program and SIP Certification Program, was even more important. Other AVAs may therefore conclude that they should take matters into their own hands by developing regional quality wine quality programs, which decreases the uncertainty in consumer wine purchases. Our research does not study direct costs and benefits to the Shawnee Hills AVA, yet such knowledge is of great importance and worthy of future research. How much profit can be gained for both growers and winemakers if a quality program is implemented? Also how much will this program cost to implement? Such an investigation may be useful because growers, heavily influenced by economic factors, may need to be shown the potential impact of a quality wine standards program in a cost/benefit format. Additionally it is known that regional reputation and knowledge regarding quality production are key drivers of consumer demand (Foti, Pilato, and Timpanaro, 2011), but outside of those factors it is not known what currently are the key drivers behind the demand of Shawnee Hills wines. This information would be of great value to the creation of a regional wine quality program.

Appendix A

See Fig. A1.

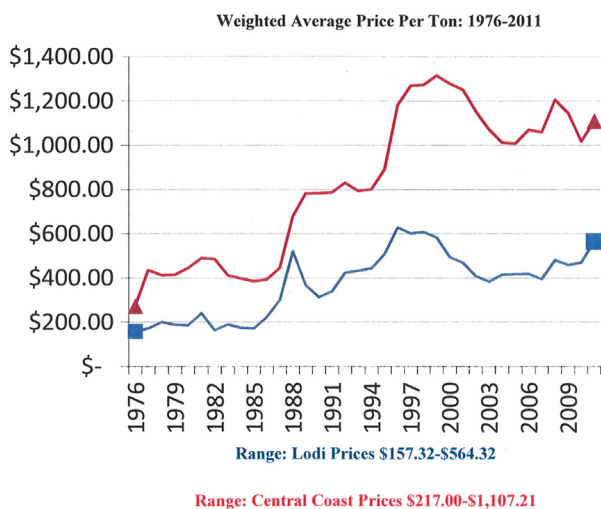


Fig. A1. Weighted Average Price Per Ton: 1976–2011.

Appendix B

See Fig. B1.

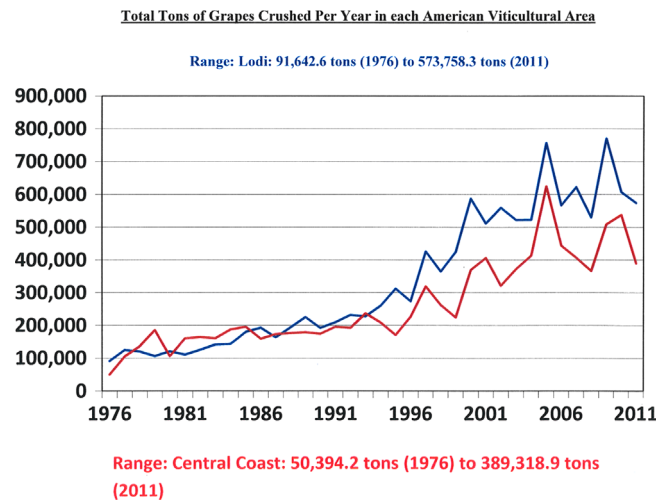


Fig. B1. Total Tons of Grapes Crushed Per Year in each American Viticultural Area.

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