Expenditures on Wine in General and Local Wine in Particular: Marketing and Econometric Analysis

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This article explores factors explaining wine spending patterns for consumers in Kentucky, Ohio, Pennsylvania, and Tennessee. We apply and compare five market segmentation measurements: wine purchase frequency, wine prices, local involvement levels, wine knowledge, and past local wine experiences. Data shows expenditures on wine. The econometric estimation employs interval estimation to interpret wine expenditures as reported in intervals and selection bias corrections to separate factors associated with decisions to purchase wine from factors associated with the amount expended. Results show that market segmentation measurements have stronger effects on local wine purchasing probability and purchasing quantity, compared with demographics.

Key words*:* Interval Regression, Local Wine, Market Segmentation, Selection Bias Correction, Wine Expenditure, Wine Knowledge

As the demand in the U.S. wine market increases, wine supply in the U.S. wine market, including wine from domestic producers, is also growing. Wine regions from all 50 states have been developing across the country. Between 1999 and 2016, the number of U.S. wineries dramatically increased from 2,688 to 8,702. The amount of wine production and the number of wineries in the northern Appalachian states including Kentucky, Ohio, Pennsylvania, and Tennessee, have also surged during the past decade, though the relative scale of wine production is smaller compared with the major wine-producing region—California. In this article, we define local wine as wine produced within a consumer's state of residency and local wineries as wineries within the state, according to the definition of "local" in the 2008 Farm Act (Martinez, 2010).

Extensive literature primarily focuses on the production of the wine industry; however, research on wine consumption is relatively limited. Compared with wine consumption studies from Australia and New Zealand (Bruwer, Li, and Reid, 2002; Thomas and Pickering, 2003; Johnson and Bruwer, 2003), wine consumption literature in the United States mainly emphasizes the health impact of alcohol consumption; the number of studies focusing on U.S. wine consumption from the economics perspective

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through expenditures is small. Wine consumption research focusing on U.S. local wine is scarce. This article aims to fill this gap.

We investigate the 2012 local wine consumption in four neighboring states—Kentucky, Ohio, Pennsylvania, and Tennessee—because local wine has drawn extensive attention to consumers, agribusinesses, and policymakers. Consuming local helps the environment by conserving energy from shipping and preserving farmland (Coley, Howard, and Winter, 2009); buying local is sustainable and beneficial for the future of local communities (Connelly, Markey, and Roseland, 2011). Moreover, compared with wine research on the four largest wine-producing states of California, Oregon, Washington, and New York, wine research rarely focuses on the other 46 relatively small wine production states which produce less than 1% of U.S. wine.

Though their production scale is relatively small, we select these four states because their wine production is important in the United States (see Table 1 for wine production and ranking). From 2007 to 2012, wine production in Kentucky, Tennessee, Ohio, and Pennsylvania has rapidly increased as has the number of wineries in these four states. Aside from their production importance, the boom of local wineries in these states is also influential to local economic development. According to Frank, Rimerman + Co. LLP (2014b), the full economic impact of Ohio wine and wine-grapes was $786 million in 2012. We expect the economic impact estimate for Pennsylvania was above $1.9 billion in 2012, and for Kentucky and Tennessee were above $420 million and $786 million[1], respectively (Frank, Rimerman + Co. LLP, 2013a; Frank, Rimerman + Co. LLP, 2013b; Frank, Rimerman + Co. LLP, 2014a). These tangible economic impact estimates contain direct economic changes including employment and spending, indirect economic changes through job creation, and induced effects of these new workers through spending their income. The intangible value of the wine industry in these states was greater in terms of overall enhanced quality of life, limitation of urban sprawl, and greater visibility for the state.

In order to investigate consumers' wine consumption trends and characteristics in these states, we employ market segmentation techniques and econometric analysis to identify and analyze determinants of wine consumption from all sources, and local wine consumption in particular. Market segmentation is not necessarily concerned with causal factors and seeks prediction models, of which the current research is an example.

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[1] Our expectations are based on closest estimates we can find: Frank, Rimerman + Co. LLP estimated that the economic impact for Pennsylvania was $1.9 billion in 2011; the estimate for Illinois (production ranked 19th) was $692 million in 2012; and that for Iowa (production ranked 25th) was $420 million in 2012.

Table 1. Wine Production and Winery Numbers in KY, OH, PA, and TN Compared to CA, NY, WA, and OR.

Production Ranking in 2012		Bulk Wine Production				Winery Number	
		2007 (Gallons)	2012 (Gallons)	2007 (Percentage)	2012 (Percentage)	2007	2012
1	California	612,480,122	719,260,245	89.05%	88.90%	2,687	3,754
2	New York	30,128,848	28,095,494	4.38%	3.47%	296	403
3	Washington	20,343,521	24,945,706	2.96%	3.08%	578	849
4	Oregon	6,317,824	6,854,272	0.92%	0.85%	351	483
6	Pennsylvania	912,755	3,602,406	0.13%	0.45%	135	215
7	Ohio	1,220,283	3,111,671	0.18%	0.38%	124	197
8	Kentucky	1,334,461	2,379,512	0.19%	0.29%	50	83
22	Tennessee	290,031	296,436	0.04%	0.04%	41	52
	All States	687,828,761	809,031,781	100.00%	100.00%	4,262	6,036

Data Source: Wine statistical reports in 2007 and 2012 are from the Alcohol and Tobacco Tax and Trade Bureau in 2010 and 2013.

   Wine marketers segment consumers based on different market needs and reach them with specific instruments (Rouzet and Seguin, 2004). Wine is an experience good and wine knowledge facilitates the wine purchasing process. We apply and compare five market segmentation measurements: wine purchase frequency, wine prices, local involvement levels measured by purchase frequency of locally produced foods, wine knowledge, and past local wine experiences. Consumers value local production when making a purchase decision. Hu, Woods, and Bastin (2009) have found that consumers value local production even more than the organic attribute. Given this, we expect that valuing local food positively influences consumers' local wine consumption.
   Our investigation has three objectives. First is to characterize wine consumers, especially those who consume local wine. Second is to identify wine consumption trends and factors correlated with wine expenditures. The third is to determine effective market segmentation measurements for wine marketing strategies, especially for local wine. We intend to predict wine consumption and advise local wine production using market segmentation based in part on past behavior and wine knowledge. This article is not a causal analysis of the attractiveness of wine consumption.
   We contribute to the gap in literature by investigating local wine consumption in relatively smaller U.S. wine-producing states, where wine production is increasing and becoming more important economically. Depicting consumer characteristics and wine expenditure patterns in this region will provide information for producers on local wine marketing. Another contribution we make to the wine expenditure research is combining methods of market segmentation and econometrics.

The rest of this article is structured as follows. The next section is a literature review of wine consumption and related research methodology. The second section describes the data and summarizes the sample statistics. Theoretical framework shows the underlying economic theory related to this article. The following section explains empirical models prior to results and discussion. The last section contains conclusions and implications.

Literature Review

Product attributes, as well as consumer intentions and behaviors, are important to consumers' purchase decisions. When choosing a product, consumers use attributes as a basis to evaluate and achieve the benefits they seek. Product attributes also provide a basis for which marketers differentiate and set the product or brand apart from that of the competitors (Belch and Belch, 1995). Product attributes are either extrinsic or intrinsic. Many researchers have examined the intrinsic and extrinsic cues as evaluative criteria that consumers apply when making a purchase decision (Forney, et al., 1999; Liefeld, Wall, and Heslop, 2000). Intrinsic criteria include attributes inherent in the product itself, such as fabric for a jacket or flavor for a drink. Extrinsic criteria are external attributes such as brand, country of origin or price (Aqueveque, 2008; Lee and Lou, 2011; Teas and Agarwal, 2000). Often, the importance assigned to extrinsic and intrinsic evaluative criteria differs and consumers rate intrinsic evaluative criteria as more important (Eckman, Damhorst, and Kadolph, 1990; Griffin and O'Neal, 1992; Purohit and Srivastava, 2001; Rao and Monroe, 1988; Velde, et al., 1996). However, because interpreting intrinsic cues prior to purchase is difficult, consumers often apply extrinsic cues as the basis on which to make inferences regarding the product (Elliott and Cameron, 1994).

Wine consumers typically make initial purchases based on extrinsic attributes such as country of origin and label (Aqueveque, 2008; Lockshin, Spawton, and Macintosh, 1997), while consumer characteristics influence the decision process for varying situations and serve as a tool for wine market segmentation. These consumer characteristics include wine knowledge, experience, demographics, and product involvement. A multitude of research has examined preferences and purchasing behavior of wine cohorts, defined by consumers' characteristics relevant to wine consumption (Quester, et al., 2007; Wilson, Rungie, and Lockshin, 2003). Accordingly, the wine market has been segmented by cohorts such as age, gender, involvement level, and environmental concern level. Understanding these consumer characteristics can facilitate the development of profiles to segment and target consumers for local wine.

Qualitative methods and econometric approaches are the main means to evaluate the effect of product attributes and consumer behaviors on wine consumption. Table 2 summarizes the variables and methods used in existing wine literature.

Table 2. Variables and Research Methods Used in Wine Literature.

Authors	Variables/Methods	Findings
Aqueveque (2008); Lockshin, Spawton, and Macintosh (1997)	product attributes	Extrinsic cues (brand, region, price, and award) are used differently by consumer groups when choosing wine.
Consumer characteristics affect wine consumption; it can be used as a tool for wine market segmentation.		
Dodd, et al. (2005); Brucks (1985)	usage experience and wine knowledge	Usage experience forms the basis for subjective knowledge (what you think you know) and objective knowledge (what you actually know), which aid to make wine purchasing decisions.
Olsen, Thach, and Nowak (2007); Wolf and McVey (2001); Wine Market Council (2015); Thach and Olsen (2005)	cohorts of *generation*	There were similarities and differences in the motivation of cohort preferences of wine. It recommends marketing and advertising differently to stimulate these diverse cohort groups.
Mitchell and Greatorex (1988); Spawton (1990); Saad (2005); Barber, Almanza, and Donovan (2006); Thach (2012)	*gender*	Wine consumers can be segmented by gender.
Wolf (2000)	*spending amount*	Wine consumers are segmented by heavy and light spenders.
Lockshin, Spawton, and Macintosh (1997)	*involvement level*	Consumers are segmented by wine consumption frequency.
Barber, Almanza, and Donovan (2006)	*income levels*	Consumers are segmented based on their income.
Bruwer and Li (2007)	*lifestyle*	Consumers can be segmented by lifestyle factors.
Two main types of approaches are applied in wine research: (a) qualitative and (b) quantitative.		
Liu and Murphy (2007)	interviews and questionnaire (a)	The image of wine, wine knowledge, wine prices, and awareness of wine producing regions affect purchasing decisions.
Goldsmith and d'Hauteville (1998)	factor analysis (a)	Heavy wine users were more likely to be interested in and involved with wine.
Hussain, Cholette, and Castaldi (2007)	categorical regression (b)	Knowledge is the most important determinant of wine consumption, compared with demographic variables and behavioral variables.
Gil and Sánchez (1997)	conjoint analysis (b)	Three wine attribute preferences—price, origin, and grape vintage year—are examined and compared; they are used to identify and characterize four wine consumer segments of two Spanish regions.
Quester and Smart (1998)	conjoint analysis (b)	Price remained the most important factor when examining how consumption and product involvement influence wine purchase.

Table 3. Variable Description and Summary Statistics of Dependent Variables and Independent Variables.

Variable	Description	Full Sample (N = 1609)				Sub-Sample (N = 546)			
		Mean	SD	Min	Max	Mean	SD	Min	Max
Exp_total[a, c]	Continuous variable, monthly expenditure on total wine in dollars.	45.661	33.482	11	280	56.721	39.100	13	375
Exp_local[a]	Continuous variable, monthly expenditure on local wine in dollars.					39.755	75.261	1	900
Try_local[e]	Dummy variable, 1=tried local wine, 0=not tried or not sure.	0.390	0.488	0	1	1	0	1	1
Marginal[b]	Dummy variable, 1= purchased wine for any occasion in the past 12 months less than once a month, 0= other frequency.	0.424	0.494	0	1	0.310	0.463	0	1
Mid_level	Dummy variable, 1= purchased wine for any occasion in the past 12 months 1-3 times a month, 0= other frequency.	0.455	0.498	0	1	0.513	0.500	0	1
Core	Dummy variable, 1= purchased wine ≥ 1 /week in the past 12 months.	0.121	0.326	0	1	0.178	0.383	0	1
Popular	Dummy variable, 1= purchase Popular wine ($4-$7) sometimes or often, 0= purchase less frequently.	0.502	0.500	0	1	0.504	0.500	0	1
Super	Dummy variable, 1= purchase Super wine ($7-$14) sometimes or often, 0= purchase less frequently.	0.714	0.452	0	1	0.804	0.397	0	1
Ultra	Dummy variable, 1= purchase Ultra wine ($14-$25) sometimes or often, 0= purchase less frequently.	0.438	0.496	0	1	0.557	0.497	0	1
Luxury	Dummy variable, 1= purchase Luxury wine (>$25) sometimes or often, 0= purchase less frequently.	0.160	0.366	0	1	0.229	0.421	0	1
Below_avg[b]	Dummy variable, 1= wine knowledge below average level.	0.507	0.500	0	1	0.359	0.480	0	1
KnwldgAvg	Dummy variable, 1= wine knowledge at average level.	0.373	0.484	0	1	0.438	0.497	0	1
KnwldgAbove	Dummy variable, 1= wine knowledge above average level.	0.109	0.311	0	1	0.185	0.389	0	1
Expert	Dummy variable, 1= wine knowledge at expert level.	0.012	0.108	0	1	0.018	0.134	0	1
Below_neu[b]	Dummy variable, 1=rate last local wine experience below neutral.					0.029	0.169	0	1
RateNeutral	Dummy variable, 1=rate last local wine experience neutral.					0.108	0.311	0	1
RateSomePos	Dummy variable, 1=rate last local wine experience somewhat positive.					0.394	0.489	0	1
RateVeryPos	Dummy variable, 1=rate last local wine experience very positive.					0.469	0.499	0	1
Belowoften[b]	Dummy variable, 1= purchase locally produced foods never or sometimes, 0= other frequency.	0.582	0.493	0	1	0.447	0.498	0	1
LocalOften	Dummy variable, 1= purchase locally produced foods often.	0.264	0.441	0	1	0.333	0.472	0	1
LocalAlways	Dummy variable, 1= purchase locally produced foods always.	0.154	0.361	0	1	0.219	0.414	0	1
Less25miles[b]	Dummy variable, 1= believe local wineries should locate within 25 miles from residency, 0= else.	0.248	0.432	0	1	0.203	0.403	0	1
25to49miles	Dummy variable, 1= believe local wineries are those located 25-49 miles away from residency, 0= else.	0.210	0.407	0	1	0.238	0.426	0	1

Variable	Description	Mean	SD	Min	Max	Mean	SD	Min	Max
50to99miles	Dummy variable, 1= believe local wineries are those located 50-99 miles away from residency, 0= else.	0.293	0.455	0	1	0.295	0.456	0	1
100more	Dummy variable, 1= believe local wineries are 100 miles or more away from residency.	0.249	0.433	0	1	0.264	0.441	0	1
Freq_visit[d]	Discrete variable, frequency of any winery visit in the past 3 years.	1.763	2.039	0	6	3.161	2.120	0	6
Freq_locvisit[d]	Discrete variable, frequency of local winery visit in the past 3 years.	1.259	1.822	0	6	2.714	2.083	0	6
White_wine	Dummy variable, 1= purchase white wine often or always, 0= else.	0.433	0.496	0	1	0.509	0.500	0	1
Red_wine	Dummy variable, 1= purchase red wine often or always, 0= else.	0.528	0.499	0	1	0.606	0.489	0	1
Fruit_wine	Dummy variable, 1= purchase fruit wine often or always, 0= else.	0.334	0.472	0	1	0.427	0.495	0	1
Champagne	Dummy variable, 1= purchase champagne often or always, 0= else.	0.149	0.356	0	1	0.179	0.384	0	1
Preparefood	Dummy variable, 1= prepare fresh food at home 7 times or more a month, 0= prepare less frequently.	0.722	0.448	0	1	0.782	0.413	0	1
Foodchannel	Dummy variable, 1=watch food channel or similar programs monthly, 0= watch less frequently.	0.620	0.485	0	1	0.700	0.459	0	1
Millennials[b]	Dummy variable, Millennials, 1=birth year 1981-1999.	0.104	0.305	0	1	0.115	0.320	0	1
GenX	Dummy variable, Generation Xers, 1=birth year 1965-1980.	0.231	0.421	0	1	0.238	0.426	0	1
Boomer	Dummy variable, Baby Boomers, 1=birth year 1946-1964.	0.501	0.500	0	1	0.491	0.500	0	1
Traditionalist	Dummy variable, Traditionalists, 1=birth year 1900-1945.	0.165	0.371	0	1	0.156	0.363	0	1
Education	Discrete variable, education years.	14.566	2.105	9	18	14.610	2.042	9	18
Income	Continuous variable, household yearly income before taxes ($1000).	67.337	41.126	7.5	225	69.634	38.909	7.5	225
No.consumer[d]	Discrete variable, number of wine consumers at home.	1.775	0.709	1	6	1.885	0.716	1	6
Female	Dummy variable, gender, 1=female, 0=male.	0.692	0.462	0	1	0.661	0.474	0	1
White	Dummy variable, ethnicity , 1= White/Caucasian, 0= else.	0.904	0.295	0	1	0.914	0.281	0	1
Urban	Dummy variable, residency area, 1=city or suburb, 0= else.	0.637	0.481	0	1	0.608	0.489	0	1
Reside_yr	Dummy variable, residency years at local state, 1=10 years or more, 0= less than 10 years.	0.859	0.348	0	1	0.874	0.333	0	1
Pennsylvania	Dummy variable, residency state, 1= Pennsylvania, 0=else.	0.250	0.433	0	1	0.253	0.435	0	1
Ohio	Dummy variable, residency state, 1= Ohio, 0=else.	0.249	0.433	0	1	0.258	0.438	0	1
Tennessee	Dummy variable, residency state, 1= Tennessee, 0=else	0.250	0.433	0	1	0.207	0.405	0	1
Ky[b]	Dummy variable, residency state, 1= Kentucky, 0=else.	0.250	0.433	0	1	0.282	0.450	0	1

Note: [a] Dependent variables. [b] Omitted in regressions. [c] Fitted Value. [d] 5 or more is coded 6. [e] Not in regressions. SD means standard deviation.

Data and Sample

We have collected wine consumption data from Kentucky, Ohio, Pennsylvania, and Tennessee consumers in 2012 using a survey questionnaire electronically distributed through Zoomerang by Market Tools, Inc., a marketing research company. Zoomerang recruited participants through email invitations. These participants received e-rewards including ZoomPoints, cash payments, and prizes for participation. We double pre-screened respondents—who were at least 21 years old and purchased wine within the last 12 months—to satisfy the age limits to legally purchase wine and to ensure they were wine consumers. Meanwhile, participants had an option of skipping questions when they were not comfortable providing answers. In this way, 74.1% of the eligible respondents in Pennsylvania completed the full survey. Similarly, the completion rate for Ohio was 74.1%, for Tennessee, 79.2%, and for Kentucky, 74.5%. The average completion rate for the four states was 75.4%. Our sample contains a total of 1,609 consumers and about 400 participants from each state. Table 3 shows a sample summary and variable description.

Note that only those consumers who registered on Zoomerang and got access to the internet completed the survey. This may affect the representativeness of our sample to the wine consumer population. The differences of our sample from the population are not clear because we are not aware of any wine consumer census data for each state in 2012 to compare with the sample. Additionally, the expenditure information gathered is based on consumers' recall of spending during the past 12 months. This might be subject to recall bias. In short, the accuracy of the stated expenditure data may limit the generalization of our results. With these limitations, however, our research is still valuable in describing wine consumers, providing consumer segmenting information for positioning local wine, and filling the literature gap in this area.

Survey respondents provided their wine consumption information and purchasing habits in the past 12 months. This information includes five market segmentation characteristics: consumers' wine consumption frequency, purchasing habits regarding differently priced wines, wine knowledge, past local wine experience, and local food purchase frequency. In addition, respondents provided lifestyle and demographic information.

Moreover, these 1,609 consumers provided their monthly wine expenditure from all sources in ranges: $0-$19, $20-$39, $40-$59, $60-$79, $80-$99, and $100 or more, with a mean expenditure of $45.661, calculated by predicting values assuming a lognormal distribution based on range data. Among these consumers, 627 respondents (39% of 1,609), who indicated that they had tried a local wine, further reported their local wine

experiences and their monthly expenditure on local wine. Whether they tried local wine or not serves as a hurdle for local wine-related questions.

Among these 627 respondents, 546 (87.1%) spent a non-zero amount of money on local wine every month, composing a sub-sample for local wine. After trying a wine, their local wine purchasing probability was 87.1%. Their average monthly wine expenditure was $56.721 (calculated using fitted values from a lognormal distribution based on the ranges), and their local wine expenditure was $39.755 (reported amount).

Table 3 shows that sub-sample consumers purchased wine more frequently, purchased more expensive wines, had more wine knowledge, had higher local purchase frequencies, and had higher average total wine expenditures compared with the full sample. The majority of sub-sample consumers rated their local wine experience positively after trying a local wine. This information elicited several follow-up research questions: are these the reasons that consumers in the sub-sample have tried local wine? And if so, which one is dominant in influencing the local wine expenditure amount and the purchase probability?

Models

We aim to investigate consumers' total wine expenditures, local wine purchase probability, and local wine expenditures. Product attributes evaluated include wine taste (based on past local wine experience), wine price, and brand/local origin (distance to the local winery). Consumer behavior factors examined are subjective wine knowledge (objective wine knowledge data is not available), past local wine experience, cohorts of involvement level (consumption frequency, winery visits frequency), age, gender, lifestyle (preparing food, watching a food channel, frequently of purchasing local food), and income. Other elements considered are ethnicity, education, the number of wine-consuming members in the household, and years and state of residency.

We aim to test the effectiveness of market segmentation measurements on influencing expenditures. The study of market segmentation is not about all exogenous variables such as consumers' age, gender, ethnicity, education, as well as physical or taste characteristics of the wine. Marketing can be based on these factors, as well as some of which are clearly endogenous but useful such as wine knowledge or past local experience. Wine knowledge is unlikely to be separated from wine consumption. Past local wine experiences or local food purchase frequencies might not be separable from local wine consumption as a cause, but it is useful for marketing. As the literature review has shown, some research in market segmentation uses only exogenous personal factors or income, while other research examines endogenous classification or predictive

variables. This research is predictive rather than causal. It is more analogous to the prediction of economic outcomes such as gross domestic production than to theoretical causation of those outcomes. A causal analysis would require instrumental variables, correlated with the wine consumption frequency or knowledge but not with expenditures, which are not available or necessary for market segmentation studies.

Total Wine Expenditure—Log-linear Regression Model under Interval Censoring

We specify the monthly wine expenditure from all sources for consumer *i* as the following:

(1) $ln\_Exp_i = \beta_0 + \beta_1 Mid\_level_i + \beta_2 Core_i + \beta_3 Popular_i + \beta_4 Super_i + \beta_5 Ultra_i + \beta_6 Luxury_i + \beta_7 KnwldgAvg_i + \beta_8 KnwldgAbove_i + \beta_9 Expert_i + \beta_{10} Freq\_visit_i + \beta_{11} White\_wine_i + \beta_{12} Red\_wine_i + \beta_{13} Fruit\_wine_i + \beta_{14} Champagne_i + \beta_{15} Preparefood_i + \beta_{16} Foodchannel_i + \beta_{17} GenX_i + \beta_{18} Boomer_i + \beta_{19} Traditionalist_i + \beta_{20} Education_i + \beta_{21} Income_i + \beta_{22} No.consumer_i + \beta_{23} Female_i + \beta_{24} White_i + \beta_{25} Urban_i + \beta_{26} Resde\_yr_i + \beta_{27} Pennsylvainia_i + \beta_{28} Ohio_i + \beta_{29} Tennessee_i + e_i,$

where *ln_Exp* is the log of total wine expenditure represented in intervals and e_i is the error term.

The total wine expenditure data is coded in ranges and interval censored. It is a continuous variable but discretely measured as six intervals: $0-$20, $20-$39, $40-$59, $60-$79, $80-$99, $100 or more.

We include three sets of explanatory variables (see Table 3). The first set contains three market segmentation measurements. Variables representing them in parentheses are 1) wine purchase frequency (*Mid_level, Core*); 2) wine prices (*Popular, Super, Ultra, Luxury*); and 3) wine knowledge (*KnwldgAvg, KnwldgAbove, Expert*, relative to *Below_avg*). The second set is lifestyle factors including the frequency of any winery visits (*Freq_visit*); wine type preference (*Red_wine, White_wine, Fruit_wine, Champagne*); the monthly frequency of fresh food preparation at home (*Preparefood*); and whether a consumer watches food channel or similar television programs monthly (*Foodchannel*). The last set is demographics covering generation (*GenX, Boomer, Traditionalist*, relative to *Millennials*); years of education (*Education*); household income before taxes (*Income*); number of wine-consuming members in the household (*No.consumer*); gender (*Female*); ethnicity (*White*); rural or urban residence area (*Urban*); years of residency in state (*Reside_yr*); as well as state of residency (*Pennsylvania, Ohio, Tennessee*, relative to *Kentucky*).

In order to select an unbiased and efficient estimator, we use two steps in our estimation strategies. With an appropriate transformation of the dependent variable, we attempt to reach an approximately normal distribution in the first step. To test which transformation is appropriate, we use a Box-Cox test (Box and Cox, 1964). With left-skewed expenditure data, we expect a log specification as usual. The preference for the log is not much affected by coding decisions, so we use the midpoint values of expenditure ranges reported by survey respondents including 10, 30, 50, 70, 90, and 110 (for $100 and more) for the Box-Cox estimation. Also, using data in midpoints is much easier than in ranges for the Box-Cox estimation.

The Box-Cox test fits the dependent variable as $(y^\alpha - 1)/\alpha$. It uses maximum likelihood estimation to fit α while also fitting the regression and seeking an approximately normal distribution. If $\alpha = 0$, the model is the logarithm of y regressed on explanatory variables; while if $\alpha = 1$, the model is a linear regression of y on the explanatory variables as usual. Applying the Box-Cox test here results in a clear preference for the logarithm, as α is -0.0707 with a standard error of 0.0337, close to 0 and far from 1. We continue with the logarithm.

Once we have justified the log transformation form based on the Box-Cox test, the next step is to select an unbiased and efficient estimator. To meet this goal, we select an interval regression according to the data. When a continuous variable is discretely measured, an ordinary least-square estimation provides unbiased but inefficient parameter estimates because the variance of the error is the variance of the usual disturbance term plus the measurement error induced by the interval (Butler and Anderson, 1984). Butler and Anderson (1984) have derived a correct likelihood function and maximized it to address the heteroscedasticity of the error term. Also, analyzing interval censored data, Huang and Wellner (1995), as well as Huang and Rossini (1995), have shown that the maximum likelihood estimations of the regression parameters are asymptotically normal. Additionally, Harrison, Lau, and Williams (2002) provide an example of applying an interval regression to estimate individual discount rates. With the log of the expenditure data, we apply "intreg" in STATA for the interval regression.

Moreover, an interval regression uses a probability distribution to solve the top-coding problem for the last interval. The last interval of our expenditure data—$100 or more—is top-coded, which means it has no upper limit. This is common in income literature. Various ways can solve a top-coding problem. Common methods include adding either a constant amount or a constant percentage of the lower limit of the top category. However, arbitrary fixed values for the top range are unsupported by data and theoretically unjustified. A more rigorous approach is based on a probability distribution, which is often Pareto for income, extrapolating from the next-to-last category's midpoint

using the frequencies of both the next-to-last and last (open-ended) categories (Hout, 2004). The Pareto distribution represents an extreme tail of high income.

Assuming that wine consumption is not as extreme as income, our estimation fits the lognormal distribution to solve the top-coding problem. The ranges coded by logs from lower to upper are minus infinity—ln(0), ln(20), ln(40), ln(60), ln(80), ln(100) —and with the top category going to plus infinity. This indicates the set up for interval regression, in which the dependent variable is stated as a range and approximately lognormal according to the Box-Cox test, but the explanatory variables are as usual. Then, by maximum likelihood, the probability of being in the range, ln (20) to ln (40) for instance, is the basis of estimation. The underlying standard deviation (σ) is estimated as a parameter, not as a sum of squared residuals.

Furthermore, with an interval regression and back-transformations from the log to the original form, we find a uniquely fitted expenditure value for each respondent, even though the original data was reported in ranges. The result of an interval regression is a set of coefficients and standard errors that are exactly interpreted as the interpretation of usual regression coefficients. For fitted values, we use the usual calculation of explanatory variables multiplied by coefficients. Noting that the log is the basis, however, the lognormal must be converted back to the original form. Specifically, if a random variable $ln(y)$ is lognormally distributed with underlying parameters μ and σ^2, the back-transformed basic statistics result of the expected mean for y is $exp\ (\mu + 0.5\sigma^2)$; we substitute the fitted value for each observation for μ and the estimated σ from the interval regression squared for σ^2. This generates a unique back-transformed fitted expenditure for each person instead of expenditures in ranges. With this method, we can also obtain a mean of \$45.661 monthly total wine expenditure for the full sample. Additionally, our method provides a mean of about \$130—a number that could not have been inferred from the data which only show that a value exceeds \$100—for the interval above \$100. The advantage of our method is that the fitted values are not restricted by an arbitrary assumption about top-coded data ranges.

Local Wine Purchase Probability and Expenditure—Heckman Model

Local wine expenditure data has included zeros and consumers who purchased local wine further provided a specific dollar value spent monthly on local wine. This is a standard setup for a selection bias model (Heckman, 1979) to understand demand and overcome the sample selection bias. Applying a Box-Cox analysis to positive local wine expenditures, the parameter on positive local wine expenditures is estimated as -0.1149, with a standard error of 0.0295, supporting the log transformation.

We use all 1,609 observations in the estimation of the Heckman model. With the maximum likelihood estimation, the selection equation estimates the probability of purchasing local wine. In the outcome equation, consumers who have purchased local wine are selected for elasticity measurements on local wine expenditure quantities by using least squares. The selection bias model tests whether consumers who have purchased local wine are different on unmeasured attributes from those who have not purchased.

We specify the monthly local wine expenditure for consumer *i* as the following (outcome equation in Heckman):

(2) $ln\_local_i = \gamma_0 + \gamma_1 Mid\_level_i + \gamma_2 Core_i + \gamma_3 Popular_i + \gamma_4 Super_i + \gamma_5 Ultra_i + \gamma_6 Luxury_i + \gamma_7 KnwldgAvg_i + \gamma_8 KnwldgAbove_i + \gamma_9 Expert_i + \gamma_{10} RateNeutral_i + \gamma_{11} RateSomePos_i + \gamma_{12} RateVeryPos_i + \gamma_{13} LocalOften_i + \gamma_{14} LocalAlways_i + \gamma_{15} 25to49miles + \gamma_{16} 50to99miles_i + \gamma_{17} 100more_i + \gamma_{18} Freq\_locvisit_i + \gamma_{19} White\_wine_i + \gamma_{20} Red\_wine_i + \gamma_{21} Fruit\_wine_i + \gamma_{22} Champagne_i + \gamma_{23} Preparefood_i + \gamma_{24} Foodchannel_i + \gamma_{25} GenX_i + \gamma_{26} Boomer_i + \gamma_{27} Traditionalist_i + \gamma_{28} Education_i + \gamma_{29} Income_i + \gamma_{30} No.consumer_i + \gamma_{34} Female_i + \gamma_{35} White_i + \gamma_{36} Urban_i + \gamma_{37} Resde\_yr_i + \gamma_{31} Pennsylvainia_i + \gamma_{32} Ohio_i + \gamma_{31} Tennessee_i + v_i,$

where *ln_local* is the log of the local wine expenditure and v_i is the error term.

Explanatory variables include three sets: market segmentation measurements, lifestyle factors, and demographics. Compared with the total wine expenditure model specification, the outcome model adds two locally related market segmentation measurements: past local wine experience ratings (*RateNeutral, RateSomePos, RateVeryPos*) and local food purchase frequency (*LocalOften, LocalAlways*). It also adds one set of lifestyle variables: a distance preference of local wineries away from a residency (*25to49miles*, *50to99miles*, and *100more*, relative to *Less25miles*). Past local wine experiences and local purchase frequency could affect local wine expenditures. Wineries of different distances may attract different consumers. A desire to visit local wineries could represent an interest in local wines, which may be correlated with a higher local wine expenditure. The distance preferences could assist existing wineries to reach different consumers for wine purchases or guide potential wineries in the selection of locations.

The selection equation of the model predicts local wine purchase probability. The model specification (not shown to avoid duplication) is similar to the outcome equation but it does not include variables representing past local wine experiences. The reason is that wine consumers probably have never had local wine experiences before purchasing. Once they have purchased, past local wine experiences can influence their sequential

purchases and local wine expenditure amounts. In addition, we run the model excluding "*Freq_locvisit*" in the selection equation. Visiting a local winery is almost the same variable as local wine purchases and would be endogenous with virtual certainties, like looking for a job in predicting having a job. The same explanatory variables would explain both visiting and purchasing.

Results

Table 4 summarizes wine purchase information. The most important wine purchase motivation is a recognized brand, followed by a holiday or celebration, spouse/partner preference, and then by premium quality. Wine from local wineries ranks as the sixth important motivation. It indicates that consumers may not be attracted to local wine only by the characteristic that the wine is produced from a local winery; promotion of local wine combined with other factors—such as marketing local wine under a recognized brand (for instance, Kentucky Proud), pairing Kentucky wine with Kentucky desserts or other foods, and marketing local wine with holiday celebration—are important to local wine sales.

     According to purchase frequency, the most important wine purchase purpose is home consumption. Restaurant consumption ranks as second followed by purchasing as a gift. Our sample contains about 69% female respondents so the "spouse/partner preference" could mainly represent the preference of males. As to preferred wine types, consumers have purchased red wine most frequently, followed by white wine, fruit wine, and then by champagne/sparkling wine as the least frequently purchased type. On wine purchase channels, the most important channel is liquor stores, followed by restaurants or other food establishments, wineries, wine specialty shops, then bars/clubs/pubs, and pharmacies. In the liquor store group, the most important type is the independent liquor store, followed by grocery-affiliated liquor stores and then by state liquor stores.

     Wine purchase channels are regulated differently by laws in each state. Pennsylvania confines wine sales to the state-owned fine wine and good spirits stores, wineries, restaurants, bars, as well as restaurants and liquor stores attached to supermarkets. Wine sales in Kentucky are not state controlled but are subject to local laws. In Kentucky, wine can be purchased through grocery-affiliated stores, drug stores, and all other outlets shown in Table 4 when local laws permit. Ohio controls wine sales by the state, and grocery stores can sell wine. Wine sales in Tennessee are not controlled by the state. Consumers can purchase wine from grocery stores in Tennessee.

     Our data do not include variables indicating policy changes regarding purchase channels. However, we expect that less restricted regulation would lead to more wine

consumption. According to Seo (2016), allowing liquor sales in grocery stores increases liquor expenditures. Future research might investigate the influences of policy changes on local wine consumption.

Table 4. Wine Purchase Information.

Wine Purchase Preferences

Motivations	Purchase Channels	Purchase Types	Importance
Recognized brand	Independent liquor store	Red wine	High
Holiday or celebration	Grocery-affiliated liquor store	White wine	
Spouse/partner preference	State liquor store	Fruit wine	
Premium quality	Restaurant/ food establishments	Champagne/sparkling wine	
Food pairing	Winery		
From local winery	Wine specialty shop		
	Bars/clubs/pubs		
	Pharmacy		Low

Wine Purchase Frequencies

Wine Purchase	Not Buy	≤ Once/Month	Once /Month	≥ Once /Month
All Purchases	0	42.40%	25.60%	32.02%
Home Consumption	1.80%	43.70%	23.43%	31.00%
Restaurant Consumption	29.30%	35.50%	15.80%	19.40%
Gift	39.90%	35.42%	16.22%	8.46%
	Not Buy	1-2 Times /Year	3-4 Times /Year	≥5 Times /Year

Source: Computed by the authors.

Total Wine Expenditures

Table 5 presents the interval regression results. By calculating fitted values from a lognormal distribution of expenditures based on ranges, we get $45.661 as the predicted mean of total wine expenditure. All three market segmentation measurements have statistically significant effects on total wine expenditures. Wine consumption frequency positively influences consumers' total wine expenditures. Compared with those who consume wine less than once per month, monthly wine consumers spend 70.5% more and weekly wine consumers spend 114.2% more, holding other variables constant. This

concurs with our expectation that the more frequently consumers purchase wine, the more they spend. Consumers' wine price preference types also positively affect consumers' total wine expenditures: the more frequently consumers purchase expensive wines, the more they spend. Consumers who frequently purchased ultra-wine ($14-$25/bottle) or luxury-wine (above $25/bottle) spend 19.9% or 31.4% more than those who less frequently purchase wine in each category, ceteris paribus.

Wine knowledge meets our expectation that it positively influences wine expenditures. The trend is that the more wine knowledge consumers possess, the higher they spend. Compared with consumers with below average wine knowledge, people who declare possessing average wine knowledge spend 12.3% more; consumers with above average wine knowledge spend 17.1% more, ceteris paribus. This clearly indicates that interest in wine by gaining more knowledge is an important factor besides wine purchase amounts and wine prices. However, wine expertise does not have a statistically significant effect, possibly because the number of wine experts included in the sample is small or a proportion of wine consumed by experts is not from self-purchases.

In the lifestyle factors, winery visits frequency positively affects consumers' wine expenditures, though the effect is smaller compared with that of the market segmentation measurements and some of the demographic factors. Winery visitors are more likely to be wine enthusiasts; as such, they spend 3.9% more than nonvisitors. Consumers who purchase red wine more frequently spend 16.6% more and frequent white wine buyers spend 14.0% more.

In the demographic elements, gender, ethnicity or years of residency do not statistically affect total wine expenditures. No significant differences exist between urban and rural residents net of other factors. Generation Xers purchase less wine than Millennials and do not show statistically significant differences among Millennials, Boomers, and Traditionalists regarding total wine expenditures. Compared with Blaylock and Blisard (1993), our results suggest a different trend in 2012: younger generations recently drink more wine. This trend continues so that Millennials, in 2015, surpass other generations in drinking wine (Chew, 2016). When education increases by one year, the monthly expenditure is likely to decrease by 3.3%, ceteris paribus. The mean of education years in the sample is 14, higher than the national average of 13 years, perhaps because of the sample selection.

In addition, when household income rises by $1,000 annually, this increases wine expenditures by 0.3%. In contrast, consumers' monthly wine expenditure would decrease by 7.6% on average when the number of wine-consuming members in the household increases by one. This is probably because consumers tend to purchase wines in a larger package when more wine consumers reside in the household. Those big, packaged wines

are usually cheaper, leading to less individual monthly expenditures. Consumers from different states spend differently on wine. Pennsylvania and Ohio consumers, respectively, spend 13.2% and 17.2% less than Kentucky consumers. That could be the result of tastes, taxes, or prices.

Local Wine Expenditure—Purchase Probability

Table 5 presents Heckman regression results. Heckman's lambda estimates the presence of a selection bias; to be precise, the correlation between omitted factors in local wine expenditures and that of the model for the probability of local wine consumption. Lambda is statistically significant, indicating the existence of a selection bias. Lambda is negative, estimating that unmeasured factors increasing the probability of local wine consumption decrease the expenditure, so the marginal consumer is spending small amounts.

All market segmentation measurements applied have influences on the purchase probability. On wine purchase frequency, monthly wine purchase consumers are more likely to purchase local wine, compared with those who purchase less frequently. However, this does not hold for weekly wine purchase consumers. As to price, consumers who have frequently purchased super-wine ($7-$14) or ultra-wine ($14-$25) are more likely to purchase local wine than those who have less frequently purchased wine in these price categories. Most local wine is priced at this range.

As to wine knowledge, experts, as the highest wine knowledge possessors, do not indicate a higher probability to purchase local wine. Two possible reasons can explain this. First, wine experts probably tend to purchase from well-known wine-producing regions such as France, Italy, or Spain. Second, aged wines probably are more appealing to experts so they purchase the relatively young wines produced in newer regions, including our research states. However, consumers who indicate holding above-average wine knowledge are more likely to buy local wine, compared with those with below-average wine knowledge. Perhaps that is the market for local wine. Local involvement levels also have shown positive effects on consumers' local wine purchase probability. This happens to consumers who "often" or "always" buy locally produced foods.

Moreover, regarding lifestyle factors, consumers who consider a local winery to be one that is within 25 to 49 miles of their residence are less likely to purchase locally than those consumers who consider a winery of 100 miles or more away. Clearly, accommodating a longer distance increases opportunities. Also, consumers' interests in local wineries can increase with more visits, thus positively influencing local wine purchase probabilities. Consumers who have prepared fresh food more frequently at

home also show a higher probability of purchasing local wine. In terms of taste, consumers who "often" or "always" purchase white wine or fruit wine, or who purchase champagne less frequently, are more likely to buy local wine. Demographically, compared with consumers from Kentucky, Tennessee wine consumers are less likely to purchase wine produced in Tennessee.

Local Wine Expenditure—Expenditure Amount

Table 5 exhibits results of the Heckman regression including coefficients in both the selection and outcome equations as well as marginal effects in the outcome equation. In the outcome equation, market segmentation measurements have shown larger effects than lifestyle factors and demographics. These effects include that consumers with higher wine purchase frequencies are inclined to spend more on local wines. Specifically, consumers who buy wine monthly spend 33.6% more on local; weekly wine purchase consumers have 52.7% higher local wine expenditures compared with those who purchase less frequently. On wine price, consumers who "often" or "always" purchase luxury wine (>\$25) not only are more likely to purchase local wine, they also spend 38.5% more than those who less frequently purchase luxury wine. Wine knowledge and ratings of previous local wine experiences do not show statistically significant effects on local wine expenditures.

Though the market segmentation measurement—local purchase frequency— positively influences local wine purchase probability, it does not show statistically significant effects on local wine expenditure quantity. Local involvement by frequently purchasing local foods apparently does not extend to spending more, just more often.

Lifestyle factors do not show statistically significant results. In demographics, when years of education increase by one, consumers spend 6.9% less on local wine, consistent with the result of total wine expenditure. With an increase of one more member in the household consuming wine, consumers' local wine expenditures increase by 12.0%, which is different from total wine. This might be because local wine does not often sell in large package sizes at a price discount. In contrast, more members drinking wine requires an individual to spend more to share with others. No statistically significant differences exist among consumers of different gender, generations, ethnicities, income levels, areas of residence, and residence years in the state, as well as the state of residency, controlling for other factors. Findings by Wolf, Carpenter, and Wolf (2005) concur with our results in terms of local wine consumption: different generations do not show statistically significant differences in the purchase quantity of wine produced in the United States. This differs from the total wine consumption trends.

Table 5. Results of Total Wine Expenditure, Local Wine Expenditure, and Purchase Probability.

Behavior	Total Wine Expenditure		Local Wine Expenditure					
Dependent Variable	ln_Exp(Intreg)		ln_local(Heckman select)		ln_local (Heckman outcome)			
	Coefficient		Coefficient		Coefficient		Marginal Effect	
Mid_level	0.705 ***	(0.054)	0.162*	(0.088)	0.340***	(0.103)	0.336***	(0.102)
Core	1.142***	(0.078)	0.176	(0.141)	0.531***	(0.162)	0.527***	(0.161)
Popular	-0.007	(0.046)	-0.009	(0.082)	-0.099	(0.090)	-0.098	(0.089)
Super	0.023	(0.051)	0.209**	(0.089)	-0.091	(0.099)	-0.09	(0.098)
Ultra	0.199***	(0.052)	0.168*	(0.093)	0.025	(0.097)	0.025	(0.096)
Luxury	0.314***	(0.061)	0.158	(0.125)	0.388***	(0.119)	0.385***	(0.118)
KnwldgAvg	0.123**	(0.051)	0.107	(0.088)	0.058	(0.100)	0.057	(0.099)
KnwldgAbove	0.171**	(0.080)	0.308**	(0.145)	0.234	(0.154)	0.232	(0.153)
Expert	0.074	(0.176)	-0.127	(0.323)	0.253	(0.425)	0.251	(0.423)
RateNeutral					0.332	(0.395)	0.33	(0.392)
RateSomePos					0.493	(0.372)	0.49	(0.368)
RateVeryPos					0.503	(0.371)	0.499	(0.366)
LocalOften			0.248***	(0.090)	-0.016	(0.094)	-0.016	(0.093)
LocalAlways			0.197*	(0.117)	0.033	(0.109)	0.033	(0.108)
25to49miles			0.285**	(0.118)	-0.095	(0.126)	-0.094	(0.125)
50to99miles			0.183	(0.116)	-0.119	(0.121)	-0.117	(0.119)
100more			0.341***	(0.119)	-0.105	(0.122)	-0.104	(0.120)
Freq_locvisit			0.461***	(0.031)				
Freq_visit	0.039***	(0.012)						
White_wine	0.140***	(0.045)	0.147*	(0.083)	-0.014	(0.083)	-0.014	(0.082)
Red_wine	0.166***	(0.047)	0.076	(0.082)	-0.06	(0.086)	-0.059	(0.086)
Fruit_wine	0.014	(0.050)	0.199**	(0.087)	0.057	(0.087)	0.057	(0.086)
Champagne	0.063	(0.058)	-0.230*	(0.120)	0.031	(0.115)	0.031	(0.114)
Preparefood	0.022	(0.051)	0.157*	(0.090)	0.164	(0.106)	0.162	(0.104)
GenX	-0.135*	(0.080)	-0.082	(0.147)	-0.016	(0.146)	-0.046	(0.144)
Boomer	-0.095	(0.073)	0.004	(0.136)	-0.095	(0.143)	-0.094	(0.142)
Traditionalist	-0.036	(0.088)	0.039	(0.156)	-0.005	(0.170)	-0.004	(0.168)
Education	-0.033***	(0.011)	-0.003	(0.019)	-0.070***	(0.022)	-0.069***	(0.022)
Income	0.003***	(0.001)	-0.001	(0.001)	-0.0001	(0.001)	-0.0001	(0.001)
No.consumer	-0.076**	(0.032)	0.011	(0.054)	0.122*	(0.064)	0.120*	(0.063)
Pennsylvania	-0.132**	(0.061)	-0.104	(0.111)	0.064	(0.123)	0.064	(0.122)
Ohio	-0.172***	(0.064)	-0.024	(0.108)	-0.132	(0.109)	-0.13	(0.108)
Tennessee	0.004	(0.058)	-0.511***	(0.110)	0.167	(0.123)	0.165	(0.122)
Constant	2.882***	(0.211)	-1.854***	(0.372)	3.280***	(0.592)		
Lambda(selection bias)			-0.277***	(0.082)				
Rho(correlation of the two equations)			-0.298***	(0.087)				

*Note: Sample sizes are 1609 for all wine expenditure, 627 for ever consuming local wine, and 546 for recent expenditures on local wine. Results show part of variables. Results for variables including Foodchannel, Female, White, Urban, Resde_yr are suppressed. Robust standard errors are in parentheses. Asterisks indicate levels of significance: *** p<0.01, ** p<0.05, * p<0.1.*

Conclusions

In this article, we use an interval regression model to estimate wine consumers' total wine expenditure patterns and apply a Heckman model to analyze local wine purchase probabilities and expenditure quantities. Consumers' expenditure patterns show different influences from the market segmentation measurements, lifestyle factors, and demographic variables. After a general comparison of the absolute marginal effects of these three categories, we find that the segmentation measurements play the most important roles in influencing wine expenditure patterns. The five segmentation measurements have various levels of influence on expenditure patterns. The important influencing factors are the ones showing relatively larger marginal effects. The important factors for the total wine expenditure ranked according to importance, highest to lowest, include 1) wine purchase frequency, 2) wine prices, 3) wine knowledge, and 4) wine taste (white wine and red wine). Interest in local winery visits, residing more than 25 miles away from a local winery, and possessing above-average wine knowledge are three strong forces leading to purchases of local wines, based on regression results. On local wine expenditures, important factors include wine purchase frequency and frequently purchasing luxury wine.

Local wine production and the number of local wineries are increasing. Understanding consumer characteristics and their expenditure patterns are important to local wineries to be competitive. This article provides information which can contribute to marketing plans in increasing wine sales and staying competitive in the marketplace. To increase general wine sales in our selected regions, our results recommend targeting consumers who consume wine at least once per month, sometimes or often purchase wines priced at or above $14 per bottle, have average or above-average (but not below-average or expert) wine knowledge, frequently purchase red wine or white wine, have an interest in winery visits (perhaps for food or rural tourism as well as wine consumption), have relatively low education, and have a relatively small number of wine-consuming members in the household. To increase local wine purchase probability, we propose to target consumers who are interested in local winery visits, consider a local winery as one over 25 miles away from their residency and within their state, have above-average wine knowledge, often or always purchase locally produced foods (thus suggesting advertising venues), purchase wine monthly, prepare fresh food at least seven times a month at home, and often or always purchase white wine or fruit wine. It suggests that higher local wine purchasers are consumers who buy wine at least once a month, sometimes or often buy wine priced above $25, and have more than one member consuming wine in the household.

Results from our article are mainly consistent with findings by Zepeda and Li (2006): attitudinal and behavioral characteristics generally predict local food buying behavior better than demographic factors. From our results, these attitudinal and behavioral characteristics including wine purchase frequency, wine price preferences, wine knowledge, purchasing local frequently, having higher frequencies of visiting a local winery, and favoring the taste of white wine and fruit wine generally have stronger effects on local wine purchasing probability and purchasing quantity compared with demographic variables. The results from Dodd, Kolyesnikova, and Wilcox (2010) focusing on Texas wine are comparable with ours, too. These results include preferring white wine and fruit wine in local wine categories, and a wine knowledge level that is not the highest.

Though a few limitations may affect the generalization of our results, our research is still valuable to the literature and local wineries. One limitation of this research is that we use cross-section data. Panel data with several years' information may help us predict not only the characteristics of wine consumers but also their expenditure trends in the future. Another limitation is that our results focus on the four selected states. Generalization of our results to other states needs more analyses such as matching to states with consumers of similar characteristics. Additionally, if respondents are not representative of wine consumers, it could also affect the accuracy of our results.

However, our research fills a literature gap and provides evidence for the highly under-researched local wine consumption market to consider; our method is also applicable to the research on local wine produced in other states. Furthermore, our predicted characteristics of potential local wine consumers and their consumption information can facilitate businesses to target consumers and develop wines and services to fulfill the needs of existing patrons and attract new fans.

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