Evolving Consumption Patterns in the U.S. Alcohol Market: Disaggregated Spatial Analysis

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ABSTRACT. Global consumption patterns for beer, wine, and other alcoholic beverages are evolving, with some convergence in per capita consumption among nations as traditionally beer-drinking nations increase their consumption of wine and, conversely, wine-consuming nations shift towards beer. This paper explores the patterns of alcoholic beverage consumption among regions within the United States. One purpose is to see if similar patterns of convergence in consumption patterns can be observed at a finer (sub-national) spatial scale as have been documented in international comparisons. A more fundamental purpose is to explore the converse question and seek to better understand the persistent differences in alcoholic beverage consumption among groups, whether within or among countries. These issues are addressed using annual U.S. national and state-level data over four decades and, for the more recent period, supermarket scanner data at finer scales of geopolitical aggregation.

1. Introduction

Alcohol consumption patterns and their determinants are of interest to public policymakers and others for various reasons. One reason is public finance. In many places, alcohol excise taxes are a significant source of government revenue. Another is public health. A primary rationale for the excise taxes is that they correct for externalities that arise when the alcohol consumption imposes external social costs through its consequences for health, drunk driving, and other antisocial behavior. Some evidence suggests these taxes are not set high enough to maximize net social welfare—even in Australia where the tax rates are comparatively high (e.g., see Freebairn 2010)—and various groups around the world are pressing for stronger policies to reduce alcohol consumption and its social costs (e.g., WHO, 2014, U.S. Office of the

Surgeon General, 2016).[1] A deeper understanding of the nature of the demand for alcohol and the evolving consumption patterns will be potentially helpful in all such considerations, as well as for informing industrial policy and commercial decisions by those who produce and market alcoholic beverages.

In a recent article in the *Journal of Wine Economics*, Holmes and Anderson (2017) document and discuss trends in alcohol consumption patterns around the world using national per capita data. They report evidence of a general convergence in alcohol consumption patterns among countries, in terms of both total per capita consumption of alcohol, and the mix of beer, wine, and spirits in that total. After some discussion, the authors conclude: "In short, we find strong but not unequivocal indications of convergence in national alcohol consumption patterns across the world" (Holmes and Anderson 2017, p. 146). On the other hand, revealed in their study is the strong persistence of systematic differences in national alcohol consumption patterns, in terms of both total per capita consumption and the mix of alcoholic beverages, in spite of the substantial integration of the global market wrought by globalization. A study by Colen and Swinnen (2016) reports similar findings.

These studies of national alcohol consumption patterns provides both inspiration and a launching pad for the present study. Among nations, the United States is one of the world's largest consumers of alcoholic beverages, but it is a physically large and culturally and economically diverse country. Simple analysis of state-level data reveals large and apparently persistent differences among U.S. states in terms of total per capita consumption of alcohol, and the mix (e.g., see Fogarty and Parameswaran, 2017; Fogarty and Voon, 2018; Haughwout and

[1] Though we have seen much more public advocacy for taxing beverages containing sugar than beverages containing alcohol in recent years in the United States and several other countries.

Slater 2018). We wondered whether these data might show the same types of patterns over time—allowing U.S. states to play the roles played by countries—as revealed by the analysis of Colen and Swinnen (2016) and Holmes and Anderson (2017) using national aggregate data in a global context. Furthermore, what accounts for the large and persistent spatial differences in alcohol consumption patterns nowadays, when markets are well integrated spatially, interstate trade barriers are comparatively small, and prices are similar across the nation (and, indeed, among countries)?

To pursue these questions, in addition to some descriptive analysis using state-level per capita data for the period 1977–2016, we conduct some demand systems analysis using scanner data from supermarkets for the more recent period, 2006–2016, in which we further investigate spatial patterns of consumption among types of beer and wine. Delving beneath the aggregate categories, we find diverging trends within product categories. Market shares of higher-priced (craft) beer are growing, whereas shares of lower-priced (macro) beer shares are diminishing. We also see an increase in the share of higher-priced wine. These patterns of "premiumization" suggest a trend of demand shifting toward "higher-quality" (at least, higher-priced) beer and wine. Persistent spatial differences in consumption patterns appear to reflect differences in preferences among populations, which we explore by examining the links with demographic characteristics of U.S. market areas.

2. Accounting for Differences Among States in Per Capita Alcohol Consumption

While most U.S. states drink more beer than any other form of alcohol, they vary in terms of how much they drink and the extent to which they are specialized in beer drinking; and these

differences are persistent, though not totally unchanging.[2] What can account for these persistent differences among states? Candidate explanations include interstate differences in prices and income among consumers, differences in policies, and differences in tastes—some of which might be connected to the causes of the differences in policies and prices.

In the context of international data, both Colen and Swinnen (2016) and Holmes and Anderson (2017) focus on per capita income as a primary consideration (finding some evidence of an inverted U-shaped relationship between per capita income and alcohol consumption) along with prices paid by consumers (and taxes as an influence on them), as factors influencing per capita demands among nations. But a non-economist might examine cultural differences—we eat and drink in ways that our grandparents and parents and friends and neighbors did because that is what they taught us to do; some tastes are acquired, some habits are persistent if not addictive, and we identify to some extent with the culture from which we came. If these aspects are important, in general and on average we would expect to observe Americans of, say, German descent drinking significantly more beer and less wine per capita, compared with other Americans of, say, Italian descent, holding other factors constant.

Among the 50 states and the District of Columbia, populations differ ethnically and culturally in ways that are likely to matter for alcohol consumption. Much of the country—especially in the mid-west—was settled by Northern Europeans who are traditionally drinkers of beer or spirits, rather than wine; Southern Europeans, who are traditionally more likely to be wine drinkers, are more predominant in the Northeast. Other significant ethnic groups—Hispanics, blacks, and Asians—are also traditionally more likely to be beer drinkers than wine

[2] Change over time in per capita behavior could reflect changes in behavior of a constant population (including its age distribution and so on) or changes in composition of the population.

drinkers. Combining county-level data on ancestry of the population with national alcohol consumption shares allows us to measure the degree to which areas have cultural ties to historically beer or wine drinking nations.

Specifically, we measure the "ancestral" (predicted) rate of consumption of alcohol type *i* in a particular geographical area, *j*, A_{ij} as a weighted average of the rate of consumption of that alcohol type across nations (v_{ik} for type *i* in country *k*) where the weights are the proportions of residents in geographical area *j* having ancestry from country *k*, p_{jk}:

$$A_{ij} = \sum_{k=1}^{K} v_{ik} p_{jk} \quad (1)$$

The ancestral rate of beer consumption, for example, varies greatly across the United States. Owing primarily to the large Hispanic shares of the population, the Southwest region of the country has high ancestral beer consumption. Likewise, states in the Northeast typically have lower ancestral beer consumption owing to large Southern European population shares.

In addition to ethnicity, culture and religion may also play a role in current consumption patterns. In some states, large proportions of the population belong to religions that preach temperance or complete abstinence from consuming alcohol. Partly for those reasons, policies affecting the marketing and consumption of alcohol vary systematically among the states as a legacy of Prohibition and its Repeal. When Prohibition was repealed, it was on the condition that individual states could define their own laws governing the production and sale of alcohol, an outcome that would leave as its legacy a byzantine and bizarre set of policies that continue to hamstring alcoholic beverage producers and marketers today.

Several other socioeconomic variables may be correlated with beer and wine consumption, such as obesity prevalence, per capita income, educational attainment, and political orientation (e.g., using 2016 presidential election results).[3] Table 1 ranks states by measures of obesity prevalence, per capita income, educational attainment, and political orientation, as well as their ratio of beer to wine consumption. Some clear patterns are evident. Specifically, those states that consume relatively more wine tend to have a lower prevalence of obesity, higher income per capita, higher educational attainment, and a lower rate of voter support for Donald Trump in the 2016 national election! Does this suggest that, compared with beer drinkers, wine drinkers are more likely to be healthy, wealthy, and wise? Perhaps, however, it is important to dissect the data further, as within-state populations are quite diverse and the products are heterogeneous. Beers are not all created equal, and the beer market comprises several distinct segments that may have separate consumer bases; and the same is true for wine. In the next sections we perform more rigorous analysis using much more detailed and spatially disaggregated data to better understand the relationships between alcohol consumption and consumer demographics.

[Table 1. *State measurements and rankings for the ratio of beer to wine consumption and selected demographic variables, 2016*]

3. Demographic Influences on Demand for Beer, Wine, and Spirits: State-Level Analysis

In this section we estimate econometric models of demand to examine demographic influences on demand using annual state-level data on adult per capita ethanol consumption by alcohol type. We estimate single-equation models of per capita demand of each of the three types

[3] The data on obesity prevalence come from the Centers for Diseases Control and Prevention (2018). Per capita income and educational attainment are available through the U.S. Census (2018). Election data were accessed from www.github.com.

of alcohol, and for total alcohol, which is the sum of the three, in which the demand equation for beverage *i* in state *k* in year *t* is defined as:

$$\mathrm{D}q_{ikt} = \eta_{il}\mathrm{D}y_{kt} + \sum_{j=1}^{J} \eta_{ij}\mathrm{D}p_{jkt} + \boldsymbol{\delta}_{\mathrm{i}}\mathrm{D}\mathbf{a}_{\mathrm{ikt}} \qquad (2)$$

In this equation, the operator D denotes that each variable is expressed as a logarithmic difference relative to the mean of that variable across all states during year *t.* The per capita quantity of good *i* in state *k* in year *t* is q_{ikt}, and $\mathrm{D}q_{ikt} = \log q_{ikt} - \log \bar{q}_{it}$; y_{kt} is per capita income in state *k* in year *t*, and $\mathrm{D}y_{kt} = \log y_{kt} - \log \bar{y}_t$; similarly, p_{jkt} is the price of good *j* in year *t* for state *k* and $Dp_{jkt} = \log p_{jkt} - \log \bar{p}_{jt}$. The price coefficient η_{ij}, is the uncompensated (or Marshallian) elasticity of demand for good *i* with respect to the price of good *j*; the coefficient η_{il} is the elasticity of demand for good *i* with respect to per capita income. Both the beverage prices and per capita income were deflated by the consumer price index for all goods (CPI), representing the prices of all other goods, such that the demands are restricted to be homogeneous of degree zero with respect to prices of alcoholic beverages and all other goods (the CPI) and income. A vector of demand shift variables is represented by $\mathbf{a}_{it}$, where $\mathrm{D}\mathbf{a}_{ikt} = \log \mathbf{a}_{ikt} - \log \bar{\mathbf{a}}_{ikt}$; the vector of coefficients, $\boldsymbol{\delta}_{\mathrm{i}}$, can be interpreted as elasticities of demand for good *i* with respect to the respective elements of the vector of demand shift variables .

Results from equation (2) provide strong evidence that heritage plays a substantial role in alcohol consumption. States with high beer-consuming ancestors consume more beer, less wine, and less spirits. States with high wine-consuming ancestors consume more wine, less beer, and less spirits. States with high spirits-consuming ancestors consume more spirits and less wine.

4. Demographic Aspects of Demand for Beer and Wine: Evidence from Scanner Data

The analysis of the previous section used relatively aggregated data at the level of states, in long annual time series. These data had the disadvantage that the prices were measured poorly, and did not vary much over space, while the per capita demographic variables did not vary much over time, within a state. Now we turn to analysis using data with a higher degree of cross-sectional variation and better measures of prices. Aggregation is also an issue for the categorization of beer and wine; the product segments within each have distinct trends. Namely, the decline of U.S. beer consumption and increase in wine consumption has coincided with a trend to premiumization in the markets for both beer and wine. Our goal in this section to further dissect these spatial and temporal alcohol consumption patterns within the United States, and to do this we disaggregate states into designated market areas (DMAs) and disaggregate both beer and wine into sub-categories.

An initial motivation for this work was to understand the recent surge in demand for craft beer. The craft and macro segments of the beer industry have become quite distinct and segmented, with diverging market trajectories. We conjecture that in places where craft beer is relatively popular, compared with macro beer, wine consumption per capita might also be relatively high, reflecting the types of sociodemographic influences that were revealed in our examination of state level consumption trends and demographics.

We specify a Rotterdam model of demand (Theil, 1965) to estimate the effects of demographic variables on demand for different categories of beer and wine, controlling for the effects of relative prices and total expenditure on the beverages included in the model—i.e., treating the alcoholic beverages included in the model as a weakly separable group. This is a differential demand system model that has often been used to estimate models of demand for

alcoholic beverages including beer, wine, and spirits (e.g., Clements and Selvanathan, 1988; Clements and Selvanathan, 1991; Selvanathan, 1991; Selvanathan and Selvanathan, 2005).

In this analysis, beer sales are disaggregated into three categories: craft, macro, and import. Wine sales are disaggregated into two groups: low-priced and high-priced. The results provide strong evidence that income, ethnicity, and political affiliation are associated with differing consumer preferences for types of beer and wine. Higher income per capita is associated with a greater demand for premium beverages (craft beer and high-priced wine). When limiting the scope to demand among categories of beer, higher income per capita increases demand for imported beer as well. Areas with more Trump supporters demand more macro beer compared to all other beverages, but when examining just wine, they also demand more high-priced relative to low-priced wine. Markets with populations having a stronger ancestral link to beer-drinking nations demand relatively more macro and imported beer compared to other beverages, and more low-priced wine relative to high-priced wine.

5. Summary

The findings of the paper provide compelling evidence that alcohol consumption patterns in the U.S. are not converging in any simple or general way and the patterns are associated with enduring sociodemographic characteristics of the population. Alcohol shares differ significantly among populations and regions across the country, as do the product shares within alcohol categories. And when we try to explain these differences, it is important to look beyond the typical economic variables such as per capita income and prices. Drinking is often tied to culture and tradition. The French love their wine, and the Germans their beer; even after people immigrate to the United States their ancestral beverage preferences persist to some extent, and are instilled in younger generations.

6. References

Brewers Association. (2016). "National Beer Sales & Production Data." Available from: https://www.brewersassociation.org/statistics/national-beer-sales-production-data/. [Accessed October 1, 2016.]

Centers for Disease Control and Prevention. (2017). Overweight & Obesity. Available from: https://www.cdc.gov/obesity/data/databases.html. [Accessed July 23, 2018.]

Clements, K.W., and Selvanathan, E.A. (1988). "The Rotterdam Demand Model and its Application in Marketing." *Marketing Science* 7: 60–75.

Clements, K.W., and Selvanathan, S. (1991). "The Economic Detriments of Alcohol Consumption." *Australian Journal of Agricultural Economics* 35: 209–231.

Colen, L., and Swinnen, J. (2016). "Economic Growth, Globalisation and Beer Consumption." *Journal of Agricultural Economics* 67(1):186–207.

Github. (2017). "US President County-Level Election Results from 2012 and 2016." Available from: https://github.com/tonmcg/County_Level_Election_Results_12-16. [Accessed March 5, 2017.]

Fogarty, J., Parameswaran, G. (2017). "Alcohol Sin Taxes." Working Paper 1704, UWA Agricultural and Resource Economics, School of Agriculture and Environment, The University of Western Australia May 2017 http://www.are.uwa.edu.au

Freebairn, J.W. (2010). "Special Taxation of Alcoholic Beverages to Correct Market Failures." *Economic Papers* 29(2): 200–14.

Haughwout, S.P. and Slater, M.E. (2018). "Apparent Per Capita Alcohol Consumption: National, State, and Regional Trends, 1977–2016." National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism, Surveillance Report No. 110. [Available online at: https://pubs.niaaa.nih.gov/publications/surveillance110/CONS16.pdf (accessed 19 July 2018).]

Holmes, A.J.., and Anderson, K. (2017). "Convergence in National Alcohol Consumption Patterns: New Global Indicators." *Journal of Wine Economics* 12(2): 117–148.

Selvanathan, E. A. (1991). "Cross-Country Alcohol Consumption Comparison: An Application of the Rotterdam Demand System." *Applied Economics* 23: 1613–1622.

Selvanathan, S., and Selvanathan, E. A. (2005). "Empirical Regularities in Cross-Country Alcohol Consumption." *The Economic Record* 81: 128–142.

Theil, H. (1965). "The Information Approach to Demand Analysis." *Econometrica* 33: 67–87.

United States Office of the Surgeon General (2016). "Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health." U.S. Department of Health and Human Services (HHS). [Available online at: https://addiction.surgeongeneral.gov/sites/default/files/surgeon-generals-report.pdf (accessed July 21, 2018).]

Table 1. *State measurements and rankings for the ratio of beer to wine consumption and selected demographic variables, 2016*

	Beer/Wine		Obesity		Income		Education		GOP	
State	*Ratio*	*Decile*	*%*	*Decile*	*$*	*Decile*	*%*	*Decile*	*%*	*Decile*
WV	11.08	10	0.38	10	36,155	1	0.19	1	0.72	10
MS	7.33	10	0.37	10	32,334	1	0.21	1	0.59	7
KS	7.11	10	0.31	6	47,548	5	0.31	7	0.61	8
NE	5.96	10	0.32	8	54,660	8	0.29	6	0.64	9
IA	5.56	10	0.32	8	52,248	7	0.27	4	0.55	7
OK	5.38	10	0.33	9	44,418	4	0.24	2	0.69	10
ND	4.88	9	0.32	8	64,257	10	0.28	5	0.70	10
SD	4.66	9	0.30	5	48,306	6	0.27	4	0.66	10
SC	4.63	9	0.32	8	37,269	2	0.26	3	0.57	7
KY	4.39	9	0.34	9	38,736	2	0.22	1	0.66	9
AR	4.28	9	0.36	10	36,502	1	0.21	1	0.64	9
AL	4.21	8	0.36	10	37,158	1	0.24	2	0.64	9
PA	4.00	8	0.30	6	50,978	6	0.29	6	0.50	5
GA	3.95	8	0.31	7	45,238	5	0.29	6	0.53	6
TX	3.79	8	0.34	9	53,104	8	0.28	5	0.55	6
OH	3.76	8	0.32	7	47,419	5	0.26	3	0.54	6
WY	3.72	7	0.28	4	59,327	9	0.26	3	0.76	10
LA	3.71	7	0.36	10	44,440	4	0.23	1	0.60	8
NM	3.56	7	0.28	4	41,334	3	0.26	3	0.45	3
WI	3.38	7	0.31	6	48,063	6	0.28	5	0.50	5
IN	3.34	7	0.33	9	45,717	5	0.24	2	0.60	8
UT	3.31	6	0.25	2	44,947	5	0.31	8	0.62	8
TN	3.14	6	0.35	10	43,720	3	0.25	2	0.64	9
MT	3.14	6	0.26	2	40,041	3	0.30	7	0.61	8
ME	3.09	6	0.30	6	39,125	2	0.29	6	0.48	4
MO	3.07	6	0.32	7	42,736	3	0.27	4	0.60	7
AZ	2.85	5	0.29	5	38,940	2	0.28	5	0.52	6
MI	2.64	5	0.33	9	43,330	3	0.27	4	0.50	5
IL	2.61	5	0.32	7	54,308	8	0.32	8	0.41	2
MN	2.60	5	0.28	4	54,295	8	0.34	9	0.49	4
NC	2.44	5	0.32	8	44,194	4	0.28	6	0.52	6
NV	2.31	4	0.26	2	44,142	4	0.23	2	0.49	4
HI	2.25	4	0.24	1	51,964	7	0.31	7	0.33	1
CO	2.22	4	0.22	1	52,863	7	0.38	10	0.47	4
NH	2.12	4	0.27	3	51,827	7	0.35	9	0.50	5
MD	2.08	4	0.30	6	55,786	8	0.38	10	0.36	2
OR	2.06	3	0.29	5	50,751	6	0.31	7	0.44	3
FL	2.06	3	0.27	4	39,608	2	0.27	4	0.51	5
VA	2.05	3	0.29	5	51,443	7	0.36	9	0.47	4

AK	2.04	3	0.31	7	63,304	10	0.28	5	0.58	7
VT	1.98	3	0.27	3	44,354	4	0.36	9	0.35	1
WA	1.83	2	0.29	4	57,796	9	0.33	8	0.41	2
NY	1.72	2	0.26	2	64,522	10	0.34	9	0.38	2
DE	1.63	2	0.31	6	63,578	10	0.30	7	0.44	3
RI	1.62	2	0.27	3	47,662	6	0.32	8	0.42	2
CA	1.62	2	0.25	1	58,974	9	0.31	8	0.34	1
MA	1.47	1	0.24	1	65,168	10	0.41	10	0.35	1
NJ	1.39	1	0.27	4	56,428	9	0.37	10	0.43	3
CT	1.37	1	0.26	2	62,745	9	0.38	10	0.43	3
DC	1.10	1	0.23	1	159,141	10	0.55	10	0.04	1
ID	0.78	1	0.27	4	36,256	1	0.26	3	0.68	10

Notes: The income column is the median household income. The GOP column reflects the number of votes cast for Donald Trump in the 2016 national election, as a percentage of total votes cast for Donald Trump and Hillary Clinton.