Alcohol Consumption and Food-at-Home Dietary Quality in the United States

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Abstract

We investigate the relationship between alcohol purchases and food purchase healthfulness. A number of scientific studies suggest that wine consumption has health benefits but many do not account for potential confounding factors, such as food consumption. Using a rich data set of consumer purchases for alcohol and food-at-home, we identify a significant link between preferences for wine and preferences for healthy foods, suggesting that a confounding factor may account for a substantial portion of the health benefits that have been attributed to wine. American wine drinkers, on average, purchase healthier foods than do beer or liquor drinkers, controlling for important socioeconomic effects and demographics; the effect is even more pronounced for low-income households. The reverse is observed for users of tobacco products, who tend to eat a less healthful diet than other consumers. In this way, wine and tobacco consumption appear to signal a consumer's attitude about healthfulness.

Keywords: dietary quality, wine economics, health, Homescan, stochastic dominance, panel regression

Numerous empirical studies associate moderate alcohol consumption with cardioprotective benefits (Breslow, Guenther and Smothers 2005). In addition, experimental studies confirm that substances in certain types of alcohol, especially red wine, have biological properties that can lead to improved cardiovascular health (Frankel, et al. 1993; Bierenbaum, et al. 1994). However, less is understood about the relative merits of different types of alcohol consumption (Gronbaek 2003). Moreover, it has been theorized that at least some of the beneficial health effects attributed to alcohol may be a result of confounding error (Gronbaek 2007).

In particular, individuals may self-select for alcohol consumption based on their traits or behaviors. Principal among the latter is dietary choice. For example, individuals who eat a healthier diet may simply prefer wine to beer or liquor, as an alcohol of choice. Because a good diet is also associated with preferable health outcomes, research that attributes healthful benefits to wine consumption while failing to control for diet overstates the positive effects of wine. Indeed, several studies that rely on self-reported drinking and eating habits link wine consumption to a healthier diet than is exhibited by other types of alcohol consumers. Whether self-reported data is reliable, especially when the dietary health measure is based on a very short (24-hour) recall period, is an open question. Alternatively, two recent studies that examine actual food purchasing patterns of consumers in the United Kingdom (Gell and Meier 2011) and Denmark (Johansen, et al. 2006) also find that wine purchases are in fact associated with healthier dietary choices; moreover, effects in the former are statistically significant even after controlling for income, which has been shown to correlate very strongly with health outcomes. However, the healthfulness measure in each of these studies is somewhat subjective, one relies

on a two-week consumption diary, and the other does not include important demographic and socioeconomic controls.

Our goal in this paper is to identify in a large US panel dataset the relationship between various types of alcohol consumption at the household level and a more objective measure of dietary health, controlling for numerous demographic and socioeconomic variables as well as regional and time effects. Like Gell and Meier (2011) and Johansen et al. (2006), this study uses actual purchase data; ours is drawn from the Nielsen Homescan panel dataset, which was collected in the U.S. from 2006-2010. To evaluate the food-at-home dietary choices of American consumers with respect to their alcohol preference, we use a recently developed set of methods that quantify dietary healthfulness based on US Department of Agriculture (USDA) healthy eating guidelines (Volpe and Okrent 2012), which, among other factors, emphasize the consumption of fruits, vegetables, and whole grains while penalizing added sugars, refined grains, and packaged snacks. The most robust of Volpe and Okrent's methods devises a flexible dietary healthfulness score for each household by comparing the shares of food categories it purchased over some time period against the ideal as represented by the USDA healthy-eating pyramid.

Using pooled ordinary least squares regression analysis we find that, for all three measures, household wine consumption is a highly statistically significant predictor of a healthy food-at-home diet among American consumers, even after controlling for a range of demographic and socioeconomic factors, and smoking. At the quarterly frequency, we show that household dietary health increases with its expenditure on wine, its share of wine consumed against all alcoholic beverages, and the number of visits made to purchase wine. Using an innovative

classification system, we find that households who devote a plurality of their alcohol-directed dollars toward wine have healthier diets than those that prefer beer or spirits. By interacting alcohol preference with income level, we show the correlative wine effect is stronger for lower income consumers. For example, a no-income household that prefers wine is estimated to choose a diet with 5% higher level of healthy foods, versus a household that prefers beer consumption; but, as household income approaches $100 thousand, wine preference is no longer associated with a more healthful diet (although income level is). Finally, we organize wine purchases into share quartiles to examine in more detail how a household's wine preference intensity relates to dietary healthfulness.

Our results shed more light on the relationship between alcohol choices and a healthy diet, and confirm the existence of a likely confounding effect of diet on wine health benefits. The panel feature our data invites future study about whether the health effects associated with alcohol consumption are due to the drink or the drinker. Moreover, the results in this paper represent just one application of the systematic calculation of dietary health presented by Volpe and Okrent (2012); food purchase healthfulness can be applied to a wide range of economic and health issues.

Data and Methodology

The primary dataset used in this study is the 2006-2010 Nielsen Homescan Database. This dataset consists of the self-scanned purchases of a sample of households. For each shopping trip, a participating household records its complete purchases from any outlet channel by scanning the UPCs of all food and beverage products, including alcoholic beverages and tobacco products,

using a scanning device provided by the Nielsen company.[1] We aggregate these individual trips into quarterly observations, summing over the purchases and categorizing them. Like Gell and Meier (2011), we exclude homes that did not scan any alcohol purchases from 2006-2010. A total of 70,676 households yield usable records for both food and alcohol purchases during the sample period. Many households participated in the survey for repeated years, making the dataset an unbalanced panel; the average length of household participation of nearly 16 quarters, or four years. The Homescan data include detailed information on product names and characteristics as well as household demographics and socioeconomic status.

Several previous studies have used self-reported measures of dietary health and alcohol consumption to study the empirical relationship between alcohol preference and dietary intake. In contrast, although Homescan does not include health indicators such as BMI found in some other datasets, and only includes food and beverage purchases for at-home consumption, these data have the advantage of covering a longer time series, include households with repeated participation, and clearly differentiate among wine, beer, and spirits. This last point is the basis of our empirical investigation.

Measuring Dietary Quality

A typical household purchases hundreds of food and beverage products over a quarter-year. Assuming parity between purchase and consumption, we assess the dietary quality of each household's consumption based on how its purchases conform to the Dietary Guidelines for

[1] Starting in 2007 Nielsen ceased collecting data on individual random weight products, or those without UPCs. As a result we do not have data on the purchases of non-UPC coded products.

Americans (DGA).[2] The Quarterly Food-at-Home Price Database (QFAHPD), a data product of the Economic Research Service, provides a useful foundation for this task by organizing the Homescan database products into 52 comprehensive and non-overlapping food groups. The food groups were selected with the DGA in mind, making this organizational scheme particularly well-suited to our research aims. Todd et al. (2010) provide the complete details behind the creation and maintenance of the QFAHPD.

For robustness, we use three distinct approaches to measure the healthfulness of quarterly shopping baskets, each rooted in household expenditures according to the QFAHPD food groups. These measures were devised by Volpe and Okrent (2012) and the complete details behind their formulation and construction are available in those authors' Appendix A. Below, we briefly describe each healthfulness measure as well as their relative strengths and weaknesses. Because these measures are calculated quarterly, a household's purchases are allowed to vary over the five-year sample period. All healthfulness measures are normalized to a 100-point scale.

The simplest measurement is the expenditure share on healthful foods (*HealthShare*), which is calculated as the total share of each shopping basket attributed to those QFAHPD food groups recommended for consumption by the USDA (see table A.1). Because the classification system is binary, this approach benefits from ease of interpretation and construction as well as the fact that there is no need to match the QFAHPD-defined food groups up with food groups defined by other methodologies. The *Healthshare* measure appears to mirror the classification method used by Gell and Meier (2011). An obvious weakness of *Healthshare* is that it does not take into

[2] The DGA are a joint product of USDA and Health and Human Services. For more information, including the details of their latest revision, see CNPP (2010).

account the importance of variety in food consumption, as described by the DGA and illustrated in USDA's MyPlate[3]. For example, a diet consisting entirely of eggs will be classified as 100% healthful, which is probably not the case.

We also calculate scores for each quarterly shopping basket based on recommended expenditure shares, by food category, as determined by the Center for Nutritional Policy and Promotion (CNPP) (Carlson et al., 2007). These scores are intended to provide guidance for households seeking to purchase food for at-home consumption that meets the DGA. In constructing these scores we assume that shoppers who apportion their food expenditures according to these recommendations are meeting the guidelines, and penalties accrue for deviations from recommendations. The CNPP provides expenditure recommendations by age and gender, so the extensive demographics in the Homescan database allow us to calculate recommendations specific to each household without making assumptions based on U.S. Census information. One drawback is that, while these scores account for the importance of dietary variety, they are adversely affected by missing data. Most Homescan households do not record the entirety of their FAH purchases. As a result we calculate these scores three different ways to deal with common cases of unreported food categories (*USDAScore1-3*). We only report the results of USDAScore1, since it well represents the estimates generated for USDAScore2 & 3, with respect to magnitude, sign, and significance.

For our final measure, we assign each quarterly shopping basket a score based on the 2005 Healthy Eating Index (HEI), a measure of diet quality designed by USDA, revised in

[3] Details of MyPlate are available here: http://www.choosemyplate.gov/.

collaboration with the National Cancer Institute.[4] HEI reports a score for overall diets based on how the total number of servings consumed compares to the recommendations of MyPlate. Consumption is organized into nine major components and points are awarded for each individual component based on whether or not consumers meet the requirements of MyPlate. We apply this procedure to food purchases in the Homescan database to generate *HEIScore*; a 100 point *HEIScore* represents 100% compliance with USDA's healthy eating pyramid. However this approach also requires a matching process as the QFAHPD food groups need to align with those of the National Health and Nutrition Examination Survey (NHANES), as documented in appendix A of Volpe and Okrent (2012). One other complication with *HEIScore* is that some households exhibit unreported food categories. See the appendix referenced above for more details.

Incorporating Alcohol Purchases

Neither the QFAHPD nor any of the healthfulness measures described above accounts for alcohol purchases. In 2006 the Homescan database began to incorporate alcohol purchases; we link these to contemporaneous household food purchases, by quarter. We also include expenditures on tobacco products, since these may serve as a proxy for overall attitudes towards healthfulness and thus be an important control in our analysis.

The key variables measuring alcohol and tobacco purchases pertain to the total expenditures and purchase frequency of each. We calculate *ExpWine*, *ExpBeer*, and *ExpLiquor* to represent total expenditures on the various alcohol types by household and quarter. *AlcTotExp* is the quarterly sum of these three variables. Furthermore *VisitsWine*, *VisitsBeer*, and *VisitsLiquor* give the total

[4] Guenther, Reedy, and Krebs-Smith (2008) provide a thorough discussion of the development of the HEI.

number of shopping trips, regardless of outlet or store format, that included each variety in any quantity. Analogous variables offer the same information for tobacco. We include both expenditure and purchase frequency to account for the fact that we cannot directly measure alcohol consumption, only purchases. Moreover, alcoholic products are typically very storable—indeed, some are *meant* to be stored—and are regularly purchased for social gatherings, which opens the possibility of a time lag between quantities purchased and quantities consumed among individual households. Presumably however, outlier purchases are smoothed at the quarterly frequency. Substantively similar findings for both expenditures and the number of visits lend robustness to our results. *WineShare*, *BeerShare*, and *LiquorShare* are the respective quarterly expenditure shares of each alcohol category, calculated as shares of *AlcTotExp*. Calculation of alcohol expenditure shares affords another way to examine the examination of the relationship between diet quality and alcohol choice, focusing on the relative choices made by households rather than absolute expenditures.

We use the variables above to identify households according to their preferred alcohol choice over the entire time series, i.e., *WineDrinker*, *BeerDrinker*, and *LiquorDrinker* are dummy variables equal to one for households having the most total expenditure on wine, beer, and liquor respectively. *WineDrinker_year*, *BeerDrinker_year*, and *LiquorDrinker_year* are calculated in the same way for each individual year in the sample, allowing a household the flexibility to alter its alcohol preference over time. Finally, we classify wine preference intensity by splitting the *WineDrinker* households according to quartile, using dummy variables. The higher a household's wine quartile, the higher is the share of its alcohol budget devoted to wine.

Controls

Regional effects are dummied according to the US geographic location of the participating household: *Northeast*, *South*, *Midwest*, and *West*. The racial makeup of the household is indicated by *White*, *Black*, *Asian*, and *Other Race*. Our socioeconomic controls are income, education, hours worked, and occupation. *HH Income* is annual household income in thousands of dollars, and *Education* is categorical variable representing the educational attainment of the household head, ranging from 0-6, or grade school through postgraduate school. *Hours Worked* is the number of hours worked by the household head; defined on a weekly basis, it ranges from 0-3, representing the number of paid work hours to greater than 35 hours. Another vector of dummy variables represents the occupation of the household head. Finally, we define a household that purchases more than $100 worth of tobacco products in a single year as a *Smoker* for that year.

The Model

To identify the relationship between dietary quality and preferred type of alcohol consumption, we model the healthfulness measure of household food shopping basket, for household i, quarter q, and metric m, as:

$$(1) \qquad DietaryHealth_{i,q,m} = Z_i'\theta_1 + X_{i,q}'\theta_2 + alcohol_{i,q}'\beta + \varepsilon_{i,q,m}.$$

Equation (1) explains household dietary choices as a function of time-invariant attributes (Z_i) like race and region, socioeconomic variables and other effects that vary over time ($X_{i,q}$) such as income and year of observation, a measure of alcohol preference, and an error term that captures

unobserved variation in the outcome. The vector β represents the relationship of interest; our objective is to determine if it remains statistically significant after controlling for a range of predictors of dietary healthfulness. By changing the way the alcohol preference term enters (1), we can determine the average conditional correlation between purchase level, share, and number of visits and diet health, as well as considering the impact of preference intensity. For example, if the third term in (1) is defined according to the flexible vector represented by:

$$(2) \qquad alcohol_{i,q} = [Winedrinker\_year],$$

then β yields the correlation between the preference for wine drinking in a given calendar year on dietary health, after controlling for the regressors Z_i and $X_{i,q}$. Adding the variable $Smoker_{i,q}$ to (1) as a proxy for a household's attitude towards health, may improve the precision of β, which is intended to represent to the association between alcohol choice and diet. Using the Homescan panel, we estimate (1) by pooled OLS regression of the dietary outcome on the controls and the alcohol term. Several versions of (1) are estimated, according to the three dietary measures and the construction of the alcohol variable.

We make the following empirical assumptions, which allow us to interpret our findings as the association between alcohol preference and dietary choices:

I. The Nielsen data accurately represent food- and alcoholic-beverage-at-home purchases.

II. Food-at-home (FAH) purchases signify household consumption patterns

a. Although away-from-home food purchases may be different with respect to healthfulness, cross-household diet ordering is similar to that of those found in the Nielsen data

III. The distribution of away-from-home alcohol purchases is similar to that of the alcohol purchases in the Nielsen data.

However, even if these assumptions are faulty, our results are still valuable, in that they show how the healthfulness of FAH purchases correlate with alcohol purchasing for at-home consumption in a large sample of US consumers.

Statistics and Results

Table 1 displays descriptive statistics for the Homescan variables in our analysis. Dietary measures increase in healthfulness; they also share the same scale, ranging from 0-100. On average, nearly 33% of a sample households' FAH purchases were in healthy categories, as defined by USDA. In addition, quarterly household diets attained a mean score of about 40 and 52 based on the USDA and HEI criteria, respectively. These two measures are based on systems that favor healthy food types, while penalizing the purchase of unhealthy food.

According to table 1, the average Homescan household spent $16.88 on wine in a given quarter, more than on any other alcohol type. Of course, many households in the sample did not to buy any wine at all, accounting for the large standard deviation and range. The same pattern is observed for beer and liquor, and is magnified for alcohol products, which have the highest

average spending level for any sin product, but a standard deviation twice as high, and a range five times larger than beer, its closest competition.

In a given quarter, a participating household spent just less than half its alcohol budget on wine, on average, and split the remainder almost equally between beer and spirits. It also made two store visits to purchase wine, and devoted one visit for each of the other products. On the other hand, the most active household in the sample made 89 store visits to purchase tobacco products in a single quarter, about one trip per day. When participants are classified using dummy variables that identify their preferred alcohol type by expenditure share over the entire sample, table 1 shows that 46% of Homescan households are considered "wine drinkers", while beer and spirits drinkers make up 21% and 33% of the sample, respectively.

The designation *Smoker* signifies a household that spent more than $100 on tobacco products in a calendar year; 10% of the household observations in the sample carry that label. Average household size is just above 2, while mean income is 65 thousand dollars. Average education and hours worked variables indicate that the average education level of household heads in the sample was "some college", while hours worked are just at a full work week (40 hours). 85% of the sample is white, 8% are black, 2% are Asian, and 5% classify themselves as another race. Most of the Homescan population lives in the Midwest and South.

Table 2 shows the correlation matrix between the three dietary measures, total household alcohol expenditure over the entire sample, and whether the household earned the *Smoker* designation. The three diet measures are all positively correlated, but only at a level of 0.28 for *Healthshare*

and *HEI*. Spending on every alcohol type is positively correlated with dietary health, although wine is consistently higher than beer or spirits. This result is shown graphically in figure 1, which depicts the frequency distribution of *Healthshare* for Homescan households, based on the type of alcohol preferred. In the figure, the wine drinkers' distribution appears to stochastically dominate that of households who prefer wine or spirits. Figure 2 shows the associated cumulative distribution functions (CDFs), which confirm that result: the wine drinker's CDF is below and to the right of households who prefer beer or spirits. Whether this finding stands up in the face of our controls is explored in the next section. In table 2, *Smoker* households all correlate negatively with the diet measures and wine purchasing, but positively with beer and liquor spending.

Regression analysis by quarter

To identify the relationship between alcohol type consumption and dietary health in the panel data while controlling for the impact of other predictors, we estimate pooled OLS models shown in table 3. Standard errors for table 3 (and all regression output tables in this paper) are corrected for clustering at the household level, since repeated observations from the same household are not independent. Without this correction, standard errors would be too low, confusing the interpretation of the estimates. These models represent household behavior, by quarter, and the coefficients are interpreted as the impact a one unit increase in the regressor has on the outcome variable (which follows a 100-point scale). For example, we interpret the highly significant value 0.37 for wine in column 3a to mean that one additional store visit to purchase wine is associated with a 0.37 point higher *Healthshare* score, on average. Beer purchasing shares are excluded to avoid perfect collinearity.

For every health measure, wine consumption is consistently associated with a strongly significant, positive association with dietary health. Were the quarterly alcohol expenditure share on wine to somehow rise 100%, it would be associated with 3.08, 1.35, and 0.56 higher levels of *Healthshare*, *USDAScore1*, and *HEI*, respectively. Expenditure and visits exhibit a similar pattern. For the average household, an additional $100 in wine spending is associated with a 4.4 higher *Healthshare* score.

Among the controls, households who purchase tobacco products demonstrate a strong and significant tendency to purchase foods that yield a lower dietary health score. Larger household sizes are associated with lower *Healthshare* and *HEI* scores, but higher *USDAScore1* values. Higher income is associated with a higher diet, as expected. For work hours, this is the case too, with respect to *Healthshare* and *USDAScore1*; the negative correlation between work hours and *HEI* is marginally significant.

Analysis of household behavior over the sample period

Table 4 shows the estimates of models that classify households as *WineDrinkers*, *BeerDrinkers*, and *LiquorDrinkers* based on the sum of their behavior over the entire sample period (columns 1a, 2a, and 3a); we refer to this as a "fixed" preference. To provide a more flexible alternative, we do the same based on their behavior in any given calendar year (columns 1b, 2b, and 3b). Once again, beer drinker terms are excluded to avoid the dummy variable trap. Table 4 shows that both fixed and flexible wine preference is associated with a consistently better diet, according to all three measures, versus beer preference. For the same income level, a household

that prefers wine has a 5.47 point higher *Healthshare* score than one that prefers beer. For two households that display the same preference discrepancy, but over only a single calendar year, the household with the wine preference enjoys a 4.87 point *Healthshare* advantage over the household with the beer preference. The diet result for spirits is less than half that of wine. Still, table 4 shows that liquor preference is associated with a better *Healthshare* and *USDAScore1* than those of beer drinkers, but their *HEI* scores are not distinguishable. By interacting the preference dummies with income, we find that the diet effects of wine and decreases with income. That is, the lower a household's income, the more likely it is to eat healthier if it prefers wine than if it prefers to consume other type of alcohol

Preference intensity

In table 5, we present models that split the household *Winedrinker* classification according to quartile, based on the share of its alcohol budget that it spends on wine, i.e., the highest quartile contains those homes that devote 100% of their alcohol expenditure to wine. Beer drinkers are excluded from the table to avoid the dummy variable trap. The impacts of the other preference variables are interpreted relative to the average beer drinker. The results in table 5 show that homes that just make the cutoff as wine drinkers exhibit a healthier diet—for all three measures—than beer drinkers. The magnitude of the association between wine choice and *Healthshare* increases with preference intensity, while the opposite is true for the other measures, but these trends are not statistically significant. Liquor drinkers also eat healthier than beer drinkers, but the magnitude of all liquor estimates are exceeded by every wine quartile in each model.

Conclusions

In this study we investigate the possibility that dietary quality is a confounding factor in the identification health benefits for wine consumption. That is, we ask if it is possible that previous studies have overestimated the health benefits of wine consumption by neglecting to account for food preferences, as measured by dietary quality. We demonstrate using Nielsen Homescan data that wine purchases are more strongly correlated with food purchase quality than are beer consumption or liquor consumption. We then subject the data to rigorous econometric analysis to control for demographics, regional effects, and other important considerations and show that these relationships persist and are statistically significant.

Our study confirms for American consumers the findings of several recent empirical analyses of foreign populations: the dietary health of wine drinker may account for a substantial portion of the health benefits that have been attributed to wine. Moreover, the effect is even more pronounced for low-income households. The reverse is observed for users of tobacco products, who tend to eat a less healthful diet than other consumers. In this way, wine and tobacco consumption appear to signal a consumer's attitude about healthfulness.

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Table 1. Descriptive statistics for variables in the Nielsen Homescan panel: 2006-2010

	Obs.	Mean	Std. Dev.	Low	High
Dietary Health Measures					
Healthshare	384066	32.9	11.8	0	100.0
USDAScore1	384066	39.5	12.6	4.5	99.4
HEI	364171	51.7	12.8	0	100.0
Household Spending ($), by quarter					
Wine	384066	$16.88	$25.18	0	$121.50
Beer	384066	$7.64	$13.66	0	$74.18
Liquor	384066	$16.06	$30.32	0	$163.44
Tobacco Products	384066	$17.49	$65.65	0	$544.82
Shares of Alcohol Spending, by quarter					
Wine	384066	45%	44%	0	100%
Beer	384066	27%	40%	0	100%
Liquor	384066	28%	40%	0	100%
Store Vists for Sin Purchases, by quarter					
Wine	384066	2	3	0	49
Beer	384066	1	1	0	32
Liquor	384066	1	2	0	57
Tobacco Products	384066	1	4	0	89
Households by Alcohol Preference, entire sample (plurality of purchases)					
Wine	384066	46%	50%	0	100%
Beer	384066	21%	41%	0	100%
Liquor	384066	33%	47%	0	100%
Controls					
Smoker	384066	0.10	0.30	0	1
Household size	384066	2.13	0.76	1	9
Income ($K)	380216	65.0	38.2	2.5	200
Education	384066	3.39	1.99	0	6
Work hrs. per week	384066	3.75	3.21	0	9
White	384066	0.85	0.07	0	1
Black	384066	0.08	0.14	0	1
Asian	384066	0.02	0.07	0	1
Other race	384066	0.05	0.11	0	1
Midwest	384066	0.35	0.19	0	1
Northeast	384066	0.15	0.14	0	1
South	384066	0.27	0.23	0	1
West	384066	0.23	0.19	0	1

Table 2. Correlation between dietary measures, total household alcohol spending, and tobacco preference

	Healthshare	*USDAScore1*	*HEI*	*Wine*	*Beer*	*Liquor*	*Smoker*
Healthshare	1						
USDAScore1	0.62	1					
HEI	0.28	0.27	1				
Wine	0.14	0.10	0.06	1			
Beer	0.00	0.08	0.06	0.20	1		
Liquor	0.04	0.03	0.01	0.24	0.20	1	
Smoker	-0.14	-0.09	-0.06	-0.05	0.02	0.08	1

Table 3. Pooled OLS results for several measures of dietary health and alcohol preference

	Healthshare			*USDAScore1*			*HEI*		
	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
	Exp.	*Exp. Share*	*Visits*	Exp.	Exp. Share	Visits	*Exp.*	*Exp. Share*	*Visits*
Alcohol choice[a]									
Wine	0.044***	3.08***	0.37***	0.033***	1.35***	0.33***	0.018***	0.56***	0.18***
	(0.0015)	(0.081)	(0.014)	(0.0015)	(0.082)	(0.016)	(0.0014)	(0.080)	(0.014)
Beer	-0.031***		-0.33***	0.0095***		0.11***	0.012***		0.036*
	(0.0018)		(0.019)	(0.0019)		(0.020)	(0.0020)		(0.020)
Liquor	0.0073***	1.44***	0.034	0.0071***	0.42***	0.083***	-0.00050	-0.12	-0.055***
	(0.0012)	(0.094)	(0.021)	(0.0013)	(0.094)	(0.021)	(0.0012)	(0.092)	(0.019)
Controls									
Smoker	-5.01***	-4.89***	-4.96***	-2.75***	-2.63***	-2.75***	-1.95***	-1.90***	-1.90***
	(0.13)	(0.13)	(0.14)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)	(0.14)
HH Size	-1.46***	-1.48***	-1.49***	0.63***	0.61***	0.62***	-0.94***	-0.94***	-0.94***
	(0.038)	(0.038)	(0.038)	(0.041)	(0.041)	(0.041)	(0.035)	(0.035)	(0.035)
Income ($K)	0.030***	0.031***	0.031***	0.023***	0.025***	0.025***	0.041***	0.042***	0.041***
	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.0014)	(0.0014)	(0.0012)	(0.0012)	(0.0012)
Education	-0.029	-0.012	-0.028	1.06***	1.08***	1.06***	0.26***	0.27***	0.27***
	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)	(0.027)	(0.027)	(0.027)
Work Hrs	0.26***	0.27***	0.27***	0.099***	0.11***	0.11***	-0.030**	-0.027*	-0.028*
	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.015)	(0.015)	(0.015)
Constant	32.5***	31.1***	32.6***	31.9***	31.7***	31.8***	49.8***	49.8***	49.8***
	(0.14)	(0.15)	(0.14)	(0.14)	(0.15)	(0.14)	(0.12)	(0.13)	(0.12)
Dummies[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.055	0.053	0.053	0.067	0.064	0.067	0.027	0.026	0.027
Observations	380216	380216	380216	380216	380216	380216	360504	360504	360504

[a]For each dietary measure, the columns signify the unit of alcohol choice as (1) quarterly expenditure, (2) quarterly expenditure share [beer omitted], and (3) number of purchase visits over the quarter.

[b]All regressions include region, race, occupation, and year dummies.

Note: Standard errors are reported in parentheses, and are robust to household level clustering. Significance levels are indicated by asterisks: *** p<0.01, ** p<0.05, * p<0.1.parentheses.

Table 4. Pooled OLS results for majority alcohol preference (1) over the entire sample period and (2) caculated for each calendar year

	Healthshare		*USDAScore1*		*HEI*	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
	Exp.	*Visits*	Exp.	Visits	*Exp.*	*Visits*
Alcohol preference[a]						
Winedrinker	5.47***	4.87***	2.42***	2.18***	1.91***	1.62***
	(0.21)	(0.17)	(0.20)	(0.17)	(0.19)	(0.16)
Winedrinker X Income ($K)	-0.026***	-0.025***	-0.0088***	-0.0091***	-0.018***	-0.016***
	(0.0028)	(0.0023)	(0.0028)	(0.0023)	(0.0027)	(0.0023)
Liquordrinker	2.35***	2.13***	0.69***	0.62***	0.14	0.090
	(0.22)	(0.19)	(0.21)	(0.18)	(0.20)	(0.17)
Liquordrinker X Income ($K)	-0.0071**	-0.0073***	0.0011	0.00084	-0.0041	-0.0028
	(0.0030)	(0.0025)	(0.0030)	(0.0026)	(0.0030)	(0.0025)
Controls						
Smoker	-4.77***	-4.81***	-2.56***	-2.59***	-1.82***	-1.85***
	(0.14)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)
HH Size	-1.43***	-1.45***	0.64***	0.63***	-0.94***	-0.94***
	(0.038)	(0.038)	(0.041)	(0.041)	(0.035)	(0.035)
Income ($K)	0.045***	0.045***	0.028***	0.029***	0.052***	0.050***
	(0.0023)	(0.0019)	(0.0022)	(0.0019)	(0.0023)	(0.0020)
Education	-0.0017	-0.0084	1.09***	1.09***	0.28***	0.28***
	(0.029)	(0.029)	(0.030)	(0.030)	(0.027)	(0.027)
Work Hrs	0.27***	0.27***	0.11***	0.11***	-0.024	-0.024
	(0.016)	(0.016)	(0.017)	(0.017)	(0.015)	(0.015)
Constant	29.7***	30.0***	31.1***	31.2***	49.1***	49.2***
	(0.19)	(0.17)	(0.18)	(0.17)	(0.18)	(0.16)
Dummies[b]	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.061	0.057	0.066	0.065	0.027	0.027
Observations	380216	380216	380216	380216	360504	360504

[a]For each dietary measure, alcohol preference is represented as a dummy variable for each alcohol type that equals one if (1) the majority of purchases over the entire sample period are of that type, or (2) the majority of alcohol purchases over a single calendar year are of that type [beer excluded].

[b]All regressions include region, race, occupation, and year dummies.

Note: Standard errors are reported in parentheses, and are robust to household level clustering. Significance levels are indicated by asterisks: *** p<0.01, ** p<0.05, * p<0.1.parentheses.

Table 5. Pooled OLS results for wine preference intensity

	Healthshare	*USDAScore1*	*HEI*
	(1)	(2)	(3)
Preference Intensity[a]			
Winedrinker Q1	3.23***	2.22***	1.09***
	(0.16)	(0.17)	(0.15)
Winedrinker Q2	3.87***	2.43***	1.04***
	(0.16)	(0.17)	(0.15)
Winedrinker Q3	4.06***	1.96***	0.91***
	(0.17)	(0.17)	(0.16)
Winedrinker Q4	4.07***	0.82***	0.0048
	(0.16)	(0.16)	(0.14)
Other Alcohol preference			
Liquordrinker	1.95***	0.77***	-0.080
	(0.11)	(0.11)	(0.11)
Controls			
Smoker	-4.80***	-2.61***	-1.87***
	(0.14)	(0.13)	(0.14)
HH Size	-1.42***	0.64***	-0.94***
	(0.038)	(0.041)	(0.035)
Income ($K)	0.029***	0.024***	0.041***
	(0.0013)	(0.0014)	(0.0012)
Education	-0.0023	1.08***	0.27***
	(0.029)	(0.030)	(0.027)
Work Hrs	0.27***	0.11***	-0.026*
	(0.016)	(0.017)	(0.015)
Constant	30.6***	31.4***	49.8***
	(0.15)	(0.15)	(0.14)
Dummies[b]	Yes	Yes	Yes
R^2	0.060	0.067	0.027
Observations	380216	380216	360504

[a]Wine preference intensity represents the share of alcohol expenditure devoted to wine over the entire sample, for wine drinkers (households that spend more on wine than beer or spirits), separated by quartile. Beerdrinker [exluded] and liquordrinker are defined likewise.

[b]All regressions include region, race, occupation, and year dummies.

Note: Standard errors are reported in parentheses, and are robust to household level clustering. Significance levels are indicated by asterisks: *** p<0.01, ** p<0.05, * p<0.1.parentheses.

Figure 1

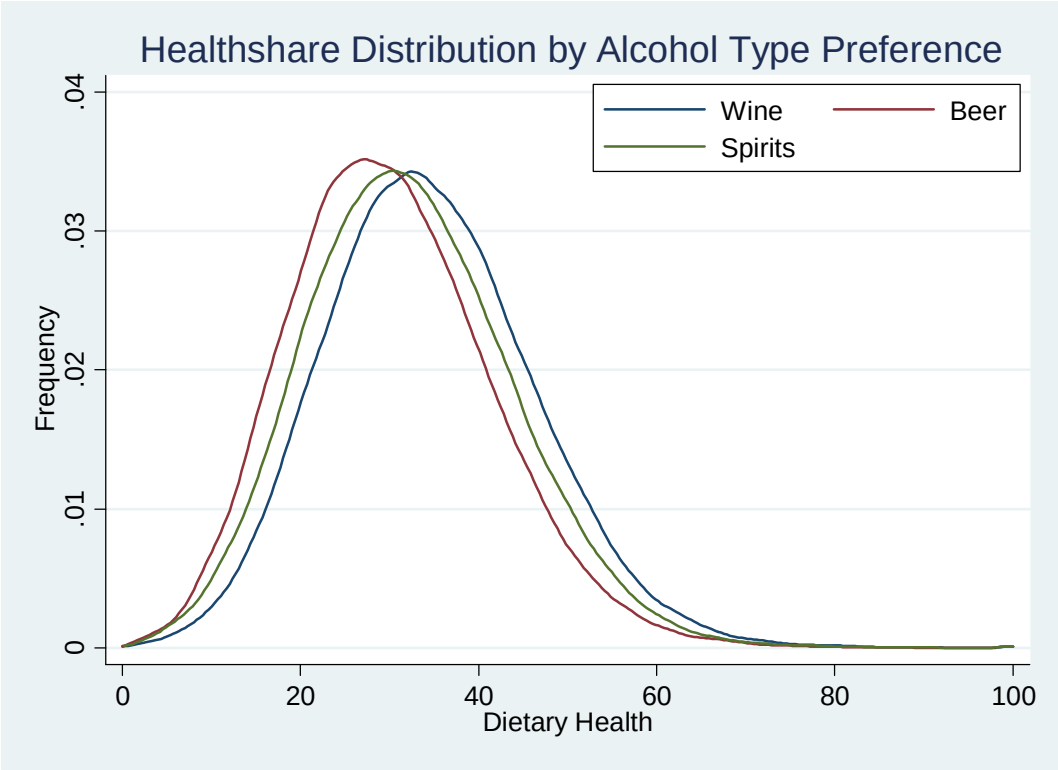

Figure 2