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# Alcohol Control Laws and the Consumption of Distilled Spirits and Beer

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This article tests the social marketing effectiveness of alcohol control laws designed to reduce the consumption of alcoholic beverages. The study uses state-level historical data to estimate the demand for distilled spirits and beer using economic, sociodemographic, and control-law explanatory variables. Spirits and beer consumption are found to react differently to changes in economic, sociodemographic, and regulatory variables. These differences suggest a consumer and product segment-based approach to alcohol control laws or social marketing that emphasizes measures directed at youths for beer and at price for spirits.

Much research attention is given to the impact of economic and informational variables such as price, product quality, and advertising on consumer behavior. Less attention is given to the impact of market regulations, although a host of regulations is often in operation in a given market. Economic, informational, and regulatory factors are of course interrelated since, for example, regulations often change the amount and kinds of information available to consumers (Day and Brandt 1974) or the real price facing consumers. Nevertheless, the impact of regulations on consumer behavior deserves separate study to examine how effective the regulations are—especially as they relate to economic and other factors affecting consumers. What, for example, dominates consumer decisions in a given market: price, advertising, or market regulations? Although much regulatory legislation is passed, its effectiveness in influencing consumer decisions is often open to question.

Another regulatory issue that has not received much attention is the interaction of regulations with consumer and product segments. Social marketers and the architects of market-influencing laws expect segmentation to maximize results—as in traditional demand-increasing efforts—since segmentation can produce larger gains than a uniform treatment of consumers and products can. It is well recognized that social marketing is a far more difficult task than

traditional marketing for a variety of reasons, among them a lack of good information on consumers relating to social issues and a general inability to segment the market (Bloom and Novelli 1981). To the extent that consumer and product segments can be more clearly identified, laws and social marketing can be directed to specific market segments, reducing coercive and wasteful effects on all other segments.

This article studies these issues in a product area that has long been heavily regulated: alcoholic beverages. It looks at the fundamental, aggregate determinants of demand for alcoholic beverages in order to assess the role of regulations relative to economic and sociodemographic variables, and to identify consumer and product segments relative to regulation.

Alcoholic beverages are the tranquilizer of choice in this country, providing relaxation and facilitating social interaction for millions. But excessive alcohol consumption produces externalities of unknown size as the result of auto accidents, medical costs, fires, and social services for alcoholics. Attempts to minimize these and other alcohol-induced social costs by means of alcohol control laws have been made in many countries for centuries. While numerous studies have examined individual control laws (frequently finding little relationship between a law and consumption) or such social indicators of drinking as drunk arrests, driving while intoxicated, or alcohol mortalities (Popham, Schmidt, and de Lint 1976), few studies have examined a variety of control laws as a group. As a result, the overall efficacy of control laws in reducing consumption and their differing effects on each beverage are in doubt. The purpose of this study is to fill this gap by estimating the impact of a variety of control measures on the demand for distilled spirits

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and beer. Unfortunately, wine had to be deleted because of a lack of price data.

This article is organized around a discussion of the three major groups of factors that determine alcohol consumption: economic, sociodemographic, and regulatory. After a brief history of U.S. alcohol control laws, various hypotheses about the effects of these factors are offered. Next, the results of econometric demand estimation for distilled spirits and beer are discussed, with special attention paid to models for license states. Finally, conclusions are formulated, particularly concerning the relative influence of economic, sociodemographic, and regulatory variables on consumers, and the government's ability to "demarket" alcohol products.

### A BRIEF HISTORY OF ALCOHOL CONTROL LAWS

Alcohol control laws can be divided into three general categories: (1) economic legislation directed at raising revenues for the state and/or protecting sellers from competition, (2) attempts to control the social costs resulting from excessive drinking, and (3) attempts to prevent product adulteration and false advertising. Following the end of Prohibition in December 1933, each state (and in many cases, local city and county governments) adopted a wide range of alcohol control laws. Many of these—control of hours and days of sales, limited licenses, one drink sales—had been in existence at various times for centuries. The most prominently mentioned public interest purposes for such laws were the control of crime, the raising of public revenue, and the control of problems stemming from consumption—particularly excessive consumption. The central focus of consumption control was a systematic attack on the market mechanism through price controls, limits on entry, advertising restrictions, state monopoly controls, elimination of tied houses, and bans on such nonprice competition as consumer credit, games, prizes, giveaways, and free samples. There is little doubt that following Prohibition there was broad public support for protecting the public interest by restricting competition.

Unique post-Repeal control laws restricted price competition by using resale price maintenance in license states and uniform pricing in monopoly states. The laws also restricted alcohol brand-label content and the media's use of advertising, and they eliminated tied "saloon" houses or forward integration into retail sales. They banned advertising in certain media or heavily censored its content under the justification that such restrictions would reduce the demand for alcoholic beverages. Interestingly, there is little evidence to support the view that the absence of advertising during Prohibition lowered consumption (Warburton 1932). Advertising-content regulations were

also designed to prevent such false and misleading advertisements as the widespread pre-Prohibition ads proclaiming the miraculous healing powers of alcoholic beverages.<sup>1</sup> Label contents were regulated to control misinformation, but there is some evidence to suggest that label regulations were used by existing distilled spirit manufacturers to control new firm entry (Urban and Mancke 1972).

Targeting saloons and tied houses for elimination was a central focus of temperance groups, since under the system of tied houses, manufacturers and wholesalers were said to put continual pressure on saloonkeepers to increase sales and profits. And striving for greater profits was held to be incompatible with consumption-control policies. The resulting ban on vertical integration was thought to weaken the profit motive (McGuire and Staelin 1983). A similarly specious argument was used to justify the state monopoly system of sales, which was thought to remove the profit motive from the sale of alcoholic beverages, thereby reducing sales.

There was clearly both antagonism and cooperation between temperance groups and various levels of sellers of alcoholic beverages around the time of Repeal. Conflicts existed over such policies as state monopoly selling and vertical integration. However, under the licensing system of sales, unwittingly or by design both temperance groups and retail sellers worked to restrict competition—one group seeking a reduction in drinking externalities and the other group seeking monopoly rents.

### THE DEMAND MODEL

There have been a number of attempts to estimate the demand for individual alcoholic beverages (Ornstein and Levy 1983), ranging from complex treatments like Niskanen's (1962) simultaneous-equation system for beer, wine, and distilled spirits and the systemwide approach of Clements and Johnson (1983) to simple single-equation price-income models, like Hogarty and Elzinga's (1972) study of the demand for beer. Many of these models share an almost complete lack of attention to the highly regulated markets in which

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<sup>1</sup>Some of the more egregious examples of health claims appearing in liquor ads before prohibition were: "America's greatest medicine," "Nursing mothers—build up your strength and the health of your infant by taking an invigorating stimulant," "Coughs, colds, grippe, asthma, bronchitis, and consumption speedily cured," "Good for the kidneys—that concentrated essence of the juniper berry known in its purest form as gin," (Russell 1940). Before condemning advertisers for what is now known to be patently false, it should be remembered that the curative powers of alcoholic beverages were widely subscribed to for centuries. In 17th and 18th century England and America many people thought a daily ration of beer or ale was a necessary ingredient for good health and thus for life itself.

alcoholic beverages are sold, and to how various regulations may affect the demand for alcoholic beverages. (Major exceptions include Morin 1966; Simon 1966; Smith 1976; and Weinstein 1983.) The main purpose of our demand estimation is to assess the significance of various control laws as a guide for judging their effectiveness in demarketing alcohol consumption. Since the main control laws are at the state level, this requires a cross-sectional demand model. The model in aggregate form is:

$$C_{it} = k \prod_{j=1}^n E_{jit}^{b_j} \prod_{j=n+1}^m SD_{jit}^{b_j} \prod_{j=m+1}^p R_{jit}^{b_j} e^{u_{it}}$$

where

$C_{it}$  = Consumption per capita in state  $i$  in year  $t$

$E_{jit}$  = Economic variables ( $j = 1, \dots, n$ )

$SD_{jit}$  = Sociodemographic variables ( $j = n + 1, \dots, m$ )

$R_{jit}$  = Regulatory variables ( $m + 1, \dots, p$ )

$u_{it}$  = Error term

We postulated a multiplicative demand model because we expected the economic, sociodemographic, and regulatory variables to have nonlinear, interactive effects on consumption. The log-linear, constant-elasticity formulation makes it possible to distinguish increasing and decreasing scale effects. The variables tested are listed in the Exhibit.<sup>2</sup> Data sources are in the Appendix.

An alternative research test would have involved long time series data, which allow comparison of pre- and post-regulation effects on consumption. This is a superior test because of the potential endogeneity of regulations in each state; for example, if regulations simply reflect prior cultural attitudes towards drinking, then passing new regulations may have little effect on consumption. However, since such data are not available for all regulations for a sufficient time period, we were forced to use the cross-section analysis. The latter is nevertheless quite powerful in that it explains differences in equilibrium consumption levels under different regulatory regimes.

No supply equation is specified, since the cost of supply, absent transportation costs, is relatively invariant across states. Distilled spirits are produced in a few states or they are imported; beer is manufactured regionally because of transportation-cost considerations. Roughly three-quarters of all states have "affirmation" laws requiring manufacturers to sell to wholesalers at prices no higher than the lowest price in all other states. Finally, simultaneous-equation es-

timation of a cross-section model by Smith (1976) did not prove superior to ordinary least squares.

## Economic Variables

The dependent variable is annual consumption per capita. For distilled spirits there is some measurement error because all sales in a given year are not necessarily consumed in that year and because some consumption comes from illegal production. But this error is minor and is taken up by the error term. More specifically, inventoried spirits are more than likely to be consumed on a regular basis, creating little distortion in any given year. Illegal production and sale is a minor problem today. For example, in 1956—the peak post-war year for federal seizures of stills—there were over 14,000 stills seized, while in 1977 and 1978 there were 481 and 361, respectively (*The Liquor Handbook*, 1979). Total consumption is deflated by the population 14 years of age and older, rather than by the minimum legal drinking age, to account for underage consumption.<sup>3</sup> If the starting age for underage drinking differs across states, this can introduce some error; however, the results are insensitive to differing levels of population age deflation.

The economic variables consist of real price, real income per capita, price in adjacent states, and out-of-state travel. A conventional demand variable that is not included is the price of substitutes. Previous demand estimation studies over the past thirty years have found no consistent evidence of substitutability between beer, wine, and distilled spirits (Ornstein and Levy 1983). This lack of evidence does not mean that substitutability does not take place but rather that without large shocks to the market, substitutability is difficult to detect econometrically.

The relationship between consumption and price is subject to bias because state boundaries do not coincide

<sup>3</sup>Some would maintain that the dependent variable should measure the amount of consumption by heavy drinkers since heavy drinkers are primarily responsible for the social costs of drinking. Attempting to meet this argument, alcohol-related mortality as a proxy for excessive drinking was also used as a dependent variable, covering deaths from alcohol cirrhosis, alcohol psychosis, and alcoholism. The results were distinctly inferior to those obtained using mean consumption, with such perverse results as positive price elasticities. A major problem in the use of alcohol-mortality data is measurement error—reported alcohol mortalities grossly understate true alcohol mortalities. For example, in 1977 there were 18,783 alcohol mortalities reported, but HEW personnel estimate the true figure to be in excess of 200,000. The discrepancy arises from a lack of autopsies in some areas, large variance in the quality and incidence of autopsies across states and within states, and the social stigma of listing alcohol as a contributor to death on death certificates. In any event, mean consumption is a fair proxy for heavy drinking. The simple correlation between mortality per capita and consumption per capita in our samples is 0.60 for distilled spirits and 0.28 for beer, both significant at the 0.01 level. Liver cirrhosis mortality data has, however, been used successfully in other studies (Cook and Tauchen 1982).

<sup>2</sup>A more complete description of the data is available from the authors.

**EXHIBIT**  
**KEY TO VARIABLES**

Variable	Description
<b>Economic</b>	
CONDS	Consumption per capita in gallons of distilled spirits
CONB	Consumption per capita in gallons of beer
PDS	Real price of distilled spirits
PB	Real price of beer
PDADJ	(Price of spirits in lowest priced adjacent state ÷ own state price) ÷ own state size
INC	Real income
TOUR	Tourism, measured by annual state payroll in hotels, motels, and tourist courts ÷ total state payroll
<b>Sociodemographic</b>	
URBAN	Urbanization, measured as state metropolitan population ÷ total state population
YOUTH	Main drinking population, measured as population 18 to 44 ÷ total state population
CATH	Percentage of state population that is Catholic
BAPT	Percentage of state population that is Southern Baptist or Latter-Day Saints
PROT	Percentage of state population that is Protestant, measured as (1 – CATH – BAPT) × percentage of state population that is Christian
TEMP	Mean average temperature in degrees centigrade
<b>Regulatory; Retail availability</b>	
MINAGE	Minimum legal drinking age for distilled spirits or beer
LICON	Number of on-premise liquor outlets per capita
LICOF	Number of off-premise liquor outlets per capita
SUNDAY	Dummy variable for Sunday sales; equals one if off-premise sales are allowed and zero if prohibited
DRUG	Dummy variable for drug store sales; equals one if drug store sales allowed and zero if prohibited
GROC	Dummy variable for grocery store sales; equals one if grocery sales allowed and zero if prohibited
LOCOP	Dummy variable for local option; equals one if local option exists and zero if nonexistent
<b>Regulatory; Price controls</b>	
RPM	Dummy variable for resale price maintenance; equals one if there is mandatory fair trade, mandatory markups, or price posting from retailer to consumer and zero otherwise
RPOST	Dummy variable for wholesaler to retailer price posting; equals one if there is price posting and zero otherwise
PSTAX	Excise tax on distilled spirits in dollars
<b>Regulatory; Advertising controls</b>	
BILLB	Dummy variable for billboard advertising; equals one if allowed and zero if prohibited
NOVEL	Dummy variable for retailer novelties; equals one if allowed and zero if prohibited
PPRINT	Dummy variable for print price advertising; equals one if allowed and zero if prohibited
PBILLB	Dummy variable for billboard price advertising; equals one if allowed and zero if prohibited
<b>General regulation</b>	
MONOP	Dummy variable for monopoly states versus license states; equals one for monopoly states and zero for license states

with economic markets in some cases (Wales 1968). Because of price differentials between states, consumers cross state borders to purchase alcoholic beverages. As a consequence, states with relatively high prices have understated per capita consumption while states with relatively low prices have overstated per capita consumption. When this border-crossing effect is in operation, price elasticity is biased upward. To correct this bias, the lowest-price-adjacent-state variable is included. Border crossing is a function of the relative price differential between adjacent states and the cost of transportation (ignoring the cost of being caught). As a crude proxy for transportation costs the size of state is included in adjacent state price. The adjacent state price variable is measured by dividing the lowest adjacent state price by own state price and then dividing this new ratio by state size. To illustrate, holding state size constant, in states with relatively higher prices, adjacent state price is less than one, while in states with relatively low prices, adjacent state price is greater than one. In both cases, as adjacent state price increases, consumption per capita increases, leading to a positive coefficient for adjacent state price.

This is a crude procedure compared to that of Wales (1968), who measured population within various distances from the border of each state. However, the Wales border-crossing variable is not only costly to reproduce and subject to arbitrary measurement (how far from the border is population to be measured and how should major highways be factored in?), but it gave Wales results—zero price elasticity—that are hard to believe. In contrast, our border-crossing variable performs as predicted, correcting the upward bias in price elasticity to a plausible level.

Another major cause of out-of-state consumption is travel due to tourism, business meetings, conventions, and so on. In states and areas where such activities are prominent, such as Nevada, Hawaii, and the District of Columbia, consumption is overstated relative to true resident consumption. Lacking direct measurement of tourism and other out-of-state travel, a proxy measure is used: the percent of state payroll in hotels, motels, and courts. This variable—called tourism—should be positively related to consumption.

Distilled spirit price consists of a weighted average of manufacturer-suggested retail prices for eight leading brands in each state.<sup>4</sup> The price index probably deviates from actual mean prices, but it nonetheless should provide a reliable rank ordering across states. In states where private-label selling is substantial, mean price is likely to be lower than the index reflects, but the suggested mean price should also be lower in such

<sup>4</sup>The brands are: Seagram's 7-Crown, Old Crow, Old Grand-Dad, Dewar's, Smirnoff, Bacardi, Canadian Club, and Beefeater.

states. Transaction prices will also differ from suggested retail prices owing to periodic price discounting when discounting is not blocked by regulation. To the extent that discounting is due to regulatory differences across states—such as banning or allowing price advertising—these differences should be captured by our regulatory variables, as explained later. However, a price distortion may arise between monopoly states and private-license states if manufacturer discounts are not passed on to consumers in monopoly states.

Because of “affirmation” laws it may be thought that price differences across states are due solely to differing state tax levels. This is not the case. The correlation in our sample between state distilled-spirits taxes and prices is 0.42, indicating that prices differ for reasons other than tax levels. Prices may vary because of differing demand and supply conditions at the wholesale and retail levels in each state and because of differing market regulations. Certain brands and types of liquor have higher demand in some states than others. Also, where price advertising is allowed, prices should be lower.

The price of a single brand of medium-priced, nationally sold beer is used as the beer price. How representative this price is for all beer in a given state is unknown, although as a medium-priced beer it should track well with mean price. Nevertheless, because a single brand is used, estimates of the price elasticity of demand for beer are expected to be subject to greater error than are those of distilled spirits.

Inadequate beer-price data has been a persistent problem in studies of the demand for beer in the United States. Horowitz and Horowitz (1965) used state taxes on beer as a proxy for beer price, and found that price elasticity was not significantly different from zero. Weinstein (1983) used tax data, finding very low price elasticity. Hogarty and Elzinga (1972) used a weighted average price of packaged and draught beer by state for Pabst Blue Ribbon and Blatz Pilsner, using data developed in an antitrust case. They found a unitary price elasticity. No general index of beer price by state has been developed to date.

### Sociodemographic Variables

Drinking surveys have shown a variety of drinking patterns across sociodemographic groups (Cahalan and Cisin 1976; Cahalan, Cisin, and Crossley 1969). For example, drinking intensity tends to be higher in urban areas, to be highest between the ages of 18 and 44, and to vary across different religious groups. Thus, variables for urbanization, for the percent of population 18 to 44, and for different religious affiliations are included in the model.

These variables are included to avoid specification error. Strong a priori arguments have not been devel-

oped to explain why these variables are related to consumption. For example, in considering the finding that there is more drinking in urban areas, one can easily speculate on such economic and sociological causes as higher income, more leisure time, greater cultural acceptance of drinking, a concentration of skid-row alcoholics, and greater peer group pressure to drink. From this list we would emphasize income, and we would expect a strong correlation between urbanization and income, but we recognize that urbanization may represent a summary statistic for noneconomic explanations of consumption. Similarly, the reasons why age and religion are related to drinking are not completely understood, but there are some well known causal factors. For example, the ability of the body to tolerate alcohol declines with age, while religion may signal strong moral convictions and peer group pressure against excessive drinking.

Religious variables by state are available for Christian religions only. Population-religion variables were constructed for Protestants, Catholics, Southern Baptists, and Latter-Day Saints. Because of their proscriptions against alcoholic beverages, the latter two denominations were combined into a single variable with an expected inverse relationship to consumption. Finer designations—of liberal or conservative Protestants, for example—were not possible. No a priori hypotheses are offered for Protestants and Catholics, although religious groups in general are likely to be more opposed to excessive drinking than are secular groups.

In addition to these sociodemographic variables, a variable measuring mean temperature is included in the expectation that distilled spirits are consumed more in cold climates and beer is consumed more in warm climates.

### Regulatory Variables

The regulatory variables can be divided into four categories: retail availability, price controls, advertising restrictions, and ownership control.

*Retail Availability.* Retail restrictions include minimum age, number of outlets, legality of Sunday sales, legality of drug store and grocery store sales, and the existence of local option votes in dry versus wet counties. Minimum age is expected to be inversely related to consumption. The effect may not be substantial since drinking by 18 to 20-year-olds is not likely to be a large percentage of total drinking. Moreover, illegal drinking by underage youth may be widespread, cancelling out legal age differences. However, in terms of the two beverages examined, minimum legal drinking age is expected to influence beer consumption more than distilled spirits consumption. Beverages lower in alcohol content tend to be lower

in price, leading to a greater quantity demand—especially among low-income, younger drinkers.

The number of liquor outlets is measured in two ways: on-premise and off-premise. In states where it is legal for a single outlet to have both on- and off-premise sales, on- and off-premise are combined. Number of outlets is not a purely exogenous variable, since it is a function of the demand for alcoholic beverages in a given area. Thus, a positive relationship is expected, but the direction of causality is ambiguous.

Availability is also determined by sales in nonliquor stores, such as drug stores and grocery stores. Such sales are legal in certain license states, where in most cases, both drug and grocery stores are licensed to sell. As with the number of liquor outlets, since drug store and grocery store sales are not strictly exogenous variables, the meaning of a positive relationship obtained with them is ambiguous. It is interesting to include number of outlets and sales in nonliquor stores in the analysis despite this identification problem because alcohol reformers consider them to be major determinants of demand.

Off-premise Sunday sales are expected to be positively related to beer consumption and unrelated to distilled spirit consumption. Since spirits are easily stored, a ban on Sunday sales will likely affect the purchasing pattern of spirits but not the quantity of spirits consumed. Beer is not so easily stored: it is bulkier and needs to be refrigerated prior to consumption. The acts of purchasing and consuming it are generally more proximal. Thus, spontaneous decisions to drink beer on Sundays at picnics, ballgames, barbecues, beach parties, and the like can be adversely affected by a Sunday sales ban.

Legal option refers to the constitutional legality of counties voting for or against restricted sales. It is used as a proxy for the existence of dry counties and for strong public sentiment against drinking. It is expected to have an inverse relationship to consumption.

*Price Controls.* Regulations that have the potential to restrict price competition are a chief concern of this study. State governments regulate price competition by means of wholesaler and retailer price-posting ordinances,<sup>5</sup> mandatory markup policies, and mandatory resale price maintenance.<sup>6</sup> In modeling these

controls, mandatory resale price maintenance and markups are assumed to have identical effects: restrictions on price competition and higher prices. Price posting on retail prices is also assumed to be equivalent to resale price maintenance since it prevents retailers from lowering prices below posted levels (although the levels can be changed, generally on a monthly or quarterly basis). A composite dummy variable is thus used to reflect price fixing above competitive levels. If a state has mandatory resale price maintenance, mandatory markups, or price posting at the retail level, it is regarded as having resale price maintenance. This variable is expected to be negatively associated with consumption. Price posting also exists in some states at the wholesale level. Such information availability among a small group of nonexclusive-dealing wholesalers can facilitate price conspiracies. Evidence in support of wholesaler collusion would result in an inverse relationship between wholesale price posting and consumption.

*Advertising Restrictions.* The main advertising media under state control are print (local newspapers and magazines), outdoor (billboards and signs), and point-of-purchase (in-store displays, window advertising, and “giveaway” novelties). Advertising restrictions consist of limitations on content (references to children, motherhood, Santa Claus, or price), value of novelties, and size of signs, as well as prohibition of contests, games, and prizes—and in some cases, total prohibition of advertising.

Critics of liquor advertising are concerned chiefly with the content of advertising messages, the total amount of advertising, and the advertising of price. Modelling content is beyond the scope of this study, and data on dollar advertising by state are unavailable. Therefore, our analysis is limited to whether billboard advertising is prohibited, whether novelties can be used, and whether price advertising is allowed in print and outdoor advertising. The effect of banning print advertising could not be tested: since only two states prohibit its use, there was insufficient variability across states.

Our a priori hypothesis holds that advertising’s main effect is on intra-industry sales (shifts in sales across brands) and not on industry demand. There is little evidence of a positive relationship between industry advertising and industry consumption in alcoholic beverages (Duffy 1982; Grabowski 1976; McGuinness 1980). Therefore, no significant relationship between the presence or absence of nonprice advertising and per capita consumption is expected. Exceptions

<sup>5</sup>Price posting refers to a legal requirement for each manufacturer to post its wholesale and/or retail price with the state alcohol beverage commission, usually on a monthly or quarterly basis, and to maintain those prices for a fixed period of time. This eliminates intrabrand as well as interbrand price competition for the fixed price period.

<sup>6</sup>Another means of influencing price is through tax policy. Excise taxes vary widely across states, ranging in 1978 from \$1.50 per gallon in New Mexico, Maryland, and the District of Columbia to

\$4.75 per gallon in Florida for distilled spirits. Beer excise taxes in 1978 ranged from 2 cents per gallon in Wyoming to 77 cents per gallon in South Carolina. Since excise tax is reflected in the price variable, no separate variable for excise taxes is required.

to this are novelty giveaways, since these allow discounts in kind, lowering real price. In contrast to nonprice advertising, the absence of price advertising will increase consumer search costs, raising the mean and variance of prices and reducing consumption. Conversely, in states where price advertising is allowed, price should be lower and consumption greater. This indicates a positive relationship between price advertising and per capita consumption.

*Ownership Control.* The final regulatory variable is whether a state is a monopoly state; that is, whether it owns and operates the wholesale and retail distribution system or licenses private individuals and firms at the wholesale and retail level. Numerous studies have tested for consumption differences between monopoly and license states, with most finding no significant difference when holding price, income, etc. constant (Morin 1966; Popham, Schmidt, and de Lint 1978; Simon 1966). Curiously enough, no prior studies have offered a hypothesis for why consumption should differ between monopoly and license states.

One reason for differing consumption is that nominal prices tend to be lower in monopoly states, suggesting greater consumption in such states. This pattern of lower prices deserves an explanation because early justification of the monopoly system centered on keeping prices high—at profit-maximizing levels—to discourage consumption. Simon (1966) argued that lower prices in monopoly states might result from lower operating costs due to fewer, more efficient stores (for example, resale price maintenance in license states encourages large numbers of inefficient stores) or from some unexplained institutional bias toward lower prices, such as a belief that current revenues are “satisfactory” or “fair.” Peltzman (1971) offers another explanation, arguing that “Government firm management will use prices to confer benefits on voters in return for effective political support for the enterprise and its management.” Since tax liabilities and purchases differ across voters, all voters will not gain from a lower price. But if a sufficient number of voters can be given a price reduction that exceeds their tax liability, then prices will be lower. Peltzman maintains that in low-priced whiskies, prices are lower in monopoly states than in open states, providing greater benefits to low-income groups.

Whatever the reason for lower prices in monopoly states, holding everything else constant, lower prices should lead to greater consumption. But as just noted, most studies find no difference in consumption. The question is whether after holding price, income, religion, etc. constant, there is a basis for hypothesizing lower consumption in monopoly states because of the form of ownership.

Form of ownership can clearly change the incentives of managers and employees. By limiting competition

and severing the link between profits and rewards for managers, monopoly systems will reflect a totally different operation, changing the real price to consumers. For example, brand selection is greatly restricted in monopoly states, with state stores carrying only leading brands. By not carrying private-label and cheaper brands available in license states, monopoly states restrict consumption. In addition, shopping costs are, in general, higher in monopoly states: there are far fewer outlets—about a third of the outlets available in license states, on average; store hours are greatly restricted; and in-store layouts and product displays in some monopoly states make brand selection a costlier process. Contrary to studies based on list prices, monopoly states effectively raise the true price to consumers. This should result in lower consumption in monopoly states.

### Sample and Parameter Estimation

The sample for distilled spirits was constructed from observations made on 50 states plus the District of Columbia during the years 1974–1978 and resulted in 255 observations. For beer, price data were missing in two states, Hawaii and Alaska, and were only available for the years 1976–1978, yielding an initial sample of 147 observations. We chose a pooled time-series cross-section sample in order to have sufficient degrees of freedom, given the large number of explanatory variables, and because we anticipated multicollinearity problems. A Chow test for pooling across years on the distilled spirits sample yielded an F-ratio of 0.195, insignificant at the 0.01 level, indicating that model homogeneity across years cannot be rejected. A similar test for the beer sample produced an F-ratio of 0.182, which is also highly insignificant. Since the primary variation is across states and not over time, we made the assumption that the 1976 beer-price data were applicable for 1974 and 1975 (using 1974 and 1975 beer-price deflators), making the number of beer-price observations compatible with all other variables.

Parameter estimation was done using ordinary least squares (OLS), ordinary least squares with dummy variables (OLSDV), and variance components (VC) methods. These methods imply different assumptions about the stochastic structure in the pooled time-series cross-sectional design. When using OLS, the error term is assumed to be totally stochastic across states and over time. At the other extreme, OLSDV assumes the existence of a fixed intercept for every state, capturing all state-specific effects that are not in the model. Finally, VC assumes a random intercept for each state; this places VC in between no state specific effects (OLS) and fixed state intercepts (OLSDV).

The reported findings are based solely on OLS estimation for two reasons. First, OLSDV could not



provide unique estimates of the state intercepts because of apparent linear combinations between some intercept and regulatory dummy variables. Second, the assumption of random intercepts, implied by the VC method, is difficult to justify when one models the entire population of cross sections (Judge et al. 1980, p. 331). Indeed, the primary objective of the empirical analysis is to explain differences in per capita consumption across all states; thus the fifty-one cross sections are not a random sample of a larger population. The VC estimates, which are very close to the OLSDV estimates of the slope coefficients, were occasionally meaningless (e.g., nonsignificant price effects), probably because of collinearity between the random intercepts and some explanatory variables (Judge et al. 1980, pp. 336–338). While the OLS results may overstate somewhat the significance levels of some estimates, they are very stable, and for the most part, economically plausible.

## EMPIRICAL RESULTS

### Distilled Spirits

The regression results for the full sample are in Table 1 and for license states only in Table 2. We divided the total sample in this manner, since certain regulatory variables—drug and grocery stores, resale price maintenance, etc.—are applicable only in license states. Three or four regression equations are presented for each sample tested. Multiple regression runs were used to illustrate the stability or sensitivity of the parameters in light of the presence of collinearity. Certain variables are collinear—print-price and billboard-price advertising, income and youth, and resale price maintenance and wholesale price posting. As a consequence, certain collinear variables were selectively deleted to test the sensitivity of the results to multicollinearity.

*All States.* Table 1 shows that price is highly significant. The coefficient of price suggests that demand is price-inelastic, but in almost every case the coefficient is not significantly different from one at the 0.05 level. There is, however, some confounding between price and adjacent-state price because price appears in the adjacent-state price variable as well. However, the net effect of adjusting price for its component in adjacent-state price is to raise the price coefficient about 0.06; that is, closer to  $-1.0$ . In the absence of holding adjacent-state price constant, price would be biased upward, and in fact, when adjacent-state price is dropped from equation 1.1 (see Table 1), the price coefficient rises to  $-1.085$ . But clearly, there is a significant adjacent-state price effect, requiring its inclusion. In short, holding constant adjacent-

TABLE 1  
CONSUMPTION REGRESSIONS FOR DISTILLED SPIRITS,  
ALL STATES

Variable	Equation		
	1.1	1.2	1.3
Intercept	3.509 (.810) <sup>a</sup>	4.139 (.794) <sup>a</sup>	4.136 (.778) <sup>a</sup>
PDS	-.859 (.148) <sup>a</sup>	-.969 (.138) <sup>a</sup>	-.917 (.137) <sup>a</sup>
PDADJ	.063 (.011) <sup>a</sup>	.062 (.011) <sup>a</sup>	.067 (.011) <sup>a</sup>
INC	.555 (.158) <sup>a</sup>	.432 (.155) <sup>a</sup>	.436 (.152) <sup>a</sup>
TOUR	.311 (.024) <sup>a</sup>	.325 (.024) <sup>a</sup>	.322 (.023) <sup>a</sup>
URBAN	.122 (.039) <sup>a</sup>	.120 (.039) <sup>a</sup>	.133 (.039) <sup>a</sup>
YOUTH	-.007 (.331)	.089 (.326)	.058 (.319)
CATH	-.114 (.031) <sup>a</sup>	-.132 (.031) <sup>a</sup>	-.135 (.031) <sup>a</sup>
BAPT	-.059 (.016) <sup>a</sup>	-.068 (.016) <sup>a</sup>	-.065 (.016) <sup>a</sup>
PROT	-.255 (.092) <sup>a</sup>	-.296 (.091) <sup>a</sup>	-.191 (.094) <sup>b</sup>
TEMP	-.222 (.050) <sup>a</sup>	-.260 (.052) <sup>a</sup>	-.254 (.050) <sup>a</sup>
MINAGED	-.020 (.177)	-.116 (.182)	-.137 (.177)
LICON	.107 (.027) <sup>a</sup>	.094 (.027) <sup>a</sup>	.099 (.026) <sup>a</sup>
SUNDAY	-.033 (.032)	-.066 (.031) <sup>b</sup>	-.062 (.030) <sup>b</sup>
LOCOP	.024 (.028)	.022 (.028)	.022 (.028)
BILLB	-.105 (.041) <sup>a</sup>		
NOVEL	.085 (.039) <sup>b</sup>	.087 (.040) <sup>b</sup>	.083 (.038) <sup>b</sup>
MONOP	-.116 (.038) <sup>a</sup>	-.083 (.039) <sup>b</sup>	-.081 (.037) <sup>b</sup>
PPRINT		.072 (.033) <sup>b</sup>	
PBILLB			.138 (.038) <sup>a</sup>
F-RATIO	53.79 <sup>a</sup>	53.34 <sup>a</sup>	55.68 <sup>a</sup>
R <sup>2</sup>	.794	.793	.800
N	255	255	255

<sup>a</sup> $p \leq 0.01$ .

<sup>b</sup> $p \leq 0.05$ .

state purchasing effects, price elasticity is approximately unitary.<sup>7</sup>

The other economic variables—income and tourism—are consistently positive and significant, as expected. Income is inelastic, a finding consistent with previous studies (Ornstein and Levy 1983). Tourism is highly significant in each case and is the most important variable in terms of explaining variation in consumption.

The sociodemographic variables are all significant and have the expected sign, except youth, which is insignificant. Urbanization is positive, which is consistent with previous studies. Youth is insignificant in each equation in Table 1, suggesting that distilled spirits consumption is unrelated to the age distribution of the population. Youth and income, however, are

<sup>7</sup>Previous price elasticity estimates for distilled spirits in the United States range from 0.0 to  $-2.0$ , while estimates for European countries are typically less than  $-1.0$  (Ornstein and Levy 1983). The results of any given study for the United States seem highly sensitive to the sample tested and also to the specification of the model and the method of estimation.

TABLE 2  
CONSUMPTION REGRESSIONS FOR DISTILLED SPIRITS, LICENSE STATES

Variable	Equation			
	2.1	2.2	2.3	2.4
Intercept	.627 (.892)	.612 (.871)	.917 (.901)	.876 (.904)
PDS	-.614 (.156) <sup>a</sup>	-.639 (.153) <sup>a</sup>	-.685 (.157) <sup>a</sup>	-.717 (.160) <sup>a</sup>
PDADJ	.042 (.009) <sup>a</sup>	.039 (.009) <sup>a</sup>	.041 (.009) <sup>a</sup>	.041 (.009) <sup>a</sup>
INC	.576 (.147) <sup>a</sup>	.644 (.144) <sup>a</sup>	.497 (.156) <sup>a</sup>	.541 (.155) <sup>a</sup>
TOUR	.273 (.021) <sup>a</sup>	.264 (.021) <sup>a</sup>	.270 (.022) <sup>a</sup>	.265 (.022) <sup>a</sup>
URBAN	.148 (.039) <sup>a</sup>	.132 (.039) <sup>a</sup>	.131 (.039) <sup>a</sup>	.130 (.039) <sup>a</sup>
YOUTH	-.490 (.298)	-.641 (.285) <sup>b</sup>	-.298 (.293)	-.294 (.293)
CATH	-.162 (.029) <sup>a</sup>	-.184 (.029) <sup>a</sup>	-.174 (.031) <sup>a</sup>	-.170 (.030) <sup>a</sup>
BAPT	-.080 (.019) <sup>a</sup>	-.072 (.019) <sup>a</sup>	-.087 (.021) <sup>a</sup>	-.083 (.019) <sup>a</sup>
PROT	-.406 (.095) <sup>a</sup>	-.447 (.094) <sup>a</sup>	-.432 (.097) <sup>a</sup>	-.429 (.097) <sup>a</sup>
TEMP	-.185 (.061) <sup>a</sup>	-.224 (.060) <sup>a</sup>	-.172 (.062) <sup>a</sup>	-.164 (.064) <sup>b</sup>
MINAGED	.438 (.194) <sup>a</sup>	.371 (.186) <sup>b</sup>	.407 (.199) <sup>b</sup>	.430 (.198) <sup>b</sup>
LICON	.148 (.033) <sup>a</sup>	.161 (.033) <sup>a</sup>	.148 (.034) <sup>a</sup>	.151 (.034) <sup>a</sup>
SUNDAY	-.081 (.033) <sup>b</sup>	-.114 (.034) <sup>a</sup>	-.091 (.036) <sup>b</sup>	-.082 (.035) <sup>b</sup>
DRUG	-.003 (.034)		-.044 (.031)	-.043 (.031)
GROC		.081 (.031) <sup>a</sup>		
RPM	-.081 (.033) <sup>b</sup>	-.039 (.035)	-.093 (.036) <sup>a</sup>	-.084 (.034) <sup>b</sup>
RPOST	-.044 (.032)	-.050 (.031)	-.028 (.034)	-.037 (.033)
LOCOP	-.010 (.032)	-.032 (.033)	-.017 (.033)	-.017 (.033)
BILLB	-.132 (.054) <sup>b</sup>	-.175 (.050) <sup>a</sup>		
NOVEL	.164 (.048) <sup>a</sup>	.175 (.047) <sup>a</sup>	.130 (.050) <sup>b</sup>	.114 (.046) <sup>b</sup>
PPRINT			.024 (.047)	
PBILLB				-.019 (.045)
F-RATIO	64.43 <sup>a</sup>	67.66 <sup>a</sup>	61.89 <sup>a</sup>	61.84 <sup>a</sup>
R <sup>2</sup>	.888	.892	.884	.884
N	185	185	185	185

<sup>a</sup> $p \leq 0.01$ .

<sup>b</sup> $p \leq 0.05$ .

strongly correlated, which obscures the results for youth. When income is dropped, youth becomes positive and significant. However, the causal meaning of youth is unclear, since youth is a proxy for such determinants of drinking as income, tastes, and physical capacity to handle alcohol.

The religious variables are all negative and significant, supporting the view that religious affiliation fosters less drinking. Contrary to our expectation that the Baptist variable would show the strongest relationship, Protestant appears to have the largest effect; however, the size of Protestant's coefficient and level of significance is the most erratic of the three religious variables across the models tested. Thus, although we cannot establish which religion has the strongest effect, Christian religious affiliation as a whole is consistently inversely related to consumption, as expected. Temperature, the last variable in the sociodemographic category, is negative and highly significant, supporting the a priori expectation that the consumption of distilled spirits is greater in colder climates.

The regulatory variables present a mixture of sig-

nificant and insignificant results, although as a group they are significant. The group significance should not be overstated, however; as we will show, one significant variable (billboard advertising) has a contrary sign, and a second significant variable (number of licenses) has an ambiguous relationship to consumption. Minimum age, Sunday sales, and local option are all generally unrelated to consumption. The minimum age result is consistent with prior findings (Barsby and Marshall 1977) and suggests that youthful drinkers tend to prefer beer and wine to distilled spirits. The Sunday sales variable is significant in equations 1.2 and 1.3 (see Table 1), but has the wrong sign. The on-premise licenses per capita variable is consistently positive and significant, but as indicated before, the direction of causality between consumption and licenses is ambiguous. When the off-premise licenses variable is used, it is insignificant. This results from its high correlation with monopoly of  $-0.75$ . When licenses are deleted there are no major changes, although Catholic is only marginally significant.

The price-advertising variables (bans on print and

billboard-price advertising) are both positive and significant in equations 1.2 and 1.3, respectively (see Table 1). This finding supports the view that price advertising leads to lower price and higher consumption. In a separate study, it was found that absence of price advertising raised mean price approximately three percent (Ornstein and Hanssens 1984). In contrast, general advertising on billboards shows perverse results, since the sign of billboard is counterintuitive. The novelty giveaways variable is positive, indicating a lower effective price and thus higher consumption. However, its significance is sensitive to the inclusion of off-premise outlets and Catholic affiliation.

The last regulatory variable—monopoly states—is negative and significant, indicating that consumption is approximately 8 to 12 percent lower in monopoly states after holding all other variables constant. This finding suggests that there is something unique occurring in monopoly states beyond the factors that have been controlled for that leads to lower per capita consumption. As indicated earlier, in the absence of competition and the ability to share in profits, demand-increasing efforts are reduced. This is reflected in number of outlets, convenience of store hours, brand availability, and lack of promotion relative to private license outlets.

The economic and sociodemographic variables, then, account for most of the explained variation, indicating the relative unimportance of the regulatory variables. Moreover, price, income, and tourism are the variables with the largest elasticities, while the regulatory variables have the smallest elasticities. Lack of explanatory power coupled with low elasticities indicates that manipulation of regulatory variables is likely to have a very minor impact on the consumption of distilled spirits, unless they indirectly affect price.

*License States.* The purpose of the license-state regressions is to test regulatory variables unique to license states—namely, resale price maintenance, wholesale price posting, and legality of sales in drug and grocery stores (see Table 2). The results show drug-store sales to be insignificant in each regression, but grocery-store sales (equation 2.2) to be positive and significant. Resale price maintenance is negative and generally significant, as expected, supporting the usual inverse relationship between consumption and price. Wholesale price posting is negative but insignificant in most cases, providing no support for the hypothesis that price posting facilitates wholesaler collusion. The correlation between resale price maintenance and wholesale price posting (equal to 0.52), does not influence this finding: in unreported regressions, resale price maintenance remains negative and significant when price posting is deleted and price posting remains negative and insignificant when resale

price maintenance is deleted. The results on some of the remaining variables for license states differ from those for all states. This is not unexpected, since the variance of the estimates and collinearity worsen with the smaller sample.

To summarize the results on regulatory variables, for all states price advertising, novelties, and monopoly-license distribution are significantly related to consumption, but the significance of novelties is sensitive to collinearity. In the case of license states, resale price maintenance and novelties are related to consumption. Other regulatory variables such as minimum age, Sunday sales, drug-store sales, wholesale price posting, and total billboard-advertising bans are either unrelated or perversely related to consumption. Moreover, the regulatory variables explain a minute proportion of consumption and have very small elasticities. This suggests that regulatory changes, outside of those that impact on price, have little or no effect on consumption.

## Beer

*All States.* Price and income have a far less significant impact on beer consumption than on distilled spirits consumption. As Table 3 shows, for all states the demand for beer is highly price inelastic. (Prior studies found price elasticities clustering around  $-0.3$  to  $-0.4$ ; Ornstein and Levy 1983.) The adjacent-state price variable is not included on the assumption that a low-price, high-bulk item like beer does not justify interstate travel. Income is unrelated to beer consumption (this is also consistent with prior beer demand studies). However, the results on income are obscured by collinearity with youth. When youth is omitted, income becomes positive and marginally significant. Tourism is, once again, highly related to consumption.

Results for the sociodemographic variables for beer show major changes from the results for distilled spirits. Youth is now strongly positive and significant, with the highest elasticity of all the variables. The importance of youth is reinforced in the minimum-age variable, which shows that the lower the minimum age, the higher the beer consumption. These two variables indicate the crucial importance of age distribution to the consumption of beer. The contrast between the significance of youth to beer and the insignificance of youth to distilled spirits is striking, supporting the view that youthful drinkers prefer beer. Another major change from results for distilled spirits is that the religious variables for beer are now positive and significant. This is unexpected in the case of the Baptist variable, since it measures Baptist and Latter-Day Saints affiliates, and since neither religion allows the drinking of any kind of alcoholic beverage. This

positive association suggests that religious proscriptions do not include beer, or that if one cheats, drinking beer is perhaps less sinful than drinking distilled spirits. Finally, temperature is unrelated to beer consumption, providing no support for the hypothesis that beer consumption is greater in warmer climates.

The regulatory variables are again significant as a group but offer mixed results for each individual variable. Number of outlets presents a measurement-error problem since we do not have data on beer-license-only outlets. Off-premise licenses for the sale of beer only, for example, are common in monopoly states. Lacking such data, the number of on-premise outlets was judged to be more reliable for beer, although some states issue on-premise licenses for beer and wine only. Nevertheless, the number of on-premise outlets is positive and significant, as was the case for distilled spirits.

A unique finding for beer is the positive and significant relationship of Sunday sales to consumption. This supports our a priori hypothesis that beer consumption is more a function of immediate availability due to higher storage costs. Local option is marginally significant in the case of beer versus distilled spirits.

Billboard advertising is insignificant in most regressions, consistent with the hypothesis that advertising's primary influence is on individual brand shares and not on industry demand. Novelty giveaways is insignificant for beer in contrast to distilled spirits. Separate regressions to test for the sensitivity of billboard advertising and novelty giveaways to collinearity resulted in no changes. Price advertising is positive and significant for billboard but not for print advertising, giving partial support to the search theory of advertising in the case of beer. The last difference between beer and distilled spirits results is that monopoly is insignificant for beer, indicating no difference in consumption between monopoly and license states. This last result may be due to the large number of beer-only outlets in monopoly states.

*License States.* The license-states results in Table 4 show that resale price maintenance is negative and marginally significant, which is consistent with the results for distilled spirits. Wholesale price posting is consistently negative and highly significant for beer, in contrast to the findings for distilled spirits. Because of collinearity between resale price maintenance and wholesale price posting, separate unreported regressions were run, but no changes were found.

Thus, the major differences between the beer and distilled spirits results are as follows:

- Beer consumption is strongly related to youth, but distilled spirits consumption is unrelated to youth. Price and income are far more inelastic for beer demand than for distilled spirits demand.

**TABLE 3**  
CONSUMPTION REGRESSIONS FOR BEER, ALL STATES

Variable	Equation		
	3.1	3.2	3.3
Intercept	7.881 (.540) <sup>a</sup>	7.835 (.534) <sup>a</sup>	7.983 (.521) <sup>a</sup>
PB	-.112 (.068) <sup>c</sup>	-.111 (.067) <sup>c</sup>	-.130 (.067) <sup>c</sup>
INC	-.067 (.093)	-.061 (.089)	-.065 (.088)
TOUR	.122 (.015) <sup>a</sup>	.122 (.014) <sup>a</sup>	.120 (.014) <sup>a</sup>
URBAN	.047 (.023) <sup>b</sup>	.047 (.023) <sup>b</sup>	.053 (.022) <sup>b</sup>
YOUTH	.817 (.199) <sup>a</sup>	.816 (.198) <sup>a</sup>	.714 (.193) <sup>a</sup>
CATH	.141 (.019) <sup>a</sup>	.141 (.019) <sup>a</sup>	.132 (.019) <sup>a</sup>
BAPT	.037 (.009) <sup>a</sup>	.037 (.008) <sup>a</sup>	.036 (.008) <sup>a</sup>
PROT	.151 (.047) <sup>a</sup>	.153 (.048) <sup>a</sup>	.172 (.048) <sup>a</sup>
TEMP	-.057 (.038)	-.053 (.040)	-.063 (.037) <sup>c</sup>
MINAGED	-.606 (.123) <sup>a</sup>	-.595 (.125) <sup>a</sup>	-.659 (.122) <sup>a</sup>
LICON	.030 (.016) <sup>c</sup>	.031 (.016) <sup>b</sup>	.033 (.016) <sup>b</sup>
SUNDAY	.094 (.019) <sup>a</sup>	.095 (.019) <sup>a</sup>	.094 (.019) <sup>a</sup>
LOCOP	-.028 (.017) <sup>c</sup>	-.028 (.017) <sup>c</sup>	-.027 (.017) <sup>c</sup>
BILLB	.004 (.023)		
NOVEL	-.024 (.025)	-.024 (.026)	-.011 (.025)
MONOP	.010 (.023)	.009 (.023)	.017 (.023)
PPRINT		-.004 (.020)	
PBILLB			.049 (.022) <sup>b</sup>
F-RATIO	42.34 <sup>a</sup>	42.34 <sup>a</sup>	43.54 <sup>a</sup>
R <sup>2</sup>	.748	.748	.753
N	245	245	245

<sup>a</sup> $p \leq 0.01$ .

<sup>b</sup> $p \leq 0.05$ .

<sup>c</sup> $p \leq 0.10$ .

- Religious affiliation tends to be associated with greater beer consumption but lower distilled spirits consumption.
- Availability on Sundays is important to beer consumption but not to distilled spirits consumption.
- Beer consumption is not significantly different between monopoly and license states, in contrast to distilled spirits consumption.

## SUMMARY AND CONCLUSIONS

The main determinants of interstate differences in per capita consumption of distilled spirits are price, income, and interstate travel—not differences in alcohol-control laws. Control laws are either unrelated to distilled spirits consumption, as in the cases of minimum legal age and Sunday sales, or are related but with very low elasticities, as in the cases of resale price maintenance and print and billboard price advertising. This suggests, not too surprisingly, that control laws affecting price have the greatest impact on consumption. In the case of beer, the primary

TABLE 4  
CONSUMPTION REGRESSIONS FOR BEER, LICENSE STATES

Variable	Equation		
	4.1	4.2	4.3
INTERCEPT	8.361 (.629) <sup>a</sup>	8.044 (.642) <sup>a</sup>	7.460 (.670) <sup>a</sup>
PB	-.110 (.065) <sup>c</sup>	-.131 (.067) <sup>b</sup>	-.257 (.066) <sup>a</sup>
INC	.017 (.094)	.067 (.098)	.177 (.099) <sup>c</sup>
TOUR	.089 (.014) <sup>a</sup>	.090 (.015) <sup>a</sup>	.062 (.015) <sup>a</sup>
URBAN	.021 (.026)	.012 (.027)	-.002 (.028)
YOUTH	1.195 (.199) <sup>a</sup>	1.035 (.200) <sup>a</sup>	.875 (.210) <sup>a</sup>
CATH	.111 (.020) <sup>a</sup>	.093 (.020) <sup>a</sup>	
BAPT	.007 (.012)	.002 (.012)	-.017 (.012)
PROT	.186 (.063) <sup>a</sup>	.210 (.064) <sup>a</sup>	.200 (.069) <sup>a</sup>
TEMP	.033 (.056)	.063 (.057)	.123 (.059) <sup>b</sup>
MINAGEB	-.874 (.137) <sup>a</sup>	-.847 (.141) <sup>a</sup>	-.748 (.149) <sup>a</sup>
LICON	-.022 (.021)	-.018 (.022)	.026 (.021)
SUNDAY	.190 (.022) <sup>a</sup>	.173 (.023) <sup>a</sup>	.185 (.024) <sup>a</sup>
DRUG	-.066 (.023) <sup>a</sup>		-.024 (.024)
GROC		.006 (.020)	
RPM	-.036 (.021) <sup>c</sup>	-.021 (.023)	-.050 (.022) <sup>b</sup>
RPOST	-.115 (.020) <sup>a</sup>	-.115 (.020) <sup>a</sup>	-.123 (.021) <sup>a</sup>
LOCOP	-.004 (.020)	-.006 (.020)	.024 (.021)
BILLB	.077 (.036) <sup>b</sup>	.021 (.034)	.049 (.039)
NOVEL	.006 (.034)	.033 (.035)	.087 (.035) <sup>b</sup>
F-RATIO	40.22 <sup>a</sup>	37.79 <sup>a</sup>	33.59 <sup>a</sup>
R <sup>2</sup>	.832	.823	.795
N	175	175	175

<sup>a</sup>  $p \leq 0.01$ .

<sup>b</sup>  $p \leq 0.05$ .

<sup>c</sup>  $p \leq 0.10$ .

influence on demand is the youthfulness of the population. Control laws with the strongest relationship to beer are minimum legal age and Sunday sales. Price and income are far more inelastic for beer than for distilled spirits, implying that control laws influencing price will have a relatively lesser effect on beer consumption than on spirits consumption. The practical importance of these findings in terms of reducing drinking externalities is unknown since the relationship between changes in mean consumption and drinking externalities is as yet unknown.

From a public policy perspective these results can be used for a segment-based demarketing of alcohol. Price intervention through tax increases, resale price maintenance, or bans on price advertising will have a much larger effect on spirits consumption than on beer consumption. The history of state excise taxes shows that they are rarely changed, except at times of budgetary crises. Resale price maintenance in alcohol has been on the decline for years and is fast disappearing in light of recent legal rulings.<sup>8</sup> But advertising

<sup>8</sup>California Retail Liquor Dealers Assn. v. MidCal Aluminum Inc. et al., 445 U.S. 97 (1980).

bans are increasingly being called for. Ten states proposed legislation to ban advertising in 1983, and a variety of public interest groups called on the Federal Trade Commission to restrict the advertising of alcoholic beverages. A ban on price advertising raises the mean and variance of price by increasing search costs, and this results in lower consumption (Ornstein and Hanssens 1984).

Availability by age is a key consumption determinant for beer. Minimum legal drinking age for beer varies across states, with 28 states having below-age-21 drinking standards in 1983. Raising the minimum drinking age to 21, as The Presidential Commission on Drunk Driving proposed in 1983—a federal standard now being forced on states by threat of a loss of federal highway funds—will reduce beer consumption. However, for both beer and distilled spirits the influence of control measures is small relative to that of sociodemographic and economic variables that affect consumers' overall attitudes toward drinking. For example, higher urbanization and increased tourist activity were found to be strongly associated with higher alcohol consumption. Since these phenomena are often observed in modern societies, they suggest that the task of controlling alcohol consumption may not become easier in years to come.

Clearly, this study only begins the process of demand estimation for consumer and product segments of alcoholic beverages. With survey data such as that available for cigarette consumption (Lewit and Coate 1982), more detailed relationships can be uncovered. Elasticity could be measured by intensity of user or by more narrowly defined sociodemographic groups—sex, race, education, etc. Social marketing would do well to direct its efforts at individual product lines, not at alcoholic beverages as a whole. Targeting specific consumer segments may be more efficacious than targeting drinkers in general.

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## APPENDIX

### Data Sources

#### Consumption

Distilled Spirit Council of the United States (1978), *Apparent Consumption of Distilled Spirit by Months and by States, 1968-1977*, Washington, D.C.

*The Liquor Handbook* (1979), New York: Gavin-Jobson Associates.

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——— (Annual), *Current Population Reports*, Series P-25.

**Price<sup>9</sup>**

Distilled Spirits Council of the United States (1973-1978), "Price per Fifth for Selected Types and Brands in License and Control States," unpublished report.

*The Liquor Handbook* (1979), New York: Gavin-Jobson Associates.

**Consumer Price Indices**

*CPI Detailed Reports* (1979), April.

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**Income**

*Survey of Current Business*, August 1977 and April 1979.

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**Temperature**

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**Number of Licenses**

*The Liquor Handbook* (Annual), New York: Gavin-Jobson Associates.

**Legal Drinking Age**

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**Price and Advertising Restrictions; Monopoly and License States; Drug, Grocery Store, and Sunday Sales**

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**Distilled Spirits Excise Tax**

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<sup>9</sup> Beer price data, provided by a major beer manufacturer, consisted of the average price for a six-pack of 12-ounce cans of a leading beer brand in each state.

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