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Alcohol Addiction : An Econometric Analysis

By

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Abstract

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Alcohol and heavy drinking demand equations derived under the assumptions of rational addictive behavior are estimated using a time-series of annual state cross-sections covering the period from 1962 through 1983. Per capita distilled spirits consumption is employed as the measure of alcohol consumption and the cirrhosis mortality rate is used for excessive alcohol consumption. The estimates indicate that per capita distilled spirits consumption is not characterized by rational addiction in data aggregated to the state level, but rational addiction does characterize heavy alcohol consumption.

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This dissertation is dedicated to my parents.

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Introduction

Becker and Murphy(1988) develop a theoretical model of addictive behavior which assumes that individuals behave rationally. The main element of this model is that past consumption plays an important role in determining current consumption. More specifically, a good is addictive if an increase in past consumption raises current consumption because it raises the marginal utility of current consumption. Hence, past consumption reinforces current consumption. They also introduce the related concept of harmful addiction and that is the one in which past consumption of a good has some negative impact on current period utility. These may be in terms of health or other kinds of negative aspects. So, increase in past consumption lowers current period utility and at the same time raises the marginal utility of current period consumption. They also draw a distinction between rational or far-sighted addicts and myopic addicts. A rational addict takes account of the fact that when he raises current consumption, that will have a negative impact on his utility next period. The person picks his optimal level of consumption taking account of that fact, whereas the myopic addict does not take account of that fact. He ignores the impact of a current period consumption on utility next period.

There are two key implications of rational addiction model.[1] They both pertain to the price effects. The first one is that there should be negative cross price effects or intertemporal complementarity due to symmetry. Increase in past consumption or an increase in future consumption caused by the reductions in past or future prices should cause current

[1] The Becker-Murphy model has several other empirical implications for addictive behavior that include a bimodal distribution of consumption, quitting by cold turkey, larger responses to anticipated than unanticipated price changes, and larger responses to permanent than temporary price changes.

consumption to rise. Put it differently, since an increase in past consumption raises the marginal benefit of current consumption, it must be the case that an increase in future consumption also raises the marginal benefit of current consumption. So, if people are rational, then there are going to be these linkages in consumption and they take the form that the current consumption will be positively related to past consumption and consumption next period. In turn, past consumption is negatively related to the past price. The second one is that the long run own price elasticity of demand should be bigger than the short run price elasticity. The short run price elasticity holds past consumption fixed while the long run elasticity does not hold past consumption fixed. So, those are two key implications. The Becker-Murphy model also relates the consumption of addictive goods to stressful events, such as unemployment and divorce. This paper evaluates the effects of education and religious affiliation by using state- and time-specific measures of divorce, unemployment, the fraction of the population with a high school degree, and measures of religion.

Chapter 1
Review of Literature

1.1 Empirical Applications of Rational Addiction: Cigarettes, Gambling, and Leisure

Becker, Grossman, and Murphy (1994) fit models of rational addiction to cigarettes to a U.S. time series of State cross-sections for the period 1955-85. Their study capitalizes on the existence of substantial interstate variation in the price of cigarettes at a moment in time due to large differences in state excise tax rates on cigarettes. The main findings are that there are positive and significant past and future consumption effect, the positive and significant future consumption effect is some evidence in favor of the rational addiction model, and then there is a negative and significant price effect. The long-run price elasticity (-0.75) is about two times bigger than the short-run elasticity (-0.40). Smoking levels in different years appear to be complements: cigarette consumption in any year is lower when both future prices and past prices are higher. To be specific, a 10 percent reduction in the current price increases cigarette consumption by approximately 1.5 percent next period and by approximately 0.7 percent in the previous period.

Chaloupka (1991) provides further evidence in support of the rational addiction model of cigarette addiction in a micro data set using data from the Second National Health and Nutrition Examination Survey. Using measures of cigarette consumption in three adjacent periods, he fits demand functions similar to those in the Becker et al. 1994 study. He reports positive and significant future and past consumption coefficients and a short-run price elasticity(-0.20) that is less than one-half of the long-run price elasticity of -0.45. He also finds that smoking by the less educated is considerably more responsive to changes in cigarette prices than is smoking by the more educated; a similar result has been obtained by Townsend (1987) with British data. To sum up, he finds substantial support for the hypothesis that cigarette smoking is an addictive behavior(in the sense that current cigarette consumption is heavily dependent upon past consumption) and that individuals are farsighted(in the sense that the future is an important determinant of current smoking decisions).

Mobilia (1990) applies the rational addiction framework to the demand for gambling at horse-racing tracks. Her data consists of a U.S. time series of horse track cross-sections for the period 1950-86. She measures consumption by the real amount bet per attendant(handle per attendant) and price by the takeout rate(the fraction of the total amount of bet that is retained by the track). Her findings are are similar to those in the rational addictive studies of cigarettes by Becker et al. (1994) and Chaloupka (1991). The long-run price elasticity of demand for gambling at horse tracks equals -0.7, which is more than twice as large as the short-run elasticity of -0.3. Moreover, an increase in the current takeout rate lowers handle per attendant in past and future years.

Hotz et al. (1988) and Bover (1991) apply variants of rational addiction models to the demand for leisure time or the supply of hours of work over the lifecycle. Both studies use panel data on males in the University of Michigan's Panel Study of Income Dynamics. Both report evidence of rational addiction in the sense that current hours of work are positively related to past and future hours of work.

1.2 Rational Addiction and the Demand for Excessive Alcohol Consumption

In the previous section, empirical applications of the rational addiction model to the demand for cigarettes was discussed. Attempts to apply similar models to the demand for alcohol consumption are inherently more difficult for two reasons. First, alcohol consumption is not nearly as addictive as cigarette smoking since many persons consume relatively small quantities of alcohol but not cigarettes. Stated differently, the distribution of alcohol consumption is more continuous than the bimodal distribution that Becker and Murphy (1988) show is likely to characterize consumption of an addictive good.

Second and in light of the factor just mentioned, applications of rational addiction to alcohol consumption must pay attention to the behavior of heavy drinkers. Limiting the analysis to heavy drinkers, one then confronts the stereotype of the alcoholic who is completely unresponsive to price. One also confronts a second sterotype of the heavy drinking nonalcoholic-a person who drinks heavily from time to time but whose annual consumption is smaller than that of an alcoholic. As in the case of alcoholics, the conventional wisdom is that heavy drinking occasions and consumption by heavy drinkers are not sensitive to price. If the conventional wisdom with respect to the behavior of alcoholics and heavy drinkers were correct, it would be difficult to justify the application of rational addiction models to alcohol consumption. However, a variety of studies suggest that the consumption of heavy drinkers and alcoholics is responsive to price.

In a clinical experiment, Bigelow and Liebson (1972) used two male, skid row, chronic alcohol volunteers residing in Baltimore to show that alcohol-dependent persons reduce their alcohol consumption as a function of beverage costs. Babor et al. (1978) recruited 20 adult male volunteers with a prior history of causal drinking and 14 adult male volunteers with a prior history of heavy drinking to conduct an experimental study of price reductions during afternoon "happy hours" in Boston. Approximately half of the subjects in each category could purchase alcohol under a single-price condition(50 cents per drink), while a matched group was given a price reduction daily(25 cents per drink) during a 3-hour period in the afternoon. The afternoon price reductions substantially increased alcohol consumption among both causal and heavy drinkers. Reinstatement of the standard purchase price reduced consumption in both groups.

Kendell et al. (1983) examined alcohol consumption by heavy and moderate drinkers before and after Scotland increased its excise tax on alcoholic beverages in March 1981. They used a sample of 463 residents of the Lothian region(Edinburgh and its hinterland). Alcohol consumption and its associated adverse effects(for example, getting into a fight due to drinking, being in a road accident after drinking) fell proportionately more among heavy drinkers than among other drinkers.

Although the above evidence is impressive, the studies cited should be interpreted with some caution because of the limited and nonrepresentative nature of the samples employed. Clearly, it would be misleading to generalize their results to the population at large.

But, these studies highlight the potential payoffs of research that is directed toward obtaining refined estimates of demand functions for alcohol use and abuse by persons of different ages.

More definitive evidence with regard to the behavior of heavy drinkers is contained in a well-known study by Cook and Tauchen (1982). They examine variations in death rates from cirrhosis of the liver(a standard measure of excessive alcohol use) as well as variations in per capita consumption of distilled spirits in a time series of license(open) State cross sections for 1962-1977. They find that the State excise tax rate on distilled spirits has a negative and statistically significant effect on the cirrhosis death rate. Moreover, a $1 increase in the State excise tax rate lowers the death rate by approximately the same percentage(between 5.4 and 10.8 percent) as it lowers per capita consumption(7.2 percent). Cook and Tauchen conclude that "liquor consumption, including consumption of heavy drinkers, is quite responsive to price"(1982, p.387).

Grossman's research on youth alcohol use in micro data with Coate and Arluck (Grossman et al. 1987; Coate and Grossman 1988), and research by Kenkel (1993) and by Manning et al. (1991) on alcohol use by all segments of the population in similar data, also highlight the importance of price. Grossman's research deals with youths ages 16 through 21 in the first National Health and Nutrition Examination Survey, conducted between 1971 and 1975 (Grossman et al. 1987), and in the second National Health and Nutrition Examination Survey, conducted between 1976 and 1980 (Coate and Grossman 1988). They find that the use of alcohol by youths is inversely related to the prices of alcoholic beverages in both data sets. The beverage-specific price is a particularly important determinant of beer consumption. This is a key result because beer is the drink of choice among youths who consume alcoholic beverages. The negative and statistically significant price effect is by no means limited to reductions in the fraction of youths who consume beer infrequently (less than once a week). Instead, the fractions of fairly heavy (three to five cans on a typical drinking day) and heavy (six or more cans on a typical drinking day) youthful beer drinkers decline more in absolute or percentage terms than the fraction of light (one to two cans on a typical drinking day) drinkers in response to price increases.

Kenkel's (1993) outcome measure is the number of days in the past year on which a person consumed five or more drinks in the 1985 National Health Interview Survey. He reports that this measure is inversely related to price among adults and youths. Manning et al. (1991) report a similar finding for this outcome and for average daily consumption of ethanol in the 1983 National Health Interview Survey.

The studies by Cook and Tauchen (1982), Grossman et al. (1987), Coate and Grossman (1988), Kenkel (1993), and Manning et al. (1991) are conducted in the context of a standard model of consumer behavior rather than in the context of a model of rational addiction. That is, no attempts are made to estimate a structural demand function in which current consumption depends on past and future consumption, both of which are endogenous, as well as on current price. Stated somewhat differently, the addiction model generates a reduced-form demand function in which current consumption depends on current price and on past and future prices. The studies at issue fit reduced form demand functions with past and future prices omitted. In the context of the addictive model, the price coefficients that they obtain may be viewed as biased estimates of long-run price effects.

The main message of these studies is that it is a mistake to assume that incidence of heavy drinking and consumption by heavy drinkers are not sensitive to price.

This dissertation aims to refine and enrich the empirical literature dealing with the sensitivity of alcohol consumption and excessive consumption to differences in the prices of alcoholic beverages. The main refinement pertains to the incorporation of insights provided by the Becker and Murphy model of rational addictive behavior which emphasizes the interdependency of past, current, and future consumption of an addictive good. The data employed in this study are a time-series of annual state cross-sections for the states of the U.S. and Washington D.C. over the period from 1962 through 1984. Per capita consumption of distilled spirits and the age-adjusted liver cirrhosis mortality rate of persons aged 30 and over are used as measures of alcohol use and excessive alcohol consumption, respectively.

Chapter 2
Empirical Framework

2.1 Structural Equation for Alcohol Demand and Excessive Alcohol Demand

This study uses the Becker and Murphy model of rational addictive behavior which assumes that consumers maximize a lifetime utility function of the form:

(1) $V = \sum_{t=0}^{\infty} \beta^t U(Y_t, C_t, A_t, e_t)$

subject to an appropriate budget constraint, where Y_t is consumption of a composite of non-addictive goods at time t, C_t is consumption of the addictive good(alcohol) at time t, A_t is the stock of addictive consumption(the depreciated sum of all past alcohol consumption), e_t reflects the impact of unmeasured life cycle variables on utility, and β is a discount factor.[2] Note that the current period utility function, U is well behaved in the sense that an indifference curve between the non-addictive good and the addictive good is convex to the origin. Note also that the lifetime utility function is separable over time in the non-addictive good, addictive good, and the stock of addictive consumption, but it is not separable in C_t amd Y_t alone.

[2] More formally: $A_t = (1-\delta)A_{t-1} + C_{t-1}$ where δ is the rate of depreciation on the addictive stock, and $\beta = [1/(1+\sigma)]$, where σ is the rate of time preference.

Becker, Grossman, and Murphy (1992) show that when the utility function is quadratic and the marginal utility of wealth is held constant, the Becker and Murphy model generates a structural demand function for addictive consumption of the form:[3]

$$(2) \quad C_t = \alpha C_{t-1} + \beta\alpha C_{t+1} + \alpha_1[1+(1-\delta)^2\beta]P_t - \alpha_1(1-\delta)P_{t-1} - \beta\alpha_1(1-\delta)P_{t+1} + \alpha_2 e_t + \alpha_3 e_{t+1}$$

where P_t is the price of addictive consumption at time t. This structural demand equation[4] is the basis of the empirical estimation of alcohol demand described below. In addition to estimating equation (2) directly, a version of equation (2) is also estimated which imposes the restriction that the rate of depreciation on the addictive stock is one. The result of imposing this restriction is that the past and future prices of the addictive good are excluded from the demand equation. In this demand function, current consumption is expected to be positively related to past consumption ($\alpha > 0$) and negatively related to current price($\alpha_1 < 0$). In particular, α measures the impact of an increase in past consumption on the marginal utility of current consumption. By symmetry, it also measures the effect of an increase in future consumption on the marginal impact of current consumption on next period's utility. The larger the the value of α, the greater is the degree of reinforcement or addiction.

In equation (2), rational addiction implies that the coefficients on the past and future prices are positive. This may seem odd, given that past and future consumption are com-

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[3] See Becker, Grossman, and Murphy (1992) or Chaloupka (1992) for the detailed derivation of this demand function.

[4] Following Chaloupka, this demand equation is obtained by maximizing $V^* = K + Max_C[\sum_{t=0}^{\infty} \beta^t F(C_t, A_t)]$ subject to $A_t = C_{t-1} + (1-\delta)A_{t-1}$ where $\beta = 1/(1+\sigma)$, $F(C_t, A_t) = \alpha_A A_t + \alpha_C C_t + [\alpha_{AA}/2]A_t^2 + [\alpha_{CC}/2]C_t^2 + \alpha_{CA} C_t^2 + \alpha_{CA} C_t A_t - \mu P_t C_t$

plementary with current consumption when behavior is addictive. However, controlling for past consumption eliminates the channel through which past prices affect current consumption. But, the only way that past consumption stays fixed when past prices are higher would be for another force to offset higher past prices by raising the addictive stock. Since this higher value of the stock continues into the present period, reduced only by depreciation, current consumption must be higher when past prices are higher. This also explains why past and future prices are dropped when the depreciation rate is assumed to be one and the larger past stock is eliminated entirely by depreciation.

To obtain the short-run price effect, the long-run price effect, and the temporary past, current, and future effects of anticipated and unanticipated changes in prices, one solves the second-order difference equation shown in equation (2). The long-run response is defined as the effect on consumption of a price change in all periods, while the short-run response is defined as the effect on consumption of an unanticipated change in price in the current and all future periods (that is, past consumption is held constant). The long-run price response can also be obtained by assuming that consumption has reached a steady state $(C_{t-1} = C_t = C_{t+1} = C)$,

(3) $$\frac{\delta C}{\delta P} = \{[\alpha_1(1 + (1-\delta)^2\beta) - \alpha_1(1-\delta) - \beta\alpha_1(1-\delta)]/(1 - \alpha - \beta\alpha)\},$$

where the denominator of equation (3) must be positive for a stable steady state.[5] Clearly, the long-run price effect rises in absolute value as the degree of addiction (α) rises. Fur-

[5] If the sum of the coefficients on past and future consumption exceeds one, then the roots of the second order difference equation described by equation (2) are not real. More formally, the roots to the difference equation are:
$\phi_1 = [1 - (1 - 4\alpha^2\beta)^{0.5}]/2\alpha$ and $\phi_2 = [1 + (1 - 4\alpha^2\beta)^{0.5}]/2\alpha$ Thus, if the product of the coefficient on past consumption and the coefficient on future consumption exceeds 0.25, then the roots will not be real.

thermore, the long-run price response for an addictive good is expected to be larger than the short-run price response given the intertemporal complementarity of consumption and since, in the long run, consumption in all periods responds to the price change, while in the short run, by definition, only current and future consumption change in response to the price change.[6]

Nested within this model of rational addiction are the competing hypothesis of non-addictive behavior and myopic addictive behavior. If consumption is not addictive, then α would be equal to zero (current consumption would be independent of past consumption) and δ would be equal to one (current consumption would depend on current price only). Alternatively, if consumption is addictive but consumers behave myopically, then $\sigma \rightarrow \infty$, or $\beta \rightarrow 0$, implying that past price and consumption are important determinants of current consumption, but future price and consumption have no impact on current consumption. Thus, the hypotheses of rational addictive behavior can be tested directly. If consumption is not addictive, then the coefficients on past consumption and price should not be statistically different from zero. Alternatively, if consumption is addictive but consumers behave myopically, then current consumption should be independent of future price and consumption as well as unobserved future events.

Equation (2) is the basis of the empirical application of the rational addiction model to alcohol consumption. Note that ordinary least squares estimation of this equation would lead to biased estimates of the parameters of interest. The unobserved variables that affect

[6] See Becker, Grossman, and Murphy (1992) for the detailed derivations of the short- and long-run price effects as well as for derivations and discussions of the responses to anticipated and unanticipated temporary changes in past, current, and future prices.

utility in each period are likely to be serially correlated. Even if these variables are uncorrelated, C_{t-1} depends on e_t and C_{t+1} depends on e_{t+1} through the optimizing behavior. These relationships imply that ordinary least squares estimation of the equation might incorrectly imply that past and/or future consumption affect current consumption, even when the true value of α is zero. Put differently, past and future consumption are endogenous variables and must be treated as such when estimating the model.

Fortunately, the reduced form equation generated by this model (the solution to the second order difference equation given in equation (2)) suggests a way to handle the endogeneity problem. In the reduced form, consumption at any point in time is a function of all past, current, and all future prices. In the structural demand equation (2), consumption is dependent on at most one lag, current, and one lead of price. Thus, longer lags and leads of price are appropriate instruments for past and future consumption.

As mentioned above, treating overall consumption of alcoholic beverages as addictive may be inappropriate given that many persons regularly consume relatively small amounts of alcohol and are not likely to be addicted to alcohol. More promising results are obtained when the age-adjusted cirrhosis mortality rate at time $t + 1(M_{t+1})$ is used to develop a measure of excessive alcohol consumption at that time. Assume that this rate is a function of excessive alcohol consumption in all previous periods (C_i, $i = 1, 2, ..., t - 1$) with exponentially declining weights:

(4) $$M_{t+1} = \sum_{i=1}^{t} \gamma(1 - \delta)^{t-i} C_i$$

Here, γ is the positive effect of an increase in C_t on M_{t+1}, and δ is the constant rate at which the adverse health effects of heavy drinking at time t depreciate. Since equation (4) holds for M_t as well for M_{t+1},

(5) $$M_{t+1} - (1-\delta)M_t = \Delta M_{t+1} = \gamma C_t$$

Equation (2) specifies a demand function for C_t in the context of the general model of rational addiction (the model in which the rate of depreciation on the addictive stock is less than one). Substitute this demand function into equation (5) and make use of the fact that $\gamma C_{t-1} = M_t - (1-\delta)M_{t-1}$ and $\gamma C_{t+1} = M_{t+2} - (1-\delta)M_{t+1}$ to obtain

(6) $$\Delta M_{t+1} = \alpha \Delta M_t + \beta\alpha\Delta M_{t+2} + \gamma\alpha_1[1+(1-\delta)^2\beta]P_t - \gamma\alpha_1(1-\delta)P_{t-1} - \gamma\beta\alpha_1(1-\delta)P_{t+1} + \gamma\alpha_2 e_t + \gamma\alpha_3 e_{t+1}$$

This equation is the basis of the analysis of excessive alcohol consumption. If δ were known, consistent estimates of its parameters could be obtained by two-stage least squares with ΔM_t and ΔM_{t+2} treated as endogenous. Since this rate is not known, we fit equation (6) for assumed values of δ ranging between 0.1 and 0.9. As described above, further leads and lags of price are appropriate instremental variables.

In addition, the three constraints implied by the model are imposed. These are (1) the coefficient of ΔM_{t+2} equals the coefficient of ΔM_t multiplied by the discount factor (β); (2) the coefficient of future price (P_{t+1}) equals the coefficient of past price (P_{t-1}) multiplied by β; and (3) the ratio of the coefficient of current price (P_t) to the coefficient of past price equals $-[1+(1-\delta)^2\beta]/(1-\delta)$. For a given value of δ, the constraints are imposed for alternative discount factors ranging from 0.8 to 0.95. The significance of each restriction using a Lagrange Multiplier test is tested.

2.2 Wu-Hausman Exogeneity Test

Suppose that we have a population model,

(7) $y = \alpha z + u$

and let's suppose that z is potentially endogenous in the sense that z and u may be correlated. In other words, the basic orthogonality condition between the errors and the explanatory variables is not satisfied. The relevant examples of this situation include (1) any case where the data contain errors introduced by the process of collection (errors in variables problem); (2) the inclusion of a dependent variable of one equation in a system of simultaneous equations as an explanatory variable in another equation in the system; and (3) the inclusion of a lagged dependent variable as an explanatory variable in the presence of serial correlation. So, the Wu-Hausman test basically amounts to test whether z and u are correlated or not. Suppose that we write the following.

(8) $z = \hat{z} + e = \beta X + e$

Suppose that we can find a set of variables X that predicts z and assume $cov(X, e) = cov(X, u) = 0$. Put (8) into (7), then

(9) $y = \alpha\hat{z} + \alpha e + u$

This is the population model and we look at the sample estimate of (9) since we have data on $\widehat{z}$. e(residual).

$$(10) \qquad y = a_1\widehat{z} + a_2 e + v$$

The Wu-Hausman test amounts to testing the hypothesis that $a_1 = a_2$. If it turns out that a_2 is not statistically significant different from a_1, then we can accept the hypothesis that z is not correlated with u, or z is exogenous, or OLS estimate of z is consistent.

Another easier way of testing is to note

$$(11) \qquad \widehat{z} = z - e$$

So, one can rewrite (10) as (12).

$$(12) \qquad y = a_1 z + (a_2 - a_1)e + v = a_1 z + ce + v$$

Now the test is simply whether c is significantly different from zero and that is a simple t-test. The basis idea is to run the first stage, save the residuals and then run the second stage. Treating past alcohol consumption and future alcohol consumption as potentially endogenous variables in the estimation of structural equation (2), we can employ Wu-Hausman test and since we have two potentially endogenous variables, the relevant test would be a F-test instead of a T-test for unrestricted cases, but for the restricted cases, it would be a simple T-test. The same is true for the estimation of heavy drinking equations where all models are estimated with restrictions on the coefficients.

2.3 Bound et al Test and Over-Identification Test

There is other problem with the instrumental variables estimation when the correlation between the instruments and the exogenous explanatory variable is weak (Bound et al, 1995). The F-statistic and the partial R-Square which can be obtained from regressing the first stage dependent variable (i.e., past and future consumption) on the excluded instruments are vital in measuring the quality of the IV estimates. If F-statistic is close to 1 or the R-Square approaches 0, then the magnitude of the bias of IV estimates approaches that of OLS estimates. One can actually retrieve the magnitude of relative bias with the appropriate K (number of excluded instruments) and the F-statistic from the appendix table of Bound et al (1995). The point is whether those excluded instruments have additional explanatory power or explanatory power conditional on the other exogenous variables in the model. The over-identification test is also performed for all two stage least square models.

2.4 Formulas for the Elasticities

Depending on whether the depreciation rate, δ equals one or not, we can have different formulas for the functional form of elasticities and therefore the standard errors for the short-/long-run elasticities.

2.4.1 The case where the depreciation rate equals one

Suppose that we have the following simple demand equation.

$$C_t = \alpha_1 + \alpha_2 C_{t-1} + \alpha_3 C_{t+1} + \alpha_4 P_t \tag{13}$$

Since the depreciation rate is equal to one (if one puts $\delta = 1$ into equation (2), the future and past price terms vanish), this equation is relevant for analysis.

The two roots, as before, of the second-order difference equation are obtained as below.

(14) $Root1 = \phi_1 = [1 - (1 - 4\alpha_2\alpha_3)^{0.5}]/2\alpha_2$

(15) $Root2 = \phi_2 = [1 + (1 - 4\alpha_2\alpha_3)^{0.5}]/2\alpha_2$

The long-run price effect pertains to a price change in all periods, and the short-run price effect is the effect of a price change in the current period and in all future periods that is not anticipated until the current period. So, past consumption is held constant. Likewise, the temporary current price effect is a change in the price in period t that is not anticipated until period t so that past consumption remains constant. The temporary past price effect is a change in the price in period $t-1$ that is not anticipated until period $t-1$. The temporary future price effect is a change in the price in period $t+1$ that is not anticipated until period $t+1$.

(16) Long Run Effect $= \alpha_4/(1 - \alpha_2 - \alpha_3)$

(17) Short Run Effect $= \alpha_4/[\alpha_2 * (1 - Root1) * Root2]$

(18) Temp Current Effect$= \alpha_4/[\alpha_2 * Root2]$

(19) Temp Past Effect$= \alpha_4/[\alpha_2 * (Root2)^2]$

(20) Temp Future Effect$= [\alpha_4 * Root1]/[\alpha_2 * Root2]$

2.4.2 The case where the depreciation rate is not equal to one

In addition to the variables in (13), we will have the terms for future price and past price variables as below.

(21) $C_t = \beta_0 + \beta_1 P_t + \beta_2 P_{t-1} + \beta_3 P_{t+1} + \beta_4 C_{t-1} + \beta_5 C_{t+1}$

(22) $Root1 = \phi_1 = [1 - (1 - 4\beta_4\beta_5)^{0.5}]/2\beta_4$

(23) $Root2 = \phi_2 = [1 + (1 - 4\beta_4\beta_5)^{0.5}]/2\beta_4$

(24) Long Run Effect $= [\beta_1 + \beta_2 + \beta_3]/\beta_4(1 - \phi_1)(\phi_2 - 1)$

(25) Short Run Effect $= [\beta_3 + \beta_1 + \phi_1\beta_2]/\beta_4(1 - \phi_1)\phi_2$

(26) Temp Current Effect $= [\beta_1 + \beta_2\phi_1]/\beta_4\phi_2$

(27) Temp Past Effect $= \{\beta_1/[\beta_4\phi_2^2]\} + \{\beta_2/[\beta_4(\phi_2 - \phi_1)]\}\{1 - [\phi_1/\phi_2]^2\}$

(28) Temp Future Effect $= [\beta_3 + \phi_1\beta_1 + \phi_1^2\beta_2]/\beta_4\phi_2$

2.4.3 Standard Error Formulation using Delta Method

Using the formula for the long run elasticity (when the depreciation rate is equal to one), one can construct the formula for the variance of long run elasticity using delta method. The formula is as follows.

(29) Var(Long Run Elasticity) $= L_1^2 Var(\alpha_4) + L_2^2 Var(\alpha_2) + L_3^2 Var(\alpha_3) + 2L_1L_2Cov(\alpha_4, \alpha_2) + 2L_2L_3Cov(\alpha_2, \alpha_3) + 2L_1L_3Cov(\alpha_4, \alpha_3)$

where L = long run elasticity, L_1 is the derivative of L with respect to α_4, L_2 is the derivative of L with respect to α_2, and L_3 is the derivative of L with respect to α_3. Once the variance is obtained, the standard error for the elasticity can be obtained by taking the square root.

The standard error for the short run elasticity can also be calculated in a similar way. The rationale stays the same. These standard errors can be used to obtain t-ratios for the short run and long run elastcities to show the significance of the estimates.

Chapter 3
Data and Empirical Implementation

3.1 Dependent Variables

The data used to estimate the alcohol and excessive alcohol demand equations described above are a time-series of annual state cross-sections covering the years from 1962 through 1984.[7] Table 1 contains definitions, means, and standard deviations of variables that are employed in the regression analyses . Unlike Cook and Tauchen(1982), the sample includes both license states and monopoly states.

The total sales of distilled spirits per capita, taken from the Distilled Spirits Council of the United States'(DISCUS) Annual Statistical Review, is employed as the measure of aggregate alcohol consumption. These data are assumed to reflect the behavior of the representative consumer. Unfortunately, given the aggregate nature of these data, it is not possible to analyze start, stop, and restart behavior.

More importantly, given the discussion above, these data reflect the average alcohol consumption of all persons, including abstainers and heavy drinkers. Thus, a detailed examination of the excessive alcohol consumption associated with an addiction to alcohol is not possible in the aggregate consumption data. To more closely examine excessive alcohol consumption, the age adjusted cirrhosis mortality rate for individuals ages thirty years

[7] Hawaii is excluded from the sample due to its ad valorem taxation of alcoholic beverages. As described, beer excise taxes are used as an additional instrument for past and future consumption and ΔM_t and ΔM_{t+2}.

and older is employed.[8] This is commonly used measure of excessive consumption which reflects chronic, long term heavy drinking. Philip Cook graciously provided the data for 1962 through 1977. The remainder(1978 through 1984) were obtained from their source, the National Center for Health Statistics. The sample begins in 1962 due to a change in the definition of liver cirrhosis as a cause of death in the seventh revision of the International Classification of Diseases(ICD) codes in 1962. Subsequent revisions of the ICD did not change the definition of this cause of death. While not all deaths from liver cirrhosis result from excessive drinking, Cook(1981) notes that about seventy-five percent of these deaths are alcohol related. The death rate is defined for age thirty years and above since liver cirrhosis deaths prior to age thirty are very rare and generally unrelated to alcohol use.

3.2 Independent Variables

The distilled spirits price is used as the measure of the price of alcoholic beverages in both the distilled spirits demand equations and the excessive alcohol demand equations. This variable is a Divisia index of the prices of the three leading brands of distilled spirits from 1958 through 1984. These are the price of a fifth of Seagram's 7 Crown (a blended whisky), Smirnoff (vodka), and Bacardi (rum).[9] The price series begins in 1958 so that four lags of prices are available in fitting the addictive demand equations. Prices from 1961 through 1972 are obtained from the annual Liquor Handbook published by Gavin-Jobson.

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[8] Once the populations and deaths had been obtained for each of the required age intervals, the age-adjusted mortality rates for each state were obtained as follows: $d_{jt} = \sum_a (d_{jtm} * k_{us,70a})$ where $a = 1, 2, 3, ..., 11$ are the eleven age intervals, d_{jtm} is the mortality rate(deaths/population) in the j_{th} state, in year t, for the a^{th} interval, $k_{us,70a}$ is the fraction of the US population ages 30 and over in the a^{th} age interval.

[9] For the years from 1961 through 1964, the brand of rum is Carioca.

Prices for the remainder of the sample were provided by DISCUS.[10] These sources stopped reporting prices after 1984.

One problem with using state level data on alcohol sales as a measure of alcohol consumption is that this data includes the purchases of out-of-state residents and may not be reflective of alcohol consumption within the state. This is more likely to be a problem in states where the price of alcohol is quite different from the prices in surrounding states. That is, if a state's price is higher than that in a bordering state, residents from the higher priced state have an incentive to cross the border to purchase alcohol in the lower priced state. Thus, using sales figures understates consumption in the higher priced state and overstates consumption in the lower priced state.

The magnitude of this problem increases as the price differentials increases and as a greater fraction of the state population lives near the borders of states with lower prices. To control for this potential border crossing, two variables are constructed: one which represents the potential for "import" activity, and one which represents the potential for "export" activity. For a given state, they both depend on the difference between the own price and the border-price(s), as well as the fraction(s) of the relevant states' populations living on the border. Becker, Grossman, and Murphy (1992) find that comparable variables are impor-

[10] DISCUS prices were preferable to the Gavin_Jobson prices for the period from 1973 through 1984 since there were fewer missing values. DISCUS, however, was unable to provide prices before 1973. The brand specific correlation between the two series in years when both were available exceeded 0.9. Certain state-, year-, and brand-specific prices were either not reported in the published data or were dropped from the data because they were inconsistent with prices in surrounding years and/or with trends in the state excise tax rates. A regression algorithm was developed to predict prices which were missing or dropped. The predicted prices are based on on a set of state and time dummy variables; per capita income; the per capita number of establishments licensed to sell alcoholic beverages for consumption on and/or off premise; the state sales tax rate applied to distilled spirits; a dichotomous indicator for control states; and the state excise tax rate on distilled spirits in license states.

tant determinants of cigarette sales. This may be less relevant in these data, since alcohol is bulkier and more difficult to transport. However, in an attempt to control for the possibility of border crossing, these variables will be included in some of the alcohol demand equations presented below. Both are expected to be negatively related to sales. Excluding these variables from the demand equations creates a potential bias in the estimated price responsiveness of demand. Since the liver cirrhosis mortality data are reflective of excessive consumption within the state, only the "import" variable is relevant, since it reflects the opportunity to obtain alcohol at a lower price in a nearby state. Excluding this variable would lead to price elasticities of demand which are underestimated in absolute value. The import and export variables are constructed for the Divisia index of distilled spirits prices.

The price index and the import[11] and export[12] variables are deflated by the National Consumer Price Index, base year 1961.

States are likely to differ in income, demographic composition, and other factors that are correlated with drinking. To control for differences in income, all of the equations presented include real per capita income. Differences in the availability of alcoholic beverages are controlled for by including variables representing the percentage of the state population residing in counties which prohibit the sale of alcohol (dry counties) and the number of establishments per capita licensed to sell alcoholic beverages off-premise, on-premise, and on- or off-premise. Availability is lower in states with a greater percentage of the

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[11] $IMPORT_i = \sum_j [K_{ij}(P_i - P_j)]$ where K_{ij} is the fraction of the population of state i (the higher price state) living within 20 miles of the border with state j (the lower price state). The weights are computed based on the 1970 Census of the population.

[12] $EXPORT_i = \sum_j [K_{ji}(P_i - P_j)(POP_j - POP_i)]$ where K_{ji} is the fraction of the higher priced state's population living within 20 miles of the border of the exporting state (i).

population residing in dry counties and higher in states with a greater number of licensed establishments per capita.

The percentage of the state population aged twenty-five and older with at least a high school education[13] is included in some equations to control for the effects of education on demand. Becker and Murphy (1988) suggest that stressful life-cycle events may lead abstainers to initiate addictive consumption or lead current addicts to increase their consumption of an addictive good. To control for some of these events, the percentage of women ages 25 through 34 years who are divorced and the state unemployment rate are included in some equations. To control for sentiment towards alcohol, the percentages of the state population who profess to be Mormons, Southern Baptists, Catholics, and Protestants (excluding Mormons and Southern Baptists) are also included in some of the equations presented. In order to control for national trends in unmeasured determinants of alcohol consumption and excessive alcohol consumption, all equations contain dichotomous indicators for each year, except one. Finally, in some equations, the demographic variables (education, divorce, unemployment, and religion) are replaced by a set of dichotomous indicators for each state, except one.

Consumers may not have perfect information concerning future prices. Therefore, past, current, and future state beer excise tax rates are included as instruments in some of the equations presented. The beer tax is used given its availability for all states and, for license states, the high correlations between beer excise taxes and wine and spirits excise taxes as well as the distilled spirits prices during the sample period.

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[13] Intercensal years computed using an exponential growth rate and adjusted so that a weighted average of the state values for intercensal years was equal to the observed national rate during intercensal years.

Chapter 4
Results and Conclusions

4.1 Ordinary Least Squares Estimation

Table 2 contains the results from the Ordinary Least Squares estimation of alcohol demand equations under the assumption of non addictive behavior. These estimates provide a comparison with those estimated elsewhere, in addition to the results presented from the addictive demand equations.

Panel A of Table 2 presents the results from the models which include the state dummy variables to capture state specific differences, while Panel B presents the findings from equations which include the set of demographic variables to control for differences in state specific factors related to alcohol consumption. Four alternative models are presented: the first, in addition to the dummy/demographic variables, includes only real price and real income; the second adds the two measures of alcohol availability; the third and fourth add the import and export variables to the first and second models, respectively. Finally, the estimated price elasticity of demand associated with each specification is also presented.

These estimates generally confirm the findings of other econometric studies of alcohol demand. The Divisia price index for alcoholic beverages is negative and significant at better than the one percent level in all models. The estimated price elasticity of demand ranges from -0.33 to -0.42 in the specifications including the state dummies, and from -1.26 to -1.55 in the models which replace the state dummies with the set of demographic variables. These latter estimates are consistent with the estimates centering around -1.5 for the demand for distilled spirits which Phelps and Leung (1991) obtain from their review of econometric studies of alcohol demand using aggregate data. The relative low elasticities obtained in the models including the state dummies may be the result of collinearity between the price variables and the state and time dummy variables, given the relative stability of state and federal excise taxes on distilled spirits throughout the sample period.

Income is found to have a positive and significant inpact on demand, indicating that alcohol is a normal good. In general, the measures of alcohol availability perform as expected, with the exception of the license variable in the equations which include the the set of demographic variables. States with greater restrictions on the purchase of alcohol and/or more limited access to alcohol have lower distilled spirits sales than their counterparts where alcohol is more easily obtained.

In general, the import and export variables perform poorly in the distilled spirits equations. In the specifications which include the state dummies, the import variable is negative and statistically significant at the five percent level (based on a one-tailed test), while the export variable is positive and highly significant. When the state dummy variables are replaced by the set of demographic variables, both remain statistically significant, but the signs are reversed. This may be the result of the strong positive correlation between the two variables.

The measures of stressful life-cycle events produce mixed results. In general, alcohol consumption is positively related to divorce, as expected, but appears unrelated to unemployment. Similarly, no clear relationship was obtained between distilled spirits consumption and education. Finally, religious adherence is found to have negative impact on alcohol consumption.

4.2 Two Stage Least Squares Estimation : Rational Addiction Model

Results from the two-stage least squares estimation of the rational addictive demand equations are presented in Tables 3, and 4. Panel A of Table 3 presents the results from equations which impose the assumption that the depreciation rate on the addictive stock is equal to one, while Panel B presents the results when no assumption is made concerning the depreciation rate. Model 1 of each panel includes the very limited set of independent variables comprised of past and future consumption, alcohol price(s), and real income, in addition to the year and state dummy variables. Model 2 adds the two alcohol availability measures and the import and export variables to those included in Model 1. Model 3 and 4 are the comparable models in which the set of state dummies is replaced by the set of demographic variables. Models 1 through 4 use a very limited set of instrumental variables for past and future consumption. In the models which assume that the depreciation rate is one (and only current price enters the second stage), one lag and one lead of the distilled spirits Divisia price index are used as instruments, in addition to all exogenous variables from the second stage. In Panel B, the set of instruments includes one lag, current, and one lead of the real beer tax, in addition to the exogenous variables from the second stage. Models 5 through 8 are identical to Models 1 through 4, except that they employ an expanded set of instruments for past and future consumption. This set, in addition to the exogenous variables in each model, includes a second lag of the distilled spirits price index, the first two lags, current, and the first lead of the real beer tax, the first three lags of income, and the first three lags and the current unemployment rate. Note that since this set of instruments includes the second lag of the price index, one year of data is lost.[14]

Table 4 presents results comparable to those found in Table 3 after imposing the restrictions suggested by the theory concerning the relative magnitudes of the coefficients on past and future consumption and on past and future price, when included. More specifically, as shown in equation (2), the ratio of the coefficient on future consumption to that on past consumption should equal the discount factor. This is also true for the ratio of the coefficient on future price to that on past price. Table 4 presents the results when this restriction is imposed for an assumed discount factor of 0.95.[15]

The results presented in Table 4 for aggregate distilles spirits consumption provide at best limited support for the rational addiction theory. In general, past consumption has the expected positive impact on current consumption, consistent with the hypothesis of addictive behavior. Similarly, future consumption has the anticipated positive impact on current consumption. When the limited set of instruments is used, these coefficients are rarely significant at the five percent significance level. However, when the larger set of

[14] A wide variety of different sets of instruments were tested, including further leads and lags of: the distilled spirits price index, the real beer tax, real income, the unemployment rate, the percentage of the population in dry counties, and the per capita number of licenses. In addition, attemps were made to include the state excise tax rate in license states (and various leads and lags) and a dichotomous indicator of control states. Finally, similar equations were fit limiting the sample to license states only when the distilled spirits excise tax was used as an instrument for past and future consumption. The results presented here are representative of those obtained in other specifications.

[15] A number of other discount factors were assumed with little substantive change in the results. In addition, the further restriction that the ratio of the coefficient on current consumption to that on past consumption equals $[1 + (1 - \delta)^2\beta]/(1 - \delta)$ was also assumed for alternative assumed rates of depreciation ranging from 0.1 to 0.9. This additional restriction had virtually no impact on the estimates.

instruments is employed, the coefficients on both are significant at at least one percent level. In these models, however, the coefficient on future consumption is generally much larger than that on past consumption, contrary to the predictions of the model. Imposing the restriction on these coefficients suggested by the model improves the significance of past and future consumption.

More troubling is the finding that, in every model, the price of distilled spirits has no impact on demand. This finding is the opposite of the negative and significant effect of price on addictive consumption predicted by the Becker and Murphy theory of rational addiction and is inconsistent with the findings shown in Table 2 as well as the results of numerous other studies which find a strong negative relationship between the prices of alcoholic beverages and their consumption.[16] The apparent lack of a price effect may be the result of the difficulties associated with using aggregate data on alcohol consumption by all drinkers discussed above. That is, drinking may not be an addictive behavior for most individuals who consume some quantity of alcohol. However, it may be very addictive for those who regularly consume relatively large quantities. Thus, fitting a demand equation for aggregate consumption based on the rational addiction theory may be a mis-specification.

Excessive alcohol demand, however, is more likely to reflect addictive consumption. To test this hypothesis, the demand for heavy drinking shown in equation (6) is fit using data on liver cirrhosis mortality rates. The results for this demand equation are presented in Table 5. As mentioned above, the depreciation rate reflecting the effects of past consump-

[16] This finding persists when alternative measures of alcohol consumption and price are employed. These alternatives include beer consumption and the beer excise tax and total ethanol consumption and a price index based on distilled spirits prices and the beer tax.

tion on the development of liver cirrhosis as well as on the addictive stock is unknown. To fit the heavy drinking demand equation, alternative rates of depreciation are imposed.[17] Panels A, B, and C of Table 5 present the results for assumed depreciation rates of 0.30, 0.50, and 0.70, respectively.[18] State and year dummies and real income are included as additional independent variables in Models 1 and 5 of Table 5. Models 2 and 6 add the two variables reflecting alcohol availability and the import variable to the specifications in Models 1 and 5. The independent variables included in Models 3, 4, 7, and 8 are comparable to those in Models 1, 2, 5, and 6, except that the set of state dummy variables is replaced by the set of demographic variables described above.

The heavy drinking demand equations are quite taxing on the data. To address this difficulty, the three constraints implied by the demand equation are imposed on the estimates. These are: (i) that the coefficient on ΔM_{t+2} is equal to that on ΔM_t multiplied by the discount factor; (ii) that the coefficient on P_{t+1} is equal to that on P_{t-1} multiplied by the discount factor; and (iii) that the coefficient on P_t is equal to that on P_{t-1} multiplied by $-[(1+(1-\delta)^2\beta]/(1-\delta)$. The significance of each restriction is tested using a Lagrange multiplier test.[19] Models 1 through 4 of Table 5 assume a discount factor of 0.95, while

17 Attempts to fit the heavy drinking equation using non-linear techniques which would produce estimates of the depreciation rate and the discount factor proved to be too taxing on the data.

18 Assumed rates of depreciation ranged from 0 to 1. The estimated coefficients on past, current, and future prices and ΔM_t and ΔM_{t+2} from equations which imposed a relatively low depreciation rates were generally insignificant and inconsistent with the predictions of the model. Alternatively, relatively high assumed rates of depreciation produced estimates which were more significant, but which were also inconsistent with the model.

19 The significance of the estimates and their consistency with the predictions of the model are generally mixed when these restrictions are not imposed. This is not surprising given the relatively high correlations between prices in different years as well as between ΔM_t and ΔM_{t+2}. The t-statistic associated with the Lagrange Multiplier test for each of the restrictions is presented in the table. These restrictions are rarely significant at conventional levels in the models which perform best and, as a result, should be considered valid.

Models 5 through 8 assume a discount factor of 0.80. Finally, the relatively large set of instruments including the second lag of price, the first two lags, current, and the first lead of the beer tax, and the first three lags of income and the unemployment rate is used for ΔM_t and ΔM_{t+2} in all models.[20]

The estimates obtained from the restricted heavy drinking demand equations are much more consistent with the predictions of the model of rational addiction than those obtained from the aggregate demand equations, as expected. The coefficients on ΔM_t and ΔM_{t+2} are positive and significant at least the five percent level in the models presented. Moreover, the significance of these coefficients increases as lower rates of depreciation are assumed, while the significance of the restriction imposed on them falls, suggesting that depreciation rates in the range from 0.3 to 0.5 are more appropriate.[21]

The lack of significance on the restriction which makes the coefficient on future consumption smaller than that on past consumption by a factor which depends on the rate of time preference can be interpreted as providing some support for the hypothesis that heavy drinkers behave rationally rather than myopically. If this restriction was significant, that would indicate that the discount factor being assumed was inappropriate. In general, the significance of this restriction does not depend on the choice of the discount factor (0.95 or 0.80).

Similarly, in the models which impose a rate of depreciation of 0.50, the coefficients on past, current, and future prices are significant at at least the ten percent level. Again,

[20] Various other sets of instruments were experimented with as well. The results presented here are representative of those obtained when a relatively larger set of instruments is employed.

[21] Future plans include performing various goodness-of-fit tests to determine the most appropriate assumed depreciation rate, as well as the most appropriate discount factor.

these coefficients are more significant when a lower depreciation rate is assumed. Similarly, they are generally more significant when a lower rate of time preference is assumed. Again, the two restrictions on price are generally insignificant at conventional levels, with the importance of the restrictions falling as lower rate of depreciation is assumed.

Table 5 presents the short and long run price elasticities of demand associated with the estimated coefficients on ΔM_t, ΔM_{t+2}, and the price variables. The consistency of the estimated elasticities with the predictions of the rational addiction model improves when a higher rate of depreciation is assumed. In the models which impose depreciation rates of 0.5 and 0.7, the estimated long run price elasticity of demand exceeds the short run price elasticity of demand, with the exception of the model including the state dummies and a very limited set of independent variables. For these models, the estimated short run price elasticity of demand is in the range from -0.30 to -0.66 in the models which include the state dummies. When the set of demographic variables replaces the set of state dummies, the short run price elasticity generally increases in absolute value, falling in the range from -0.60 to -1.06 (with the exception of model 3 & 7 in Panel C). Similarly, the ranges for the estimated long run elasticities for these models are -0.62 to -1.00 and -0.90 to -1.43 (with the exception of model 3 in Panel C) in the models which include the state dummies and the demographic variables respectively.

Also, in the models which impose depreciation rates of 0.5 and 0.7, the estimated standard errors (employing the delta method) for long run elasticities exceed those for short run elasticities with the exception of model 8 in Panel B. The associated t-ratios are calculated in Table 7 (Table 6 contains t-ratios for short/long run elasticities for Table 3 and

Table 4) to help substantiate the significance of the long run and short run elasticities for a different set of depreciation rates. When the depreciation rate is equal to 0.3, the t-ratios for short run elasticities are marginally significant at the conventional levels, but significant for long run elasticities. In the models which impose depreciation rates of 0.5 and 0.7, the associated t-ratios for short run elasticities are quite significant at the conventional level across the models and the t-ratios for long run elasticities are also significant in many of the models with some exceptions.[22]

The tables (Table 3 through Table 5) also contain F-ratios and P-values resulting from the test of Basmann (1960) that the overidentification restrictions are valid. In all models of three panel heavy drinking equations (Table 5), the P-values are insignificant at 5 % level implying that the overidentification restrictions are valid. On the other hand, the Basmann overidentification tests yield mixed results for Table 3 and Table 4. For models 5 through 8, Basmann P-values are significant at 5 % rejecting the null hypothesis that the overidentification restrictions are valid. For models 1 through 4, the tests indicates that the overidentification restrictions are valid with the exception of Panel A for both Table 3 and Table4.

The Wu-Hausman tests are also performed on all models with different depreciation rates to test the consistency of two stage least squares estimation. The t-ratios and associated p-values are presented at the bottom of the tables. When the depreciation rate is equal to 0.3, the test rejects the null hypothesis that OLS is consistent for all models. When the depreciation rates are 0.5 and 0.7, the test still accepts the efficiency of two stage least

[22] The t-ratios for short and long run elasticities in Table 3 and Table 4 are, in most cases, insignificant at the conventional levels and this result can be contrasted against that of Table 5.

square estimation in many cases of models. This finding can be constrasted against the findings for Table 3 and Table 4, which, in most cases, fail to reject the consistency of OLS. This finding for Table 3 and 4 leads us to construct OLS estimations for both tables. Table 9 and Table 10 contain ordinary least squares estimations of unrestriced and restricted alcohol demand equations with the same specifications with Table 3 and Table 4. Simply, OLS estimation replaces TSLS (Two Stage Least Squares) estimation. The same set of formulas for relevant elasticities are used as Table 3 and Table 4. The results are not much different as TSLS estimation, still having insignificant current price effects and with higher levels of T-ratios for past and future consumption.

In light of two stage least squares estimation, there exists a potential problem when the correlation between the instruments and the endogenous explanatory variables is weak (Bound at al, 1995). The F-Statistic and the partial R^2 which can be obtained from regressing the first stage dependent variable on the excluded instruments are vital in measuring the quality of IV estimates. To put it differently, the test is whether those excluded instruments have additional explanatory power or explanatory power conditional on the other exogenous variables in the model. Again, the general rule of thumb is, if F-Statistic is close to 1 or the R^2 approaches 0, then the magnitude of the bias of IV estimates approaches that of OLS estimates. The results for Table 5 indicates that excluded instruments have additional explanatory power or the magnitude of the bias deviates from that of OLS bias. The R^2 centers around 0.3 in most models with different depreciation rates and F-Statistic centers around 30, which is quite distant from 1. With additional information on the number of excluded instruments, the appendix table A.1. from Bound et al (1995) can be used to roughly pinpoint the level of relative bias and it still shows, in most models, that the excluded instruments have additional explanatory power. Table 8 summarizes relevant F-ratios for Table 3, Table 4, and Table 5.

As discussed above, the state and time dummies may be highly correlated with the distilled spirits price index, given the relatively infrequent changes in state taxes on distilled spirits and the stability of the Federal tax throughout the sample period. Thus, the estimated elasticities from the models which replace the state dummies with the demographic variables could be viewed as more reliable. Regardless, these models clearly indicate that heavy drinkers are responsive to price in both the short and long runs.

4.3 OLS and TSLS : Myopic Model

As a way to deal with the assumption of perfect foresight in the rational addiction model, the myopic model is used as an alternative specification. The myopic version would say basically that β is zero, people have an infinite rate of time preference. In other words, individuals completely discount the future. So there is no impact of the future consumption on current consumption. Therefore, in the myopic model, future consumption and future price are deleted from the demand function and future variables are deleted as instruments. In other words, all future variables are omitted both as regressors and instruments. As in the cigarette demand equation derived under the assumption of rational behavior, current alcohol consumption is expected to be inversely related to the current price of alcohol, but directly related to the lagged price of alcohol and lagged alcohol consumption. Table 11 and Table 12 correspond to Table 3 and Table 5 with future consumption and future price deleted as regressors with OLS estimation. In Table 11 of myopic OLS estimation of alcohol demand equations, insignificant current price effects persist throughout the models while highly significant positive past consumption effects is in line with the predictions of the myopic model. The significance of current price effects is restored in most models in Table 12, but it has mixed coefficients for past consumption across the models. These myopic version of models are still fit by two stage least squares as well as ordinary least squares since past consumption is correlated with the error term if the error is serially correlated over time. Table 13 and Table 14 correspond to two stage least square versions of Table 11 and Table 12. Table 13 and Table 14 exclude future variables as instruments in the estimation process and produces Basmann F-ratio/P-value, Wu-Hausman F-ratio/P-value, and Bound F-ratio. We still have insignificant current price effects in alcohol demand equations, and even in heavy drinking demand equations, the current price effects turn out to be insignificant in most of the models. Table 12 and Table 14 contain just one restriction between the coefficients of past price and current price, other restrictions vanish since future consumption are future price are omitted. The elasticities for the myopic model are computed differently due to different specifications of the model.[23] As with the case of the rational addiction model, there are two specifications to consider, one is when the depreciation rate is equal to one and the other when the depreciation rate is not equal to one.

[23] In myopic model, if the depreciation rate is equal to one, then $C_t = a_1 + a_2 C_{t-1} + a_3 P_t$. The short run price effect is simply a_3, and the long run price effect is $a_3/(1-a_2)$. If the depreciation rate is not equal to one, then $C_t = b_1 + b_2 P_t + b_3 P_{t-1} + b_4 C_{t-1}$. The long run price effect is given by $(b_2 + b_3)/(1 - b_4)$. The short run price effect is b_2.

Chapter 5
Discussions

Alcohol consumption and heavy drinking demand equations derived under the assumption of rational addictive behavior were estimated using a time-series of annual state cross-sections covering the period from 1962 through 1983. Per capita distilled spirits consumption is employed as the measure of alcohol consumption and the cirrhosis mortality rate is used for excessive alcohol consumption. The estimates indicate that per capita distilled spirits consumption is not characterized by rational addiction in data aggregated to the state level, but rational addiction does characterize heavy alcohol consumption.

These results indicate that increases in distilled spirits excise tax rates at the Federal and/or state level can have a substantial impact on overall alcohol consumption, heavy alcohol consumption, and the consequences of heavy consumption. Throughout the sample period, Federal alcoholic beverage excise taxes were fixed at \$10.50 per proof gallon of distilled spirits, 16 cents per six pack of beer, and just over 3 cents per 750 ml bottle of table wine. As a result of the Deficit Reduction Act of 1984, distilled spirits taxes were raised for the first time since 1951 to \$12.50 per proof gallon, while the taxes on wine and beer remained constant at their 1951 levels. Due in part to the stability of these taxes, the real prices on alcoholic beverages declined significantly over time. While the Federal, state, and local governments actively used numerous other policies to discourage alcohol abuse, if, as the results presented here indicate, alcohol consumption and heavy drinking are sensitive to price, then allowing real prices to fall offsets the impact of the government sponsored anti-drinking campaign.

As a result of Title XI of the Omnibus Budget Reconciliation Act of 1990, the tax on beer was doubled, the tax on wine rose almost seven-fold, and the tax on distilled spirits was increased slightly to $13.70 per proof gallon. While these increases are substantial, the beer and distilled spirits tax hikes fall well short of those necessary to offset the effects of inflation since 1951. The results presented indicate, for example, that maintaining the distilled spirits tax at its 1951 level in real terms would have reduced cirrhosis deaths by approximately 13 percent on average, from 1963 through 1982. This amounts to an annual reduction in premature deaths of about 3,900 per year.

Appendix A
Construction of Alcohol Price Index

DILIQPR - Divisia Alcohol Price Index, based on the prices of blended whisky, rum, and vodka described above, 1961=1.

Calculated as follows:

for 1961:

$$DILIQPR_{J,61} = KR_{U,61}PR_{J,61,61} + KV_{U,61}PV_{J,61,61} + KB_{U,61}PB_{J,61,61}$$

for 1962-1984:

$$DILIQPR_{j,t} = DILIQPR_{j,61} \prod_{i=1962}^{1984}(1 + S_{j,i})$$

Where:

$KR_{u,t}$ is the fraction of total US case sales of rum, vodka, and all whiskeys which were rum in year t

$KV_{u,t}$ is the fraction of total US case sales of rum, vodka, and all whiskeys which were vodka in year t

$KB_{u,t}$ is the fraction of total US case sales of rum, vodka, and all whiskeys which were whiskey in year t (includes blends, bonded, scotch, straight, and canadian whiskeys)

$PR_{j,t,61}$ is defined as PRUM in state j, year t divided by the average price of rum in the US in 1961 (using only states for which data was actually available)

$PV_{j,t,61}$ is defined as PVODKA in state j, year t divided by the average price of vodka in the US in 1961 (using only states for which data was actually available)

$PB_{j,t,61}$ is defined as PBLEND in state j, year t divided by the average price of blend in the US in 1961 (using only states for which data was actually available)

and:

$$1 + S_{j,i} = WR_{u,i}\frac{PR_{j,i}}{PR_{j,i-1}} + WV_{u,i}\frac{PV_{j,i}}{PV_{j,i-1}} + WB_{u,i}\frac{PB_{j,i}}{PB_{j,i-1}}$$

where:

$WR_{u,i} = [KR_{u,i-1} + KR_{u,i}]/2$, and similarly for WB and WV, weights are obtained from the Gavin Jobson Liquor Handbook.

Appendix B
Cirrhosis Mortality Rates

CIRRMORT – Age adjusted cirrhosis mortality rate for individuals ages 30 and older, in deaths per 1,000 population age 30 and over

The age adjusted cirrhosis death rate was provided for the years 1962 through 1977 by Cook and Tauchen. Data for 1978 through 1984 were added as follows.

The goal was to calculate the age-adjusted cirrhosis mortality rate for the population ages 30 and over for the years 1978 through 1984 similar to the way in which Cook and Tauchen calculated it for the period 1962 through 1977. To do so, population and deaths from cirrhosis were required for each of the following age intervals: 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-84, and 85 & over. Data on deaths from liver cirrhosis were available for each of these age intervals for the years 1978-1984. Population was available for the following age categories for the years 1978 through 1984: 25-29, 30-34, 35-44, 45-54, 55-59, 60-64. For the years 1978 and 1979, data was available for the category 65 and over. For the years 1980 through 1984, data was available for the categories: 65-69, 70-74, 75-84, and 85 and over. For the year 1980, from the Census of the Population, data was obtained for the following categories: 35-39, 40-44, 45-49, 50-54. The census data was used to estimate the populations in the 35-39, 40-44, 45-49, and 50-54 age intervals in all other years in the same manner as follows:

$$Population_{30-34,1979} = [Population_{30-34,1980}/Population_{25-34,1980}]*Population_{25-34,1979}$$

The other intervals needed for 1978 and 1979 were estimated in the same way based on the 1980 census. Once the populations and deaths had been obtained for each of the required age intervals, the age adjusted mortality rates for each state was obtained as follows:

$d_{jt} = \sum_a (d_{jtm} * k_{us,70a})$ where $a = 1, 2, 3, ..., 11$ are the eleven age intervals, d_{jtm} is the mortality rate(deaths/population) in the j_{th} state, in year t, for the a^{th} interval, $k_{us,70a}$ is the fraction of the US population ages 30 and over in the a^{th} age interval.

Source: Data for 1962-1977 were provided by Cook and Tauchen, Mortality data in five year age intervals for the period 1978-1984 was taken from unpublished data provided by the National Center for Health Statistics, Age specific population data for 1980 was obtained from the 1980 U.S. Census of the Population. Other age specific population data was taken from unpublished data made available by the U.S. Census Bureau.

Range: 1962-1984, all states

Table 1
Definitions, Mean, and Standard Deviation

Variable name	Definition	Mean, Standard Deviation
Real Income	Per Capita Real Income	2991.823, 613.779
Percentage of High School Education	Percentage of the state population ages 25 and over with at least a high school education.	59.642, 11.560
Divorce Rate	Percentage of Women ages, 25-35 who are divorced, obtained from state census volumes.	6.043, 2.924
Unemployment Rate	State Unemployment Rate. Missing observations computed using census year unemployment rates and observed national unemployment rates.	5.779, 2.272
Mormon	Percentage of the state population who are Mormons	2.857, 10.439
Southern Baptist	Percentage of the state population who are Southern Baptists	6.935, 9.768
Catholic	Percentage of the state population who are Catholics	19.251, 13.565
Protestant	Percentage of the state population who profess some Judeo-Christian faith, excluding Mormons, Southern Baptists, and Roman Catholics (<100%)	21.728, 9.657
License Per Capita	Number of licenses for the sale of Distilled Spirits, includes licenses from both on and off promise consumption.	1.207, 0.750
Real Price	Divisia Alcohol Price Index, divided by Consumer Price Index, based on the price of blended whiskey, rum, and vodka.	0.749, 0.203
Exports	Index which measures short distance (export) smuggling incentives. The index is a weighted average of differences between the exporting state's excise tax and excise taxes of neighboring states, with weights based on border populations.	-0.026, 0.076
Imports	Index which measures short distance (import) smuggling incentives in a state. Similar to exports.	0.014, 0.022
Alcohol Consumption	Apparent consumption of distilled spirits, in 1000's of wine gallons.	1.933, 1.089
Percent Dry	Percent of the state population living in counties dry for alcohol consumption.	5.152, 10.729
Beer Tax	Average state excise tax, in dollars, on 24-12 ounce containers of beer, computed as a weighted average of the tax rates in effect during the year, where the weights are the fraction of the year each rate was in effect.	0.398, 0.407
Cirrhosis Mortality Rate	Age adjusted cirrhosis mortality rate for individual's ages 30 and older, in deaths per 1,000 population age 30 and over.	0.263, 0.119
Population 30 & Over	State population in each year of individuals ages 30 and over.	2066.53, 2226.95

Table 2
Ordinary Least Squares Estimates of Alcohol Demand*
Panel A

Variable	(1)	(2)	(3)	(4)
Real Price	-0.88	-0.854	-1.093	-1.009
	(-4.24)	(-4.08)	(-37.88)	(-3.50)
Imports			-1.342	-1.465
			(-1.68)	(-1.79)
Exports			2.100	2.109
			(6.43)	(6.44)
Real Income	0.0001	0.0001	0.0001	0.0001
	(2.56)	(2.35)	(2.76)	(2.50)
Percent in Dry Counties		-0.009		-0.009
		(-3.32)		(-3.22)
Licenses Per Capita		-0.005		-0.055
		(-0.10)		(-1.15)
R-squared	0.952	0.953	0.954	0.955
F	284.83	279.92	289.12	284.17
Price Elasticity of Demand	-0.341	-0.331	-0.424	-0.391

* All equations also include an intercept and a set of dichotomous year indicators for the period from 1962 through 1983, excluding one year. t-ratios are in parentheses.

Table 2
Ordinary Least Squares Estimates of Alcohol Demand*
Panel B

Variable	(5)	(6)	(7)	(8)
Real Price	-3.246	-3.271	-3.953	-4.000
	(-7.95)	(-8.43)	(-9.20)	(-10.44)
Imports			15.925	17.767
			(14.20)	(17.66)
Exports			-3.461	-4.030
			(-10.45)	(-13.59)
Real Income	0.001	0.001	0.001	0.001
	(17.23)	(13.31)	(16.34)	(15.15)
Percent in Dry Counties		-0.008		-0.006
		(-2.60)		(-2.64)
Licenses Per Capita		0.452		0.588
		(10.55)		(16.58)
Divorce Rate	0.065	0.073	0.080	0.094
	(2.59)	(3.07)	(3.60)	(4.77)
Unemployment Rate	-0.036	-0.054	0.008	-0.010
	(-1.99)	(-3.11)	(0.50)	(-0.69)
Percent with	0.004	-0.013	0.017	-0.003
High School Education	(0.60)	(-2.14)	(3.01)	(-0.50)
Mormon	-0.018	-0.015	-0.014	-0.009
	(-5.14)	(-4.35)	(-4.44)	(-3.13)
Southern Baptist	-0.009	-0.007	-0.0004	0.002
	(-1.64)	(-1.34)	(-0.08)	(0.40)
Catholic	-0.009	-0.019	-0.010	-0.023
	(-3.19)	(6.52)	(-3.77)	(-9.32)
Protestant	-0.029	-0.033	-0.025	-0.029
	(-7.16)	(-8.53)	(-6.90)	(-8.98)
R-squared	0.445	0.500	0.578	0.667
F	28.45	33.27	45.55	62.47
Price Elasticity of Demand	-1.258	-1.267	-1.532	-1.550

* All equations also include an intercept and a set of dichotomous year indicators for the period from 1962 through 1983, excluding one year. t-ratios are in parentheses

Table 3
Two-Stage Least Squares of Alcohol Demand Equations*
(Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	0.620	0.585	0.519	0.908
	(1.17)	(1.21)	(1.12)	(0.40)
Future Consumption**	0.322	0.338	0.458	0.550
	(0.54)	(0.57)	(1.03)	(0.40)
Past Price				
Current Price	-0.092	-0.113	-0.076	1.818
	(-0.40)	(-0.54)	(-0.49)	(0.20)
Future Price				
R-Squared	0.991	0.991	0.983	0.892
F	1659.27	1596.85	1936.69	251.05
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.088	-0.112	-0.192	—
Long Run Price Elasticity	-0.613	-0.568	-1.278	1.535
Root 1 from Difference Eq.	0.444	0.464	0.750	—
Root 2 from Difference Eq.	1.168	1.246	1.177	—
Temp Current Elasticity	-0.049	-0.060	-0.048	—
Temp Past Elasticity	-0.042	-0.048	-0.041	—
Temp Future Elasticity	-0.022	-0.028	-0.036	—
Standard Error for Long Run Elasticity	1.082	0.802	1.266	0.237
Standard Error for Short Run Elasticity	0.167	0.185	0.429	—
Wu-Hausman F-ratio	0.045	0.043	0.042	0.039
Wu-Hausman P-value	0.956	0.958	0.959	0.960
Basmann F-ratio***	N/A	N/A	N/A	N/A
Basmann P-value***	N/A	N/A	N/A	N/A

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

— indicates that the elasticities and roots could not be computed given the estimated coefficients. See the text for a description of the difference among the various models.

***The total number of instruments equals the number of parameters in the equation. The equation is just identified, and the test for over identification is not computed.

Table 3
Two-Stage Least Squares of Alcohol Demand Equations*
(Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.376	0.365	0.387	0.391
	(3.69)	(3.88)	(4.12)	(4.19)
Future Consumption**	0.585	0.596	0.585	0.590
	(6.27)	(6.38)	(6.30)	(6.46)
Past Price				
Current Price	-0.061	-0.093	-0.092	-0.093
	(-0.56)	(-0.66)	(-1.05)	(-0.81)
Future Price				
R-Squared	0.991	0.991	0.982	0.988
F	1643.36	1549.13	1857.12	2502.32
N	1046	1046	1046	1046
Short Run Price Elasticity	-0.260	-0.416	-0.505	-0.715
Long Run Price Elasticity	-0.589	-0.898	-1.237	-1.843
Root 1 from Difference Eq.	0.869	0.876	0.895	0.923
Root 2 from Difference Eq.	1.791	1.863	1.689	1.634
Temp Current Elasticity	-0.034	-0.051	-0.053	-0.055
Temp Past Elasticity	-0.019	-0.028	-0.032	-0.034
Temp Future Elasticity	-0.030	-0.045	-0.047	-0.051
Standard Error for Long Run Elasticity	1.008	1.519	0.752	1.318
Standard Error for Short Run Elasticity	0.416	0.585	0.430	0.741
Wu-Hausman F-ratio	0.805	1.065	1.676	0.925
Wu-Hausman P-value	0.4474	0.3451	0.1876	0.3968
Basmann F-ratio	2.377	2.303	2.444	2.726
Basmann P-value	0.009	0.011	0.009	0.004

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 3
Two-Stage Least Squares of Alcohol Demand Equations*
(Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	0.577	0.556	0.564	0.552
	(1.41)	(1.89)	(1.90)	(1.84)
Future Consumption**	0.438	0.431	0.440	0.453
	(1.69)	(1.67)	(1.50)	(1.54)
Past Price	0.020	0.013	0.018	0.016
	(0.09)	(0.06)	(0.12)	(0.10)
Current Price	-0.070	-0.103	-0.075	-0.069
	(-0.36)	(-0.48)	(-0.39)	(-0.33)
Future Price	0.051	0.059	0.081	0.086
	(0.27)	(0.23)	(0.50)	(0.64)
R-Squared	0.992	0.992	0.983	0.9889
F	1685.24	1623.94	1906.92	2526.65
N	1095	1095	1095	1095
Short Run Price Elasticity	—	-0.079	0.077	—
Long Run Price Elasticity	—	-0.922	-2.321	—
Root 1 from Difference Eq.	—	0.716	0.810	—
Root 2 from Difference Eq.	—	1.082	0.963	—
Temp Current Elasticity	—	-0.034	-0.019	—
Temp Past Elasticity	—	-0.047	-0.032	—
Temp Future Elasticity	—	-0.001	0.016	—
Standard Error for Long Run Elasticity	3.500	3.528	4.185	3.615
Standard Error for Short Run Elasticity	—	0.659	1.857	—
Wu-Hausman F-ratio	0.033	0.043	0.04	0.067
Wu-Hausman P-value	0.968	0.958	0.961	0.935
Basmann F-ratio	0.137	0.124	0.138	0.145
Basmann P-value	0.711	0.725	0.711	0.704

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

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Table 3
Two-Stage Least Squares of Alcohol Demand Equations*
(Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.368	0.354	0.382	0.384
	(3.49)	(3.56)	(3.97)	(4.02)
Future Consumption**	0.591	0.602	0.589	0.597
	(6.22)	(6.32)	(6.16)	(6.36)
Past Price	-0.046	-0.063	-0.039	-0.029
	(-0.32)	(-0.42)	(-0.29)	(-0.21)
Current Price	-0.040	-0.041	-0.048	-0.136
	(-0.21)	(-0.19)	(-0.25)	(-0.63)
Future Price	0.026	-0.008	-0.010	0.079
	(0.16)	(-0.05)	(-0.06)	(0.56)
R-Squared	0.991	0.991	0.982	0.988
F	1589.12	1497.98	1730.78	2353.70
N	1046	1046	1046	1046
Short Run Price Elasticity	-0.228	-0.434	-0.506	-0.671
Long Run Price Elasticity	-0.551	-0.959	-1.260	-1.705
Root 1 from Difference Eq.	0.869	0.870	0.895	0.927
Root 2 from Difference Eq.	1.849	1.955	1.723	1.677
Temp Current Elasticity	-0.037	-0.045	-0.038	-0.067
Temp Past Elasticity	-0.049	-0.061	-0.050	-0.074
Temp Future Elasticity	-0.023	-0.042	-0.038	-0.032
Standard Error for Long Run Elasticity	0.523	0.690	0.379	0.682
Standard Error for Short Run Elasticity	0.538	0.883	0.455	2.176
Wu-Hausman F-ratio	0.866	1.135	1.509	0.964
Wu-Hausman P-value	0.421	0.322	0.222	0.382
Basmann F-ratio	2.349	2.275	2.472	2.679
Basmann P-value	0.010	0.012	0.009	0.005

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 4
Restricted Two-Stage Least Squares Estimates of Alcohol Demand Equations* (Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	0.492	0.485	0.501	0.689
	(5.00)	(6.79)	(22.79)	(0.87)
Future Consumption**	0.467	0.461	0.476	0.655
	(5.00)	(6.79)	(22.79)	(0.87)
Past Price				
Current Price	-0.065	-0.098	-0.077	1.348
	(-0.33)	(-0.52)	(-0.50)	(0.22)
Future Price				
t-statistic, cons. rest	-0.26	-0.22	-0.04	-0.14
t-statistic, price rest.				
R-Squared	0.992	0.992	0.983	0.932
F	1812.09	1712.34	2003.73	430.61
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.143	-0.188	-0.227	—
Long Run Price Elasticity	-0.613	-0.702	-1.295	-1.516
Root 1 from Difference Eq.	0.727	0.696	0.784	—
Root 2 from Difference Eq.	1.305	1.366	1.212	—
Temp Current Elasticity	-0.039	-0.057	-0.049	—
Temp Past Elasticity	-0.030	-0.042	-0.040	—
Temp Future Elasticity	-0.028	-0.040	-0.038	—
Standard Error for Long Run Elas	1.462	1.122	0.908	0.158
Standard Error for Short Run Ela	0.339	0.297	0.407	—
Wu-Hausman F-ratio	0.003	0.028	0.307	0.32
Wu-Hausman P-value	0.9592	0.8664	0.5794	0.5716
Basmann F-ratio***	N/A	N/A	N/A	N/A
Basmann P-value***	N/A	N/A	N/A	N/A

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

— indicates that the elasticities and roots could not be computed given the estimated coefficients. See the text for a description of the difference among the various models.

***The total number of instruments equals the number of parameters in the equation. The equation is just identified, and the test for over identification is not computed.

Table 4
Restricted Two-Stage Least Squares Estimates of Alcohol Demand Equations* (Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.498	0.493	0.499	0.504
	(15.89)	(16.21)	(51.33)	(44.03)
Future Consumption**	0.473	0.469	0.474	0.479
	(15.89)	(16.21)	(51.33)	(44.03)
Past Price				
Current Price	-0.061	-0.072	-0.094	-0.058
	(-0.57)	(-0.53)	(-1.10)	(-0.54)
Future Price				
t-statistic, cons. rest	1.29	1.47	1.22	1.25
t-statistic, price rest.				
R-Squared	0.992	0.992	0.983	0.989
F	1729.69	1635.20	1988.06	2675.48
N	1046	1046	1046	1046
Short Run Price Elasticity	-0.156	-0.161	-0.249	-0.192
Long Run Price Elasticity	-0.792	-0.714	-1.311	-1.285
Root 1 from Difference Eq.	0.763	0.736	0.769	0.808
Root 2 from Difference Eq.	1.245	1.292	1.235	1.176
Temp Current Elasticity	-0.037	-0.043	-0.057	-0.037
Temp Past Elasticity	-0.030	-0.033	-0.047	-0.031
Temp Future Elasticity	-0.028	-0.031	-0.044	-0.030
Standard Error for Long Run Elasticity	1.555	1.375	0.670	1.174
Standard Error for Short Run Elasticity	0.257	0.295	0.225	0.339
Wu-Hausman F-Ratio	0.005	0.013	2.032	0.311
Wu-Hausman P-value	0.9449	0.9094	0.1543	0.5773
Basmann F-ratio	2.641	2.6296	2.6703	3.0174
Basmann P-value	0.0035	0.0037	0.0046	0.0015

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 4
Restricted Two-Stage Least Squares Estimates of Alcohol Demand Equations* (Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	0.505	0.490	0.512	0.515
	(5.38)	(5.33)	(40.41)	(43.39)
Future Consumption**	0.480	0.466	0.487	0.489
	(5.38)	(5.33)	(40.41)	(43.39)
Past Price	0.013	-0.001	0.036	0.044
	(0.09)	(-0.003)	(0.34)	(0.46)
Current Price	-0.061	-0.086	-0.065	-0.064
	(-0.33)	(-0.42)	(-0.36)	(-0.38)
Future Price	0.013	-0.001	0.034	0.042
	(0.09)	(-0.003)	(0.34)	(0.46)
t-statistic, cons. rest	-0.28	-0.24	-0.35	-0.33
t-statistic, price rest.	0.26	0.26	0.42	0.46
R-Squared	0.992	0.992	0.984	0.989
F	1784.42	1692.52	2060.30	2696.26
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.135	-0.187	0.024	—
Long Run Price Elasticity	-0.902	-0.774	1.934	—
Root 1 from Difference Eq.	0.817	0.720	0.927	—
Root 2 from Difference Eq.	1.163	1.321	1.027	—
Temp Current Elasticity	-0.043	-0.087	-0.002	—
Temp Past Elasticity	-0.020	-0.040	0.004	—
Temp Future Elasticity	-0.009	-0.025	0.013	—
Standard Error for Long Run Elasticity	3.050	0.751	42.483	3.380
Standard Error for Short Run Elasticity	0.520	0.336	0.922	—
Wu-Hausman F-ratio	0.007	0.006	0.001	0.114
Wu-Hausman P-value	0.9313	0.9406	0.9761	0.7362
Basmann F-ratio	0.1746	0.179	0.1969	0.163
Basmann P-value	0.6762	0.6723	0.6573	0.6865

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

— indicates that the elasticities and roots could not be computed given the estimated coefficients. See the text for a description of the difference among the various models.

Table 4
Restricted Two-Stage Least Squares Estimates of Alcohol Demand Equations* (Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.498	0.492	0.499	0.504
	(15.09)	(15.00)	(47.99)	(43.96)
Future Consumption**	0.474	0.468	0.474	0.479
	(15.09)	(15.00)	(47.99)	(43.96)
Past Price	0.001	-0.008	-0.015	0.039
	(0.01)	(-0.06)	(-0.14)	(0.39)
Current Price	-0.063	-0.062	-0.071	-0.129
	(-0.34)	(-0.30)	(-0.38)	(-0.61)
Future Price	0.001	-0.007	-0.014	0.037
	(0.01)	(-0.06)	(-0.14)	(0.39)
t-statistic, cons. rest	1.30	1.51	1.24	1.21
t-statistic, price rest.	0.15	0.09	-0.09	0.37
R-Squared	0.992	0.992	0.983	0.989
F	1704.23	1612.14	1915.66	2596.00
N	1046	1046	1046	1046
Short Run Price Elasticity	-0.160	-0.163	-0.256	-0.200
Long Run Price Elasticity	-0.820	-0.725	-1.395	-1.174
Root 1 from Difference Eq.	0.767	0.731	0.769	0.808
Root 2 from Difference Eq.	1.241	1.302	1.235	1.176
Temp Current Elasticity	0.023	-0.027	-0.034	-0.029
Temp Past Elasticity	-0.030	-0.035	-0.050	-0.028
Temp Future Elasticity	-0.017	-0.022	-0.031	-0.009
Standard Error for Long Run Elasticity	0.834	0.659	0.376	0.725
Standard Error for Short Run Elasticity	0.264	0.281	0.194	0.326
Wu-Hausman F-ratio	0.005	0.012	1.616	0.32
Wu-Hausman P-value	0.9454	0.9913	0.2039	0.572
Basmann F-ratio	2.6364	2.6268	2.7464	2.9856
Basmann P-value	0.0036	0.0037	0.0036	0.0016

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.306	0.282	0.362	0.387
	(2.62)	(2.23)	(3.42)	(5.01)
ΔM_{t+2}**	0.290	0.268	0.344	0.368
	(2.62)	(2.23)	(3.42)	(5.01)
Past Price	0.073	0.066	0.078	0.098
	(1.98)	(1.64)	(2.12)	(2.41)
Current Price	-0.152	-0.139	-0.163	-0.205
	(-1.98)	(-1.64)	(-2.12)	(-2.41)
Future Price	0.069	0.063	0.074	0.093
	(1.98)	(1.64)	(2.12)	(2.41)
t-statistic, restriction 1	-0.11	-0.29	-0.16	-0.14
t-statistic, restriction 2	0.67	1.07	0.30	-0.52
t-statistic, restriction 3	0.68	1.21	0.37	-0.62
R-Squared	0.410	0.418	0.264	0.288
F	10.77	10.69	13.33	13.60
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.902	-0.809	-1.046	-1.379
Long Run Price Elasticity	-0.229	-0.206	-0.347	-0.529
Root 1 from Difference Eq.	0.322	0.292	0.403	0.444
Root 2 from Difference Eq.	2.946	3.254	2.360	2.140
Temp Current Elasticity	-1.167	-1.093	-1.170	-1.412
Temp Past Elasticity	0.302	0.295	0.241	0.252
Temp Future Elasticity	0.264	0.264	0.215	0.234
Standard Error for Long Run Elasticity	0.096	0.092	0.232	0.172
Standard Error for Short Run Elasticity	0.645	0.636	0.879	0.750
Wu-Hausman F-ratio	42.5	32.8	5.1	16.7
Wu-Hausman P-value	0.0001	0.0001	0.0238	0.0001
Basmann F-ratio	1.5958	1.6263	1.8124	1.688
Basmann P-value	0.1028	0.0943	0.0622	0.0875

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(5)	(6)	(7)	(8)
ΔM_t**	0.329	0.305	0.381	0.407
	(2.60)	(2.21)	(3.32)	(4.78)
ΔM_{t+2}**	0.263	0.244	0.305	0.325
	(2.60)	(2.21)	(3.32)	(4.78)
Past Price	0.073	0.067	0.079	0.103
	(1.93)	(1.57)	(2.10)	(2.43)
Current Price	-0.146	-0.134	-0.158	-0.206
	(-1.93)	(-1.57)	(-2.10)	(-2.43)
Future Price	0.059	0.054	0.063	0.083
	(1.93)	(1.57)	(2.10)	(2.43)
t-statistic, restriction 1	-0.15	-0.33	-0.20	-0.19
t-statistic, restriction 2	0.79	1.12	0.45	-0.35
t-statistic, restriction 3	0.75	1.26	0.49	-0.53
R-Squared	0.410	0.417	0.265	0.290
F	10.78	10.67	13.44	13.77
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.950	-0.854	-1.110	-1.490
Long Run Price Elasticity	-0.318	-0.267	-0.472	-0.691
Root 1 from Difference Eq.	0.291	0.265	0.352	0.385
Root 2 from Difference Eq.	2.749	3.013	2.272	2.072
Temp Current Elasticity	-1.135	-1.062	-1.166	-1.472
Temp Past Elasticity	0.283	0.287	0.232	0.250
Temp Future Elasticity	0.217	0.218	0.173	0.201
Standard Error for Long Run Elasticity	0.129	0.123	0.184	0.203
Standard Error for Short Run Elasticity	0.545	0.568	0.596	0.648
Wu-Hausman F-ratio	41.7	32.3	4.7	14.9
Wu-Hausman P-value	0.0001	0.0001	0.0307	0.0001
Basmann F-ratio	1.5985	1.625	1.8293	1.6978
Basmann P-value	0.1021	0.0947	0.0593	0.0852

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.406	0.415	0.445	0.419
	(4.58)	(4.14)	(6.49)	(7.46)
ΔM_{t+2}**	0.385	0.394	0.422	0.398
	(4.58)	(4.14)	(6.49)	(7.46)
Past Price	0.045	0.046	0.041	0.073
	(1.67)	(1.33)	(1.62)	(2.12)
Current Price	-0.111	-0.113	-0.113	-0.180
	(-1.67)	(-1.33)	(-1.62)	(-2.12)
Future Price	0.043	0.043	0.043	0.069
	(1.67)	(1.33)	(1.62)	(2.12)
t-statistic, restriction 1	0.31	0.09	-0.15	0.03
t-statistic, restriction 2	1.33	1.51	1.46	0.72
t-statistic, restriction 3	1.40	1.68	1.56	0.85
R-Squared	0.681	0.677	0.528	0.573
F	30.98	29.32	39.55	42.90
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.617	-0.659	-0.801	-1.062
Long Run Price Elasticity	-0.615	-0.702	-1.219	-1.161
Root 1 from Difference Eq.	0.478	0.496	0.563	0.550
Root 2 from Difference Eq.	1.985	1.913	1.684	1.882
Temp Current Elasticity	-0.471	-0.471	-0.459	-0.745
Temp Past Elasticity	-0.001	-0.008	-0.092	-0.022
Temp Future Elasticity	0.015	0.007	-0.018	0.010
Standard Error for Long Run Elasticity	0.320	0.483	0.588	0.271
Standard Error for Short Run Elasticity	0.259	0.346	0.210	0.244
Wu-Hausman F-ratio	8.0	35.2	1.5	2.1
Wu-Hausman P-value	0.0001	0.0001	0.2265	0.1503
Basmann F-ratio	1.499	1.4687	1.7658	1.7706
Basmann P-value	0.1345	0.146	0.0708	0.0698

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(5)	(6)	(7)	(8)
ΔM_t**	0.441	0.449	0.480	0.445
	(4.53)	(4.11)	(6.33)	(6.88)
ΔM_{t+2}**	0.352	0.360	0.384	0.356
	(4.53)	(4.11)	(6.33)	(6.88)
Past Price	0.043	0.043	0.037	0.073
	(1.58)	(1.22)	(1.52)	(2.06)
Current Price	-0.102	-0.102	-0.089	-0.175
	(-1.58)	(-1.22)	(-1.52)	(-2.06)
Future Price	0.034	0.034	0.030	0.058
	(1.58)	(1.22)	(1.52)	(2.06)
t-statistic, restriction 1	0.35	0.13	-0.11	0.04
t-statistic, restriction 2	1.43	1.59	1.58	0.89
t-statistic, restriction 3	1.45	1.73	1.65	0.98
R-Squared	0.679	0.676	0.527	0.574
F	30.82	29.19	39.42	42.98
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.604	-0.621	-0.604	-1.059
Long Run Price Elasticity	-0.675	-0.732	-0.904	-1.236
Root 1 from Difference Eq.	0.436	0.452	0.508	0.444
Root 2 from Difference Eq.	1.832	1.776	1.576	1.804
Temp Current Elasticity	-0.441	-0.434	-0.359	-0.753
Temp Past Elasticity	-0.017	-0.025	-0.056	-0.042
Temp Future Elasticity	-0.002	-0.006	-0.014	-0.010
Standard Error for Long Run Elasticity	0.361	0.528	0.448	0.265
Standard Error for Short Run Elasticity	0.229	0.302	0.209	0.291
Wu-Hausman F-ratio	40.3	34.8	1.4	1.6
Wu-Hausman P-value	0.0001	0.0001	0.2372	0.2131
Basmann F-ratio	1.5045	4720	1.7647	1.7891
Basmann P-value	0.1325	0.1447	0.071	0.0663

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.461	0.474	0.489	0.451
	(6.98)	(6.40)	(9.83)	(7.91)
ΔM_{t+2}**	0.438	0.45	0.465	0.428
	(6.98)	(6.40)	(9.83)	(7.91)
Past Price	0.013	0.011	0.008	0.026
	(1.02)	(0.59)	(0.74)	(1.18)
Current Price	-0.048	-0.041	-0.019	-0.093
	(-1.02)	(-0.59)	(-0.74)	(-1.18)
Future Price	0.013	0.011	0.008	0.024
	(1.02)	(0.59)	(0.74)	(1.18)
t-statistic, restriction 1	0.58	0.36	0.09	0.34
t-statistic, restriction 2	1.78	1.86	1.98	1.71
t-statistic, restriction 3	1.95	2.09	2.18	1.98
R-Squared	0.833	0.831	0.730	0.764
F	71.32	67.22	94.33	102.11
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.385	-0.379	-0.114	-0.695
Long Run Price Elasticity	-0.872	-1.001	-0.261	-1.423
Root 1 from Difference Eq.	0.609	0.651	0.715	0.579
Root 2 from Difference Eq.	1.560	1.459	1.330	1.638
Temp Current Elasticity	-0.148	-0.123	-0.041	-0.291
Temp Past Elasticity	-0.071	-0.071	-0.012	-0.117
Temp Future Elasticity	-0.038	-0.036	0.003	-0.072
Standard Error for Long Run Elasticity	0.673	1.367	0.691	0.325
Standard Error for Short Run Elasticity	0.087	0.187	0.149	0.065
Wu-Hausman F-ratio	25.8	24.2	0.6	0.04
Wu-Hausman P-value	0.0001	0.0001	0.43	0.84
Basmann F-ratio	1.1465	1.3878	1.6352	1.7591
Basmann P-value	0.1677	0.1807	0.1008	0.0721

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 5
Restricted Two-Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(5)	(6)	(7)	(8)
ΔM_t**	0.504	0.516	0.533	0.493
	(6.93)	(6.36)	(9.74)	(7.63)
ΔM_{t+2}**	0.403	0.413	0.426	0.395
	(6.93)	(6.36)	(9.74)	(7.63)
Past Price	0.012	0.01	0.007	0.023
	(0.97)	(0.51)	(0.67)	(1.03)
Current Price	-0.044	-0.035	-0.025	-0.081
	(-0.97)	(-0.51)	(-0.67)	(-1.03)
Future Price	0.01	0.008	0.006	0.018
	(0.97)	(0.51)	(0.67)	(1.03)
t-statistic, restriction 1	0.72	0.51	0.17	0.38
t-statistic, restriction 2	1.79	1.85	2.00	1.78
t-statistic, restriction 3	1.94	2.07	2.18	2.05
R-Squared	0.832	0.830	0.729	0.763
F	70.65	66.70	93.68	101.54
N	1000	1000	1000	1000
Short Run Price Elasticity	-0.348	-0.302	-0.256	-0.596
Long Run Price Elasticity	-0.947	-0.959	-1.172	-1.430
Root 1 from Difference Eq.	0.562	0.597	0.654	0.537
Root 2 from Difference Eq.	1.422	1.341	1.222	1.491
Temp Current Elasticity	-0.138	-0.106	-0.072	-0.257
Temp Past Elasticity	-0.079	-0.067	-0.060	-0.125
Temp Future Elasticity	-0.038	-0.031	-0.023	-0.066
Standard Error for Long Run Elasticity	0.789	1.474	1.222	0.355
Standard Error for Short Run Elasticity	0.084	0.141	0.095	0.073
Wu-Hausman F-ratio	26.2	24.3	0.7	0.1
Wu-Hausman P-value	0.0001	0.0001	0.4	0.77
Basmann F-ratio	1.4258	1.3963	1.6177	1.7394
Basmann P-value	0.1636	0.1768	0.1055	0.0761

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price in Models 1-4, while a value of 0.80 is used in Models 5-8. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 6

T-Ratios for Short/Long Run Elasticities: Tables 3 and 4
Panel A and B

Table	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Depreciation on Addictive Stock Equal to 1								
Table 3 (Short)*	-0.088	-0.112	-0.192	—	-0.260	-0.416	-0.505	-0.715
	(-0.529)	(-0.605)	(-0.448)	—	(-0.625)	(-0.711)	(-1.174)	(-0.965)
(Long)**	-0.613	-0.568	-1.278	-1.535	-0.589	-0.898	-1.237	-1.843
	(-0.567)	(-0.708)	(-1.010)	(-6.486)	(-0.584)	(-0.591)	(-1.645)	(-1.399)
Table 4 (Short)*	-0.143	-0.188	-0.227	—	-0.156	-0.161	-0.249	-0.192
	(-0.424)	(-0.632)	(-0.558)	—	(-0.606)	(-0.547)	(-1.106)	(-0.567)
(Long)**	-0.613	-0.702	-1.295	-1.516	-0.792	-0.714	-1.311	-1.285
	(-0.419)	(-0.626)	(-1.427)	(-9.574)	(-0.510)	(-0.519)	(-1.957)	(-1.094)
Panel B: Depreciation on Addictive Stock Not Equal to 1								
Table 3 (Short)*	—	-0.079	0.077	—	-0.228	-0.434	-0.506	-0.671
	—	(-0.119)	(0.042)	—	(-0.423)	(-0.491)	(-1.112)	(-0.308)
(Long)**	—	-0.922	-2.321	—	-0.551	-0.959	-1.260	-1.705
	—	(-0.261)	(-0.554)	—	(-1.053)	(-1.389)	(-3.323)	(-2.499)
Table 4 (Short)*	-0.135	-0.187	0.024	—	-0.160	-0.163	-0.256	-0.200
	(-0.259)	(-0.557)	(0.026)	—	(-0.607)	(-0.581)	(-1.321)	(-0.615)
(Long)**	-0.902	-0.774	1.934	—	-0.820	-0.725	-1.395	-1.174
	(-0.296)	(-1.030)	(0.046)	—	(-0.984)	(-1.101)	(-3.707)	(-1.620)

* Asymptotic t-ratios for short run elasticities are in parentheses.
** Asymptotic t-ratios for long run elasticities are in parentheses.

Table 7

T-Ratios for Short/Long Run Elasticities: Table 5
Panel A, B, C

Table	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A : Assumed Depreciation Rate = 0.30								
Table 5 (Short)*	-0.902	-0.809	-1.046	-1.379	-0.950	-0.854	-1.110	-1.490
	(-1.398)	(-1.272)	(-1.189)	(-1.839)	(-1.744)	(-1.504)	(-1.863)	(-2.298)
(Long)**	-0.229	-0.206	-0.347	-0.529	-0.318	-0.267	-0.472	-0.691
	(-2.396)	(-2.245)	(-1.497)	(-3.071)	(-2.462)	(-2.174)	(-2.570)	(-3.411)
Panel B : Assumed Depreciation Rate = 0.50								
Table 5 (Short)*	-0.617	-0.659	-0.801	-1.062	-0.604	-0.621	-0.604	-1.059
	(-2.386)	(-1.905)	(-3.808)	(-4.349)	(-2.640)	(-2.057)	(-2.889)	(-3.638)
(Long)**	-0.615	-0.702	-1.219	-1.161	-0.675	-0.732	-0.904	-1.236
	(-1.924)	(-1.456)	(-2.072)	(-4.279)	(-1.873)	(-1.385)	(-2.018)	(-4.660)
Panel C : Assumed Depreciation Rate = 0.70								
Table 5 (Short)*	-0.385	-0.379	-0.114	-0.695	-0.348	-0.302	-0.256	-0.596
	(-4.416)	(-2.023)	(-0.763)	(-10.769)	(-4.146)	(-2.141)	(-2.704)	(-8.170)
(Long)**	-0.872	-1.001	-0.261	-1.423	-0.947	-0.959	-1.172	-1.430
	(-1.296)	(-0.732)	(-0.378)	(-4.375)	(-1.200)	(-0.650)	(-0.959)	(-4.028)

* Asymptotic t-ratios for short run elasticities are in parentheses.
** Asymptotic t-ratios for long run elasticities are in parentheses.

Table 8

Test of the Significance of the Instruments in the First Stage (Bound et al Test F-Ratios)†

Table			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Table 3	Panel A	*	36.155	36.155	36.155	36.155	42.078	42.078	45.443	45.443
		**	20.101	20.101	20.101	20.101	35.674	35.674	38.087	38.087
	Panel B	*	17.770	17.770	17.770	17.770	42.078	42.078	45.443	45.443
		**	14.155	14.155	14.155	14.155	35.674	35.674	38.087	38.087
Table 4	Panel A		27.734	27.734	27.734	27.734	39.043	39.043	41.954	41.954
	Panel B		16.082	16.082	16.082	16.082	39.043	39.043	41.954	45.783
Table 5	Panel A		22.304	22.304	23.778	23.778	22.430	22.430	23.927	23.927
	Panel B		32.094	32.094	34.740	34.740	32.359	32.359	35.042	35.042
	Panel C		36.774	36.774	39.982	39.982	37.109	37.109	40.358	40.358

† All equations have a set of excluded instruments as regressors and F-ratios are shown above to represent the additional explanatory power in the first stage.

* Past consumption is used as a dependent variable.

** Future consumption is used as a dependent variable.

Table 9
Unrestricted Ordinary Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.475	0.474	0.490	0.489
	(24.993)	(23.792)	(27.563)	(27.152)
Future Consumption	0.495	0.495	0.509	0.508
	(25.336)	(24.972)	(28.857)	(27.932)
Past Price				
Current Price	-0.054	-0.075	0.003	-0.017
	(-0.606)	(-0.631)	(0.058)	(-0.280)
Future Price				
R-Squared	0.992	0.992	0.992	0.992
F	1864.71	1762.38	4457.34	3649.22
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.163	-0.225	0.086	-0.220
Long Run Price Elasticity	-0.684	-0.936	1.389	-2.450
Root 1 from Difference Eq.	0.795	0.793	0.975	0.945
Root 2 from Difference Eq.	1.312	1.317	1.066	1.099
Temp Current Elasticity	-0.033	-0.047	0.002	-0.012
Temp Past Elasticity	-0.025	-0.035	0.002	-0.011
Temp Future Elasticity	-0.027	-0.037	0.002	-0.012

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 9
Unrestricted Ordinary Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.474	0.474	0.490	0.489
	(24.959)	(23.789)	(27.612)	(27.162)
Future Consumption	0.496	0.495	0.509	0.508
	(25.476)	(25.003)	(29.011)	(28.061)
Past Price				
Current Price	0.034	0.043	0.004	-0.004
	(0.667)	(0.784)	(0.114)	(-0.099)
Future Price				
R-Squared	0.992	0.992	0.992	0.992
F	1889.42	1784.84	4605.46	4065.59
N	1095	1095	1095	1095
Short Run Price Elasticity	0.103	0.129	0.115	-0.054
Long Run Price Elasticity	0.432	0.541	1.859	-0.629
Root 1 from Difference Eq.	0.797	0.795	0.975	0.950
Root 2 from Difference Eq.	1.314	1.314	1.066	1.094
Temp Current Elasticity	0.021	0.027	0.003	-0.003
Temp Past Elasticity	0.016	0.020	0.003	-0.002
Temp Future Elasticity	0.017	0.021	0.003	-0.003

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 9
Unrestricted Ordinary Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.475	0.474	0.490	0.489
	(24.936)	(23.714)	(27.513)	(27.102)
Future Consumption	0.495	0.495	0.510	0.508
	(25.336)	(24.943)	(28.821)	(27.887)
Past Price	-0.022	-0.020	-0.003	-0.001
	(-0.163)	(-0.150)	(0.023)	(-0.008)
Current Price	-0.059	-0.084	-0.061	-0.096
	(-0.322)	(-0.412)	(-0.342)	(-0.517)
Future Price	0.036	0.037	0.077	0.090
	(0.240)	(0.238)	(0.578)	(0.667)
R-Squared	0.992	0.992	0.992	0.992
F	1812.25	1715.09	4188.58	3735.89
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.123	-0.189	-8.9E+12	-0.084
Long Run Price Elasticity	-0.580	-0.836	-2.3E+14	-0.902
Root 1 from Difference Eq.	0.796	0.793	1.000	0.941
Root 2 from Difference Eq.	1.309	1.316	1.041	1.104
Temp Current Elasticity	-0.034	-0.042	-0.026	-0.038
Temp Past Elasticity	-0.050	-0.059	-0.049	-0.064
Temp Future Elasticity	-0.013	-0.019	0.004	-0.001

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 9
Unrestricted Ordinary Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.474	0.474	0.490	0.489
	(24.918)	(23.738)	(27.565)	(27.114)
Future Consumption	0.496	0.496	0.509	0.508
	(25.455)	(24.977)	(28.961)	(27.995)
Past Price	0.000	-0.001	-0.004	0.004
	(-0.003)	(-0.004)	(-0.033)	(0.003)
Current Price	-0.059	-0.041	-0.061	-0.094
	(-0.321)	(-0.205)	(-0.340)	(-0.509)
Future Price	0.102	0.087	0.073	0.094
	(0.761)	(0.605)	(0.566)	(0.710)
R-Squared	0.992	0.992	0.992	0.992
F	1836.49	1736.86	4319.52	3840.42
N	1095	1095	1095	1046
Short Run Price Elasticity	0.132	0.139	0.205	0.046
Long Run Price Elasticity	0.554	0.580	3.094	0.516
Root 1 from Difference Eq.	0.797	0.797	0.971	0.941
Root 2 from Difference Eq.	1.312	1.312	1.070	1.104
Temp Current Elasticity	-0.023	-0.016	-0.026	-0.034
Temp Past Elasticity	-0.028	-0.020	-0.048	-0.056
Temp Future Elasticity	0.021	0.021	0.003	0.005

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 10
Restricted Ordinary Least Squares Estimates of Alcohol Demand Equations* (Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.497	0.497	0.512	0.511
	(74.723)	(72.143)	(280.179	(215.886)
Future Consumption	0.472	0.472	0.487	0.486
	(74.723)	(72.143)	(280.179	(215.886)
Past Price				
Current Price	-0.056	-0.073	0.002	-0.143
	(-0.636)	(-0.616)	(0.035)	(-0.236)
Future Price				
t-statistic, cons. rest	1.240	1.221	1.274	1.228
t-statistic, price rest.				
R-Squared	0.992	0.992	0.992	0.992
F	1889.24	1784.39	4598.38	4060.07
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.143	-0.186	0.019	-1.019
Long Run Price Elasticity	-0.699	-0.912	1.024	-19.136
Root 1 from Difference Eq.	0.756	0.756	0.932	0.899
Root 2 from Difference Eq.	1.257	1.256	1.019	1.056
Temp Current Elasticity	-0.035	-0.045	0.001	-0.102
Temp Past Elasticity	-0.028	-0.036	0.001	-0.097
Temp Future Elasticity	-0.003	-0.034	0.001	-0.092

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

Table 10
Restricted Ordinary Least Squares Estimates of Alcohol Demand Equations* (Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.497	0.497	0.513	0.512
	(74.724)	(72.215)	(287.970	(224.956)
Future Consumption	0.472	0.472	0.487	0.486
	(74.724)	(72.215)	(287.970	(224.956)
Past Price				
Current Price	0.037	0.046	0.006	0.002
	(0.722)	(0.851)	(0.187)	(0.045)
Future Price				
t-statistic, cons. rest	1.311	1.236	. 1.280	1.243
t-statistic, price rest.				
R-Squared	0.992	0.992	0.992	0.992
F	1914.29	1807.36	4756.07	4182.97
N	1095	1095	1095	1095
Short Run Price Elasticity	0.093	0.119	0.070	0.013
Long Run Price Elasticity	0.455	0.586	4.294	0.267
Root 1 from Difference Eq.	0.756	0.758	0.934	0.905
Root 2 from Difference Eq.	1.256	1.254	1.017	1.050
Temp Current Elasticity	0.023	0.029	0.005	0.001
Temp Past Elasticity	0.018	0.023	0.005	0.001
Temp Future Elasticity	0.017	0.022	0.004	0.001

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

Table 10
Restricted Ordinary Least Squares Estimates of Alcohol Demand Equations* (Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.497	0.497	0.513	0.511
	(74.519)	(71.820)	(279.529)	(215.798)
Future Consumption	0.472	0.472	0.487	0.486
	(74.519)	(71.820)	(279.529)	(215.798)
Past Price	0.004	0.009	0.037	0.045
	(0.039)	(0.081)	(0.386)	(0.469)
Current Price	-0.063	-0.087	-0.065	-0.096
	(-0.343)	(-0.425)	(-0.361)	(-0.520)
Future Price	0.004	0.008	0.035	0.043
	(0.039)	(0.081)	(0.386)	(0.469)
t-statistic, cons. rest	1.239	1.218	1.267	1.214
t-statistic, price rest.	0.258	0.261	0.400	0.469
R-Squared	0.992	0.992	0.992	0.992
F	1861.89	1759.79	4451.12	3944.39
N	1095	1095	1095	1095
Short Run Price Elasticity	-0.141	-0.183	0.055	-0.090
Long Run Price Elasticity	-0.676	-0.870	4.947	-1.083
Root 1 from Difference Eq.	0.756	0.756	0.934	0.899
Root 2 from Difference Eq.	1.257	1.256	1.017	1.056
Temp Current Elasticity	-0.022	-0.029	0.001	-0.008
Temp Past Elasticity	-0.027	-0.034	0.005	-0.005
Temp Future Elasticity	-0.015	-0.019	0.014	0.009

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

Table 10
Restricted Ordinary Least Squares Estimates of Alcohol Demand Equations* (Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.497	0.497	0.513	0.511
	(74.613)	(72.019)	(287.848	(224.411)
Future Consumption	0.472	0.473	0.487	0.486
	(74.613)	(72.019)	(287.848	(224.411)
Past Price	0.054	0.045	0.038	0.050
	(0.562)	(0.441)	(0.404)	(0.525)
Current Price	-0.062	-0.038	-0.065	-0.093
	(-0.340)	(-0.191)	(-0.362)	(-0.504)
Future Price	0.052	0.043	0.036	0.047
	(0.562)	(0.441)	(0.404)	(0.525)
t-statistic, cons. rest	1.293	1.218	1.266	223
t-statistic, price rest.	0.529	0.433	0.400	0.491
R-Squared	0.992	0.992	0.992	0.992
F	1886.81	1782.48	4599.03	4060.69
N	1095	1095	1095	1095
Short Run Price Elasticity	0.079	0.101	0.067	-0.008
Long Run Price Elasticity	0.557	0.641	5.946	0.562
Root 1 from Difference Eq.	0.758	0.759	0.935	0.903
Root 2 from Difference Eq.	1.254	1.251	1.016	1.052
Temp Current Elasticity	0.002	0.007	0.001	-0.004
Temp Past Elasticity	0.023	0.026	0.006	0.003
Temp Future Elasticity	0.021	0.022	0.015	0.015

* An assumed discount factor of 0.95 is used to restrict the coefficients on past and future consumptions and past and future price. Asymptotic t-ratios in parentheses. All equations include an intercept real income and a set of dichotomous year dummy variables for every year except one.

Table 11
Myopic Ordinary Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.858	0.869	0.992	0.976
	(57.111)	(55.475)	(214.22)	(166.431)
Future Consumption				
Past Price				
Current Price	-0.191	-0.149	-0.063	-0.028
	(-1.730)	(-1.007)	(-0.73)	(-0.366)
Future Price				
R-Squared	0.987	0.987	0.987	0.987
F	1196.33	1143.58	2687.05	2435.97
N	1145	1145	1145	1145
Short Run Price Elasticity	-0.073	-0.057	-0.024	-0.011
Long Run Price Elasticity	-0.399	-0.387	-0.401	-0.382

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 11
Myopic Ordinary Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.858	0.869	0.994	0.979
	(57.006)	(55.511)	(221.011	(174.38)
Future Consumption				
Past Price				
Current Price	0.009	0.039	0.058	0.111
	(0.150)	(0.596)	(1.382)	(2.357)
Future Price				
R-Squared	0.987	0.987	0.987	0.987
F	1208.600	1157.50	2764.07	2498.53
N	1145	1145	1145	1145
Short Run Price Elasticity	0.004	0.015	0.022	0.042
Long Run Price Elasticity	-0.323	-0.316	-0.356	-0.331

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 11
Myopic Ordinary Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption	0.858	0.869	0.992	0.976
	(56.977)	(55.353)	(514.139	(166.395)
Future Consumption				
Past Price	-0.016	0.039	0.091	0.118
	(-0.093)	(0.230)	(0.550)	(0.721)
Current Price	-0.177	-0.182	-0.151	-0.143
	(0.972)	(-0.882)	(-0.874)	(-0.808)
Future Price				
R-Squared	0.986	0.986	0.986	0.986
F	1179.07	1127.92	2601.46	3735.89
N	1145	1145	1145	1145
Short Run Price Elasticity	-0.067	-0.069	-0.058	-0.054
Long Run Price Elasticity	-0.516	-0.415	-2.772	-0.385

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 11
Myopic Ordinary Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption	0.858	0.870	0.994	0.979
	(56.894)	(55.416)	(220.960	(174.310)
Future Consumption				
Past Price	0.036	0.068	0.118	0.140
	(0.217)	(0.406)	(0.714)	(0.851)
Current Price	-0.025	-0.025	-0.059	-0.028
	(-0.147)	(-0.148)	(-0.349)	(-0.165)
Future Price				
R-Squared	0.987	0.987	0.987	0.987
F	1190.99	1141.57	2673.75	2426.56
N	1145	1145	1145	1145
Short Run Price Elasticity	-0.009	-0.010	-0.022	-0.011
Long Run Price Elasticity	0.031	0.124	4.064	2.063

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(1)	(2)	(3)	(4)
ΔM_t	-0.249	-0.258	0.191	0.140
	(-8.092)	(-8.403)	(6.266)	(4.547)
Past Price	0.047	0.015	0.090	0.180
	(1.512)	(0.401)	(2.749)	(5.114)
Current Price	-0.067	-0.021	-0.128	-0.257
	(-1.512)	(-0.401)	(-2.749)	(-5.114)
t-statistic, restriction 1	-0.837	0.671	-0.535	-2.964
R-Squared	0.544	0.548	0.303	0.331
F	18.60	18.18	16.75	17.23
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.620	-0.194	-1.177	-2.367
Long Run Price Elasticity	-0.149	-0.046	-0.436	-0.826

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(5)	(6)	(7)	(8)
ΔM_t	-0.249	-0.258	0.191	0.140
	(-8.092)	(-8.403)	(6.266)	(4.547)
Past Price	0.047	0.015	0.090	0.180
	(1.512)	(0.401)	(2.749)	(5.114)
Current Price	-0.067	-0.021	-0.128	-0.257
	(-1.512)	(-0.401)	(-2.749)	(-5.114)
t-statistic, restriction 1	-0.837	0.671	-0.535	-2.964
R-Squared	0.544	0.548	0.303	0.331
F	18.60	18.18	16.75	17.23
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.620	-0.194	-1.177	-2.367
Long Run Price Elasticity	-0.149	-0.046	-0.436	-0.826

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(1)	(2)	(3)	(4)
ΔM_t	-0.019	-0.035	0.596	0.541
	(-0.598)	(-1.082)	(23.756)	(20.471)
Past Price	0.033	-0.003	0.043	0.103
	(1.682)	(-0.125)	(2.367)	(4.926)
Current Price	-0.066	0.007	-0.085	-0.206
	(-1.682)	(0.125)	(-2.367)	(-4.926)
t-statistic, restriction 1	-0.250	1.044	0.734	-0.437
R-Squared	0.747	0.751	0.606	0.618
F	44.68	43.65	56.52	53.91
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.367	0.038	-0.473	-1.140
Long Run Price Elasticity	-0.180	0.018	-0.585	-1.242

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(5)	(6)	(7)	(8)
ΔM_t	-0.019	-0.035	0.596	0.541
	(-0.598)	(-1.082)	(23.756)	(20.471)
Past Price	0.033	-0.003	0.043	0.103
	(1.682)	(-0.125)	(2.367)	(4.926)
Current Price	-0.066	0.007	-0.085	-0.206
	(-1.682)	(0.125)	(-2.367)	(-4.926)
t-statistic, restriction 1	-0.250	1.044	0.734	-0.437
R-Squared	0.747	0.751	0.606	0.618
F	44.68	43.65	56.52	53.91
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.367	0.038	-0.473	-1.140
Long Run Price Elasticity	-0.180	0.018	-0.585	-1.242

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(1)	(2)	(3)	(4)
ΔM_t	0.257	0.239	0.801	0.766
	(8.255)	(7.644)	(42.436)	(37.440)
Past Price	0.016	-0.007	0.014	0.034
	(1.636)	(-0.487)	(1.731)	(3.634)
Current Price	-0.054	0.024	-0.045	-0.114
	(-1.636)	(0.487)	(-1.731)	(-3.634)
t-statistic, restriction 1	0.279	1.085	1.287	0.913
R-Squared	0.850	0.852	0.795	0.798
F	84.97	82.79	141.42	130.57
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.213	0.096	-0.179	-0.451
Long Run Price Elasticity	-0.200	0.089	-0.629	-1.351

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 12
Restricted Myopic Ordinary Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(5)	(6)	(7)	(8)
ΔM_t	0.257	0.239	0.801	0.766
	(8.255)	(7.644)	(42.436)	(37.440)
Past Price	0.016	-0.007	0.014	0.034
	(1.636)	(-0.487)	(1.731)	(3.634)
Current Price	-0.045	0.024	-0.045	-0.114
	(-1.636)	(0.487)	(-1.731)	(-3.634)
t-statistic, restriction 1	0.279	1.085	1.287	0.913
R-Squared	0.850	0.852	0.795	0.798
F	84.98	82.79	141.42	130.57
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.213	0.096	-0.179	-0.451
Long Run Price Elasticity	-0.200	0.089	-0.629	-1.351

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

Table 13
Myopic Two Stage Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	0.881	0.812	0.822	16.285
	(3.494)	(3.269)	(1.786)	(0.767)
Future Consumption				
Past Price				
Current Price	-0.170	-0.210	-0.646	61.725
	(-0.684)	(-0.684)	(-0.409)	(0.721)
Future Price				
R-Squared	0.947	0.9515	0.9365	0.9867
F	281.218	292.392	545.541	2367.297
N	1145	1145	1145	1145
Short Run Price Elasticity	-0.065	-0.080	-0.246	23.485
Long Run Price Elasticity	-0.400	-0.389	-0.558	17.289
Basmann F-ratio***	N/A	N/A	N/A	N/A
Basmann P-value***	N/A	N/A	N/A	N/A
Wu-Hausman F-ratio	0.009	0.053	0.302	0.520
Wu-Hausman P-value	0.926	0.818	0.583	0.471
Bound F-ratio	58.968	58.968	58.968	58.968

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

*** The total number of instruments equals the number of parameters in the equation. The equation is just identified, and the test for over identification is not computed.

Table 13
Myopic Two Stage Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel A: Depreciation on Addictive Stock Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.895	0.854	0.960	0.980
	(12.028)	(11.756)	(35.434)	(34.696)
Future Consumption				
Past Price				
Current Price	-0.165	-0.114	-0.179	0.034
	(-1.270)	(-0.676)	(-1.515)	(0.244)
Future Price				
R-Squared	0.951	0.954	0.971	0.981
F	258.061	264.974	1204.589	1692.576
N	1096	1096	1096	1096
Short Run Price Elasticity	-0.063	-0.043	-0.068	0.013
Long Run Price Elasticity	-0.404	-0.368	-0.433	-0.360
Basmann F-ratio	4.356	4.416	4.211	4.846
Basmann P-value	0.000	0.000	0.000	0.000
Wu-Hausman F-ratio	0.257	0.043	1.192	0.087
Wu-Hausman P-value	0.613	0.836	0.275	0.768
Bound F-ratio	47.554	47.554	52.091	52.091

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 13
Myopic Two Stage Least Squares of Alcohol Demand Equations* (Model 1-4)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(1)	(2)	(3)	(4)
Past Consumption**	1.202	1.044	1.013	1.011
	(4.193)	(4.261)	(26.939)	(32.373)
Future Consumption				
Past Price	0.213	0.158	0.102	0.118
	(0.763)	(0.648)	(0.607)	(0.708)
Current Price	-0.072	-0.094	-0.091	-0.001
	(-0.300)	(-0.376)	(-0.443)	(-0.006)
Future Price				
R-Squared	0.980	0.985	0.970	0.980
F	762.79	975.00	1170.33	1577.26
N	1145	1145	1145	1145
Short Run Price Elasticity	-0.027	-0.036	-0.035	0.000
Long Run Price Elasticity	-0.267	-0.550	-0.344	-4.133
Basmann F-ratio	0.699	0.892	0.979	0.983
Basmann P-value	0.403	0.345	0.323	0.322
Wu-Hausman F-ratio	2.158	0.573	0.317	1.354
Wu-Hausman P-value	0.142	0.449	0.574	0.245
Bound F-ratio	26.151	26.151	26.151	26.151

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 13
Myopic Two Stage Least Squares of Alcohol Demand Equations* (Model 5-8)
Panel B: Depreciation on Addictive Stock Not Equal to 1

Variable	(5)	(6)	(7)	(8)
Past Consumption**	0.898	0.859	0.961	0.980
	(11.601)	(11.404)	(35.374)	(34.677)
Future Consumption				
Past Price	0.020	0.046	0.074	0.119
	(0.116)	(0.262)	(0.437)	(0.724)
Current Price	-0.020	-0.147	-0.247	-0.082
	(-0.972)	(-0.695)	(-1.267)	(-0.384)
Future Price				
R-Squared	0.987	0.987	0.971	0.981
F	1122.31	1083.07	1168.11	1643.71
N	1096	1096	1096	1096
Short Run Price Elasticity	-0.008	-0.056	-0.094	-0.031
Long Run Price Elasticity	0.000	-0.274	-1.672	0.718
Basmann F-ratio	4.347	4.408	4.199	4.782
Basmann P-value	0.000	0.000	0.000	0.000
Wu-Hausman F-ratio	0.275	0.016	1.091	0.081
Wu-Hausman P-value	0.600	0.900	0.297	0.776
Bound F-ratio	47.554	47.554	52.091	52.091

* Asymptotic t-ratios in parentheses. All equations include an intercept, real income, and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.557	0.484	0.559	0.590
	(2.348)	(1.900)	(2.565)	(3.474)
Past Price	0.063	0.050	0.071	0.112
	(1.542)	(1.030)	(.1.953)	(2.415)
Current Price	-0.090	-0.071	-0.102	-0.160
	(-1.542)	(-1.030)	(-1.953)	(-2.415)
t-statistic, restriction 1	0.533	1.080	0.529	-0.775
R-Squared	0.391	0.410	0.260	0.285
F	10.47	10.83	13.71	14.09
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.831	-0.651	-0.935	-1.468
Long Run Price Elasticity	-0.563	-0.379	-0.636	-1.075
Basmann F-ratio	1.625	1.687	1.742	1.563
Bamann P-value	0.095	0.079	0.075	0.122
Wu-Hausmann F-ratio	19.735	13.084	3.305	9.358
Wu-HausmannP-value	0.000	0.000	0.069	0.002
Bound F-ratio	20.870	20.870	22.765	22.765

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel A: Assumed Depreciation Rate = 0.30

Variable	(5)	(6)	(7)	(8)
ΔMt**	0.557	0.484	0.559	0.590
	(2.348)	(2.310)	(2.565)	(4.136)
Past Price	0.063	0.050	0.071	0.112
	(1.542)	(1.296)	(1.953)	(5.847)
Current Price	-0.090	-0.071	-0.102	-0.160
	(-1.542)	(-1.296)	(-1.953)	(-5.847)
t-statistic, restriction 1	0.533	1.080	0.529	0.069
R-Squared	0.391	0.410	0.260	0.305
F	10.47	10.83	13.71	16.34
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.831	-0.651	-0.935	-1.468
Long Run Price Elasticity	-0.563	-0.379	-0.636	-1.075
Basmann F-ratio	1.625	1.687	1.742	1.563
Bamann P-value	0.095	0.079	0.075	0.122
Wu-Hausmann F-ratio	19.735	13.084	3.305	9.358
Wu-HausmannP-value	0.000	0.000	0.069	0.002
Bound F-ratio	20.870	20.870	22.765	22.765

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.823	0.806	0.860	0.733
	(4.113)	(3.604)	(5.109)	(4.666)
Past Price	0.032	0.025	0.024	0.065
	(1.255)	(0.701)	(1.082)	(1.740)
Current Price	-0.065	-0.051	-0.048	-0.130
	(-1.255)	(-0.701)	(-1.082)	(-1.740)
t-statistic, restriction 1	1.106	1.382	1.451	0.775
R-Squared	0.632	0.636	0.480	0.540
F	26.39	25.74	34.33	39.48
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.358	-0.282	-0.267	-0.720
Long Run Price Elasticity	-1.013	-0.726	-0.956	-1.348
Basmann F-ratio	1.466	1.451	1.477	1.589
Bamann P-value	0.147	0.153	0.152	0.114
Wu-Hausmann F-ratio	35.341	24.465	2.993	1.873
Wu-HausmannP-value	0.000	0.000	0.084	0.172
Bound F-ratio	35.341	35.341	38.893	38.893

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel B: Assumed Depreciation Rate = 0.50

Variable	(5)	(6)	(7)	(8)
ΔM_t**	0.823	0.806	0.860	0.733
	(4.113)	(3.604)	(5.109)	(4.666)
Past Price	0.032	0.025	0.024	0.065
	(1.255)	(0.701)	(1.082)	(1.740)
Current Price	-0.065	-0.051	-0.048	-0.130
	(-1.255)	(-0.701)	(-1.082)	(-1.740)
t-statistic, restriction 1	1.106	1.382	1.451	0.775
R-Squared	0.632	0.636	0.480	0.540
F	26.39	25.74	34.33	39.48
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.358	-0.282	-0.267	-0.720
Long Run Price Elasticity	-1.013	-0.726	-0.956	-1.348
Basmann F-ratio	1.466	1.451	1.477	1.589
Bamann P-value	0.147	0.153	0.152	0.114
Wu-Hausmann F-ratio	35.341	24.465	2.993	1.873
Wu-HausmannP-value	0.000	0.000	0.084	0.172
Bound F-ratio	35.341	35.341	38.893	38.893

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 1-4)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(1)	(2)	(3)	(4)
ΔM_t**	0.947	0.957	0.994	0.903
	(5.739)	(5.527)	(7.965)	(5.956)
Past Price	0.011	0.008	0.004	0.015
	(0.919)	(0.408)	(0.396)	(0.668)
Current Price	-0.038	-0.026	-0.013	-0.051
	(-0.919)	(-0.408)	(-0.396)	(-0.668)
t-statistic, restriction 1	1.292	1.455	1.655	1.612
R-Squared	0.789	0.788	0.669	0.718
F	53.65	53.65	74.12	84.24
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.151	-0.102	-0.053	-0.202
Long Run Price Elasticity	-2.013	-1.666	-6.169	-1.451
Basmann F-ratio	1.348	1.392	1.220	1.383
Bamann P-value	0.200	0.179	0.784	0.191
Wu-Hausmann F-ratio	33.201	27.596	3.105	1.169
Wu-HausmannP-value	0.000	0.000	0.078	0.280
Bound F-ratio	35.341	35.341	47.674	47.674

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

Table 14
Restricted Myopic Two Stage Least Squares Estimates of Heavy Drinking Equations* (Model 5-8)
Panel C: Assumed Depreciation Rate = 0.70

Variable	(5)	(6)	(7)	(8)
ΔM_t^{**}	0.947	0.957	0.994	0.903
	(6.169)	(5.527)	(7.965)	(5.956)
Past Price	0.011	0.008	0.004	0.015
	(1.018)	(0.408)	(0.396)	(0.668)
Current Price	-0.038	-0.026	-0.013	-0.051
	(-1.018)	(-0.408)	(-0.396)	(-0.668)
t-statistic, restriction 1	1.329	1.455	1.655	0.972
R-Squared	0.787	0.788	0.669	0.718
F	55.59	53.65	74.12	84.24
N	1050	1050	1050	1050
Short Run Price Elasticity	-0.151	-0.102	-0.053	-0.202
Long Run Price Elasticity	-2.013	-1.666	-6.169	-1.451
Basmann F-ratio	1.417	1.392	1.220	1.383
Bamann P-value	0.167	0.179	0.784	0.191
Wu-Hausmann F-ratio	33.201	27.596	3.105	1.169
Wu-HausmannP-value	0.000	0.000	0.078	0.280
Bound F-ratio	35.341	35.341	47.674	47.674

* Myopia implies a discount factor of zero, and the restriction on past and current prices is given as follows: current price = -[1/(1-depreciation rate)]*past price. Asymptotic t-ratios in parentheses. All equations include an intercept, real income and a set of dichotomous year dummy variables for every year except one.

**Indicates an endogenous variable.

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