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Essays on the Aggregate Burden of Alcohol Abuse

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THE AGGREGATE BURDEN OF ALCOHOL ABUSE

BY

RESUL CESUR

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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Table of Contents

Page

ABSTRACT

ESSAYS ON THE AGGREGATE BURDEN OF ALCOHOL ABUSE

BY

RESUL CESUR

AUGUST 2009

Committee Chair: Dr. Inas Rashad

Major Department: Economics

This dissertation attempts to uncover the causal relationship between alcohol abuse and both income growth and crime. These two research questions are investigated in three essays: Essay I investigates the relationship between alcohol abuse and income growth in the United States; Essay II examines the impact of alcohol abuse on income growth at the international level; Essay III investigates the effect of alcohol abuse on crime in the united states.

Essay I of this dissertation uses state level data from the United States for the period 1970-1998 to estimate the impact of alcohol abuse on income growth by utilizing per capita beer consumption as the measure of alcohol abuse. Results suggest that, even though generally small, there is a negative relationship between alcohol abuse and income growth once the endogeneity between income growth and per capita beer consumption is addressed by utilizing levels of excise alcohol taxes and the Minimum Drinking Age Law of 21 as instruments. These results indirectly favor the previous research on two dimensions: First, alcohol abuse generates a significant burden on the economy; Second, increases in excise alcohol taxes would be efficient in terms of income growth.

Essay II of this dissertation uses data from 72 countries for the period 1960-1995 to estimate the impact of alcohol abuse on income growth by utilizing per capita beer, wine, liquor, and total ethanol consumption as the measures of alcohol abuse. Results suggest that, even though generally small, there is a negative significant relationship between per capita beer consumption and income growth once the endogeneity between income growth and per capita beer consumption is addressed with system GMM dynamic panel estimators. These results show that per capita beer consumption is the medium of alcohol abuse not only in the United States, but also around the world. Moreover, these results favor the previous research on the fact that alcohol abuse generates a significant burden on economies.

Essay III of this dissertation uses state level data from the United States for the period 1982-2000 to investigate the relationship between crime and alcohol abuse by utilizing per capita beer consumption as the measure of alcohol abuse. Potential endogeneity between per capita beer consumption and crime is addressed by using excise beer taxes and alcohol control measures as instruments. Results show that alcohol abuse seems to have a positive impact overall on the crime rate. Nevertheless, the effect is not uniform among different crime types. In the case of property crime types, results suggest that alcohol abuse plays a more important role in crime types that require a lesser degree of organization and more spontaneity (i.e., larceny theft versus burglary and motor vehicle theft). In the case of violent crime types, results suggest that the impact of alcohol abuse is more pressing in non-murder crime types versus murder. These results have policy implications: excise alcohol taxes and alcohol control policies may play a role in reducing certain crime types, which are larceny theft, rape, robbery, and aggravated assault, but not the other crime types, which are burglary, motor vehicle theft, and murder.

Chapter I: Introduction

Phillip J. Cook's recent book, "Paying the Tab: The Costs and Benefits of Alcohol Control (2007)," starts its foreword as follows:

"What drug provides Americans with the greatest pleasure and the greatest pain? The answer, hands down, is alcohol. The pain comes not only from drunk driving and lost lives but also addiction, family strife, crime, violence, poor health, and squandered human potential. Young and old, drinkers and abstainers alike, all are affected. Every American is paying for alcohol abuse."

Likewise, the World Health Organization (WHO) reports from various years document that both alcohol abuse and the costs associated with alcohol abuse are common around the world, and affect well being of societies through various channels.

Hence, given the fact that alcohol abuse imposes economic and social burdens on societies both in the United States and all around the globe, this dissertation attempts to uncover the impact of alcohol abuse at the aggregate level in a general equilibrium framework in two dimensions. First, this dissertation investigates the potential relationship between economic well being and alcohol abuse in terms of income growth both in the United States and around the globe. Second, this dissertation investigates the potential relationship between alcohol abuse and crime in the United States.

Research Question

Before proceeding with the research question at stake, I want to introduce a definition for *alcohol abuse*, which I borrowed from the Centers for Disease Control and Prevention (CDC). The CDC defines *alcohol abuse* as follows:

"A person can abuse alcohol without actually being an alcoholic--that is, he or she may drink too much and too often but still not be dependent on alcohol. Some of the problems linked to alcohol abuse include not being able to meet work, school, or family responsibilities; drunk-driving arrests and car crashes; and drinking-related medical conditions. Under some circumstances, even social or moderate drinking is dangerous--for example, when driving, during pregnancy, or when taking certain medications."

There is no predetermined volume of alcohol consumption, on a single occasion, that leads to alcohol abuse or intoxication. It changes from person to person. Furthermore, not all alcohol abuse leads to adverse economic outcomes. For instance, a person may get intoxicated due to excessive alcohol consumption in the evening, and wake up the next day a sober individual and move on with his life without being affected by the incidence of intoxication the night before. For the purposes of this dissertation, this particular example does not qualify for being an example of alcohol abuse. In order for an excessive drinking incidence to be qualified as an example of *alcohol abuse* for the purposes of this dissertation, it should lead to an outcome which generates an economic burden.[1] Some examples of relevant incidences of *alcohol abuse* for the purposes of this dissertation are: an excessive alcohol consumption induced workplace accident affecting productivity, alcohol intoxication related missing workdays, and alcohol intoxication induced crime incidents.

[1] For the purposes of simplicity, the term *economic burden* also includes a criminal incidence.

Given that the relevant definition of alcohol abuse is provided, this dissertation attempts to answer the following three specific research questions in three different essays:

(1) How does alcohol abuse affect income growth in the United States?

(2) How does alcohol abuse affect income growth at the international level?

(3) How does alcohol abuse affect crime in the United States?

One of the determinants of the extent of an empirical research project is the availability of data. As it will be further discussed, availability of panel data is one of the major determinants of the extent of this dissertation in particular. Panel data are available for state level crime in the U.S. in addition state level income growth in the U.S. and country level income growth data internationally. Therefore, this dissertation attempts to answer two different research questions by using three available data sets.

Contribution of the Dissertation to the Literature

Major contributions of this dissertation to the literature are in at least three dimensions: (1) This dissertation documents the negative relationship between alcohol abuse and income growth; (2) This dissertation documents the positive relationship between alcohol abuse and crime; (3) This dissertation provides indirect evidence on the effectiveness of excise alcohol taxes and alcohol control policies.

Identification of Alcohol Abuse

The key factor to the validity of this dissertation and meaningfulness of the estimated empirical results is the identification of alcohol abuse. Ideally, availability of a perfect measure of “per capita alcohol abuse” would empower a researcher in investigating the causal relationship between alcohol abuse and a variety of outcomes including aggregate income growth and crime. The percentage of people who drink excessively or a measure of per capita excessive drinking rate (or frequency) would be examples of (close to) ideal measures of *alcohol abuse*. However, such measures are not available for long enough time periods to conduct aggregate level analysis in addition to suffering from serious degrees of measurement error bias.[2] Even though an ideal measure is not available, a vast literature suggests a *second best* measure of alcohol abuse at the aggregate level. As is discussed in depth in the first essay of this dissertation, changes in per capita alcohol consumption in general and changes in per capita beer consumption in particular are the best available measures of changes in alcohol abuse for conducting aggregate level analysis for the purposes of this dissertation.[3] Per capita beer consumption is used as the measure of alcohol abuse for the United States since evidence based on various disciplines supports the view that per capita beer consumption is the best available aggregate measure of alcohol abuse in the United States. Since there is no uniform evidence with respect to a particular measure of per capita alcoholic drink's representativeness of alcohol abuse, not only per capita beer consumption, but also per capita wine consumption, per capita liquor consumption, and per capita ethanol consumption are used as measures of alcohol abuse in Essay II of this dissertation. Nevertheless, evidence from the Essay II of this dissertation suggests that per capita beer consumption is the most appropriate aggregate measure of alcohol abuse not only in the United States, but around the globe.

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[2] A more thorough explanation with respect to the availability of such measures is presented in the first essay of the dissertation.

[3] A vast literature with respect to the credibility of per capita alcohol consumption as a proxy of alcohol abuse is presented in the second chapter.

The power of the representativeness of per capita beer consumption relies on three factors: (1) Availability of panel data. Without having panel data, representativeness of per capita beer consumption as a measure of alcohol abuse would be very limited since the necessary variation to conduct such an analysis comes from the changes in per capita beer consumption over time; (2) Prevalence of alcohol consumption in the population is relatively stable in short periods of time. Therefore changes in per capita beer consumption can represent changes in the alcohol consumption intensity of drinking population; (3) Pareto Law of Consumption. According to the Pareto law of consumption, 20 percent of the consumers consume a good 80 percent of total consumption of a product. Indeed, alcohol consumption complies with the Pareto law of consumption very well (i.e., it follows a log normal distribution) (Cook, 2007). As a result, any given level of increase in per capita beer consumption results in a higher increase in consumption of heavy drinkers. This fact suggests that changes in per capita beer consumption reflect the changes in alcohol abuse well.

Essays

This dissertation is composed of three essays which conduct empirical analysis. Essay I examines the effect of alcohol abuse on income growth in the United States by using state level data. Essay II examines the effect of alcohol abuse on income growth by employing international data. Essay III investigates the impact of alcohol abuse on crime rates in the United States by employing state level data.

The next chapter of the dissertation continues with Essay I: "The Aggregate Spillover Effects of Alcohol: The Impact of Alcohol Abuse on State Level Income Growth." Chapter III presents Essay II: "Alcohol Abuse and Income Growth: A Cross Country Investigation." Chapter IV presents Essay III: "Alcohol Abuse and Crime: A State Level Investigation."

Chapter 2: Essay I

The Aggregate Spillover Effects of Alcohol: The Impact of Alcohol Abuse on State Level Income Growth

I. Introduction

Alcohol abuse not only affects an individual's long term health outcomes, but also his immediate behavior. Alcohol abuse in particular has severe socioeconomic consequences: lost productivity, disability, early death, crime, neglect of family responsibilities, personality deterioration, and other problems.[4] Therefore, not surprisingly, alcohol is the most extensively researched commodity of all kinds.[5]

Even though the effects of alcohol consumption and abuse have been examined at the individual level in different fields, including medicine, economics, public health, criminology, and sociology, not much has been done on the aggregate level regarding the economic impact of alcohol consumption.

On the one hand, researchers who have done extensive research on the impact of alcohol consumption and abuse on various outcomes, such as public health, economics, and crime, claim that the overall costs outweigh the benefits. As Cook and Moore (2002) state, "The production and sale of alcoholic beverages account for a small share of national product in the United States and in other advanced economies. However, the deleterious effects of alcohol consumption on health and safety constitute a substantial economic burden, reducing our overall standard of living." In addition, Irving Fisher (1926), who was one of the biggest proponents of Prohibition, made an early effort to assess the impact of drinking on overall productivity. Based on an

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[4] Evidence and related literature will be presented in the remaining parts of this paper.

[5] A simple (scholar.google.com) search for the word 'alcohol' gives almost 5.5 million results while the same search for 'sugar', whose effects are extensively examined in medical field and other fields, gives 2.25 million results in comparison. Similar searches for commodities such as corn, beef, meat gives fewer results than that of alcohol.

experiment with respect to the impact of drinking on productivity, he predicted that prohibition would lead to a 5% increase in national productivity.[6]

On the other hand, Beer Serves America, which is sponsored by the Beer Institute and National Beer Wholesalers Association (NBWA), representing America's leading brewers and beer distributors, claims that the beer industry contributes to the U.S. economy through wages and taxes. In addition, they claim that the beer industry contributes to economic growth through the expansions of the industry.

This paper attempts to contribute to economic literature by doing the following: First, uncovering the effects of excessive alcohol consumption, which are alcohol abuse, alcohol intoxication, and alcohol dependence, on state level per capita personal income growth. Second, testing the validity of the NBWA's claim of beer industry's contribution to U.S. economic growth. Third, providing an explanation for how the increases in alcohol excise taxes, which is supported by a large number of scholars, would affect the overall economy in a general equilibrium framework.

Even though there are a few studies examining the impact of macroeconomic conditions on drinking prevalence and patterns, such as those by Ruhm and Black (2002) and Ruhm (1995), there is no established literature on the research question this study is trying to address.

The following methodology is undertaken to uncover the effect of alcohol abuse on state level per capita personal income growth. First, the author refers to a broad spectrum of literature, examining the effects of alcohol consumption and abuse on a variety of outcomes, to identify the channels through which alcohol abuse can affect economic productivity (i.e., the impact of excess drinking on various productivity outcomes at the micro level). Second, by

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[6] In the experiment, two or four typesetters were given drinks for four days, while the other two were used as a control group. They found that drinking three beers a day reduced typesetting output by about 10 percent.

consulting the literature with respect to alcohol consumption and abuse in various fields (i.e., public health, crime, economics, and other related fields), the author tries to identify a measure of alcohol abuse at the aggregate level. Third, once the per capita beer consumption is identified as the most plausible measure of alcohol abuse at the aggregate level in the United States, the author tries to address the potential endogeneity between per capita personal income growth and per capita beer consumption by utilizing state level excise alcohol taxes. Fourth, potential shortcomings of the mentioned methodology and the likely bias stemming from them are discussed. Finally, the author estimates a reduced form model of per capita personal income growth on per capita beer consumption (which is the measure of alcohol abuse) to unearth the aggregate effect of alcohol abuse on income growth.

By utilizing the state level per capita beer consumption as a measure of alcohol abuse, even though generally small, this study finds a negative statistically significant relationship between per capita beer consumption and income growth once the endogeneity between income growth and per capita beer consumption is controlled for using excise alcohol taxes. These results favor the view that an increase in excise alcohol taxes, which is suggested by many scholars, would not be inefficient in terms of per capita personal income growth.

The paper proceeds as follows. The next section reviews a broad range of literature to discuss the various channels through which alcohol abuse and consumption may affect worker productivity, and national savings, which eventually can have an impact on economic growth. Section 3 lays out the theoretical framework based on the evidence provided in Section 2. Section 4 reviews the relevant literature to identify an aggregate level measure of alcohol abuse. Section 5 discusses the empirical methodology and how I deal with the endogenous nature of per capita beer consumption, which is identified as the best measure of alcohol abuse in the previous section, to income growth. Section 7 presents the results. Section 8 discusses policy implications of the results.

II. Micro Channels

Alcohol abuse is defined as follows by Centers for Disease Control and Prevention (CDC):

"A person can abuse alcohol without actually being an alcoholic--that is, he or she may drink too much and too often but still not be dependent on alcohol. Some of the problems linked to alcohol abuse include not being able to meet work, school, or family responsibilities; drunk-driving arrests and car crashes; and drinking-related medical conditions. Under some circumstances, even social or moderate drinking is dangerous--for example, when driving, during pregnancy, or when taking certain medications."[7]

Therefore, for the purposes of this study, any alcohol consumption leading to outcomes that have negative economic consequences is considered as alcohol abuse for the purposes of this paper.

It is well documented in the economics literature that labor productivity, changes in population, human capital accumulation, and physical capital accumulation are among the determinants of economic growth.[8] Therefore, alcohol abuse can effect economic growth through its effect on the determinants of economic growth listed above. Therefore, this section reviews an extensive literature to identify the channels through which alcohol abuse can affect labor productivity and national savings.

In order for a factor to have an impact at the macroeconomic level, it should be based on a microeconomic level relationship. Such relationships are best identified through micro level studies. For example, since education (on average) improves worker productivity, it is an interesting research question to examine the impact of education on income growth at the

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[7] Retrieved May 20, 2009 from http://www.niaaa.nih.gov/FAQs/General-English/.

[8] A host of other factors can be listed as the determinants of economic growth. For the sake of providing a clear argument, I restrict the discussion to the factors which are relevant to my argument.

aggregate level. Likewise, in order to claim a relationship between alcohol abuse and economic growth, one needs to show the effect of alcohol abuse on various growth related microeconomic outcomes so that a possible relationship between the two at the aggregate level can be attributed to a theoretical foundation. The nature of the phenomenon does not always allow micro level studies to be conducted. For instance, one of the best ways to identify the impact of alcohol abuse on labor productivity is to conduct controlled experiments by choosing a random group of workers and dictating them to consume excessive amounts of alcohol so that analyzing their outcomes would allow us to establish a theoretical relationship between alcohol abuse and economic growth through worker productivity. When the subjects are human beings, ethical concerns do not allow one to undertake such experiments. Hence, not all the evidence presented here is based on micro level studies. Therefore, when it is relevant, studies using aggregate data sets are used as a reference.

Alcohol abuse may affect economic growth through various channels. Some of them are classified as follows: lost workdays and lost productivity at work, morbidity, mortality, and the impact through reductions in national savings (or financial externalities).[9] I will continue with the discussion of how each of these factors can affect microeconomic channels of economic growth.

II.I. Lost Workdays and Labor Productivity at Work

It is trivial that, given the number of workers a country has, increases in hours worked has a positive impact on production. A lost workday should likewise have a negative impact on production. In other words, a lost workday is a direct shock to the labor supply of a worker. Alcohol abuse related lost workdays can be resulted from sickness absence, driving under the

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[9] The nature of this analysis requires one to discuss the overlapping effects of different factors. Hence, in order to avoid being repetitive, not all the aspects of underlying factors are discussed under each heading.

influence (DUI) arrests, alcohol related injury work leaves, being involved in alcohol abuse induced criminal activity, and of course the alcohol dependence related withdrawals from the labor force.

Lost Workdays

Absence at work has a direct impact on the supply of labor and hence on overall economic productivity. It makes sense that alcohol abuse may lead to sickness absence at work since it has an immediate impact on various health related outcomes. Several studies have found a positive relationship between alcohol use and reduced workplace performance measured through absenteeism, poor relations with co-workers, and accidents. Johansson et al. (2009), using regional level panel data from Finland for the period of 1993-2005, find that per capita alcohol consumption is positively associated with sickness absence, particularly for men. By using aggregate time series data from Sweden for the period of 1935-2002, Norström (2006) argues that a one liter increase in per-capita alcohol consumption[10] results in a 13% increase in sickness absence among men while the relationship is not statistically significant for women. French and Zarkin (1995), who use data on 1000 workers from four different worksites, find that both overall drinking and frequency of abuse are positively related to absenteeism. Their findings on the relationship between alcohol use and absenteeism are parallel to the findings of some other studies (Rosenbaum et al., 1992; Lehman and Simpson, 1992).

Driving under the influence of alcohol or other drugs is the act of operating a motor vehicle after having consumed alcohol to the degree that mental and motor skills are impaired. It is a crime which is subject to arrest in all states in the U.S. Although DUI laws encompass other

[10] The relationship between per capita alcohol consumption and alcohol abuse is well documented. In order to avoid being repetitive I defer the discussion on the relationship between per capita alcohol consumption measures and alcohol abuse to Section 4.

types of substance abuse, excess alcohol consumption is the major cause behind DUI arrests. It is trivial that alcohol abuse is the major cause of DUI arrests, and the expected impact of alcohol related DUI arrest on lost workdays is positive.[11]

The expected impact of alcohol abuse related absence on lost workdays is positive. Therefore, alcohol related absence is expected to have a negative impact on per capita personal income growth.

Lost Productivity at Work

Alcohol abuse hinders productivity at work. Even though we lack the experimental evidence on the direct effect of alcoholism and alcohol abuse on labor productivity, various survey based studies point to the fact that overindulgence in alcohol impedes productivity at work. Studies reviewing the literature show that in general problem drinking causes a decline in earnings which can be as high as 20% (Harwood et al., 1984; Rice et al., 1990). Kenkel and Wang (1998) compare the job attributes of alcoholic and non-alcoholic men by using data from the National Longitudinal Survey of Youth (NLSY). Their results show that without controlling for occupational status, alcoholics are estimated to earn 9.8% less than non-alcoholics do. Nevertheless, when non-wage components of workers compensation, fringe benefits, are considered, the estimated loss of an alcoholic is about 20% in terms of fringe benefits. Additionally, they find that alcoholics are less likely to be in white-collar jobs and conditional on being in a blue-collar occupation, alcoholics earn 15% less than their non-alcoholic colleagues. Apparently, possibility of reverse causality, potential worker frustration leading to excessive alcohol intake, should be taken into consideration when evaluating this kind of literature.

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[11] One can mistakenly claim that repealing DUI arrest laws would have a positive impact on lost workdays and hence positively affect economic growth. This would be a very naïve approach since abandoning DUI arrest laws would provide incentives to drive while intoxicated and hence cause an increase in car accidents, which would create other costs and negative externalities in an economy.

Blum et al. (1993) examine the relationship between alcohol use and job performance measures for a sample of 136 employed men, including both self-reports and reports of workplace collaterals. They conclude that heavy drinkers were seen by others as having lower technical achievement, lower self-direction, weaker interpersonal relations, and lower degrees of conflict avoidance.

There are also surveys asking the respondents whether they suffered from the negative consequences of drinking. According to Hilton and Clark (1987), 2.9 % of men in the U.S. stated that drinking harmed their employment opportunities while 0.8% stated that they had either lost or nearly lost a job as a result of their drinking. Such percentages for women, on the other hand, were about half of that for men.

Despite the fact that heavy drinking lowers productivity at work, the studies examining the impact of moderate drinking on wages find a positive relationship between the two. In other words, moderate drinkers on average make more than abstainers and heavy drinkers.[12]

Berger and Leigh (1988) were the first to identify the positive association between alcohol consumption and wages. They find that the premium for male drinkers is 10% while it is 35% percent for the female drinkers. Bray (2005) examines the effect of alcohol consumption on wage determination. Although generally insignificant, his results suggest that moderate alcohol use while in school or working has a positive effect on the returns to education or experience and hence to human capital accumulation. Therefore he concludes that alcohol use does not appear to adversely affect returns to education or work experience and therefore has no negative effect on the efficiency of education or experience in forming human capital. Hamilton and Hamilton

[12] Even though alcohol abuse is at the center of this study, as will be discussed in Section 4, because per capita beer consumption is the best available measure of alcohol consumption at the aggregate level, potential positive effects of moderate alcohol consumption should be discussed since it is possible that per capita beer consumption is likely to be correlated with moderate alcohol consumption as well.

(1997) show that moderate alcohol consumption leads to increased earnings relative to abstention. On the other hand, heavy drinking leads to reduced earnings. Moreover, heavy drinkers possess flatter age-earnings profiles and attain lower returns for higher education than non-drinkers and moderate drinkers. Tekin (2004) finds in a Russian sample that alcohol consumption has an inverse-U shaped impact on employment and wages for females and the impact on males appears to be positive but the inverse-U shape is less pronounced. However, once unobserved individual heterogeneity is accounted for using fixed effects, alcohol consumption is found to have no significant effect on either males or females. The fixed effect wage models indicate that alcohol consumption has a small, positive, but linear impact on the wage rate for both males and females. Likewise, French and Zarkin (1995) find an inverse-U shaped relationship between earnings and drinking. Using a set of instrumental variables, McDonald and Shields (2001) find positive and significant returns to moderate drinking for male and female employees which drop off rapidly as consumption increases.

However, the evidence is not conclusive for two reasons. First, the causal link between moderate drinking and productivity has not been successfully identified. Second, there are some studies claiming that the moderate drinker bonus is just a myth.

Peters (2004), using a panel of NLSY data, shows that the OLS estimate of wages on drinking produces biased results. When individual specific effects are controlled for, the coefficients are rendered statistically insignificant. Cook and Peters (2005) show that the drinker’s bonus is just a myth. They demonstrate some evidence of a positive association between alcohol prices, proxied by an index of excise taxes, and wages of full time workers. They find strong evidence that the prevalence of full time work increases with alcohol prices - suggesting that a reduction in drinking increases labor supply. They also demonstrate some positive association between alcohol prices and the earnings of a full-time worker, and conclude that the positive relationship between drinking and earnings is the result of the fact that alcohol is a normal good, for which consumption increases with income, rather than alcohol consumption enhancing productivity.

These findings cast strong doubts on the impact of moderate drinking on earnings. Furthermore, studies finding positive associations between moderate drinking and earnings do not make strong references to increased productivity as a result of alcohol intake. Instead, they stress the possibility that drinking facilitates social networking, which in turn generates improved job options based on the assumption that most people find jobs through word of mouth which is facilitated by the presence of a wide network of friends. Hence, alcohol consumption induced social networking may not affect aggregate productivity even though it may potentially affect a person's income. In addition, it is very likely that the causality would be in the opposite direction. People may increase their alcohol consumption in response to increases in their earnings. Indeed, there is a good deal of evidence supporting the view that alcohol is a normal commodity whose demand increases with income (Ruhm and Black, 2002; Ruhm, 1995; Cook and Tauchen, 1982).

The evidence on the impact of alcohol abuse on productivity suggests that alcohol abuse is likely to have a negative impact on productivity at the workplace. Studies analyzing moderate drinking, however, suggest that the impact of moderate drinking on productivity is ambiguous. Therefore, alcohol *abuse* related lost productivity at work would affect growth rates negatively. Taking the recent studies into consideration, it could be expected that the impact of moderate alcohol consumption gained productivity at work should be close to zero.

II.II. Morbidity and Mortality

The impact of alcohol consumption and abuse on injury and death is well documented. Studies in different disciplines confirm each other. Drinking is involved in about two thirds of all injury deaths, the victim or other involved party has been drinking enough to be intoxicated by the usual standard (Center for Disease Control and Prevention, 2004b; Smith, Branas, & Miller, 1999). According to Hingson and Winter (2003) in 41% of fatal crashes in 2002, there was a driver or a pedestrian who had at least one drink, and 35% involved a blood alcohol content (BAC)[13] greater than the legal limit of 0.08 percent. Drivers with alcohol in their blood are seven times more likely to cause a fatal crash; legally drunk drivers pose a risk 13 times greater than sober drivers (Levitt and Porter, 2001). Traynor (2005) shows that alcohol use on average increases crash severity. Low and moderate levels of drinking could stimulate car accidents as well. Even moderate amount of alcohol intake can increase the average response time to hazards (2.5 s in no alcohol condition compared with 3.2 s in moderate alcohol condition) (West et al., 1993).

Alcohol is one of leading causes of disease burden in the world. Murray and Lopez (1996) estimate alcohol to be responsible for 1.5% of all deaths and 3.5% of the total burden of disease in disability adjusted life years. Alcohol taxes have a negative effect on the spread of sexually transmitted diseases. By using state level data from the U.S., Chesson et al. (2000) find that a "$1 increase in the per-gallon liquor tax reduces gonorrhea rates by 2.1 percent, and a beer tax increase of $0.20 per six-pack reduces gonorrhea rates by 8.9 percent, with similar though

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[13] Blood alcohol content or blood alcohol concentration (abbreviated BAC) is the concentration of alcohol in a person's blood. BAC is most commonly used as a metric of intoxication for legal or medical purposes. It is usually measured in terms of mass per volume, but can also be measured in terms of mass per mass. Blood alcohol concentration is given in many different units and notations, but they are all relatively synonymous with each other numerically.

more pronounced effects on syphilis rates." Higher beer taxes are associated with lower rates of gonorrhea for males and are suggestive of lower AIDS rates (Markowitz et al., 2004).

Morbidity reduces the returns to human capital and lowers labor productivity. Furthermore, injuries cause an increase in lost workdays. Injury related spending shifts the funds from productive investments to injury treatment and related rebuilding costs. A car accident or a work related injury may require replacement costs for the equipment, such as repairing or replacement of the car or the machinery. Furthermore, a high prevalence of DUI alcohol abuse may force various levels of governments to undertake strict preventive efforts. For instance, a higher number of police officers and related equipment, such as police cars, computers, telecommunication devices, jail and prison space, may be needed. As a result, public funds have to be shifted from productive investments, such as additions to physical capital stock, to cover the costs originated from excess alcohol use. Therefore, I expect a negative impact of morbidity on per capita personal income growth through lost workdays and the reallocation of savings from productive uses to injury prevention and damage replacement spending.

Even though the majority of studies focus on the negative effects alcohol has on health outcomes, there are also studies which focus on the positive aspects of alcohol consumption. Hoffmeister et al. (1999) find that light (and possibly moderate) alcohol consumption reduces the risk of cardiovascular disease and total mortality risk and is favorably related to HDL-cholesterol. There are other studies verifying the beneficial effect of alcohol consumption on cardiovascular health (i.e. Gronbaek, 2001; Rehm, et al. 2003; Klatsky, 2002; Thun, et al. 1997).

Most macroeconomic studies examining the impact of health on economic growth makes their analysis through the impact of longevity. Acemoglu and Johnson (2007) use predicted mortality as an instrument to find the impact of life expectancy on economic growth. They find that a one percent increase in life expectancy leads to a 1.7-2 percent increase in population and a small positive effect of life expectancy on total GDP over the first 40 years, which somewhat grows over the next 20 years, but not enough to compensate for the increase in population. Overall, the increases in life expectancy (and the associated increases in population) appear to have reduced income per capita (Acemoglu and Johnson, 2007). On the other hand, some studies find a positive impact of mortality decline on economic growth. Kalemli-Ozcan, Ryder, and Weil (2000) and Kalemli Ozcan (2002) find a positive impact of increases in life expectancy to economic growth in the long run since longevity increases the investment in human capital through education, while fertility decreases as a response to longevity increases. Thus, in the long run life expectancy has a positive impact on economic growth. A more recent study by Ashraf et al. (2008) finds that the impact of positive health shocks on income growth depends on which part of population is most affected by the disease. For example, in the short run, eradicating tuberculosis raises income per capita whereas eradicating malaria lowers it. The different effects on income of eradicating these diseases arise largely because tuberculosis strikes mostly prime-aged workers, while malaria affects mainly young children (Ashraf et al., 2008).

When it comes to evaluating the impact of mortality on economic growth, one should be very careful to distinguish between how it affects economic growth through two different channels which can oppose each other. A person’s death decreases population which has a positive impact on per capita personal income whereas loss of his productivity has a negative impact on per capita personal income. The aggregate impact depends on the magnitude of these opposing factors. Death of a prime aged worker and baby do not have the same impact on per capita income growth.[14] A prime aged worker has a much higher marginal productivity in comparison to a baby, which simply has zero productivity. Hence, while both deaths would have a positive effect on per capita personal income through a decrease in population, the expected effect through productivity would differ for the two–that is, the impact of the prime aged person would be negative while it would be positive for the baby.

Based on the discussion above, the impact of alcohol related death on per capita personal income is ambiguous. Abuse leads to death mostly through accidents while moderate drinking enhances cardiovascular health and longevity. Hence, the immediate impact of these two factors on mortality should have balancing effects on per capita income growth, though the magnitudes are not clear. Since the relevance of both alcohol consumption and abuse and related death is particularly among the prime aged population, the aggregate impact on economic growth would be either zero or negative assuming that the impact of alcohol related mortality on per capita income is somewhat balanced by enhanced longevity.

II.III. Reductions in National Savings

Alcohol abuse affects national savings through various channels. Even though it is possible that a person can shift his personal funds from savings to consumption, the reduction in savings discussed here are not necessarily focused on the changes in individual savings behavior. Alcohol consumption and abuse related accidents, injuries, and health outcomes cause the funds to shift from savings to restoration spending. Various studies in different countries find that alcohol abuse is costly to societies.

[14] The morality of this argument can be questioned. However, the nature of our analysis forces us to discuss every aspect of subject matter. Gruber (2005) and others have discussed the possible welfare benefits that can arise due to early deaths through lowering Social Security and Medicare payments.

According to U.S. Department of Health and Human Services 2000 report, the economic cost of alcohol abuse in the U.S. for 1992 is about $148 billion. This report makes its calculations based on medical expenses, lost present and future earnings due to alcohol related illness, death and crime, and costs of crashes, fires, and criminal justice expenses. Alcohol-related hospital charges in 1998 in New Mexico, U.S., were US$51 million in comparison to US$35 million collected as alcohol taxes, clearly showing that communities spend more money on taking care of alcohol problems than they earn from alcohol. In Canada, the economic costs of alcohol amount to approximately US$18.4 billion, representing 2.7 percent of the gross domestic product. Studies in other countries have estimated the cost of alcohol-related problems to be around one percent of the gross domestic product (Collins and Lapsely, 1996; Rice et al., 1990). Alcohol related externalities also impose large costs to the economies in the European Union. Total tangible costs of alcohol were estimated to be €125 billion in the EU in 2003. These costs are those associated with the criminal justice system, health care, and lost workdays. This amount equals to 1.3 percent of GDP of EU and total of excise alcohol taxes are only one fourth of it. They estimate intangible costs more than twice the tangible costs. Barker (2002) finds that in New Zealand in 1999 alcohol excise taxes only account for the half of alcohol related direct costs. Weisner (2001), using data from heterogeneous California county with a population of 900,000, finds that those who report ‘problem drinking’ have the following statistical characteristics: 41 percent were seen by the criminal justice system, 8.0 percent by the social welfare system, 42.1 percent by the general health system, which are primary health clinics and emergency rooms, 3.1 percent by the public mental health system, and 5.9 percent by public alcohol or drug treatment agencies.

For the reasons mentioned, various studies advocate that increases in alcohol excise taxes would produce favorable outcomes, particularly through reducing the negative externalities associated with alcohol consumption. Manning et al. (1989) show that alcohol excise taxes cover only about half the costs imposed to others. According to a discussion paper by Parry et al. (2006), the optimal excise taxes in the U.S. should be three to ten times more than the current levels.

These studies do not directly measure the impact of alcohol consumption and abuse on national savings rates. However, their findings strongly hint that alcohol abuse shifts funds from savings to the funding of the costs generated by alcohol-related outcomes. Hence, I expect that increases in alcohol abuse have a negative impact on national savings rates. Reduced savings rates affect economic growth negatively through investment and physical capital accumulation.

III. Theoretical Framework

In Section 2 the evidence for how alcohol abuse can affect the microeconomic growth factors was presented. Based on the discussion in Section 2 the following summary could be made with respect to the impact of alcohol abuse and consumption on income growth:

(i) Alcohol related lost workdays: expected impact on economic growth is negative.

(ii) Alcohol related lost productivity at work: expected impact on economic growth is negative.

(iii) Alcohol related productivity gain at work: expected impact is either zero or positive (i.e., the evidence is not conclusive).[15]

(iv) Alcohol related morbidity: expected impact on economic growth is negative.

(v) Alcohol related mortality: expected impact on economic growth is ambiguous.

[15] Apparently, alcohol consumption related productivity gains are not based on alcohol abuse. Even though the effect of alcohol abuse on income growth is in the center of this paper, because utilized measure of alcohol abuse (per capita beer consumption) can also be related to moderate alcohol consumption, potential positive effects of moderate alcohol consumption is also taken into consideration.

(vi) Alcohol related reductions in National Savings: expected impact on economic growth is negative.

Therefore, the theoretical relationship this dissertation trying to investigate can be summarized as follows:

$$alcohol\ abuse\left(and\ consumption\right) \Rightarrow microeconomic\ growth\ channels \Rightarrow income\ growth$$

Based on the literature discussed above, the expected impact of alcohol abuse on income growth is therefore negative. The next section continues with quantification of alcohol abuse.

IV. Identifying Alcohol Abuse at the Aggregate Level

Evidence from individual level studies from a variety of different disciplines supports the view that alcohol abuse and only hinders the productivity of a worker but also shifts the funds from productive uses—that is, investments to increase physical capital stock and improve technology—to unproductive uses as discussed above. Therefore, it is reasonable to expect that alcohol abuse affects per capita personal income growth negatively. The challenge of this study is to quantify alcohol abuse in an appropriate manner in order to be able to estimate its impact on aggregate outcomes. Thus, in order to proceed with the empirical analysis I need to have a proper measure to identify alcohol abuse at the aggregate level.

In an ideal world, complete information about the level of alcohol abuse of each individual in a society would help in quantifying the excess alcohol use at the macroeconomic level. Survey data on alcohol abuse can be one of the ways to quantify such measures. Indeed, prevalence of alcohol abuse in the whole population would be a good measure. Since it is very common to use per capita measures in growth estimations, a measure of per capita alcohol abuse would be an ideal fit. However, survey based data on alcohol consumption is particularly problematic regarding the measures of alcohol abuse, since the quality of the data is limited by the respondent's willingness and ability to report just much they drink (Cook 2007). A great deal of stigma exists in revealing alcohol abuse in surveys. Hence, survey data with respect to alcohol abuse is like to suffer from a serious measurement error. Midanik (1982) shows that when tax data on sales are used as the standard, the survey-based estimates of national consumption only capture 40% to 60% of actual consumption in the 1970s. This phenomenon persists in recent surveys as well. The National Epidemiological Survey on Alcohol and Related Conditions (NESARC), which is conducted by National Institute on Alcohol Abuse and Alcoholism (NIAAA) for period 2001-2002, confirms the results of Midalnik (1982). Per capita self-reported ethanol consumption in the last twelve months for people 18 years and older averaged 141.3 ounces. According to NIAAA reports, per-capita alcohol sales in 2000 were 277.6 ounces consumed by people who are age fifteen and older. The disparity between the two measures is great. Based on these reports the underreporting is almost about 50 percent.[16] Besides, self-reported survey data on alcohol abuse is not available at the state level in a longitudinal form for a long period of time. Even if the survey based alcohol abuse data were available, estimations based on such data should have been interpreted with caution for the reasons discussed above.

Since we do not live in an ideal world (for data purposes), other forms of data which could be suitable for this analysis is considered. Indeed, sales based apparent per-capita alcohol consumption data are the most reliable data that reflect excess alcohol use. Per capita tax-paid sales provide fairly accurate trends and interstate patterns in per capita ethanol consumption (Cook, 2007). Different studies conducted in different times and locations confirm the

[16] The claim that the age group between fifteen and seventeen years of age is responsible for the disparity between the two measures is obviously not a valid one as it is unlikely that the mentioned age group can be responsible for such a big disparity between self reported data and per-capita alcohol sales.

relationship between per capita alcohol consumption measures and drinking patterns. Alcohol consumption among different groups does not follow a uniform distribution - that is, consumption among individuals differs tremendously.

A well-known rule of thumb in marketing science, known as the Pareto Law or the Law of Heavy Half or the 80-20 Rule, is that the top 20 percent of buyers for most any consumer product account for fully 80 percent of the sales. Alcoholic beverages are no exception. The heaviest drinkers account for the bulk of ethanol consumption. The distribution is highly skewed to the right, with the median less than the mean; in other words, most drinkers consume less than the per capita average (Cook, 2007). Hence, a log-normal distribution provides a fairly good fit for the distribution of alcohol consumption among drinkers. According to Edwards et al. (1994), the consumption associated with each quintile tends to change in the same direction with per-capita alcohol by drinkers; thus, the prevalence of heavy drinking changes faster than the prevalence of per-capita alcohol consumption does (Skog, 1985; Bruun. et al., 1975). Thus, if one group has twice the average consumption of another, it would be expected to have four times the prevalence of heavy drinking. And the 20 percent decline in average consumption in the United States in the 1980s and 1990s implies a 36 percent decline in the prevalence of heavy drinking (Cook 2007). Based on NESARC data, Cook (2007) presents that for both men and women, and for each age group, the likelihoods of drinking and of bingeing increase with state per capita consumption, as does the amount drinkers choose to drink. Hence, per capita alcohol consumption is the best available measure of alcohol abuse at the aggregate level.

Furthermore, in different parts of the world different beverage types are used as a means to alcohol abuse. Greenfield and Rogers (1999), find that it is not hard liquor but beer which is consumed most by heaviest drinkers. And hazardous beer consumption is more predictive of alcohol-related problems than hazardous consumption of wine or spirits. Berger and Snortum (1985), by summarizing the related literature, show that beer is the drink preferred by most of the drinkers and those who prefer beer are more likely to drive while intoxicated than those who prefer wine or distilled spirits. They also conclude that beer is disproportionately preferred by higher risk groups, which are men versus women, youths versus the elderly and heavy drinkers versus moderate drinkers. Therefore, per capita beer consumption is in the center attention of this study.

There can still be some doubts on the ability of per capita beer consumption measures in representing excess alcohol use. Changes in the prevalence of beer consumption would cast doubts on the validity of it as a measure of alcohol abuse. If the change in per capita alcohol consumption results from the change in the prevalence of alcohol consumption in the population, the variation in per capita alcohol consumption measures may not reflect the changes in abuse. Since prevalence of alcohol consumption is not available for a long enough period at the state level, I will have to restrict my analysis to the use of beer capita beer consumption.[17] Consequently, this study utilizes per-capita beer consumption as a measure of alcohol abuse based on the evidence presented above.

Even though per capita beer consumption is the best available measure of alcohol, it imposes apparent limitations. Yearly changes in per capita beer consumption can only reflect the short term effects of alcohol abuse even though alcohol abuse has long term effects as well. For instance, schooling and human capital formation of children may be negatively affected by their

[17] The Behavioral Risk Factor Surveillance System (BRFSS) has information on the prevalence of alcohol consumption at the state level. BRFSS survey started in 1984 and continues since then. Nevertheless, the BRFSS survey only included 15 states in 1984 and a full participation of all the states did not happen until mid 1990s. Furthermore, the data are not available for every year even after all the states are included to the survey. Hence, such data do not provide a long enough panel to use in my analysis. Even though such data were available, problems with respect to self reported alcohol consumption would still exist.

parents' alcohol abuse. Long run income growth is definitely affected by schooling and human capital formation of children. Nevertheless, yearly changes in per capita beer consumption can only represent the short term effects of alcohol abuse. Even though this study does not ignore the potential negative long term effects of alcohol abuse, it definitely lacks the appropriate means to conduct an analysis to extract the long run effects of alcohol abuse.

V. Data

Data on yearly state-level per-capita alcohol consumption measures for the period 1970-1998 come from National Institute on Alcohol Abuse Alcoholism. Per capita beer consumption is calculated based on population 14 years and above. Per capita beer consumption reflects the per capita pure ethanol taken through the consumption of beer. Data on state level excise beer taxes are taken from the U.S. Brewers Association's Brewers' Almanac. Data on state level excise liquor and wine taxes are taken from the Distilled Spirits Council of the United States (DISCUS). Excise taxes are the sum of state and federal excise taxes. Population data are taken from the U.S. Census Bureau. State level per capita personal income data and Consumer Price Index (CPI) are taken from Bureau of Economic Analysis website. Per capita personal income growth rates calculated based on per capita personal income data after calculating the real per capita personal income by taking inflation into account. Data on state level economic growth and the control variables (state level average total tax rate, average total expenditure rate, and state aid from federal government in real per-capita terms) are taken from Tomjlanovich (2004) for the period 1970-1998.[18] Descriptive statistics for the data are provided in Table 2.1.

[18] The author is grateful to Mark Tomljanovic for very generously sharing his data from Tomljanovic (2004).

IV. Empirical Methodology

In order to deal with the potential endogeneity of right hand side variables, an instrumental variable (IV) approach is used in this paper in addition to a state fixed effects model. The following is the general model estimated:

$$Y_{s,t} = \alpha + \beta_1 X_{s,t} + \beta_2 Z_{s,t} + \eta_s + \tau_t + \varepsilon_{s,t}$$

where subscripts *s* and *t* refer to state and year, respectively. State fixed effects, year dummies, and an idiosyncratic error term are denoted by $\eta_s, \tau_t, and\, \varepsilon_{s,t}$, respectively. $Y_{s,t}$ is the yearly state level per capita personal income growth. *X* refers to variable of interest, state level natural log of per capita beer consumption. *Z* is the vector of control variables. Lagged per capita personal income controls for the impact of convergence on economic growth. Additionally, controlling for lagged per capita personal income takes into account the impact of income differences on alcohol consumption. Average total public expenditure to gross state product controls for the effect of size of government to per capita personal income growth. Average total expenditure rate controls for the impact of government size on economic activity. Average total tax rate controls for the impact of taxes on business activity. State aid from the federal government controls for the impact of state aid to state per capita personal income growth. Population captures various state specific trends such as between state migrations. Furthermore, controlling for population also helps to reveal the impact of alcohol abuse related mortality on income growth in comparison to not controlling for population. Percent of population older than 65 years old and percent of population younger than 17 both control for the changes in labor force and the impact of population change on alcohol demand. These population groups are both drinking less alcohol and supplying fewer labor hours. Hence, controlling for them takes care of both issues. Now, I will discuss the potential endogenous relationship between alcohol abuse (per capita beer consumption) and economic growth.

Potential Endogeneity of Per Capita Beer Consumption (Alcohol Abuse) to Income Growth

On the one hand, if people start excessive drinking as a reaction to job loss, during bad economic times, i.e., when economic growth slows down or becomes negative, OLS estimates would falsely find a negative relationship between economic growth and alcohol consumption and abuse. On the other hand, if people drink more since they have jobs and hence have a higher income, then OLS estimates would lead to a false positive relationship between economic growth and alcohol abuse. Moreover, if unobserved factors related to both economic growth and alcohol consumption exist, statistical endogeneity may be an issue. At the aggregate level, all of these factors may be a part of the picture.

Research stressing psychological responses to economic conditions predicts that alcohol use will rise during economic downturns as a tool for stress control medication (see, for example, Brenner and Mooney, 1983; Winton et al., 1986; Pierce et al., 1994). Even though per capita alcohol consumption would fall during an economic downturn because of an income effect, alcohol abuse would go up in contrast. This fact would cast doubts on OLS results since the decreases in per capita alcohol consumption can mask the alcohol abuse generated with the influence of an economic downturn. By using a monthly time series data for the period January 1955-December 1994, Freeman (2001), finds that overall beer sales are mostly immune to the business cycle. Using BRFSS data from 1984 to 1995, Dee (2001) finds that overall drinking and the probability of having 60 or more drinks falls during economic downturns; however, the probability of binge drinking, defined as drinking five or more drinks on a single occasion, increases. Thus, he concludes that the prevalence of binging is countercyclical.

Nevertheless, there are studies providing very credible counter evidence against this view. Studying the impact of job stress, research in psychology (Baker, 1985; Karasek & Theorell, 1990; Fenwick & Tausing, 1994; Sokejima & Kagamimori, 1998) implies that drinking may increase with the intensity of employment. Furthermore, other studies find that alcohol consumption is positively related to income (Skog, 1986; Sloan et al., 1995). Ettner (1997), using the 1988 National Health Interview Survey (NHIS), shows that non-employment significantly reduces both alcohol consumption and dependence symptoms with the exception of mixed evidence with respect to involuntary employment. She finds that job loss increases the consumption of alcohol in the overall sample but reduces dependence symptoms among individual drinkers. Ruhm and Black (2002), and Ruhm (1995) find that intake of hard liquor declines in bad economic times and this fact leads to a decrease in alcohol abuse as well. Thus, stress-induced drinking during depressed periods might be partially or fully offset by reductions due to decreased earnings (Ruhm & Black 2002). Using individual level data from the BRFSS for the period 1987-1999, they find that the decrease in per capita alcohol consumption measures in bad economic times are concentrated among heavy consumers while light drinking increases. These results suggest that any stress-induced increases in drinking during bad economic times are more than offset by declines resulting from changes in economic factors such as lower incomes (Ruhm & Black 2002).

Therefore, in order to deal with the possible endogenous nature of per capita beer consumption with income growth, I use an instrumental variable (IV) approach in addition to a state fixed effects specification. In IV specifications, levels of alcohol excise taxes[19] (i.e., beer, wine, and liquor excise taxes) are used as the instruments. Next, I follow with a discussion of whether excise taxes are suitable instruments for per capita alcohol consumption measures, and an overview before estimating the specifications, respectively.

Are Excise Alcohol Taxes Suitable Instruments?

Alcohol demand is determined by various factors including income, wetness of the environment, defined as how common and acceptable drinking is in a social surrounding, price of alcohol, related regulation, and other factors. In order for the levels of excise alcohol taxes to be suitable IVs for alcohol consumption, the following criteria need to be met: (1) excise taxes need to be strong predictors of alcohol abuse, and (2) excise taxes need to be legitimately excludable from the economic growth equation.

(1) Are excise taxes strong predictors of alcohol abuse?

Controlled experiments provide the best means to identify the causality between any two phenomena. Due to ethical concerns, controlled experiments are not possible to hold with human subjects. Therefore, Sarbaum et al. (1999) conducted an experiment with rats to test how drinkers, including heavy drinkers, respond to price changes. They confirm the law of demand, which states a negative relationship between prices and quantities consumed. They found that a 100 percent increase in ethanol prices reduces ethanol consumption by marginal amounts whereas a 400 percent increase in ethanol prices reduces consumption dramatically.

One of the concerns with respect to the validity of alcohol excise taxes arises from the fact that alcohol excise taxes make up only a small fraction of the price of alcohol. Using pooled cross sectional time series data on state and Federal alcohol taxes and beverage prices for the

[19] "Excise alcohol taxes" and "levels of excise alcohol taxes" are used interchangeably.

period 1982-1997, Young and Bielinska-Kwapisz (2002) find that alcohol taxes are poor measures of beverage prices. Hence, they state that studies using excise taxes as the measure of the price of alcohol should be regarded with caution. However, they also caution that there are a number of factors that cause measurement errors in beverage prices. Hence, Young and Bielinska-Kwapisz (2003) estimate alcohol demand by employing pooled data across U.S. states for the years 1982-1997. They find that price elasticity of demand for ranges from (-.53) to (-1.24). They also confirm that the 1991 increase in alcohol excise taxes reduces alcohol consumption between 2.5 and 6 percent. Cook and Moore (1994), by reviewing the literature on alcohol related outcomes, conclude that increasing beer taxes would both decrease various social costs of alcohol and increase government revenues. Hence, there is evidence in the literature confirming that excise taxes have a negative effect on alcohol demand as well as alcohol abuse. However, since the excise taxes comprise only a small fraction of alcohol price in the United States, they may not be strong predictors of a change in alcohol abuse even though they predict per capita beer sales. In other words, even though they can predict alcohol abuse to some degree, the excise alcohol taxes are weak instruments for predicting alcohol abuse. In conclusion, even though levels of alcohol excise taxes can predict alcohol abuse, their magnitude is questionable. In addition to excise alcohol taxes, I used minimum legal age drinking law (MLDA) of 21. Therefore, in the IV specifications per capita beer consumption is instrumented with excise beer, wine, and liquor taxes in addition to MLDA of 21.

(2) Are excise taxes exogenous to income growth?

Excise taxes need to be uncorrelated with the disturbance term in order for them to be valid instruments. Excise alcohol taxes are quite static over time. Once a level of excise taxes for alcohol is legislated, it takes eight to ten years before the new legislation. Because of inflation, the real value of levels of alcohol excise taxes diminishes over time and hence consumer price index (CPI) adjusted values of excise taxes are calculated. Using CPI adjusted values of excise alcohol taxes increases their power in predicting alcohol consumption and abuse. However, since inflation is known to affect economic growth, the validity of real excise alcohol taxes as instruments in growth equations is questionable. That is, if inflation is determining both economic growth and real excise alcohol taxes, the exclusion of inflation from the specification can raise doubts about the validity of excise taxes as instruments. Hence, in order to test whether CPI adjusted excise alcohol taxes are valid instruments for per capita beer consumption in estimating the impact of per capita beer consumption on per capita personal income growth, an over-identification test, which is Hansen J test, is employed in the IV specifications. Therefore, the validity of real excise alcohol taxes as valid instruments in growth estimations is tested. Indeed, Hansen J test results show that CPI adjusted excise alcohol taxes are weak instruments (i.e., Hansen J test p-values are very close to 0.10). Hence, since nominal values of excise alcohol taxes are theoretically exogenous to growth rates, all the specifications are also estimated by using nominal excise alcohol taxes.[20] Using nominal values of levels of excise alcohol taxes ensures that excise alcohol taxes are exogenous to income growth whereas the power of nominal excise alcohol taxes to predict alcohol consumption and abuse is lower. As expected, nominal values of excise alcohol taxes do not fail the over-identification test in addition being statistically significant determinants of per capita beer consumption. Thus, estimations which use nominal excise taxes as the instrumental variables are the preferred specification in IV estimates.

[20] One can argue that nominal legislation to change nominal excise alcohol are undertaken since the value of excise alcohol taxes shrinks over time due to inflation. This is a valid argument. However, it is safe to assume that the relationship between current inflation and the legislation with respect to nominal excise alcohol taxes is quite weak since such legislation is undertaken every eight to ten years.

Table 2.8 presents the first stage estimates of per capita beer consumption. The nominal excise beer tax elasticity of beer demand is -0.437 and it statistically significant at the one percent level. Furthermore, an F test shows that nominal excise beer, wine and liquor taxes are jointly significant predictors of beer demand.

Are there other suitable instruments?

As discussed above, survey data on a direct measure of alcohol abuse is neither reliable nor available for a long enough period of time for the purposes of this study. Some other potential instruments are either not strong enough to predict alcohol abuse on themselves or not suitable instruments just because they violate the exclusion restrictions (i.e., they are very likely to be correlated with economic growth). For instance, prevalence of dry counties in a state can successfully predict alcohol abuse, but I believe it is not a credible instrument in this context. Dry county laws have a direct impact on business activity since they automatically crowd out some businesses out of the county. For instance, people from dry counties go to other counties to have entertainment involving alcohol and thus not only alcohol abuse but also business activity diminishes in the country. Therefore it is not reasonable to claim that the complete effect of a dry county law is through alcohol abuse or consumption. Furthermore, employing a fixed effects methodology controls some of the affects generated by dry county laws anyway.

Overview before estimating the specifications

Both yearly and four-year averages are estimated for both per capita beer consumption and excise alcohol taxes specifications.[21] Even though four year averages control for the impact of business cycle on the estimates, their power to represent alcohol abuse is more questionable

[21] Average business cycle is four to five years. Hence, it is a common practice to have five year averages in growth equations. However, five year averages produce the same results with four year averages. Therefore, I prefer four year averages to five year averages since number of observations are higher with four year averages.

than yearly per capita beer consumption. Ruhm and Black (2002) confirm the preceding literature and state that "pro-cyclical variation in overall drinking largely result from changes in consumption by existing drinkers, rather than movements into or out of drinking." Therefore, their results imply that prevalence of drinkers does not significantly change in a yearly framework. Hence, we can assume the prevalence of drinking is quite steady in a yearly framework. However, the same assumption may not apply to a four year period since it is likely that prevalence of alcohol consumption may change in a four year period. One of the important questions to be answered before the estimations is whether the theoretical framework and the empirical methodology perfectly match each other (i.e., is per capita beer consumption is a perfect representative of alcohol abuse?). Even though per capita beer consumption is the best available measure of the alcohol abuse at the aggregate level according to the literature referred above, it is far from being a perfect measure of alcohol abuse. Because per capita beer consumption is not a perfect measure of alcohol abuse and it is likely to be correlated with moderate alcohol consumption to some degree, the estimates of this study should be interpreted with caution at least for two reasons: First, even though this study can provide insights on the direction of the impact of alcohol abuse at the aggregate level, the estimates probably lack precision (i.e., they may not represent true magnitude of the impact of abuse on income growth). Second, the estimates of this study should be interpreted as conservative estimates (i.e., a lower bound estimate of the impact of alcohol abuse on income growth).

VII. Results

Yearly Estimates

Table 2.2 presents the results for fixed effects estimates of income growth on per capita beer consumption for the yearly data. In column (1) the coefficient on log of per capita beer consumption is positive and statistically significant at five percent. If it were to represent the causal relationship between per capita beer consumption and income growth the following conclusion could be made: a 50 percent increase in per capita beer consumption will lead to about 0.9 percentage point increase in income growth. In column (2) the coefficient on log of per capita beer consumption is rendered insignificant once the effect of population controlled for. In column (3) percentage of population below 17 and percentage of population over 65 are controlled for. Controlling for the impact of percentage of population below 17 and above 65 does not have an impact on the coefficient for per capita beer consumption. The fact that controlling for population renders the coefficient on log of per capita beer consumption significant suggests that alcohol related mortality is obviously a significant phenomenon. It implies that alcohol related mortality puts an upward pressure on income growth.

Table 2.3 presents the instrumental variable estimates of the impact of per capita beer consumption on income growth when log of per capita beer consumption is instrumented with CPI adjusted excise alcohol taxes and MLDA of age 21. Once per capita beer consumption is instrumented with CPI adjusted excise alcohol taxes and MLDA of age 21, the coefficient on per capita beer consumption becomes negative, but the coefficient is not statistically significant at conventional levels. These estimates may not be reliable since the instruments fail the over-identification test (i.e., Hansen J. test p value is less than 0.05 in column (1) and (3), and it is less than 0.10 in column (3)).

Table 2.4 presents the instrumental variable estimates of the impact of log of per capita beer consumption on income growth when per capita beer consumption is instrumented with nominal excise alcohol taxes and MLDA of age 21. In column (1), the coefficient on log of per capita beer consumption is negative though it is not statistically significant at conventional levels. In column (2), once the log of population is controlled for, the coefficient on log of per capita beer consumption increase in magnitude and becomes statistically significant at the five percent level. In column (3), the magnitude of the coefficient on log of per capita beer consumption slightly decreases once the impact of percentage of population below age 17 and above age 65 are controlled for. The coefficient is statistically significant at the ten percent level. These estimates seem to be reliable since the instruments do not fail the over-identification test (i.e., in all cases Hansen J. test p value is well above 0.10). According to these results, a 20 percent increase in per capita beer consumption leads to a one percentage point decrease in economic growth. The magnitude of the coefficient is economically meaningful, too. Considering the Pareto law of consumption (in other words, the 80-20 rule discussed above), a 20 percent increase in per capita beer consumption in a year yields a very significant increase in alcohol abuse which can obviously lead to economic outcomes through the various channels discussed earlier.

Other control variables are mostly in the expected direction. The coefficient on initial income is negative, which confirms the presence of convergence; a higher public expenditure and total tax rate are associated with a lower income growth; higher federal government aid is associated with a lower income growth; a higher level of population is associated with a lower income growth; the coefficients on percent of population higher than age 65 is associated with a lower income growth; and the coefficient on percent of population younger than age 17 is positive, which is contrary to the expectation, though it is not statistically significant.

Four Year Averages

The results with respect to four year estimates follow a similar pattern with yearly estimates. However, the coefficient on per capita beer consumption is not statistically significant in this case. One of the reasons behind this fact is that even though per capita beer consumption is a good measure of alcohol abuse, its capacity to represent alcohol abuse may be lower when the data is averaged for four year periods. For instance, the impact of changes in the prevalence of drinking may be more pressing in the long run and hence hinder the power of per capita beer consumption's representativeness of alcohol abuse. Additionally, these estimates are conservative estimates which are likely representing the lower bound estimates of alcohol abuse on income growth because it is likely that changes in per capita beer consumption in the long run may be more strongly related to moderate alcohol consumption.

VIII. Discussion and Policy Implications

Considering the fact that per capita beer consumption does not change in great magnitude from year to year and hence alcohol abuse does not change dramatically as well, the share of alcohol abuse in per capita income growth is small in magnitude. Therefore, it would be naïve to claim that curbing alcohol abuse would boost income growth tremendously.

These results suggest that alcohol abuse has a negative impact on overall productivity even though the magnitude of alcohol abuse on income growth seems to be small at the aggregate level.

These results definitely disprove the claim of NBWA with respect to the beer industry's contribution to economic growth through the expansion of the beer industry in the United States. Indeed, the beer industry does not contribute to economic growth at the aggregate level! Furthermore, objections to increases in excise alcohol taxes cannot be justified on efficiency grounds.

It is well documented by various literature that alcohol, particularly beer, abuse generated externalities are large in magnitude. Various studies suggest that an increase in excise beer taxes would reduce such externalities. These results suggest that increases in levels of excise beer taxes may not be inefficient in terms of income growth and therefore provide indirect support for the studies which advocate increases in excise alcohol taxes. Welfare implications of changes in the levels of excise alcohol taxes are viewed in a relatively close context. Effects of changes in excise alcohol taxes would depend on the changes in other taxes as well. Therefore, further analysis is necessary with respect to the efficiency implications of excise alcohol taxes.

Table 2.1: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.
Per-capita personal income growth	1296	0.02	0.03
Average Total Tax Rate	1296	5.32	0.96
Average Total Expenditure Rate	1296	6.91	1.46
Per capita federal aid from Federal Govt.	1344	3.91	1.29
Population	1344	4922.5	5137.4
Percent of Population >65	1344	0.27	0.48
Percent of Population <17	1344	0.33	0.39
Per capita Personal Income	1344	12.63	2.39
Per capita beer consumption in liters	1344	4.96	0.94
Nominal - Excise beer tax	1344	0.57	0.21
Nominal - Excise wine tax	1344	0.97	0.66
Nominal - Excise liquor tax	1344	13.60	2.29
CPI* Adjusted - Excise beer tax	1344	0.51	0.22
CPI Adjusted - Excise wine tax	1344	0.80	0.47
CPI Adjusted - Excise liquor tax	1344	12.71	4.45

*CPI base year is 1982-1984

Table 2.2: Yearly State Level Fixed Effects Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	0.0179**	0.0133	0.0133
	(0.00870)	(0.00847)	(0.00867)
Average Total Tax Rate	-0.00666	-0.00721*	-0.00707*
	(0.00407)	(0.00384)	(0.00381)
Average Total Public Expenditure Rate	-0.00851**	-0.00865**	-0.00868**
	(0.00339)	(0.00340)	(0.00341)
Per Capita Federal Aid	0.00416	0.00218	0.00217
	(0.00269)	(0.00270)	(0.00276)
Lagged Per Capita Personal Income	-0.0119***	-0.0119***	-0.0118***
	(0.00355)	(0.00345)	(0.00352)
Log of population		-0.0309**	-0.0316**
		(0.0116)	(0.0118)
Percent population older than 65 years old			-0.00717
			(0.00578)
Percent population younger than 17 years old			0.00267
			(0.00228)
Observations	1248	1248	1248
R-squared	0.600	0.604	0.604
Number of states	48	48	48

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1

Table 2.3: State Level IV Estimates with CPI adjusted Excise Alcohol Taxes Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	-0.0150	-0.0217	-0.0229
	(0.0144)	(0.0147)	(0.0154)
Average Total Tax Rate	-0.00709**	-0.00774***	-0.00760***
	(0.00276)	(0.00273)	(0.00266)
Average Total Public Expenditure Rate	-0.00840***	-0.00856***	-0.00859***
	(0.00272)	(0.00276)	(0.00279)
Per Capita Federal Aid	0.00431**	0.00205	0.00205
	(0.00197)	(0.00195)	(0.00197)
Lagged Per Capita Personal Income	-0.0120***	-0.0121***	-0.0120***
	(0.00146)	(0.00144)	(0.00144)
Log of population		-0.0355***	-0.0364***
		(0.00855)	(0.00852)
Percent population older than 65 years old			-0.00729
			(0.0156)
Percent population younger than 17 years old			0.00259
			(0.00577)
Observations	1248	1248	1248
R-squared	0.595	0.599	0.599
Number of state	48	48	48
Hansen J Test	10.18258	8.75974	7.53296
Hansen J P-value	0.0171	0.0327	0.0567
1st F-test	80.62	82.46	87.00
1st p-value	0.000	0.000	0.000
1st partial R2	0.3018	0.2959	0.2957

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1

Table 2.4: State Level IV Estimates with Nominal Excise Alcohol Taxes Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	-0.0101	-0.0558**	-0.0513*
	(0.0252)	(0.0278)	(0.0286)
Average Total Tax Rate*	-0.00702**	-0.00826***	-0.00801***
	(0.00276)	(0.00277)	(0.00268)
Average Total Public Expenditure Rate*	-0.00842***	-0.00848***	-0.00851***
	(0.00271)	(0.00276)	(0.00279)
Per Capita Federal Aid	0.00429**	0.00192	0.00195
	(0.00196)	(0.00201)	(0.00202)
Lagged Per Capita Personal Income	-0.0120***	-0.0122***	-0.0121***
	(0.00146)	(0.00145)	(0.00146)
Log of population		-0.0400***	-0.0402***
		(0.00958)	(0.00948)
Percent population older than 65 years old			-0.00740
			(0.0156)
Percent population younger than 17 years old			0.00253
			(0.00581)
Observations	1248	1248	1248
R-squared	0.596	0.584	0.587
Number of states	48	48	48
Hansen J Test	0.93885	2.30721	0.14729
Hansen J P-value	0.625	0.511	0.929
1st F-test	53.20	32.14	38.33
1st p-value	0.000	0.000	0.000
1st partial R2	0.0911	0.0759	0.0747

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1

Table 2.5: Four Year Averages State Level Fixed Effects Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	0.00839	0.00498	0.00487
	(0.00519)	(0.00600)	(0.00571)
Average Total Tax Rate	0.000365	-0.000410	-2.64e-05
	(0.00506)	(0.00480)	(0.00460)
Average Total Public Expenditure Rate	-0.00806**	-0.00805***	-0.00817***
	(0.00301)	(0.00282)	(0.00273)
Per Capita Federal Aid	0.00389	0.00183	0.00182
	(0.00244)	(0.00279)	(0.00297)
Initial Per Capita Personal Income	-0.00587***	-0.00600***	-0.00575***
	(0.00129)	(0.00132)	(0.00124)
Log of population		-0.0232*	-0.0244*
		(0.0117)	(0.0124)
Percent population older than 65 years old			-0.0129*
			(0.00656)
Percent population younger than 17 years old			0.00511*
			(0.00267)
Observations	336	336	336
R-squared	0.656	0.665	0.670
Number of states	48	48	48

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ $p<0.1$

Table 2.6: State Level IV Estimates with CPI adjusted Excise Alcohol Taxes Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	-0.00243	-0.00773	-0.00934
	(0.0119)	(0.0122)	(0.0120)
Average Total Tax Rate*	0.000101	-0.000767	-0.000414
	(0.00329)	(0.00309)	(0.00305)
Average Total Public Expenditure Rate*	-0.00792***	-0.00788***	-0.00798***
	(0.00222)	(0.00212)	(0.00212)
Per Capita Federal Aid	0.00390*	0.00171	0.00168
	(0.00218)	(0.00222)	(0.00231)
Initial Per Capita Personal Income	-0.00590***	-0.00604***	-0.00580***
	(0.00120)	(0.00118)	(0.00119)
Log of population		-0.0247**	-0.0262***
		(0.00964)	(0.00985)
Percent population older than 65 years old			-0.0130
			(0.0125)
Percent population younger than 17 years old			0.00515
			(0.00473)
Observations	336	336	336
R-squared	0.654	0.663	0.667
Number of states	48	48	48
Hansen J Test	5.04601	5.70469	5.12586
Hansen J P-value	0.0802	0.0577	0.0771
1st F-test	34.96	35.27	35.57
1st p-value	0.000	0.000	0.000
1st partial R2	0.3466	.3390	0.3402

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1 p<0.1

Table 2.7: State Level IV Estimates with Nominal Excise Alcohol Taxes Estimates of Income Growth on Per Capita Beer

	(1)	(2)	(3)
Log of Per Capita Beer Consumption	-0.0102	-0.0416	-0.0372
	(0.0238)	(0.0267)	(0.0280)
Average Total Tax Rate*	-8.85e-05	-0.00172	-0.00117
	(0.00340)	(0.00333)	(0.00331)
Average Total Public Expenditure Rate*	-0.00782***	-0.00744***	-0.00762***
	(0.00228)	(0.00223)	(0.00224)
Per-capita Federal Aid	0.00391*	0.00138	0.00142
	(0.00221)	(0.00249)	(0.00256)
Initial Per Capita Personal Income	-0.00592***	-0.00615***	-0.00588***
	(0.00119)	(0.00115)	(0.00118)
Log of population		-0.0289**	-0.0296**
		(0.0115)	(0.0117)
Percent population older than 65 years old			-0.0134
			(0.0127)
Percent population younger than 17 years old			0.00522
			(0.00480)
Observations	336	336	336
R-squared	0.651	0.633	0.644
Number of states	48	48	48
Hansen J Test	2.80957	2.05381	0.81650
Hansen J P-value	0.245	0.358	0.665
1st F-test	16.51	17.36	12.39
1st p-value	0.000	0.000	0.000
1st partial R2	0.1066	0.0911	0.0917

Notes: Dependent variable is per capita personal income growth. Robust standard errors are in parentheses. Lagged growth rates and year dummies are not reported. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1 p<0.1

Table 2.8: First Stage Estimates of Per Capita Beer Consumption

	(1)
Log of nominal excise beer tax	-0.437***
	(0.0653)
Log of nominal excise wine tax	-0.00590
	(0.0227)
Log of nominal excise liquor tax	0.359
	(0.215)
Minimum drinking age is 21	-0.0176
	(0.0156)
Income growth	0.181*
	(0.101)
Lagged income growth	0.173*
	(0.0866)
Average Total Tax Rate*	-0.0102
	(0.00951)
Average Total Public Expenditure Rate*	0.00285
	(0.00696)
Per Capita Federal Aid	0.00384
	(0.0111)
Lagged Per Capita Personal Income	0.00292
	(0.00912)
Observations	1248
Number of states	48
R-squared	0.451
F test	0.000

Notes: Dependent variable is per capita beer consumption in liters. Robust standard errors are in parentheses. Year dummies and the constant term are not reported. F test pertains to the joint significance of beer, wine and liquor excise taxes. Average total tax rate and average total public expenditure are the percentages calculated based on gross state product. *** p<0.01, ** p<0.05, * p<0.1 p<0.1

Chapter 3: Essay II

Alcohol Abuse and Income Growth: A Cross Country Investigation

Introduction[22]

As opposed to the first chapter, which uses data from the United States and utilizes per capita beer consumption as the measure of alcohol abuse, there is no universal evidence claiming that a particular alcoholic beverage (i.e., beer, wine or liquor) is the medium of alcohol abuse (i.e., a good proxy for alcohol abuse in a country) around the world. Therefore, not only per capita beer consumption, but also per capita wine, per capita liquor and per capita total ethanol consumption are separately estimated. Based on the evidence presented in the first chapter of this dissertation, per capita alcohol consumption measures are the best proxies for alcohol abuse at the aggregate level. Hence, chapter two of this dissertation attempts to uncover the causal impact of alcohol abuse on income growth using country level aggregate data from 72 countries. Results suggest that once the endogeneity between per capita beer consumption and income growth is addressed by employing system Generalized Method of Moments dynamic panel estimator method, the negative impact of alcohol abuse on income growth is uncovered. Furthermore, these results suggest that beer is the medium of alcohol abuse not only in the United States but also around the globe. The next section continues with presenting the data and empirical methodology. Section 3 presents the results. Section 4 concludes.

II. Data and Empirical Methodology

Data

The data for alcohol consumption were obtained from the World Health Organization's Global Alcohol Database. Estimated amount of pure ethanol in terms of liters for total ethanol and separately beer, wine, and spirits per-person yearly consumption is the unit of measure.

[22] Please refer to Chapter II, parts "Introduction," "Micro Channels," and "Theoretical Framework" for a longer discussion.

These calculations are mostly made based on official statistics on production, sales, import and export while taking stocks into consideration whenever possible.[23]

The aggregate nature of the data imposes some limitations in the analysis. One of the major shortcomings of the data is that they do not provide information about how the distribution of alcohol consumption changes in a country when alcohol sales increase or decrease. An increase in alcohol sales may mean that same group of individuals drink more on average or there is an increase in the number of drinkers or both and vice versa. Hence, compositional assumptions need to be made here. Ruhm and Black (2002) confirm the preceding literature and state that "pro-cyclical variation in overall drinking largely result from changes in consumption by existing drinkers, rather than movements into or out of drinking." Therefore, their results imply that prevalence of drinkers does not significantly change in a yearly framework. Changes in alcohol sales implies that existing drinkers change their drinking habits such as some moderate drinkers become heavy drinkers and some light drinkers become moderate drinkers and vice versa.

Tourist and overseas consumption can have different effects. Obviously, the interpretation of the effects of such factors on this analysis depends on the signs of the coefficients. If increases in alcohol sales have negative effects on income growth, presence of tourist and overseas consumption, expected to have a positive effect in themselves on alcohol sales and thus GDP, would cause the coefficients to be smaller since tourist and overseas consumption do not impose the costs of alcohol consumption on the countries where the alcohol

[23] Detailed information on the data is provided in the Appendix 1.

is consumed. On the other hand, if the effect is positive, tourist and overseas consumption would cause the coefficients be larger than actually they are.[24]

Because the data are established based on administrative sources, the variables are expected to be biased downward.[25] In the case of cross sectional analysis, this would cause serious problems. However, since we have panel data, changes in alcohol sales over time can still explain a substantial amount as long as the direction of bias is not changing over time. Hence, in the following analysis I will assume that the direction of bias does not change over time.

Data for growth variables are obtained from the World Bank web site: Beck et. al. (2002) Financial Intermediation Data Set. The sample is reduced to 72 countries because of the limitations with respect to control variables. Data are averaged over five-year intervals: 1960-1965, 1965-1970, 1970-1975, 1975-1980, 1980-1985, 1985-1990, 1990-1995, so there are seven variable for a country when available. Data are averaged over five year periods in order control for the effects of business cycle. Averaging the data has both advantages and disadvantages in terms of quantifying alcohol abuse. Because it is possible that prevalence of drinking and abuse may change in a five year period, changes in five year averaged alcohol consumption may not successfully represent the changes in alcohol abuse. Nevertheless, considering the fact that this is an international data set, measurement error in the yearly data, which may lead to attenuation bias, can very well be more prevalent. Furthermore, some of the control variables are only available in five year periods only. Hence, estimations with yearly are ruled out.

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[24] Note that if tourists contribute to traffic fatalities or crime, or even emergency health costs, through alcohol consumption, then this effect might turn negative. These effects, however, are expected to be negligible.

[25] Detailed information is provided in the Appendix 1.

Descriptive statistics for growth equations are presented in Table 3.1. Average growth rate is 1.78 percent. Per capita consumption levels for beer, wine and, spirits are 2.23, 2.06, and 1.69 liters respectively. Per capita alcohol consumption on average is 6.08 liters.

Empirical Methodology

Econometrics techniques used in this paper are country fixed effects and Generalized Method of Moments (GMM) dynamic panel estimators, which has been used by a variety of authors including, Levine et al (2000), Beck et al. (2000), and Rioja and Valev (2004). Particularly a GMM System dynamic panel data estimation technique is used besides a Generalized Least Squares methodology. The major reason behind using System GMM, which is fully developed by Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998) and, Bond et al. (2001), is to deal with the potential endogeneity in the data by using internal instruments where external instruments are not available.

Another way of dealing with the endogeneity issue is by applying an instrumental variable methodology. However, in the international level data sets the availability of instruments is highly limited. Therefore, GMM System dynamic panel data estimating techniques became the standard since they deal with the possible endogeneity by creating internal instruments.

System GMM estimation technique addresses the potential "econometrics problems induced by unobserved individual (country)-specific effects and joint endogeneity of the explanatory variables in lagged-dependent variable models, such as growth regressions." The model undertaken here is fully described by Arellano and Bond (1991), Arellano and Bover (1995), and Bond et al. (2001). The following is the model estimated.

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (1)$$

where the left side of the argument, is the growth rate per-capita GDP, productivity growth, or capital growth, depending on the model estimated. $y_{i,t-1}$ is the lagged value of dependent variable, $X_{i,t}$ represents a vector of independent variables: measures of alcohol consumption; initial GDP, which controls for income convergence; government size of GDP controls the impact of government presence on income growth; trade share of GDP controls for the impact of international openness on income growth; inflation rate controls for the impact of inflation on income growth; average years of secondary schooling controls for the impact of education on income growth; black market premium controls the impact of functioning of free markets on income growth; η_i is the country-specific unobserved heterogeneity, and $\varepsilon_{i,t}$ is the error term. In order to account for country specific heterogeneity first differences of equation (1) are taken

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \qquad (2)$$

However, in addition to the potential endogeneity of the dependent variable with the independent variables, now we have a problem of serial correlation since the new error term, $\varepsilon_{i,t} - \varepsilon_{i,t-1}$ is correlated with the lagged dependent variable $y_{i,t-1} - y_{i,t-2}$. Under the assumptions that error term is not serially correlated and the explanatory variables are weakly exogenous, the following moment conditions are used by GMM dynamic panel estimator.

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for \quad s \geq 2; t = 3,....,T \qquad (3)$$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for \quad s \geq 2; t = 3,....,T \qquad (4)$$

The GMM estimator based on these conditions is called GMM difference estimator. One important feature of the model undertaken, as is stated in the moment conditions, is that in order to implement GMM dynamic panel estimators one needs to have the data for each country in three consecutive periods or more. Otherwise, the model undertaken cannot exploit the necessary moment conditions.

In GMM difference estimator, the predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels. Strictly exogenous covariates and instruments enter the model in the usual fashion. One problem with this model is that lagged levels are in general bad instruments for first differences, particularly when variables follow a random walk.

Therefore the difference estimator is further combined by Arellano and Bover (1995) with an estimator in levels to produce a system estimator because the persistence in the independent variables can adversely affect the small-sample and asymptotic properties of the difference estimator. They showed how the efficiency of the model can be increased further by bringing additional moment conditions if the original equations in levels were added to the system. This model uses the same instruments for the regression in differences. However, lagged differences are used as instruments for regression in levels. Blundell and Bond (1998) improved the model by introducing further necessary assumptions, which they tested with Monte Carlo simulations. These further assumptions are as follows: error terms are not serially correlated and there is no correlation between the difference in the explanatory variables and the error term even though individual (country)-specific error terms and levels of explanatory variables may be correlated. Hence the following stationary properties are achieved.

$$E\left[y_{i,t+p}\eta_i\right] = E\left[y_{i,t+q}\eta_i\right]$$
$$and \quad E\left[X_{i,t+p}\eta_i\right] = E\left[X_{i,t+q}\eta_i\right] \qquad \text{for all p and q.} \qquad (5)$$

For the second part of the system there are following additional moment conditions:

$$E\left[\left(y_{i,t-s} - y_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad for \quad s = 1 \qquad (6)$$

$$E\left[\left(X_{i,t-s} - X_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad for \quad s = 1. \qquad (7)$$

By using the moment conditions stated in the equations (3), (4), (6) and (7) and employing GMM procedure, consistent and efficient parameter estimates can be generated.

Meanwhile, the validity of the instruments generated by System GMM estimator is vital since System GMM estimators are not otherwise consistent. A Hansen J test is employed in order to test the validity of the internal instruments – that is, the null hypothesis that the lagged differences of the explanatory variables are not correlated with the residuals. Therefore, in order for the instruments to be valid we should not be able to reject the null hypothesis that instruments are uncorrelated with the residuals.

A second test, which is called the Arellano Bond test, is undertaken in order to test whether the error term $\varepsilon_{i,t}$ is serially correlated. Our main interest here is whether a second-order serial correlation exits. The way the model is constructed, a first-order serial correlation is expected. That is, the differenced error term $D.\varepsilon_{i,t} = \varepsilon_{i,t} - \varepsilon_{i,t-1}$, should correlate with $D.\varepsilon_{i,t-1} = \varepsilon_{i,t-1} - \varepsilon_{i,t-2}$ since they share the term $\varepsilon_{i,t-1}$. Nevertheless, presence of a higher-order autocorrelation shows that some lags of the dependent variable, which might be used as instruments, are in fact endogenous and thus bad instruments. That is, $y_{i,t-2}$, where 2 is the lag, would be correlated with $\varepsilon_{i,t-2}$, which would be correlated with $D.\varepsilon_{i,t-2}$, which would be correlated with $D.\varepsilon_{i,t}$ if there is AR(2). Therefore, if we cannot reject the null hypothesis that errors in the first-differenced regression do not exhibit second-order serial correlation, we can state that our instruments are serially uncorrelated.

Since the standard deviations of two-step GMM System estimators tend to be significantly downward biased according to Arellano and Bond (1991) and Blundell and Bond (1998), Windmeijer's (2005) finite sample correction is applied. Hence, all the standard errors are robust standard errors.

Robustness Checks with Productivity Growth and Capital Growth

In addition to income growth regressions, specifications which estimate productivity growth and capital growth are employed in order to check the robustness of the results since productivity growth and capital growth are the sources income of growth.

The measure of productivity is derived from the Neoclassical Production Function with physical capital K, labor L, and the level of total factor productivity A. The underlying assumption here is that there is a common production function across the countries. That is, the aggregate production in a country is given by the following production function.

$$Y_i = A_i K^{\alpha} L_i^{1-\alpha} \qquad (8)$$

where Y_i is the output for country i, *K* is capital, *L* is labor, *A* is productivity, and the constant returns to scale assumption is imposed. In order to solve for growth rate of productivity, both sides are divided by *L* to get the per capita production. Then natural logs of both sides and time derivates are taken. At the end capital share of production is assumed as α=0.3 and solved for growth rate of capital. Hence we have:

Productivity Growth=Growth-0.3*Capital-Growth (9)

III. Results

Table 3.2 presents OLS with fixed effects estimates of income growth. Per capita alcohol consumption measures are positively related to income growth. The coefficients on control variables are mostly in the expected direction. F test p-value pertains to joint significance of control variables other than per-capita alcohol consumption measures. They are jointly significant at one percent level. Because of the potential endogeneity between per capita alcohol consumption and income growth (i.e., reverse causality and omitted variables bias), OLS may not represent the causal relationship between the two. Table 3.3 presents the results for GMM system dynamic panel data estimators. The p-value on Hansen J-test shows that the null hypothesis, GMM type instruments are correlated with the error term, cannot be rejected. P-value on AR (2) shows that errors in the first-difference regression exhibit no second-order serial correlation. Therefore, GMM type instrument are valid instruments. Once the endogeneity between per capita alcohol consumption measures and income growth is controlled for, the coefficient on per capita beer consumption becomes negative and statistically significant at the 10 percent level. The coefficient on log of per capita beer consumption shows that a 100 percent increase in per capita beer consumption leads to a 2.26 percentage point decrease in income growth. The coefficients on other measures of per capita alcohol consumption measures are neither statistically significant nor large in magnitude. The magnitude of the coefficient on per capita beer consumption is economically meaningful. Considering the "Pareto Law of Consumption" (i.e., 20 percent of the consumers consume 80 percent of a good consumed in the market), a 100 percent increase in per capita beer consumption is likely to represent a tremendous increase in alcohol abuse. Again, given the fact that per capita beer consumption is not a perfect measure of alcohol abuse, it is hard to claim that these estimates are precise. However, these results hint that there is a negative relationship between alcohol abuse and income growth. Control variables are in the expected direction: black market premium is negatively related income growth; secondary schooling is positively related to income growth; inflation is negatively related to income growth; trade share of GDP is positively related income growth; government share of GDP is negatively related to income growth; and initial GDP is positively related to income growth at low levels of GDP, with the coefficient becoming negative at higher levels of GDP. Control variables are jointly significant at the one percent level. Some of them are statistically significant at conventional levels on their own.

Table 3.4 presents the OLS estimates of productivity growth. In OLS estimates the coefficient on per capita alcohol consumption measures is positive and it is statistically significant at the five percent level for per capita beer consumption and per capita liquor consumption. Table 3.5 presents the GMM system estimates of productivity growth. Once the endogeneity between income growth and per capita alcohol consumption measures are controlled for, the coefficients on per capita alcohol consumption measures change sign and become negative. The coefficient on per capita beer consumption is statistically significant at the ten percent level. The coefficients on other measures of per capita alcohol consumption are neither statistically significant at conventional levels nor large in magnitude. Hence, these results show that alcohol abuse seems to affect productivity growth through the channels presented above.

Table .6 and Table 7 repeat the OLS and GMM system estimations for capital growth. The coefficients on per capita alcohol consumption measures are not statistically significant at conventional levels in any cases.

Table 3.8 presents the results for GMM system income growth estimates with legal origin and financial structure variables as controls. Results are very similar to those in Table 3.3, which presents GMM system income growth estimates with conventional control variables. Once there is a negative relationship between per capita beer consumption and income growth. The coefficients on other measures of alcohol consumption are neither large in magnitude nor statistically significant.

Table 3.9 presents the GMM system productivity growth estimates using financial structure and legal origin as control variables. Results are very similar to those in Table 3.5, which presents the GMM system productivity growth estimates using conventional control variables.

Table 3.10 presents the GMM system capital growth estimates using financial structure and legal origin as control variables. Results are qualitative similar to those in Table 3.7.

IV. Conclusions

This chapter attempts to uncover the causal relationship between alcohol abuse and income growth in a cross country setting. Because there is no established literature stating that a particular alcoholic beverage type is the medium of alcohol abuse around the world, all measures of per capita alcohol consumption are considered in estimating the relationship between alcohol abuse and income growth. There seems to be a negative relationship between per capita beer consumption and income growth. Other measures of per capita alcohol consumption do not seem to have an effect on income growth.

A natural question arises out of these results: Why does beer have a negative impact on GDP growth and not other measures of alcohol consumption? The relationship between alcohol abuse and per capita beer consumption may be similar to the one in the U.S. all around the world. That is, beer drinking would be more prevalent and among those alcohol abuse would be more common in comparison to other alcoholic beverage types. That is, beer drinkers may be the ones who are more likely consume excessively as is the case in the United States. Furthermore, the beer industry is one of industries in which there is a high concentration ratio (i.e., a few firms sharing most of the market share) while this is not the case for liquor and wine. Presence of high concentration may reduce the possibilities for measurement error since larger firms are more likely to report their volume of business accurately.

These results should be interpreted with caution for a few reasons. First, even though these results strongly suggest a relationship between alcohol abuse and aggregate income growth, because they are based on reduced form estimates, they may not be precise. Second, these results definitely do not suggest a negative relationship between alcohol consumption in general and income growth since there is no theoretical basis for such an assertion. Third, these results do not suggest that alcohol abuse generated by wine or liquor consumption does not have economic consequences.

These results provide evidence in favor of the economic literature suggesting an increase in excise alcohol taxes on efficiency grounds in terms of income growth though commenting the magnitude of such excise alcohol tax increases is beyond the scope this analysis.

Further research attempting to uncover the magnitude of the relationship between alcohol abuse and aggregate productivity is necessary and can contribute to the literature and policy discussion tremendously.

Table 3.1: Descriptive Statistics

GDP Growth	.0178
	(.0286)
Productivity Growth	.0102
	(.0248)
Capital Growth	.0273
	(.0342)
Initial GDP	3920.588
	(4802.72)
Government Share of GDP	.146
	(.0586)
Trade Share of GDP	.5532
	(.3059)
Inflation Rate	.1525
	(.2943)
Average Years of Secondary Schooling	1.1516
	(.9602)
Black Market Premium	.6794
	(5.5667)
Commercial-Central Bank, period average	.7763
	(.1969)
Bank Assets period, average	.3704
	(.2855)
Private Credit, period average	.3803
	(.329)
Liquid Liabilities, period average	.4188
	(.2566)
French legal origin	.5278
	(.4997)
German legal origin	.0694
	(.2545)
Scandinavian legal origin	.0556
	(.2293)
Per capita beer consumption	2.2554
	(2.1971)
Per capita wine consumption	2.058
	(3.8352)
Per capita liquor consumption	1.6884
	(1.425)
Per capita ethanol consumption	6.0606
	(5.0778)
Observations	511

Standard deviations in parentheses.

Table 3.2: Fixed Effects Income Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	0.0114			
	(0.00890)			
Logarithm of Per capita wine consumption		0.00119		
		(0.00841)		
Logarithm of Per capita liquor consumption			0.0171	
			(0.0119)	
Logarithm of Per capita total ethanol consumption				0.00376
				(0.0113)
Logarithm of Initial Income Per Capita	-0.0335	-0.0299	-0.0546	-0.0340
	(0.0579)	(0.0568)	(0.0559)	(0.0554)
Logarithm of Initial Income Per Capita Squared	-0.00176	-0.00174	-0.000304	-0.00151
	(0.00357)	(0.00356)	(0.00359)	(0.00350)
Logarithm of Government Size	-0.0196*	-0.0188*	-0.0208*	-0.0192*
	(0.0108)	(0.0108)	(0.0111)	(0.0110)
Logarithm of Trade Share of GDP	0.00722	0.00829	0.00717	0.00794
	(0.0124)	(0.0122)	(0.0120)	(0.0122)
Logarithm of (1+Inflation)	-0.0369***	-0.0353***	-0.0340***	-0.0356***
	(0.00711)	(0.00678)	(0.00648)	(0.00674)
Logarithm of Years of Secondary Schooling	-0.00836	-0.00815	-0.00879	-0.00810
	(0.00521)	(0.00546)	(0.00538)	(0.00526)
Logarithm of (1+Black Market Premium)	-0.00323	-0.00362	-0.00412	-0.00359
	(0.00682)	(0.00679)	(0.00696)	(0.00683)
Observations	384	384	384	384
R-squared	0.346	0.342	0.350	0.343
Number of countries	72	72	72	72
F test p-value	0.00000	0.00000	0.00000	0.00000

Note: Dependent variable is per capita GDP growth. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.3: GMM System Income Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.0226*			
	(0.0114)			
Logarithm of Per capita wine consumption		0.00499		
		(0.00776)		
Logarithm of Per capita liquor consumption			-0.000701	
			(0.0146)	
Logarithm of Per capita total ethanol consumption				-0.00162
				(0.0106)
Logarithm of Initial Income Per Capita	0.0199	0.0338	0.0518	0.0210
	(0.0504)	(0.0733)	(0.0648)	(0.0816)
Logarithm of Initial Income Per Capita Squared	-0.00121	-0.00274	-0.00371	-0.00171
	(0.00316)	(0.00451)	(0.00400)	(0.00497)
Logarithm of Government Size	-0.0134	-0.0211	-0.0258*	-0.0224
	(0.0159)	(0.0147)	(0.0138)	(0.0184)
Logarithm of Trade Share of GDP	0.0101	0.00633	0.00661	0.00319
	(0.0119)	(0.0115)	(0.00954)	(0.0124)
Logarithm of (1+Inflation)	-0.0177	-0.0294*	-0.0334**	-0.0226
	(0.0170)	(0.0160)	(0.0168)	(0.0169)
Logarithm of Years of Secondary Schooling	0.0218**	0.0222**	0.0203**	0.0231*
	(0.00907)	(0.0100)	(0.00928)	(0.0121)
Logarithm of (1+Black Market Premium)	-0.0139**	-0.0101	-0.0115	-0.0129*
	(0.00680)	(0.00634)	(0.00778)	(0.00753)
Observations	384	384	384	384
Number of countries	72	72	72	72
Hansen J Test	54.31049	53.98011	55.35455	56.22047
Hansen J P-value	0.247	0.257	0.217	0.194
AR (1)	-3.333	-3.176	-3.244	-3.225
AR(1) p-value	0.000860	0.00149	0.00118	0.00126
AR (2)	-0.520	-0.239	-0.406	-0.363
AR(2) p-value	0.603	0.811	0.685	0.716
F test	0.000	0.000	0.000	0.000

Note: Dependent variable is per capita GDP growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.4: Fixed Effects Productivity Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	0.0156*			
	(0.00914)			
Logarithm of Per capita wine consumption		0.00209		
		(0.00721)		
Logarithm of Per capita liquor consumption			0.0239**	
			(0.0111)	
Logarithm of Per capita total ethanol consumption				0.00907
				(0.0109)
Logarithm of Initial Income Per Capita	-0.0396	-0.0342	-0.0712	-0.0439
	(0.0599)	(0.0587)	(0.0590)	(0.0571)
Logarithm of Initial Income Per Capita Squared	-0.00164	-0.00168	0.000468	-0.00113
	(0.00360)	(0.00359)	(0.00365)	(0.00350)
Logarithm of Government Size	-0.0186*	-0.0184*	-0.0214*	-0.0194*
	(0.0104)	(0.0106)	(0.0110)	(0.0108)
Logarithm of Trade Share of GDP	0.00154	0.00310	0.00112	0.00220
	(0.0116)	(0.0116)	(0.0113)	(0.0114)
Logarithm of (1+Inflation)	-0.0387***	-0.0364***	-0.0345***	-0.0371***
	(0.00900)	(0.00890)	(0.00786)	(0.00876)
Logarithm of Years of Secondary Schooling	-0.00764*	-0.00727	-0.00790*	-0.00711
	(0.00434)	(0.00452)	(0.00452)	(0.00448)
Logarithm of (1+Black Market Premium)	-0.00249	-0.00279	-0.00401	-0.00287
	(0.00559)	(0.00562)	(0.00549)	(0.00560)
Observations	378	378	378	378
R-squared	0.325	0.317	0.336	0.321
Number of countries	72	72	72	72
F test	0.00000	0.00000	0.00000	0.00000

Note: Dependent variable is productivity growth. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.5: GMM System Productivity Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.0219*			
	(0.0126)			
Logarithm of Per capita wine consumption		-0.000886		
		(0.00834)		
Logarithm of Per capita liquor consumption			-0.00277	
			(0.0129)	
Logarithm of Per capita total ethanol consumption				-0.00473
				(0.00921)
Logarithm of Initial Income Per Capita	0.000962	-0.00844	-0.00913	-0.0178
	(0.0647)	(0.0569)	(0.0681)	(0.0687)
Logarithm of Initial Income Per Capita Squared	0.000180	0.000367	0.000384	0.00101
	(0.00390)	(0.00365)	(0.00426)	(0.00421)
Logarithm of Government Size	-0.0140	-0.0140	-0.0211	-0.0181
	(0.0183)	(0.0157)	(0.0172)	(0.0169)
Logarithm of Trade Share of GDP	-0.0133	-0.0173	-0.0137	-0.0182
	(0.0125)	(0.0150)	(0.0130)	(0.0127)
Logarithm of (1+Inflation)	-0.0218	-0.0236	-0.0271	-0.0216
	(0.0184)	(0.0149)	(0.0168)	(0.0145)
Logarithm of Years of Secondary Schooling	0.0149	0.0163	0.0190**	0.0201*
	(0.00987)	(0.0104)	(0.00950)	(0.0104)
Logarithm of (1+Black Market Premium)	-0.0140**	-0.0117**	-0.0100*	-0.0124**
	(0.00578)	(0.00559)	(0.00530)	(0.00574)
Observations	378	378	378	378
Number of countries	72	72	72	72
Hansen J Test	56.08628	60.45422	55.25824	55.99077
Hansen J P-value	0.198	0.107	0.220	0.200
AR (1)	-3.157	-3.134	-3.092	-2.970
AR(1) p-value	0.00160	0.00172	0.00199	0.00298
AR (2)	-0.869	-0.639	-0.704	-0.763
AR(2) p-value	0.385	0.523	0.481	0.446
F test	0.000400	2.48e-05	0.000274	0.000701

Note: Dependent variable is productivity growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Fixed Effects Capital Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.00985			
	(0.0112)			
Logarithm of Per capita wine consumption		-0.00235		
		(0.0102)		
Logarithm of Per capita liquor consumption			-0.0124	
			(0.00989)	
Logarithm of Per capita ethanol consumption				-0.00736
				(0.00941)
Logarithm of Initial Income Per Capita	0.0978**	0.0933**	0.113**	0.102**
	(0.0437)	(0.0442)	(0.0484)	(0.0465)
Logarithm of Initial Income Per Capita Squared	-0.00517*	-0.00507*	-0.00621**	-0.00557*
	(0.00269)	(0.00278)	(0.00299)	(0.00290)
Logarithm of Government Size	-0.0138	-0.0140	-0.0124	-0.0132
	(0.0151)	(0.0150)	(0.0151)	(0.0149)
Logarithm of Trade Share of GDP	0.0111	0.0100	0.0110	0.0108
	(0.0121)	(0.0118)	(0.0120)	(0.0119)
Logarithm of (1+Inflation)	-0.0142	-0.0158	-0.0161	-0.0151
	(0.0132)	(0.0130)	(0.0124)	(0.0125)
Logarithm of Years of Secondary Schooling	-0.00619	-0.00645	-0.00614	-0.00657
	(0.00795)	(0.00814)	(0.00777)	(0.00787)
Logarithm of (1+Black Market Premium)	-0.00453	-0.00440	-0.00377	-0.00433
	(0.0112)	(0.0111)	(0.0113)	(0.0112)
Observations	386	386	386	386
R-squared	0.374	0.372	0.375	0.373
Number of countries	73	73	73	73
F test	0.29194	0.32606	0.27243	0.31845

Note: Dependent variable is capital growth. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.7: GMM System Capital Growth Estimates

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.0167			
	(0.0242)			
Logarithm of Per capita wine consumption		0.00451		
		(0.00858)		
Logarithm of Per capita liquor consumption			-0.0115	
			(0.0209)	
Logarithm of Per capita ethanol consumption				0.0131
				(0.0147)
Logarithm of Initial Income Per Capita	-0.0188	0.0325	0.0514	-0.00542
	(0.0523)	(0.0510)	(0.0724)	(0.0583)
Logarithm of Initial Income Per Capita Squared	0.00111	-0.00252	-0.00361	-0.000454
	(0.00319)	(0.00318)	(0.00445)	(0.00348)
Logarithm of Government Size	-0.00318	-0.0220	-0.0136	-0.0118
	(0.0200)	(0.0209)	(0.0193)	(0.0193)
Logarithm of Trade Share of GDP	0.0344**	0.0286	0.0349	0.0283
	(0.0168)	(0.0172)	(0.0222)	(0.0185)
Logarithm of (1+Inflation)	0.00617	-0.00804	0.00240	-0.00399
	(0.0146)	(0.0144)	(0.0159)	(0.0137)
Logarithm of Years of Secondary Schooling	0.0181	0.0185	0.0201	0.0191
	(0.0125)	(0.0117)	(0.0126)	(0.0137)
Logarithm of (1+Black Market Premium)	-0.00645	-0.00345	-0.00548	-0.00576
	(0.0122)	(0.0134)	(0.0119)	(0.0130)
Observations	386	386	386	386
Number of countries	73	73	73	73
Hansen J Test	60.10567	58.56599	59.62452	59.22431
Hansen J P-value	0.113	0.141	0.121	0.128
AR (1)	-2.787	-2.747	-2.960	-2.739
AR(1) p-value	0.00532	0.00602	0.00307	0.00615
AR (2)	-1.265	-1.049	-1.075	-1.122
AR(2) p-value	0.206	0.294	0.283	0.262
F test	0.402	0.300	0.482	0.350

Note: Dependent variable is capital growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. F test p-value refers to the joint significance of independent variables excluding per capita alcohol consumption measures. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.8: GMM System Growth Estimates with Legal Origin and Financial Structure Controls

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.0410**			
	(0.0175)			
Logarithm of Per capita wine consumption		-0.00176		
		(0.0209)		
Logarithm of Per capita liquor consumption			0.0295	
			(0.0226)	
Logarithm of Per capita ethanol consumption				-0.00871
				(0.0294)
Commercial-Central Bank, period average	0.0850**	0.0203	0.0605	0.0283
	(0.0411)	(0.0631)	(0.0441)	(0.0660)
Bank Assets period, average	-0.0153	-0.0163	-0.0103	-0.0175
	(0.0385)	(0.0552)	(0.0465)	(0.0661)
Private Credit, period average	0.0319	0.0551	0.0330	0.0436
	(0.0359)	(0.0467)	(0.0352)	(0.0428)
Liquid Liabilities, period average	-0.0378	-0.0812	-0.0762*	-0.0775
	(0.0526)	(0.0719)	(0.0419)	(0.0718)
French legal origin	0.0406*	0.154	0.0995*	0.173*
	(0.0217)	(0.102)	(0.0566)	(0.101)
German legal origin	0.123	0.380	0.219	0.484
	(0.0799)	(0.253)	(0.147)	(0.311)
Scandinavian legal origin	0.0750	0.223	-0.0234	0.288
	(0.124)	(0.228)	(0.208)	(0.305)
Observations	391	391	391	391
Number of countries	71	71	71	71
Hansen J Test	39.56815	44.86927	37.69879	40.12951
Hansen J P-value	0.578	0.352	0.660	0.553
AR (1)	-2.966	-2.478	-2.369	-2.422
AR(1) p-value	0.00302	0.0132	0.0178	0.0154
AR (2)	0.104	-0.370	-0.400	-0.709
AR(2) p-value	0.917	0.712	0.689	0.478

Note: Dependent variable is per capita GDP growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.9: GMM System Productivity Growth Estimates with Legal Origin and Financial Structure Controls

	(1)	(2)	(3)	(4)
Logarithm of Per-capita beer consumption	-0.0343*			
	(0.0179)			
Logarithm of Per-capita wine consumption		0.000801		
		(0.0167)		
Logarithm of Per-capita liquor consumption			0.0266	
			(0.0201)	
Logarithm of Per-capita ethanol consumption				-0.00356
				(0.0248)
Commercial-Central Bank, period average	0.108**	0.0500	0.0664*	0.0467
	(0.0459)	(0.0616)	(0.0387)	(0.0615)
Bank Assets period, average	-0.0228	-0.0294	-0.0352	-0.0341
	(0.0354)	(0.0536)	(0.0557)	(0.0584)
Private Credit, period average	-0.00129	0.0159	0.0121	0.0186
	(0.0236)	(0.0378)	(0.0327)	(0.0345)
Liquid Liabilities, period average	0.00155	-0.0427	-0.0312	-0.0355
	(0.0569)	(0.0582)	(0.0487)	(0.0651)
French legal origin	0.0185	0.0896	0.0654	0.113
	(0.0207)	(0.0776)	(0.0469)	(0.0910)
German legal origin	0.101	0.284	0.182	0.318
	(0.103)	(0.244)	(0.157)	(0.280)
Scandinavian legal origin	0.0863	0.122	-0.0377	0.133
	(0.123)	(0.155)	(0.158)	(0.215)
Observations	384	384	384	384
Number of countries	71	71	71	71
Hansen J Test	37.21930	41.29330	35.58132	39.44921
Hansen J P-value	0.681	0.502	0.747	0.584
AR (1)	-2.315	-2.283	-2.388	-2.392
AR(1) p-value	0.0206	0.0224	0.0169	0.0168
AR (2)	-0.761	-1.056	-0.809	-0.883
AR(2) p-value	0.447	0.291	0.419	0.377

Note: Dependent variable is productivity growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.10: GMM System Capital Growth Estimates with Legal Origin and Financial Structure Controls

	(1)	(2)	(3)	(4)
Logarithm of Per capita beer consumption	-0.0172			
	(0.0323)			
Logarithm of Per capita wine consumption		-0.0159		
		(0.0111)		
Logarithm of Per capita liquor consumption			0.0183	
			(0.0210)	
Logarithm of Per capita ethanol consumption				-0.000732
				(0.0251)
Commercial-Central Bank, period average	0.0935***	0.0513	0.0793**	0.0682*
	(0.0322)	(0.0414)	(0.0368)	(0.0358)
Bank Assets period, average	-0.0341	-0.0124	-0.0263	-0.0530
	(0.0252)	(0.0356)	(0.0439)	(0.0366)
Private Credit, period average	0.0645*	0.0511*	0.0768**	0.0737**
	(0.0327)	(0.0300)	(0.0329)	(0.0361)
Liquid Liabilities, period average	-0.0161	-0.00703	-0.0675	-0.00484
	(0.0532)	(0.0415)	(0.0540)	(0.0629)
French legal origin	0.0216	0.0649	0.0321	0.0525
	(0.0304)	(0.0442)	(0.0568)	(0.0433)
German legal origin	-0.00835	0.0666	0.0359	0.0155
	(0.0778)	(0.0867)	(0.100)	(0.0908)
Scandinavian legal origin	-0.173	0.0324	-0.248	-0.113
	(0.185)	(0.0830)	(0.218)	(0.131)
Observations	399	399	399	399
Number of countries	72	72	72	72
Hansen J Test	39.28413	51.35572	47.00200	45.60459
Hansen J P-value	0.591	0.153	0.275	0.325
AR (1)	-2.821	-2.624	-2.485	-2.599
AR(1) p-value	0.00479	0.00868	0.0129	0.00934
AR (2)	-0.747	-0.806	-1.053	-0.942
AR(2) p-value	0.455	0.420	0.292	0.346

Note: Dependent variable is capital growth. Hansen J test p-value refers to whether GMM type instruments are correlated with the error term (i.e. the null hypothesis is that GMM type instruments are uncorrelated with the error terms). AR (1) p-value refers to whether there is a first degree serial correlation in the difference regressions. AR (2) p-value refers to whether there is a second degree serial correlation in the difference regressions. Controls for country fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Chapter IV: Essay III

Alcohol Abuse and Crime: A State Level Investigation

I. Introduction

This chapter of the dissertation investigates the relationship between state level aggregate crime measures and alcohol abuse and therefore attempts to uncover the aggregate effect of alcohol abuse from a different angle.[26] Various studies examined the link between alcohol consumption and availability of alcohol on criminal behavior.

According to Cook and Moore (1993a), a large number of crimes are committed by people who just consumed alcohol. Cook and Moore (1993b) find that alcohol availability increases alcohol consumption which in turn increases crime.

According to Lang and Sibrel (1989) and Scribner et al (1999), alcohol affects criminal behavior by either pharmaco-physiological way by either impairing reasoning or reducing inhibition. Therefore, alcohol acts as a catalyst rather than being the pure cause of criminal activity.

Chaloupka and Weschler (1996) show that lower alcohol prices and alcohol availability are positively correlated with binge drinking and crime rates among US college students. Further, they find that crime rates are substantially higher among college students when alcohol is available on campus than when it is not.

An increase in the price of pure alcohol, as measured by a weighted average of the price of alcohol from beer, wine, and liquor, will reduce violence aimed at wives Markowitz and Grossman (2000). Markowitz and Grossman (1998) show that increases in beer taxes can be an

[26] The term alcohol abuse is preferred to alcohol consumption again because it is trivial that criminal activity induced by alcohol consumption can only happen if alcohol abuse for which a definition is provided in the first chapter.

effective policy tool in decreasing violence against children. The price of beer is inversely related to violence in college campuses Markowitz and Grossman (2001).

Hutchinson et al. (1995) show a disproportionately high number of crime incidences happen in or near pubs during the peak hours of operation in the United Kingdom. By using census tract data from the city of Detroit, Gymah-Brempong (2001) shows that alcohol availability is positively and significantly related to total, property and violent crime rates and homicide rates. Gyimah-Brempong and Racine (2006) show by applying robust nonparametric methods that there is a positive and statistically significant relationship between crime rates and alcohol availability. Zimmerman and Benson (2007) find a strong positive relationship between alcohol consumption and rape rates. Their estimated elasticity per capita beer consumption elasticity of rape is about 1.7.

This study analyzes alcohol abuse crime relationship by utilizing per capita beer consumption as the representative measure of alcohol abuse by employing yearly state level data from the United States for the period 1982-2000.[27] In order to account for the potential endogeneity between alcohol abuse (per capita beer consumption) and crime, a two stage least squares method is employed, utilizing excise beer taxes and state level alcohol control policies as instruments. Results confirm the past literature which finds a positive relationship between alcohol abuse (i.e., per capita beer consumption) and state level aggregate crime. The relationship is not uniform among different crime types. It is larger in magnitude with respect to violent crime types in comparison to property crime types. The relationship between alcohol abuse and crime seem to be strongest in the case of rape with an elasticity of about 0.72.

[27] The evidence with respect to the representativeness of per-capita beer consumption as a measure of alcohol abuse is presented in Chapter I.

The next section continues with discussion of theoretical relationship between alcohol abuse and crime. Section 3 presents the data and empirical methodology. Section 4 presents the results. Section 5 discusses the results and concludes.

II. Identifying the Alcohol Abuse Crime Relationship

The relationship between alcohol consumption and crime can either be causal, in which alcohol consumption can induce or facilitate criminal activity, or spurious, in which alcohol consumption and crime may emerge as a result of a third factor.

Alcohol abuse may induce, or facilitate criminal behavior through different channels. Alcohol abuse can reduce the productivity of a person in the legal sector in comparison to the illegal sector. As a result, instead of getting a regular job a person may prefer to be involved in illegal activities. Alcohol abuse may as well increase a person's violent behavior by triggering a person's violent tendencies. This may be through a reduction in the ability to assess risk due to excessive consumption or as a result of unexplained behavioral changes as a result of alcohol consumption. In some cases, alcohol consumption abuse may alter the potential victim's defending ability. For example, a female's ability to defend herself against a rape offender or to avoid from a potential rape offense can severely be hindered as a result of her own alcohol excessive drinking. Likewise, ceteris paribus, an intoxicated person can be a much easier target for a robber in comparison to a sober person.

The correlation between crime and alcohol abuse (consumption) may be based on a spurious relationship in some cases, as well. Age structure of population can affect criminal behavior and alcohol abuse simultaneously: people who are in prime age group (i.e., between 17 and 65) are more likely to drink more and commit crime and therefore both crime and alcohol abuse can be expected to be observed together. Presence of alcohol abuse may increase a crime offender's chances of getting caught and hence alcohol abuse and crime can be observed together. In some cases, a crime offender may choose to drink alcohol in order to reduce the severity of punishment in case s/he gets caught, which naturally leads to a positive correlation between crime and alcohol consumption. Similarly, a criminal may choose to drink before he commits a crime in order to prepare himself mentally ready for the act of crime. The positive correlation between crime and alcohol consumption (abuse) may result from the personal characteristics of criminals. That is, if people who prefer risky activities (such as crime) also prefer consuming alcohol, the correlation between crime and alcohol consumption will be positive as well. If some outlets induce gathering and interaction of people who prefer both to consume alcohol and take risky behavior, in such areas a positive correlation between alcohol consumption and crime emerges. Such environments may also attract criminals since search costs to find a potential victim is likely to be lower in such areas. For instance, a person who intends to rape someone may target the night life friendly areas of a city or a town and thus may be drinking while searching for his potential victim as well. This possibly can lead to a positive correlation between crime and alcohol consumption.

Based on the arguments presented above, a positive correlation between alcohol consumption and crime is expected. However, whether such correlation represents the causal relationship between alcohol abuse and crime is an empirical matter. The next section continues with presenting data and empirical methodology.

III. Data and Empirical Methodology

Data[28]

Table 4.1 presents the descriptive statistics. The dependent variable is the crime rate. Crime is divided into two broad categories: property crime and violent crime. Property crime includes robbery, larceny-theft, motor-vehicle-theft, and burglary. Violent crime includes murder, rape, and aggravated assault. Data on yearly state-level reported crime rates are taken from the Uniform Crime Reports (UCR), published by Federal Bureau of Investigation (FBI) from 1982 to 2000. Crime rates which refers to crime per 100,000 people. These measures represent reported crime rates to the police. However, many victims fail to report crime incidences for various reasons such as pride, fear of reprisal, relative importance of the crime to the victim, and expecting that the problem will not be resolved. Underreporting of crime rates would be a more pressing problem if we were to use cross-sectional data. Since I am using panel data, variation over time in addition to cross-sectional variation can still explain a lot as long as underreporting follows a consistent path. Hence, in the remaining part of the analysis the consistency of the underreporting of crime rates over time is assumed.

Per capita beer consumption, which is the variable of interest reflecting the per capita pure ethanol taken through the consumption of beer, is calculated based on population 14 years and older. Data on population and age structure of population are taken from the U.S. Census Bureau. Data on prisoners per 100,000 citizens, and the total number of full-time equivalent persons employed in police protection services per 100,000 citizens come from the Sourcebook of Criminal Justice Statistics (various years), U.S. Bureau of Justice Statistics, Regional Economic Accounts (state population various years), and U.S. Bureau of Economic Analysis.

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[28] The author is grateful to Paul R. Zimmerman, and Bruce L. Benson for very generously sharing their data from Zimmerman and Benson (2004).

Data on the unemployment rate, the percent of population living below the poverty rate, and the percent of population residing in metropolitan areas come from the Statistical Abstract of the United States of the U.S. Census Bureau. Data on total private SIC manufacturing wage and salary disbursements divided by total private SIC manufacturing employment come from Regional Economic Accounts.

Empirical Methodology

The empirical estimation is based on economics of crime approach introduced by Becker (1968). The aggregate supply of criminal offenses model, developed by Gymah-Brempong (2001), which is based on Becker (1968), Erlhich (1973) and Eide (1998), is used. The model asserts that criminal behavior depends positively on the benefit derived from criminal behavior while it depends negatively on cost of criminal behavior. The model assumes that alcohol consumption causes the consumer to either over-estimate the benefits or under-estimate the costs of criminal activity. Furthermore, the model assumes that the proportions of the population who consume alcohol are involved in crime either as the criminal or the victim of the criminal activity. In the model, per capita beer consumption levels reflect the effect the alcohol abuse which in turn facilitates criminal activity.

Equation (1) is the longitudinal model estimated:

$$\ln(Crime_{s,t}) = \alpha + \beta_1 X_{s,t} + \beta_2 Z_{s,t} + \eta_s + \iota_t + \varepsilon_{s,t} \qquad (1)$$

where subscripts *s* and *t* refer to state and time, respectively. State fixed effects, year fixed effects, and an idiosyncratic error term are denoted by $\eta_s, \iota_t, and\, \varepsilon_{s,t}$, respectively. Left hand side of the argument refers to crime measures, which are total crime rates and its components which are divided as violent crime rates or property crime rates. Dependent variable is the natural logarithm of crime rate, which refers to crime rate per 100,000 population. Violent crime and property crime rates are also divided into their sub-categories. Violent crime is composed of rape, robbery, aggravated assault and murder. Property crime is composed of motor vehicle theft, larceny theft, and burglary. *X* refers to variables of interest, which are natural log of alcohol per capita beer consumption. Therefore, since both sides of the equation are in natural logarithm form, coefficients of interest refer to elasticities. Vector *Z* consists of control variables. Lagged crime rates control for the learning curve and various other unobservable factors related to crime. Crime in the last period is a predictor of the crime in the current period. There are two variables pertaining to deterrent factors: number of police per 100,000 and number of prisoners per 100,000. Police is theoretically expected to be negatively correlated to crime rates since it is a deterrent factor. Nevertheless, because of the potential endogeneity of number of policy officers to crime rates, the estimated coefficient can be positive as well. The coefficient on the numbers of prisoners is expected to have a negative impact on crime rates for two reasons: first, it may be a deterrent factor since it can cause potential criminals to think that they will be incarcerated if they commit a crime; second, if criminals are in prison, they will evidently be incapacitated. Unemployment rate and poverty rate control for the opportunity cost of crime. That is, when unemployment rates and poverty rates are low, relative returns to criminal activities are low as well. Therefore, the expected sign on them is theoretically positive. Following Zimmerman and Benson (2007), consumer price index (CPI) adjusted hourly wage in the manufacturing sector (Low Wage) is used as the third measure of relative attractiveness of jobs in the legal sector. The reasoning behind using Low Wage instead of other measures of income is the fact that Low Wage seem to be more binding in comparison to other measures of income. For instance, Freeman (1996) finds that educational attainment is lower among criminals in comparison to non-criminals. The variable potentially less criminal populations, which is percentage of population above 65 years old plus percentage of population below 17, controls for demographic factors that can influence crime rates via supply of potential criminals. Furthermore, people between 15-65 both drink more and are more likely to be involved in criminal activities. Hence, controlling for such age group also controls for one of sources of endogeneity between drinking and crime. Furthermore, in rape regressions percentage of females between ages 15-21 is also controlled since this group of population is more likely to be rape victims. Percent of population living in metro areas controls for the impact of population density on crime rates.

Potential Endogeneity of Per Capita Beer Consumption to Crime Rates

Alcohol consumption may be endogenous to crime rates for different reasons: a criminal may drink alcohol before committing a crime to prepare himself psychologically in order to execute the crime; a criminal may drink alcohol before committing a crime in order to reduce the potential punishment associated with criminal activity; alcohol consumption and crime may be an outcome of a person's unobserved characteristics such as risky behavior; alcohol consumption may increase an offender's chances of getting caught. Mentioned factors can reduce the credibility of OLS estimates of the impact of per capita beer consumption on crime may on the causal relationship between crime and alcohol abuse. Therefore, in order to control the potential endogeneity between crime and per-capita beer consumption, an instrumental variable approach, in which excise beer taxes and some alcohol control policies are employed as instruments, is undertaken. CPI adjusted excise beer taxes, whether a state has DUI Administration Per Se Law, Minimum Drinking Age, whether a state has Keg registration Law, whether a state has Open Container Law, whether a state has server training laws, and whether a state has Youth Blood

Alcohol Content law are the utilized instruments. First stage F-test value, first state partial R-squared value and first stage F-test p-value is presented in the estimates. As it could be inferred from the first stage F-test, partial R-squared, and F-test p-values, the instruments employed are statistically significant predictors of per capita beer consumption. Table 4.8 presents the first stage estimates of determinants of beer consumption. The exogenous instruments are jointly significant at one percent level. Log of excise beer tax and server training law are statistically significant at one and five percent, respectively. The coefficients are also at the expected direction. The fact that instruments are statistically significantly correlated to per capita beer consumption satisfies one of the conditions for being valid instruments. The second condition for the instruments to be valid instruments is the exclusion restriction (i.e., instruments should not be correlated with the error term). In order to test the validity of the instruments an over-identification test, Hansen J. test, is undertaken. Tables pertaining to instrumental variables estimates present Hansen J. test, and Hansen J. test p-values. The null hypothesis is that instruments are uncorrelated with the error terms.

IV. Results

In all regressions state and year fixed effects are controlled for. In addition, all the standard errors are robust to arbitrary heteroskedasticity.

OLS Estimates

Table 4.2 presents the OLS estimates of total crime rates. The per capita beer consumption elasticity of crime rate is 0.123 and it is statistically significant at the one percent level. The coefficient on lagged crime rate is not presented. The coefficient on log of prisoners is negative and statistically significant at the five percent level. The coefficient on log of police is positive but not statistically significant. Likewise, the coefficients on unemployment rate and poverty rate are both small and statistically insignificant. Metropolitan rate is positively associated with crime and it is significant at the five percent level. Percent (under 17 + over 65) is negatively correlated to total crime rate and it is statistically significant at the one percent level. The coefficient on low wage is negative though it is not statistically significant at conventional levels.

Table 4.3 presents the OLS estimates of property crime and its components. The coefficient of log of per capita beer consumption is 0.130, 0.179 and 0.134 for property crime rate, burglary rate, and larceny rate and they each are statistically significant at the one percent level. The coefficient on motor vehicle theft rate is positive but not statistically significant. Control variables are close to those in total crime rate regression for which the results are presented in Table 4.2. The coefficients on log of prisoners and percent (under 17 + over 65) are statistically significant at conventional levels in each case.

Table 4.4 presents the OLS estimates of violent crime and its components. The coefficient on log of per capita beer is statistically significant only in column (4), in which robbery rate is the dependent variable. In all other cases the coefficient on per capita beer consumption is not statistically significant. The coefficients on metropolitan rate, percent (under 17 + over 65), and log of low wage is statistically significant in about 60 percent of the specifications. The coefficient on log of prisoners is statistically significant only in column (4), in which robbery rate is the dependent variable. Percent female 15-21 is positively and statistically significantly related rape rates.

OLS estimates show a positive relationship between per capita beer consumption and various crime types in general. However, for the reasons discussed earlier, OLS estimates may not reflect the causal relationship between per capita beer consumption and crime rates. Next, I present instrumental variable estimates of crime rates.

Instrumental Variables Estimates

Table 4.5 shows results for instrumental variable estimation of total crime rate. The coefficient on log of per capita beer consumption is 0.250, which is about twice as much as the coefficient in OLS estimations. Hence, a ten percent increase in per capita beer consumption leads to a 2.5 percent increase in total crime rate. Hansen J test p-value shows that the instruments are uncorrelated with the error terms.

Table 4.6 presents the results for instrumental variable estimates of property crime and its components. The property crime elasticity of per capita beer consumption is 0.253 and it is statistically significant at the ten percent level. The coefficient on burglary crime is positive but not statistically significant at conventional levels. The elasticity between larceny theft rate and per capita beer consumption is 0.335. That is, a ten percent increase in per capita beer consumption leads to a 3.35 percent increase in larceny theft rate. In column (4), which presents the estimation of motor vehicle theft rate, the coefficient on per capita beer consumption is both negative and statistically insignificant. Therefore, per capita beer consumption is statistically significantly related only to larceny theft rate among property crime types. Hansen J test values and first stage F-test values show that the instruments are valid instruments.

Table 4.7 presents the results for instrumental variable estimates of violent crime and its components. In violent crime regressions, the coefficient on per capita beer consumption is only statistically significant in two cases: in estimations of rape rates and robbery rates. The coefficient is not statistically significant in estimations of violent crime, murder rate, and aggravated assault rates. The rape rate elasticity of per capita beer consumption is 0.719 (i.e., a 10 percent increase in per-capita beer consumption leads to a 7.19 percent increase in rape rates). The robbery rate elasticity of per capita beer consumption is 0.564 (i.e., a ten percent increase in per capita beer consumption leads to a 5.64 percent increase in robbery rates).

V. Discussion and Conclusion

These results show that alcohol abuse has a positive impact on crime rates. However, the effect is not uniform among different crime types. In general the coefficient on per capita beer consumption is larger in violent crime regressions in comparison to property crime types. These results are consistent with Grossman and Markowitz (1998) and (2000). Hence, increases in beer sales cause an increase in criminal activity.

When it comes to interpreting whether these results are plausible, a careful approach should be undertaken. That is, in interpreting the meaningfulness of these estimates, nature of data and its limitations, and nature of particular crime types should be taken into consideration. Considering that property crime has three subcomponents and violent crime has four subcomponents, the coefficient on per capita beer consumption is only statistically significant in three cases: larceny theft rate; rape rate; and robbery rate. The theoretical relationship between rape rate and alcohol abuse is more apparent than the other crime types. That is, most rape incidences include victim offender interaction and both the victim and offender may be under the influence of alcohol. The theoretical relationship between alcohol consumption and crime is not very apparent in the cases of larceny theft rate and robbery rate.

A careful reading of these results suggests interesting patterns with respect to the alcohol abuse and crime relationship. In property crime regressions, alcohol abuse seems to affect a less organized crime type, larceny theft rate, in comparison burglary rate and motor vehicle theft rate.

Apparently, larceny theft requires less of an organization than burglary and mother vehicle theft and it is subject to less severe punishment in comparison to burglary. Therefore, with respect to property crime types, the role of alcohol is more pronounced when the severity of crime is lower. These results do not exclude a possible relationship between crime types that requires higher level or organization and alcohol abuse. These results show that alcohol control policies can be effective tools in reducing less severe property crime types while they may not be effective policy tools to reduce burglary rate and motor vehicle theft rate. In violent crime regressions, the relationship between alcohol abuse and crime is more pressing for less violent crime types (i.e., per capita beer consumption is not statistically significantly related to murder rates). As is documented by Zimmerman and Benson (2007), the relationship between alcohol abuse and rape is positive and significant. The fact that the coefficient on the robbery rate is larger in comparison, the coefficient on aggravated assault rate may raise questions with respect to the credibility of these estimates since robbery seem to require more organization in comparison to aggravated assault. One possible explanation supporting the findings of this research is that when aggravated assault and larceny theft occur together, the executed crime is classified as robbery (Uniform Crime Reports 2000). Hence, it is likely that measurement error with respect to robbery and aggravated assault may affect the magnitudes and statistical significance of the coefficients. Similar to the property crime, alcohol control policies may be effective tools in reducing some violent crime types, which are rape, robbery and aggravated assault, but not murder.

Table 4.1: Descriptive Statistics

Variable	(1)
Total crime rate	4783.6
	(1280.836)
Property crime rate	4295.928
	(1097.301)
Burglary rate	1015.524
	(367.1607)
Larceny theft rate	2872.495
	(687.0186)
Motor vehicle theft rate	407.9096
	(218.5896)
Violent crime rate	487.6722
	(254.6622)
Murder rate	6.4093
	(3.5306)
Rape rate	35.6634
	(13.1191)
Robbery rate	142.3363
	(105.8607)
Aggravated assault rate	303.2604
	(160.6062)
Prisoners	257.4348
	(130.5488)
Police	260.4598
	(50.5408)
% Unemployment	5.8141
	(2.0438)
% Poverty	13.2512
	(4.0932)
% Metro	65.5824
	(21.7579)
% population under17 + above 65	40.171
	(2.5015)
Log of low wage	3.3182
	(0.2619)
% Males Ages 18-29	9.1895
	(1.1673)
% Males Ages 40-60	11.358
	(1.2456)
% Females Ages 15-21	5.1419
	(0.5636)
Observations	864

Standard deviations in parentheses.

Table 4.2: Fixed Effects Estimate of Total Crime Rate

VARIABLES	(1) Total Crime Rate
Log of per capita beer consumption	0.123***
	(0.0424)
Log of prisoners	-0.0494**
	(0.0185)
Log of Police	0.0277
	(0.0472)
Unemployment rate	0.000189
	(0.00207)
Poverty Rate	-0.00127
	(0.000993)
Metropolitan Rate	0.00159**
	(0.000787)
Percent (under 17 + over 65)	-0.00996***
	(0.00276)
Log of low wage	-0.0450
	(0.0375)
Observations	912
Number of states	48
R-squared	0.867

Note: Dependent variable is log of total crime rate. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4.3: Fixed Effects Estimates of Property Crime and its Components

VARIABLES	(1) Property	(2) Burglary	(3) Larceny	(4) M-vehicle
Log of per capita beer consumption	0.130***	0.179***	0.134***	0.0897
	(0.0430)	(0.0579)	(0.0475)	(0.0890)
Log of prisoners	-0.0535***	-0.0619**	-0.0431**	-0.113***
	(0.0184)	(0.0265)	(0.0179)	(0.0381)
Log of Police	0.0301	0.0151	0.0788*	-0.115
	(0.0467)	(0.0634)	(0.0458)	(0.0974)
Unemployment rate	0.000555	0.00558**	3.52e-05	-0.00586
	(0.00207)	(0.00251)	(0.00199)	(0.00408)
Poverty Rate	-0.00146	-0.00144	-0.00136	-0.00305*
	(0.00107)	(0.00135)	(0.00115)	(0.00165)
Metropolitan Rate	0.00129*	0.000941	0.000985	0.00489**
	(0.000766)	(0.000742)	(0.000799)	(0.00183)
Percent (under 17 + over 65)	-0.0102***	-0.0171***	-0.00676*	-0.0176***
	(0.00282)	(0.00314)	(0.00354)	(0.00633)
Log of low wage	-0.0405	-0.0138	-0.0561	-0.0644
	(0.0391)	(0.0573)	(0.0356)	(0.0955)
Observations	912	912	912	912
R-squared	0.867	0.924	0.824	0.844
Number of states	48	48	48	48

Note: Dependent variable is log of crime rate labeled in each column. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.4: Fixed Effects Estimates of Violent Crime and its Components

VARIABLES	(1) Violent	(2) Murder	(3) Rape	(4) Robbery	(5) Assault
Log of per capita beer consumption	0.107	-0.0403	0.0753	0.236**	0.0828
	(0.0685)	(0.229)	(0.0966)	(0.112)	(0.0828)
Log of prisoners	-0.0130	-0.143	0.0323	-0.0759*	0.00270
	(0.0252)	(0.0876)	(0.0315)	(0.0431)	(0.0298)
Log of Police	-0.00591	0.130	-0.0727	-0.0713	0.0625
	(0.0880)	(0.195)	(0.0966)	(0.106)	(0.0974)
Unemployment rate	-0.00191	-0.0122	-0.000937	-0.000523	-0.00356
	(0.00344)	(0.00894)	(0.00351)	(0.00559)	(0.00486)
Poverty Rate	0.000314	-0.000706	0.00170	0.00164	-0.000544
	(0.00140)	(0.00473)	(0.00201)	(0.00243)	(0.00190)
Metropolitan Rate	0.00489***	-0.00421	0.000735	0.00368**	0.00543**
	(0.00156)	(0.00377)	(0.00161)	(0.00148)	(0.00204)
Percent (under 17 + over 65)	-0.00932*	-0.0318**	-0.0398***	-0.0173***	-0.00227
	(0.00538)	(0.0154)	(0.0134)	(0.00638)	(0.00785)
Log of low wage	-0.163**	0.196	-0.0662	-0.00658	-0.197**
	(0.0644)	(0.239)	(0.122)	(0.102)	(0.0897)
Yfemale			0.0767***		
			(0.0239)		
Observations	912	912	912	912	912
R-squared	0.817	0.328	0.748	0.749	0.779
Number of states	48	48	48	48	48

Note: Dependent variable is log of crime rate labeled in each column. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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Table 4.5: Instrumental Variable Estimation of Total Crime Rate

VARIABLES	(1) Total Crime Rate
Log of per capita beer consumption	0.250*
	(0.140)
Log of prisoners	-0.0543***
	(0.0151)
Log of Police	0.00842
	(0.0387)
Unemployment rate	0.00272
	(0.00241)
Poverty Rate	-0.000980
	(0.00104)
Metropolitan Rate	0.000955
	(0.000864)
Percent (under 17 + over 65)	-0.00928**
	(0.00377)
Log of low wage	-0.0368
	(0.0424)
Observations	869
Number of states	48
R-squared	0.860
Hansen J Test	2.460
Hansen J P-value	0.873
1st F-test	11.03
1st p-value	0.000
1st partial R2	0.084

Note: Dependent variable is log total crime rate. Hansen J test p-value refers to whether are correlated with the error term (i.e. the null hypothesis is that the instruments are uncorrelated with the error terms). 1st F-test pertains to the first stage F-test value. 1st p-value pertains to the p value of the first stage F-test. 1st partial R2 pertains to the partial R-squared. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.6: Instrumental Variable Estimates of Property Crime and its Components

VARIABLES	(1) Property	(2) Burglary	(3) Larceny	(4) M-vehicle
Log of per capita beer consumption	0.253*	0.214	0.335**	-0.0677
	(0.142)	(0.175)	(0.160)	(0.227)
Log of prisoners	-0.0595***	-0.0640***	-0.0475***	-0.135***
	(0.0155)	(0.0195)	(0.0156)	(0.0350)
Log of Police	0.0100	-0.00117	0.0591	-0.107
	(0.0386)	(0.0571)	(0.0402)	(0.0875)
Unemployment rate	0.00310	0.00613*	0.00363	-0.00541
	(0.00248)	(0.00317)	(0.00261)	(0.00438)
Poverty Rate	-0.00119	-0.00126	-0.000978	-0.00366
	(0.00106)	(0.00131)	(0.00111)	(0.00225)
Metropolitan Rate	0.000655	0.000695	0.000136	0.00460**
	(0.000876)	(0.00101)	(0.000978)	(0.00194)
Percent (under 17 + over 65)	-0.00964**	-0.0167***	-0.00545	-0.0224***
	(0.00385)	(0.00477)	(0.00425)	(0.00710)
Log of low wage	-0.0336	-0.0141	-0.0433	-0.0824
	(0.0433)	(0.0497)	(0.0459)	(0.0779)
Observations	869	869	869	869
R-squared	0.860	0.922	0.817	0.842
Number of states	48	48	48	48
Hansen J Test	2.276	9.635	4.339	8.366
Hansen J P-value	0.893	0.141	0.631	0.213
1st F-test	10.83	10.55	9.89	16.32
1st p-value	0.000	0.000	0.000	0.000
1st partial R2	0.084	0.087	0.074	0.116

Note: Dependent variable is log of the crime rate labeled in each column. Hansen J test p-value refers to whether are correlated with the error term (i.e. the null hypothesis is that the instruments are uncorrelated with the error terms). 1st F-test pertains to the first stage F-test value. 1st p-value pertains to the p value of the first stage F-test. 1st partial R2 pertains to the partial R-squared. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.7: Instrumental Variable Estimates of Violent Crime and its Components

VARIABLES	(1) Violent	(2) Murder	(3) Rape	(4) Robbery	(5) Assault
Log of per capita beer consumption	0.288	-0.247	0.719**	0.564**	0.195
	(0.194)	(0.470)	(0.313)	(0.276)	(0.248)
Log of prisoners	-0.00621	-0.164***	0.0770**	-0.0801***	0.00742
	(0.0231)	(0.0632)	(0.0308)	(0.0309)	(0.0294)
Log of Police	-0.0346	0.166	-0.176*	-0.124	0.0449
	(0.0858)	(0.177)	(0.104)	(0.100)	(0.109)
Unemployment rate	0.000280	-0.0116	0.00638	0.00483	-0.00272
	(0.00350)	(0.0105)	(0.00514)	(0.00494)	(0.00441)
Poverty Rate	0.000808	-0.000365	0.00200	0.00237	0.000149
	(0.00167)	(0.00498)	(0.00265)	(0.00260)	(0.00218)
Metropolitan Rate	0.00423***	-0.00378	-0.00113	0.00222	0.00482***
	(0.00145)	(0.00403)	(0.00208)	(0.00196)	(0.00178)
Percent (under 17 + over 65)	-0.00715	-0.0402**	-0.0271*	-0.0138	-0.000699
	(0.00622)	(0.0170)	(0.0144)	(0.00888)	(0.00874)
Log of low wage	-0.139*	0.134	0.00285	0.00257	-0.163
	(0.0818)	(0.211)	(0.122)	(0.0960)	(0.103)
Yfemale			0.0856***		
			(0.0219)		
Observations	869	869	869	869	869
R-squared	0.814	0.329	0.723	0.748	0.778
Number of states	48	48	48	48	48
Hansen J Test	14.65	3.533	0.769	8.816	17.36
Hansen J P-value	0.0232	0.740	0.993	0.184	0.00805
1st F-test	12.55	12.01	9.85	10.58	12.72
1st p-value	0.000	0.000	0.000	0.000	0.000
1st partial R2	0.094	0.095	0.085	0.086	0.096

Note: Dependent variable is log of the crime rate labeled in each column. Hansen J test p-value refers to whether are correlated with the error term (i.e., the null hypothesis is that the instruments are uncorrelated with the error terms). 1^{st} F-test pertains to the first stage F-test value. 1^{st} p-value pertains to the p value of the first stage F-test. 1^{st} partial R2 pertains to the partial R-squared. Controls for state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4.1: First Stage Estimation of Log of Per Capita Beer Consumption

	(1)
Log of excise beer tax	-0.100***
	(0.0373)
Administration Per Se Law	-0.00686
	(0.00858)
Drinking Age	-0.00203
	(0.00628)
Key Registration Law	-0.0162
	(0.0209)
Open Container Law	0.00715
	(0.0126)
Server Training Law	-0.0257**
	(0.0111)
Youth BAC Law	-0.0111
	(0.00808)
Observations	869
Number of states	48
R-squared	0.621
F-test p-vale	0.001

Note: Dependent variable is the log of per capita beer consumption. F-test p-value pertains to the joint significance of exogenous instruments. Controls for all the control variables in the estimated specifications, state fixed effects, year dummies, and a constant term. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix 1: Alcohol Consumption Data Information for Essay II

"Estimated amount of pure ethanol in liters of total alcohol, and separately beer, wine and spirits consumed per adult (15 years and older) in the country during a calendar year, as calculated from official statistics on production, sales, import and export, taking into account stocks whenever possible. Conversion factors used to estimate amount of pure alcohol in (barley) beer is 5.0%, wine 12% and spirits 40% of alcohol (other conversion factors were used for some types of beer and other beverages). Data are collected and calculations made mainly using three sources: FAOSTAT - United Nations Food and Agriculture Organization`s Statistical Database, World Drink Trends, regularly published by Produktschap voor Gedistilleerde Dranken (Netherlands) and in some cases direct government data. Data is available for most countries of the world since 1961 onwards. Data is presented for the groups of total, and also beer, wine and spirits separately. The category beer includes data on barley, maize, millet and sorghum beer combined. Please note that the amounts from beer, wine and spirits do not necessarily add up to the presented total, as in some cases the total includes other beverage categories, such as palm wine, vermouths, cider, fruit wines etc.

It is important to note that these figures comprise in most cases of the recorded alcohol consumption only and have some inherent problems. Factors which influence the accuracy of per capita data are: informal production, tourist and overseas consumption, stockpiling, waste and spillage, smuggling, duty-free sales, variation in beverage strength and the quality of the data whereupon it is based. In some countries there exists a significant unrecorded alcohol consumption that should be added for a comprehensive picture of total alcohol consumption".[29]

[29] Copied from WHO alcohol database.

References

Acemoglu, D., & S. Johnson. (2007). Disease and development: the effect of life expectancy on economic growth. *Journal of Political Economy*, December (115), 925-985.

Arellano, M., & S. Bond, (1991). Some tests of specification for panel data: Monte Carlo evidence with an application for employment equations. *Review of Economic Studies*, 58(2), 277-97.

Arellano, M., & O. Bover. (1995). Another look at the instrumental variable estimation of error-component models. *Journal of Econometrics*, 68(1), 29-51.

Babor, Thomas, R. Caetano, S. Casswell, G. Edwards, N. Giesbrecht, K. Graham, J. Grube, P. Gruenewald, L. Hill, H. Holder, R. Homel, E. Osterberg, J. Rehm, R. Room, I. Rossow. (2003). Alcohol: no ordinary commodity. Research and Public Policy. Oxford: *Oxford University Press*.

Baker, D.B. (1985). The study of stress at work. *Annual Review of Public Health*, 6, 367–381.

Barker, Felicity. (2002). Consumption externalities and the role of government: The case of alcohol. New Zealand Treasury Working Paper 02/25.

Beck, T., R. Levine, & N. Loayza. (2000). Finance and the sources of growth. *Journal of Financial Economics*, 58(1,2), 261-300.

Beck, T & R. Levine. (2002). Industry growth and capital allocation: Does having a market- or bank-based system matter. *Journal of Financial Economics*, 64(2), 147-180.

Berger, D. E., & Snortum, J. R. (1985). Alcoholic beverage preferences of drinking-driving violators. *Journal of Studies on Alcohol* 46 (3), 232-39

Berger, M.C. & J.P. Leigh. (1988). The effect of alcohol use on wages, *Applied Economics* 20, 1343-1351.

Blum, T.C., Roman, P.M., & Martin, J.K., (1993). Alcohol consumption and work performance. *Journal of Studies on Alcohol* 54:61-70.

Bray, J.W. (2005). Alcohol use, human capital, and wages. *Journal of Labor Economics,* 23 (2):279-312.

Brenner, M.H., & Mooney, A. (1983). Unemployment and health in the context of economic change. *Social Science Medicine* 17 (16), 1125–1138.

Bruun, K., Edwards, G., Lumio, M., Makela, K., Pan, L., Popham, R.E., Room, R., Schmidt, W., Skog, O., Sulkunen, P., & Sterberg, E. (1975). Alcohol Control Policies in Public Health Perspective (Aurasen Kirjapaino, Forssa, Finland).

Centers for Disease Control and Prevention (2004). In WISQARS Fatal Injuries: Mortality Reports. Retrieved December 1, 2009 from http://webappa.cdc.gov/sasweb/ncipc/mortrate.html.

Chaloupka, F. J. & Weschler, H. (1996). Binge drinking in college: the impact of price, availability and alcohol control policies, *Contemporary Economic Policy*, XIV, 112–24.

Chatterji P., DeSimone, J., 2006. High school alcohol use and young adult labor market outcomes, NBER Working Papers 12529

Chesson, H., Harrison, P., & Kassler, W. J. (2000). Sex under the influence: The effect of alcohol policy on sexually transmitted disease rates in the United States, *Journal of Law and Economics* April, vol. XLIII.

Collins, D.J. & Lapsley, H.M. (1996), The social costs of drug abuse in Australia in 1988 and 1992, *National Drug Strategy Monograph Series,* No. 30

Cook, P. J. (2007). Paying the tab: The costs and benefits of alcohol control. Princeton: Princeton University Press

Cook, P. J., & Moore, M. J. (2002). The economics of alcohol abuse and alcohol control policies, *Health Affairs*, 21(2), 120-133.

Cook, P.J. & Moore, M.J. (1994). This tax's for you, *National Tax Journal* (September) 559-573.

Cook, P. J., & Moore, M. (1993a). Violence reduction through restrictions on alcohol availability, *Alcohol, Health, and Research World*, 17, 148–54.

Cook, P. J., & Moore, M. (1993b). Economic perspectives on reducing alcohol-related violence, in alcohol and interpersonal violence: Fostering multidisciplinary perspectives, (Eds) Susan E. Martin, National Institute on Alcohol Abuse and Alcoholism Research Monograph 24, US Government Printing Office, Washington DC.

Cook, P. J., & Bethany Peters. (2005). The myth of the drinker's bonus, NBER Working Papers 11902

Cook, P.J. & G. Tauchen. (1982). The effect of liquor taxes on heavy drinking, *Bell Journal of Economics* 13(2):379-390.

Dee, T.S. (2001). Alcohol abuse and economic conditions: evidence from repeated cross-sections of individual-level data. *Health Economics*, 10 (3), 257–270.

Edwards, G., Anderson, P., & Babor, T. F., (1994). Alcohol policy and the public good. New York: Oxford University Press.

Ettner, S.L. (1997). Measuring the human cost of a weak economy: Does unemployment lead to alcohol abuse? *Social Science Medicine* 44 (2), 251–260.

Fenwick, R., & Tausig, M. (1994). The macroeconomic context of job stress. *Journal of Health and Social Behavior,* 35 (3), 266–282.

Freeman, R. B. (1996). Why do so many young American men commit crimes and what might we do about it? *Journal of Economic Perspectives* 10 (Winter), 25-42

Freeman, D.G. (1999). A note on economic conditions and alcohol problems. *Journal of Health Economics* 18 (5), 661–670.

French, M.T. & G.A. Zarkin. (1995). Is moderate alcohol use related to wages? Evidence from four worksites. *Journal of Health Economics* 14(3):319-344.

Greenfeld, L. (1998). Alcohol and crime: An analysis of national data on the prevalence of alcohol involvement in crime. NCJ #168632, April.

Greenfield, T. K., & Rogers, J. D. (1999). Who drinks most of the alcohol in the U.S.? The policy implications. *Journal of Studies on Alcohol*, 60(1), 78-89. (B762)

Greenfield, T. K., & Rogers, J. D. (1999). Alcoholic beverage choice, risk perception, and self-reported drunk driving: effects of measurement on risk analysis. *Addiction*, 94(11), 1735-1743. (B847)

Gronbaek, M. (2001). Factors influencing the relation between alcohol and mortality-with focus on wine. *Journal of Internal Medicine*, 250, 291-308

Grossman, M., & Markowitz, S. (1998). Alcohol regulation and domestic violence towards children, *Contemporary Economic Policy*, 16, No. 3, 309-320.

Grossman, M., & Markowitz, S. (2000). Effects of beer taxes on domestic child abuse, *Journal of Health Economics*, 19, 271–82.

Grossman, M., Chaloupka, Frank J., & Sirtalan, I. (1998). An empirical analysis of alcohol addiction: Results from the Monitoring the Future Panels. *Economic Inquiry*, 36(1), 39–48.

Grossman, M., Kaestner, R., & Markowitz, S. (2004). An investigation of the effects of alcohol policies on youth STDs, *National Bureau of Economic Research* Working Paper 10949

Gruber, J., (2005). Public finance and public policy, First Edition. New York: Worth Publishers

Gruenewald, P. J., Maddison, P. & Janes, K. (1992). Alcohol availability and the formal power of and resources of state alcohol beverage control agencies, *Alcoholism: Clinical and Experimental Research*, 16, 591–7.

Gruenewald, P. J., Ponicki, W. R. & Holder, H. D. (1993). The relationship of outlet densities to alcohol consumption: A time series cross-sectional analysis, *Alcoholism: Clinical and Experimental Research*, 17,38–47.

Gyimah-Brempong, K. (1997) Crime and race in the US: what is the connection?, in "Race, markets and social outcomes (Eds) Patrick Mason and Rhonda Williams, Kluwer Publishers, New York.

___________. (2001). Alcohol availability and crime: evidence from census tract data, *Southern Economic Journal*, 68, 2–21.

Gyimah-Brempong, K., & Racine, J. (2006). Alcohol availability and crime: a robust approach. *Applied Economics*, 2006, 38, 1293–1307.

Homel, R., Tomsen, S. & Thommeny, J. (1992). Public drinking and violence: not just an alcohol problem, *Journal of Drug Issues*, (Summer), 679–97.

Hamilton, V., & Hamilton, B. (1997) Alcohol and earnings: Does drinking yield a wage premium? *Canadian Journal of Economics*, 30 (1), 135-151

Harwood, H.J., D.M. Napolitano, P.L. Kristiansen & J.J. Collins, eds. (1984). Economic costs to society of alcohol and drug abuse and mental illness: (Research Triangle Institute, Research Triangle Park, NC).

Hilton, M.E., & W.B. Clark. (1987). Changes in American drinking patterns and problems, 1967-1984, *Journal of Studies on Alcohol* 48(6):515-522.

Hingston, R., & Winter, M. (2003). Epidemiology and consequences of drinking and driving. *Alcohol Research and Health*, 27(1), 63-78.

Hoffmeister H, FP Schelp, GB Mensink, E Dietz & D Bohning, (1999). The relationship between alcohol consumption, health indicators and mortality in the German population *International Journal of Epidemiology*, Vol 28, 1066-1072.

Johansson, E., Böckerman, P. & Uutela, A. (2009), Alcohol consumption and sickness absence, evidence from micro-data. *European Journal of Public Health* 19(1):19-22

Kaestner, R. (1991) The effect of illicit drug use on the wages of young adults, *Journal of Labor Economics*, 9, (4), 381-412

Kalemli-Ozcan, S. (2002). Does the mortality decline promote economic growth? *Journal of Economic Growth*, 7(4), 311-349.

Kalemli-Ozcan, S., Ryder H. E., & Weil, D. (2000). Mortality decline, human capital investment, and economic growth, *Journal of Development Economics*, Vol. 62, 1-23.

Karasek, R.A., & Theorell, T., (1990). Healthy work: Stress, productivity, and the reconstruction of working life. Basic Books, New York.

Kenkel, D.S. & P. Wang (1998), Are alcoholics in bad jobs? National Bureau of Economic Research Working Paper 6401. Published in “The economic analysis of substance use and abuse. Chaloupka, Frank J., Michael Grossman, Warren K. Bickel, & Henry Saffer, eds., Chicago: The University of Chicago Press, 1999, pp.251-278.

Klatsky, A. L. (2002). Alcohol and cardiovascular diseases: A historical overview. *Annals of the New York Academy of Sciences*, 957, 7-15.

Lang, A. R. & Sibrel, P. A. (1989). Psychological perspectives on alcohol consumption and interpersonal aggression: the potential role of individual differences in alcohol-related criminal violence, *Criminal Justice and Behavior*, 16, 299–324.

Lehman, W. E. K., & Simpson, D. D. (1992). Employee substance use and on-the-job behaviors. *Journal of Applied Psychology*, *77*,309-321.

Levine, R., N. Loayza, & T. Beck. (2000). Financial intermediation and growth: Causality and causes, *Journal of Monetary Economics,* 46(1), 31-77.

Levitt, Steven D. & Porter, J. (2001). How dangerous are drinking drivers? *Journal of Political Economy*, V. 109, n.61: 1198-1237.

Manning, W, G., Emmet B. Keeler, J. P. Newhouse, E., M. Sloss, & Wasserman J. (1989). The taxes of Sin. Do smokers and drinkers pay their way? *Journal of the American Medical Association*, 261: 1604-1609.

Markowitz, Sara. (2005). Alcohol, drugs, and violent crime. *International Review of Law and Economics*, 25:1, 20-44.

Markowitz, S. Chatterji, P. Kaestner, R., & Dave, D. (2004). Alcohol abuse and suicide attempts among youth, *Economics of Human Biology*, 2:2 159-180.

Markowitz, S., & Chatterji, P. (2001). The impact of maternal alcohol and marijuana use on children's behavioral problems, *Journal of Health Economics*, 20, No. 5, 703-731.

Markowitz, Sara. (2000). The price of alcohol, wife abuse and husband abuse, *Southern Economic Journal*, 67, No. 2 (October 2000), 279-303.

Markowitz, S., Kaestner, R., & Grossman, M. (2005). An investigation of the effects of alcohol consumption and alcohol policies on youth risky sexual behaviors, *American Economic Review*, 95(2), 263–266.

McDonald, Z. & Shields, M. A. (2001). The impact of alcohol consumption on occupational attainment in England. *Economica*, 68, 455–463.

Midanik, L., (1982). The validity of self reported alcohol consumption and alcohol problems: A literature review. *British Journal of Addiction* 77, 357-82.

Millar, A. B. & Gruenewald, P. J. (1997). Use of spatial models for community program evaluation of changes in alcohol outlet distribution, *Addiction*, 92 (Supplement 2), S292–S283.

Moore, M. & Cook, P. (1995). Habit and heterogeneity in the youthful demand for alcohol NBER Working Paper No. 5152, NBER, Cambridge, MA.

Murray C. J. L., & Lopez A. D. (1996). The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020". Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank (Global Burden of Disease and Injury Series, Vol. I).

New Mexico Department of Health Report (2001).

NIAAA, (2000). Estimates of the economic costs of alcohol abuse in the United States: Estimates, update methods, and data. Retrieved November 2007 from. http://pubs.niaaa.nih.gov/publications/economic-2000/index.htm.

National Institute on Alcohol Abuse and Alcoholism (2003). 2001-2002 National epidemiologic survey on alcohol and related conditions (NESARC). Bethesda, MD.

Norström T. (2006). Per capita alcohol consumption and sickness absence. *Addiction*, 110, 1421-1427.

Parker, R. N. (1995) Bring the ‘booze’ back in: the relationship between alcohol and homicide, *Journal of Research in Crime Delinquency*, 32, 3–38.

Parker, R. N. & Cartmill, R. S. (1998). Alcohol and homicide in United States 1934–1995 or one reason why US rates on violence may be going down, *The Journal of Criminal Law and Criminology*, 88, 1369–98.

Parry I. W.H., Laxminarayan, R., & West, S. E. (2006). Fiscal and externality rationales for alcohol taxes. Resources for the Future, (Discussion Paper)

Per capita alcohol consumption, based on alcohol sales data for the United States. Retrieved May 15, 2007 from http://www.niaaa.nih.gov/Resources/DatabaseResources/QuickFacts/AlcoholSales/default.htm

Peters, B. L. (2004). Is there a wage bonus from drinking? Unobserved heterogeneity examined. *Applied Economics*, 36, (20), 2299 – 2315.

Pierce, R.S., Frone, M.R., Russell, M., & Cooper, M.L. (1994). Relationship of financial strain and psychosocial resources to alcohol use and abuse: the mediating role of negative affect and drinking motives. *Journal of Health and Social Behavior,* 35 (4), 291–308.

Quamrul H. A., Lester, A., & Weil, D. N. (2008). When does improving health raise GDP? *NBER Macroeconomics Annual*.

Racine, J. & Li, Q. (2004). Nonparametric estimation of regression functions with both categorical and continuous data, *Journal of Econometrics*, 119, 99–130.

Rehm, J., (1998). Measuring quantity, frequency, and volume of drinking. *Alcoholism: Clinical and Experimental Research,* 22 (2), 4S-14S.

Rehm, J., Gmel, G., Sempos, C. T., & Trevisan, M. (2003). Alcohol-related morbidity and mortality. *Alcohol Research and Health,* 27 (1), 39-51.

Rehm J., Greenfield, T. K., & Rogers, J. D. (2001). Average volume of alcohol consumption, patterns of drinking, and all-cause mortality: results from the U.S. National Alcohol Survey. *American Journal of Epidemiology* 153, (1), 64-71.

Rehm J., Gutjahr, E., & Gmel, G. (2001). Alcohol and all-cause mortality: a pooled analysis. *Contemporary Drug Problems,* 28 (3), 337-62.

Rice, D.P., S. Kelman, L.S. Miller & S. Dunmeyer. (1990). The economic costs of alcohol and drug abuse and mental illness: 1985, Report submitted to the Office of Financing and Coverage Policy of the Alcohol, Drug Abuse, and Mental Health Administration, (US

Department of Health and Human Services, Institute for Health & Aging, University of California, San Francisco).

Rioja, F. and Valev, N. (2004). Finance and the sources of growth at various stages of economic development, *Economic Inquiry* 42(1), 27-40.

Roodman, D. 2005. xtabond2: Stata module to extend xtabond dynamic panel data estimator. Center for Global Development, Washington. http://econpapers.repec.org/software/bocbocode/s435901.htm

Rosenbaum, D.P.; S.F. Bennett; B.D. Lindsay; D.L. Wilkinson; B.D. Davis; C. Taranowski; & P.J. Lavrakas. (1992). Executive summary: The Community responses to drug abuse national demonstration program final process report. Chicago, Ill.: Center for Research in Law and Justice, University of Illinois.

Ruhm, Christopher J. & Black, William E. (2002). Does drinking really decrease in bad times? *Journal of Health Economics* 21, 659-678.

Ruhm, Christopher J. (1995). Economic conditions and alcohol problems, *Journal of Health Economics*, Vol. 14, No. 5, pp. 583-603.

Saffer, H. & Chaloupka, F. (1995). The demand for illicit drugs, NBER Working Paper No. 5238.

Sarbaum, J. K., S. W. Polachek, & N. E. Spear. (1999). The effects of price changes on the consumption of alcohol in alcohol experienced rats. The economic analysis of substance use and abuse: An integration of econometric and behavioral analysis. Chicago, University of Chicago Press.

Scribner, R. A., MacKinnon, D. P. & Dwyer, J. H. (1995). The risk of assaultive violence and alcohol availability in Los Angeles county, *American Journal of Public Health*, 85, 335–338.

Scribner, R., Cohen, D., Kaplan, S. & Allen, S. (1999). Alcohol availability and homicide in New Orleans: conceptual considerations for small area analysis of the effect of alcohol outlet density, *Journal of Studies on Alcohol*, 60, 310–6.

Skog, O-J. (1980). Social interaction and the distribution of alcohol consumption, *Journal of Drug Issues* (Winter), 71-92.

Skog, O-J. (1985). The collectivity of drinking cultures: A theory of the distribution of alcohol consumption, *British Journal of Addiction* 80:83-99.

Skog, O.-J., (1986). An analysis of divergent trends in alcohol consumption and economic development, *Journal of Studies on Alcohol* 47, 19–25.

Skog, O-J, & Z. Elekes. (1993). Alcohol and the 1950-90 Hungarian suicide trend - Is there a causal connection? *Acta Sociologica* 36:33-46.

Sloan, F.A., Reilly, B.A., & Schenzler, C. (1995). Effects of tort liability and insurance on heavy drinking and drinking and driving. *Journal of Law and Economics* 38, 49–78.

Smith G. S., Branas C. C., & Miller T. R., (1999) Fatal nontraffic injuries involving alcohol: A meta-analysis. *Annals of Emergency Medicine* 33, 5, 659-68.

Sokejima, S., & Kagamimori, S., (1998). Working hours as a risk factor for acute myocardial infarction in Japan: a case-control study. *The British Medical Journal* 317 (19), 775–780.

Stitt, B. G. & Giacopassi, D. J. (1992) Alcohol availability and alcohol-related crime, *Criminal Justice Review*, 17, 268–79.

Tekin, E. (2004). Employment, wages, and alcohol consumption in Russia, *Southern Economic Journal*, 71(2), 397-417.

Thun, M. J., Peto, R., Lopez, A. D., Monaco, J. H., Henley, S. J., Heath, C. W. Jr., & Doll, R., (1997). Alcohol consumption and mortality among middle-aged and elderly U.S. adults. *New England Journal of Medicine* 337 (24), 1705-14.

Tomljanovic, M., (2004). The Role of Fiscal Policy in State Economic Growth. *Contemporary Economic Policy*, 22 (3), 318-330.

Traynor, Thomas L. (2005). The impact of driver alcohol use on crash severity: A crash specific analysis. Transportation Research: Part E: *Logistics and Transportation Review*, 41, (5), pp. 421-37.

U.S. Department of Health and Human Services Report (2000). The economic costs of alcohol abuse in the United States. Retrieved July 17, 2008 from http://pubs.niaaa.nih.gov/publications/economic-2000/index.htm.

Valdez, A. C., Kaplan, C. D., Curtis Jr, R. L. & Yin, Z. (1995). Illegal drug use, alcohol and aggressive crime among Mexican Americans and white male arrestee in San Antonio, Journal of Psychoactive Drugs, 27, 135–43.

Van Oers, J. A. & Garretsen, H. F. (1993). The geographic relationship between alcohol use, bars, liquor shops and traffic injuries in Rotterdam, *Journal of Studies of Alcohol*, 54, 739–44.

Weisner, C., (2001). The provision of services for alcohol problems: a community perspective for understanding access. *Journal of Behavioral Health Services and Research*, 28, 130-42.

West, R., Wilding, J., ,French, D., Kemp, R., & Irving, A., (1993). Effect of low and moderate doses of alcohol on driving hazard perception latency and driving speed. *Addiction*, 88 (4), 527–532.

Winton, M., Heather, N., & Robertson, I., (1986). Effects of unemployment on drinking behavior: a review of the relevant evidence. *The International Journal of Addictions* 21 (12), 1261–1283.

Windmeijer, F. (2005) A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics*, 126 (1), 25-51.

World Bank Financial Structure and Economic Development Data Base, updated (2005). Retrieved May 16, 2006 from http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20699076~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

WHO International Alcohol Consumption Data. Retrieved May 10, 2006 from http://www3.who.int/whosis/menu.cfm?path=whosis,alcohol,alcohol_apc&language=english

WHO. 1999 - World Health Report.

WHO. 2000 - World Health Report.

WHO. 2001 - World Health Report.

WHO. 2002 - World Health Report.

WHO. 2003 - World Health Report.

WHO. 2004 - World Health Report.

WHO. 2005 - World Health Report.

WHO. 2006 - World Health Report.

WHO. 2007 - World Health Report.

Young, Douglas, & Bielinska-Kwapisz, A. (2003). Alcohol Consumption, Beverage Prices and Measurement Error. *Journal of Studies on Alcohol* 64 (2).

Young, Douglas, & Bielinska-Kwapisz, Agnieszka. (2002). Alcohol Taxes and Beverage Prices. *National Tax Journal* LV-1: 57-74.

Zimmerman, Paul R, & Benson, Bruce L. (2007). Alcohol and rape: An “economics-of-crime” perspective. *International Review of Law and Economics* 27, 442-473.

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