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ABSTRACT

This study investigates the effect of economic downturns on substance abuse treatment admissions using data from the Treatment Episodes Data Set between 1992 and 2010. Given the differences between alcohol and illicit drugs, we separately examine these two classes of substances. Changes in admissions may be driven by both demand and supply side determinants of substance abuse treatment, and we include supply side proxies in our regressions to isolate the role of demand. We find that admissions for both alcohol and illicit drugs decrease in downturns. Unconditional quantile regressions reveal that the relationship varies across the admissions distribution: results are driven by states with low admissions. Our findings shed new light on the relationship between economic downturns and substance abuse, and have implications for public health policy and prioritization of government spending.

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1. Introduction

An extensive economics literature has emerged demonstrating, perhaps counter-intuitively, that economic downturns are associated with reduced mortality and improved physical health outcomes. Ruhm (2000) was the first to show that mortality rates decline during economic downturns, and his results suggest that the association is true for a wide range of causes of death, including heart disease, pneumonia, vehicle accidents, and infant and neonatal mortality. Extending on Ruhm's initial findings, more recent work has examined associations between economic downturns and health behaviors, including alcohol use (Davalos et al., 2012; Ruhm and Black, 2002), smoking (Ásgeirsdóttir et al., 2012; Ruhm, 2005), obesity (Ruhm, 2005), diet (Dave and Rashad Kelly, 2010), leisure time physical activity (Colman and Dave, 2011), and sleep (Ásgeirsdóttir et al., 2012). And indeed there is evidence that economic downturns lead to improvements in many of the studied health behaviors. Of course, there are exceptions and particular demographic groups tend to respond differentially to economic downturns (Charles and DeCicca, 2008; Coile et al., 2012; Okechukwu et al., 2012).

In this study, we provide the first evidence on the relationship between economic downturns and admissions to substance abuse treatment in the American medical system. The question of whether economic downturns lead to more or less substance abuse treatment is relevant not just because of an interest in understanding the association of the business cycle and a particular health behavior. Unlike other areas of medical care, the federal, state, and local governments fund the majority of substance abuse treatment in the United States today. Spending on substance abuse treatment is predicted to reach $35 billion by 2014, of which 83% will be paid for by public payers (Levit et al., 2008). In 2014, the Patient Protection and Affordable Care Act, which lists substance abuse treatment as one of the ten elements of

essential health benefits, will expand access to health insurance to an additional 62 million Americans, suggesting that future public payments will be higher than current predictions. Further, clinical studies link substance abuse with health problems requiring medical services, including injuries, respiratory problems, suicide attempts, stroke, heart attacks, sexually transmitted diseases, cancers, and seizures (Han et al., 2010), some of which is likely provided by public health insurance systems (e.g., Medicaid). Thus treatment for substance abuse represents a direct financial burden on the American taxpayer. Understanding how demand for costly medical services varies across the business cycle, particularly in economic downturns when tax-based revenues decline, is essential for prioritizing government spending.

The economics literature links substance use and abuse to a variety of costs that extend beyond excess medical service utilization. Many of these costs are born by both the affected individual and those with whom he interacts, and are attributable to: risky sexual behavior, violence, child abuse, motor vehicle accidents, crime, and employment problems (Balsa et al., 2009; Carpenter, 2007; Chatterji et al., 2004; Corman and Mocan, 2000; Corman and Mocan, 2013; French et al., 2011; Markowitz, 2000, 2005; Markowitz and Grossman, 2000; Mullahy and Sindelar, 2008; Mullahy and Sindelar, 1996).

Not surprisingly then, the economic burden of alcohol and illicit drug abuse is large: $223.5 billion for alcohol and $193 billion for illicit drugs (Bouchery et al., 2011; National Drug Intelligence Center, 2011). The true economic burden is likely even larger as the negative consequences of substance abuse spillover into future generations. For example, Balsa (2008) finds that parental alcoholism leads to worse labor market outcomes during adulthood for children while Fertig and Watson (2009) document that maternal alcohol use leads to low birth weight and premature birth. Taken together these statistics suggest that understanding

determinants of substance abuse, and developing effective policy responses, could lead to substantial welfare improvements for society in both the current and future generations.

We exploit rich information on admissions to substance abuse treatment to test whether economic downturns lead to more or less utilization of treatment services. We make use of nationally representative data from the Treatment Episode Data Set (TEDS) and construct measures of admissions to substance abuse treatment for both alcohol and illicit drug abuse by state and year between 1992 and 2010. Given differences between alcohol and illicit drugs (e.g., legalization, heterogeneity in purity, ability to differentially use the drug to obtain euphoria), we analyze alcohol and illicit drugs separately. Because changes in admissions may be driven by changes in demand and supply side determinants of substance abuse, we include proxies of supply side variables in our regressions to isolate the role of demand. We examine heterogeneity by illicit drug type, time period, client characteristics (sex, employment status, age, race/ethnicity, referral source) and treatment setting to better understand the relationship and to gain insight on possible mechanisms. To further investigate supply side changes, we directly examine how the number of days waiting for substance abuse treatment varies across the business cycle. Rather than simply focusing on mean effects using least squares we explore how the relationship may vary across the distribution of admissions with unconditional quantile regression (Firpo et al., 2009).

We find that admissions to substance abuse treatment, both alcohol and illicit drug, decline in economic downturns. Although our data prevent us from definitively identifying mechanisms, we speculate that fear of job loss among employed persons and a lowered return on employment-promoting health investments for those outside the labor market are important pathways. Further, we find modest evidence that reductions in supply side determinants may

limit availability of treatment during economic downturns. Finally, unconditional quantile regressions reveal that our findings are driven by low admissions states.

2. Conceptual framework

We take the Grossman (1972) demand for health model as a starting point. The Grossman model is a standard theoretical model used to describe health behaviors such as obesity, smoking, and substance use and abuse (Cawley and Ruhm, 2012; Pacula, 2011). Health is produced using market goods (e.g., medical services) and non-market goods (e.g., time investments) as inputs. Consumers are endowed with a health stock, and value both health and other goods. They make consumption decisions to maximize utility given preferences, prices, the budget set, and the health production function. Individuals do not demand health inputs *per se*, rather they gain utility from non-illness and the demand for health inputs is a derived demand. In this framework health behaviors, such as substance abuse and the decision to enter treatment, can be viewed as inputs to the health production function. We review how economic downturns may impact demand and supply side determinants of substance abuse treatment.

2.1 Demand side determinants of substance abuse treatment

In his seminal work, Ruhm (1995, 2000) proposed four, potentially contradictory, mechanisms through which economic downturns may impact the demand for health and health behaviors. In downturns, workers are more likely to lose their job which lowers the opportunity cost of time. Thus the full cost of time-intensive health investments declines and, all else equal, these investments should increase. If health is a normal good the quantity demanded will decline in downturns as income falls. In upturns the employed work longer hours and are more likely to experience on-the-job injuries and job strain, and immigration to areas experiencing an economic upturn may lead to congestion and the emergence of new diseases. In a series of studies Ruhm

shows that physical health and health behaviors improve in economic downturns, with reductions in the opportunity cost of time identified as the most important mechanism (Gerdtham and Ruhm, 2006; Ruhm, 1995, 2000, 2003, 2005; Ruhm and Black, 2002). Unlike other health outcomes and health behaviors, mental health displays a pro-cyclical relationship in that mental health declines in economic downturns.

Additional mechanisms, including changes in the relative prices of substances, substance use and abuse, and the cost of treatment link economic downturns with demand for treatment (Pacula, 2011; Storti et al., 2011), but in potentially offsetting ways leaving the net result ambiguous. Differences between alcohol and illicit drugs, noted earlier, suggest that the relationship need not be consistent across the two substances.

There is evidence that individuals enter the illicit drug trade, thus increasing seller competition and potentially lowering the full price of procuring illicit drugs, during economic downturns (Arkes, 2007, 2011). Lower illicit drug prices should increase illicit drug use, all else equal, and hence lead to a greater need for illicit drug treatment in economic downturns. Spillover effects for alcohol treatment depend on whether or not alcohol and illicit drugs are economic compliments or substitutes, an open question within the economics literature (Cameron and Williams, 2001; DiNardo and Lemieux, 2001; Williams et al., 2004).

Periods of unemployment provide free time to procure and to consume substances and may lead to self-medication of stress from economic insecurity, suggesting that the need for treatment may increase in economic downturns. At the same time, employee reported on-the-job injuries decline during economic downturns (Boone and van Ours, 2006; Boone et al., 2011), suggesting that workers are less likely to report injuries for fear of signaling to the employer they are a low productivity worker. Engagement in substance abuse treatment could similarly signal

poor performance, and hence those who retain jobs may be less likely to enter treatment. When making the decision to enter substance abuse treatment, individuals may weigh the potential benefits and costs from this treatment. A benefit from successful treatment is improved employability in the labor market. Storti et al. (2011) propose that some individuals with substance abuse problems may rationally decide that entering treatment does not pass the benefit-cost ratio in economic downturns when employment opportunities are low.

Substance use is conceptually a normal good and as noted earlier we expect the quantity demanded to decline in economic downturns. However, the development of dependence and addiction coupled with the euphoria of intoxication can make it difficult for individuals to reduce their consumption even when income falls. While there is some evidence that alcohol and illicit drugs are normal goods even for heavy users (Bretteville-Jensen and Biorn, 2003; Farrell et al., 2003; Petry, 2000; Petry and Bickel, 1998), the issue of how heavy users/addicts will respond to a potential loss of income and significant stress associated with economic downturns is not clear and may cause offsetting behaviors. Moreover, there is evidence that at least some heavy substance users obtain a sizeable portion of their income from illegal sources (Arkes, 2007, 2011; Bretteville-Jensen and Sutton, 1996; DeBeck et al., 2007). If true, these users may be less susceptible to downturns in the legal economy.

During downturns workers are more likely to lose access to health insurance (Cawley et al., 2011; Cawley and Simon, 2005). Loss of private health insurance may increase the price of substance abuse treatment, at least among the proportion of the privately insured that has coverage for substance abuse treatment, and admissions should fall. Alternatively, if workers experience sufficiently large income losses that they become eligible for public insurance and/or publically provided substance treatment, this could cause the full price of treatment to decrease.

Thus it is unclear whether job loss, or loss in private insurance, would necessarily translate to a rise or decline in treatment admissions as it would depend on whether those newly income-eligible for public insurance take up this insurance.

Models of addiction (Becker and Murphy, 1988) provide yet another mechanism through which economic downturns could influence substance abuse and demand for treatment. Arrival of a negative shock, such as a job loss, can shift a potential addict from a steady state of abstinence (or low substance use) to a steady state of heavy use or abuse, independent of income effects. The risk of job loss increases during economic downturns. It is an empirical question as to whether the shock effect outweighs the income effect, and whether substance abuse treatment admissions will increase or decrease in economic downturns.

2.2 Supply side determinants of substance abuse treatment

The above mechanisms focus on changes in the demand for substances and need for treatment. Economic downturns may also impact supply side determinants of substance treatment. For example, if federal, state, or local governments reduce funding for substance-related public services, such as treatment or policing services, these cutbacks may lead to decreases in access to substance treatment and lower admissions. During the 2007 to 2009 recession and recovery period, 89% of state health agencies cut services and 44,000 state and local public health jobs were lost (Association of Schools of Public Health, 2008; Association of State and Territorial Health Officials, 2011), suggesting that the provision of medical services, and perhaps other services related to substance abuse treatment, declines in economic downturns.

3. Related work

The empirical work on the relationship between economic downturns, and substance use and abuse has produced heterogeneous findings that are difficult to reconcile. As mentioned

earlier, Ruhm shows that alcohol use (as measured by any use, binge drinking, heavy use, and alcohol-related motor vehicle crashes) declines in downturns. However, work by Dee (2001), Davalos et al. (2012), and Frijters et al. (2013) is at odds with Ruhm's findings: these studies show that problematic alcohol use and related behaviors increase during downturns. Alternatively, Charles and DeCicca (2008) find no robust relationship between economic downturns and binge drinking among a sample of urban men. Freeman (1999, 2001) shows that although overall alcohol use declines during economic downturns, beer consumption is not substantially impacted by the business cycle.

We are able to locate three studies that examine the effect of economic downturns on illicit drug use and abuse. Arkes (2007, 2011) uses the National Longitudinal Survey of Youth 1997 Cohort and shows that marijuana and cocaine use among young adults increases modestly during downturns. Using Australian data, Chalmers and Ritter (2011) find mixed evidence that marijuana use is influenced by economic downturns: young (working age) adults are more (less) likely to use marijuana during downturns.

Storti et al. (2011), in the study most closely related to the current work, test the impact of economic downturns on admissions to substance abuse treatment using European data. They find that admissions decline during downturns. Is it not clear how well these findings translate to the U.S. The health insurance, and social security systems, between these two regions differ substantially, and Gerdtham and Ruhm (2006) show in an analysis of OECD countries that more generous social security systems can moderate the impact of economic downturns on health.

The literature as it stands does not provide sufficient evidence for development of specific U.S. public health policy, such as funding for substance abuse treatment over the business cycle. In this study, we aim to provide new information to help fill this research dearth.

4. Data and methods

4.1 TEDS data

We obtain data on admissions to substance abuse treatment from the Treatment Episodes Data Set (TEDS). The TEDS contains nearly the universe of substance abuse treatment admissions that receive funding from the state or federal government, or are certified by the state to provide substance abuse treatment (Inter-university Consortium for Political and Social Research, 2011). The data are collected annually by state substance abuse agencies and are coordinated by the Substance Abuse and Mental Health Service Administration (SAMHSA). The unit of observation is an admission, and the TEDS contain over 33 million observations. Thus, an individual who receives multiple treatment episodes will appear more than once in our data set. The TEDS contains highly detailed treatment information on the primary, secondary, and tertiary substances reported at admission (19 separate substance types are measured). Further, the TEDS reports client information (age, sex, race/ethnicity, employment, referral source), treatment setting, and geographic information (state). As such, we view the TEDS as the best available data to analyze substance abuse treatment admissions in the U.S.

For computational purposes, we aggregate the TEDS to the state/year level.[1] In our core analyses, we construct the number of alcohol and illicit drug admissions, and admissions by specific illicit drug type: crack and cocaine, marijuana and hashish, opiates (heroin, non-prescription methadone, other opiates and synthetics), hallucinogens (PCP, LSD, etc.), stimulants (methamphetamines, amphetamines, and other stimulants), tranquilizers (benzodiazepines and other non-benzodiazepine tranquilizers, barbiturates, non-barbiturate sedatives or hypnotics), and

[1] Not all states report information in all years of the TEDS. During our sample period, 1992 to 2010, we have missing data for Alabama (2007), Alaska (2005, 2006), Arizona (1992 to 1997), DC (1992, 1993, 2004 to 2007, 2009 to 2010), Georgia (2007 to 2010), Indiana (1997), Kentucky (1992 to 1994, 1996), Mississippi (1992 to 1994), West Virginia (1994, 1997 to 1998, 2000 to 2002), and Wyoming (1995 to 1996). We re-estimate all models on the balanced panel of states (i.e., excluding state with any missing years of data) and the results are robust.

other illicit drugs (inhalants, over-the-counter medications, and other illicit drugs or licit drugs used illegally). We use information on the primary substance listed at treatment admission to define our measures. As a sensitivity check, we replicate all analyses using information on any substance use (i.e., primary, secondary, or tertiary substance) and results are consistent. We take the logarithm of admissions to address skewness and parameter estimates can be interpreted as approximations to the percent change. Results using untransformed admissions are consistent.

In an extension to the core analysis and to gain insight on potential mechanisms, we examine heterogeneity in the relationship between admissions to substance abuse treatment and economic downturns by client characteristics (sex, employment status, race/ethnicity, age, referral source) and treatment setting. We construct three mutually exclusive and collectively exhaustive treatment settings: 1) detoxification (hospital inpatient and free-standing residential), 2) inpatient (hospital but not detoxification, short term [30 days or less] residential, long term [more than 30 days] residential), and 3) outpatient (intensive outpatient, non-intensive outpatient, ambulatory setting).

4.2 Economic data

We proxy economic conditions with the annual state unemployment rate from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics database. There is no single measure of economic conditions, but the unemployment rate is used by the National Bureau of Economic Research to date business cycles (National Bureau of Economic Research, 2010a) and is a standard measure in the health economic literature (Ruhm, 1995, 2000). Our results are consistent if we proxy economic conditions with the employment-to-population rate, past year growth rate in unemployment rates, or deviation from state-specific long-run (i.e., 1992 to 2010) trend in unemployment rates. In unreported analysis, we explore quartiles of the current

unemployment rate, and one and two year lags in this rate to allow for a time delay between an economic downturn and treatment entrance. Results are consistent, but imprecise.

Figure 1 plots the seasonally adjusted average state unemployment rate between 1992 and 2010, the years covered by the TEDS. During this period the U.S. experienced two economic downturns (March 2001 to November 2001; December 2007 to June 2009) (National Bureau of Economic Research, 2010b). States were differentially impacted by these economic events: the bars in Figure 1 indicate the yearly minimum and maximum state unemployment rates. One interpretation of this figure is that the period between 1992 and 2010 provides sufficient variation to estimate the effect of economic downturns on substance abuse treatment admissions.

4.3 Other state-level control variables

We merge data on beer shipments from brewers to wholesalers in 31 gallon barrels and the tax for a gallon of packaged beer in 2010 dollars from the The Beer Institute (2012), and an indicator for whether marijuana is decriminalized in an individual state based on legislative research conducted by the MayaTech Corporation (Pacula et al., 2003) into the TEDS on state and year. These variables proxy state-level substance use preferences, price of substances, and access to substances. Next we merge in population from the University of Kentucky Center for Poverty Research (2012) to account for state differences in size and demographics (sex, age, race/ethnicity, marital status, education, rural status) from the Annual Social and Economic (ASEC) Supplement to the Current Population Survey (CPS).[2]

4.4 Empirical model

The demand for substance abuse treatment is a derived demand, influenced by factors associated with the demand for substances and better health. Therefore, like other health derived

[2] The majority of data relevant to our study in the ASEC pertains to the past year, so we merge these data into the TEDS on lagged year. Results are consistent if we merge on the current year.

demands, we want to control for factors that influence the need for services, the cost of services, and the price of related goods and services. However, we are estimating here not individual demand for substance abuse treatment services, but an aggregated version at the state level. We therefore include state level factors that might proxy for the overall general demand for substances and substance abuse treatment. With this general framework in mind, we specify derived demand for substance abuse treatment admissions as follows:

$$(1) \qquad ln(A_{st}) = \alpha_0 + \alpha_1 U_{st} + \alpha_2' P_{st} + \alpha_3' X_{st} + \alpha_4' S_s + \alpha_5' D_t + \varepsilon_{st}$$

Here, A_{st} is a measure of substance abuse treatment admissions in state *s* in year *t*. The key explanatory variable is U_{st}, the unemployment rate in state *s* in year *t*. We compare the number of admissions in states in which the unemployment rate is high to states in which the unemployment rate is low. P_{st} is a vector of state-level variables (population, beer shipments, beer tax, marijuana decriminalization) and X_{st} is a vector of state-level demographics (age, sex, race/ethnicity, marital status, education, rural residence). These variables are entered into the health production function to control for between state differences that may be correlated with both economic downturns and admissions. S_s and D_t are vectors of state and year fixed effects. The inclusion of state fixed effects implies that we use within state variation to identify the effect of economic downturns on admissions, and these fixed effects allow us to control for unobservable between state differences that may be correlated with economic downturns and admissions. ε_{st} is the error term. We cluster standard errors around the state.

In our core analyses, we estimate Equation (1) with least squares. This estimator captures the effect of economic downturns on admissions to substance abuse treatment at the mean level of admissions. Focusing on the mean may miss interesting, and policy relevant, information if there is heterogeneity in the relationship across the distribution of admissions. For example, we

might expect differential effects among states with low vs. high levels of admissions. States with high levels of admissions may have better ability to respond to changes in treatment funding, or the number/composition of clients presenting for treatment, than low admission states (including changes generated by economic downturns). Thus this analysis may shed further light on potential mechanisms. We apply unconditional quantile regression (UQR) (Firpo et al., 2009) to explore possible this heterogeneity. UQR allows for consistent estimates of treatment effects at virtually any quantile of the unconditional distribution, where quantiles are points taken at regular intervals from the cumulative distribution function of a random variable. As articulated by Maclean et al. (2012), UQR is more appropriate for analysis of state-level variables than conditional quantile regression (Koenker and Bassett, 1978).

5. Results

5.1 Summary statistics

Summary statistics are reported in Table 1. The average annual number of alcohol and illicit drug admissions is 16,633 and 18,865 respectively. We stratify the sample by the unemployment rate: states at or below the sample mean state unemployment rate and states above the sample mean state unemployment rate (5.37%). The unadjusted statistics show that admissions rates for both alcohol and illicit drug treatment are lower in states below the sample mean unemployment rate than in states above the sample mean unemployment rate. For example, the mean number of alcohol admissions is 14,600 in states at or below the sample average unemployment rate and 19,531 among states above the sample average unemployment rate, and this difference is statistically significant ($p \leq 0.001$). We observe comparable patterns across the majority of the individual illicit drug types (one exception is other illicit drugs). However, the data reveal similarly large, and statistically significant, differences in state policies

and demographics. For example, the average percent of the population that is white in states at or below the sample mean unemployment rate is 85% while the average percent of the population that is white in states above the sample mean unemployment rate is 81% ($p \leq 0.001$). These differences highlight the importance of controlling for a comprehensive set of state characteristics when examining the relationship between economic downturns and substance abuse admissions.

Figure 2 reports alcohol and illicit drug admissions by year between 1992 and 2010. During this time period alcohol admissions are trending downwards and illicit drug admissions are trending upwards, and the differences between the 1992 and 2010 values are statistically significant ($p \leq 0.001$). The trend lines cross over in 1998. The number of both alcohol and illicit drug admissions drops substantially between 2009 and 2010. This finding may be a reporting limitation of the TEDS: the data are continuously updated by TEDS administrators as they receive information from states, and states often report admission information to SAMHSA late (Inter-university Consortium for Political and Social Research, 2011). The decline in 2010 is potentially attributable to incomplete reporting rather than a true drop in admissions. In unreported analyses, we re-estimate all models for the 1992 to 2009 period (i.e., years with complete data collection) and results are consistent.

5.2 Regression analysis

Table 2 reports selected estimation results for alcohol and illicit drug admissions between 1992 and 2010. The results display a counter-cyclical pattern: both alcohol and illicit drug admissions decline when the state unemployment rate rises, although effects are only statistically different from zero in the alcohol use regressions. Thus, controlling for observable state characteristics, and year and state fixed effects provides a different picture of the relationship

between admissions and downturns than we observe in bivariate analysis (i.e., Table 1). Specifically, a 1 percentage point increase in the state unemployment rate leads to 3.4% decrease in the total number of alcohol use admissions and a 2.5% reduction in illicit drug admissions although the latter effect is imprecisely estimated.

During economic downturns, income levels decline. At the same time some workers lose access to employer-sponsored health insurance and other workers become income-eligible for government-provided health insurance. Changes in income levels; and the cost and quality (if private and public health insurance are not perfect substitutes) of medical services are conceptually linked with admissions to substance abuse treatment. Further, the relationship between economic fluctuations and admissions may be driven by changes in demand and supply side determinants of substance abuse treatment. Our earlier regressions 1) do not control for changes in income and health insurance and 2) estimate the net effect of both supply and demand side factors, as no controls are included for supply side determinants.

We next attempt to shed light on the relative importance of these two sets of factors. We isolate the role of demand after conditioning on income and health insurance changes by including proxies for supply side determinants of substance abuse treatment. We include state-level income (household income level in 2010 dollars) and health insurance information (proportion of state population covered by health insurance) from the ASEC Supplement to the CPS. Our proxies for treatment supply determinants include the number of treatment facilities from the National Survey of Substance Abuse Treatment Services (N-SSATS) data, the number of residential beds allocated to substance abuse treatment from the N-SSATS, number of workers in the healthcare industry from the ASEC Supplement to the CPS,[3] and state expenditures on

[3] Specifically, we use 3-digit CPS primary industry codes (812 to 840 and 861 to 871) in years 1992 to 2002; and 4-digit CPS primary industry codes (7970 to 8470) in years 2003 to 2010.

police services from the Bureau of Justice Statistics. The N-SSATS data is available for 1997, 1998, 2000, and 2002 to 2010. Police expenditures are available for all years of the TEDS sample except 2001 and 2003. To preserve sample size, we impute missing years of the police and N-SSATS data. Data on workers in the health care sector are available in all years. We convert nominal policy expenditures to 2010 dollars using the Consumer Price Index.

Results from this analysis are reported in Table 3. Column (1) replicates Equation (1) (no controls for supply side changes) and Column (2) re-estimates this model for the time period we have data on supply side determinants of treatment (1997 to 2010) to determine whether changes in estimated effects are attributable to changes in the time period under study or improved identification. Columns (3), (4), and (5) sequentially include household income, health insurance, and our supply side measures into the regression model. Presenting the findings in this manner allows us to explore the relative importance of each set of covariates.

The effect of economic downturns on admissions increases when we limit the sample period from 1992-2010 to 1997-2010: a 1 percentage point increase in the state unemployment rate leads to a 3.4% and 4.2% (2.5% and 4.1%) reduction in alcohol (illicit drug) admissions. The illicit drug effect becomes statistically significant in the 1997 to 2010 period. The increased magnitude, and improved precision, of the illicit drug admissions parameter estimate may be attributable to differences in the composition of illicit drug admissions between these time periods. Figure 3 reports the trends in illicit drug admissions by separate illicit drug types between 1992 and 2010, and differential trends are apparent. For example, crack and cocaine admissions are trending downwards during this period while admissions for marijuana and hashish, and opiates are increasing. It may be that the behavior or underlying characteristics of individuals who consume particular drugs differs in important ways that could be confounded

with job opportunities, making certain groups of users more or less responsive to economic downturns. We explore the heterogeneity by illicit drug type directly later in the study.

Interestingly controlling for income, health insurance, and supply side changes further increases the magnitude of the estimated treatment effect. In the full model (i.e., controlling for all the above mentioned pathways) a 1 percentage point increase in the state unemployment rate leads to a 4.7% reduction in alcohol admissions and a 4.9% reduction in illicit drug admissions. One interpretation of these findings is that the relationship between economic downturns and admissions to substance abuse treatment cannot be fully explained by changes in realized income levels, access to health insurance, or supply side determinants. In fact including these proxies for these pathways increases the estimated effects. A caveat to this analysis is that our measures of supply side determinants are imperfect. From this point onwards, we present results for the model reported in Column (5), i.e., with controls for income, health insurance, and supply side determinants in the period 1997 to 2010 unless otherwise indicated.

In unreported analysis, we examine the impact of controlling for federal block grants to states for substance abuse treatment and prevention services. Because these block grants are directed at specific sub-groups of the population (e.g., low income mothers), they may insulate the effects of economic downturns on the targeted groups. We obtain these data from SAMSHA's Congressional Budget justifications between 2003 and 2010. Specifically, we convert the block grants to 2010 dollars with the CPI and enter this variable into the regression model. The parameter estimates are largely unchanged after including this variable.

Table 4 reports results for admissions by specific illicit drug types described above. In all specifications the parameter estimates suggest that admissions for these illicit drugs types decline in economic downturns. However the parameter estimates, with the exception of opiates, are

indistinguishable from zero. A 1 percentage point increase in the state unemployment rate leads to a 6.7% reduction in opiate admissions but this estimate is only marginally statistically significant ($p \leq 0.10$). The coefficient on stimulants carries a positive sign, suggesting that stimulant admissions increases in downturns, but the coefficient is imprecisely estimated. It is somewhat surprising that the majority of the relationships between economic downturns and the specific illicit drug types are indistinguishable from zero, but analyzing all illicit drugs collectively demonstrates a strong counter-cyclical relationship. It may be that, even with a data set as large as the TEDS, we are underpowered to separately examine specific illicit drug types.

As we articulated earlier in this study, it may be informative to observe whether the relationship between admissions and economic downturns varies across the distribution of admissions. To explore heterogeneity in the link between economic downturns and admissions across the admissions distribution, we apply unconditional quantile regression or UQR (Firpo et al., 2009). This estimator allows consistent estimation of treatment effects across the unconditional distribution of admissions. At present, there is no statistically valid method to cluster standard errors in UQR (or conventional quantile). We rely on Huber-White heteroskedasticity robust standard errors and note this as a limitation of the study. As a sensitivity check, we re-estimate the least squares regressions with Huber-White standard errors rather than clustering at the state level. The standard error estimates are highly consistent, and suggest that failure to cluster the UQR standard errors around the state does not substantially overstate the precision of our findings.

Results for the 5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} quantiles are reported in Table 5. The top panel includes results for alcohol admissions and the bottom panel pertains to illicit drug admissions. We identify heterogeneity across the admissions distribution: among states with

relatively low level of admissions we find that admissions decrease during downturns, consistent with effects estimated at the mean (although the estimated parameter is often larger than the mean effect). However, beyond the 50th quantile the direction of the changes for illicit drugs relationship (although imprecisely estimated): increases in the state unemployment rate are linked with increases in admissions. The coefficients in the alcohol admissions regressions, although imprecise, suggest that states with high levels of admissions (at and beyond the 95th quantile) experience larger than average admission declines during economic downturns. Perhaps states with lower admissions may have more income elastic demand for illicit drug abuse treatment than states with higher admissions. Alternatively, our measures of supply side determinants of substance abuse treatment may be poor proxies, at least for low admissions states: such states are potentially less able to respond to changes in supply side determinants that occur during downturns than high admission states.

The literature on the relationship between economic downturns and health has produced heterogeneous effects that are difficult to reconcile. One potential source of the differential findings is the time period or economic event used for identification (Pacula, 2011). We next explore how sensitive our findings are to different time periods (and thus economic events). We regress alcohol and illicit drug admissions on the unemployment rate in in the full period 1992 to 2010, and 1992 to 1999, and 2000 to 2010. In these specifications we do not include controls for the number of treatment facilities or beds as the data are only available for the 1997 to 2010 period, and results are reported in Table 6. These time periods experienced different economic fluctuations: 1992 to 1999 was a period of recovery from the early 1990s recession and economic growth in the mid- to late-1990s, while the 2000 to 2010 period experienced the mild recession of 2001 to 2002, growth in the mid-2000s, and the severe 2007 to 2009 recession.

The relationship between economic downturns and admissions, both alcohol and illicit drugs, appears to be driven by the 2000 to 2010 period (the parameter estimates are generally consistent, but imprecisely estimated, in the 1992 to 1999 period). Specifically, a 1 percentage point increase in the state unemployment rate leads to a 4.3% (4.1%) reduction in alcohol (illicit drug) admissions in the 2000 to 2010 period. Results for both alcohol and illicit drug admissions are indistinguishable from zero in the 1992 to 1999 period, and the coefficient on illicit drug treatment switches sign. Several different, and non-mutually exclusive, theories are consistent with this pattern of results: the relationship between economic downturns and admissions may have evolved over time, the relationship may be sensitive to the economic event, or the 1992 to 1999 period may not provide sufficient variation to identity effects. Returning to Figure 3, admissions for different types of illicit drugs were more and less prevalent during these two time periods, and substance abuse admissions patterns may have undergone a structural change during this period. In aggregate these different types of admissions respond differently to economic downturns. Unfortunately, our data do not allow us to discriminate between these theories.

6. Robustness checks and extensions

In this section we report the robustness of our findings to various sensitivity checks and extensions to the core analysis.

6.1. Controls for between state differences

The models presented thus far include state fixed effects. These models use only within state unemployment rates in identification, thus they throw away potentially useful between state variation. Further, the core models control for unobservable time invariant state characteristics. If important unobservable state level characteristics vary over time this specification may suffer from omitted variable bias. We re-estimate all models with 1) no state fixed effects (i.e., we use

both within and between state variation to identify the effect of economic downturns on substance abuse treatment admissions) and 2) state-specific time trends (specifically, we replace the year fixed effects with a linear time trend, and interact the time trend with each state fixed effect) and control for both unobservable time variant and time invariant state characteristics. Results are reported in Table 7.

Failure to include state fixed effects leads to a change in the direction of the relationship between admissions and economic downturns: an increase in the state unemployment rate leads to an increase in both alcohol and illicit drug admissions (although the estimate for alcohol is indistinguishable from zero). We interpret these findings as support for including state fixed effects in the regression models. The large differences between high and low unemployment rate state characteristics identified in Table 1 lend credence to this claim. Results that include state-specific time trends are consistent (although smaller in magnitude, particularly for alcohol admissions) with our core models: a 1 percentage increase in the state unemployment rate leads to a 2.1% and 4.5% reduction in alcohol and illicit drug admissions.

6.2 Heterogeneity in the relationship between economic downturns and admissions

We next consider heterogeneity in the relationship between substance abuse treatment admissions by sex, employment status, age, and referral source.

Appendix Table A reports results separately by sex. Men and women have different labor market participation, and substance use and abuse patterns (Blau and Kahn, 2007; Naimi et al., 2003). Thus we might expect the relationship between economic downturns and admissions to substance abuse treatment to differ between these two groups. We find that admissions to alcohol abuse treatment decline during downturns among both sexes: a 1 percentage point

increase in the state unemployment rate leads to a 4.7% and 4.5% reduction in admissions for men and women respectively. The estimates are comparable for illicit drug admissions.

Results by employment status are reported in Appendix Table B. Previous work by Ruhm (2000) shows that the effect of economic downturns on health is strongest for employed individuals. A caveat to this extension is required: if employment status is impacted by economic downturns, then stratifying the sample on this variable could lead to sample selection bias. However, we view the insight we can gain on mechanisms to outweigh potential bias. Our findings are broadly consistent: we identify larger effects among the employed than unemployed, although the sign and magnitude of the effect is similar between the employed and those not in the labor force. A 1 percentage point increase in the state unemployment rate leads to a 7.1% and 6.9% (6.7% and 7.1%) reduction in alcohol (illicit drug) admissions among the employed and those not in the labor force. The results for unemployed are consistent in sign, but smaller and indistinguishable from zero. As suggested by studies of the relationship between economic downturns and worksite injuries, perhaps employed persons decide not to enter treatment during downturns for fear of sending a negative signal to their employers. Further, as proposed by Storti et al. (2011), individuals with substance abuse problems weigh the costs and benefits of entering treatment, and one potential benefit of successful treatment is improved employment opportunities. Some individuals, particularly those outside the labor market, may decide that the costs of entering treatment do not outweigh the benefits during economic downturns when employment prospects are low.

Appendix Table C reports regression results by age group. We might expect these groups to respond differentially to economic downturns given their different labor market attachment: youth and the elderly are less likely to participate in the labor market than working age adults.

Although increases in the unemployment rate lead to reductions in admissions among all age groups, the effects are largest among those 25 years and older. A 1 percentage point increase in the unemployment rates leads to a 2.4%, 5.0%, and 5.8% (2.3%, 6.0%, and 5.3%) decrease in alcohol (illicit drug) admissions among those 12 to 24, 25 to 54, and 55+ years. The estimates for those 12 to 24 are imprecise. The elderly (65+) may be isolated from downturns as they have transitioned out of the labor market but are important to study from a public finance perspective as they place a financial burden on society through their universal access to public health insurance (i.e., Medicare). However, age information in the TEDS is provided in categories and we cannot separately identify the elderly (the highest age category is 55+ years).

The TEDS data also includes information on the primary referral source. In other words, how the client entered substance abuse treatment. We construct five mutually exclusive and collectively exhaustive referral categories: self, criminal justice system, employer, health system, or other (school, community, or other category). Examining how a client is referred to substance abuse treatment may inform us as to the mechanisms through which economic downturns lead to reductions in admissions. Results from this extension are reported in Appendix Table D.

We find that alcohol and illicit drug admissions from all referral sources decline in economic downturns, although the estimates are largest and most precisely estimated for self, employer, and health system referrals. Based on the large coefficients for employer referral it is possible that employed individuals decide against entering treatment for fear of signaling to employers that they are low productivity workers. Further, the self-referral effects may suggest that opportunity cost of time is not the dominate mechanism in the observed relationship: if opportunity cost of time is an important mechanism we would expect, all else equal, self-referrals to increase in economic downturns when the opportunity cost of time-intensive health

investments declines. The reduction in referrals from the health system is consistent with both reduced medical services and access to health insurance during economic downturns, or our supply side determinant proxies are not adequately controlling for these mechanisms.

6.3 Effect of economic downturns on treatment setting

In this section we explore whether the treatment setting (detoxification, inpatient, or outpatient) varies across the business cycle. As we note earlier in the study, we might expect the supply of substance treatment to decline in downturns as tax-based revenues fall and governments reduce spending. If there are changes in supply of treatment, it may be that clients receive treatment in lower cost settings (e.g., outpatient vs. inpatient settings). At the same time, if individuals with the most severe substance abuse problems have inelastic demand for treatment while those while those with less severe problems respond to changes in economic conditions (for example, those with moderate substance abuse problems may decide not to enter treatment in downturns), then we might expect that only outpatient services will vary across the business cycle. Finally treatment received in detoxification settings may capture heavy episodic substance use rather than a substance abuse problem that requires longer-term rehabilitation and could respond differentially to economic downturn than inpatient and outpatient treatment.

Results from this analysis are reported in Appendix Table E. Although all coefficients are negative, we observe a statistically significant effect for outpatient treatment only. For example, a 1 percentage point increase in the state unemployment rate leads to a 7.6% and 6.6% reduction in alcohol and illicit drug admissions to outpatient treatment. However, outpatient treatment is by far the most common treatment setting in the TEDS, and we may simply be underpowered to detect effects for other settings.

6.4 Effect of economic downturns on the number of days waiting to enter treatment

The TEDS includes information on the number of days waiting to enter treatment. This information is not contained in the minimum data that states are required to provide to state substance abuse agencies (Inter-university Consortium for Political and Social Research, 2011), and thus these data are not available for all states. Why states provide this information is not clear and may limit the generalizability of results. However, with these caveats in mind, we directly test whether economic downturns lead to changes in supply side determinants of substance abuse treatment. Specifically, we regress the number of days waiting for alcohol and illicit drug treatment on the state unemployment rate, covariates included in Equation (1), household income, health insurance, and supply side determinants. We report the findings in Appendix Table F. Although generally imprecise, the estimates suggest that the number of days waiting for treatment may increase in economic downturns: a 1 percentage point increase in the state unemployment rate leads to roughly a 15 to 16% increase in days waiting for treatment and effect is only precisely estimated for illicit drugs, and then only marginally ($p \leq 0.10$). These results suggest that changes in supply side determinants may explain some, but likely not all, of our findings on economic downturns and substance abuse treatment admissions.

7. Discussion

In this study, we provide the first evidence on the impact of economic downturns on admissions to substance abuse treatment in the U.S. medical system using rich admissions data from the Treatment Episode Data Set (TEDS) between 1992 and 2010. Our findings show that admissions decrease during economic downturns. The relationship may have changed over time, or may be sensitive to the size and severity of the economic event. Our net findings are consistent with the work of Ruhm, although the mechanisms that lie behind the net effect differ. Ruhm highlights the decline in the opportunity cost of time during economic downturns as the

most salient mechanism. Substance abuse treatment is a time intensive health investment and, all else equal, the quantity demanded should increase with the opportunity cost of time declines. We suspect three possible mechanisms for our findings. First, individuals opt not to enter substance abuse treatment during downturns for fear of signaling that they are low productivity to employers. Second, the return on health, and other employment-promoting, investments declines during economic downturns when employment prospects are low and some individuals may rationally decide that entering substance abuse treatment during economic downturns does not pass the benefit-cost ratio. Third, supply side determinants of substance abuse treatment may decline during economic downturns. These mechanisms are not necessarily mutually exclusive, and could work in conjunction with one another. As none of these mechanisms are able to fully explain our empirical result, we are left with an interpretation that income effects associated with economic downturns lead to a reduction in the use of these substances and hence lead also to less need for treatment. In our regressions, we control for realized changes in household income but perceived or expected income reductions during economic downturns are perhaps more important for substance use, abuse, and treatment.

A potentially useful method to situate our study within the economics literature is to compare our findings with existing studies of the relationship between economic downturns and substance abuse treatment. As noted earlier, only one study investigates this question and it uses European data (Storti et al., 2011). Even with the differences between Europe and the U.S. in terms of labor market and substance use patterns, and provision of medical services, our findings are consistent with the findings of Storti et al. (2011). The broader literature on economic downturns and substance use has produced much more mixed results, and like other studies of

economic downturns and substance use, our findings are consistent with some work (Ruhm, 1995; Ruhm and Black, 2002) but inconsistent with others.

This study has several limitations. Although the TEDS covers a substantial proportion of all admissions to substance abuse treatment, it does not include all admissions. Differences across states in licensure, certification, and accreditation rules, and disbursement of public funds affects what admissions are included in the TEDS (Inter-university Consortium for Political and Social Research, 2011). For example, some states regulate private substance abuse treatment facilities and in correctional facilities while other states do not. We include state fixed effects in our core regressions which may partially address these differences. The primary objective of the TEDS is to monitor substance abuse treatment admissions, and therefore the data does not include prevention or early intervention substance abuse services. The TEDS collects information on up to three drugs that led to treatment, but these drugs may not represent a complete enumeration of all drugs used. Further, we know where treatment was received but we do not know the client's state of residence. Thus, our results are vulnerable to measurement error. If measurement error is random it should attenuate our parameter estimates toward zero, but if the measurement error is non-random than it is difficult to sign the direction of the bias.

Policy makers may find our results useful. If individuals do not enter substance abuse treatment during downturns for fear of job loss, or because they do not think this health investment passes the benefit-cost analysis when employment prospects are low, substance abuse problems that impose costs on both the affected person and society may go untreated. This might suggest that policies targeting such individuals during downturns could be developed and implemented. If supply side determinants of substance abuse treatment decline in downturns than individuals who could benefit from treatment may go without. Prioritizing government

spending is a difficult task and when resources are constrained some services must be eliminated. Policy makers should be aware that there may be pent up demand for substance abuse treatment services as the economy recovers.

Our findings add to the health economic literature on economic downturns and health. Further, they underscore the importance of employment on health behaviors generally, and substance use and abuse specifically. Understanding determinants of health behaviors, such as substance abuse, that likely impose external costs on society are a particularly important from a social welfare perspective. Future research should leverage the rich substance use and abuse data available in the U.S. (e.g., Drug Abuse Warning Network, N-SSATS) to better understand how substance use and abuse responds to changes in the economic environment.

Table 1. Substance abuse treatment admissions, unemployment rates, and state-level demographics: TEDS 1992 to 2010

	Full sample	≤ mean UE rate	> mean UE rate	Difference[1] (*p*-value)
Substance abuse treatment admissions				
Alcohol	16,632.65	14,599.56	19,530.99	0.0009
Illicit drug	18,864.99	15,494.35	23,670.14	0.0000
Substance abuse treatment admissions by illicit drug type				
Crack and cocaine	5,046.53	4,260.18	6,167.54	0.0001
Marijuana and hashish	5,052.91	4,390.00	5,997.94	0.0002
Opiate	6,209.38	4,876.73	8,109.19	0.0001
Hallucinogen	115.83	89.67	153.12	0.0000
Stimulant	1,990.34	1,487.53	2,707.14	0.0061
Tranquilizer	241.22	197.66	303.32	0.0000
Other illicit drug	208.78	192.58	231.89	0.1701
State unemployment rates, polices, and demographics				
Unemployment rate	5.37	4.21	7.02	0.0000
Beer tax (dollars)	0.32	0.31	0.34	0.1903
Beer shipments (millions, 31 barrel gallons)	3.98	3.38	4.83	0.0000
Marijuana decriminalized	0.24	0.20	0.31	0.0000
Population (millions)	5.64	4.75	6.92	0.0000
Age (years)	43.03	43.06	42.98	0.2910
Female	0.51	0.51	0.51	0.0156
Male	0.49	0.49	0.49	0.0156
White	0.84	0.85	0.81	0.0000
African American	0.10	0.09	0.12	0.0000
Other race	0.06	0.06	0.06	0.2879
Hispanic	0.08	0.07	0.09	0.0000
Married	0.64	0.65	0.62	0.0000
Divorced	0.18	0.18	0.19	0.0000
Never married	0.17	0.17	0.19	0.0000
Urban	0.20	0.17	0.23	0.0000
Rural	0.80	0.83	0.77	0.0000
Less than high school	0.11	0.10	0.12	0.0000
High school	0.33	0.33	0.32	0.0100
Some college	0.28	0.28	0.27	0.0225
College graduate	0.28	0.28	0.28	0.3012
Year	2001	2001	2001	0.1085
Observations	929	546	383	

Notes: The unit of observation is a state in a year. Mean state unemployment rate is 5.37%.

[1]Differences are calculated with *t*-tests (binary variables) and χ^2 tests (binary variables).

Table 2. Effect of the state unemployment rate on substance abuse treatment admissions: TEDS 1992 to 2010

	Alcohol	**Illicit drug**
Sample mean	16,633	18,865
State unemployment rate	-0.0340**	-0.0251
	(0.0163)	(0.0208)
Observations	929	929

Notes: All regressions estimated with least squares and control for state-level policies and demographics, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Table 3. Effect of the state unemployment rate on substance abuse treatment admissions with additional control variables: TEDS 1992 to 2010

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Time period	**1992-2010**	**1997-2010**	**1997-2010**	**1997-2010**	**1997-2010**
Sample mean	16,633	15,976	15,976	15,976	15,976
Alcohol	-0.0340**	-0.0417***	-0.0488***	-0.0472***	-0.0468***
	(0.0163)	(0.0134)	(0.0157)	(0.0155)	(0.0153)
Sample mean	18,865	20,252	20,252	20,252	20,252
Illicit drug	-0.0251	-0.0409**	-0.0478**	-0.0506***	-0.0487***
	(0.0208)	(0.0169)	(0.0184)	(0.0181)	(0.0180)
Household income	No	No	Yes	Yes	Yes
Health insurance	No	No	No	Yes	Yes
Supply side proxies	No	No	No	No	Yes
Observations	929	692	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, state fixed effects, and year fixed effects. Supply side proxies include the logarithm of state-level drug abuse treatment facilities, number of beds available for drug abuse treatment, number of workers in the health care industry, and police expenditures. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Table 4. Effect of the state unemployment rate on substance abuse treatment admissions by illicit drug type: TEDS 1997 to 2010

	Sample mean	Coefficient (Standard error)
Crack and cocaine	4,773	-0.0135
		(0.0291)
Marijuana and hashish	5,762	-0.0180
		(0.0168)
Opiates	6,741	-0.0664*
		(0.0364)
Hallucinogens	112	-0.0494
		(0.0416)
Stimulants	2,366	0.0114
		(0.0344)
Tranquilizers	266	-0.0026
		(0.0257)
Other illicit drugs	233	-0.0813
		(0.0642)
Observations		692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Table 5. Heterogeneity in the effect of the state unemployment rate on substance abuse treatment admissions: TEDS 1997 to 2010

Quantile	**5th**	**25th**	**50th**	**75th**	**95th**
Sample mean	1,997	4,417	8,980	20,830	43,526
Alcohol	-0.0547	-0.1061***	-0.0504	-0.0244	-0.0788
	(0.0731)	(0.0405)	(0.0394)	(0.0269)	(0.0578)
Sample mean	1,434	4,149	9,901	24,964	54,161
Illicit drug	-0.2413***	-0.0599	-0.0150	0.0215	0.0331
	(0.0802)	(0.0447)	(0.0363)	(0.0235)	(0.0266)
Observations	692	692	692	692	692

Notes: All regressions estimated with unconditional quantile regression and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Heteroskedastic robust standard errors are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Table 6. Effect of the state unemployment rate on substance abuse treatment admissions by time period: TEDS 1992 to 2010

	1992-2010	1992-1999	2000-2010
Sample mean	16,633	17,721	15,859
Alcohol	-0.0398**	-0.0307	-0.0427**
	(0.0163)	(0.0366)	(0.0185)
Sample mean	18,865	15,457	21,287
Illicit drug	-0.0283	0.0346	-0.0411**
	(0.0205)	(0.0326)	(0.0180)
Observations	929	386	543

Notes: All regressions estimated with least squares and control for state-level policies and demographics, state average household income and proportion with health insurance, state police expenditures, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Table 7. Effect of the state unemployment rate on substance abuse treatment admissions using alternative controls for between state differences: TEDS 1997 to 2010

	(1)	(2)	(3)
Sample mean	15,976	15,976	15,976
Alcohol	0.0174	-0.0468***	-0.0210*
	(0.0457)	(0.0153)	(0.0115)
Sample mean	20,252	20,252	20,252
Illicit drug	0.0940**	-0.0487***	-0.0454***
	(0.0462)	(0.0180)	(0.0109)
Year fixed effects	Yes	Yes	No
State fixed effects	No	Yes	Yes
State-specific time trend	No	No	Yes
Linear time trend	No	No	Yes
Observations	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, and supply side proxies. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table A. Effect of the state unemployment rate on substance abuse treatment admissions by sex: TEDS 1997 to 2010

	Men	Women
Sample mean	11,887	4,067
Alcohol	-0.0466***	-0.0448***
	(0.0156)	(0.0155)
Sample mean	13,139	7,107
Illicit drug	-0.0471**	-0.0507**
	(0.0178)	(0.0195)
Observations	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table B. Effect of the state unemployment rate on substance abuse treatment admissions by employment status: TEDS 1997 to 2010

	Employed	Unemployed	Not in the labor force
Sample mean	5,588	4,181	5,723
Alcohol	-0.0705***	-0.0066	-0.0688**
	(0.0183)	(0.0319)	(0.0291)
Sample mean	4,491	6,328	8,906
Illicit drug	-0.0672***	-0.0420	-0.0711**
	(0.0236)	(0.0335)	(0.0311)
Observations	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table C. Effect of the state unemployment rate on substance abuse treatment admissions by age group: TEDS 1992 to 2010

	12-24 years	25-54 years	55+ years
Sample mean	2,740	12,180	1,056
Alcohol	-0.0240	-0.0495***	-0.0579***
	(0.0173)	(0.0158)	(0.0180)
Sample mean	6,325	13,498	429
Illicit drug	-0.0232	-0.0596***	-0.0532**
	(0.0171)	(0.0197)	(0.0258)
Observations	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table D. Effect of economic fluctuations on drug treatment admissions by referral source: TEDS 1997 to 2010

	Self-referral	Criminal justice system referral	Employer referral	Health system referral	Other referral
Sample mean	4,677	6,042	157	3,028	1,637
Alcohol	-0.0804**	-0.0615**	-0.1370**	-0.1207***	-0.0684
	(0.0353)	(0.0298)	(0.0526)	(0.0388)	(0.0442)
Sample mean	7,209	6,781	140	3,316	2,315
Illicit drug	-0.0788**	-0.0295	-0.1210**	-0.1137***	-0.0725*
	(0.0296)	(0.0315)	(0.0516)	(0.0317)	(0.0379)
Observations	692	692	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, state average household income and proportion with health insurance, supply side measures, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table E. Effect of the state unemployment rate on substance abuse treatment admissions by treatment setting: TEDS 1997 to 2010

	Detoxification	Inpatient	Outpatient
Sample mean	4,229	2,401	9,344
Alcohol	-0.0647	-0.0423	-0.0763**
	(0.0720)	(0.0628)	(0.0351)
Sample mean	3,389	3,889	12,970
Illicit drug	-0.0848	-0.0506	-0.0655*
	(0.0780)	(0.0658)	(0.0341)
Observations	692	692	692

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Appendix Table F. Effect of the state unemployment rate on the logarithm of days waiting to enter treatment: TEDS 1997 to 2010

	Log(days waiting to enter alcohol treatment)	Log(days waiting to enter illicit drug treatment)
Sample mean	595	917
State unemployment rate	0.1573	0.1506*
	(0.1018)	(0.0750)
Observations	419	419

Notes: All regressions estimated with least squares and control for state-level policies and demographics, household income, health insurance coverage, supply side proxies, state fixed effects, and year fixed effects. Standard errors are clustered around the state and are reported in parentheses.
***; **; *=statistically different from zero at the 1%; 5%; 10% level.

Figure 1. Mean, minimum, and maximum state unemployment rate: Bureau of Labor Statistics Local Area Unemployment rates 1992 to 2010

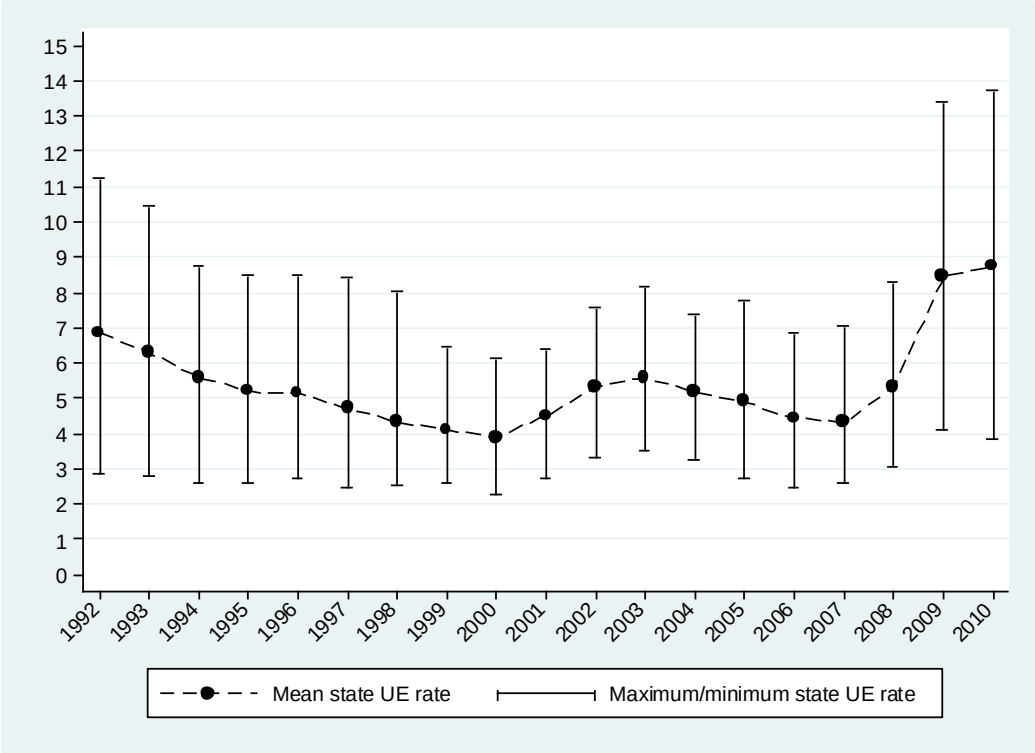


Figure 2. Total alcohol and illicit drug admissions: 1992 to 2010 TEDS

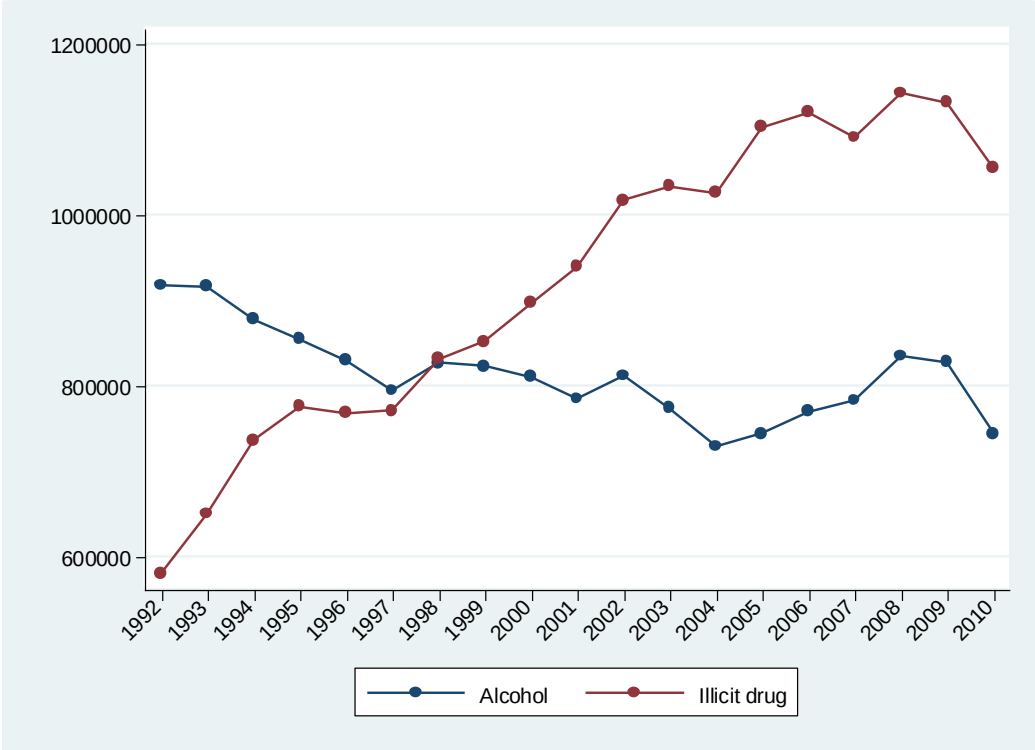
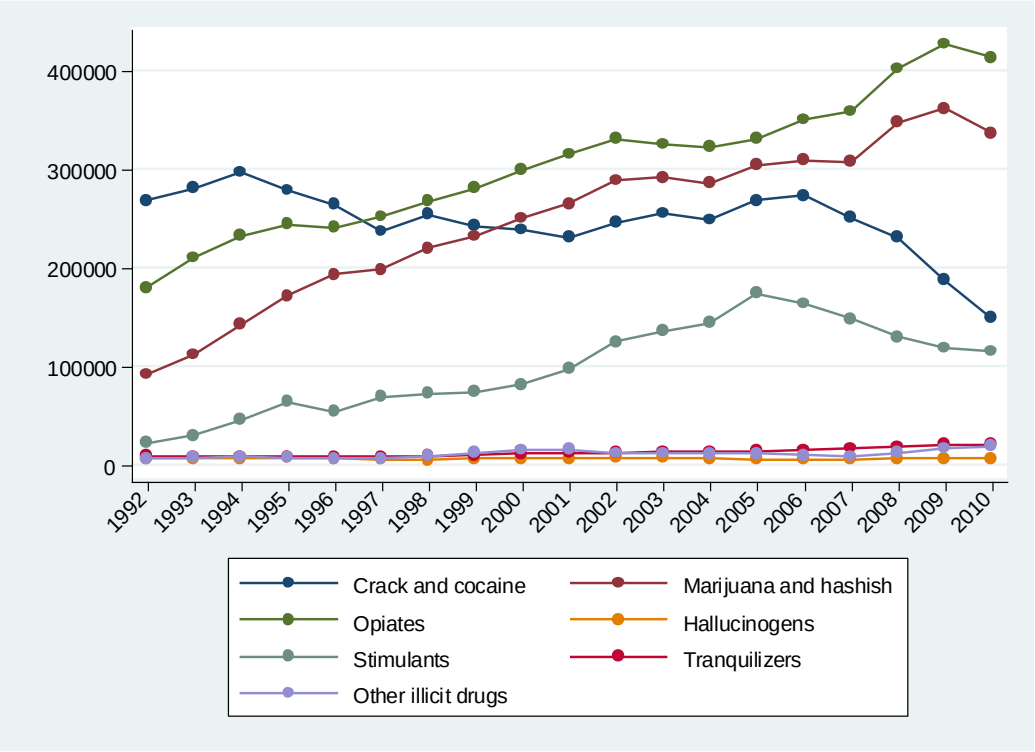


Figure 3. Total illicit drug admissions by drug type: 1992 to 2010 TEDS



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