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ABSTRACT

With the goal of lowering incentives for alcohol and substance abuse, U.S. states have historically permitted private health insurers to deny reimbursement of medical claims stemming from alcohol or opioid impairment. However, a potential unintended consequence of such "exclusion provisions" is that they may reduce providers' incentives to screen patients for alcohol intoxication and substance abuse, leading to an increase in risky health behaviors that carry substantial externality costs. In response to these concerns, 16 states and the District of Columbia repealed their exclusion provisions and replaced them with explicit prohibitions on the denial of health insurance claims resulting from alcohol and other substance use impairment (PDHIAs). This study is the first to comprehensively explore the effects of PDHIAs on alcohol- and drug- related outcomes, with a particular focus on externalities associated with these risky health behaviors, allowing us to broadly assess their potential welfare effects. Leveraging a variety of national data sources (Uniform Crime Reports, Fatality Analysis Reporting System, Behavioral Risk Factor Surveillance System, Treatment Episode Data Set, and Medical Expenditure Panel Survey) in conjunction with a generalized difference-in-differences approach, we find little support for the hypothesis that PDHIAs generated ex ante moral hazard. To the contrary, there is some evidence that PDHIAs may have reduced some criminal arrests, drunk driving behaviors, and alcohol use. One explanation for these findings is that physicians may be more willing to refer treatment services for substance use-related health issues when patients and hospitals are not financially penalized by PDHIAs. Lastly, there is little evidence that PDHIAs had broader impacts on private insurance markets, either in affecting private health insurance coverage or average premiums.

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1. Introduction

The economic toll of alcohol misuse and illicit drug use is staggering, costing the U.S. as much as $1.6 trillion combined on an annual basis.[1] In 2023, there were almost 7.6 million drug-related hospital emergency department (ED) visits, with alcohol constituting the most prevalent substance reported and being involved in over 3.1 million of these ED visits nationally.[2] Excessive alcohol use alone is responsible for more than 178,000 deaths each year and over 4.3 million years of potential life lost (Centers for Disease Control and Prevention – CDC 2024), imposing societal costs exceeding $340 billion (Sacks et al. 2015; in 2023 dollars). Drug overdose was responsible for an additional 110,000 deaths in 2023, with about three-fourths of the overdose deaths driven by opioids (CDC 2025). Recent estimates place the economic cost of opioid abuse at over $1.2 trillion (in 2023 dollars; Luo et al. 2021). While some of these societal costs of alcohol and drugs are private and borne directly by the user (e.g. chronic and acute health conditions such as heart disease and liver disease, addiction, premature mortality, productivity losses), a substantial portion of the economic burden extends to non-users.[3] Notably, the bulk of these external costs accrue from drug and alcohol-attributable crimes and motor vehicle accidents.[4]

With the goal of reducing alcohol and other substance abuse (notably prescription opioid abuse) — as well as externalities associated with these behaviors — 39 states and the District of Columbia (D.C.) had adopted alcohol and other substance exclusion provisions (AEPs) as part of their Uniform Accident and Sickness Policy Provision Law (UPPLs).[5] AEPs allow private health insurance providers to deny insurance claims for injuries stemming from alcohol impairment or the

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[1] Estimate is inflated to 2023 dollars, and based on the combined economic burden of alcohol misuse reported in Sacks et al. (2015) and of opioid abuse reported in Luo et al. (2021). Broader, but older, estimates of the cost of illicit drug use amounted to $193 billion in 2007 ($284 billion in 2023 dollars) (see: National Drug Intelligence Center - NDIC 2011).

[2] Data from the Drug Abuse Warning Network (DAWN) show that alcohol was the most commonly reported substance in drug-related ED visits (41.0%). See: Substance Abuse and Mental Health Services Administration (SAMHSA; 2024). Evidence also points to a rising trend in alcohol-related ED admissions over the past two decades (Esser et al. 2022; White et al. 2018).

[3] To the extent that some substance users have time-inconsistent preferences or present bias, some of the private costs would not be internalized and, as with the external costs, lead to a greater than socially optimally level of alcohol and drug consumption (Gruber & Köszegi, 2001).

[4] The National Highway Traffic Safety Administration (NHTSA), for instance, estimates that alcohol-involved crashes imposed $69 billion in economic costs in 2019 ($82 billion in 2023 dollars) (Blincoe et al. 2022). Alcohol-related economic costs associated with the crime and the criminal justice system amount to almost $44 billion annually (Sacks et al. 2015; in 2023 dollars). Almost a third of the estimated cost of illicit drug to society comprises costs of drug-related crime (NDIC 2011).

[5] Insurance markets are regulated at the state-level. The UPPL was a model legislation that was developed by the National Association of Insurance Commissioners (NAIC), a non-governmental entity comprised of insurance regulators from all states. UPPLs have been adopted by each state and aim to establish a standard of adequate coverage and quality, as defined by each state, by delineating which provisions in insurance policies are mandatory vs. optional.

use of non-prescribed narcotics. Using insurance coverage as a leverage, the primary intention behind the AEPs was to deter excessive drinking and substance use, though there is no evidence to date that such provisions have curbed problem drinking.[6] Instead, medical professionals fear unintended consequences of these exclusion provisions due to physicians' concerns about insurance claim denials. For instance, there is evidence that AEPs reduce the likelihood that physicians test the blood alcohol concentration (BAC) levels of injured patients (Rivera, et al., 2000 and Schermer, et al., 2003) as well as reduce the likelihood that healthcare professionals refer patients for alcohol use disorder treatment (Azagba, et al., 2022b). Moreover, with 20 percent of alcohol-related hospital ED admissions involving at least one additional substance, and with the exclusion provisions also extending to narcotics, the concern that trauma care physicians may not adequately screen for alcohol also carries over to screening for other drugs.

These unintended behavioral responses on the provider-side may be quite harmful, as the Substance Abuse and Mental Health Services Administration (SAMHSA) recommends that primary care clinicians periodically and routinely screen all patients for substance use disorders (SAMHSA, 1997).[7] Indeed, drawing on findings from the above studies, the American Public Health Association (APHA), National Highway Traffic Safety Administration (NHTSA), and the National Association of Insurance Commissioners (NAIC) – an organization comprised of state insurance regulators that had originally developed the model for the Uniform Accident and Sickness Policy Provision legislation, recommended the repeal of the alcohol and other substance exclusion provisions (National Conference of Insurance Legislators, 2004; American Public Health Association, 2004).[8] Since 2000, 16 states and D.C. have followed this recommendation; they repealed the provision that had originally allowed insurers from denying claims for alcohol and narcotics-related injuries, and enacted a new model law that explicitly prohibited such practice. However, to date, there is very little evidence on the impact of repealing AEPs and prohibiting this practice on adult alcohol use and downstream consequences related to alcohol and substance use. Importantly, there is no published evidence on the effects of repealing AEPs on drinking and drug use-related outcomes that capture externalities

[6] It is important to note that potential behavioral changes do not actually require insurance companies to follow through with this practice; that private insurers have this option, and the possibility of claims denial can potentially impact consumers alcohol use and physicians' screening behaviors.

[7] Screening and brief alcohol-related intervention have also been found to be highly cost-effective in trauma centers and hospital inpatient admissions following an injury, where approximately 27 percent of such patients had an indication of a high BAC or problem drinking behaviors (Gentilello et al., 2005b).

[8] The NAIC unanimously voted in 2001 to repeal the alcohol exclusion provision of the UPPL in favor of a new model law that would specifically remove this option from health insurance plans. The vote was not binding, and not all states followed through.

associated with these risky health behaviors, including crime and deaths to non-drivers from impaired driving. Examining these outcomes is critical for assessing the social welfare impacts of laws that prohibit the denial of health insurance benefits for alcohol-related health claims (PDHIAs).

The effects of PDHIAs on alcohol- and drug-related outcomes is, a priori, ambiguous. On the one hand, covering alcohol-related health insurance claims may encourage problem drinking (and associated alcohol-related outcomes). By lowering the cost of adverse medical outcomes associated with alcohol consumption, PDHIAs may generate ex ante moral hazard by disincentivizing efforts to prevent such events and incentivize problem drinking behaviors. Studies of ex ante moral hazard effects have largely explored how more broadly gaining insurance coverage – and in particular public insurance coverage – impacts risky and health-promoting behaviors.[9] Studies of ex ante moral hazard in the context of specific incentivized or disincentivized conditions and behaviors are less common in this literature.[10] To that end, in linking a specific policy provision targeting private health insurance claims for alcohol (and drug) related injuries to outcomes directly related to these behaviors, PDHIAs may arguably provide a more precise and salient test of ex ante moral hazard.

In addition, by decreasing the likelihood that insured patients will have to pay out-of-pocket for newly covered alcohol- and drug-related health events, PDHIAs may generate income gains that increase insured persons' alcohol consumption (to the extent that alcohol is a normal good). PDHIAs could also reduce privately insured persons' incentive to engage in broader preventive efforts to remain healthy (Chen, et al., 2023), generating unintended consequences that (1) increase health insurance premiums, as well as (2) reduce the likelihood of affordable private health insurance coverage.

On the other hand, it is possible that PDHIAs may have little effect on alcohol (drug) consumption or related outcomes. If healthcare provider behavior (for instance, by disincentivizing screening for alcohol or drug use) has already counteracted any incentives for insured individuals to curb their drinking when subject to the alcohol exclusion provisions, then prohibiting these exclusions

[9] See, for instance, Dave et al. (2019), De Preux (2011), Dave and Kaestner (2009), Kelly and Markowitz (2009), Stanciole (2008) and Courbage and Coulon (2004) for analyses and discussion of ex ante moral hazard effects in the context of public health insurance (Medicare, Medicaid) and general health insurance coverage for certain populations. Also see Kenkel (2000) for a comprehensive overview of prevention efforts in the context of health insurance, and market failures such as ex ante moral hazard that led to less-than-optimal efforts devoted to such behaviors.

[10] The few exceptions are Willage (2019), who assesses the effects of the Affordable Care Act's contraception coverage mandate on contraception use and sexually transmitted infections, and Klick and Stratmann (2007), who study the effects of health insurance coverage mandates for diabetes on body mass index.

would be predicted to generate little change in net incentives for patients.[11,12] Moreover, prior to PDHIAs, competition among insurance providers may have led to expansions in health insurance coverage policies that cover alcohol-related health claims thus mitigating the effects of PDHIAs.

Finally, by eliminating disincentives for healthcare providers to refer patients for alcohol-and other substance-related treatment, PDHIAs could lead to a *reduction* in alcohol and substance use disorder. Relatedly, increases in the availability of alcohol-related treatment could positively affect insured persons' mental health, decreasing the likelihood of turning to alcohol and other substances as a coping mechanism. Improving substance use-related health and protecting the wellbeing of insured patients are, in fact, key reasons why the APHA and the NAIC supported the prohibition of insurance claim denials.

This study is the first to comprehensively estimate the impact of PDHIAs on alcohol- and drug- related outcomes, with particular attention to (1) externalities associated with these risky health behaviors, (2) potential heterogeneous and dynamic treatment effects and (3) heterogeneity across the age distribution. We explore a more expansive set of outcomes than have been previously analyzed in the prior limited literature, and capturing, importantly, externalities related to risky health behaviors, including criminal arrests, drinking and driving behavior, alcohol-related traffic fatalities. Examining effects on these outcomes is particularly salient given that they account for the bulk of the external and societal costs imposed by alcohol and drug abuse, particularly for young adults. Moreover, we also consider effects on alcohol and substance use treatment admissions, thereby informing a key concern that allowing health insurers to deny claims related to alcohol and drug use may have created disincentives for providers to screen for these substances in inpatient settings. And, we further widen the lens and explore general equilibrium effects on health insurance markets – which may materialize due to shifts in prevention efforts, risk-taking, and insurance claims costs – by assessing any downstream effects on health insurance premiums and coverage rates.

We leverage information from a variety of national data sources (Uniform Crime Reports, Fatality Analysis Reporting System, Behavioral Risk Factor Surveillance System, Medical Expenditure Panel Survey, and Treatment Episode Data Set), in conjunction with difference-in-differences

[11] It is also possible that physicians and patients may not be fully aware of the existence of AEP provisions that allow the denial of health insurance claims. For example, Gentilello, et al. (2005) argue that trauma center surgeons' familiarity with the UPPL was limited while Subbaraman, et al. (2022) suggest that many covered individuals are not aware of AEPs and that this lack of knowledge is not improving over time.

[12] In addition, we note that those covered by public health insurance programs (i.e., Medicaid) are not covered by these provisions. To the extent that public health insurance has crowded out private health insurance coverage due to the Affordable Care Act (see Clemens et al. 2021), the effects of AEP repeals may diminish over time.

methods, including newly developed estimators that account for heterogeneous treatment effects spatially and temporally. We document several findings. First, we find no evidence of statistically significant or economically meaningful ex ante moral hazard effects that generate externalities. For instance, with 95% confidence, we can rule out that the adoption of PDHIAs resulted in any increases in violent and property crime arrests or increases in arrests for Driving Under the Influence (DUI) exceeding 1.8%. We can also rule out PDHIA-induced increases in binge drinking of around 6%.

Second and to the contrary, there is some suggestive evidence of some beneficial health behavior effects of PDHIAs, in the form of decreases in alcohol use, drunk driving behavior, drug-related arrests, and arrests for property and violent crime offenses. We uncover one possible mechanism for these findings: some (albeit weaker) evidence of increases in substance use treatment referrals for some drugs. This finding is consistent with the hypothesis that physicians may be more willing to identify and refer patients to substance use treatment if such diagnoses and treatment referrals do not cause financial hardship to patients due to the denial of insurance claims. Finally, we can rule out that these provisions generated any meaningful increase in health insurance premiums or shifts in private insurance coverage.

A causal interpretation of our findings is supported by event study analyses, and these findings are also robust to the use of newer difference-in-differences estimators that adjust for any potential biases due to heterogeneity in the treatment effects dynamically or spatially across the treated states.

The remainder of the manuscript proceeds as follows. In Section 2, we provide background on the Uniform Sickness and Accident Policy Provision legislation and frame our study's contributions relative to the prior literature. Sections 3 and 4 provide details on the data sets and research design, respectively, followed by a discussion of the results in the next section. The concluding sections draws out the policy implications of our findings.

2. Background

2.1 History and Descriptive Evidence on AEP-Inclusive UPPLs

Laws permitting the use of intoxication exclusionary clauses in insurance contracts have their roots in the 1947 UPPL, a non-binding model statute drafted by the NAIC (Teitelbaum, Rosenbaum, Goplerud, 2004). In 1951, Kansas and Pennsylvania became the first two states to adopt an AEP-

inclusive UPPL (Azagba, Ebling, and Hall, 2023). By the mid-1950s, most states had adopted such a statute, many of which also applied to non-medicinal use of narcotics.[13]

AEP-inclusive UPPLs were designed to provide a disincentive for problem drinking and substance use among privately insured individuals and to prevent the costs of such risky behaviors to be passed along to consumers not engaging in such behaviors. Indeed, classical economic theory suggests that because health insurance covers the financial costs that would be caused by alcohol and narcotics use, individuals may have less incentive to avoid them if private insurance coverage covers adverse health consequences caused by such behaviors (Ehrlich and Becker, 1972).

There is descriptive evidence that the alcohol exclusion provisions led to an increase in denials of alcohol-related health insurance claims. In a study of trauma center surgeons, Gentilello et al. (2005a) finds that 24% reported an alcohol- or drug-related insurance denial in the prior 6 months, consistent with the hypothesis that such laws may deter the ordering of BAC tests. O'Keefe et al. (2009) focus primarily on the effects of alcohol intoxication on increased use of diagnostic and therapeutic procedures in trauma centers. They argue that because alcohol intoxication increases resource utilization, health insurance denials due to the exclusion provisions compound the financial burden of alcohol use on trauma centers. O'Keefe et al. (2009) conclude that UPPLs penalize trauma centers for identifying intoxicated patients and, hence, should be repealed.

Federal regulations safeguarding the confidentiality of alcohol screening information generally do not routinely cover trauma patients (Rivara et al. 2005). There is some indirect evidence from survey reports that AEPs may be reducing the likelihood of testing the blood alcohol concentration (BAC) levels of injured patients. In a survey of trauma surgeons, 9 out of 10 reported that alcohol is a major burden on their trauma center and believed that it is important to measure BAC, though less than half reported that they routinely screened the BAC of their patients (Gentilello et al. 2005a); moreover, over 80%of respondents reported that if insurance was not a barrier they would be willing to help establish a brief alcohol intervention program in their center. In another study of trauma surgeons, 27% perceived alcohol screening to jeopardize reimbursement from insurers (Schermer et al. 2003). Interestingly, most trauma surgeons remained unfamiliar with the actual UPPL provisions in their state; despite the fact that 70% of surgeons in the analysis sample practiced in an AEP-inclusive UPPL state, only 13% reported that they practiced in such a state (Gentilello et al. 2005a).[14]

[13] The content of the UPPL is relatively similar across different states that have these laws. Cochran (2010) notes that among those states with a UPPL, there are no meaningful differences between each state's law.

[14] These findings suggest that concerns about reimbursement are broadly reported and shared across surgeons in trauma centers, in spite of a lack of familiarity with the direct provisions in effect in their state; thus, it is also possible that these

In response to concerns about disincentives for health care providers to identify and refer treatment for alcohol and substance use-related problems — including lobbying efforts by the APHA and the NAIC — states began repealing AEP-inclusive UPPLs. Between 2000 and 2021, 14 states repealed these laws that contained alcohol exclusionary clauses and replaced them with statutes that explicitly prohibit the denial of reimbursement claims for injuries involving alcohol (or other substances); two additional states, which did not have an AEP-inclusive UPPL in effect, preemptively passed such legislation prohibiting the denial of claims.

2.2 Prior Literature

The repeal of UPPLs that contain alcohol exclusion provisions provides a unique opportunity to study the potential for behavioral effects on both the provider side and the consumer side, the latter reflecting possible ex ante moral hazard in health insurance. Azagba, et al. (2022b) investigate the effect of a state repeal of an AEP-inclusive UPPL on healthcare provider referrals for alcohol-related treatment. Using a two-way fixed effects (TWFE) reduced-form approach, the authors estimate a substantial intention-to-treat effect; specifically, the repeal of a UPPL was found to have increased admissions for alcohol treatment admissions referred from healthcare providers by 16%, consistent with the hypothesis that denial of healthcare coverage changed provider behavior in a way to protect insured individuals' ability to receive insurance benefits.[15] Along the same lines, Azagba, et al. (2024) find that the prohibition of denying alcohol-related claims in both health and accident insurance in Colorado (in 2007) and Illinois (in 2008) was associated with a significant increase in alcohol-related treatment admission referrals from healthcare professionals.[16]

In addition, Azagba et al. (2022a) test for ex-ante moral hazard by investigating the effects of the repeal of AEP-inclusive UPPLs on the odds that an adult reported drinking or binge drinking at least once in the prior 30 days. With small point estimates that are largely insignificant in most

concerns may impact screening practices in non-UPPL states. In a survey of legislators in 26 states, Gentilello et al. (2005a) also find, as with surgeons, that the majority of legislators remained unsure of the UPPL status in their own state; 64 percent of those who believed that the UPPL was not adopted by their state were incorrect and were indeed from a UPPL state.

[15] In spite of UPPLs applying only to private insurers, the study also reports significant and similarly sized effects on admissions for patients who are publicly insured as well as patients who are uninsured.

[16] There was marked dynamic heterogeneity in these effects, however, with point estimates indicating that the increase persisted in Illinois throughout the nine-year post-policy window, but dissipated and reversed course in Colorado after five to six years post-enactment. Azagba et al. (2024) interpret Colorado's prohibition statute as effectively repealing its earlier adoption of the Uniform Policy Provision Law (UPPL) and replacing those exclusion provisions with an explicit prohibition. However, according to the Alcohol Policy Information System (APIS, 2024), Colorado did not have any laws related to the UPPL prior to January 1, 2007. This could explain the different results for Colorado vs. Illinois in Azagba et al. (2024).

specifications, the study concludes that there is little evidence of AEP repeals increasing alcohol consumption behaviors.

While the above studies make important contributions to our understanding of the literature on the effects of AEP-inclusive UPPLs on alcohol treatment admissions and binge drinking, they are not without important limitations. First, in their study of the effects of UPPL repeals, Azagba et al. (2022a, 2022b, and 2024) conflate two separate treatments. That is, not all states that repeal an AEP-inclusive UPPL replace this law with a new regulation that explicitly prohibits private insurance companies from denying claims due to intoxication by the insured. Between 1998 and 2021, 16 states and D.C. repealed their earlier AEP-inclusive UPPLs and explicitly enacted statutes prohibiting private insurers from denying alcohol-related claims, whereas 4 states repealed their AEP-inclusive statutes without replacing them with a prohibition.[17] In estimating the average effects of UPPL repeals without distinguishing these jurisdictions, the prior work conflated two disparate treatments – the effects of repealing a UPPL and explicitly replacing it with a PDHIA with the effects of repealing a UPPL with no further legislative action. Simply repealing the alcohol exclusion provisions does not prohibit an insurance company from denying coverage to alcohol-related claims. As a result, PDHIAs are expected to have larger (1) moral hazard effects, (2) income effects, and (3) alcohol/substance use treatment effects than repealing the alcohol exclusion provision without an explicit prohibition on denying claims. Therefore, conflating the two different treatment margins may result in possible attenuation bias in the estimated treatment effect.

Second, recent advancements in the difference-in-differences (DiD) literature demonstrate that when the adoption of treatment is staggered across states and average treatment effects vary across groups and over time, standard TWFE estimates may be biased (de Chaisemartin and D'Haultfœuille, 2020; Sun and Abraham, 2021, and Gardner, 2021). Given that the effects of repealing UPPLs may be dynamic and differ across groups and over time (as pointed to by Azagba et al. 2023), it is important to explore the robustness of estimated treatment effects to new DiD methodologies.

Third, the set of outcomes studied in the above papers is limited, failing to capture alcohol- and drug-related consequences such as criminal activity, drinking-and-driving, alcohol-related traffic fatalities. These outcomes may be potentially important to measure to capture externalities associated with problem drinking and substance use, including injuries and deaths to non-drinkers and victims

[17] Additionally, two states preemptively enacted statutes to prevent insurers from denying alcohol-related claims despite not having an AEP-inclusive UPPL. Since these are technically not "repeal" states (they had not adopted any earlier UPPL that contained alcohol exclusion provisions to repeal), they would potentially contaminate the control group despite being strongly treated due to their enactment of a prohibition statute.

of alcohol and substance-related crime.[18] Evaluating such outcomes is critical for assessing the social welfare effects of such insurance provisions.

Finally, given the various counteracting and reinforcing mechanisms at play in the context of a risky behavior that is highly prevalent in the population, it is possible that prohibiting insurers from denying claims may have general equilibrium effect in the private insurance markets. These effects remain unexplored in the albeit limited prior literature.

2.3 Contributions

Our study makes several important contributions to this literature. This study is the first to comprehensively explore the effects of PDHIA adoption on a variety of alcohol- and drug-related outcomes, including those related to externalities from these risky health behaviors. Examining outcomes such as drug- and alcohol-related criminal arrests and drunk driving fatalities, which have potentially large social costs, is crucial for assessing whether such interventions enhance social welfare. Our focus on the treatment margin capturing states that repeal their AEP-inclusive UPPL and replace this with an explicit statute prohibiting insurers from denying alcohol-related (or other substance-related) claims is salient for two reasons. First, if there is any impact or unintended consequences of the repeal, this would be the margin where such effects may be strongest and most likely. Second, the vast majority of states that have repealed the UPPL have enacted a PDHIA in its stead; 22 states still continue to have AEP-inclusive UPPLs in effect.

An additional contribution is that we employ an alternate DiD estimator developed by Sun and Abraham (2021) to overcome potential bias in TWFE estimates caused by heterogeneous and dynamic treatment effects. Finally, in addition to exploring the effects of PDHIA adoption among those most likely to be affected by such legislation (those covered by health insurance), we also explore the general equilibrium effects of such laws on health insurance markets, by assessing impacts on private health insurance premiums, and on the likelihood of receiving private health insurance, which could be affected by such law changes.

3. Data

[18] Almost 90 percent of the total societal cost of excessive alcohol use comprises indirect costs outside the healthcare system, including productivity losses, mortality from motor vehicle crashes, and criminal justice-related costs (Sacks et al. 2015).

We use several complementary data sets to estimate the effect of the PDHIAs on a variety of outcomes related to externalities, including alcohol- and drug-related crime, drunk driving fatalities and drinking and driving behavior. In terms of mechanisms, we measure outcomes related to "first order" risky behavior (e.g., drinking) by insured persons and alcohol-/drug-related treatment admissions resulting from health care professional referrals. Finally, to capture general equilibrium effects in health insurance markets, we measure private health insurance coverage and average premiums paid by covered persons. Our main analyses focus on young adults aged 18-29 years, as this sub-group experiences the highest rates of binge drinking, DUI and motor vehicle fatalities, and criminal activity, though in supplementary analyses we also report results for other age groups.

3.1 Uniform Crime Reports (UCR)

First, to explore the effects of PDHIAs on alcohol- and substance-related criminal activity, which capture important costly externalities from drinking and drug use, we utilize administrative data on arrests spanning 1998-2021 from the Federal Bureau of Investigation's (FBI's) Uniform Crime Reports (UCR). Over 16,000 city, county, and state law enforcement agencies report arrest data to the FBI, and the UCR data cover arrests in all 50 states and the District of Columbia, with a coverage rate of about 98 percent of the U.S. population.[19] We compute state-by-year arrest counts from the UCR and then generate an offense-specific *Arrest Rate* per 100,000 (age-specific) state population using data from the Surveillance, Epidemiology, and End Results (SEER) Program. We define such arrest rates for various categories for alcohol-related offenses (DUI, disorderly conduct), drug-related offenses (including those related to opioids), and Part I offenses, including *Violent Crime Arrests* (homicide, robbery, and aggravated assault) and *Property Crime Arrests* (larceny, burglary, motor vehicle theft, and arson).[20] Among young adults ages 18-29, means arrests for DUI and disorderly conduct were 421.9 and 177.1 per 100,000 persons, respectively. The arrest rate for drug-related offenses was 711.1, and that for property and violent offenses were 592.5 and 214.4 as shown in Appendix Table 1A.

[19] Florida is excluded from the UCR analyses due to lack of reporting; data are available for only a small handful of years. Law enforcement agencies also did not report arrest data for the year 2000 for D.C and Wisconsin.

[20] The UCR program divides criminal offenses into Part I and Part II offenses. Part I offenses are more severe, occur with more regularity across the U.S., and more likely to be reported to law enforcement. Part II offenses are generally less serious and reported with less frequency, and include offenses such as fraud and "white collar" crimes, prostitution and solicitation, drunk driving, vandalism, violations of liquor laws, simple assaults (where no weapon was involved and no injury resulted to the victim), disorderly conduct, and such. Drug-related violations are categorized as Part II offenses.

Characteristic of administrative crime data, there are measurement concerns with the UCR due to incomplete agency reporting across months and over time.[21] In order to minimize reporting gaps while maintaining reliability, we limit our sample to a balanced panel of agencies that report each year over the entire sample period and report for at least 6 months or in December in a given year (because some agencies do not report monthly but just once per year in December). We also conduct a series of empirical checks, which are standard in UCR-based studies, to assess robustness to the sample restriction and further account for reporting variance. First, we control for the number of law enforcement agencies that report arrests in each state-year, along with the share of the state's population that is covered by the reporting agencies ("coverage rate"). Second, we assess sensitivity to including controls for police officials and expenditures on police, to account for any variation in criminal arrests across agency jurisdictions due to differences in enforcement and personnel. Third, we utilize a less stringent sample restriction and utilize a larger – albeit unbalanced – panel of agencies. Fourth, we omit state-year outliers to confirm that our results are not driven by any small subset of extreme values, which may possibly be due to inconsistent reporting in that year.

3.2 Fatality Analysis Reporting System (FARS)

In addition to DUI-related arrests (from the UCR), we draw upon administrative information from the Fatality Analysis Reporting system to study spillover effects of the PDHIAs on alcohol-related motor vehicle fatalities. Maintained by the National Highway Traffic Safety Administration, the FARS contains data on the census of all fatal injuries suffered in motor vehicle crashes on public roadways nationwide. Information on the characteristics of each crash and the vehicles and persons involved is derived from various sources, including police crash reports, driver licensing files, vehicle registration files, state highway department data, emergency medical services records, medical examiners' reports, toxicology reports, and death certificates.

To identify traffic fatalities involving alcohol, we make use of information collected on the blood alcohol content (BAC) of the driver.[22] Where the BAC of the driver is missing, the NHTSA

[21] Data from the FBI's National Incident Based Reporting System (NIBRS), another widely used data set on crime and which contains information on victim-reported criminal incidents to law enforcement, is not well-suited for our study. A major drawback of the NIBRS is that it had very limited coverage over the bulk of our sample period. Specifically, over the 2000-2010 period which witnessed much of policy action on repealing the alcohol exclusion provisions and prohibiting insurers from these practices (see Table 1), NIBRS representation went from 18 states (in 2000) to 32 states (in 2010); moreover, not all agencies from these states were reporting their data into the NIBRS program. It is only since 2021 that the FBI fully transitioned its crime reporting platform to the NIBRS, and NIBRS is now the national standard of law enforcement-reported crime data in the U.S.

[22] Information on BAC of the driver is available for between 60-65 percent of all traffic fatalities.

imputes the BAC measure based on observed conditions of the crash and characteristics of the driver (time/day and severity of the crash, vehicle type, opinion of law enforcement agents on the site regarding alcohol involvement, vehicle type, prior convictions of the driver, license status, etc.). The NHTSA transitioned to a multiple imputations approach, in 2001, to account for the variance in the imputed values; recognizing that a range of plausible potential BAC values are possible (when BAC is not observed), the FARS data include 10 imputed values of the BAC for each missing record. For our main analyses, we use the measured BAC when available, and the lowest of the 10 imputed BAC values when BAC is not observed; thus, when the BAC is not observed, we are conservatively defining a crash as involving DUI if all 10 imputations indicate a BAC>0.

We define two measures of DUI-involved traffic fatality rates: 1) motor vehicle fatalities of all persons involved in a crash where the driver, aged 18-29, had a BAC>0 (per 100,000 persons); 2) fatalities of all DUI-involved motor vehicle drivers, ages 18-29 (per 100,000 persons). Over our sample period, there were an average of 8.6 motor vehicle deaths involving an alcohol-impaired young adult driver, and 5.4 deaths of alcohol-impaired drivers, per 100,000 persons as shown in Appendix Table 1A.

3.3 Behavioral Risk Factor Surveillance Survey (BRFSS)

Next, we turn to an alternate measure of DUI (in addition to DUI arrests or alcohol-related traffic fatalities), using self-reported drinking and driving behavior at the individual level by relying on data spanning 1998-2021 from the Behavioral Risk Factor Surveillance System (BRFSS), a nationally representative telephone-based health survey conducted annually by the Centers for Disease Control and Prevention (CDC). In addition, the BRFSS allows us to directly measure several key mechanisms through which the above externalities could be affected: self-reported individual-level alcohol use and misuse. The BRFSS interviews more than 400,000 noninstitutionalized adults (18 and older) by phone each year, making it the largest continuously conducted health survey system in the world. There are several advantages in using the BRFSS for our analysis, including detailed measures of alcohol use and misuse, as well as information on current health insurance coverage, the latter of which allows us to measure risky health behaviors among those most likely to be affected by PDHIAs (and hence closer

to a treatment-on-treated estimate). Our main analysis sample comprises 824,000 adults aged 18-29 over the period 1998-2021.[23] All of our estimates are weighted using population sample weights.[24]

To investigate the effect on alcohol consumption and DUI behaviors, we define indicators for (1) whether the respondent consumed alcohol over the past month at least once (*Alcohol Use*), (2) whether the respondent participated in binge drinking in the past month at least once (*Binge Drink*), and (3) whether the respondent had driven after they assessed that they had drank "too much" (*Drinking and Driving*). The latter question of driving under the influence (DUI) of alcohol is asked biennially and only to those who reported consuming alcohol at least once in a given month. As seen in Appendix Table 1A, among all young adults ages 18-29, 55.9% report current alcohol use, 27.3% report engaging in binge drinking, and 6.4% report having driven under the influence. Among insured young adults, these numbers are 57.5%, 27.5% and 6.1%, respectively.

3.4 Treatment Episode Data Set (TEDS)

To explore the impact of PDHIAs on alcohol- and substance-related treatment admissions, a potentially important mechanism through which PDHIAs may operate, we rely on information on admission flows into substance abuse treatment facilities from the Treatment Episode Data Set (TEDS). All facilities that receive public funding are required to report to their state's reporting agency data on clients admitted for treatment for substance use disorder; these data are assembled and compiled by the Substance Abuse and Mental Health Services Administration (SAMHSA) across states and into the TEDS program. For each admission, we observe the primary, secondary, and tertiary substance related to the treatment admission, personal characteristics of the patient, and source of referral to the treatment program are observed. Referrals can originate from within the criminal justice system (i.e. court-ordered) or from the patients themselves, family and peers, and health care providers. Our focus is on treatment admissions resulting from referrals from alcohol/drug use care providers, other health care providers, and Employer/Employee Assistance Programs (EAPs).

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[23] We also assess effects for the sample restricted to those with any insurance coverage (~642,000 observations). Consistent information on type of health insurance coverage is not available in the BRFSS. Hence, we are not able to condition on privately insured adults. Though, we note that since private coverage may be potentially impacted by PDHIAs, conditioning the analyses specifically on individuals with private coverage may result in a selected sample. In subsequent analyses, we assess the impact of the policy on private insurance coverage and premiums using supplementary data from the MEPS to explore spillover effects on health insurance markets.

[24] Since 2011, the CDC started making survey calls to cell phone numbers in addition to landlines to keep the data representative of the U.S. population. Furthermore, it changed the statistical method used to compute sampling weights, moving from post-stratification to iterative proportional fitting (Pierannunzi et al., 2012). We follow prior research that pools all BRFSS waves and adjusts weights accordingly (Simon et al., 2017).

As with the UCR, there are well-known reporting issues with the TEDS. To address reporting variance across states and over time, we follow the literature and define the drug treatment admissions ratio as the rate of individual drug treatment admissions to total drug treatment admissions. Over our sample period, 24.9% of admissions involving clients ages 18-29 mentioned alcohol as the primary substance of abuse, and 43.9% mentioned alcohol as either the primary, secondary or tertiary substance of abuse as shown in Appendix Table 1A. Turning to other substances, we find that 15.9% are treatment admissions for marijuana as a primary substance of abuse and 29.5% are treatment admissions for cocaine or heroin.

3.5 Medical Expenditure Panel Survey (MEPS)

A limitation of the BRFSS is that while these data include information on health insurance coverage, it is not possible to determine the type of coverage, which may be problematic because PDHIAs specifically apply to private health insurance plans. To explore broader general equilibrium effects on private insurance markets, we turn to data from the 1998-2021 Medical Expenditure Panel Survey (MEPS) administrated by the Agency for Healthcare Research and Quality (AHRQ). The Insurance/Employer Component of the MEPS (MEPS-IC) provides aggregated information on the private health insurance plans offered, benefits received, annual premiums, and annual contributions for each state-year, which are derived from a sample of private and public sector employers on the health insurance plans that they offer their workers. Specifically, we measure (1) *Private Health Insurance Coverage Rate*, the share of private sector employees covered by private health insurance, and (2) *Average Health Insurance Premium,* the average total premium charged per enrolled employee for single coverage at private-sector establishments that offer private health insurance. Over the analysis period, 51.3% of private sector workers were covered by private health insurance plans under single coverage. The average total annual premium for such coverage was $5983.23 as provided in the sample means of Appendix Table 1A.

3.6 Prohibitions on Denials of Health Insurance Claims for Alcohol-Related Health Outcomes

The Alcohol Policy Information System (APIS) of the National Institute on Alcohol Abuse and Alcoholism provides the exact date of policy changes related to AEP-inclusive UPPLs for each state since 1998 (APIS, 2024). Between 1998 and 2021, 16 states and D.C. repealed alcohol and other substance exclusion provisions *and* replaced them with an explicit statute prohibiting private insurers from denying claims (PDHIAs). This is our primary treatment of interest, and the states that adopted

a PDHIA, along with their effective dates, are listed in Table 1.[25] Figure 1 shows the spatial and temporal distribution of states that adopted a PDHIA, starting from the first state (South Dakota) in 1998 to 5 states by 2004, increasing to 12 states plus D.C by 2008; three additional states enacted a PDHIA in 2009, and New Jersey became the most recent state to do so in 2019.[26] Prohibition statutes are largely well-distributed across the U.S. regions (5 states in the West; 6 states in the Midwest; 2 states and D.C. in the South; 3 states in the Northeast). Moreover, the bulk of the treated states became treated by 2010 (16 out of 17 treated), and with our data spanning through 2021, this also affords us a sufficiently long post-treatment window to detect any effects that may materialize slowly or with a lag.

4. Methodology

Our empirical approach is guided by the mechanisms described above, and we estimate a reduced-form model that directly links the PDHIA statutes to alcohol misuse and related outcomes. We leverage the staggered adoption of the repeal and replacement of the alcohol exclusion provisions with a PDHIA statute across states since the late 1990s, and start with the following generalized difference-in-differences (DiD) specification estimated via a standard two-way fixed effects (TWFE) setting.

$$A_{st} = \lambda\, PDHIA_{st} + \alpha\, NLA_{st} + Z_{st}\,\beta + \mu_s + \tau_t + \varepsilon_{st} \quad (1)$$

A_{st} denotes our aggregate outcomes of interest related to alcohol misuse, for a given state *s* measured over year *t*, which are derived from the UCR (crime), FARS (DUI motor vehicle fatalities), TEDS (substance use treatment admissions), and the MEPS (private insurance coverage and premiums). Except for private insurance coverage (from the MEPS), we model these outcomes with the natural

[25] In addition, 4 states (Montana, Tennessee, Texas and Vermont) repealed their AEP-inclusive UPPL but did not replace them with an explicit prohibition (No Legislative Action – NLA). Each of our specifications includes treatment variables for such repeals in order to separately identify our main treatment of interest, repealing and replacing the AEP-inclusive UPPL with a PDHIA statute. Two states (Colorado and Connecticut) did not have an AEP-inclusive UPPL in place, but preemptively adopted a PDHIA statute.

[26] In three states, the scope of UPPLs is not clear as the relevant law allows some exceptions. In Maine, from September 20, 2007, until present, intoxication exclusions are prohibited in health insurance contracts with the exception that they are permitted in group or blanket policies. In Maryland, between October 30, 2000, and December 31, 2001, intoxication exclusions were permitted by statute in individual health insurance policies but were prohibited by regulation in group health insurance policies, individual and group health maintenance contracts, and individual nonprofit health service plans. In New Jersey, from May 6, 2019 until present, a blanket insurance policy or certificate or other group policy or certificate providing health insurance may include an exclusion for losses resulting from the covered person's use of alcohol, but this does not apply to a group health benefits plan. Because most private health insurance policies are group policies, in our main analyses, we assume that Maine has a UPPL while Maryland and New Jersey explicitly prohibit the denial of claims due to intoxication for the relevant periods.

log to account for the skewness in the outcome distribution, for ease of interpretation as relative impacts, and to facilitate comparison of the point estimates across outcomes and data sets. The vector Z_{st} includes an extended set of state-level socio-economic characteristics, alcohol, tobacco, and other substance policy factors, and social policy controls.[27] In addition, μ_s is a (time-invariant) state fixed effect and τ_t is (state-invariant) year fixed effect, which respectively account for all unobserved stable heterogeneity across states and secular trends in alcohol consumption and related behaviors. Standard errors are corrected for clustering at the level of policy variation, the state level (Bertrand et al., 2004) and we weight all regressions using state-population weights to make the regression parameters representative of the U.S. young adult population. For the individual-level analyses of alcohol use and DUI behaviors from the BRFSS, equation (1) is extended to further include individual-level controls for age, gender, race/ethnicity, educational attainment, and marital status.

The main treatment variable is an indicator for PDHIA adoption, and our key parameter of interest is λ, which captures the reduced-form intention-to treat impact of a PDHIA on alcohol-related behaviors operating through all reinforcing and/or counteracting pathways noted above.[28] Importantly, all models also include an indicator for states ("no legislative action"; NLA_{st}) that repealed their alcohol exclusion provisions without replacing it with an explicit prohibition (as well as states that did not have any prior alcohol exclusion provisions to begin with) in order not to conflate the effect of the PDHIA with these more ambiguous, less common, and weaker changes. Consequently, the local treatment margin specifically captured by λ is the impact of a "repeal and

[27] The means of our state-level controls are shown in Appendix Table 1B. All models include the following: state-level socio-economic characteristics (population share that is Black, Hispanic and female, unemployment rate, cumulative deaths from COVID-19, COVID-19 vaccination rate, Oxford University government stringency index), alcohol policy controls (beer tax, BAC 0.08 laws, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policy controls (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws, Good Samaritan laws for drugs), tobacco policy controls (cigarette tax rate, e-cigarette tax rate), and social policy controls (Medicaid expansions under the Affordable Care Act, effective minimum wage in the state, maximum Supplemental Nutrition Assistance Program benefits for a family of four, and the state Earned Income Tax Credit refundable rate). In models of crime rates (based on the UCR data), we further include the number of law enforcement agencies reporting in each state and year, and the population coverage rate (percent of state population that is represented by the reporting agencies).

[28] Given that the UPPLs operate only for private insurance, and not all private insurers engage in the practice of denying coverage because of alcohol/substance use even in states with the alcohol exclusion provisions, the coefficient on treatment provides the intention-to-treat (ITT) impact of the policy on outcome variables compared to the states that explicitly permit the denial of health insurance claims. It is important to note, however, that this ITT is not necessarily predicated on private insurers actually following through on the practice of denying claims; that they previously had this option, and the possibility that claims could be denied if alcohol/drugs are involved, can independently motivate consumer and provider behaviors.

replace" PDHIA relative to states that have not repealed their alcohol exclusion provisions and continue to allow private insurers to deny claims.[29]

Our intention-to-treat estimate, λ, is identified from within-state variation in UPPL repeal and adoption of PDHIA statutes, as outlined in Table 1 and Figure 1, drawing on the non-repeal UPPL states as controls. This parameter will represent an unbiased causal effect of the policy in the absence of reverse causality (policy exogeneity assumption) and if the control states are a credible set of counterfactuals for outcome trends that would have evolved in the absence of the treatment (the standard "parallel" trends assumption underlying any DiD approach). First, we extend the baseline specification in equation (1) to account for unobserved time-varying spatial heterogeneity, a common source of potential violation of the parallel trends assumption. We do this by including parametric state-specific linear time trends, which control for the influence of unobservables that could be unfolding systematically and coincidentally with the adoption of PDHIA and the outcomes under study, and alternately by adding region-specific year fixed effects, which control non-parametrically for all unobserved common shocks experienced by states within Census regions. These latter region-by-year fixed effects constrain the counterfactuals for the treated states to be within the same Census region ("proximate controls"). This may help identify more credible estimates if geographically proximate states are better counterfactuals, though if the restriction results in worse counterfactuals, this could exacerbate bias. Another caveat to be mindful of is that such spatial heterogeneity controls may absorb some of the treatment effects in case there are dynamic effects of the policy that unfold over time (Wolfers, 2006 and Neumark et al., 2014). In light of these considerations, we examine the sensitivity of our main estimates from equation (1) to augmenting the specification with these controls.

Second, we estimate event-study analyses, where we decompose the estimated treatment effect over time.

$$A_{st} = \sum_{j=\underline{J}}^{\bar{J}} \lambda^j D_{st}^j + \alpha\, NLA_{st} + Z_{st}\,\beta + \mu_s + \tau_t + \varepsilon_{st} \quad (2)$$

[29] As underscored earlier, this is the more salient and policy-relevant treatment margin for at least three reasons. First, this is the policy shift that is most prevalent; virtually all states that have acted on the NAIC recommendation and have repealed their alcohol exclusion provisions have also enacted a new prohibition statute in its place, which explicitly bans private insurers from denying claims. Second, the PDHIA represents a stronger treatment; if there are any positive or negative effects of the statutes, they would be most likely to materialize here. In states that only repeal their alcohol exclusion provisions without replacing them with an explicit ban on the practice, private insurers can still continue to deny claims post-repeal. Third, currently 22 states continue to have alcohol exclusion provisions in place. Hence, the treatment effect that we identify helps inform what would happen if these states were to repeal their exclusion provisions and explicitly ban insurers from rejecting claims.

Equation (2) replaces the treatment indicator (PDHIA) with a series of pre- and post-policy timing indicators wherein D_{st}^{j} is a treatment indicator for the policy adoption (repeal of the UPPL and replacing it with a prohibition statute) happening *j* periods away from year *t*; treatment indicators are binned at the "endpoints" (the last open-ended lead and lag variables). The vector λ denotes the coefficients on the treatment effect, with the reference period being *j-1*, the year prior to PDHIA enactment. If the estimates of λ for the period [$\underline{J}$, *-2*] are equal to 0, this would provide evidence in support of the parallel trends and policy exogeneity assumptions. Moreover, examination of the estimates of λ for post-policy treatment indicators (periods *j=0 to* $\bar{J}$) will inform where there are dynamics in the policy effects.

Recent developments in the DiD literature indicate that estimates of λ^{j} from the standard TWFE specification of the event study (equation 2) may be biased in the presence of dynamic and spatial treatment effect heterogeneity (Athey and Imbens, 2018; Goodman-Bacon, 2021; de Chaisemartin and D'Haultfœuille, 2020; Imai and Kim, 2020; Sun and Abraham, 2021). To address this possibility, we apply interaction-weighted estimator proposed by Sun and Abraham (2021). The Sun and Abraham estimator combines estimates of the treatment effect for each adoption cohort (defined based on treatment timing), with weights equal to the sample shares of each treatment cohort in the relevant periods. These cohort-specific treatment effects are estimated using an interacted model that interacts treatment cohort indicators with each treated unit *s* and its leads and lags relative to its initial treatment, using the never treated states as counterfactuals. Sun and Abraham (2021) show that this estimator, unlike the standard TWFE estimator, is not contaminated by bias from spatial and dynamic heterogeneity in the treatment effects.

We supplement these main analyses with a series of supplementary models to assess effects for and heterogeneity across older adult sub-populations, and to explore the sensitivity of our main findings to alternate functional forms, sample restrictions, outcome definitions, and potential compositional selection due to young adults' expanded access to private insurance under the Affordable Care Act's dependent coverage mandate. We discuss these issues in turn below as we report these results.

5. Results

Our main findings are reported in Tables 2 through 11 and Figures 2 through 7. Supplemental analyses and robustness checks are presented in appendix tables.

5.1. Crime

We start with an analysis of alcohol-related criminal offenses among young adults ages 18-29, based on arrest data from the FBI's Uniform Crime Reports, in Table 2. Panel I presents results for arrests related to driving under the influence of alcohol (DUI), beginning with a parsimonious specification (model 1) that includes only controls for state socio-demographic and economic factors along with the requisite fixed effects. Subsequent models incrementally add alcohol, substance use, tobacco and social policy measures to gauge the sensitivity of the estimates to additional time-varying controls. Across these specifications, we find no evidence that repealing alcohol exclusion provisions and explicitly prohibiting private insurers from denying health care claims has had any adverse effects on young adults' DUI arrests. To the contrary, all of the coefficients, albeit imprecisely estimated, are negative and suggestive of a decrease in DUI arrests.[30] The point estimate from our preferred saturated specification (model 5) indicates that PDHIA adoption is associated with a 7.2 percent reduction in DUI arrests. And, with 95 percent confidence we can rule out any sizeable ex ante moral hazard driven increases in DUI offenses exceeding 1.8 percent. In Panel II, we turn to arrests for disorderly conduct, an offense category that involves disruptive behavior including fighting, making threats, or causing a public nuisance; while not always the case, alcohol intoxication is frequently a contributing factor of such. As with DUI arrests, the point estimates are imprecise; they are consistently negative and more supportive of possible beneficial impacts of PDHIAs on disorderly conduct as opposed to adverse impacts from ex ante moral hazard channels.

Figure 2 visually presents estimates from the event study analyses for alcohol-related offenses, based on equation (2) using the standard TWFE estimator and based on the Sun and Abraham (2021) estimator that is robust to potential biases from dynamic and spatial heterogeneity. Overall, these analyses underscore four points. First, estimates in the pre-treatment periods do not point to any substantial or significant deviation in trends between the treated and control units; lead effects are statistically insignificant, close to zero, and support the parallel trends assumption underlying our DiD approach. Second, any declines in DUI and disorderly conduct arrests only materialize subsequent to the adoption of the PDHIA statute.[31] Third, there is suggestive indication that the policy response

[30] Standard errors remain robust across the specifications; if anything, the addition of the vector of time-varying policy controls reduces residual variance and helps improve estimated standard errors.

[31] In Appendix Figure 1 we separately estimate an event study specification for public drunkenness, which is a misdemeanor Part II offense and part of a broader category of public order crimes that also include offenses like disorderly conduct. While not all arrests for disorderly conduct implicate alcohol, arrests for public drunkenness present a more direct

may operate with some lag, which may reflect the various links in the causal chain relating PDHIAs to downstream behavioral consumer and provider responses. For instance, physician practice patterns tend to be sticky, and it may take time for physicians (and patients) to be informed regarding the change in the policy landscape and adjust their practices. Fourth, findings are largely consistent across both the TWFE and the Sun and Abraham approaches.

PDHIA statutes explicitly prohibit health insurers from denying claims from both alcohol-related losses as well as those stemming from non-prescribed narcotics. Consequently, any disincentives for hospital ED physicians to screen injury or accident patients for substances are more generalized beyond just testing for alcohol intoxication. Thus, PDHIAs may also affect outcomes related to narcotics and other drugs, directly by removing these disincentives as well as indirectly to the extent that these substances are complementary to or substitutes for alcohol.

We explore this possibility by estimating models for arrests related to drug offenses in Table 3 and corresponding event studies in Figure 3. Most of these estimates are statistically insignificant, and we therefore interpret these patterns as suggestive rather than definitive. In Panel I of the Table and the Figure, we report estimated effects of PDHIAs on arrests for any drug-related offense, and find effect magnitudes that are not statistically or economically significant. In the remaining panels, we disentangle potential differential effects across specific drug categories starting with marijuana-related arrests (Panel II), which constitute half of all drug arrests among young adult offenders. Notably, marijuana is the only drug offenses category for which we find positive coefficients across the extended specifications, a small post-treatment uptick – albeit highly imprecise – that is also somewhat evident in the Sun and Abraham event study.[32]

After marijuana, arrests for heroin and cocaine (reported in Panel III) – both narcotics – constitute the next largest share (approximately one third) of drug offenses; effects for these narcotics turn out to be negative, small, and not statistically distinguishable from zero. Finally, we consider how PDHIA impacted arrests for synthetic narcotics or synthetic opioids (Panel IV) such as fentanyl and carfentanil, and arrests for other dangerous non-narcotics (Panel V) such as amphetamines and barbiturates. Interestingly, we find strong declines in arrests associated with these substances, on the

measure of alcohol misuse and intoxication; however, arrests for public drunkenness may be also more prone to reflect variation in local ordinances (such as open container laws, allowances for public alcohol consumption) and law enforcement. These caveats notwithstanding, as with DUI and disorderly conduct arrests, the event study estimates for public intoxication indicate a marked post-treatment decline, consistent with an overall decrease in criminal offenses related to excessive alcohol consumption as a result of PDHIA statutes.

[32] This suggestive adverse consequence may be reflective of potential substitution from alcohol misuse to marijuana use (Subbaraman 2016).

order of 21.7 to 23.7 percent.[33] As with the patterns reported in Table 2 for alcohol-related offenses, these reductions in arrests for certain drug-related offenses are broadly consistent with improving incentives for providers to now screen for substances post-PDHIA adoption.

Alcohol and substance use are known causal risk factors for criminal engagement (Corman and Mocan 2000, 2015; Dave et al. 2021). Through the estimates reported in Table 4, we widen the lens and explore broader effects on all Part I violent and property offenses. Here we find consistent evidence that PDHIA adoption is associated with a significant decline in Part I offense-related arrests, by about 10.9 percent for violent offenses and 13.5 percent for property offenses. A causal interpretation of these findings is supported by the event study analyses (see Figure 4). There is no evidence of differential pre-treatment trends, adding a degree of confidence regarding the validity of the counterfactuals, and any marked deviation in trends between the treated and control units becomes apparent only post-treatment. As with alcohol-related offenses, coefficient patterns in the event study are reflective of dynamic effects that operate with some lag and strengthen over the post-treatment window.

While our main analyses focus on young adults ages 18-29, we explore further age-related heterogeneity with the estimates reported in Table 5. Within our main sample, we generally find that PDHIA adoption is associated with declines in alcohol-related arrests, drug arrests for synthetic narcotics and other non-narcotics, and arrests for violent and property criminal offenses across the youngest (ages 18-24) and oldest (ages 25-29) individuals among this group. Effects for alcohol-related offenses are somewhat larger for the former while effects for the drug-related and Part I criminal offenses are larger for the latter. Among older adults ages 30-49 and ages 50-64, we continue to find declines in DUI arrests, on the order of about 5.4 to 6.2 percent, as well as meaningful declines in arrests for drug-related, property, and violent offenses. These results indicate that any beneficial impact of PDHIAs on criminal engagement appears to be broadly distributed across the age distribution; while there are some differences in the point estimates, these are not sufficiently powered to be able to reject the null of equality in the coefficients.[34]

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[33] As intention-to-treat effects, these magnitudes may appear large. However, it is important to note that arrests for synthetic narcotics and other non-narcotics constitute relatively small shares of total drug arrests, only about 3.2 percent and 14.3 percent respectively. Hence, these effects equate to a decline in arrests for synthetic narcotics by approximately 0.5 arrest (per 100,000 young adults) and that for other non-narcotics by 24.3 arrests (per 100,000 young adults).

[34] There is a strong age gradient in criminal activity. Thus, even if the relative effects are largely similar, absolute magnitudes for the implied decline in alcohol-related, drug-related, and Part I offense-related arrests are smaller for older adults ages 30+ relative to the younger adults of our main sample.

Finally, we present a series of sensitivity analyses and checks to assess the robustness of our main findings for crime to various issues. In Table 6, we include parametric (state-specific linear trends) and non-parametric (Census region-specific year fixed effects) controls for spatial heterogeneity. And, in Table 7, we confirm that our findings are not driven by reporting gaps and measurement issues that are characteristic of administrative crime data such as the UCR. Since variation in arrests may reflect differences in criminal activity as well as differences in enforcement and policing practices, we add policing controls to the specifications reported in Panel I. In Panel II, we omit outliers (state-year cells where the outcomes are more than two standard deviations from the state-specific mean), since these may reflect reporting errors and/or represent observations that impose undue influence on the estimated treatment effects. In Panel III we employ a less stringent sample definition, which draws information from a larger unbalanced panel of agencies, in contrast to our main analyses which are based on a balanced panel of consistently-reporting law enforcement agencies (as described in the Data section). Across all of these alternate specifications and samples, we find largely similar patterns of results, pointing to post-PDHIA adoption declines in arrests involving alcohol, synthetic narcotics and other non-narcotics, and violent and property offenses.

Given that the alcohol exclusion provisions under the UPPL, their subsequent repeal, and the newly adopted prohibition on claims denial applied only to private health insurers, one concern is that our findings may be conflated by greater selection of privately insured young adults into our sample as a result of the Affordable Care Act's Dependent Coverage Mandate (DCM). The DCM took effect in September of 2010, and extended dependent coverage to young adults through age 26, essentially allowing them to remain on their parents' health insurance plans. Studies have found that the mandate significantly increased insurance coverage for eligible young adults by around four to six percentage points (Yoruk and Xu 2019; Colman and Dave 2018; Barbaresco, Courtemanche, and Qi 2015). That we find similar effects on arrets for younger adults ages 18-24 (Table 5, Panel I) is validating in that our results do not appear to be driven by any resulting compositional selection; since young adults in this age group are eligible under the ACA's dependent coverage provisions, potential compositional selection effects of the DCM would be picked up fully by the period fixed effects. In Panel V of Table 7, we further explore if the effects of the PDHIA were moderated by the enactment of the DCM. In principle, with a larger share of young adults gaining private insurance, effects of the PDHIA may be magnified due to a larger potentially treated sample post-DCM. Except for the category of non-narcotics, we generally find this to be the case; where there are post-PDHIA declines in arrests, these declines appear to be magnified after the DCM took effect. We interpret these patterns cautiously

given the high degree of imprecision in the heterogeneity parameters. Nevertheless, the weight of the evidence across these and the age-related heterogeneity indicates that our findings are not an artifact of a systematically changing sample composition.

Our main analyses include all states, but separately account for states that repealed their alcohol exclusion provisions but did not replace them with an explicit ban on the practice and states that did not have an exclusion provision to begin with (as specified in equation 1; referred to as "no legislative action" or NLA states). This ensures that the counterfactuals are drawn cleanly from states that continue to have an alcohol exclusion provision. In the event study analyses reported in Appendix Figure 2, we show that our estimates and conclusions are not materially impacted if we alternately exclude the NLA states altogether from the analyses.

5.2. DUI-related Motor Vehicle Fatalities

Next, we explore how PDHIA statutes impacted motor vehicle fatalities related to drunk driving, based on information from the FARS (results reported in Table 8). We consider two outcomes: 1) all motor vehicle fatalities involving a young adult driver under the influence of alcohol (Panel I); and 2) fatalities of young adult drunk drivers (Panel II). We find no evidence that the prohibition statutes had any statistically or economically significant effects on either of these outcomes. With 95% confidence, we can rule out increases in alcohol-related fatalities of approximately 6-8 percent. The event study analyses, reported in Figure 5, confirm these null findings and corroborate the absence of any differential pre- or post-treatment trends.[35]

5.3. Alcohol Use Behaviors

In light of our providing some evidence of reductions in alcohol- (and harder drug-) related crime — as well as reductions in arrests for costly Part I offenses — we next explore more proximate effects of PDHIAs on individuals' self-reported participation in alcohol use and misuse based on individual-level information from the BRFSS. Main estimates for the young adult sample (ages 18-29) are reported in Table 9, and Figure 6 reports the coefficient patterns from the event study analyses.

[35] We subject these estimates to the same series of robustness and heterogeneity checks outlined in our analyses of crime. Notably, we add controls for spatial heterogeneity (Appendix Table 2), explore differential impacts across various age-based sub-populations (Appendix Table 3), and explore heterogeneity in the policy response over the period after the enactment of the ACA's dependent coverage mandate (Appendix Table 4). We find largely similar results. Coefficients in the models that include the Census region-by-year fixed effects are more positive (implying about a four percent increase in drunk driving fatalities); however, these estimates are also highly imprecise with wide confidence intervals.

In addition to presenting results for the full sample of young adults (models 1 and 2 in Table 9), the use of individual-level data allows us to condition the sample on those who are insured (models 3 and 4). While the latter sample is more likely to be treated, conditioning the sample on insured adults potentially selects respondents based on an endogenous factor if insurance coverage rates are impacted by PDHIA statutes, a point which we explore in greater detail below.[36] We therefore emphasize estimates from the unconditioned sample in our discussion here, though the findings are largely similar for the insured sample.

We find consistent evidence that PDHIA adoption resulted in a significant reduction in alcohol use by between 1.3 to 1.4 percentage points (approximately two percent relative to the sample mean). Further cutting the sample by age (Appendix Table 6) shows that virtually all of this effect is driven by the youngest adults, ages 18-25; for this group, we find a significant reduction in their alcohol participation on the order of 2.3 percentage points (3.8 percent relative to their mean alcohol use prevalence). We do not find any significant or meaningful effects for binge drinking for younger or older adults (Table 7 and Appendix Table 6). However, we do find some evidence that banning health insurers from denying alcohol-related health care claims leads to a decline in self-reported DUI behavior; in our preferred specification, we find a significant 1.1 percentage point decrease (which amounts to a sizeable 14.6 percent reduction relative to the sample mean).[37] This marked, statistically significant, decline in drinking and driving is also evident in the event study (Figure 6, Panel III), which additionally points to dynamic effects that become stronger over the post-policy window (for instance, reaching approximately a two percentage point decline two or more years following PDHIA enactment). These beneficial effects on drinking and driving behavior are consistent with the reduction in DUI arrests reported above.[38]

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[36] A limitation of the BRFSS is that complete information on the type of insurance coverage is not available, and we cannot differentiate those with private vs. public coverage.

[37] We do not find any meaningful effects on alcohol use, binge drinking, or participation in DUI among older adults ages 30-64 (Appendix Table 6). As reported in Appendix Table 5, estimates from the BRFSS are more sensitive to parametric and non-parametric controls for spatial heterogeneity than prior analyses with the UCR and the FARS. The BRFSS are not designed to be state-representative of age-based sub-populations, in which case such controls could exacerbate measurement error (by forcing separate linear trends through potentially noisy state-specific individual data) and/or lead to counterfactuals of poorer quality (by forcing counterfactual states to be drawn proximately from within the same region). When we explore differential effects in relation to the ACA's dependent coverage mandate (Appendix Table 7), we find some suggestive indication of stronger (more negative) effects after the DCM was enacted, particularly for alcohol use.

[38] That the decrease in drinking and driving behavior does not discernibly shift DUI-related motor vehicle fatalities (Table 8) may reflect two reasons. First, a very small share of DUI prevalence results in motor vehicle fatalities. On average, there were approximately 2,850 drunk driver fatalities annually over our sample period based on the FARS; self-reported estimates from the BRFSS indicate that approximately 2.39 million young adults engaged in drinking and driving on average each year. This implies a crude driver fatality rate of 0.12 percent, conditional on drinking and driving. Second, if PDHIAs

5.4. Broader Effects on Private Health Insurance Markets

Given the beneficial effects of PDHIAs on crime, alcohol use, and drunk driving behaviors in conjunction with private insurance providing greater coverage for alcohol and drug-related health claims, it is conceivable that PDHIA statutes may have broader general equilibrium impacts on private insurance coverage rates and premiums. We gauge these effects in Table 10, starting with individual-level information from the BRFSS on any insurance coverage (model 1). Here, we do not find any discernible effects, with the qualification that the BRFSS does not differentiate between coverage types. To bypass this limitation, and specifically look at coverage and premiums in private health insurance markets, we turn to the MEPS. Estimated effects on private premiums are insignificant and close to zero (model 3), though we do find a small, statistically significant increase in private coverage (model 2) of about 0.6 percentage point (1.3 percent).[39] Event study analyses, presented in Figure 7, however show no evidence of any increases in private coverage post-PDHIA adoption; outcome trends between the treated and control states are essentially flat throughout the analysis period. We interpret this evidence to convey that PDHIAs had at best negligible, and likely no, impact on insurance coverage rates or premiums.

5.5. Substance Use Treatment Admissions

Lastly, we test a key mechanism that may underlie the effects of PDHIA statutes on alcohol and substance misuse, and a key concern voiced by opponents of the earlier alcohol exclusion provisions, notably the possible disincentives faced by providers to screen for alcohol and drugs when health insurers are allowed to deny resulting claims. To do so, we directly examine effects on admissions into substance treatment facilities, drawing on data from the TEDS. We focus on admissions referred by health care providers and employers, which are arguably most impacted by the alcohol exclusion provisions and their subsequent repeal and prohibition (reported in Table 11), though we also provide corollary estimates for other referrals including those initiated by the patient (self), their school, or a community organization (Appendix Table 10).[40] While estimates do not indicate any significant or substantial effects on alcohol-related treatment admissions (point estimates

reduce less intensive drinking and driving behaviors towards the left tail of the intensity distribution, then it is possible that DUI motor vehicles may remain unaffected even if drinking and driving participation is decreasing.

[39] Appendix Table 8 shows that these results are robust to accounting for spatial heterogeneity. And, in Appendix Table 9, we find some evidence of stronger effects on insurance coverage over the period that the DCM was in effect.

[40] We exclude court-ordered/criminal justice referrals as these should not be impacted by the policies under study.

imply a 1.6 percent increase), there appears to be a meaningful and significant increase in admissions involving heroin and/or cocaine between 13.1 and 17.8 percent.[41] To the extent that PDHIAs expanded screening for substances within the hospital setting by eliminating any disincentives for trauma care physicians to screen for narcotics and other drugs, this may have played a role in diverting at-need patients into substance use treatment.

6. Discussion

In an effort to discourage problem drinking and substance abuse — and to compel individuals to internalize some of the external costs associated with these risky health behaviors — 39 states and D.C. had adopted a unique cost-based intervention through the formal healthcare system, specifically targeting individuals who experience adverse health events related to alcohol misuse. These states embedded "alcohol (and substance use) exclusion provisions" in their regulation of insurance markets, which permitted private health insurance companies to deny reimbursement of claims related to injuries suffered while under the influence of alcohol or non-prescribed narcotics. Though well-intentioned, public health advocates and policy makers cautioned that such stipulations may reduce incentives for physicians to screen injured patients' BAC and other substance use, thereby limiting their ability to diagnose patients with substance use disorders and divert them into treatment. By allowing insurers to deny coverage for injuries sustained under the influence of substances, such provisions could also deter some patients from seeking medical care (NHTSA 2008). In response to these concerns, 16 states repealed these exclusion allowances and replaced them with an explicit prohibition on private insurers from denying any claims for alcohol or drug-related injuries and treatment.

To date there is very limited evidence on the broader effects of these repeals and prohibition laws. In this study, we address this knowledge gap and provide the first comprehensive analysis of the impact of these prohibition statutes (PDHIAs), focusing on a wide range of outcomes related to alcohol use and misuse, including crime and drunk driving, that constitute the bulk of the external societal costs imposed by problem drinking. We leverage information from multiple national, survey-based and administrative datasets in conjunction with generalized difference-in-differences methods to explore these relationships. If the original alcohol exclusion provisions were discouraging alcohol

[41] For self-referrals and those referred by a school or community organization, we also find a commensurate increase in heroin and cocaine-involved admissions by between 10.4 and 16.5 percent (Appendix Table 9); these estimates do not achieve statistical significance at conventional levels, however.

misuse as intended, then ending these provisions could also generate the reverse unintended effect. By lessening individuals' internalized costs of problem drinking behaviors, the prohibition statutes may further incentivize alcohol misuse. In this context, an analysis of these statutes also provides a compelling and more targeted test than previously studied of this potential ex ante moral hazard channel in health insurance markets.

We find no evidence of any discernible or meaningful ex ante moral hazard effects; prohibiting private insurers from denying claims resulting from alcohol- or drug-related injuries does not lead to increases in alcohol misuse nor any adverse spillover effects on criminal activity or DUI outcomes. To the contrary, we find suggestive evidence that repealing the alcohol exclusion provisions and explicitly prohibiting these practices can generate some beneficial effects. Among states adopting the PDHIA statutes, alcohol use among young adults declines by two percent, participation in DUI declines by 11 to 15 percent with a corresponding decline in DUI-related arrests by eight percent, and arrests for property and violent criminal offenses decline by 11 to 13 percent following policy adoption, relative to the states that continue to maintain alcohol exclusion provisions. We also find evidence of a significant increase in treatment admissions related to heroin and cocaine, consistent with the prohibition statutes re-incentivizing providers to screen for alcohol and drugs without concern for the denial of claims. Lastly, we also consider and rule out general equilibrium effects on private insurance markets; there are no significant or substance changes in private health insurance premiums or coverage rates. Event study analyses support a casual interpretation of these findings.

The majority of states (22 states out of 39 states plus D.C.) that adopted the alcohol exclusion provisions continue to have them in place. The results from this study suggest that abolishing these provisions and replacing them with an explicit ban on insurers from denying claims may have small but meaningful health-promoting effects through reductions in alcohol use, DUI outcomes, and crime. These findings are of notable policy significance in light of the high prevalence of alcohol-related ED visits in the U.S., and a stagnating alcohol control policy landscape at the state and federal levels.[42]

[42] See Dave et al. (2022) for added discussion on alcohol control policies. There is very little to no room for further policy action with respect to conventional policy levers. State and federal alcohol taxes have declined in real terms in the absence of inflation indexing and infrequent legislative actions to raise them in nominal terms. Other alcohol control policies that had been found to be effective in reducing under-age drinking and DUI outcomes (such as zero tolerance drunk driving laws, minimum legal drinking age of 21) have been universally adopted by all states.

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Substance Abuse and Mental Health Services Administration, 2019b, 2019 National survey on drug use and health detailed tables: Table 5.4A---Alcohol use disorder in past year among persons aged 12 or older, by age group and demographic characteristics: Numbers in Thousands, 2018, 2019.

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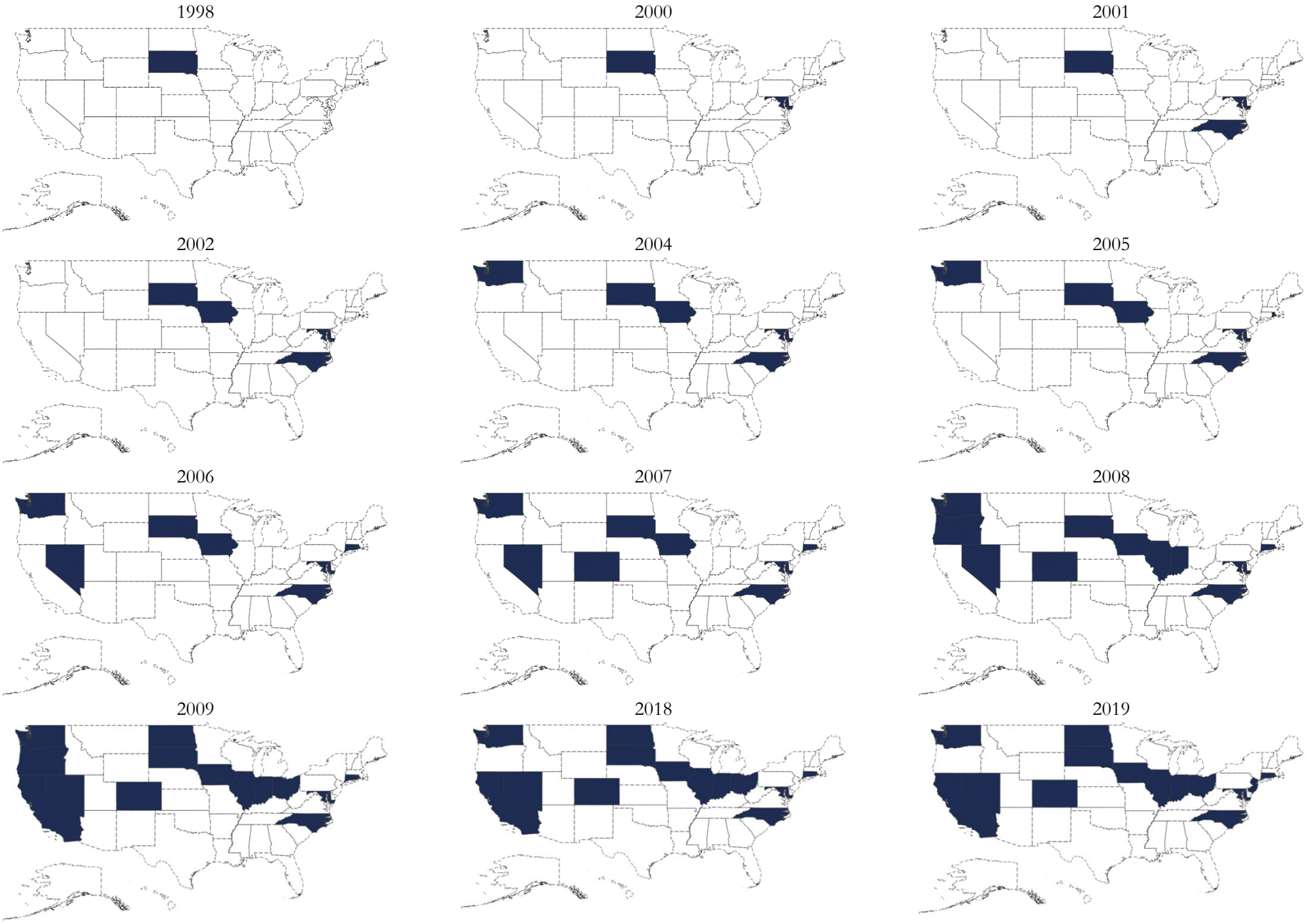
Figure 1. Adoption of Laws Prohibiting Denial Health Insurance Benefits for Alcohol/Substance-Related Claims (PDHIAs)

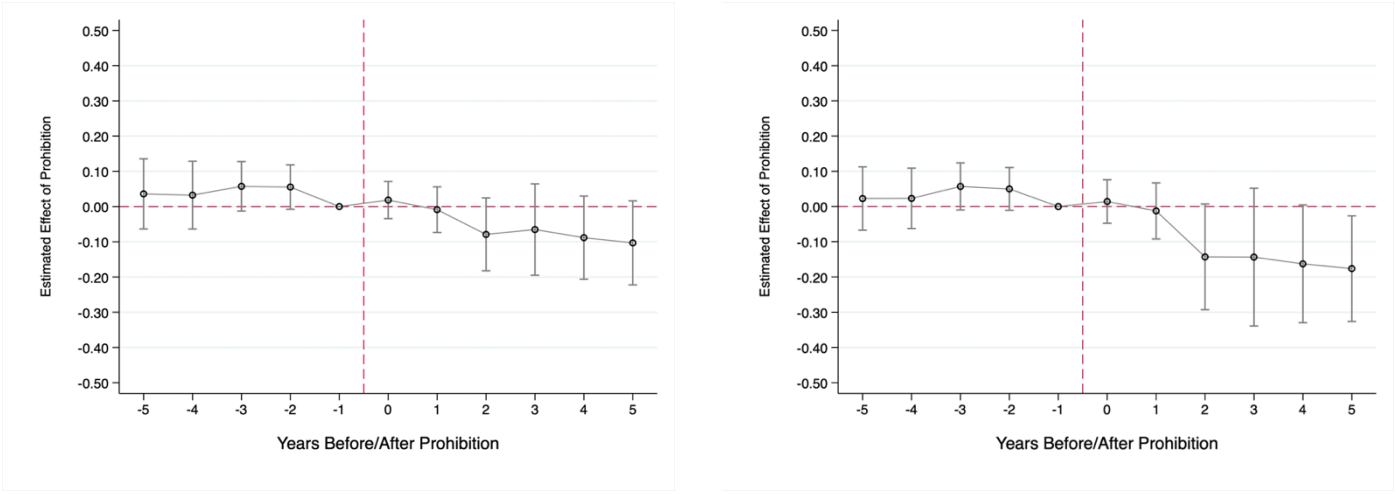


Source: Data on PDHIAs collected by the authors through searches of state legislative statutes and information available from APIS.

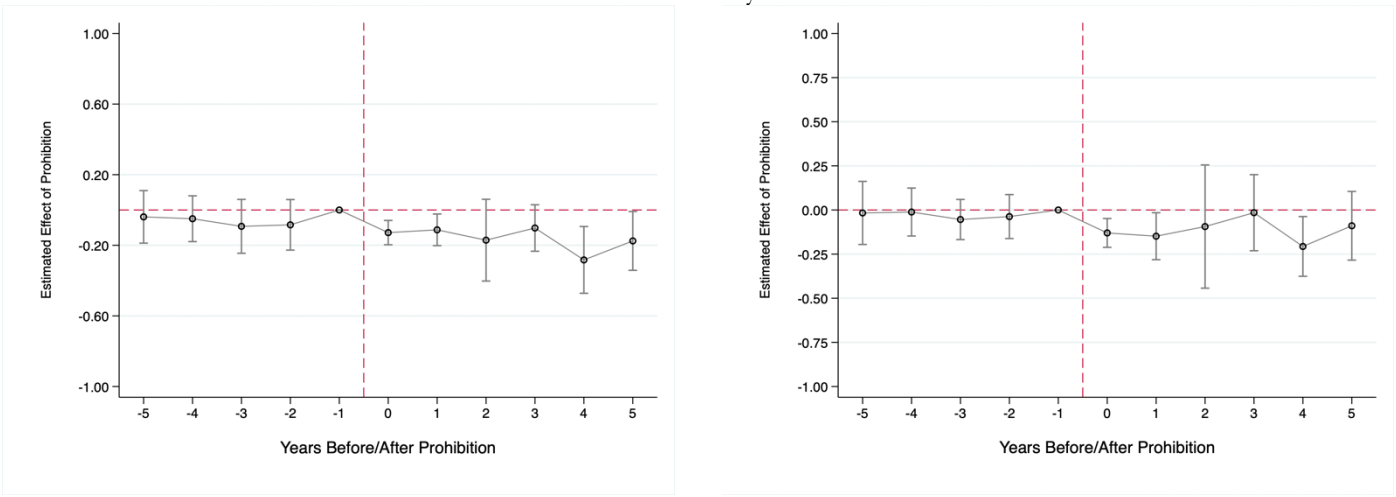
Figure 2. Event-Study Analysis of PDHIAs and Alcohol-Related Arrests Among 18-29-Year-Olds, UCR, 1998-2021

(a) TWFE Estimates (b) Sun & Abraham Estimates

Panel I: DUI



Panel II: Disorderly Conduct

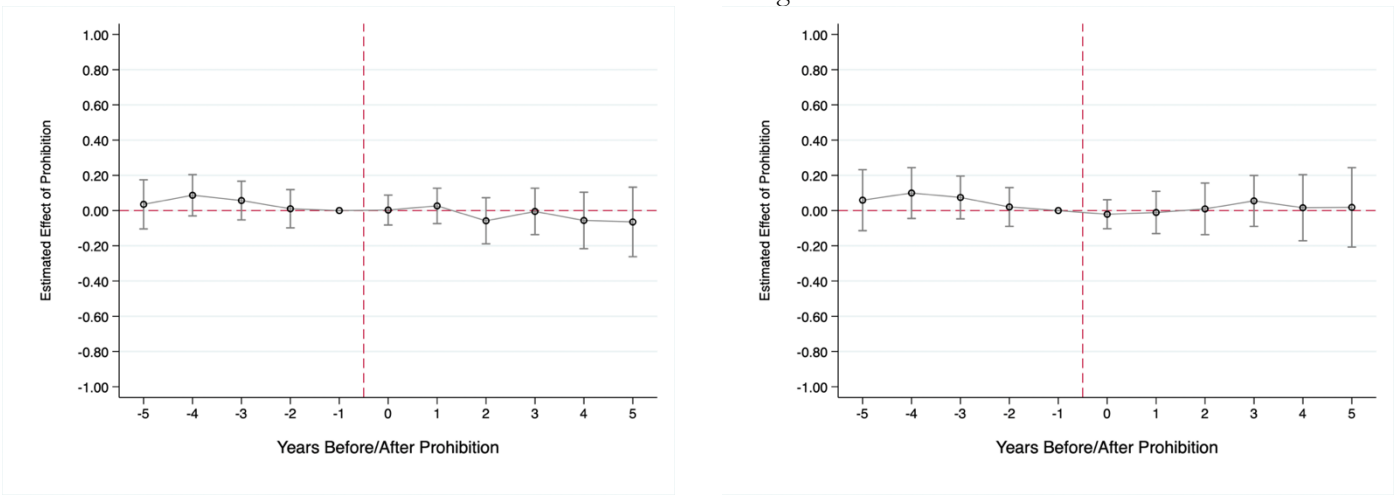


Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, the share of the state population covered by reporting agencies, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

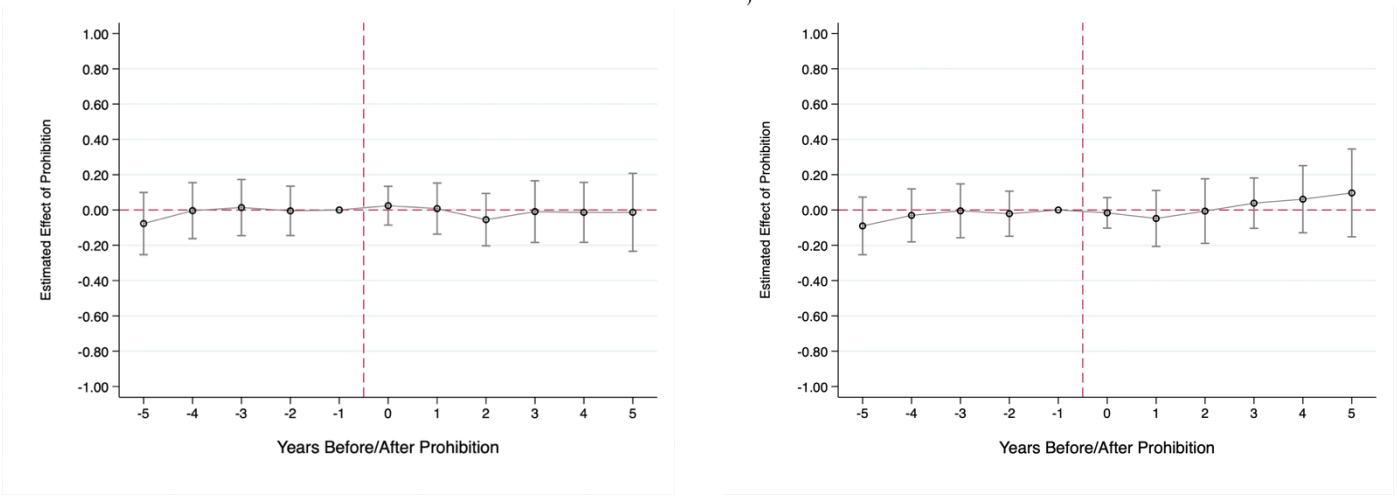
Figure 3. Event-Study Analysis of PDHIAs and Drug Arrests Among 18-29-Year-Olds, UCR, 1998-2021

(a) TWFE Estimates (b) Sun & Abraham Estimates

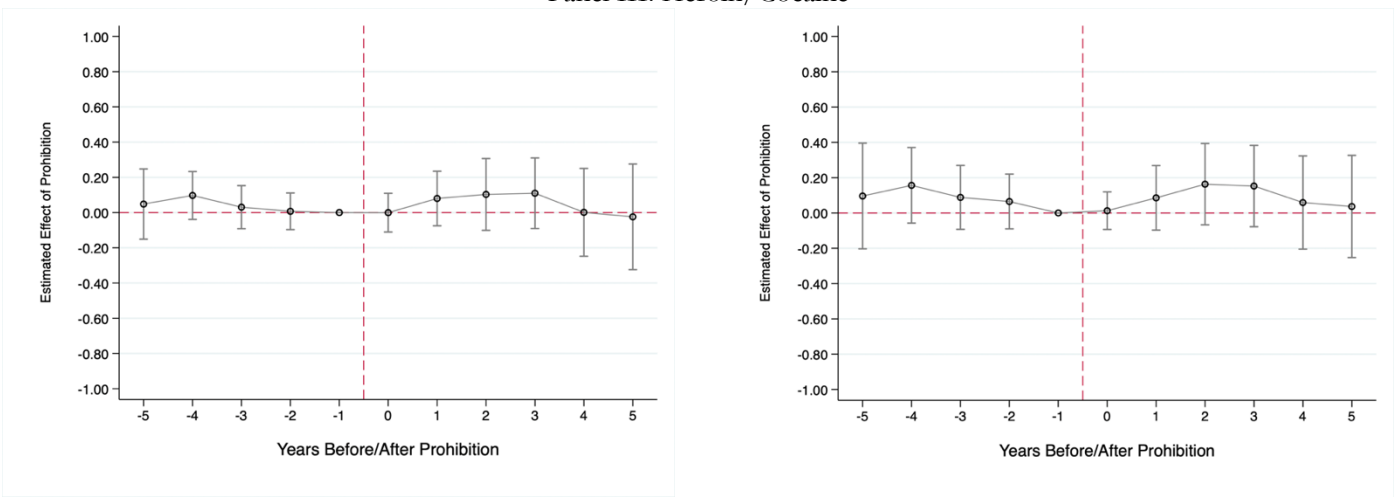
Panel I: All Drugs



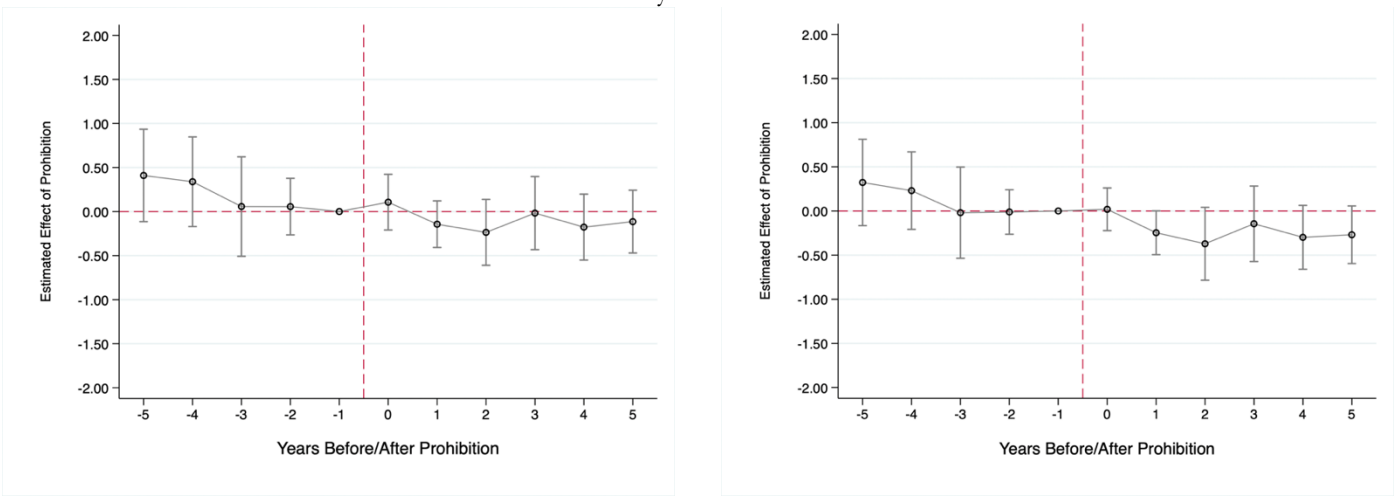
Panel II: Marijuana



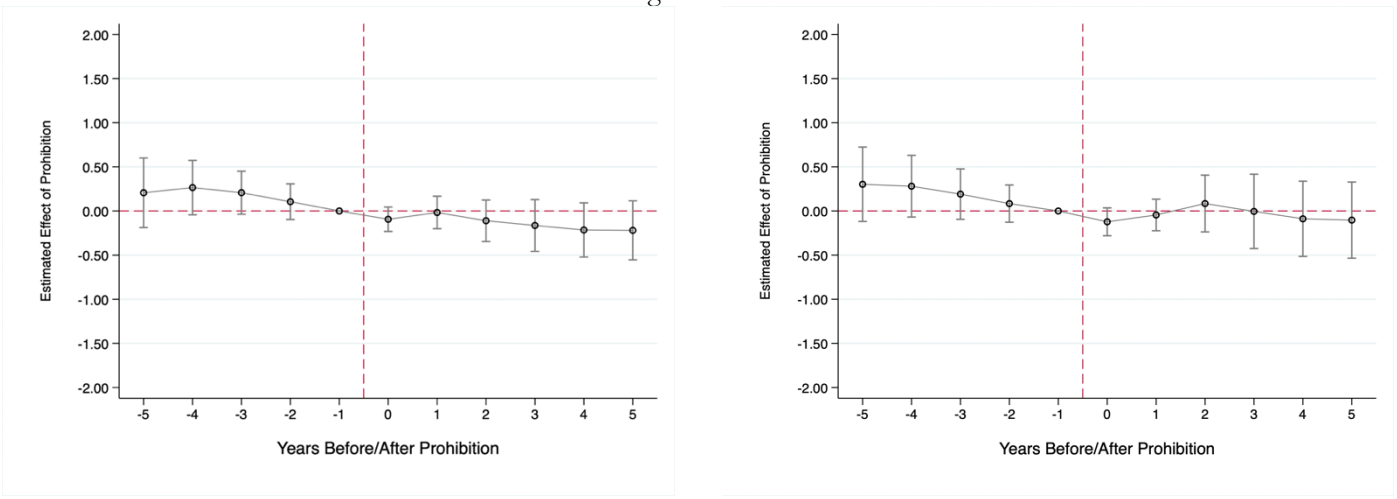
Panel III: Heroin/Cocaine



Panel IV: Synthetic Narcotics



Panel V: Dangerous Non-Narcotics

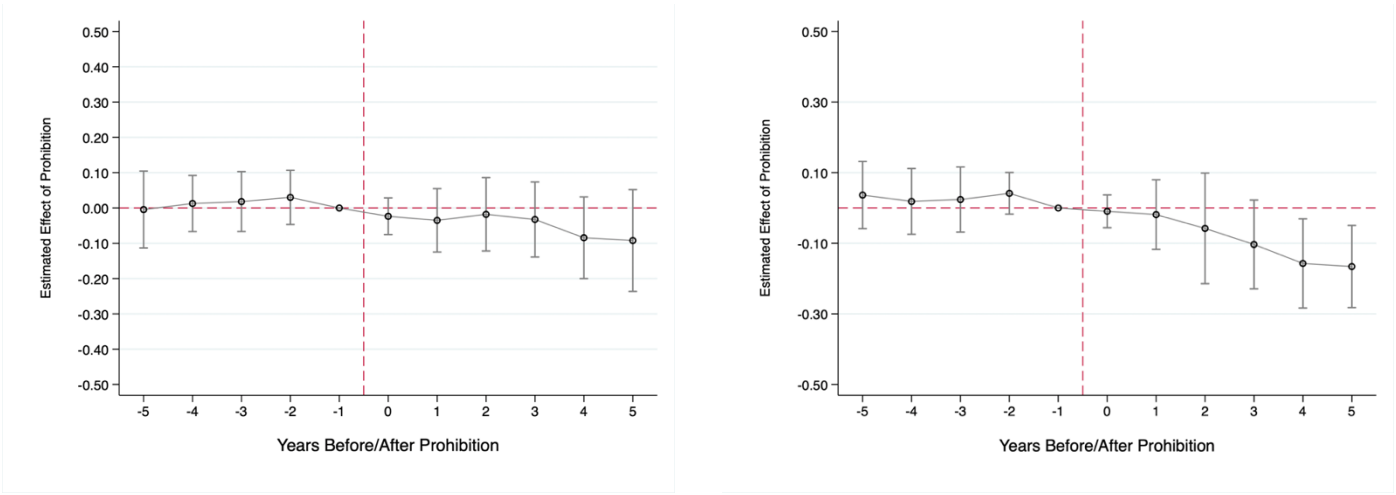


Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, the share of the state population covered by reporting agencies, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

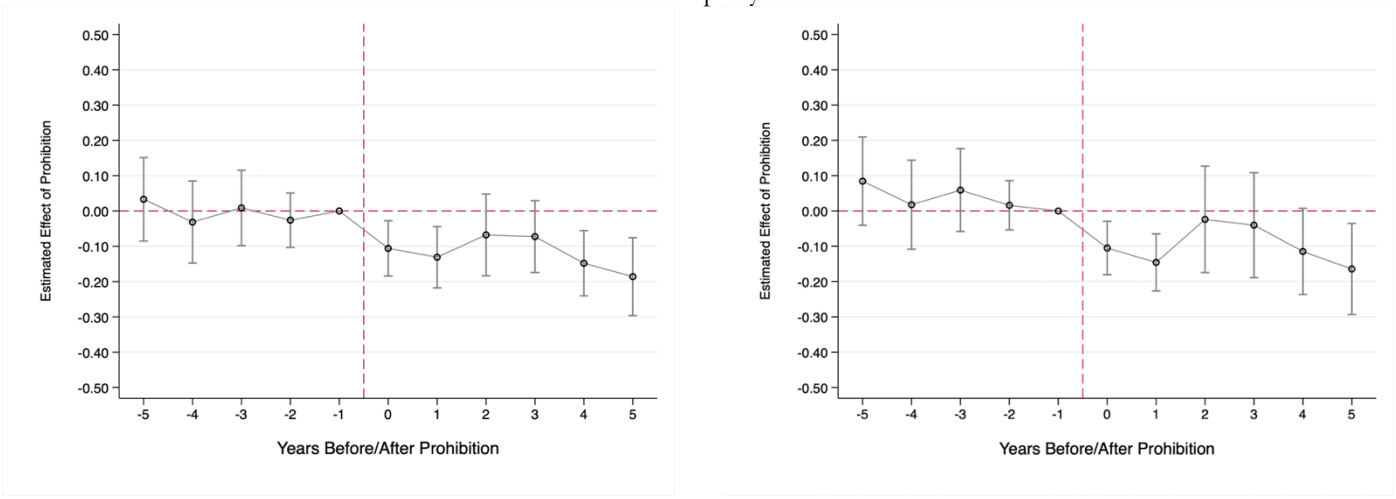
Figure 4. Event-Study Analyses of PDHIAs and Arrests for Part I Offenses Among 18-29-Year-Olds, UCR, 1998-2021

(a) TWFE Estimates (b) Sun & Abraham Estimates

Panel I: Violent Crime



Panel II: Property Crime

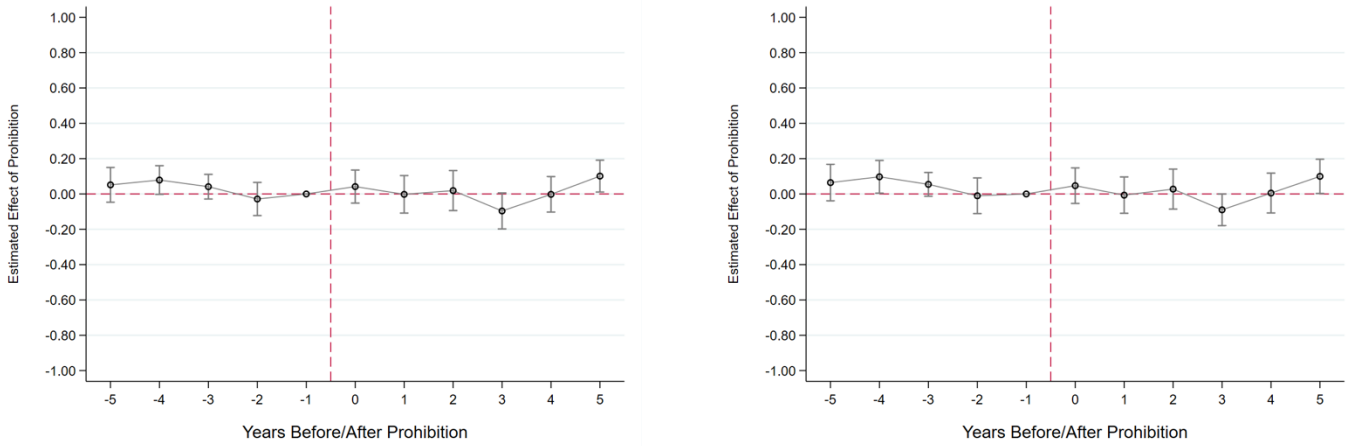


Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, the share of the state population covered by reporting agencies, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

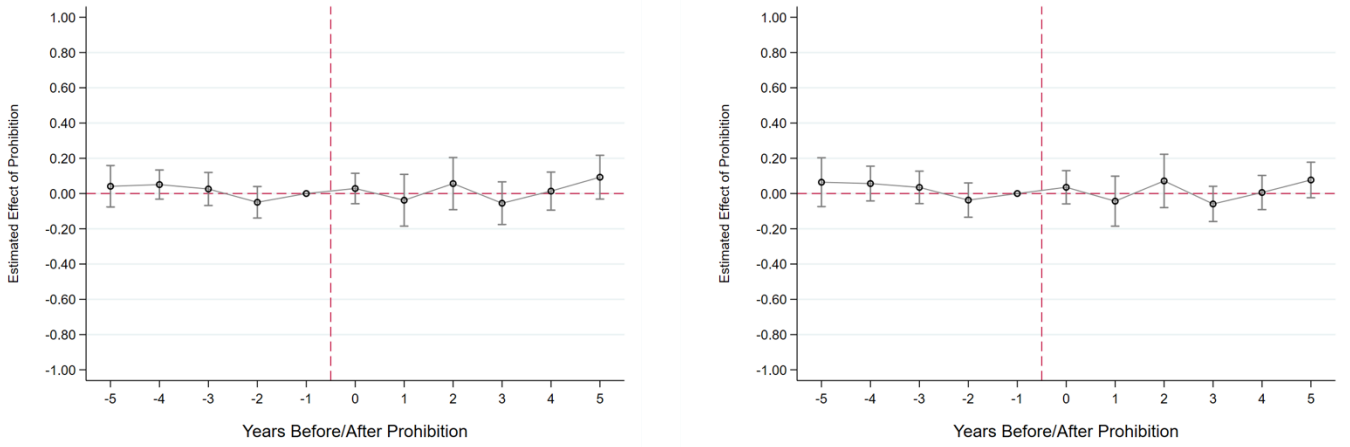
Figure 5. Event-Study Analysis of PDHIAs and Alcohol-Related Traffic Fatalities Among 18-29-Year-Olds, FARS, 1998-2021

(a) TWFE Estimates (b) Sun & Abraham Estimates

Panel I: Fatalities Caused by Drunk Drivers



Panel II: Fatalities of Drunk Drivers

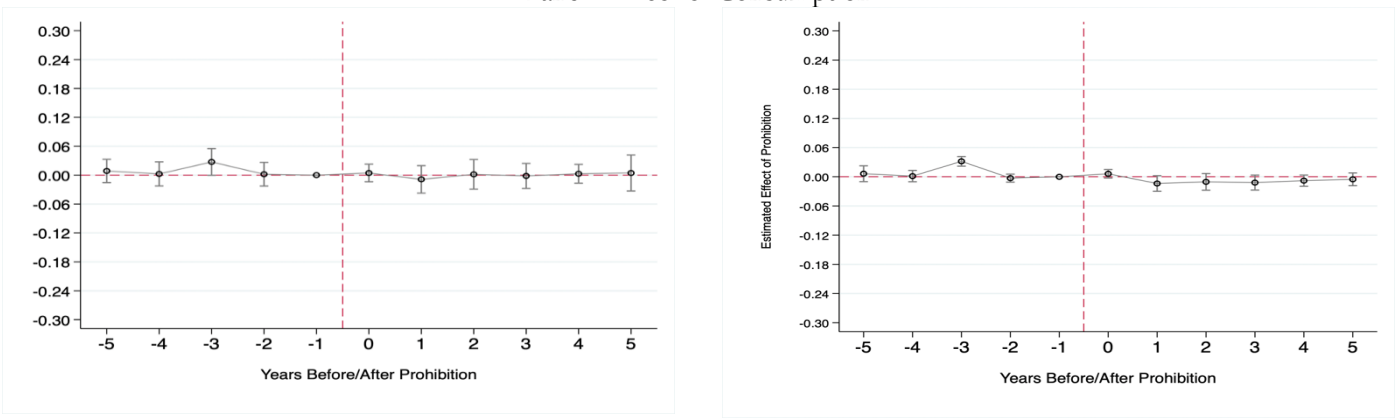


Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers per 100,000 persons aged 18-29 years. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

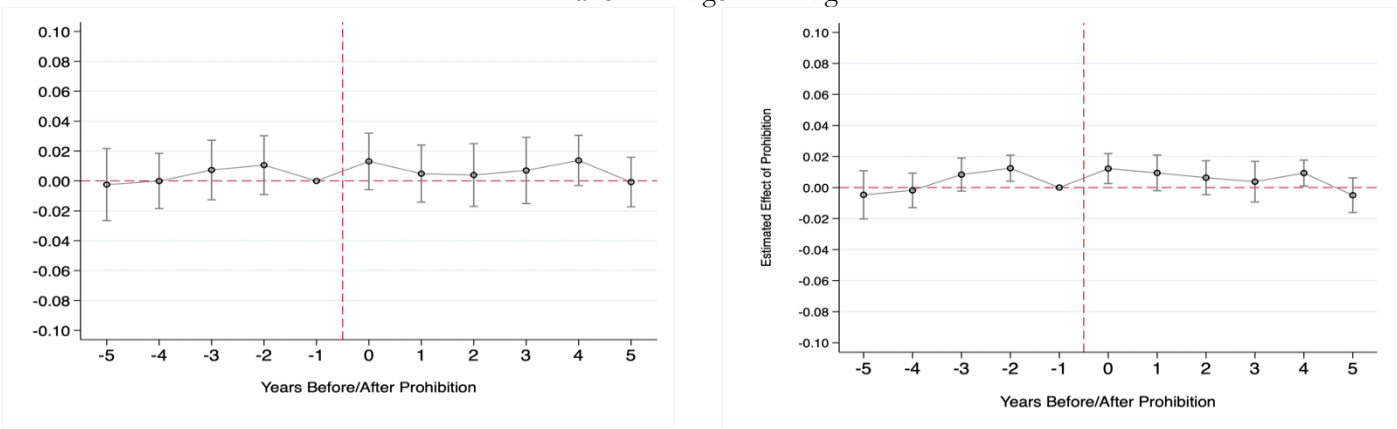
Figure 6. Event-Study Analysis of PDHIAs and Drinking Behavior Among 18-29-Year-Olds, BRFSS, 1998-2021

(a) TWFE Estimates (b) Sun & Abraham Estimates

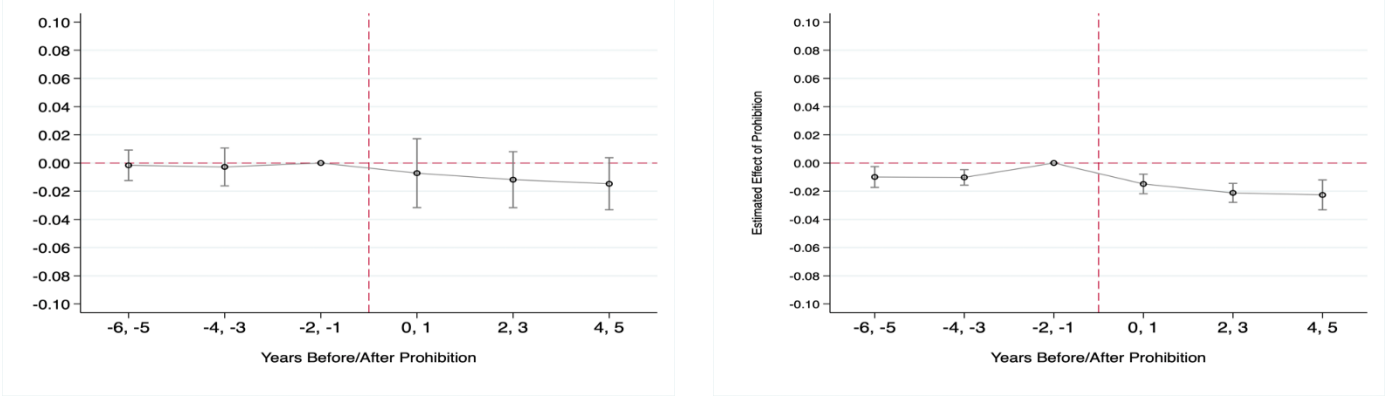
Panel I: Alcohol Consumption



Panel II: Binge Drinking



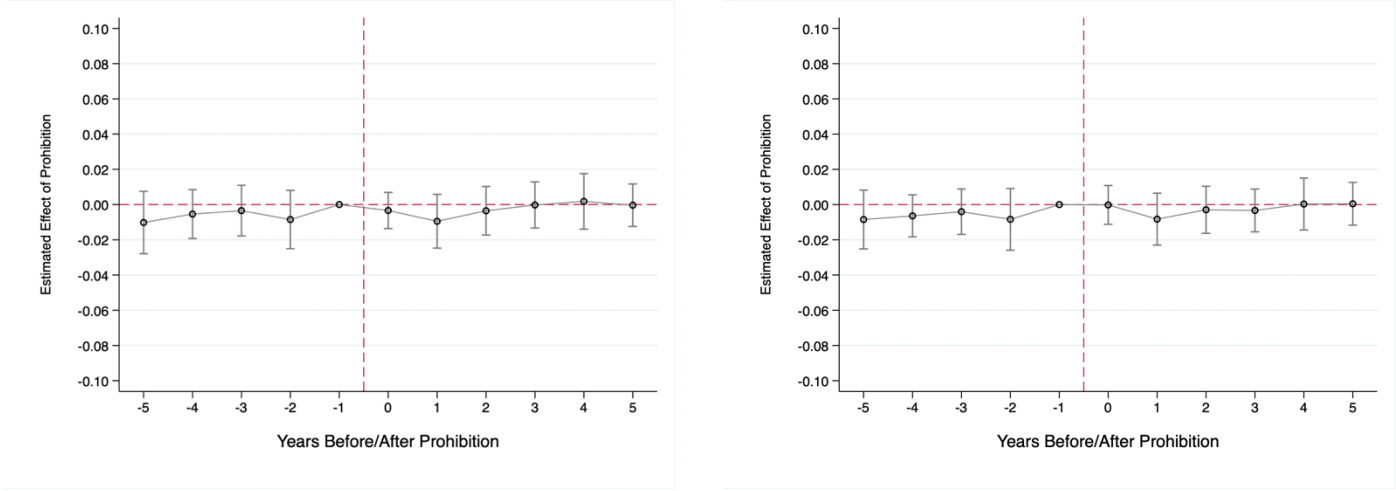
Panel III: Drinking & Driving



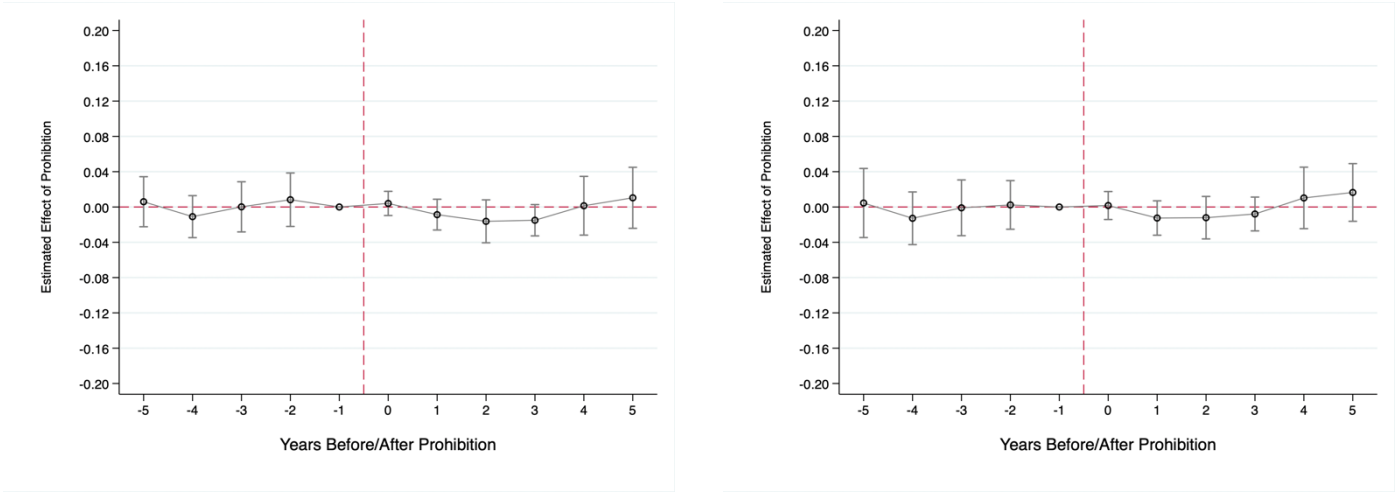
Notes: Individual level data used for the above event study regressions are obtained from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are indicators for prior-month alcohol consumption, binge drinking, and drinking and driving, respectively, in panels I, II, and III. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year and quarter fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, gender, race, age, education, marital status, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

Figure 7. Event-Study Analysis of PDHIAs and Private Health Insurance, MEPS, 1998-2021

Panel I: Private Health Insurance



Panel II: Private Insurance Premium



Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Medical Expenditure Panel Survey. The dependent variable is the share of persons who have private health insurance and the natural log of the average private health insurance premium, respectively, in panels I and II. Estimates are obtained from event study regressions using two-way fixed effects estimates in column (a) and Sun and Abraham (2021) estimates in column (b). All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

Table 1. PDHIA Effective Dates

State	Effective Date
California [a, b, c]	January 01, 2009
Colorado [a, b, c]	January 01, 2007
Connecticut [a, b, c]	October 01, 2006
District of Columbia [b, c]	March 08, 2007
Illinois [b, c]	January 01, 2008
Indiana [a, b, c]	January 01, 2008
Iowa [a, b, c]	July 01, 2002
Maryland [a, b, c]	October 30, 2000
Nevada [a, b, c]	July 01, 2006
New Jersey [a, b, c]	May 06, 2019
North Carolina [a, b, c]	October 01, 2001
North Dakota [a, b, c]	August 01, 2009
Ohio [a, b, c]	April 07, 2009
Oregon [a, b, c]	January 01, 2008[d]
Rhode Island [b, c]	June 16, 2005
South Dakota [a, b, c]	January 01, 1998
Washington [a, b, c]	June 10, 2004

Source: Data on PDHIAs collected by the authors through our own searches of state legislative statutes and information available from APIS.

[a] State identifies the treatment effect in UCR sample
[b] State identifies the treatment effect in the FARS sample.
[c] State identifies the treatment effect in the BRFSS and MEPS samples.
[d] Oregon repealed its PHDIA law on 12/31/2017.

Table 2. TWFE Estimates of the Effects of PDHIA Adoption on Log of Alcohol-Related Arrest Rate Among 18-29-Year-Olds, 1998-2021

	(1)	(2)	(3)	(4)	(5)
			Panel I: DUI Arrests		
PDHIA	-0.026	-0.029	-0.063	-0.072	-0.075
	(0.053)	(0.049)	(0.046)	(0.046)	(0.046)
	[-0.134,0.081]	[-0.128,0.071]	[-0.155,0.028]	[-0.165,0.021]	[-0.167,0.018]
Pre-Treat Mean of DV	378.062	378.062	378.062	378.062	378.062
N	1,056	1,056	1,056	1,056	1,056
			Panel II: Disorderly Conduct Arrests		
PDHIA	-0.142	-0.152	-0.082	-0.081	-0.048
	(0.130)	(0.123)	(0.087)	(0.086)	(0.061)
	[-0.403,0.120]	[-0.399,0.095]	[-0.258,0.094]	[-0.254,0.092]	[-0.171,0.074]
Pre-Treat Mean of DV	217.971	217.971	217.971	217.971	217.971
N	1,056	1,056	1,056	1,056	1,056
Controls:					
Demographic Controls?	Y	Y	Y	Y	Y
Macro & COVID Controls?	Y	Y	Y	Y	Y
Alcohol Policies?	N	Y	Y	Y	Y
Substance Use Policies?	N	N	Y	Y	Y
Tobacco Control Policies?	N	N	N	Y	Y
Social Welfare Policies?	N	N	N	N	Y

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained via ordinary least squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of 18-29-year-olds who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 3. TWFE Estimates of the Effects of PDHIA Adoption on Log of Drug Arrest Rate Among 18-29-Year-Olds, 1998-2021

	(1)	(2)	(3)	(4)	(5)
			Panel I: Drug Arrests		
PDHIA	-0.089	-0.114	-0.033	-0.027	-0.044
	(0.097)	(0.090)	(0.078)	(0.078)	(0.072)
	[-0.285,0.106]	[-0.296,0.068]	[-0.191,0.125]	[-0.184,0.131]	[-0.188,0.100]
Pre-Treat Mean of DV	718.138	718.138	718.138	718.138	718.138
N	1,056	1,056	1,056	1,056	1,056
			Panel II: Marijuana Arrests		
PDHIA	-0.491*	-0.453*	0.075	0.085	0.068
	(0.263)	(0.252)	(0.087)	(0.086)	(0.075)
	[-1.022,0.039]	[-0.961,0.056]	[-0.101,0.250]	[-0.087,0.258]	[-0.085,0.220]
Pre-Treat Mean of DV	359.038	359.038	359.038	359.038	359.038
N	1,056	1,056	1,056	1,056	1,056
			Panel III: Heroin/Cocaine Arrests		
PDHIA	0.208	0.123	0.003	-0.015	-0.031
	(0.167)	(0.120)	(0.102)	(0.095)	(0.095)
	[-0.129,0.546]	[-0.119,0.364]	[-0.204,0.209]	[-0.207,0.177]	[-0.223,0.160]
Pre-Treat Mean of DV	234.042	234.042	234.042	234.042	234.042
N	1,046	1,046	1,046	1,046	1,046
			Panel IV: Synthetic Narcotic Arrests		
PDHIA	-0.241	-0.209	-0.203	-0.228	-0.245
	(0.212)	(0.183)	(0.158)	(0.151)	(0.154)
	[-0.668,0.187]	[-0.579,0.161]	[-0.522,0.115]	[-0.533,0.077]	[-0.555,0.065]
Pre-Treat Mean of DV	22.704	22.704	22.704	22.704	22.704
N	1,020	1,020	1,020	1,020	1,020
			Panel V: Dangerous Non-Narcotic Drug Arrests		
PDHIA	-0.272**	-0.249**	-0.272**	-0.274**	-0.271**
	(0.116)	(0.115)	(0.131)	(0.128)	(0.128)
	[-0.505,-0.038]	[-0.481,-0.017]	[-0.535,-0.009]	[-0.531,-0.016]	[-0.529,-0.014]
Pre-Treat Mean of DV	102.355	102.355	102.355	102.355	102.355
N	1,053	1,053	1,053	1,053	1,053
Controls:					
Demographic Controls?	Y	Y	Y	Y	Y
Macro & COVID Controls?	Y	Y	Y	Y	Y
Alcohol Policies?	N	Y	Y	Y	Y
Substance Use Policies?	N	N	Y	Y	Y
Tobacco Control Policies?	N	N	N	Y	Y
Social Welfare Policies?	N	N	N	N	Y

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained via ordinary least

squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of 18-29-year-olds who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 4. TWFE Estimates of the Effects of PDHIA Adoption on Log of Violent and Property Crime Arrest Rate Among 18-29-Year-Olds, 1998-2021

	(1)	(2)	(3)	(4)	(5)
			Panel I: Violent Crime Arrests		
PDHIA	-0.111*	-0.113*	-0.113*	-0.114*	-0.115*
	(0.061)	(0.063)	(0.061)	(0.061)	(0.059)
	[-0.235,0.013]	[-0.240,0.015]	[-0.235,0.010]	[-0.236,0.009]	[-0.235,0.004]
Pre-Treat Mean of DV	232.816	232.816	232.816	232.816	232.816
N	1,056	1,056	1,056	1,056	1,056
			Panel II: Property Crime Arrests		
PDHIA	-0.187***	-0.196***	-0.136***	-0.139***	-0.145***
	(0.050)	(0.049)	(0.045)	(0.047)	(0.046)
	[-0.289,-0.086]	[-0.294,-0.097]	[-0.228,-0.045]	[-0.233,-0.045]	[-0.238,-0.052]
Pre-Treat Mean of DV	517.249	517.249	517.249	517.249	517.249
N	1,056	1,056	1,056	1,056	1,056
Controls:					
Demographic Controls?	Y	Y	Y	Y	Y
Macro & COVID Controls?	Y	Y	Y	Y	Y
Alcohol Policies?	N	Y	Y	Y	Y
Substance Use Policies?	N	N	Y	Y	Y
Tobacco Control Policies?	N	N	N	Y	Y
Social Welfare Policies?	N	N	N	N	Y

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained via ordinary least squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of 18-29-year-olds who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 5. Exploration of PDHIA Effects on Arrests, by Age, 1998-2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	DUI	Disorderly conduct	Drug Crime	MJ	Heroin/ Cocaine	Synthetic Narcotics	Dangerous Non-Narcotics	Violent crime	Property crime
Panel I: Ages 18-24									
PDHIA	-0.079*	-0.055	-0.010	0.081	-0.042	-0.174	-0.231*	-0.093*	-0.126**
	(0.045)	(0.055)	(0.068)	(0.069)	(0.102)	(0.153)	(0.133)	(0.052)	(0.048)
	[-0.170, 0.012]	[-0.166, 0.055]	[-0.146, 0.127]	[-0.058, 0.220]	[-0.248, 0.165]	[-0.484, 0.136]	[-0.499, 0.036]	[-0.197, 0.011]	[-0.223, -0.028]
Pre-Treat Mean of DV	396.175	263.472	870.181	480.685	257.045	24.368	108.082	263.986	632.128
N	1,056	1,056	1,056	1,056	1,046	1,012	1,051	1,056	1,056
Panel II: Ages 25-29									
PDHIA	-0.066	-0.028	-0.108	0.023	-0.084	-0.291	-0.324*	-0.156	-0.173***
	(0.059)	(0.070)	(0.077)	(0.097)	(0.097)	(0.209)	(0.162)	(0.095)	(0.062)
	[-0.185, 0.053]	[-0.169, 0.113]	[-0.264, 0.048]	[-0.172, 0.218]	[-0.279, 0.112]	[-0.713, 0.130]	[-0.650, 0.002]	[-0.347, 0.035]	[-0.298, -0.049]
Pre-Treat Mean of DV	352.667	154.175	504.963	188.479	201.790	20.370	94.324	189.113	356.180
N	1,056	1,056	1,056	1,055	1,041	1,000	1,050	1,056	1,056
Panel III: Ages 30-49									
PDHIA	-0.064*	0.040	-0.061	0.065	-0.075	-0.248*	-0.312*	-0.156	-0.099*
	(0.037)	(0.066)	(0.060)	(0.073)	(0.083)	(0.139)	(0.178)	(0.097)	(0.050)
	[-0.138, 0.011]	[-0.093, 0.173]	[-0.182, 0.060]	[-0.083, 0.213]	[-0.242, 0.092]	[-0.529, 0.033]	[-0.670, 0.047]	[-0.351, 0.039]	[-0.200, 0.002]
Pre-Treat Mean of DV	221.424	90.362	279.499	66.413	132.584	11.434	69.068	108.423	233.877
N	1, 056	1, 056	1, 056	1, 056	1, 046	1, 021	1, 053	1, 056	1, 056
Panel IV: Ages 50-64									
PDHIA	-0.055*	-0.008	-0.128*	0.008	-0.175*	-0.137	-0.214	-0.122	-0.087
	(0.032)	(0.086)	(0.073)	(0.093)	(0.094)	(0.146)	(0.192)	(0.080)	(0.057)
	[-0.120, 0.011]	[-0.183, 0.166]	[-0.276, 0.020]	[-0.181, 0.196]	[-0.365, 0.015]	[-0.430, 0.157]	[-0.601, 0.173]	[-0.283, 0.040]	[-0.202, 0.029]
Pre-Treat Mean of DV	89.804	26.443	56.839	11.781	30.666	1.978	12.414	25.286	59.942
N	1, 056	1, 056	1, 054	1, 052	1, 027	954	1, 035	1, 055	1, 056

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons of the age noted in the panel title. Estimates are obtained via ordinary least squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of panel specified aged people who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the

share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the age-specific population and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 6. Sensitivity of Arrest Estimates to Additional Controls for Spatial Heterogeneity, UCR, 1998-2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	DUI	Disorderly conduct	Drug Crime	MJ	Heroine/ Cocaine	Synthetic Narcotics	Dangerous Non-narcotics	Violent crime	Property crime
Panel I: State-Specific Linear Trends									
PDHIA	-0.034	-0.096	-0.024	0.017	0.051	-0.057	-0.335***	-0.007	-0.104**
	(0.042)	(0.071)	(0.048)	(0.060)	(0.080)	(0.181)	(0.108)	(0.039)	(0.039)
	[-0.119, 0.050]	[-0.241, 0.048]	[-0.121, 0.072]	[-0.103, 0.138]	[-0.110, 0.213]	[-0.422, 0.307]	[-0.552,-0.117]	[-0.085, 0.071]	[-0.182,-0.025]
Panel II: Census Region by Year Fixed Effects									
PDHIA	-0.019	-0.067	-0.059	0.062	-0.103	-0.305*	-0.141	-0.124**	-0.145***
	(0.036)	(0.055)	(0.057)	(0.071)	(0.116)	(0.168)	(0.162)	(0.058)	(0.041)
	[-0.091, 0.053]	[-0.178, 0.043]	[-0.175, 0.056]	[-0.081, 0.206]	[-0.337, 0.132]	[-0.644, 0.034]	[-0.467, 0.185]	[-0.240,-0.008]	[-0.228,-0.062]
Pre-Treat Mean of DV	378.062	217.971	718.138	359.038	234.042	22.704	102.355	232.816	517.249
N	1, 056	1, 056	1, 056	1, 056	1, 046	1, 020	1, 053	1, 056	1, 056

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. Estimates are obtained via ordinary least squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of 18-29-year-olds who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 7. Robustness of Arrest Findings to Controlling for Policing, Alternate Agency Reporting Requirements, Use of Levels Rather than Logs, and by Coverage of Affordable Care Act's Dependent Coverage Mandate (DCM), UCR, 1998-2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	DUI	Disorderly conduct	Drug Crime	MJ	Heroin/ Cocaine	Synthetic Narcotics	Dangerous Non-narcotics	Violent crime	Property crime
Panel I: Main Specification Adds Controls for Police and Police Expenditures Per Capita									
PDHIA	-0.063	-0.065	-0.039	0.063	-0.019	-0.238	-0.260**	-0.109*	-0.143***
	(0.044)	(0.066)	(0.072)	(0.077)	(0.097)	(0.158)	(0.129)	(0.059)	(0.047)
	[-0.151,0.025]	[-0.197,0.068]	[-0.185,0.106]	[-0.092,0.218]	[-0.214,0.176]	[-0.557,0.080]	[-0.519,-0.001]	[-0.228,0.010]	[-0.238,-0.049]
Pre-Treat Mean of DV	378.062	217.971	718.138	359.038	234.042	22.704	102.355	232.816	517.249
N	1, 056	1, 056	1, 056	1, 056	1, 046	1, 020	1, 053	1, 056	1, 056
Panel II: Removing State-Year Outliers Greater than Two Standard Deviations from State-Specific Mean									
PDHIA	-0.077	-0.064	-0.035	0.044	0.012	-0.265*	-0.300**	-0.123**	-0.135***
	(0.049)	(0.055)	(0.070)	(0.080)	(0.097)	(0.137)	(0.120)	(0.056)	(0.046)
	[-0.176, 0.022]	[-0.176, 0.048]	[-0.177, 0.107]	[-0.118, 0.205]	[-0.184, 0.207]	[-0.542, 0.012]	[-0.543, -0.057]	[-0.236, -0.009]	[-0.228, -0.043]
Pre-Treat Mean of DV	378.062	213.192	718.138	359.038	234.042	22.430	97.080	233.466	517.249
N	1, 031	1, 036	1, 011	1, 018	1, 009	992	1, 021	1, 025	1, 000
Panel III: Less Stringent Agency Reporting, Unbalanced Panel (≥ 3 Months or December, No Annual Requirement)									
PDHIA	0.067	0.100	-0.042	0.025	0.022	-0.068	-0.108	0.022	-0.094
	(0.089)	(0.122)	(0.063)	(0.070)	(0.083)	(0.180)	(0.112)	(0.102)	(0.073)
	[-0.113, 0.246]	[-0.145, 0.346]	[-0.168, 0.085]	[-0.116, 0.165]	[-0.144, 0.189]	[-0.429, 0.294]	[-0.333, 0.117]	[-0.183, 0.227]	[-0.240, 0.051]
Pre-Treat Mean of DV	1081.628	348.036	1586.492	700.623	512.507	33.585	339.777	573.171	1066.411
N	1,189	1,190	1,189	1,189	1,188	1,150	1,186	1,190	1,190
Panel IV: Dependent Variable is Level of Arrest Rate per 100,000 Persons									
PDHIA	10.809	-24.366	-87.015	-45.792	-4.150	-9.957*	-27.116*	-20.318	-127.122***
	(31.565)	(20.879)	(59.652)	(31.289)	(21.774)	(5.828)	(13.843)	(14.185)	(37.564)
	[-52.85,74.47]	[-66.47,17.74]	[-207.31,33.29]	[-108.89,17.31]	[-48.06,39.76]	[-21.71,1.80]	[-55.03,0.80]	[-48.92,8.29]	[-202.9,-51.37]
Pre-Treat Mean of DV	378.062	217.971	718.138	359.038	234.042	22.704	102.355	232.816	517.249
N	1, 056	1, 056	1, 056	1, 056	1, 056	1, 056	1, 056	1, 056	1, 056

	DUI	Disorderly conduct	Drug Crime	MJ	Heroin/ Cocaine	Synthetic Narcotics	Dangerous Non-narcotics	Violent crime	Property crime
Panel V: Testing for Heterogeneity by Dependent Coverage Mandate (DCM) Coverage Among Those Aged 18-24 Years									
PDHIA	0.017	-0.108*	0.021	0.066	0.021	-0.164	-0.303**	-0.052	-0.097*
	(0.041)	(0.054)	(0.046)	(0.044)	(0.088)	(0.161)	(0.146)	(0.049)	(0.053)
	[-0.065,0.100]	[-0.216,0.001]	[-0.072,0.113]	[-0.023,0.154]	[-0.156,0.199]	[-0.490,0.161]	[-0.597,-0.008]	[-0.152,0.047]	[-0.203,0.009]
PDHIA*DCM	-0.161**	0.078	-0.046	0.019	-0.086	0.000	0.149	-0.059	-0.045
	(0.060)	(0.090)	(0.079)	(0.085)	(0.118)	(0.213)	(0.191)	(0.064)	(0.060)
	[-0.281,-0.040]	[-0.102,0.259]	[-0.204,0.113]	[-0.153,0.190]	[-0.324,0.153]	[-0.429,0.429]	[-0.235,0.534]	[-0.189,0.071]	[-0.166,0.076]
Pre-Treat Mean of DV	396.175	263.472	870.181	480.685	257.045	24.368	108.082	263.986	632.128
N	1,056	1,056	1,056	1,056	1,046	1,012	1,051	1,056	1,056

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years for Panels I-III, arrest rates for the specified offense per 100,000 persons aged 18-29 for Panel IV, and log of the arrest rate for the specified offense per 100,000 persons aged 18-24 years for Panels V and aged 25-29 years for Panel VI. Estimates are obtained via ordinary least squares regressions using a two-way fixed effects approach. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, and the share of the state population covered by reporting agencies. Demographic controls include the share of 18-29-year-olds (18-24 for Panel V and 25-29 for Panel VI) who are Black, Hispanic, and female. Macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, and the share of the population vaccinated for COVID-19 Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds (18-24 for Panel V and 25-29 for Panel VI) and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 8. TWFE Estimates of the Effects of PDHIA Adoption on Log of Drunk Driving Fatality Rate Among 18-29-Year-Olds, 1998-2021

	(1)	(2)	(3)	(4)	(5)
	Panel I: Fatalities Caused by Drunk Drivers				
PDHIA	0.037	0.055	0.023	0.015	0.0002
	(0.041)	(0.037)	(0.041)	(0.039)	(0.039)
	[-0.046,0.120]	[-0.019,0.129]	[-0.059,0.105]	[-0.063,0.093]	[-0.078,0.079]
Pre-Treat Mean of DV	9.105	9.105	9.105	9.105	9.105
N	1,222	1,222	1,222	1,222	1,222
	Panel II: Fatalities of Drunk Driver				
PDHIA	0.023	0.041	0.014	0.007	-0.008
	(0.042)	(0.038)	(0.043)	(0.040)	(0.040)
	[-0.063,0.108]	[-0.035,0.117]	[-0.072,0.100]	[-0.074,0.088]	[-0.088,0.072]
Pre-Treat Mean of DV	5.409	5.409	5.409	5.409	5.409
N	1,217	1,217	1,217	1,217	1,217
Controls:					
Demographic Controls?	Y	Y	Y	Y	Y
Macro & COVID Controls?	Y	Y	Y	Y	Y
Alcohol Policies?	N	Y	Y	Y	Y
Substance Use Policies?	N	N	Y	Y	Y
Tobacco Control Policies?	N	N	N	Y	Y
Social Welfare Policies?	N	N	N	N	Y

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers (imputed or directly reported BAC > 0) per 100,000 persons aged 18-29 years. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 9. TWFE Estimates of the Effect of PDHIA Adoption on Drinking Behaviors Among 18-29-Year-Olds, BRFSS, 1998-2021

	(1)	(2)	(3)	(4)
		Panel I: Current Alcohol Use		
PDHIA	-0.013*	-0.013	-0.014*	-0.013*
	(0.008)	(0.008)	(0.007)	(0.007)
	[-0.028,0.002]	[-0.028,0.003]	[-0.028,-0.0001]	[-0.027,0.001]
Pre-Treat Mean of DV	0.605	0.605	0.619	0.619
N	804916	804916	628474	628474
		Panel II: Binge Drinking		
PDHIA	-0.001	-0.001	0.003	0.004
	(0.006)	(0.006)	(0.006)	(0.007)
	[-0.014,0.012]	[-0.014,0.012]	[-0.009,0.016]	[-0.009,0.017]
Pre-Treat Mean of DV	0.299	0.299	0.293	0.293
N	796025	796025	621331	621331
		Panel III: Drinking and Driving		
PDHIA	-0.003	-0.011*	-0.0001	-0.008
	(0.004)	(0.006)	(0.005)	(0.007)
	[-0.010,0.004]	[-0.023,0.002]	[-0.010,0.009]	[-0.022,0.006]
Pre-Treat Mean of DV	0.075	0.075	0.072	0.072
N	232703	232703	186047	186047
Sample	*All 18-29-Year-Olds*		*Insured 18-29-Year-Olds*	
Controls:				
Demographic Controls?	Y	Y	Y	Y
Macro & COVID Controls?	Y	Y	Y	Y
Alcohol Policies?	Y	Y	Y	Y
Substance Use Policies?	Y	Y	Y	Y
Tobacco Control Policies?	N	Y	N	Y
Social Welfare Policies?	N	Y	N	Y

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using data from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are prior-month alcohol use, binge drinking and drinking and driving among persons aged 18-29. All regressions control for state fixed effects, year and quarter fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, age, gender, race, education, and marital status; at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the sampling weights provided in the dataset and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 10. TWFE Estimates of the Effect of PDHIA Adoption on Health Insurance, BRFSS and MEPS, 1998-2021

	(1)	(2)	(3)
	Any Health Insurance (BRFSS)	Private Insurance (MEPS)	Log of Average Insurance Premium (MEPS)
	Panel I: Baseline Controls		
PDHIA	0.002	0.002	0.013
	(0.006)	(0.003)	(0.011)
	[-0.011,0.015]	[-0.004,0.008]	[-0.008,0.035]
	Panel II: Full Controls		
PDHIA	-0.005	0.006**	0.002
	(0.006)	(0.003)	(0.006)
	[-0.016,0.006]	[0.001,0.012]	[-0.011,0.014]
Pre-Treat Mean of DV	0.745	0.480	4895.08
N	857216	1,123	1,123

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using individual data from the 1998-2021 Behavioral Risk Factor Surveillance System for Column (1) and state-by-year data from the 1998-2021 Medical Expenditure Panel Survey for Columns (2) and (3). The dependent variables are share of people with any health insurance among persons aged 18-29, share of persons who have private health insurance and the natural log of the average private health insurance premium, respectively. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19, , with additional controls for age, gender, race, education, and marital status and quarter fixed effects for Column (1). Panel II has additional controls as mentioned below: Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-29-year-olds for column (1) and the state population for columns (2) and (3). Standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Table 11. TWFE Estimates of the Effect of PDHIA Adoption on Log of Referral Ratio for Alcohol or Drug Treatment Among 18-29-Year-Olds, TEDS, 1998-2021

	(1)	(2)	(3)	(4)
	Alcohol	Marijuana	Any Hard Drug	Heroin/Cocaine
		Panel I: Primary Substance		
PDHIA	0.016	-0.018	0.010	0.163*
	(0.067)	(0.087)	(0.058)	(0.093)
	[-0.119,0.151]	[-0.193,0.157]	[-0.106,0.127]	[-0.023,0.349]
Pre-Treat Mean of DV	0.273	0.171	0.525	0.311
N	1,192	1,189	1,192	1,187
		Panel II: Primary, Secondary, or Tertiary Substance		
PDHIA	0.016	-0.035	0.001	0.123*
	(0.049)	(0.056)	(0.042)	(0.067)
	[-0.083,0.115]	[-0.147,0.077]	[-0.083,0.085]	[-0.012,0.258]
Pre-Treat Mean of DV	0.517	0.449	0.675	0.421
N	1,193	1,192	1,192	1,192

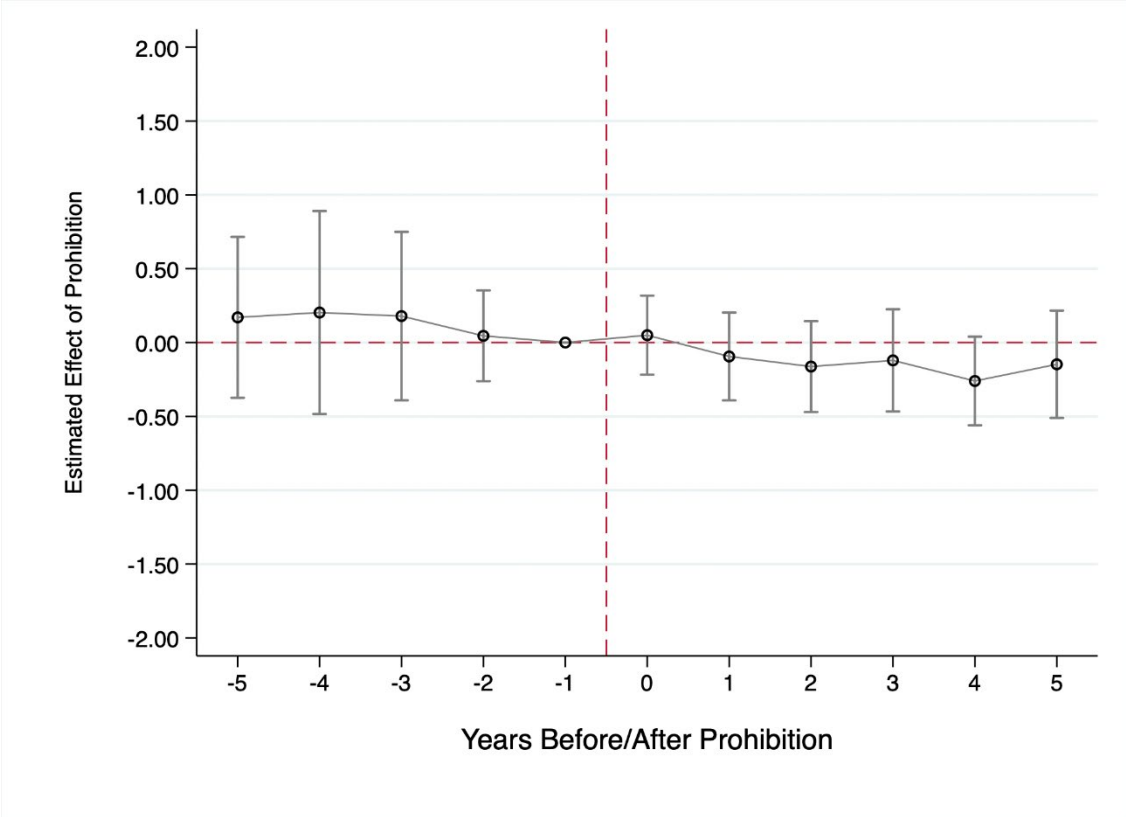
***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Treatment Episode Data Set. The dependent variables are log values of ratio of drug-specific admission to total admission among adults aged 18-29. Referrals are restricted to alcohol or drug abuse care providers, other healthcare providers, and employers. Panel I uses admissions that report the substance as primary substance of abuse. Panel II uses admissions that report the substance as primary, secondary or tertiary substance of abuse. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the overall counts for admissions of adults aged 18-29 years old, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19 and the full controls mentioned below. Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

ONLINE

APPENDIX TABLES

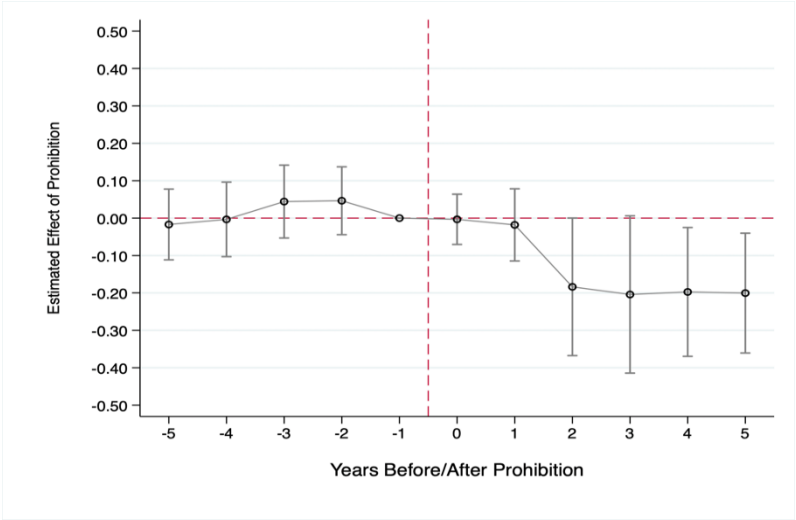
Appendix Figure 1. Event-Study Analysis of PDHIAs and Natural Log of Public Drunkenness Arrest Rate Among 18-29-Year-Olds, UCR, 1998-2021



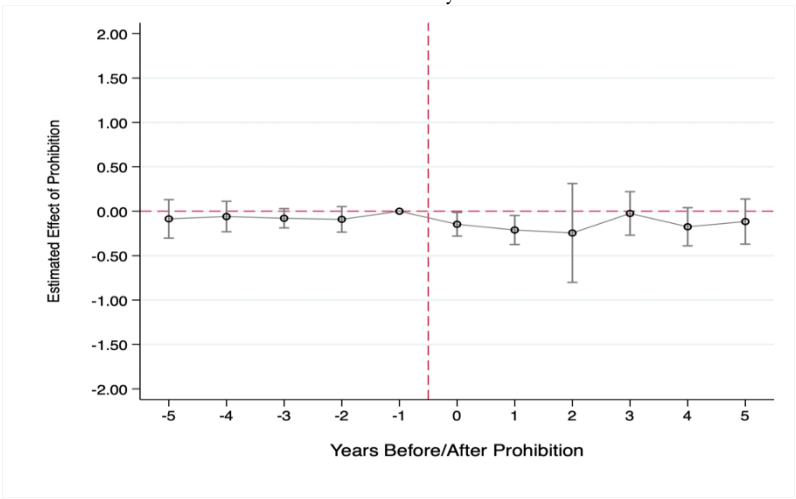
Notes: State-by-year data used for the above event study regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for public drunkenness per 100,000 persons aged 18-29 years. Estimates are obtained from event study regressions using two-way fixed effects estimates. The regression controls for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state, the share of the state population covered by reporting agencies, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

Appendix Figure 2. Event-Studies of PDHIAs and Key Outcomes, Using Sun And Abraham Estimates, restricting Counterfactuals to States that Include a Law Explicitly Permitting the Denial of Benefits

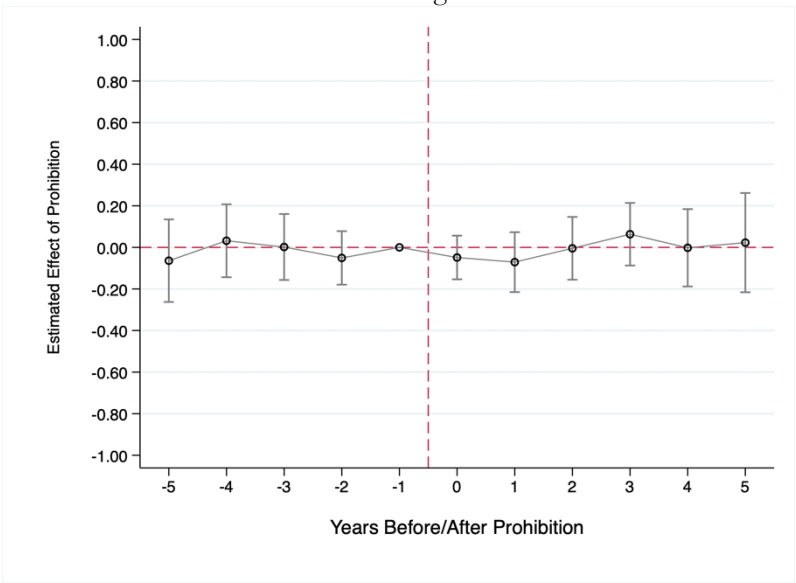
Panel I: DUI



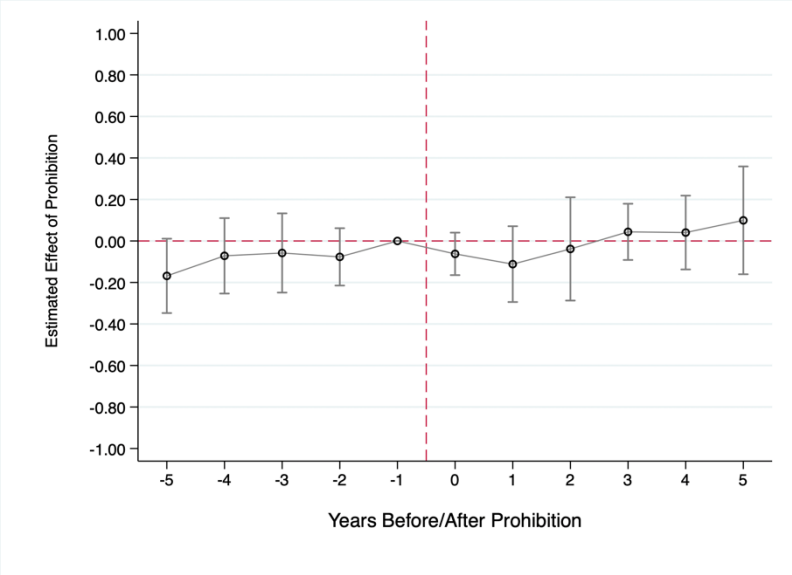
Panel II: Disorderly Conduct



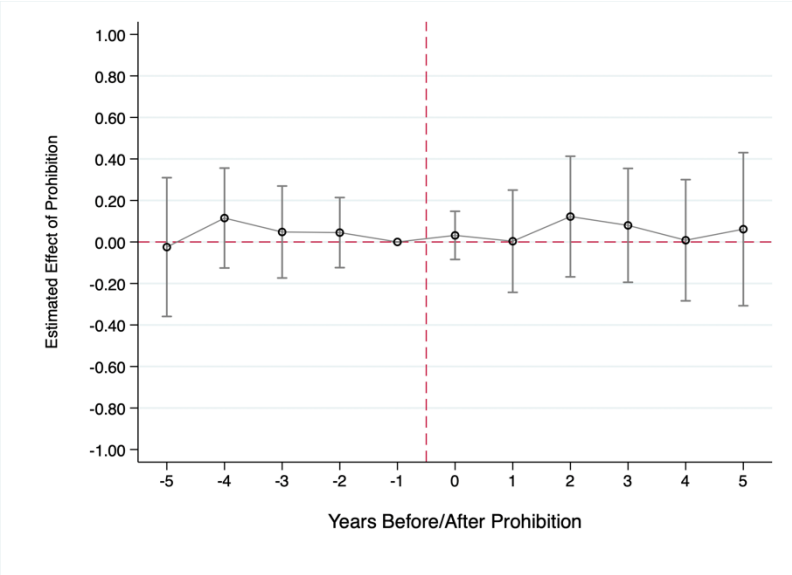
Panel III: Drug Crime



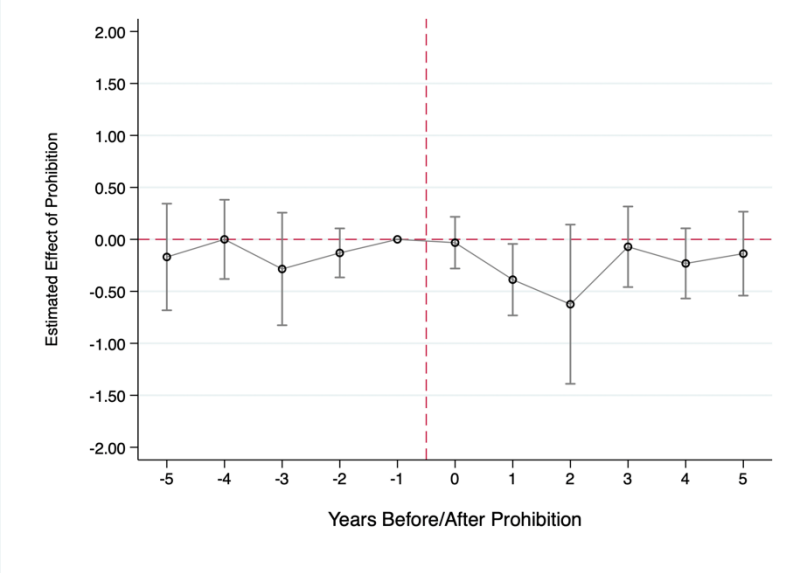
Panel IV: Marijuana



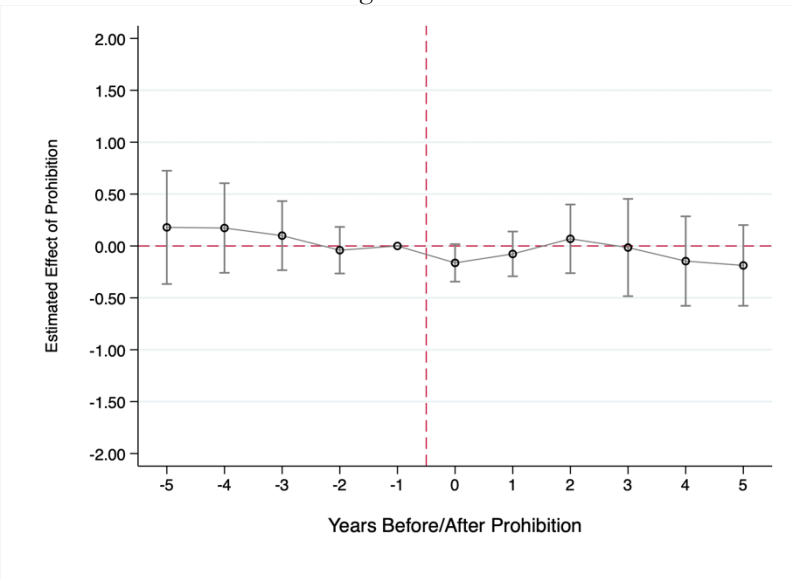
Panel V: Heroin/Cocaine



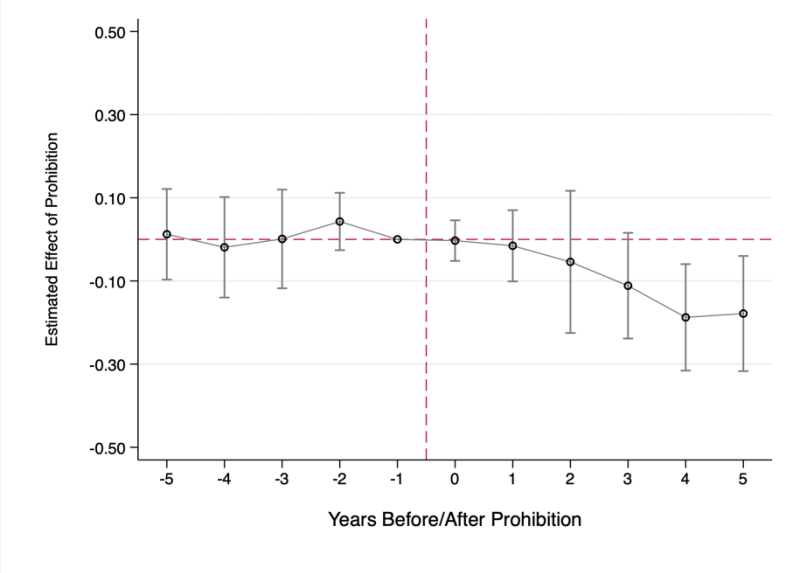
Panel VI: Synthetic Non-Narcotics



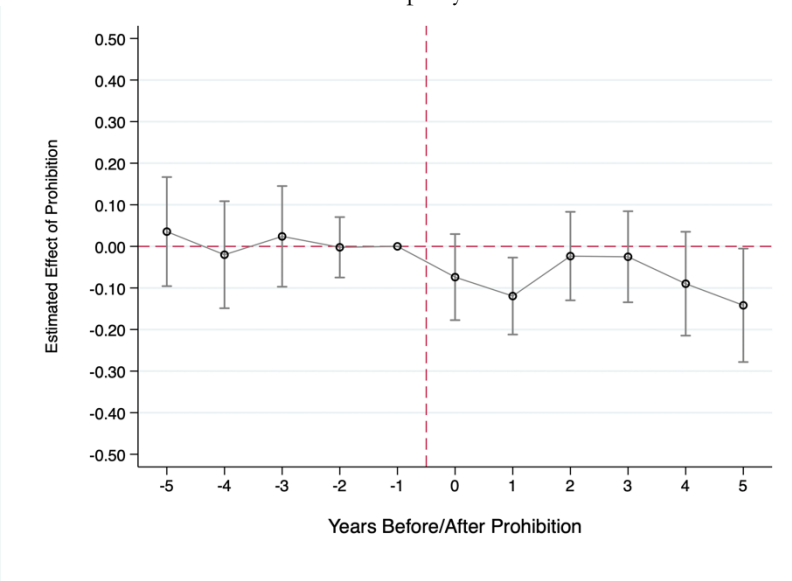
Panel VII: Dangerous Non-narcotics



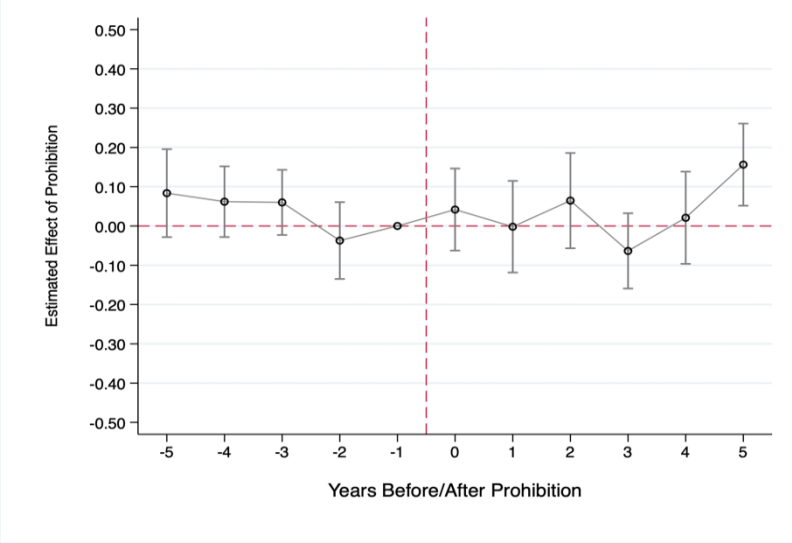
Panel VIII: Violent Crime



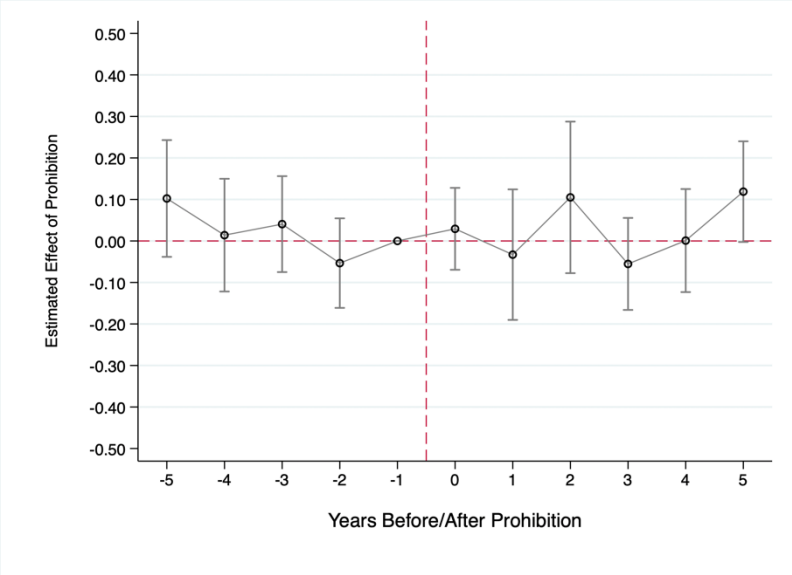
Panel IX: Property Crime



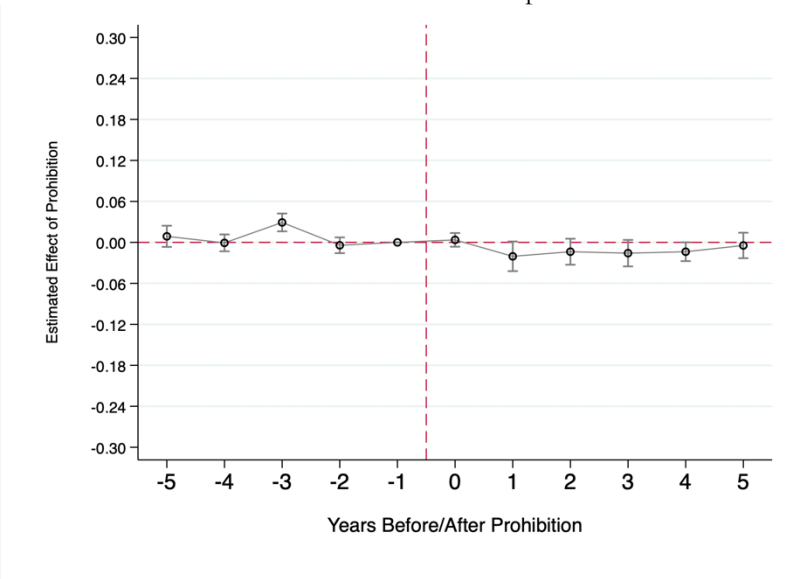
Panel X: Fatalities Caused by Drunk Drivers



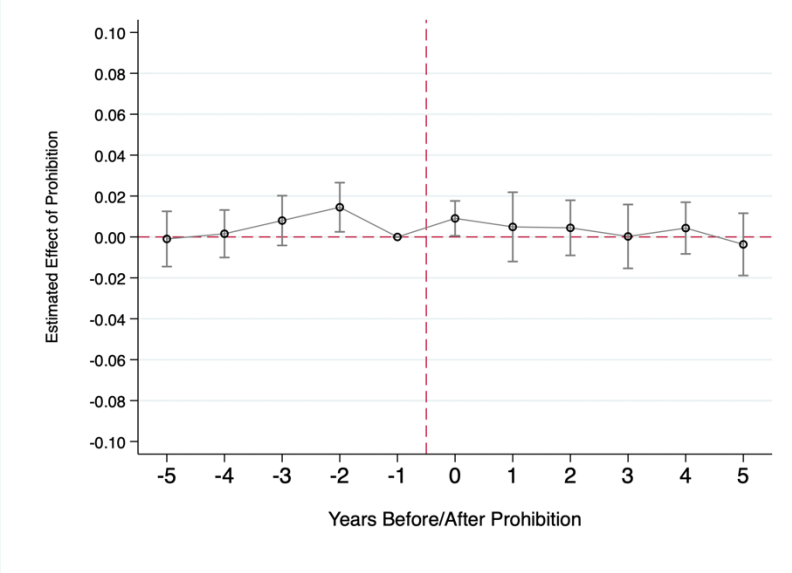
Panel XI: Fatalities of Drunk Drivers



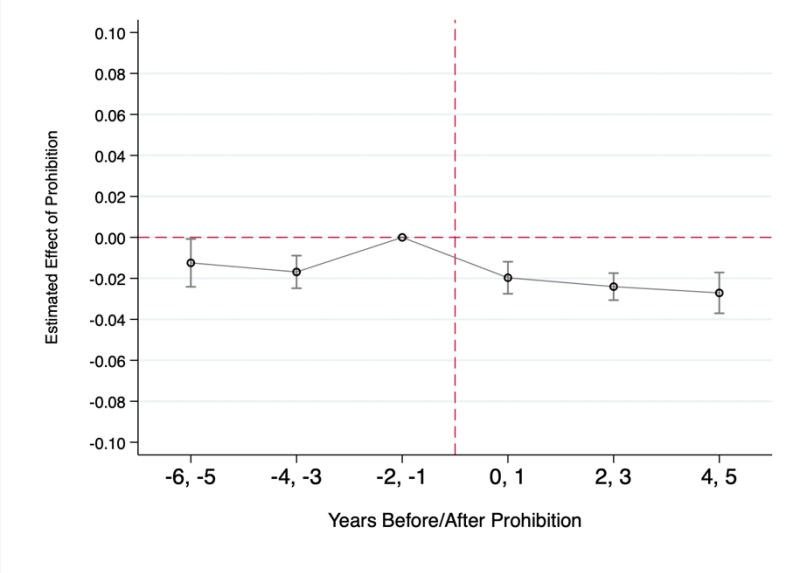
Panel XII: Alcohol Consumption



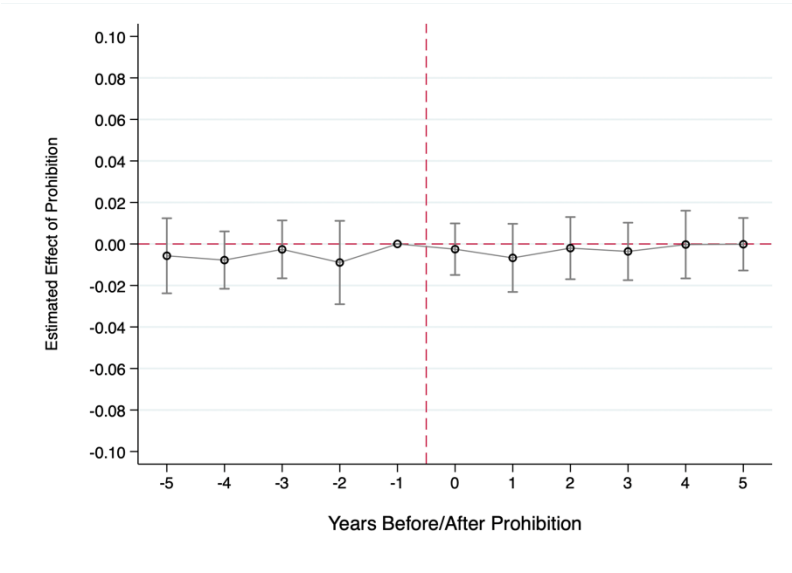
Panel XIII: Binge Drinking



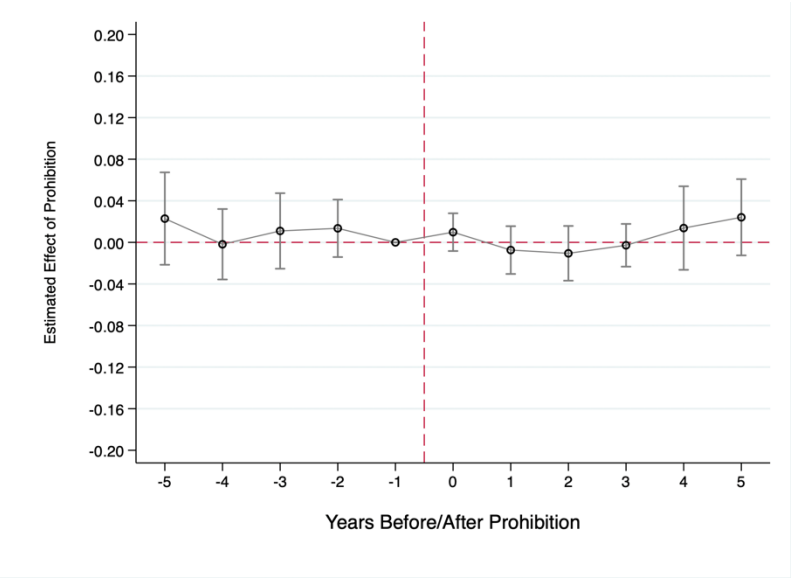
Panel XIV: Drinking & Driving



Panel XV: Private Health Insurance



Panel XVI: Private Insurance Premium



Notes: For Panels I to IX, state-by-year data used for the above Sun and Abraham event study regressions are obtained from the 1998-2021 Uniform Crime Reports. The dependent variable is the natural log of the arrest rate for the specified offense per 100,000 persons aged 18-29 years. For Panels X to XI, state-by-year data used for the above Sun and Abraham event study regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers per 100,000 persons aged 18-29 years. For Panels XII, XIII and XIV, individual level data used for the above Sun and Abraham event study regressions are obtained from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are indicators for prior-month alcohol consumption, binge drinking, and drinking and driving, respectively, in panels XII, XIII, and XIV. These panels additionally control for gender, race, age, education, and marital status along with quarter fixed effects. For Panels XV and XVI, state-by-year data used for for the above Sun and Abraham event study regressions are obtained from the 1998-2021 Medical Expenditure Panel Survey. The dependent variables are the share of persons who have private health insurance and the natural log of the average private health insurance premium, respectively, in panels XV and XVI. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the number of reporting agencies in the state and the share of the state population covered by reporting agencies for Panel I to IX, the share of 18-29-year-olds (state population for Columns XV and XVI) who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, the Oxford University government stringency index, the share of the population vaccinated for COVID-19, alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), marijuana policies (medical and recreational marijuana laws, and marijuana decriminalization laws), non-marijuana drug policies (must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate). Coefficients are represented with dots, and vertical lines indicate 95% confidence intervals, adjusted for clustering at the state level.

Appendix Table 1A: Descriptive Statistics of Dependent Variables Among 18-29-Year-Olds, UCR, FARS, BRFSS, MEPS, TEDS, 1998-2021

Datasets | Variables	*Means (SD)*
UCR	
DUI Arrest Rate	421.929 (325.139)
Disorderly Conduct Arrest Rate	177.078 (175.701)
Drug Crime Arrest Rate	711.092 (492.850)
Drug – Marijuana Arrest Rate	393.141 (311.678)
Drug- Heroin/ Cocaine Arrest Rate	166.535 (164.922)
Drug – Dangerous Synthetic Narcotics Arrest Rate	39.618 (54.056)
Drug – Other dangerous Non-Narcotics Arrest Rate	111.798 (89.118)
Violent Crime Arrest Rate	214.415 (124.123)
Property Crime Arrest Rate	592.493 (394.104)
Observations	*1056*
FARS	
Fatality Rate of drunk drivers	5.438 (2.449)
Fatality Rate involving drunk drivers	8.651 (3.839)
Observations	*1224*
BRFSS	**All [Insured]**
Current Alcohol Use	0.559 [0.575]
Current Binge Drinking	0.273 [0.275]
Drink & Drive in past 30days	0.064 [0.061]
Demographic Controls	
Female	0.484 [0.505]
Married	0.237 [0.252]
No High School	0.128 [0.091]
High School	0.332 [0.309]
Some College	0.336 [0.359]
College	0.203 [0.241]
Observations	*823,896 [642,316]*
MEPS	
Insurance Premium	5983.229 (1185.667)
Insurance Rates	0.513 (0.046)
Observations	*1173*
TEDS	
Primary Alcohol Referral ratio	0.249 (0.103)
Any Alcohol Referral ratio	0.439 (0.145)
Primary MJ Referral ratio	0.159 (0.068)
Any MJ Referral ratio	0.427 (0.110)
Primary Hard Drug Referral ratio	0.535 (0.144)
Any Hard Drug Referral ratio	0.679 (0.131)
Primary Heroin/ Cocaine Referral ratio	0.295 (0.152)
Any Heroin/ Cocaine Referral ratio	0.415 (0.168)
Observations	*1194*

Notes: For arrest rates, state-by-year data are obtained from the 1998-2021 Uniform Crime Reports. The arrest rate for the specified offense is per 100,000 persons aged 18-29 years. For fatality rates, state-by-year data used are obtained from the 1998-2021 Fatality Analysis Reporting

System. The fatality rate is of both involving drunk drivers and drunk driver fatalities per 100,000 persons aged 18-29 years. For drinking outcomes, individual level data used are obtained from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are indicators for prior-month alcohol consumption, binge drinking, and drinking and driving, respectively. For insurance data, state-by-year data used are obtained from the 1998-2021 Medical Expenditure Panel Survey. The dependent variables are the share of persons who have private health insurance and the average private health insurance premium. For treatment admissions data, state-by-year data used are obtained from the 1998-2021 Treatment Episode Data Set. The dependent variables are ratios of drug-specific admission to total admission among adults aged 18-29. Referrals are restricted to alcohol or drug abuse care providers, other healthcare providers, and employers. We measure both, admissions that report the substance as primary substance of abuse, and admissions that report the substance as primary, secondary or tertiary substance of abuse.

Appendix Table 1B. Descriptive Statistics of State-Level Independent Variables, 1998-2021.

Independent Variables	*Means(SD)*
PDHIA	0.243
No Law	0.182
Female	0.491
Black	0.150
Hispanic	0.202
Number of reporting agencies in state	165.618 (164.595)
Coverage Indicator	99.544 (1.528)
Unemployment rate	5.558 (2.556)
Cumulative covid death rate	0.001 (0.000)
Oxford COVID measure - stringency index	4.039 (13.299)
Percentage of fully vaccinated population	1.609 (7.635)
Beer Tax, 2021 $	0.327 (0.297)
BAC threshold	0.082 (0.006)
Sunday Alcohol Samles Bans	0.187
Zero Tolerance Laws	0.999
Good Samaritan law immunity extended to alcohol	0.094
Prescription drug monitoring program	0.208
Good Samaritan law immunity for drugs	0.295
Naloxone access laws	0.378
Recreational Marijuana Legalization	0.077
Medical Marijuana Legalization	0.364
Marijuana Decriminalization Laws	0.428
CA MJ decriminalization 2011 law	0.071
ENDS Tax, 35% retailer markup, 2021 $	0.123 (0.470)
Cigarette Tax, 2021 $	1.533 (1.134)
Affordable Care Act Medicaid expansion	0.234
Quarterly State Minimum Wage, 2021 $	8.885 (1.387)
SNAP Benefit for 4-person family, 2021 $	714.542 (58.040)
State EITC Rate	0.096 (0.180)

Notes: State by year data collected by authors from multiple data sources. Covid deaths multiplied by 100 for display.

Appendix Table 2. Sensitivity of Drunk Driving Results Among 18-29-Year-Olds to Spatial Heterogeneity Controls, FARS, 1998-2021

	(1)	(2)
	Fatalities Caused by Drunk Drivers	Fatalities of Drunk Drivers
	Panel I: State-Specific Linear Time Trends	
PDHIA	0.005	0.017
	(0.043)	(0.052)
	[-0.081,0.091]	[-0.086,0.120]
	Panel II: Census Region by Year Fixed Effects	
PDHIA	0.041	0.043
	(0.042)	(0.038)
	[-0.042,0.125]	[-0.033,0.119]
Pre-Treat Mean of DV	9.105	5.409
N	1,222	1,217

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers per 100,000 persons aged 18-29 years. Panel I has additional controls for state specific linear trend fixed effects. Panel II has additional controls for region specific year fixed effects. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 3. Exploration of Effects of PDHIA Adoption on Alcohol-Related Traffic Fatalities, by Age, FARS, 1998-2021

	(1)	(2)
	Fatalities Caused by Drunk Drivers	Fatalities of Drunk Drivers
	Panel I: Ages 18-25	
PDHIA	0.009	-0.002
	(0.052)	(0.054)
	[-0.095,0.113]	[-0.110,0.106]
Pre-Treat Mean of DV	9.979	5.726
N	1,217	1,209
	Panel II: Ages 26-29	
PDHIA	0.004	-0.008
	(0.053)	(0.050)
	[-0.102,0.111]	[-0.108,0.092]
Pre-Treat Mean of DV	7.537	4.590
N	1,209	1,188
	Panel III: Aged 30-49	
PDHIA	-0.018	-0.023
	(0.038)	(0.043)
	[-0.094,0.059]	[-0.110,0.064]
Pre-Treat Mean of DV	4.620	3.304
N	1,223	1,218
	Panel IV: Aged 50-64	
PDHIA	0.033	0.036
	(0.057)	(0.063)
	[-0.082,0.148]	[-0.090,0.162]
Pre-Treat Mean of DV	2.099	1.614
N	1,204	1,195

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers per 100,000 persons of the age noted in the panel title. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of panel specified aged people who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of panel specific ages and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 4. Heterogeneity in Estimated Fatality Effect by Whether Covered by the Dependent Coverage Mandate (DCM) Among Ages 18-25, FARS, 1998-2021

	(1)	(2)
	Fatalities Caused by Drunk Drivers	Fatalities of Drunk Drivers
PDHIA	0.005	0.022
	(0.039)	(0.049)
	[-0.073,0.082]	[-0.077,0.121]
PDHIA X DCM	0.016	0.047
	(0.051)	(0.055)
	[-0.087,0.119]	[-0.063,0.158]
Pre-Treat Mean of DV	9.979	5.726
N	1,217	1,209

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Fatality Analysis Reporting System. The dependent variable is the natural log of the fatality rate involving drunk drivers per 100,000 persons aged 18-25 years. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the share of 18-25-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-25-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 5. Sensitivity of Estimates of the Effect of PDHIA Adoption on Drinking Behavior to Spatial Heterogeneity Controls, BRFSS, 1998-2021

	(1)	(2)	(3)
	Current Alcohol Use	Binge Drinking	Drinking and Driving
	Panel I: State-Specific Linear Time Trends		
PDHIA	0.002	0.010	-0.013
	(0.009)	(0.008)	(0.010)
	[-0.016,0.019]	[-0.007,0.026]	[-0.032,0.007]
	Panel II: Census Region by Year fixed effects		
PDHIA	-0.0005	0.011*	-0.0004
	(0.006)	(0.006)	(0.005)
	[-0.013,0.012]	[-0.001,0.023]	[-0.011,0.010]
Pre-Treat Mean of DV	0.619	0.293	0.072
N	628474	621331	186047

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using data from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are prior-month alcohol use, binge drinking and drinking and driving among persons aged 18-29. Panel I has additional controls for state specific linear trend fixed effects. Panel II has additional controls for region specific year fixed effects. All regressions control for state fixed effects, year and quarter fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, age, gender, race, education, and marital status; at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the sampling weights provided in the dataset and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 6. Exploration of Effects of PDHIA Adoption on Drinking Behavior, by Age, BRFSS, 1998-2021

	(1)	(2)	(3)
	Alcohol Use	Binge Drinking	Drinking and Driving
		Panel I: Aged 18-25	
PDHIA	-0.023***	0.001	-0.007
	(0.008)	(0.009)	(0.009)
	[-0.039,-0.006]	[-0.017,0.019]	[-0.025,0.012]
Pre-Treat Mean of DV	0.604	0.306	0.078
N	375226	371308	106473
		Panel II: Aged 26-29	
PDHIA	0.006	0.009	-0.010
	(0.009)	(0.009)	(0.011)
	[-0.012,0.025]	[-0.008,0.026]	[-0.032,0.012]
Pre-Treat Mean of DV	0.648	0.267	0.060
N	253248	250023	79574
		Panel III: Aged 30-49	
PDHIA	-0.004	0.004	-0.001
	(0.005)	(0.003)	(0.003)
	[-0.013,0.006]	[-0.002,0.010]	[-0.008,0.005]
Pre-Treat Mean of DV	0.625	0.183	0.042
N	1936526	1913112	578186
		Panel IV: Aged 50-64	
PDHIA	-0.004	0.003	-0.005
	(0.006)	(0.003)	(0.003)
	[-0.017,0.008]	[-0.004,0.010]	[-0.011,0.002]
Pre-Treat Mean of DV	0.568	0.104	0.025
N	2119662	2107139	556924

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using data from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are prior-month alcohol use, binge drinking and drinking and driving among persons of the age noted in the panel title. All regressions control for state fixed effects, year and quarter fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, age, gender, race, education, and marital status; at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the sampling weights provided in the dataset and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 7. Heterogeneity in Effect of PDHIAs by Whether Covered by Dependent Coverage Mandate (DCM), BRFSS, 1998-2021

	(1)	(2)	(3)
	Current Alcohol Use	Binge Drinking	Drinking and Driving
		Panel I: Ages 18-25	
PDHIA	-0.015	-0.004	-0.007
	(0.010)	(0.010)	(0.009)
	[-0.035,0.006]	[-0.023,0.015]	[-0.026,0.012]
PDHIA*DCM	-0.014	-0.002	-0.003
	(0.016)	(0.012)	(0.010)
	[-0.046,0.017]	[-0.026,0.022]	[-0.023,0.016]
Pre-Treat Mean of DV	0.591	0.311	0.079
N	487154	482206	135214
		Panel II: Ages 18-29	
PDHIA	-0.009	-0.002	-0.012*
	(0.007)	(0.007)	(0.006)
	[-0.024,0.006]	[-0.015,0.011]	[-0.024,0.000]
PDHIA*Age 18-25*DCM	-0.015**	-0.002	0.003
	(0.007)	(0.006)	(0.004)
	[-0.029,-0.001]	[-0.014,0.009]	[-0.005,0.010]
Pre-Treat Mean of DV	0.605	0.299	0.075
N	804916	796025	232703

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using data from the 1998-2021 Behavioral Risk Factor Surveillance System. The dependent variables are prior-month alcohol use, binge drinking and drinking and driving among persons aged 18-25. All regressions control for state fixed effects, year and quarter fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, age, gender, race, education, and marital status; at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19. Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the sampling weights provided in the dataset and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 8. Sensitivity of Estimated Health Insurance Effects to Controls for Spatial Heterogeneity, MEPS, 1998-2021

	(1)	(3)	(2)
	Any Health Insurance	Private Health Insurance	Private Health Insurance Premium
	Panel I: State-Specific Linear Time Trend		
PDHIA	-0.017*	0.003	0.002
	(0.008)	(0.004)	(0.008)
	[-0.034,0.0002]	[-0.005,0.011]	[-0.014,0.017]
	Panel II: Census Region-Specific Year Fixed Effect		
PDHIA	-0.009	0.007***	0.001
	(0.005)	(0.003)	(0.008)
	[-0.020,0.002]	[0.002,0.012]	[-0.016,0.018]
Pre-Treat Mean of DV	0.745	0.480	4895.08
N	857216	1,123	1,123

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using individual data from the 1998-2021 Behavioral Risk Factor Surveillance System for Column (1) and state-by-year data from the 1998-2021 Medical Expenditure Panel Survey for Columns (2) and (3). The dependent variables are share of people with any health insurance among persons aged 18-29, share of persons who have private health insurance and the natural log of the average private health insurance premium, respectively. Panel I has additional controls for state specific linear trend fixed effects. Panel II has additional controls for region specific year fixed effects. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19, , with additional controls for age, gender, race, education, and marital status and quarter fixed effects for Column (1). Panel II has additional controls as mentioned below: Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-29-year-olds for column (1) and the state population for columns (2) and (3). Standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 9. Sensitivity of Estimated Health Insurance Effects to Controlling For Dependent Coverage Mandate Among Ages 18-25, MEPS, 1998-2021

	(1)	(3)	(2)
	Any Health Insurance	Private Health Insurance	Log of Average Health Insurance Premium
PDHIA	-0.009	0.003	0.003
	(0.007)	(0.003)	(0.008)
	[-0.022,0.005]	[-0.003,0.009]	[-0.012,0.018]
PDHIA*DCM	0.013**	0.005*	-0.006
	(0.006)	(0.003)	(0.009)
	[0.000,0.026]	[-0.001,0.011]	[-0.024,0.012]
Pre-Treat Mean of DV	0.732	0.480	4895.082
N	516405	1,123	1,123

***Significant at 1% level **at 5% level *at 10% level

Notes: Estimates were obtained from ordinary least squares regressions using individual data from the 1998-2021 Behavioral Risk Factor Surveillance System for Column (1) and state-by-year data from the 1998-2021 Medical Expenditure Panel Survey for Columns (2) and (3). The dependent variables are share of people with any health insurance among persons aged 18-25, share of persons who have private health insurance and the natural log of the average private health insurance premium, respectively. Panel I has additional controls for state specific linear trend fixed effects. Panel II has additional controls for region specific year fixed effects. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries at the state-level, macroeconomic and COVID-19 controls include the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19, , with additional controls for age, gender, race, education, and marital status and quarter fixed effects for Column (1). Panel II has additional controls as mentioned below: Alcohol policies (beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, Good Samaritan laws for alcohol), substance use policies (medical and recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws Good Samaritan laws for drugs), tobacco control policies (cigarette and ENDS taxes) and social welfare policies (Medicaid expansions due to the Affordable Care Act, higher of the state or Federal minimum wage, maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate) are included in subsequent columns. All regressions are weighted using the state population of 18-25-year-olds for column (1) and the state population for columns (2) and (3). Standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.

Appendix Table 10. Sensitivity of Estimates in Table 11 to Use of Other non-Court-Ordered Referral Sources, TEDS, 1998-2021

	(1)	(2)	(3)	(4)
	Alcohol	Marijuana	Any Hard Drug	Heroin/Cocaine
		Panel I: Primary Substance		
PDHIA	-0.0002	-0.063	-0.010	0.153
	(0.068)	(0.068)	(0.081)	(0.108)
	[-0.137,0.136]	[-0.200,0.074]	[-0.172,0.152]	[-0.064,0.370]
Pre-Treat Mean of DV	0.227	0.163	0.575	0.361
N	1,195	1,191	1,196	1,196
		Panel II: Primary, Secondary, or Tertiary Substance		
PDHIA	-0.006	-0.026	-0.014	0.099
	(0.051)	(0.051)	(0.062)	(0.082)
	[-0.109,0.097]	[-0.129,0.077]	[-0.138,0.110]	[-0.067,0.264]
Pre-Treat Mean of DV	0.451	0.415	0.697	0.453
N	1,196	1,195	1,196	1,196

***Significant at 1% level **at 5% level *at 10% level

Notes: State-by-year data used for the above regressions are obtained from the 1998-2021 Treatment Episode Data Set. The dependent variables are log values of ratio of drug-specific admission to total admission among adults aged 18-29. All referrals are included with the exception of court ordered, alcohol or drug abuse care providers, other healthcare providers and employers. Panel I uses admissions that report the substance as primary substance of abuse. Panel II uses admissions that report the substance as primary, secondary or tertiary substance of abuse. Estimates are obtained from ordinary least squares regressions using two-way fixed effects estimates. All regressions control for state fixed effects, year fixed effects, whether the state has no law regarding private health insurance benefit denial for claims for alcohol/drug-related injuries, the overall counts for admissions of adults aged 18-29 years old, the share of 18-29-year-olds who are Black, Hispanic, and female, the unemployment rate, the cumulative COVID-19 death rate, and the Oxford University government stringency index, the share of the population vaccinated for COVID-19 and the full controls mentioned below. Alcohol policy controls include beer taxes, BAC08 drunk driving threshold, Sunday restrictions on alcohol sales, zero tolerance laws, and Good Samaritan laws for alcohol. Substance use policy controls include medical marijuana laws, recreational marijuana laws, marijuana decriminalization laws, must-access prescription drug monitoring programs, naloxone access laws and Good Samaritan laws for drugs. Tobacco control policies include cigarette taxes and e-cigarette taxes (in 2021$). Social welfare policies include Medicaid expansions due to the Affordable Care Act, the higher of the state or Federal minimum wage, the maximum Supplemental Nutrition Assistance Program benefits for family of four, and the Earned Income Tax Credit refundable rate. All regressions are weighted using the state population of 18-29-year-olds and standard errors are clustered at the state level and are shown in parentheses. 95% confidence intervals are shown in brackets.