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Dhaval M. Dave
Bentley University, NBER & IZA

Yang Liang
San Diego State University

Caterina Muratori
San Diego State University

Joseph J. Sabia
San Diego State University & IZA

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Dhaval Dave
Center for Health Economics & Policy Studies
Bentley University, NBER & IZA
Email: ddave@bentley.edu

Yang Liang
Center for Health Economics & Policy Studies
San Diego State University
Email: yang.liang@sdsu.edu

Caterina Muratori
Center for Health Economics & Policy Studies
San Diego State University
Email: caterina.muratori@carloalberto.org

Joseph J. Sabia
Center for Health Economics & Policy Studies
San Diego State University & IZA
Email: jsabia@sdsu.edu

Abstract

Despite nearly 70 percent of the American public supporting legalization of recreational marijuana, opponents argue that increased marijuana use may diminish motivation, impede cognitive function, and harm health, each of which could adversely affect adults' economic wellbeing. This study is the first to explore the impacts of recreational marijuana laws (RMLs) on employment and wages. Difference-in-differences estimates show little evidence that RMLs adversely affect labor market outcomes among most working-age individuals. Rather, our estimates show that RML adoption is associated with an increase in agricultural employment, consistent with the opening of a new licit market. A causal interpretation of our findings is supported by (1) event-study analyses using dynamic difference-in-differences estimates designed to expunge bias due to heterogeneous and dynamic treatment effects, and (2) alternative policy estimates generated using a synthetic control design.

Keywords: recreational marijuana laws; labor market outcomes; employment; wages

JEL codes: I12; H71

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1. Introduction

"I'm not a regular smoker of weed… I don't find that it is very good for productivity."

- Elon Musk (2018)

"I smoke a lot of weed when I write."

- Seth Rogan (2011)

Recreational marijuana laws (RMLs) legalize the possession, sale, and consumption of small quantities of marijuana for recreational purposes for those ages 21-and-older. Since 2012, 21 states and the District of Columbia have adopted RMLs', resulting in over

While 68 percent of the American public support marijuana legalization (Gallup 2021), the American Medical Association (AMA) and the American Public Health Association (APHA) have stopped short of endorsing RMLs, citing many unanswered questions (AMA 2021; APHA 2020). Opponents of RMLs argue that the resultant increases in marijuana consumption may cause diminished cognition (Hanson et al. 2010), increased risk of amotivational syndrome (Volkow et al. 2016,) and lethargy (Irons et al. 2014; Pesta et al. 2013). Moreover, they claim that excessive marijuana use may lead to poorer physical (National Academies of Sciences, Engineering, and Medicine 2017) and psychological health (van Ours and Williams 2011, 2012, 2015), as well as harder drug use (DeSimone 1998; Hall 2009; Secades-Villa et al. 2015) and diminished educational attainment (Cobb-Clark et al. 2015; Chatterji 2008; van Ours and Williams 2009; Chu and Gersheson 2018). If RMLs generate adverse health, human capital, and cognitive effects, these could have substantial negative impacts on adult labor market outcomes.

On the other hand, RMLs could have positive effects on employment and wages. The introduction of a new legal industry — which may include cultivation and production of marijuana as well as legal marijuana sales at recreational dispensaries — may increase employment

(Chakraborty et al. 2021). Moreover, if legal access to marijuana induces substitution away from substances that have negative impacts on productivity, including opioids (Bachhuber et al. 2014; Bradford and Bradford 2018; Powell et al. 2018; Sabia et al. 2021)[1] or heavier drinking (Anderson et al. 2013; Sabia et al. 2017)[2], labor market outcomes may improve (or at least be no worse off). In addition, if marijuana is effective at alleviating physical health ailments (National Academies of Sciences, Health, and Engineering 2017; Blake et al. 2006; Chaves et al. 2020)[3], relieving stress (Doremus et al., 2019), or improving psychological health (Anderson et al. 2013; Sabia et al. 2017), such health improvements could generate positive labor market spillovers. Finally, RMLs may improve labor market outcomes by reducing the likelihood that individuals have a criminal record for marijuana possession (see Sabia et al. 2021 for a discussion). This may be especially true for young Black and Hispanic men, who have disproportionately suffered diminished labor market opportunities due to having a criminal record ( ).

This study is the first to explore the impact of recreational marijuana legalization on labor market outcomes of working-age individuals. First, using repeated cross-sectional data from the 2002-2020 National Survey on Drug Use and Health (NSDUH) and a difference-in-differences approach, we document that RML adoption is associated with a 2-to-4 percentage-point increase in adult marijuana use. Event-study analyses, using both two-way fixed effects (TWFE) and Callaway and Sant'Anna (2021) estimates, provide evidence in support of the parallel trends assumption, as well as evidence that the largest marijuana consumption effects occur following a year after RML adoption.

[1] See also, Vigil et al., (2017), Wen and Hockenberry (2018), Bradford et al. (2018). Chu, (2015); and McMichael et al. (2020).
[2] See also Baggio et al. (2020) and Dragone et al. (2019),
[3] See also Nicholas and Maclean (2019), Nurmikko et al. (2007), Rog et al. (2005) and Ullman (2017)

Next, turning to the monthly Current Population Survey Outgoing Rotation Group (ORG) data, we find little evidence that RML adoption has a statistically significant or economically important impact on the probability of employment or wages of all working-age individuals (ages 16-to-64). Moreover, an examination of heterogeneity in RML effects by characteristics of the working-age population (age, gender, race/ethnicity, and education) and by whether recreational marijuana dispensaries had opened reveals little evidence of adverse labor market effects of RMLs.

Instead, our findings show some evidence that RML adoption is associated with small *increases* in adult employment in the agricultural sector, consistent with opening of a new licit market to produce and cultivate marijuana. Among early-adopting states, California, Colorado, and (to a lesser extent) Oregon saw boosts in agriculture work. There is also some evidence that RML adoption is associated with modest (often short-run) employment gains for Hispanics and individuals over age 30.

Our largely null, and occasionally positive employment (and earnings) effects are robust to (1) the use of event-study analyses that permit tests of parallel pre-treatment trends, and an assessment of post-treatment dynamics in labor market effects, (2) controls for border state RMLs, which could have important spillover effects into neighboring jurisdictions, (3) the use of newly developed difference-in-differences methods designed to expunge bias in estimated treatment effects caused by heterogeneous and dynamic treatment effects (Goodman-Bacon 2021; Callaway and Sant'Anna 2021), and (4) synthetic control analyses of early adopting states that allow an exploration of longer-run economic effects. Together, we conclude that legalization of recreational marijuana has, at most, muted effects on the economic well-being of working-age individuals.

2. Background

2.1 History of Marijuana Reform in the United States

Marijuana was introduced to colonial America in the early 1600s by Jamestown settlers who used the marijuana plant in hemp production (Anderson et al. 2013), an industry that remained prominent until the mid-1800s (Deitch 2003). Through the 19th century, marijuana was commonly used by physicians to treat a variety of health ailments (Pacula et al. 2002; Bilz 1992). In 1913, California passed the first marijuana prohibition law targeting recreational use (Gieringer 1999), followed by the remainder of U.S. states by 1936 (Eddy 2010). The federal Marihuana Tax Act of 1937 (Pub. L. No. 75-238, 50 Stat. 551) prohibited the consumption and sale of marijuana for recreational and medical purposes (Bilz 1992; Anderson et al. 2013)

As part of the Nixon Administration's War on Drugs, marijuana was classified as a Schedule I Drug in the 1970 Controlled Substances Act. This designation meant that the federal government classified marijuana as having a "high potential for abuse," "no currently accepted medical use," and "a lack of accepted safety for use under medical supervision" (Public Law 91-51). Following the classification of marijuana as a Schedule I drug, several states began to enact marijuana decriminalization and depenalization laws, which applied to drug laws enacted at the state level. Such statutes were intended to eliminate incarceration as a penalty for possession of a small quantity of marijuana for personal consumption, replacing incarceration with a civil or a criminal misdemeanor fine. By December 2022, 27 states and the District of Columbia had adopted marijuana decriminalization laws (National Council of State Legislatures 2022).

By the mid-1990s, states began adopting so-called medical marijuana laws (MMLs). In 1996, California enacted the Compassionate Use Act, which legalized the possession, cultivation, and consumption of marijuana for allowable medical purposes. By December 2022,

recommendation and some allowable medical condition such as treatment for anxiety, fibromyalgia, or the side effects of cancer or HIV treatments, while more stringent laws require one to be part of a patient registry (Anderson and Rees 2014; Sabia et al. 2021).

Recreational marijuana laws constitute the most recent and broadest attempt to liberalize access to marijuana among adults. Such statutes typically legalize the possession, production, and consumption of small quantities of marijuana (usually between 1 and 2.5 ounces) for personal recreational consumption for those ages 21-and-older. In November 2012, Colorado and Washington became the first states to adopt RMLs. By December 2022, 21 states and the District of Columbia had legalized access to recreational marijuana (National Conference of State Legislatures 2022). Unlike MMLs, RMLs do not require a doctor's recommendation and do not require individuals to be part of a patient registry. The typical supply channels through which individuals could obtain recreational marijuana included through home growing of marijuana plants or at recreational dispensaries.

In early October 2022, President Joseph R. Biden issued a pardon to all individuals with a federal conviction for marijuana possession and urged all state governors to do the same with respect to state convictions. The president also directed the Secretary of Health and Human Services and the Attorney General "to initiate the administrative process to review expeditiously how marijuana is scheduled under federal law." Currently, legislation is pending in the U.S. Congress to remove marijuana as a Schedule I Drug as part of the Controlled Substances Act.

2.2 Mechanisms through which Recreational Marijuana Access May Affect Labor Market Outcomes

As noted above, the enactment of state RMLs could affect labor market outcomes through a number of interrelated channels, including: (1) motivation, (2) cognitive function and human capital acquisition (i.e., schooling), (3) physical and psychological health, (4) use of other substances that are

complements or substitutes for marijuana, (5) the presence of a criminal arrest record, and (6) employment opportunities in a new licit industry. Note that the pathway underlying the first four channels necessitates a first-order response, an RML-induced own-increase in marijuana consumption. That is, in order for RMLs to potentially impact an individual's labor market outcomes through their impact on cognition, or on mental or physical health, the policies must first increase the individual's use of marijuana. The last two channels underlying a potential labor market response can operate independently of this first-order own-increase in marijuana use, by changing how marijuana users are treated in the criminal justice system and by changing employment opportunities in the area at the retail and/or production levels (while noting that these employment effects could certainly be affected by consumer demand).[4]

The first author to discuss amotivational syndrome in relation to cannabis use was McGlothlin and West in 1968 (McGlothlin and West, 1968) who characterized it as apathy — that is, a loss of, or reduction in, motivation (Skumlien et al. 2022) — and diminished ability to concentrate, follow routines, or successfully master new material. Evidence for amotivation syndrome and increased lethargy comes from both laboratory experiments (Lane et al. 2005; Cherek et al. 2002; Lawn et al. 2016) as well as observational studies (Petrucci et al. 2020; Bernerth and Walker 2020; Irons et al. 2014; Pesta et al. 2013).[5]

[4]Also of note is that the first five of the aforementioned channels operate at the micro-level, as the RMLs may directly impact the individual's labor market outcome by directly impacting their use of marijuana or their interaction with the criminal justice system. In contrast, the last channel is a general equilibrium labor demand response, which could impact a larger pool of working age individuals irrespective of whether or not they use marijuana or have any potential engagement with criminal activity.

[5] For instance, in the context of controlled laboratory experiments, Lane et al. (2005) found lower motivation in 14 adolescent cannabis users compared to 20 controls. With respect to cross sectional studies, Petrucci et al. (2020) in a recent cross-sectional study of 1,168 young adults exploiting the Apathy Evaluation Scale, found that differences in depression, substance use, and personality between cannabis users and non-users largely explain differences in motivation between these groups. Using data from 281 employees and their direct supervisors, Bernerth and Walker (2020) find that cannabis use before and during work negatively relate to task performance, organization-aimed citizenship behaviors, and two forms of counterproductive work behaviors.

However, a recent review of the amotivational syndrome literature by Volkow et al. (2016) suggests that a causal link between marijuana use and lethargy is not well-established and may be explained in whole or in part by (1) selection into marijuana use by those who have a higher propensity for amotivational syndrome, or (2) limited non-representative samples with a low degree of external validity.[6] Moreover, a recent study by Skumlien et al. (2022) finds no evidence that non-acute cannabis use, at a frequency of three to four days per week, is associated with amotivation in either adults or adolescents.

On the other hand, there is stronger evidence that heavier and more frequent marijuana use has been found to be associated with diminished executive functions and learning, poorer memory, increased attention problems and worse verbal abilities and motor skills (Volkow et al. 2016). Hanson et al. (2010) find adolescent marijuana users to show poorer verbal learning, verbal working memory, and attention accuracy compared to demographically similar non-using controls. In addition, marijuana use has been linked to diminished educational attainment (van Ours and Williams 2015) and poorer academic performance (Chu and Gershenson 2016), each of which could impede labor market success.

The physical and mental health effects of RMLs are expected to have theoretically ambiguous effects on employment and wages. On the one hand, infrequent or modest marijuana use among adults generates relatively few large, adverse physical or mental health effects, particularly relative to tobacco or harder drug use (National Academies of Sciences, Engineering and Medicine 2017; Dave et al. 2022). On the other hand, frequent or heavier marijuana smoking can cause important respiratory and lung related injuries, including chronic cough and phlegm production and

[6] Both Taylor and Filbey (2021) and Vele et al. (2022) found that adult cannabis users selected hard trials on the Effort Expenditure for Rewards Task (EEfRT) more often than adult controls. Similarly, Acuff et al. (2022), using a sample of 47 young adult cannabis users and controls, found that frequency of cannabis use and symptoms of cannabis use disorder were positively associated with selecting a high-effort trial.

more frequent bronchitis episodes (National Academies of Sciences, Engineering and Medicine 2017), as well as an increase in the risk of cannabis hyperemesis syndrome, as measured by vomiting-related health care encounters (Wang et al. 2021). Such health problems may adversely affect labor market outcomes (Ward et al. 2002).

With respect to the adult psychological health effects of RMLs, the evidence is also mixed. Using data from Australia and Holland, Van Ours and Williams (2011; 2012) find that marijuana use is negatively related to mental health. Moreover, there is evidence in the medical literature that marijuana use is positively related to increased psychotic episodes (

Levine et al. 2017; Ladegard et al. 2020). However, randomized control trials provide evidence that cannabinoids can improve sleep quality and help alleviate the symptoms of post-traumatic stress disorder (National Academies of Sciences, Engineering, and Medicine 2017). There is also some evidence that MMLs may reduce the likelihood of poor mental health days among adults (Sabia et al. 2017; Kalbfuß et al. 2018) and reduce completed suicides (Anderson et al. 2014; Bartos et al. 2020), though this relationship appears to be sensitive to the choice of policy controls (et al. 2015).

There is stronger evidence that harder drug use and tobacco consumption may impede labor market success. For instance labor market outcomes such as employment and wages have been found to be negatively related to (1) cocaine use (Kaestner 1994; French et al. 2001; DeSimone 2002), (2) opioid abuse (French et al. 2001; Cho et al. 2022;

(3) problem drinking (Chatterji and DeSimone 2006; Renna 2008;)[8], and (4) tobacco consumption (Bray et al. 2000;) . An

[7] We also note that pioneering work by Case and Deaton (2020) suggests that regions that experienced greater worker displacement from skill-biased technological change and trade policy shocks were often among those hardest hit by the opioid epidemic ("deaths of despair").

[8] See also Yörük (2015), Böckerman et al. (2017), and Lye and Hirschberg (2010).

important question, therefore, is whether increased marijuana access increases other substance use through (1) a demand-side gateway effect, or (2) through supply-side changes in production, discounting, or "pushing"/marketing of other substances that have been documented to adversely affect labor market outcomes in response to a new licit marijuana market.[9]

Using data from four national datasets — the National Survey on Drug Use and Health, the Uniform Crime Reports, the National Vital Statistics Multiple Cause of Death Mortality Files, and the Treatment Episode Data Set — Sabia et al. (2021) find little support for the hypothesis that recreational marijuana legalization increases adult harder drug use, binge drinking, harder drug-related arrests, drug treatment admissions for harder drugs (i.e., heroin, other opioids, methamphetamine, cocaine), or harder drug-related overdose deaths. In fact, Sabia et al. (2021) find that legal access to recreational marijuana is associated with a reduction in opioid-related abuse and mortality, consistent with some prior evidence on medical marijuana.[10] Moreover, while there is little evidence that RML adoption significantly affects binge drinking (Sabia et al. 2021; Macha et al. 2022), access to recreational marijuana appears to reduce adult cigarette and e-cigarette use, consistent with the hypothesis that marijuana and tobacco are substitutes (Dave et al. 2022). Thus, substitution away from other substances could be a pathway through which RMLs improve labor market outcomes of adults.

Finally, there is some evidence that increased marijuana use is associated with diminished academic achievement and educational attainment (Cobb-Clark et al. 2015; Chatterji 2008; van Ours

[9] Several studies in the public health literature proport to show evidence of a "gateway effect" by establishing an association between marijuana use and harder drug use (Bleyer and Barnes 2018; Hunt et al. 2018; Wong and Lin 2019; Olfson et al. 2018). However, without a source of plausibly exogenous variation in marijuana use, it is unclear whether these associations are explained, in whole or in part, by selection on difficult-to-measure characteristics such as personal discount rates, personality, or family support.

[10] A large literature has shown evidence that MMLs, especially with accessible medical dispensaries is associated with a reduction in outcomes related to opioid abuse (Bachhuber et al. 2014; Bradford et al., 2018; Bradford and Bradford, 2018; Chu, 2015; McMichael et al. 2020; Powell et al. 2018; Vigil et al., 2017; Wen and Hockenberry, 2018). On the other hand, Conyers and Ayres (2020) and) find evidence of a complementary relationship between marijuana access and opioid-related mortality.

and Williams 2009; Chu and Gersheson 2018). While some of this association may be explained by difficult-to-measure characteristics associated with selection into use, these economic studies use a variety of econometric strategies to disentangle selection effects from causal impacts — including through the use of state drug policy experiments (Chatterji 2008; Chu and Gersheson 2018) — and continue to find evidence of a negative association between marijuana use and reduced school performance. Adverse school performance would be expected to lead to fewer job opportunities and diminished earnings over the longer-term, though increases in dropout rates could also lead to increased (low-skilled) employment among some teens.

2.3 Why Might RMLs Affect Labor Market Outcomes Differently from MMLs?

Two prior studies have explored the relationship between MMLs and adult labor market outcomes. Using data from the 1990-2017 Current Population Survey, Sabia and Nguyen (2018) find little evidence that MML adoption affects adults' employment or wages. Only for young males under 40 do the authors detect some evidence of a decline in wages, on the order of about 2 percent, driven by MMLs with open medical dispensaries. Along the same lines, using longitudinal data from the 1992-2012 Health and Retirement Study, Nicholas and Maclean (2019), find little evidence that medical marijuana laws adversely affect labor market outcomes among older adults. Instead, they find that MML adoption is associated with an increase in older adults' labor supply along the intensive margin.

There are important reasons to expect that the impacts of RMLs on adult labor market outcomes will differ from MMLs. First, while MMLs may spillover to the recreational market (Anderson and Rees 2021), the population directly targeted by MMLs — registering patients in medical need that stand to benefit from cannabis use upon a physician's recommendation— represents a relatively small pool of individuals. Thus, the "first-stage" effects of MMLs on adult

marijuana use are relatively small, generally around 1-to-2 percentage points at most (Anderson and Rees 2013; Wen et al. 2015; Sabia and Nguyen 2018; Choi et al. 2019). In contrast, RMLs have few restrictions, beyond the age verification, thus affecting a much broader population of current and potential recreational users. The very few studies that have tried to estimate the first-stage effect of RMLs on marijuana consumption point to an increase in marijuana use after its legalization for recreational purposes that is up to 100 to 400 percent larger relative to the effects of MMLs (et al 2020, Ambrose 2020, Sabia et al. 2021), on the order of 2-to-4 percentage-points (Sabia et al. 2021).

Second, MMLs target a specific population group, that may respond to marijuana legalization in a peculiar way, in accordance with the group's members' characteristics. If medical marijuana access is more likely to be used to effectively treat physical and mental health ailments (Blake et al. 2006; Doblin and Kleinman 1991; Fiz et al. 2011; Bonn-Miller, Zvolensky, and Bernstein 2007) than is recreational marijuana access, one might expect more negative effects of RMLs on labor market outcomes than was observed for MMLs. In addition, if those with physical or mental health problems are more likely to be using other, potentially more harmful and addictive substances to cope with health challenges, then MMLs may lead to greater improvements in health and economic wellbeing.

On the other hand, the effects of RMLs on labor market opportunities for working-age individuals may be greater for a number of reasons. A wider legal market for adults ages 21-and-older may increase labor demand and offer new economic opportunities. Moreover, recreational dispensaries were far more likely to enter the market and do so more quickly post-RML adoption (with fewer sales restrictions and state licensure requirements) as compared to medical dispensary openings relative to MML adoption. For instance, the average time to recreational dispensary

openings among RML adopting states was one year (Anderson and Rees 2013), as compared to MMLs, which was 4.5 years (Sabia and Nguyen 2018).

Third, by more broadly reducing the likelihood of having a criminal record, RMLs may be more likely to have important effects on employment and earnings opportunities of those young men with a relatively higher propensity for a marijuana possession arrest. Thus, one might expect that RMLs could have larger effects on those disproportionately harmed by marijuana prohibition: young Black and Hispanic men.

Finally, because RMLs broadly expand the market for marijuana across a far larger potential set of consumers than MMLs, expansions in production and cultivation of marijuana may be much more substantial. Thus, there is greater scope for agriculture and retail sales employment to rise (perhaps along with workers' wages) in response to this new licit market.

2.4 Case Studies on Recreational Marijuana Access and Labor Market Outcomes

While two studies have explored the labor market effects of RMLs, each is a case study of a particular state. Chakraborty et al. (2021) use county-level data on recreational dispensary openings in Colorado and finds that such openings modestly reduce the local unemployment rate through increasing employment. They find no evidence that average workers' wages are impacted by legalization. Jiang and Miller (2022) use state-level data to study the economic impact of RML adoption in Colorado and Washington. They find that RMLs are associated with a decline in the weekly wage paid per worker in the agricultural and retail sectors. Their interpretation of this result

is that RMLs "negatively impact incumbent agriculture and retail firms through the labor market channel."[11,12]

2.5 Contributions

We contribute to the scant literature on the labor market effects of RML adoption in several ways. This is the first national study to estimate the economic impact of RMLs adopted broadly across the U.S. through 2020, including laws that cover more than 30 percent of the nation's population. Moreover, we pay careful attention to heterogeneity in the impacts of RMLs across demographic groups that could be differentially influenced by RMLs through both consumption and employment channels, including by individuals of heterogeneous education levels, racial/ethnic minorities, younger individuals, males, and those employed in the agricultural and retail sectors. These advances will allow both for a more externally valid policy estimate, as well as a fuller picture of the distributional effects of RMLs.

Second, we advance the literature through the use of dynamic difference-in-differences approaches (i.e., event-study analyses), which allow for the testing of parallel pre-treatment trends in labor market outcomes in treated and untreated jurisdictions. Moreover, we also generate event studies using newly developed estimators designed to expunge bias in two-way fixed effects (TWFE)

[11] It should be noted that the authors do not use longitudinal data on firms and hence do not specifically measure firm entry or exit, nor are they able to measure wage bills in incumbent firms. An alternative explanation for their findings, therefore, could be that RML adoption increases agriculture employment, without any corresponding wage effects.
[12] In addition, two studies of which we are aware examine the impact of RMLs on workers' compensation benefits and disability claims. Using administrative caseload data from the Social Security Administration from 2001 to 2019 and a two-way fixed effects model, Maclean et al. (2021) find that RML adoption increases applications for Social Security Disability Insurance by 3.6 percent and for Supplemental Security Income by 5.5 percent, suggesting that marijuana may have a negative impact on health and work capacity. Abouk et al. (2021) use data from the Annual Social and Economic Supplement of the Current Population Survey and the BLS Survey of Occupational Injuries and Illnesses finds that RML adoption is associated with a reduction in workers' compensation benefit receipt and reported workplace injuries among adults ages 40-to-62. They interpret these findings as evidence of RML-induced substitution away from opioids.

estimators due to heterogeneous and dynamic treatment effects (Goodman-Bacon 2021; Callaway and Sant'Anna 2021).

In addition, we allow for heterogeneous treatment effects among earlier adopting states and explore whether there are important longer-run effects of RMLs in earlier-adopting states using synthetic control analyses. Finally, we pay careful attention to potentially heterogeneous treatment effects that could occur by whether a recreational dispensary has opened, as well as the role of spillover effects from border state policies.

3. Data and Methods

3.1 Adult Marijuana Use Data

To establish first-stage effects of RML enactment on adult marijuana use, we use publicly available data on state-level marijuana use among adults from the National Survey of Drug Use and Health (NSDUH).[13] These data are collected by the Center for Disease Control and Prevention's (CDC) Substance Abuse and Mental Health Services Administration (SAMHSA) and, when weighted, produce estimates that are representative of adult drug use for the non-institutionalized population of the United States.[14] For privacy related reasons — as well as to increase the probability of eliciting truthful information — information on risky health behaviors is collected using audio computer-assisted self-administered interview.

Respondents to the NSDUH were asked to report the number of days in the last month on which s/he "use[d] marijuana or hashish." SAMHSA then generates dichotomous measures of any

[13] Individual-level NSDUH data with geocoded information are not easily made available for scholars outside of the Centers for Disease Control and Prevention (CDC). Thus, the use of publicly available state-level averages has become quite common in the health and labor economics literatures (see, for example, Dave et al. 2021a, b; Hollingworth et al. 2022).

[14] Individuals who are hospitalized, living in group quarters or jails, or who are homeless, are not represented in this household-based survey.

marijuana (or hashish) consumption over the prior 30 days and then provides aggregated state—level estimates of marijuana use prevalence among adults across overlapping adjacent two-year periods (e.g., 2000-2001, 2001-2002, etc.). We are also able to disaggregate marijuana use prevalence rates among adults by age, using the age groups provided in the publicly available data for those ages 18-to-25 and those ages 26-and-older.

State-level NSDUH marijuana prevalence data are, as of this writing, available for the period 2000 through 2020. Weighted means of adult marijuana use are shown in Appendix Table 1A. We find that 8 percent of adults (ages 18-and-older) consumed marijuana during the prior 30 days over the sample period. Disaggregating across young and older adults, we find that marijuana use prevalence was higher among those ages 18-to-25 (19 percent) as compared to those ages 26-and-older (6 percent).

Appendix Figure 1A shows trends in adult marijuana use over the period of analysis by whether the state has adopted an RML. The trends reflect that states that implemented RMLs experienced a larger increase in marijuana consumption over time, when compared to states that did not.

3.2 Adult Labor Market Outcomes

To measure labor market outcomes, we draw data from the Current Population Survey (CPS) Outgoing Rotation Groups (ORG) over the period 2002-2020. Our primary sample is restricted to working age respondents (ages 16-to-64) who provide information on their current employment status. For our employment analysis, our working-age population is comprised of 4,825,765 individuals. We measure hourly earnings (wages) using data on working-age individuals

who reported being employed at the time of the interview. For our wage analysis, our working-age population is comprised of 3,037,971 individuals.[15]

Our first key outcome, *Employment*, is an indicator variable set equal to 1 if the respondent reports being currently employed; it is set equal to 0 if the respondent is not working (i.e., unemployed or not in the labor force). As shown in Appendix Table 1B, 69.5 percent of all working-age individuals were employed over the sample period. For 16-to-20-year-olds (who are under the minimum legal purchasing age for marijuana), the employment-to-population ratio (EPR) was 0.358. For young adults at or over the minimum legal purchasing age, ages 21-to-29, the EPR was 0.721, for 30-to-49-year-olds 0.787, and for 50-to-64-year-olds 0.667.[16]

For workers who report being paid hourly, we directly measure their reported hourly wages. For those who are not paid hourly (i.e., are paid weekly, monthly, or annually), we impute their hourly wages as the ratio of usual weekly earnings to usual weekly hours worked (conditional on employment). For the working-age population, we estimate an average hourly wage of $23.89 (in 2020 dollars), with average wages increasing with age. In Appendix Figure 1B, we show trends in employment and in Appendix Figure 1C we show trends in hourly wages for all working age adults, by whether the state has adopted an RML. These trends do not indicate any appreciable change in the trends of real wages or employment for RMLs adopters compared to non-adopters, presaging a likely null effect of RMLs on labor market outcomes for the working age adult population.

In addition to age, we also examine whether labor market effects differed (1) among those with less versus more schooling years attained, (2) by gender and race/ethnicity, and (3) in industries

[15] For our sample of usual work hours conditional on employment, available in the appendix, the sample for the analysis is the same as when examining wages.

[16] To measure the intensive margin of employment, work hours among those who are employed, we generate the variable Usual Work Hours, which is set equal to the usual number of hours worked at the respondents' primary job conditional on being employed. Among working-age individuals who were employed and reported a positive number of usual work hours, average hours worked per week were 36.658.

that could capture employment in the newly legal marijuana sector (i.e., in recreational marijuana dispensaries), including those identified in the CPS by their North American Industry Classification System (NAICS) two-digit code (11): agriculture, forestry and hunting, mining, construction, manufacturing-non-durable, manufacturing-durable, wholesale trade, retail trade, transportation utilities and information, financial activity, and services, and public administration.

3.3 Recreational Marijuana Laws

We obtain enactment dates of RMLs using data compiled from Anderson and Rees (2021) and Sabia et al (2021). Appendix Table 2 lists treatment states that contributed to identification during our sample period spanning 2002-2020. were the first states to adopt an RML in 2012 followed by Alaska, the District of Columbia, and Oregon in 2015 and California and Massachusetts in 2016. By December 2020, 12 states and the District of Columbia had enacted RMLs.[17] In addition, we also measure when recreational dispensaries opened in states that enacted RMLs. This can often happen with a lag following the effective date. These recreational dispensary opening dates are listed in Appendix Table 2. The average length of time between RML adoption and the date of a recreational dispensary opening was 12.2 months over the sample period.

3.4 Main Empirical Methods

We begin by using the NSDUH to estimate a two-way fixed effects (TWFE) model of the effect of RMLs on marijuana use, estimated via ordinary least squares (OLS), of the following form:

[17] In 2021, Connecticut, Montana, New Jersey, New York, New Mexico, and Virginia adopted RMLs; in 2022, Maryland, Missouri and Rhode Island adopted RMLs.

$$M_{st} = \gamma_0 + \gamma_1 RML_{st} + \gamma_2 MML_{st} + \gamma_3 MDL_{st} + \mathbf{X}_{st}'\boldsymbol{\gamma}_4 + \alpha_s + \tau_t + \mu_{st} \quad (1)$$

where M_{st} is the adult marijuana use prevalence rate in state *s* at year *t*, RML_{st} is an indicator for whether the state has an RML in effect in year *t*, MML_{st} is an indicator for whether the state has enacted an MML, and MDL_{st} is an indicator for whether the state has decriminalized the use and possession of marijuana. The vector $\mathbf{X}_{st}$ includes state-by-year controls for: (1) demographic characteristics of the state (share of population that is Black or Hispanic, share of population with a college degree or higher), (2) macroeconomic conditions (per capita income), (3) substance use policies (naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, beer tax, cigarette tax, e-cigarette tax, tobacco-21 law), (4) social welfare policy controls (minimum wage, maximum Earned Income Tax Credit refundable credit, Democratic governor, ACA Medicaid expansions), and (5) COVID controls (new cases, new deaths and stay-at-home policy)[18] In addition, α_s is a time-invariant state effect and τ_t is a state-invariant year effect.

Turning to individual-level CPS data to measure labor market outcomes, we estimate a similar TWFE model, focusing on ages younger than the minimum legal purchasing age for recreational marijuana (ages 16-to-20), young adults ages 21-to-29 and older individuals ages 30-to-49 and 50-to-64:

$$E_{ismt} = \pi_0 + \pi_1 RML_{smt} + \pi_2 MML_{smt} + \pi_3 MDL_{smt} + \mathbf{X}_{smt}'\boldsymbol{\pi}_4 + \mathbf{Z}_{imt}'\boldsymbol{\pi}_5 + \alpha_s + \sigma_m + \tau_t + \varepsilon_{ismt} \quad (2)$$

where *i* indexes the individual and *m* indexes the month. E_{ismt} measures employment (or the natural log of wages among workers) for person *i* residing in state *s* in month *m* in year *t*, $\mathbf{Z}_{ist}$ is a vector of

[18] Weighted means of the outcome measures and state-level control variables are shown in Appendix Tables 1A and 1B, respectively

individual demographic controls (age, age-squared, gender, race, years of school and marital status), $\mathbf{X}_{smt}$ is the vector of state-level covariates comparable to those described above[19], and σ_m are a set of month fixed effects.[20]

The key policy parameters of interest in equations (1) and (2), γ_1 and π_1, are identified from state-level changes in RMLs. Over the period 2002-2020, 12 states and the District of Columbia enacted RMLs (Appendix Table 2).

There are a number of threats to identification, which we attempt to address in turn: (1) the potential presence of heterogeneous and dynamic treatment effects by adoption timing, (2) reverse causality (i.e., policy endogeneity), (3) non-parallel pre-treatment or post-treatment trends in the outcomes under study, and (4) unobserved state-specific time-varying characteristics correlated with RML enactment and the dependent variables described above.

With respect to heterogeneous and dynamic treatment effects, we employ the newly developed difference-in-differences estimator (Callaway and Sant'Anna 2021) designed to expunge bias. In each case, we restrict the set of control jurisdictions to those states that had not-yet or never enacted an RML; this serves to eliminate any bias that would be introduced by the problematic comparison of "later versus earlier" adopters if there are dynamic treatment effects by adoption timing.[21]

Next, to explore parallel pre-treatment trends and descriptively examine whether changes in the outcomes under study predate the enactment of RMLs (i.e., policy endogeneity), we produce

[19] There is one exception. Because we include individual-level demographic controls in our CPS-based regressions, we do not control for state-level demographic controls.
[20] We also experiment with correcting the conditional hours and log wage equations with a Heckman sample selection correction, using the employment rate as an exclusion restriction in the employment equation. As discussed below, the estimated effect of RML enactment on hours (and log wages) is qualitatively similar using this approach.
[21] In addition, we also explore a further restriction on the control states by excluding states that never enacted an RML during the sample period. For the Callaway and Sant'Anna (2021) estimator, we control for MMLs and MDLs since Sant'Anna (2021) estimator is limited in the set of state-specific time-varying controls that permit estimation of reasonably tractable confidence intervals around estimated treatment effects.

event studies. This allows us to decompose the estimated treatment effect over time. While our primary event-study analyses use the TWFE estimator, we also explore the robustness of event study coefficients to the use of Callaway and Sant'Anna estimator (2021).

To reduce the likelihood that state-specific time-varying unmeasured heterogeneity leads to biased estimates of RML effects, we take two approaches: (1) we present estimates using an extended set of social welfare policy controls, including the Affordable Care Act's Medicaid expansions, the higher of the state or federal minimum wage, the maximum Earned Income Tax Credit refundable credit and whether the state has a Democratic governor, and (2) include state-specific linear time trends as additional controls. The latter controls are designed to capture unmeasured regional shocks and unobserved state shocks that unfold linearly. We note, however, that there are limitations to controls for jurisdiction-specific time trends. For example, the inclusion of state-specific linear time trends may obscure dynamic treatment effects (Meer and West 2016; Wolfers 2006) or isolate variation in the treatment that is less exogenous with respect to the outcomes under study (Neumark et al. 2014).

It is important to note that every state that enacted an RML had previously enacted an MML; moreover, many states that enacted MMLs later permitted medical marijuana dispensaries to open. Thus, the RML treatment effect we identify is the incremental effect of broadly liberalizing access to marijuana for recreational users over and above having liberalized access for medicinal users (and, in some cases, allowing dispensaries to become operational).[22] This raises the concern that our RML effects could be contaminated by longer-run effects of MMLs or marijuana dispensary openings. To address this concern, we re-estimate the effects of RMLs on labor market outcomes

[22] The treatment effect that we identify is policy-salient given that it captures the realistic scenario of a state expanding liberalization of marijuana access beyond medicinal use to recreational use; no state has directly transitioned from not having a medicinal marijuana law in place at first to directly legalizing use for recreational users. Similar to the RML adopters in our sample, states that adopted RMLs in 2021 and 2022 also had MMLs in place first prior to transitioning to legalization.

and (1) replace MML_{st} in equations (1) and (2) with a set of lags up to three or more years after MML enactment, and (2) add $Medical\ Dispensary_{st,}$ an indicator for whether a medical marijuana dispensary was open in the state, to equations (1) and (2). Finally, we also explore the robustness of our estimates to additional controls for medical cannabidiol law (MCL), which legalized access to CBD oils in non-MML adopting states (Abouk et al. 2022).

3.5 Recreational Dispensaries and Border State Spillovers

As noted above RMLs may increase the supply of marijuana through a number of channels, including home cultivation of marijuana plants (permissible in nearly all states) and through recreational marijuana dispensaries. As shown in Appendix Table 2, the opening of recreational marijuana dispensaries often lags RML enactment. To explore the role of this channel, we replace RML_{st} in equations (1) and (2) with two mutually exclusive indicators, $RML\ Open\ Dispenary_{st}$ (set equal to 1 if an RML is enacted and an open recreational dispensary has opened; set equal to 0 otherwise) and $RML\ No\ Dispensary_{st}$ (set equal to 1 if an RML is enacted and there is no operational recreational marijuana dispensary in the state; set equal to 0 otherwise). This will allow us to explore heterogeneity in the effects of RMLs on labor market outcomes by whether recreational dispensaries are operational.

Furthermore, recent studies in the marijuana legalization literature suggest that there may be important spillover effects in untreated border states (Hansen et al. 2020). In the context of this study, if RML legalization induced cross-border travel from a nearby non-RML state and the effects of RMLs are similar on residents of the untreated border state and the treated state, the effects of RMLs will be biased toward zero.

To test for cross-state spillovers, we generate an indicator variable, $Border\ RML_{st,}$ set equal to 1 if a border state (or, in an alternate specification, a share of border states, had enacted an RML)

and add it to the righthand side of equations (1) and (2). In addition, we also estimate a specification were we include the interaction $RML_{st,}$*$Border\ RML_{st,}$, which modifies the main effect of the enactment of an RML in one's own state of residence based on whether a neighboring state has also enacted an RML.

3.6 Synthetic Control Estimates on Early Adopters

Finally, to (1) more fully allow for heterogeneity in the effects of each state's RML, and (2) explore longer-run effects of RMLs for the earliest adopters, we use a synthetic control approach to study the impacts of RMLs on labor market outcomes (Abadie et al. 2010). Following Sabia et al. (2021), we estimate synthetic control models on the six (6) states for which we have at least five (5) full years of post-treatment data: Alaska, California, Colorado, Massachusetts, Oregon, and Washington.[23]

Our donor pool is comprised of states that had never enacted an RML. In addition, we explore an added restriction: requiring that the donor pool not include any state that enacted an MML during the period from three years prior to the treatment state's enactment of an RML and the final year of the panel. This additional restriction increases the likelihood that any (at least medium-run) dynamic effects of MMLs have dissipated by the time that the treatment state enacted an MML. Our primary strategy for selecting a synthetic counterfactual is to select a weighted linear combination of donor states that is most similar to the RML state on the outcome (marijuana use, employment, conditional hours, log wages) in each pre-treatment year. Statistical inference is conducted using permutation-based p-values generated via placebo tests (Abadie et al. 2010).

4. Results

[23] The District of Columbia is excluded from our set of early adopters as it generated a poor pre-treatment match on first-stage marijuana use.

Our main results are shown in Tables 1 through 10 and Figures 1 through 8. Supplemental findings are shown in the appendix.

4.1 First-Stage Adult Marijuana Use

We begin by establishing that RML adoption had "bite" in so far as adult marijuana consumption is concerned. Controlling for state and year fixed effects, MMLs, MDLs, and demographic characteristics, TWFE estimates show that the adoption of an RML is associated with a 3.4 percentage-point increase in prior-month adult marijuana use (Table 1, panel I, column 1). This represents a 47 percent change relative to the pre-treatment mean of the dependent variable in RML-adopting states. The addition of controls for substance use policies (column 2), social welfare policies (column 3), COVID-19 policies and conditions (column 4), macroeconomic conditions (column 5), and state-specific linear trends (column 6) only modestly changes the estimated treatment effect. In our preferred, fully specified models (column 5 and 6), we find that RML adoption is associated with a 2.3-to-4.2 percentage-point increase in adult marijuana use, representing a 32-to-58 percent increase relative to the pre-treatment mean.

If we examine age-specific heterogeneity using publicly available age segmentation for younger adults (ages 18-to-25) and older adults (ages 26-and-older), we find that RML adoption is associated with a 3.6 percentage-point increase in marijuana use for younger (panel II) and 2.1 percentage-point increase for older (panel II) adults. For older adults, this effect size is larger in percentage terms, because the pre-treatment mean of adult marijuana use is approximately one-third the size for older as compared to younger adults (0.053 versus 0.184). Thus, we conclude that, as expected, RMLs increase marijuana use among adults (1) widely across age demographic groups, and

(2) in greater magnitude (both in terms of percentage-points and percent changes) than the typical effects of MMLs, which were on the order of 1 to 2 percentage-points (see Choi et al. 2018).[24]

Event study analyses, shown in Figure 1 based on TWFE estimates (panel a) and Callaway and Sant'Anna (2021) estimates (panel b)[25], tend to support the parallel trends assumption, as adult marijuana use trends appeared to be identical in treatment and control states prior to RML adoption. Following RML adoption, adult marijuana use increases, with the effects somewhat progressively larger over time post-adoption.

4.2 Main Results on Employment and Hourly Wage Effects of RML Adoption

In Table 2 we turn to our main findings on the effects of RMLs on labor market outcomes among working-age individuals ages 16-to-64. Panel I shows our findings on employment. Controlling for a parsimonious set of controls (column 1), we find that RML adoption is associated with a statistically insignificant 0.0006 increase in the probability of employment. The precision of this null effect and its surrounding (95 percent) confidence interval, (-0.0043, 0.0054), is such that we can rule out RML-induced employment declines of greater than 0.6 percent and employment increases of greater than 0.8 percent (relative to the baseline mean). The inclusion of controls for substance use policies (column 2), social welfare policies (column 3), COVID-19 policies and conditions (column 4), and macroeconomic conditions (column 5) do not change this pattern of findings on the effects of RML adoption on employment.[26]

[24] Appendix Table 3 presents results using prior-year adult marijuana use with a similar pattern of findings as those shown in Table 1.
[25] The set of counterfactuals includes not yet and never adopting RML states and include controls for MML and MDL adoption.as well as per capita GDP.
[26] While it is important to disentangle the effects of RMLs with the state business cycle (which could be correlated with both RML adoption and with the labor market outcomes under study), one concern with adding macroeconomic controls is that they may capture "too much" relevant variation in the outcome variables. However, we note that the findings in columns (4) and (5) are qualitatively similar.

While the estimates in columns (4) through (6) control for differential impacts of COVID-19 across states by adding observable controls for stay-at-home orders and the rates of COVID-19 cases and deaths, one might still be concerned that estimates are contaminated by the pandemic given large scale reductions in labor force participation. When we restrict the analysis window to the pre-pandemic era (2002-2019), the findings are unchanged. Finally, in column (7), we add controls for state-specific linear time trends and continue to obtain small, null employment effects following RML adoption.

In panel II, we turn to assessing wage effects among workers. We find no evidence to suggest that RML adoption is associated with a statistically significant or economically important change in the wage rate paid to workers ages 16-to-64. The absolute magnitudes of the estimated treatment effects are uniformly smaller (in absolute magnitude) than 1 percent and in the most parsimonious model, the estimated effect is positive and around 0.9 percent (column 1, panel II). In our more saturated specifications (columns 2 through 5), the estimated nulls are sufficiently precise such that we can rule out, with 95 percent confidence, wage declines of well less than half of one percent.

In Table 3, we explore age-specific heterogeneity in the effects of RMLs on adult labor market outcomes. Our findings continue to provide no evidence that RML adoption is associated with changes in employment (panel I) among those ages 16-to-20 (column 1), ages 21-to-29 (column 2), ages 30-to-49 (column 3), and ages 50-to-64 (ages 50-to-64). For younger individuals under the minimum legal purchase age (MLPA) for marijuana (ages 16-to-20) and over the MLPA (ages 21-to-29), the signs of the estimated employment effects are negative. However, the magnitudes represent less than half a percentage-point decline, or a 0.7 to 0.8 percent decline, in the probability of employment, and the estimated effects are not close to achieving statistical significance at

conventional levels. For working age individuals over age 30, the employment effects are also quite small and not statistically distinguishable from zero at conventional levels.[27]

With respect to age-specific wage effects of RMLs (panel II of Table 3), we find point estimates that are positive for three of the four age groups (ages 16-to-20, ages 21-to-29, and ages 50-to-64). In no case are the estimated effect sizes economically large or statistically distinguishable from zero at conventional levels.[28]

In Appendix Table 6, we explore whether these null results can be explained by "overcontrolling" for the state business cycle. In these specifications, we replace state per capita income with an age-specific unemployment rate equal to the working-age unemployment rate net of the unemployment rate of the specific age group under study. Our findings are qualitatively similar to those shown in Table 3.[29]

If, in lieu of TWFE estimates, we instead estimate the average effect of the treatment on the treated (ATT) using the estimator proposed by Callaway and Sant'Anna (2021), using not-yet or never adopting states as the counterfactuals, the results remain robust. Consistent with the results in Table 3, our findings in Table 4 provide no evidence that RML enactment significantly (or, largely, economically) affects employment or wages among any of the age groups under study.

Age-specific event-study analyses of employment and wage effects of RMLs using TWFE estimates (Figures 2 and 3) and Callaway and Sant'Anna (2021) estimates (Figures 4 and 5) provide little support for the hypothesis that RML adoption reduces employment or wages of working-age individuals. In some cases, estimated lagged effects are positive and, in some cases, statistically

[27] It is possible that the aggregate employment effect may mask a potential displacement of employment in the illicit sector to the licit sector. When we disaggregate employment effects by whether the individual was self-employed (Appendix Table 4, panel I) or employed by others (Appendix Table 4, panel II), we find a similar pattern of null results.
[28] Moreover, when we explore the effects of RMLs on wages of workers who were paid hourly (panel I of Appendix Table 5) and monthly or annually (panel II of Appendix Table 5), we continue to find little impact of RMLs on hourly earnings.
[29] In Appendix Table 7, we explore the robustness of our findings to restricting the sample to calendar years 2002-2019, thus dropping the COVID-19 year of 2020. Our pattern of findings is qualitatively similar to that shown in Table 3.

distinguishable from zero at conventional levels. Notably, for those ages 30-to-49, event study analysis using TWFE estimates (Figure 2) show that RML adoption is associated with a statistically significant .010 increase in the probability of employment after one year and a similar .01 increase in the probability of employment after two years, before falling in subsequent years. This result could suggest some evidence of modest, short-run employment gains, either due to substitution away from other substances (such as opioids) that could generate more harm to employment (Abouk et al. 2021; Sabia et al. 2021) or due to increases in employment opportunities due to a newly legal industry This short-run employment boost also appears when we examine employment effects using a Callaway and Sant'Anna estimates (Figures 4 and 5).[30]

Could the above age-specific estimates be contaminated by state-specific time-varying unmeasured heterogeneity? In Table 5, we explore the sensitivity of the estimated treatment effects reported in Table 3 to controls for state-specific linear time trends. The results continue to show no evidence that RML adoption significantly or meaningfully affects the probability of employment or wages. The estimated effects are economically small and nowhere near achieving statistical significance at conventional levels.

In Table 6, we explore whether spillovers of the effects of RML adoption to neighboring jurisdictions could be contaminating the estimated treatment effects and bias them towards zero. That is, we examine whether a border state having an RML affects own state labor market outcomes, as well as whether a border state RML affects the impact of an own state RML on labor market outcomes (i.e., through an interactive effect). First, controlling for border state RMLs has no effect on the estimated effect of RML adoption employment (panel I) or earnings (panel II) among

[30] The findings in Appendix Figure 2 provide little support for the hypothesis that RML adoption leads to important changes in labor supply on the intensive margin. With the exception of older adults, for whom there is evidence of a very short run increase in hours of work among workers (less than 1 percent), there is little evidence of significant changes in work hours following RML adoption.

any of the four age groups under study. Second, the presence of a border state RML also has little effect on the probability of employment or wages. Third, the concordance or discordance of a bordering state's RML status does little to modify the main (own) effect of a state's RML adoption on employment. Turning to the wage effects in Panel II, we find no statistically or economically significant impacts of either a state's own RML or a border state's RML when these policies across border states are discordant. However, there is some evidence that the presence of an RML together with a nearby state having an RML results in an additional ($e^{.0189} - 1$) 1.9 percent increase in average wages among those ages 50-to-64. On the other hand, for younger individuals who are ages 16-to-20, that is, below the MLPA for marijuana, we detect some evidence of an employment decline when a border state is in concordance and has also enacted an RML, which could suggest some adverse health or human capital effects of RMLs from heavier use of marijuana among minors.[31]

4.3 Heterogeneity in RML Effects by Gender, Education, and Race

While the estimates above generally point to economically small and statistically insignificant impacts of RMLs on labor market outcomes, the results could mask important heterogeneity by gender, educational attainment, and industry. Table 7 explores heterogeneity in impacts by gender. We find little evidence that RMLs have important impacts on labor market outcomes among males (panel I) or females (panel II).[32]

[31] In Appendix Tables 8A and 8B, we explore whether our estimated RML effects are sensitive to the inclusion of additional marijuana control policies. First, to ensure that our null findings are not contaminated by lagged effects of MMLs or by the opening of medical marijuana dispensaries, we augment the specifications used to produce estimates in Table 3 with (1) additional controls for lagged effects of MMLs (up to three or more years after adoption) to disentangle the longer-run effects of MMLs from RMLs (Appendix Table 8A), and (2) laws legalizing access to CBD oils, which were enacted in many states that chose not to adopt either MMLs or RMLs (Appendix Table 8B). Our findings are highly similar across these specifications.

[32] Event study analyses in Appendix Figure 3, Panel I (males) and Panel II (females) provide little support for the hypothesis that RML adoption generates important changes in employment and wages.

There also do not appear to be any important heterogeneity in the effects of RMLs on employment or wages, by age and educational attainment (Table 8). We find no evidence that RMLs have statistically significant or economically important impacts on labor market outcomes of those with less than a high school diploma (panel I), with only a high school diploma (panel II), or with some college or more (panel III).[33]

In Table 9, we explore heterogeneity in the labor market effects of RMLs by race and ethnicity. This margin may be particularly important to the extent that removing criminal records for marijuana possession may disproportionately aid young Black and Hispanic individuals who have borne the brunt of the enforcement of marijuana prohibition. Indeed, we do detect some modest evidence that younger Hispanics and Blacks may see a modest improvement in labor market outcomes from RML adoption. Specifically, we find that RML adoption is associated with a 1.8 percentage-point (2.5 percent) increase in the probability of employment for 21-to-29-year-old Hispanics and a ($e^{.0663}$ - 1) 6.9 percent increase in average wages for 16-to-20 Blacks. For all other age and race-specific demographic groups, we find no evidence that RML adoption affects labor market outcomes. The point estimates are summarized in Figure 6.

4.4 Heterogeneity in RML Effects by Industry

In Figure 7, we show estimated effects of RMLs on employment and wages by the industry in which the individual worked. For employment outcomes, we generate a set of indicator variables for whether an individual was employed in one of 11 specific two-digit industries as defined by the NAICS.

[33] While the point estimate for low-educated (less than a high school degree) younger adults above the MLPA (ages 21-29) indicates a 1.7 percentage point decline in employment (3 percent relative to the baseline mean), suggestive of an adverse labor supply and/or demand effect, the effect is highly imprecise and not statistically significant.

Utilizing both TWFE (panels a and c) and Callaway Sant'Anna (panels b and d) estimates we find some evidence that RML adoption is associated with an increase in agriculture employment among working-age individuals. The magnitudes of these employment effects are about .1-to-.2 percentage-points (10 to 20 percent relative to the pre-treatment mean). This positive employment effect is consistent with the hypothesis that RML adoption opens up a new licit industry that may on the net increase employment opportunities in production and cultivation for marijuana.[34] Event-study analyses based on TWFE estimates (Figure 8 panel a) and Callaway and Sant'Anna (2021) estimates (panel b) support the parallel trends assumption and suggest that the boost in agriculture employment lags RML adoption by 2-to-3 years, consistent with lagged recreational dispensary openings.[35]

Turning to wages, we find little evidence that RML adoption affects hourly earnings of workers across 10 of 11 industries. Only for those employed in the mining sector do we detect evidence of a significant (approximately 5 percent) but short-lived decline in wages following RML adoption (see event-study analyses in Appendix Figure 6). This result may be reflective of some adverse productivity effects for those who select into this industry.

4.5 Recreational Dispensary Openings

Next, we examine whether the timing of recreational dispensary openings differently affects labor market outcomes. Indeed, there is some evidence to suggest that recreational dispensary openings represent an important — though not the only — supply channel through which RMLs may deliver marijuana to adults (Sabia et al. 2021). Our results in Appendix Table 10 suggest that

[34] Note that the shift in marijuana purchases from illicit sources to the licit sector would depress economic opportunities in the illicit sector, and may cause some displacement across these sectors. Though, given the evidence that RMLs expanded marijuana consumption (Table 1), it is possible that net employment opportunities could increase.
[35] When we further explore the ages of individuals that drive this increase in employment, we find that the agriculture employment effects are driven by those ages 30-and-older (see Appendix Figure 5)

RML adoption that includes open recreational dispensaries are associated with larger increases in marijuana consumption relative to RML adoption without (or prior to) the opening of dispensaries. In spite of the larger first-order response on marijuana use post-retail access, we continue to find no evidence that this liberalized access affected labor market among younger (columns 1 and 2, Table 10) or older (columns 3 and 4, Table 10) working-age individuals.

4.6. Synthetic Control Estimates on Early Adopters

We close with an alternative empirical strategy — synthetic control design — to (1) explore the robustness of the above estimates to a new identification strategy that compels pre-treatment trends and levels in the outcomes under study to be similar in treatment and synthetic control states, (2) allow for heterogeneous treatment effects across jurisdictions, and (3) explore longer-run labor market effects of RML adoption across early adopting treatment states.

Our findings, shown in Figures 9 through 14, provide little support for the hypothesis that RML adoption uniformly or adversely affected employment or wages among working-age individuals. While there is indication of some positive employment effects in Colorado (Figure 10A), synthetic control estimates for Alaska, California, and Massachusetts suggest some negative employment effects for certain age groups (Figures 11A, 13A, 14A). These effects are uniformly small. On the other hand, there is also some indication of models relative wage increases following RML adoption in Washington, Oregon, and California (Figure 9B, 12B, 13B). An examination of agriculture employment boosts following RML adoption revealed increases in the earlier adopting states of Colorado, Washington, California and Oregon (see Appendix Figure 7). The effects for Colorado and California are statistically distinguishable from zero, achieving the highest level of significance possible ($p = 0.02$), based on the number of placebos that can be performed with the donor states.

5. Conclusions

Despite dramatic increases in support for recreational marijuana legalization, research has only recently begun to explore the broader socioeconomic impacts of increases in access. This study is the first to explore the impacts of the adoption of RMLs on adults' wages and labor market outcomes. Using data from the 2002-2020 Current Population Survey Merged Outgoing Rotation Groups and various difference-in-differences approaches — including TWFE and Callaway and Sant'Anna (2021) estimators — we find little support for the hypothesis that RML adoption affects employment and wages among working-age individuals. For some demographic sub-groups, we find evidence of modest increases in employment or wages, particularly for individuals over age 30 (in the shorter-run), younger racial/ethnic minorities, and those working in the agriculture sector. These results are consistent with the opening of a new licit industry for marijuana and (especially for older individuals) a substitution away from harder substances such as opioids.

There are a number of limitations of this study worthy of note. First, recreational marijuana legalization is a relatively recent policy change, necessarily limiting our analytic lens to the shorter- and medium-runs. Longer-run labor market effects may differ as we learn about the effects of RMLs on cognitive development and human capital acquisition of those under age 21, which could take time to unfold and be reflected in market level effects on productivity, wages, and/or employment. Moreover, the labor market effects of reductions in criminal records could also take time to unfold.

Additionally, it is difficult to conclude, a priori, how this new legal industry will evolve over time. For instance, the COVID-19 period saw dramatic increases in U.S. marijuana consumption, but the post-pandemic period appears to be one of dramatically declining sales (Merrill et al. 2022 and Graupensperger et al. 2021). The downstream labor market effects could differ. Moreover, the

degree to which increased taxation of legal, recreational marijuana reinvigorates the illicit market is also unknown, and these illicit market developments may also have spillovers to the legitimate labor market.

Nonetheless, our findings answer some important early questions about the economic consequences of recreational marijuana legalization. Future work might further explore heterogeneity in the implementation of RMLs across states. For instance, some states (i.e., Washington) allow only licensed cultivators to grow marijuana, while others (such as Alaska and Oregon) permit at-home cultivation. Moreover, there is variation across states in the number of marijuana plants one is permitted to grow at home, as well as differences across states in how much marijuana one may possess and how one may legally transport such quantities. Exploiting these law differences is likely to help paint a richer picture of the health, human capital, and labor market effects of legalization of recreational marijuana.

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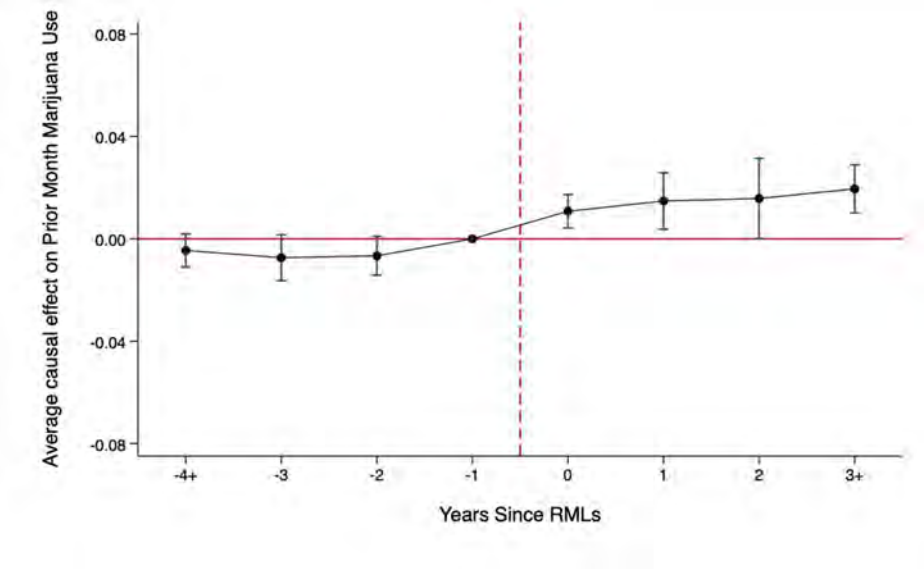
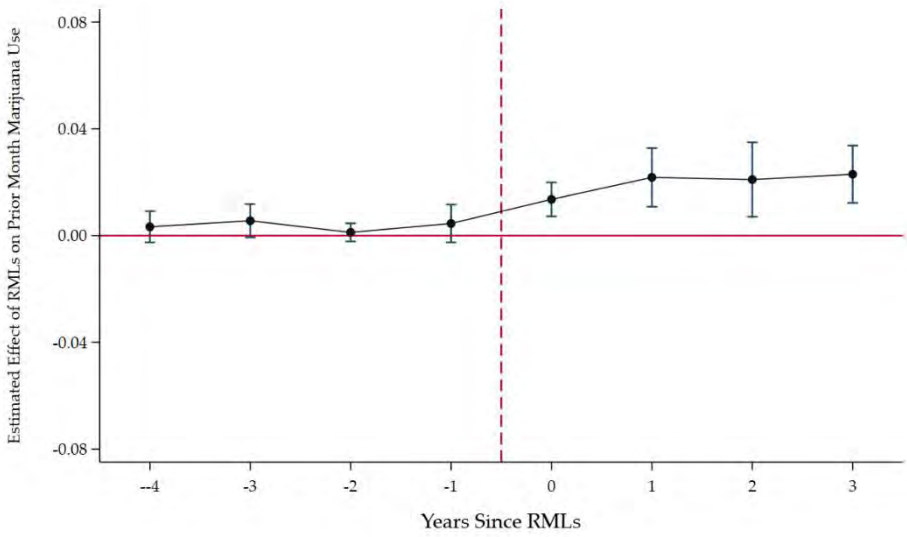
Figure 1. Event-Study Analysis of RMLs and Adult Prior Month Marijuana Use, Using TWFE and Callaway and Sant'Anna (2021) Estimates

Panel (a): TWFE Estimates

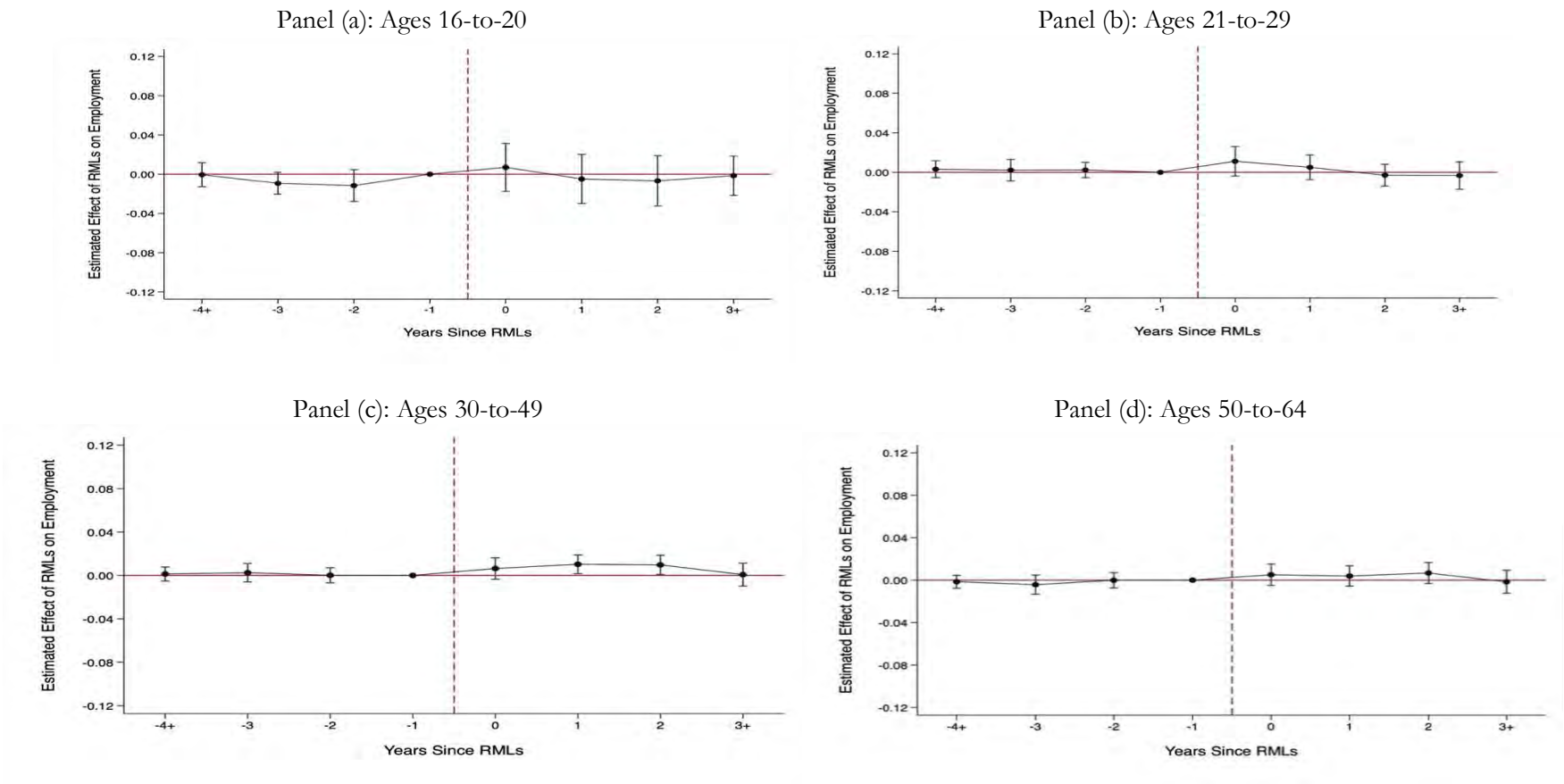


Panel (b): Callaway and Sant'Anna Estimates



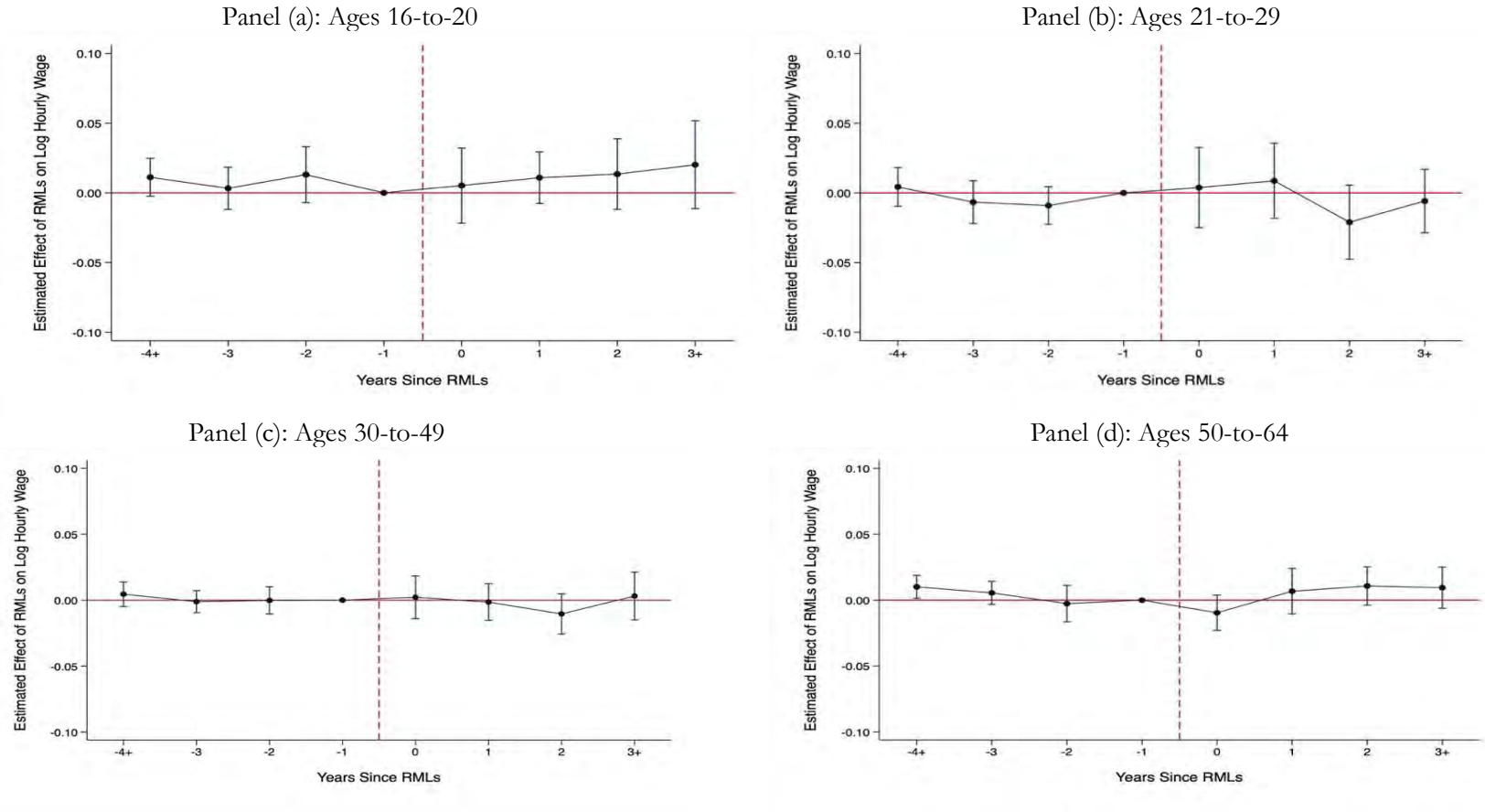
Notes: The event study in Panel (a) is estimated through OLS regressions that include state fixed and year fixed, state-specific linear trends, medical marijuana laws (MMLs), marijuana decriminalization or depenalization laws (MDLs), percentage black and Hispanic, good Samaritan alcohol and drug laws, naloxone, PDMP laws, the higher of the state or federal minimum wage, EITC, ACA expansion, beer, e-cig, cigarette taxes, per capita income, unemployment rate, and COVID controls which include new cases, deaths and shelter in place orders.. The event study in Panel (b) is obtained using Callaway and Sant'Anna estimator, which controls for MMLs, MDLs, and per capita GDP. Vertical bars plot 95% confidence intervals.

Figure 2. Event-Study Analysis of RMLs and Employment, Using TWFE Estimate



Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, cumulative Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

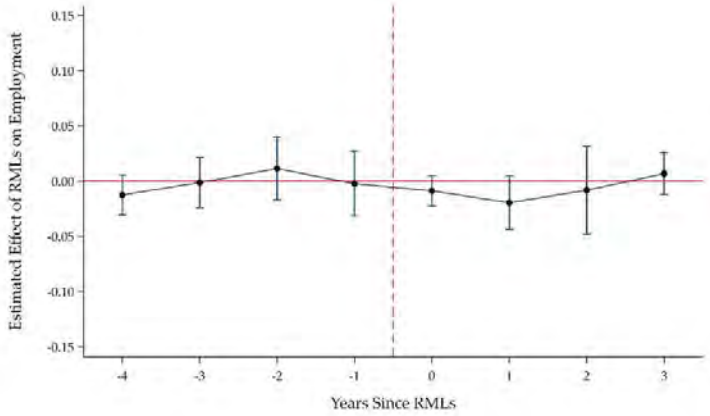
Figure 3. Event-Study Analysis of RMLs and Log (Wages), Using TWFE Estimates



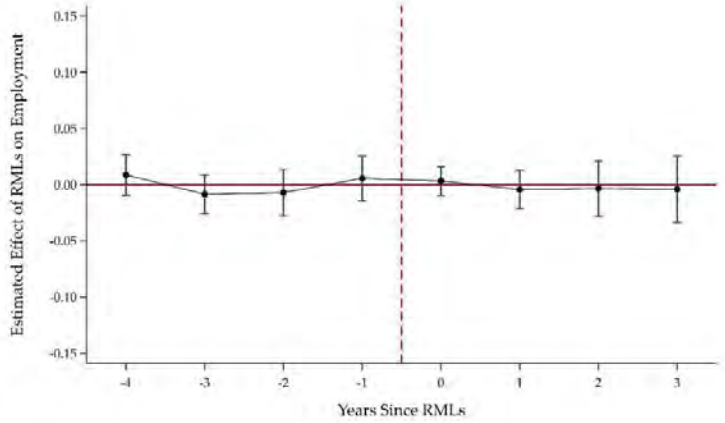
Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent, whether the worker is paid hourly and the industry classification code. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, cumulative Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

Figure 4. Event-Study Analysis of RMLs and Employment, Using Callaway and Sant'Anna Estimates

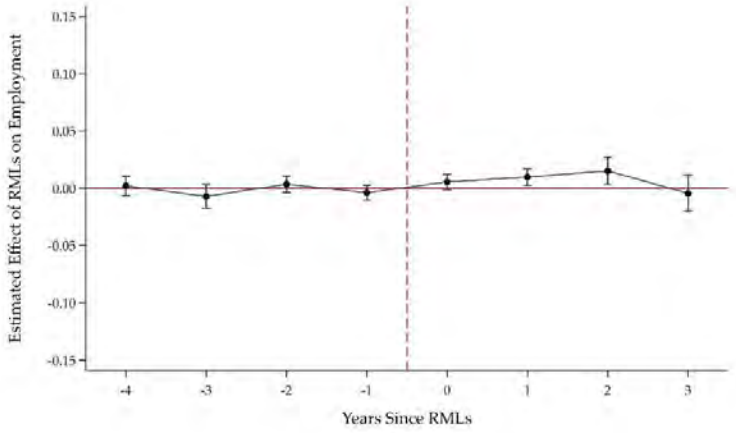
Panel (a): Ages 16-to-20



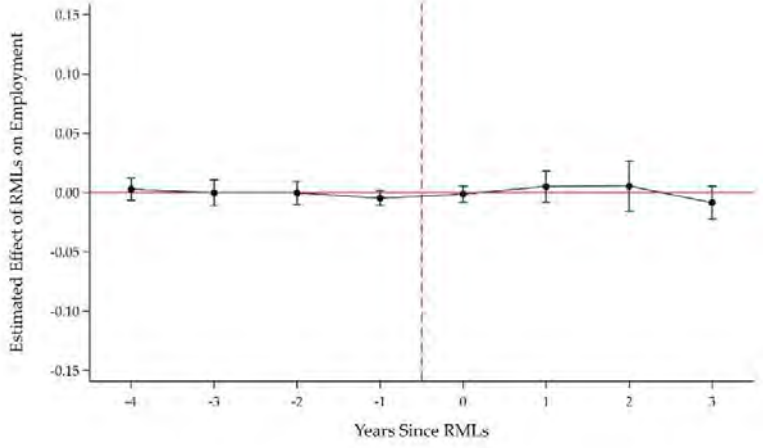
Panel (b): Ages 21-to-29



Panel (c): Ages 30-to-49

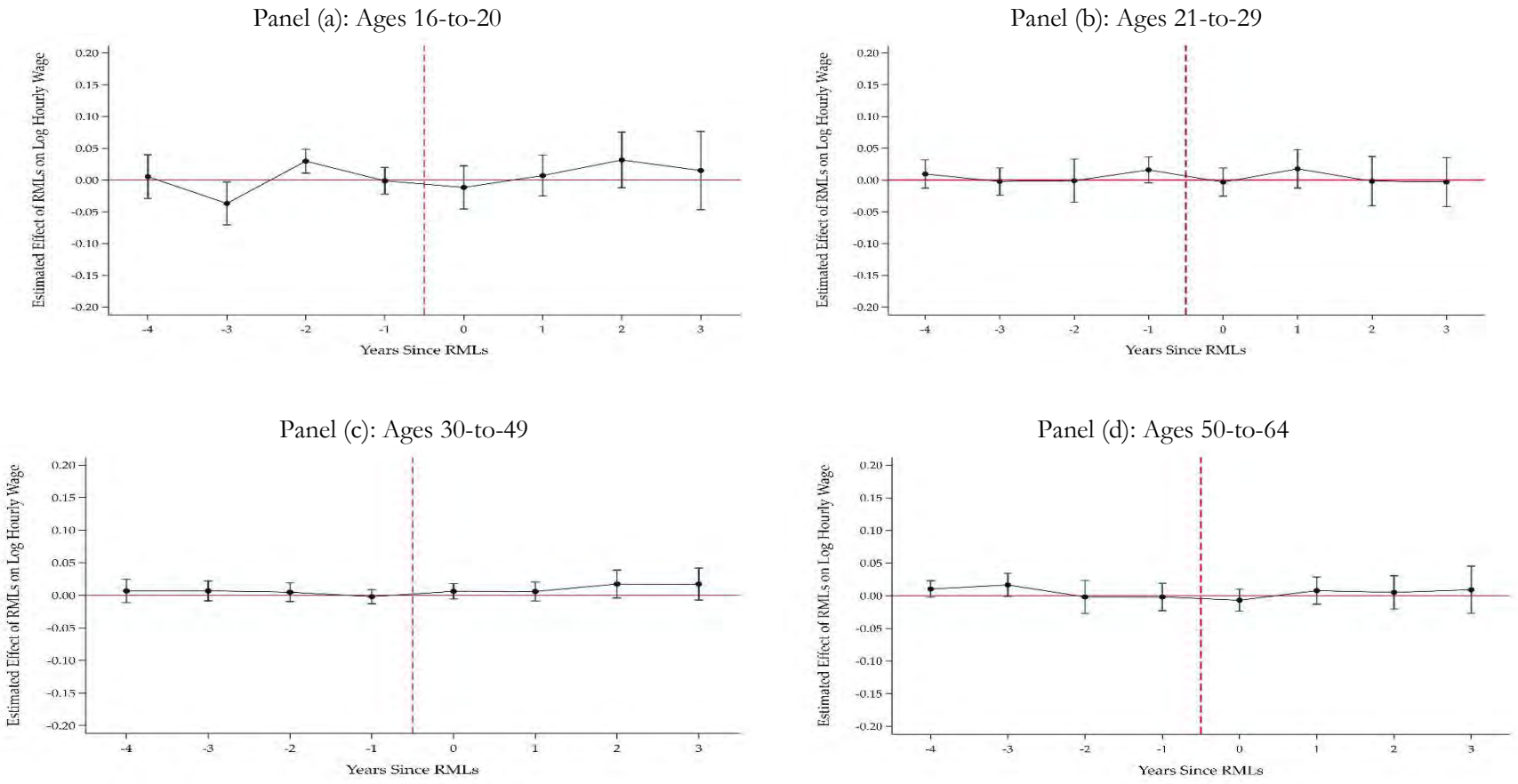


Panel (d): Ages 50-to-64



Note: The event studies are obtained using Callaway and Sant'Anna estimator. All models include share of females, medical marijuana laws, marijuana decriminalization laws, and per capita income. Vertical bars plot 95% confidence intervals.

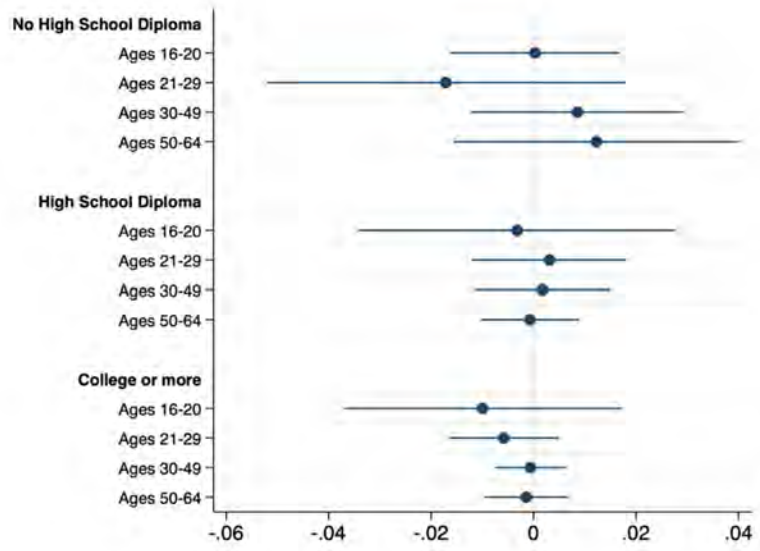
Figure 5. Event-Study Analysis of RMLs and Log (Wages), Using Callaway and Sant'Anna Estimates



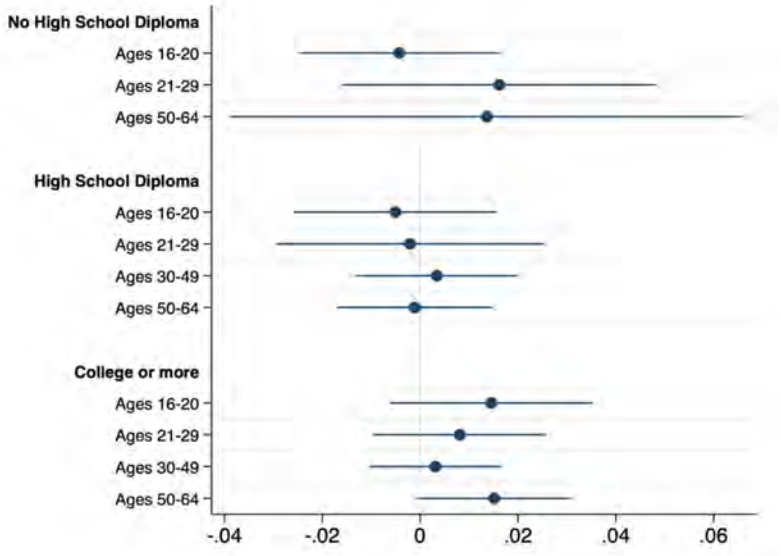
Note: The event studies are obtained using Callaway and Sant'Anna estimator. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include share of females, medical marijuana laws, marijuana decriminalization laws, and per capita income. Vertical bars plot 95% confidence intervals.

Figure 6. TWFE Estimates of Effects of RMLs on Labor Market Outcomes, by Age and Education

Panel (a): Employment



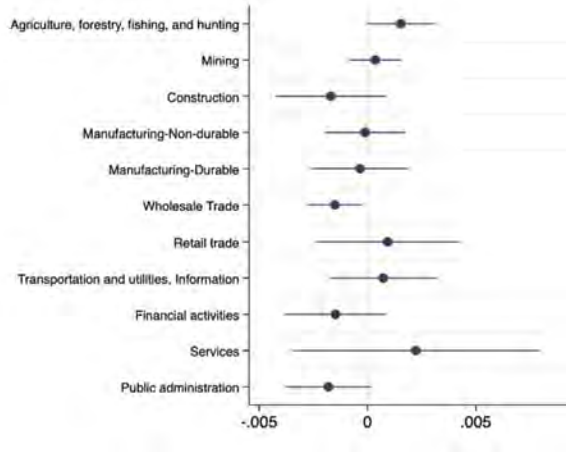
Panel (b): Log (Wages)



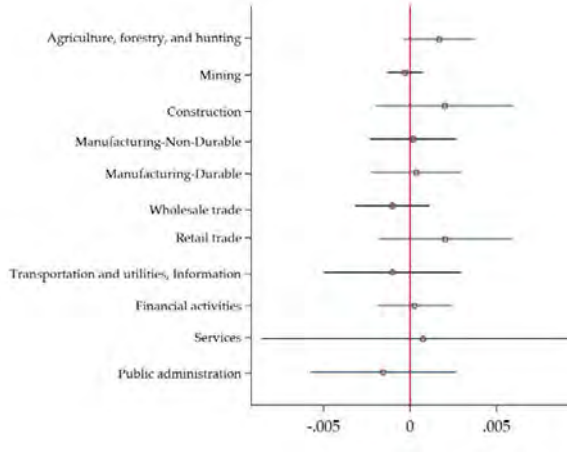
Note: Point estimates are obtained through OLS regressions. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, cumulative Covid cases and deaths, Democratic governor, and per capita income. The sample in Panel (b) is comprised of adults ages 16-to-64 who were employed at the time of interview and regressions also control for whether the worker is paid hourly and the industry classification code. Vertical bars plot 95% confidence intervals.

Figure 7. TWFE and Callaway and Sant'Anna (2021) Estimates of the Effects of RMLs on Employment, by Industry

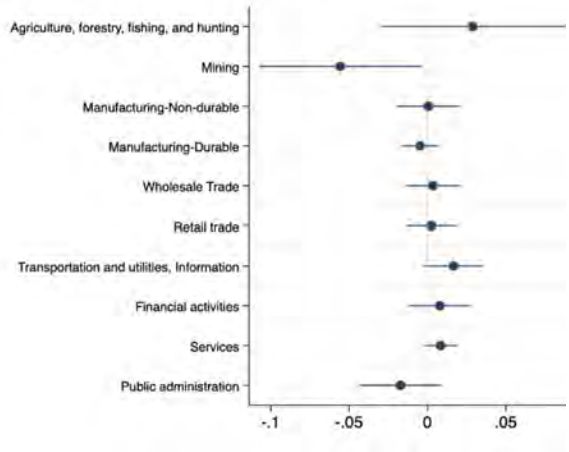
Panel (a): Employment, TWFE



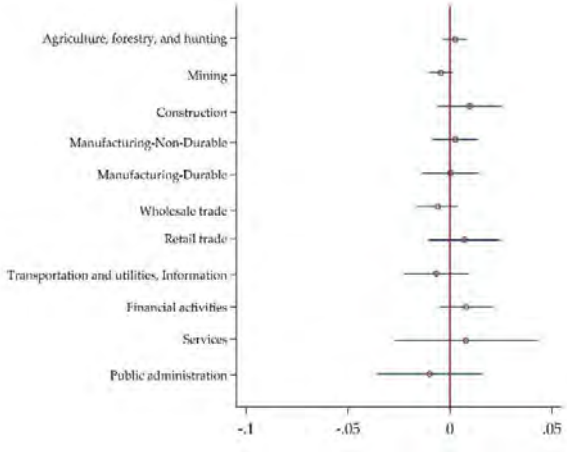
Panel (b): Employment, Callaway and Sant' Anna



Panel (c): Log (Wages), TWFE



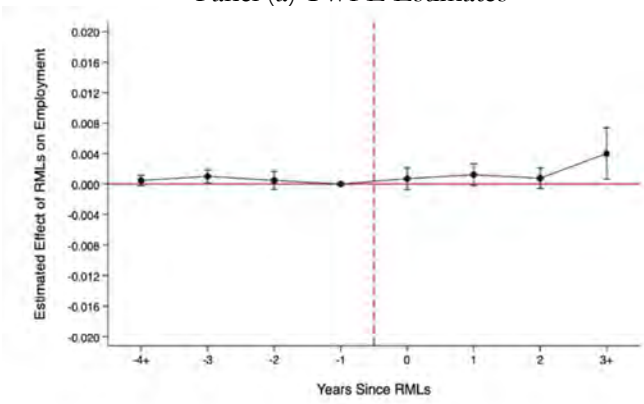
Panel (d): Log (Wages), Callaway and Sant' Anna



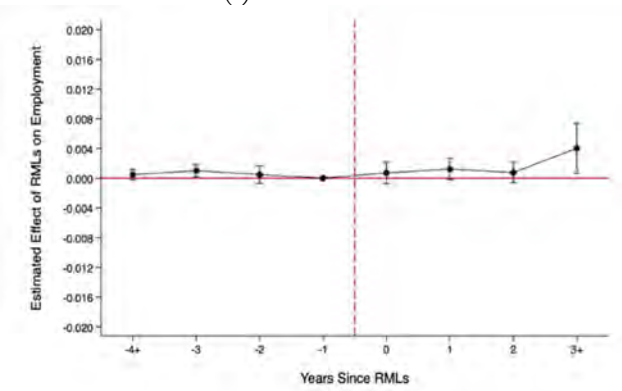
Note: Point estimates in panels (a) and (c) are obtained through OLS regressions and panels (b) and (d) provide Callaway and Sant' Anna estimates. All models include state and year fixed effects, medical marijuana laws, and marijuana decriminalization laws. Vertical bars plot 95% confidence intervals.

Figure 8. Event Study Analysis of the Effects of RMLs on Agriculture Employment, Using TWFE and Callaway and Sant'Anna Estimates

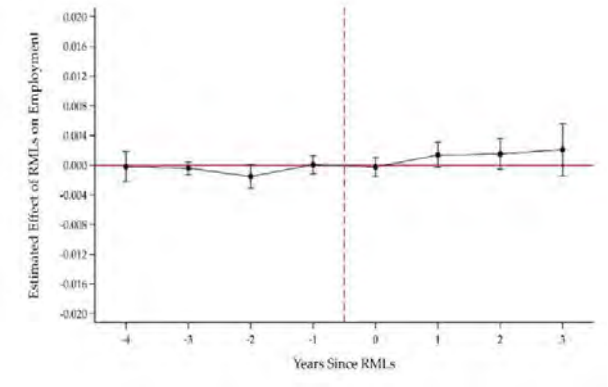
Panel (a) TWFE Estimates[a]



Panel (a) TWFE Estimates[b]



Panel (b): Callaway and Sant'Anna Estimates



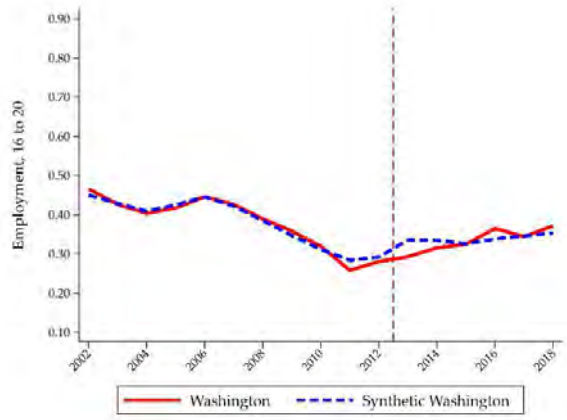
Note: Event studies are estimated through TWFE and Callaway Sant'Anna (2021). TWFE estimates include the full set of controls while Callaway and Sant'Anna (2021) models include controls for state fixed effects, year fixed effects, medical marijuana laws, and marijuana decriminalization laws. The sample is comprised of working aged respondents between the ages of 16-64. Vertical bars plot 95% confidence intervals.

[a]This definition of the agriculture sector includes the NAICS code in the CPS that also includes forestry and hunting

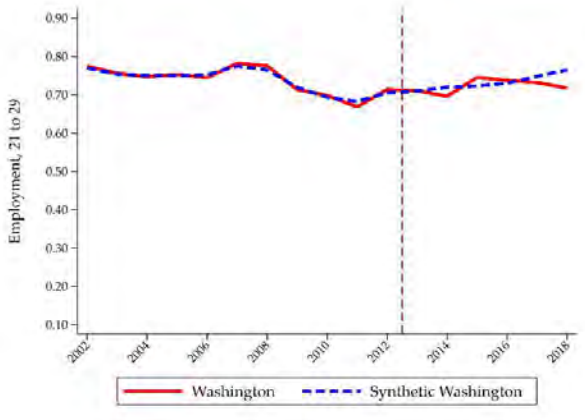
[b]This specification uses a narrower definition of the agriculture sector, which excludes forestry and hunting.

Figure 9A. Synthetic Control Estimates for Washington by Age Group, Employment

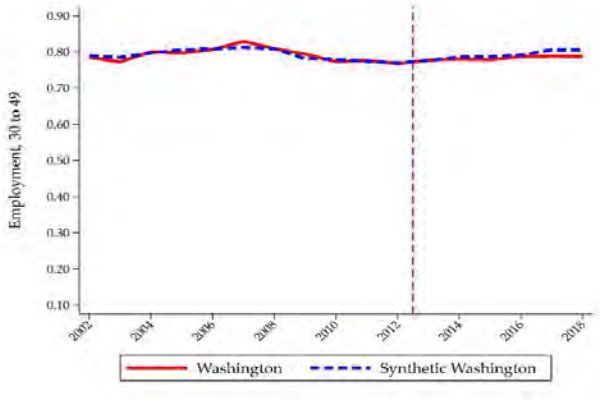
Panel (a): Ages 16-to-20
RML Effect = 0.001 (p-value = 0.745)



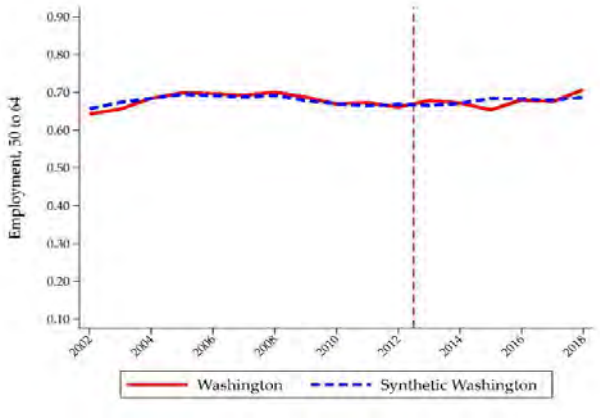
Panel (b): Ages 21-to-29
RML Effect = -0.001 (p-value = 0.235)



Panel (c): Ages 30-to-49
RML Effect = -0.009 (p-value = 0.745)



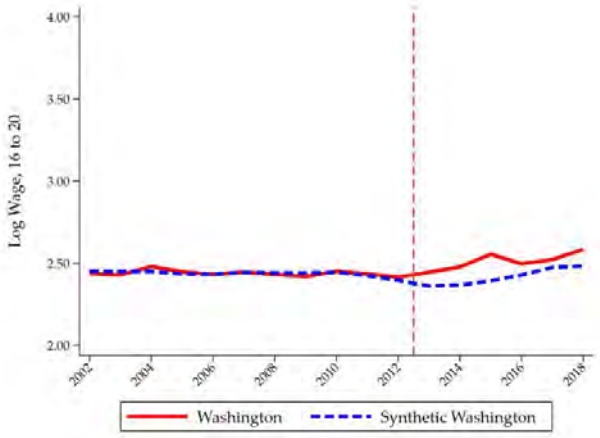
Panel (d): Ages 50-to-64
RML Effect = 0.001 (p-value = 0.588)



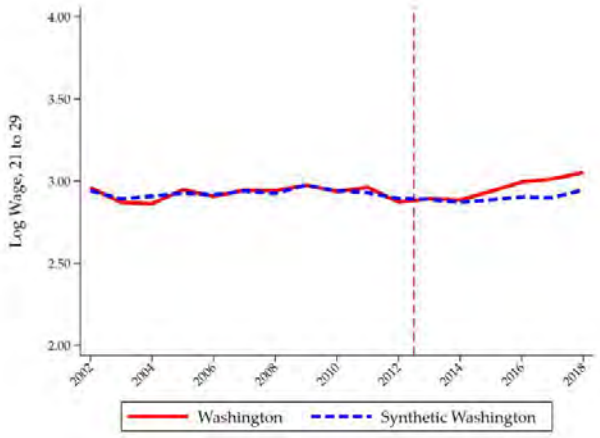
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 9B. Synthetic Control Estimates for Washington by Age Group, Log (Wages)

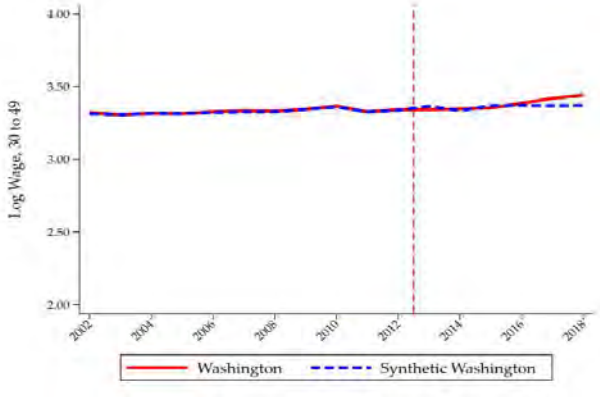
Panel (a): Ages 16-to-20
RML Effect = 0.095 (p-value = 0.157)



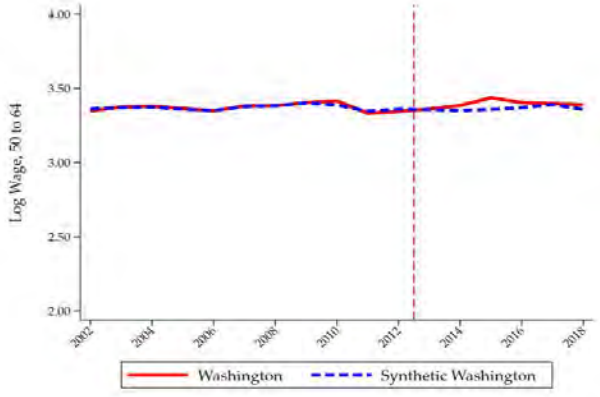
Panel (b): Ages 21-to-29
RML Effect = 0.064 (p-value = 0.216)



Panel (c): Ages 30-to-49
RML Effect = 0.018* (p-value = 0.039)



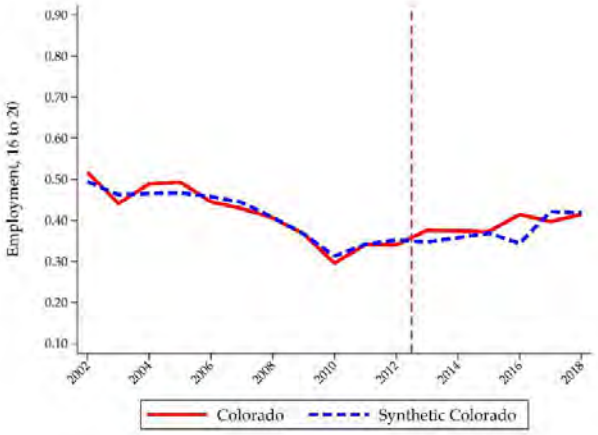
Panel (d): Ages 50-to-64
RML Effect = 0.032 (p-value = 0.255)



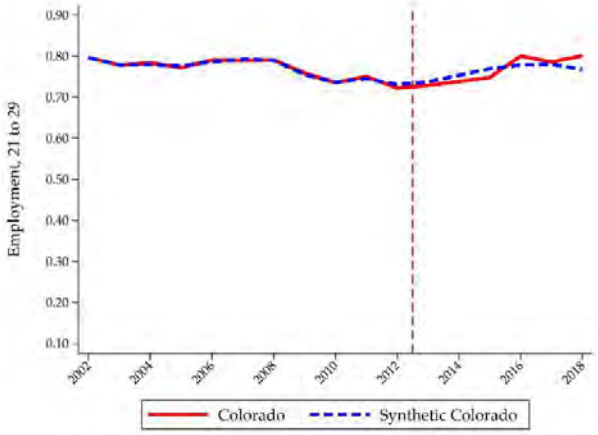
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Figure 10A. Synthetic Control Estimates for Colorado by Age Group, Employment

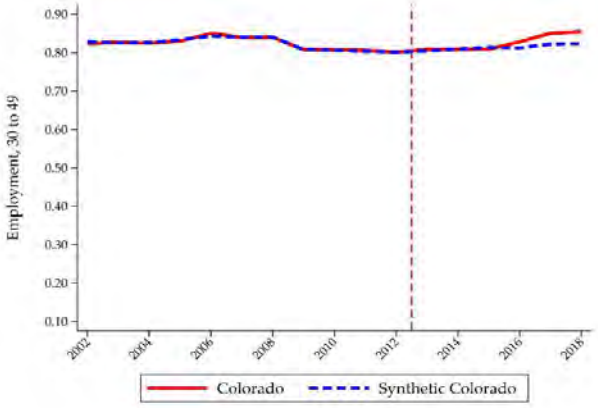
Panel (a): Ages 16-to-20
RML Effect = 0.015 (p-value = 0.569)



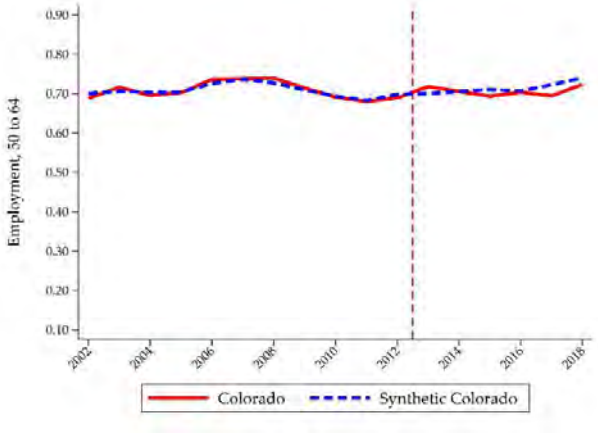
Panel (b): Ages 21-to-29
RML Effect = 0.006 (p-value = 0.078)



Panel (c): Ages 30-to-49
RML Effect = 0.015 (p-value = 0.059)



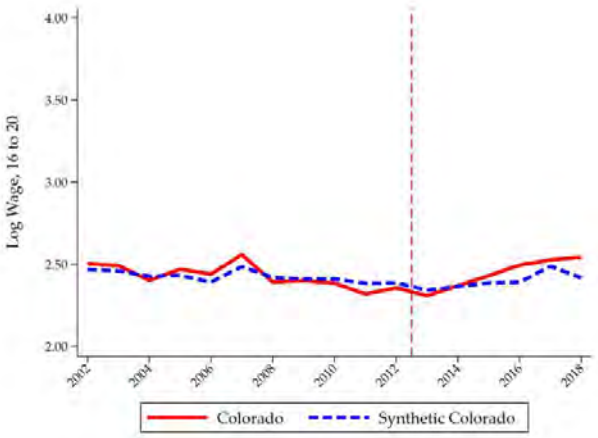
Panel (d): Ages 50-to-64
RML Effect = -0.009 (p-value = 0.510)



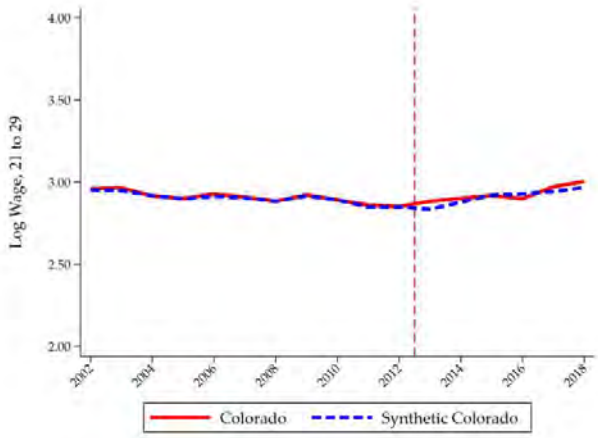
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 10B. Continued, Synthetic Control Estimates for Colorado by Age Group, Log (Wages)

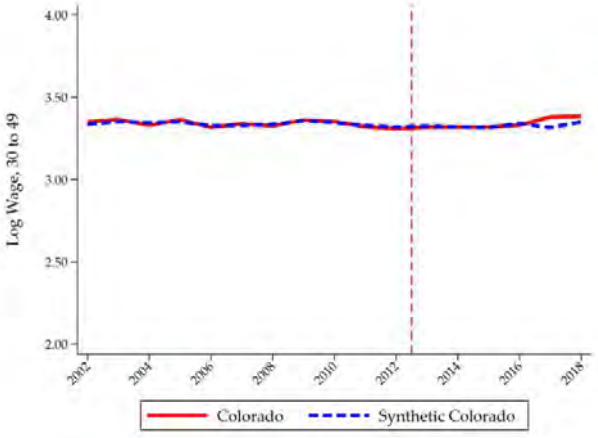
Panel (a): Ages 16-to-20
RML Effect = 0.055 (p-value = 0.608)



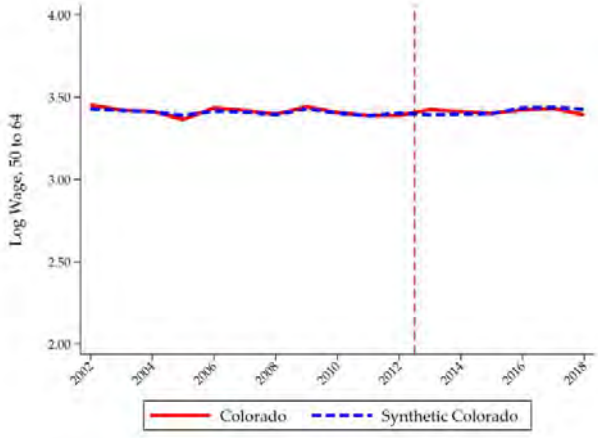
Panel (b): Ages 21-to-29
RML Effect = 0.017 (p-value = 0.412)



Panel (c): Ages 30-to-49
RML Effect = 0.017 (p-value = 0.373)



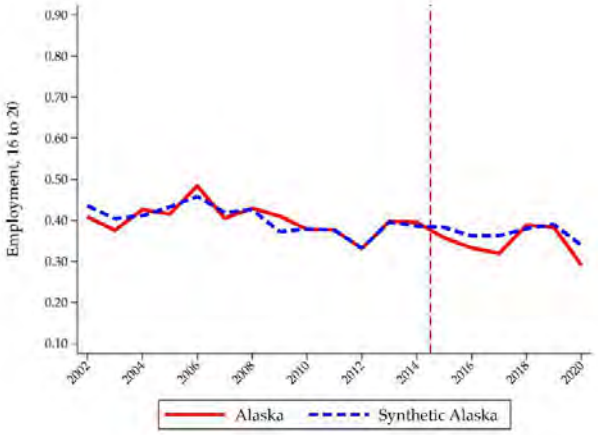
Panel (d): Ages 50-to-64
RML Effect = -0.004 (p-value = 0.725)



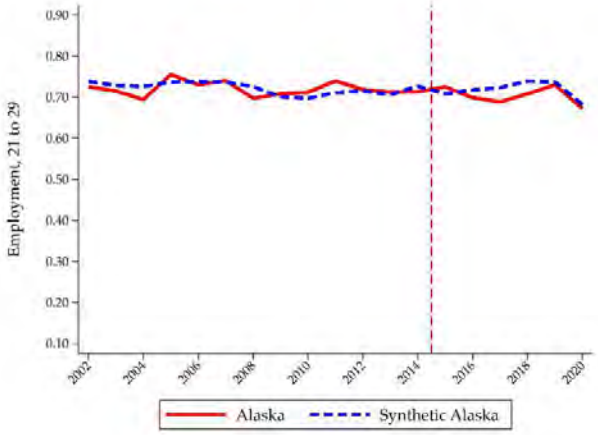
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Figure 11A. Synthetic Control Estimates for Alaska by Age Group, Employment

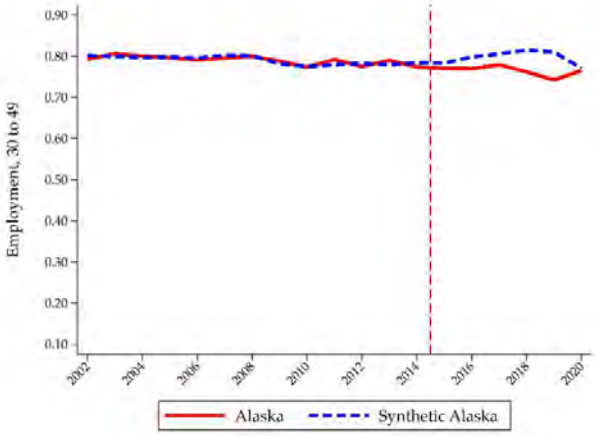
Panel (a): Ages 16-to-20
RML Effect = -0.024 (p-value = 0.686)



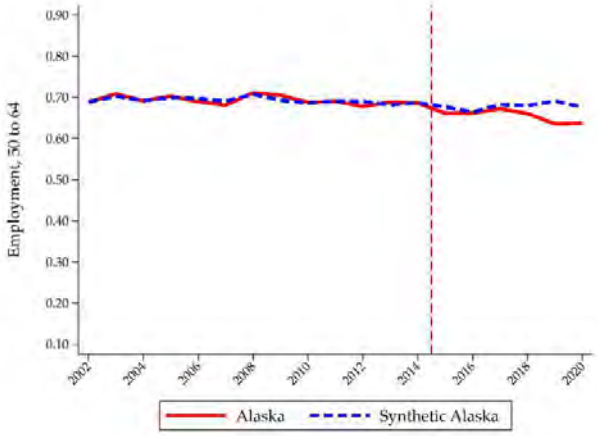
Panel (b): Ages 21-to-29
RML Effect = -0.014 (p-value = 0.765)



Panel (c): Ages 30-to-49
RML Effect = -0.033 (p-value = 0.137)



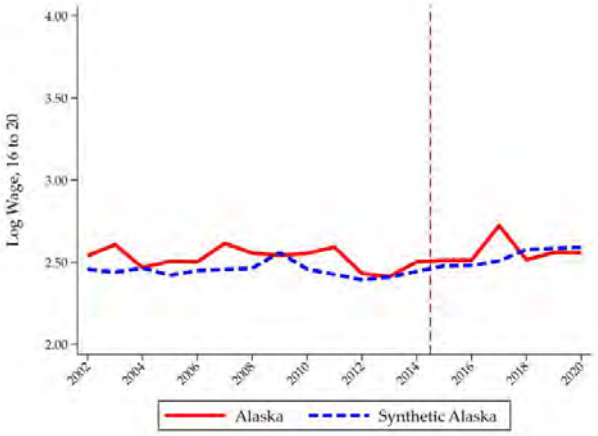
Panel (d): Ages 50-to-64
RML Effect = -0.024 (p-value = 0.098)



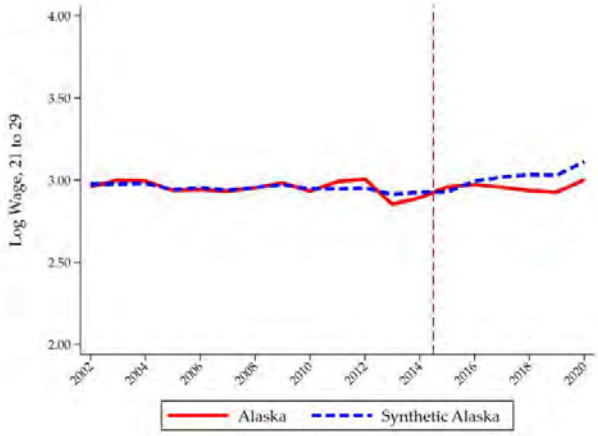
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 11B. Continued, Synthetic Control Estimates for Alaska by Age Group, Log (Wages)

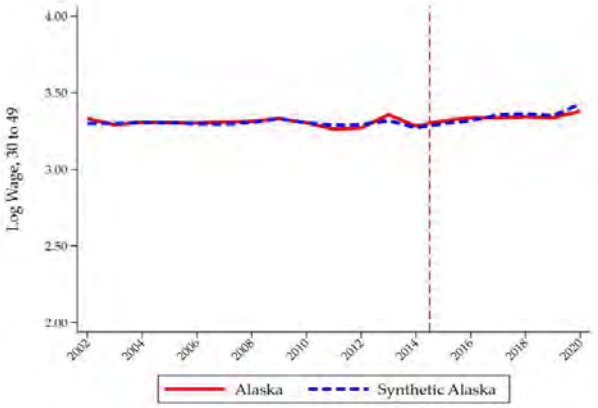
Panel (a): Ages 16-to-20
RML Effect = 0.027 (p-value = 0.863)



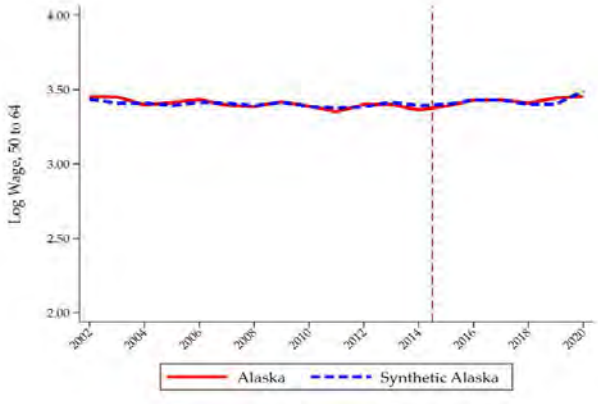
Panel (b): Ages 21-to-29
RML Effect = -0.061 (p-value = 0.255)



Panel (c): Ages 30-to-49
RML Effect = -0.001 (p-value = 0.882)



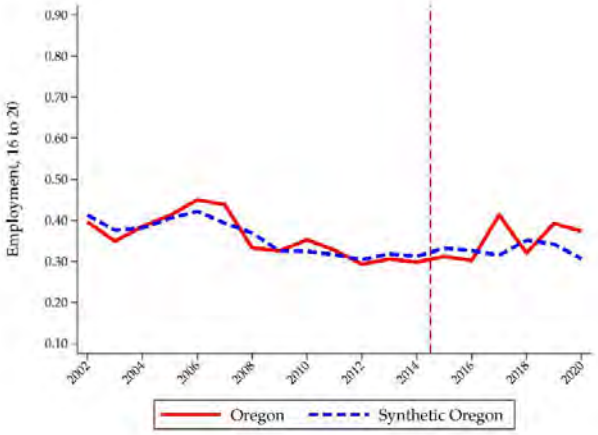
Panel (d): Ages 50-to-64
RML Effect = 0.001 (p-value = 0.667)



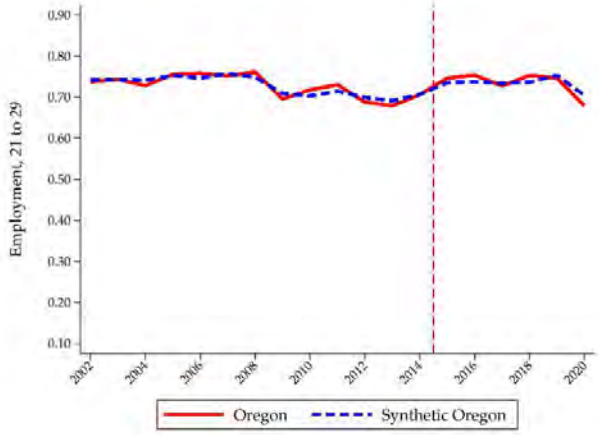
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Figure 12A. Synthetic Control Estimates for Oregon by Age Group, Employment

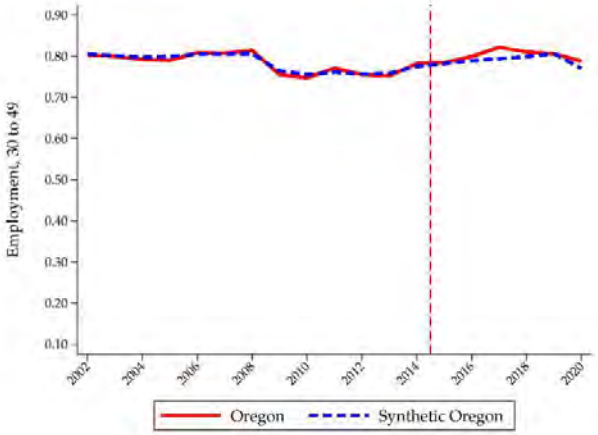
Panel (a): Ages 16-to-20
RML Effect = 0.020 (p-value = 0.314)



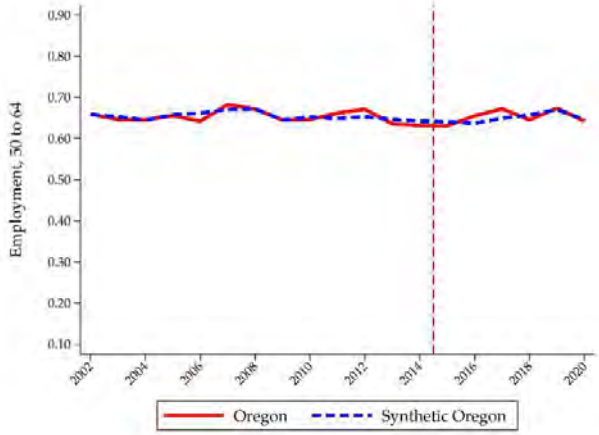
Panel (b): Ages 21-to-29
RML Effect = 0.001 (p-value = 0.725)



Panel (c): Ages 30-to-49
RML Effect = 0.011 (p-value = 0.412)



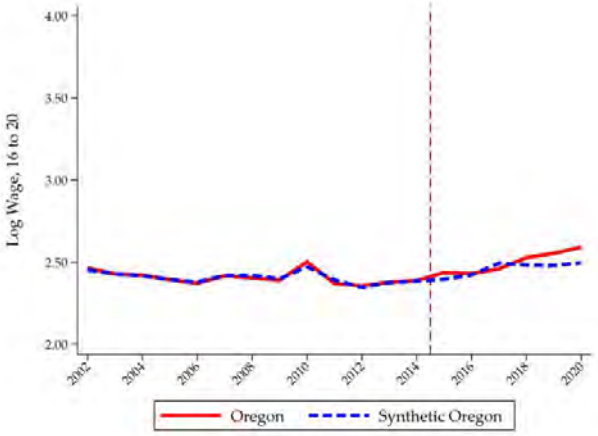
Panel (d): Ages 50-to-64
RML Effect = 0.001 (p-value = 0.784)



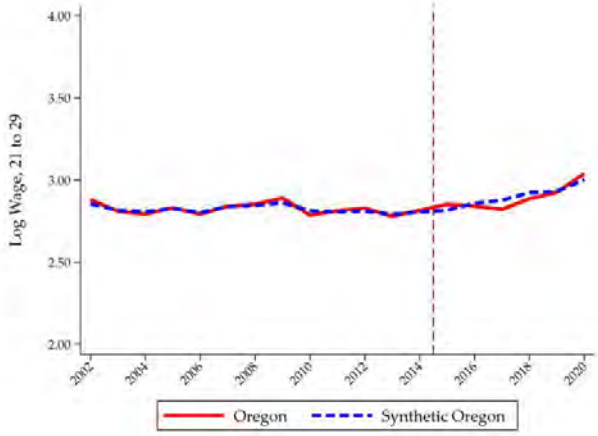
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 12B. Continued, Synthetic Control Estimates for Oregon by Age Group, Log (Wages)

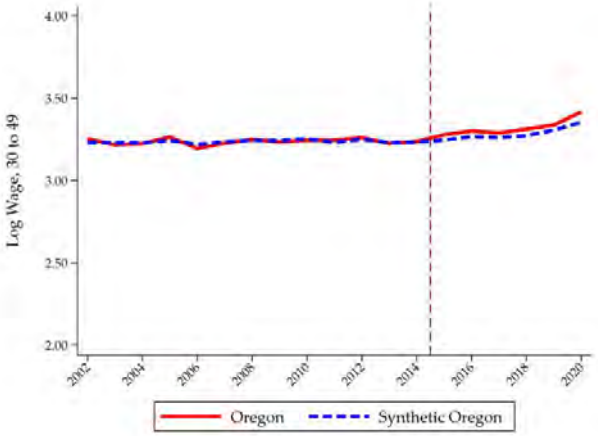
Panel (a): Ages 16-to-20
RML Effect = 0.038 (p-value = 0.098)



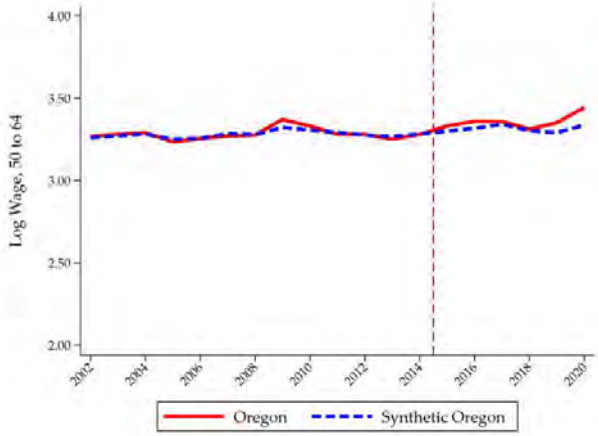
Panel (b): Ages 21-to-29
RML Effect = -0.007 (p-value = 0.471)



Panel (c): Ages 30-to-49
RML Effect = 0.038 (p-value = 0.373)



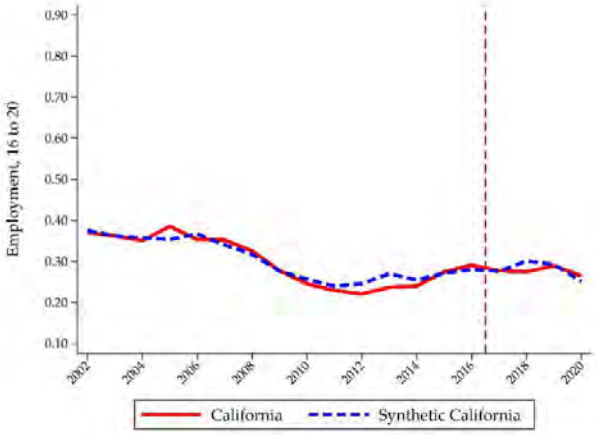
Panel (d): Ages 50-to-64
RML Effect = 0.045 (p-value = 0.196)



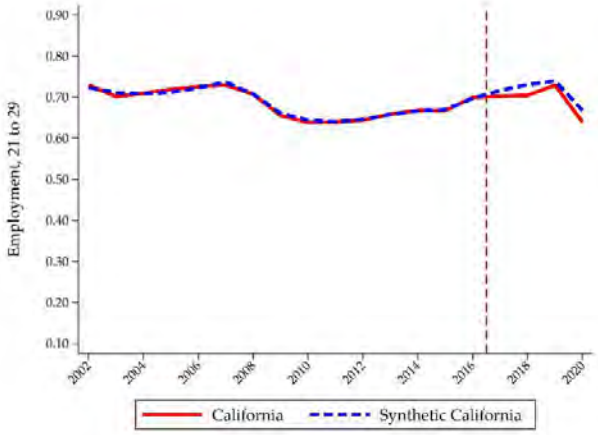
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Figure 13A. Synthetic Control Estimates for California by Age Group, Employment

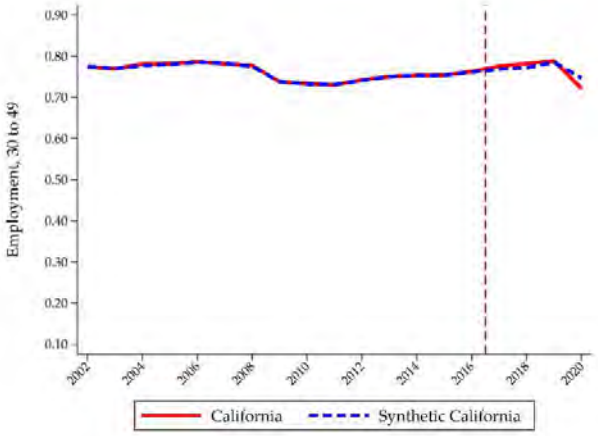
Panel (a): Ages 16-to-20
RML Effect = -0.004 (p-value = 0.922)



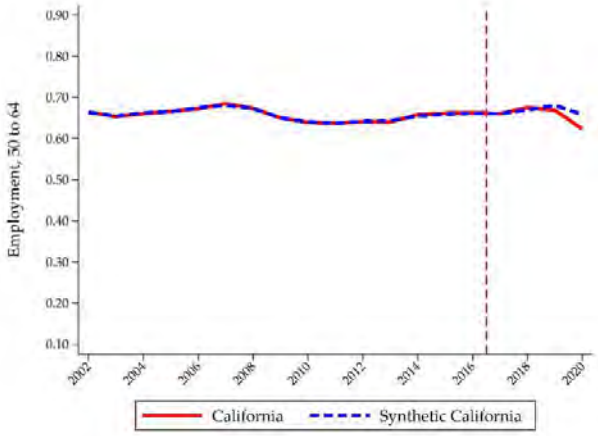
Panel (b): Ages 21-to-29
RML Effect = -0.011 (p-value = 0.078)



Panel (c): Ages 30-to-49
RML Effect = -0.011* (p-value = 0.020)



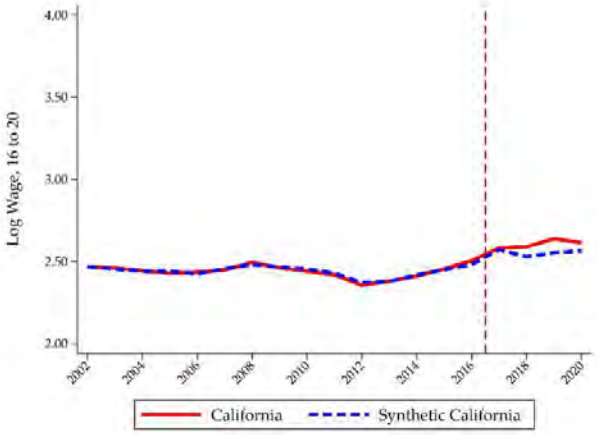
Panel (d): Ages 50-to-64
RML Effect = -0.001 (p-value = 0.059)



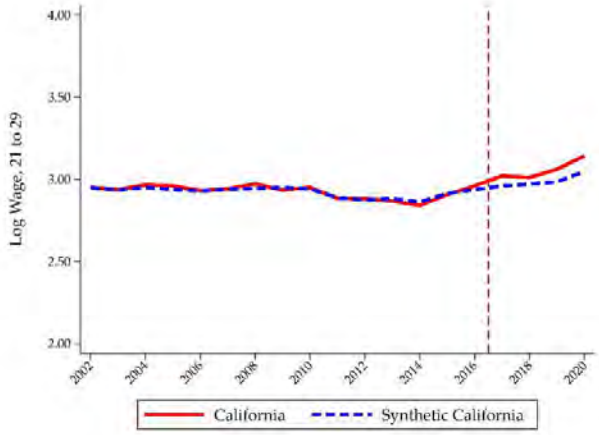
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 13B. Continued, Synthetic Control Estimates for California by Age Group, Log (Wages)

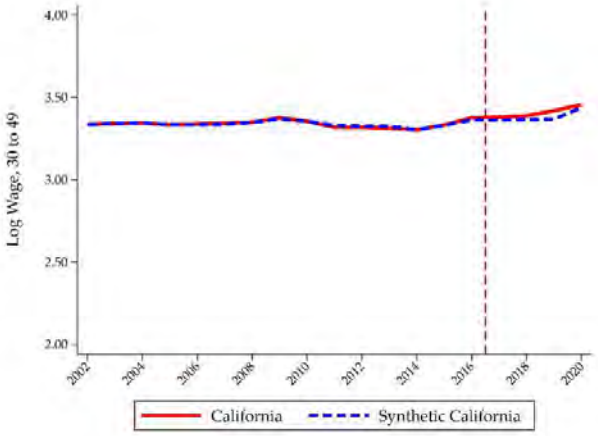
Panel (a): Ages 16-to-20
RML Effect = 0.051 (p-value = 0.078)



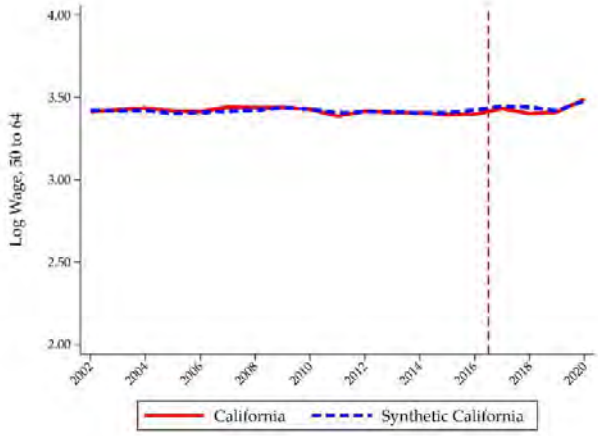
Panel (b): Ages 21-to-29
RML Effect = 0.068* (p-value = 0.020)



Panel (c): Ages 30-to-49
RML Effect = 0.028 (p-value = 0.078)



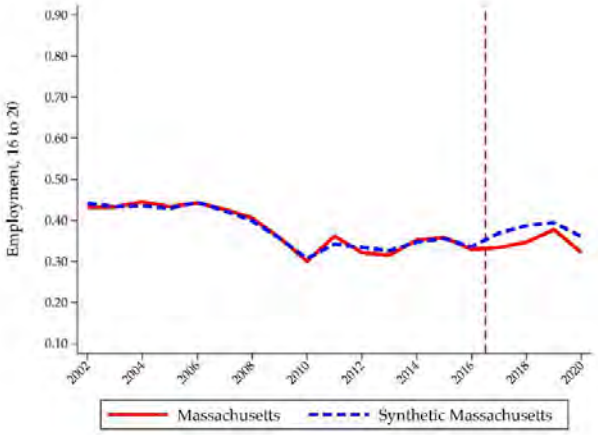
Panel (d): Ages 50-to-64
RML Effect = -0.012 (p-value = 0.569)



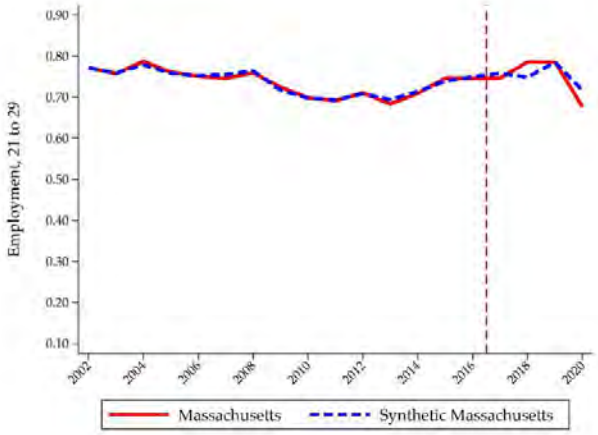
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Figure 14A. Synthetic Control Estimates for Massachusetts by Age Group, Employment

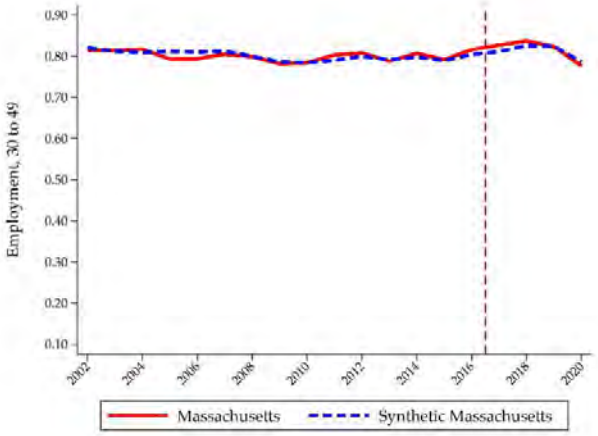
Panel (a): Ages 16-to-20
RML Effect = -0.033 (p-value = 0.078)



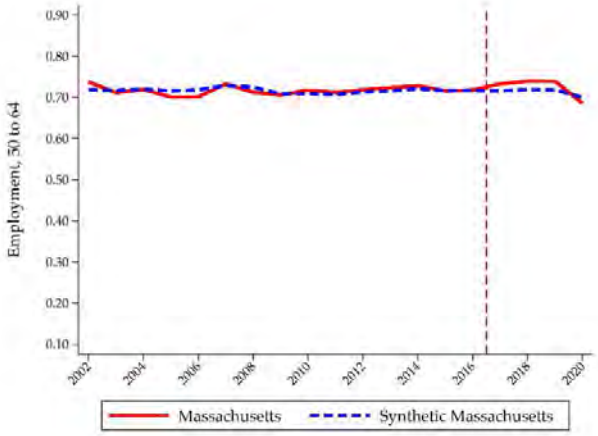
Panel (b): Ages 21-to-29
RML Effect = -0.004* (p-value = 0.039)



Panel (c): Ages 30-to-49
RML Effect = 0.004 (p-value = 0.882)



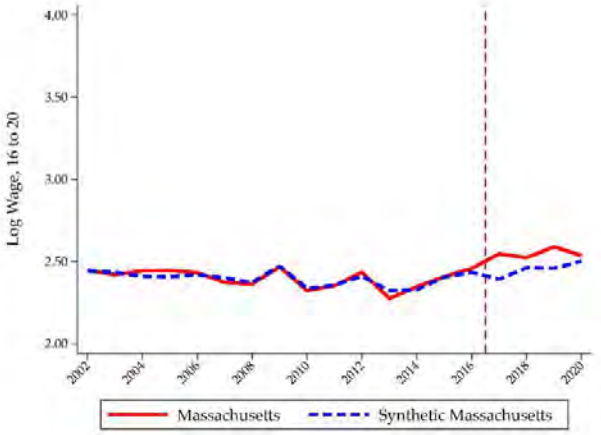
Panel (d): Ages 50-to-64
RML Effect = 0.011 (p-value = 0.588)



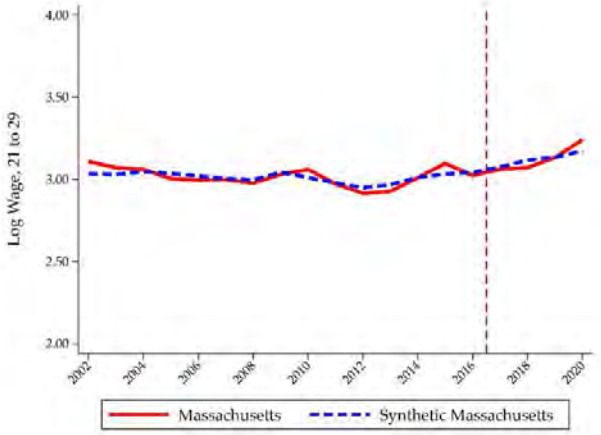
Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Figure 14B. Continued, Synthetic Control Estimates for Massachusetts by Age Group, Log (Wages)

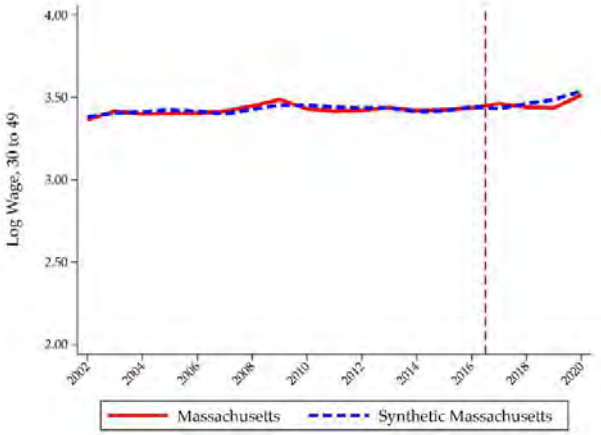
Panel (a): Ages 16-to-20
RML Effect = 0.095 (p-value = 0.118)



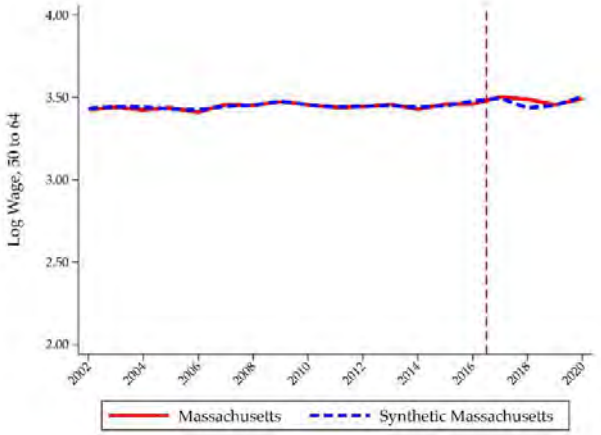
Panel (b): Ages 21-to-29
RML Effect = 0.002 (p-value = 0.706)



Panel (c): Ages 30-to-49
RML Effect = -0.016 (p-value = 0.549)



Panel (d): Ages 50-to-64
RML Effect = 0.013 (p-value = 0.118)



Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in log(wages).

Table 1. TWFE Estimates of the Relationship Between RMLs and Prior Month Adult Marijuana Use

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel I: All Adults			
RML	0.0343***	0.0428***	0.0410***	0.0411***	0.0420***	0.0230***
	(0.00770)	(0.00484)	(0.00509)	(0.00519)	(0.00506)	(0.00630)
N	918	918	918	918	918	918
Pre-Treat Mean of MJ Use	0.0725	0.0725	0.0725	0.0725	0.0725	0.0725
			Panel II: Younger Adults			
RML	0.0362***	0.0469***	0.0443***	0.0440***	0.0463***	0.0355**
	(0.0115)	(0.00997)	(0.0101)	(0.00996)	(0.00887)	(0.0126)
N	918	918	918	918	918	918
Pre-Treat Mean of MJ Use	0.184	0.184	0.184	0.184	0.184	0.184
			Panel III: Older Adults			
RML	0.0348***	0.0424***	0.0407***	0.0408***	0.0415***	0.0211***
	(0.00705)	(0.00457)	(0.00493)	(0.00503)	(0.00500)	(0.00586)
N	918	918	918	918	918	918
Pre-Treat Mean of MJ Use	0.053	0.053	0.053	0.053	0.053	0.053
Sociodemographic Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Substance Use Policies?	No	Yes	Yes	Yes	Yes	Yes
Social Welfare Policies?	No	No	Yes	Yes	Yes	Yes
Covid Controls?	No	No	No	Yes	Yes	Yes
Macroeconomic Controls?	No	No	No	No	Yes	Yes
State Specific Linear Trends?	No	No	No	No	No	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2019 National Survey of Drug Use and Health (NSDUH). Estimates in column (1) include controls for state and year FE, medical marijuana laws (MMLs), marijuana decriminalization or depenalization laws (MDLs), percentage black and Hispanic, and share of population with a college degree or higher. Column (2) adds controls for substance use policies, including cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, and beer tax. Column (3) adds controls for social welfare policies, including ACA Medicaid expansions, the higher of the state or federal minimum wage, maximum Earned Income Tax Credit refundable credit and Democratic governor. Column (4) adds state-level macroeconomic controls, including per capita income. Column (5) adds COVID controls which include new cases, deaths and shelter in place orders. The sample in Panel I is comprised of individuals ages 18-and-older. The sample in Panel II is comprised of individuals ages 18-to-25. The sample in Panel III is comprised of individuals ages 26-and-older. All regressions are weighted and standard errors are corrected for clustering at the state level.

Table 2. TWFE Estimates of Effects of RMLs on Adult Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Panel I: Employment			
RML	0.00056	0.00094	0.00112	0.00150	-0.00116	0.0018	-0.0023
	(0.00247)	(0.00308)	(0.00280)	(0.00244)	(0.00310)	(0.00277)	(0.00239)
N	4,825,765	4,825,765	4,825,765	4,825,765	4,825,765	4,621,494	4,825,765
Pre-Treat Mean of Dep Var	0.695	0.695	0.695	0.695	0.695	0.696	0.695
				Panel II: Log (Wages)			
RML	0.00938*	0.00712	0.00537	0.000520	-0.00063	-0.00046	0.00707
	(0.00414)	(0.00407)	(0.00412)	(0.00409)	(0.00471)	(0.00469)	(0.00696)
N	3,037,971	3,037,971	3037,971	3,037,971	3,037,971	2,913,789	3037,971
Pre-Treat Mean of Dep Var	23.67	23.67	23.67	23.67	23.67	23.59	23.67
Sociodemographic Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Substance Use Policies?	No	Yes	Yes	Yes	Yes	Yes	Yes
Social Welfare Policies?	No	No	Yes	Yes	Yes	Yes	Yes
Covid Controls?	No	No	No	Yes	Yes	Yes	Yes
Macroeconomic Controls?	No	No	No	No	Yes	Yes	Yes
Drop COVID-19 Year (2020)?	No	No	No	No	No	Yes	No
State-specific linear time trend?	No	No	No	No	No	No	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. Estimates in column (1) include controls for state and year FE, medical marijuana laws (MMLs), marijuana decriminalization or depenalization laws (MDLs), state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. Panel II also controls for whether the worker is paid hourly and the industry classification code. Column (2) adds controls for substance use policies, including cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, and beer tax. Column (3) adds controls for social welfare policies, including ACA Medicaid expansions, the higher of the state or federal minimum wage, maximum Earned Income Tax Credit refundable credit and Democratic governor. Column (4) adds state-level macroeconomic controls, including per capita income. Column (5) adds COVID controls which include new cases, deaths and shelter in place orders. All regressions are weighted and standard errors are corrected for clustering at the state level.

Table 3. Heterogeneity in Effects of RMLs on Adult Labor Market Outcomes, by Age

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	-0.00300	-0.00477	0.00035	-0.00065
	(0.00897)	(0.00499)	(0.00291)	(0.00390)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	0.00238	0.00012	-0.00467	0.00533
	(0.00682)	(0.00800)	(0.00593)	(0.00514)
N	179,178	577,900	1,441,121	839,772
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.33
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Table 4. Callaway and Sant'Anna (2021) Estimates of Relationship Between RMLs and Labor Market Outcomes

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	0.00096	-0.00618	0.00461	0.00220
	(0.0123)	(0.00779)	(0.00551)	(0.00637)
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	0.0128	0.00363	0.0164	0.00959
	(0.0174)	(0.0134)	(0.00832)	(0.0104)
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.32
MML and DML?	Yes	Yes	Yes	Yes

***p < 0.01 **p< .05 *p < .10

Notes: Columns (1) to (4) provide Callaway-Sant' Anna estimates using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, medical marijuana laws, marijuana and decriminalization laws. Standard errors are clustered at the state level.

Table 5. Sensitivity of Estimates in Table 3 to Controls for State-Specific Linear Time Trends

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	-0.00437	-0.00349	0.00040	-0.00610
	(0.00697)	(0.00355)	(0.00355)	(0.00431)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	0.00550	0.01003	0.00345	0.00874
	(0.00726)	(0.00915)	(0.00804)	(0.00853)
N	179,178	577,900	1,441,121	839,772
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.32
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Table 6. Sensitivity of Estimates in Table 3 to Inclusion of Control for Border State RML Policy

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
		Panel I: Employment		
RML	0.00101	0.00043	0.00295	0.00055
	(0.00942)	(0.00639)	(0.00273)	(0.00320)
Border State RML	-0.00006	-0.01135	-0.00568	-0.00292
	(0.00638)	(0.00700)	(0.00373)	(0.00554)
RML*Border State RML	-0.00815	-0.01057	-0.00503	-0.00320
	(0.01137)	(0.00710)	(0.00383)	(0.00558)
N	489,832	825,719	2,038,745	1471,469
Pre-Treat Mean Employment	0.3607743	0.7210386	0.7872089	0.6670107
		Panel II: Log (Hourly Wage)		
RML	0.01234	0.00347	-0.00607	-0.00329
	(0.00686)	(0.00842)	(0.00535)	(0.00494)
Border State RML	-0.00096	-0.00283	0.00147	0.00180
	(0.00691)	(0.00429)	(0.00533)	(0.00412)
RML*Border State RML	-0.02166*	-0.00739	0.00307	0.01889**
	(0.01046)	(0.00811)	(0.00652)	(0.00671)
N	179178	577900	1441121	839772
Pre-Treat Mean Hours	10.74045	17.7371	25.92837	27.32262

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Table 7. Heterogeneity in Effects of RMLs on Adult Labor Market Outcomes by Gender

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
		Panel I: Males		
		(a) Employment		
RML	-0.00570	-0.00331	-0.00233	-0.00255
	(0.00877)	(0.00635)	(0.00312)	(0.00515)
N	250,031	401,361	979,261	707,548
Pre-treatment Mean Employment	0.355	0.767	0.861	0.722
		(b) Log (Wages)		
RML	0.00471	-0.00027	-0.00846	0.00204
	(0.00731)	(0.00977)	(0.00725)	(0.00704)
N	88,597	296,211	737,392	414,808
Pre-treatment Mean Hours	11.29	18.50	28.13	30.48
		Panel II: Females		
		(a) Employment		
RML	0.00000	-0.00520	0.00308	0.00016
	(0.01109)	(0.00612)	(0.00381)	(0.00383)
N	135,708	424,358	1,059,484	763,921
Pre-treatment Mean Employment	0.367	0.675	0.716	0.616
		(b) Log (Wages)		
RML	-0.00056	0.00138	0.00035	0.00782
	(0.00995)	(0.00856)	(0.00645)	(0.00656)
N	90,581	281,689	703,729	424,964
Pre-treatment Mean Hours	10.20	16.89	23.48	24.16

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels (a) is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels (b) is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions whose outcome variable is log(wages) also control for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Table 8. Heterogeneity in Effects of RMLs on Labor Market Outcomes by Educational Attainment

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
		Panel I: No High School Diploma		
		(a) Employment		
RML	0.00027	-0.01715	0.00856	0.01229
	(0.00823)	(0.01738)	(0.01032)	(0.01388)
N	281,666	79,777	197,491	145,541
Pre-Treat Mean Employment	0.244	0.564	0.625	0.456
		(b) Log (Hourly Wage)		
RML	-0.00507	0.01169	0.00310	0.01028
	(0.00886)	(0.01327)	(0.00955)	(0.02915)
N	71,733	42,212	108,493	56,893
Pre-Treat Mean Wage	9.72	12.67	14.81	15.52
		Panel II: High School Completion		
		(a) Employment		
RML	-0.00321	0.00311	0.00171	-0.00071
	(0.01537)	(0.00755)	(0.00658)	(0.00476)
N	101,926	234,702	583,051	462,834
Pre-Treat Mean Employment	0.514	0.695	0.751	0.622
		(b) Log (Hourly Wages)		
RML	-0.00784	-0.00038	-0.00174	-0.00373
	(0.01083)	(0.01214)	(0.00790)	(0.00775)
N	52,847	157,589	392,232	249,582
Pre-Treat Mean Wage	11.45	15.01	19.72	20.86
		Panel III: Some College or More		
		(a) Employment		
RML	-0.00995	-0.00583	-0.00063	-0.00145
	(0.01347)	(0.00532)	(0.00343)	(0.00409)
N	106,240	511,240	1,258,203	863,094
Pre-Treat Mean Employment	0.509	0.760	0.833	0.731
		(b) Log (Hourly Wage)		
RML	0.01592	0.00042	-0.00427	0.00881
	(0.01121)	(0.00782)	(0.00578)	(0.00648)
N	54,598	378,099	940,396	533,297
Pre-Treat Mean Wage	11.29	19.51	30.02	31.79

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels (a) is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels (b) is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions whose outcome variable is log(wages) also control for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Table 9. Heterogeneity in Effects of RMLs on Adult Labor Market Outcomes by Race and Ethnicity

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
		Panel I: Non-Hispanic Whites		
		(a) Employment		
RML	-0.00762	-0.00342	-0.00072	-0.00050
	(0.00875)	(0.00569)	(0.00298)	(0.00349)
N	305,823	526,835	1,393,337	1,125,867
Pre-Treat Mean Employment	0.412	0.757	0.809	0.686
		(b) Log (Hourly Wages)		
RML	-0.00814	-0.00801	-0.00642	0.00449
	(0.01015)	(0.00810)	(0.00585)	(0.00495)
N	126,501	384,393	998,427	649,871
Pre-Treat Mean Wage	10.71	18.63	27.84	28.83
		Panel II: Blacks		
		(a) Employment		
RML	0.01330	-0.01199	-0.00000	0.01563
	(0.01802)	(0.01192)	(0.01353)	(0.01905)
N	57,615	87,609	201,441	137,114
Pre-Treat Mean Employment	0.250	0.639	0.739	0.581
		(b) Log (Hourly Wage)		
RML	0.06626**	0.01278	-0.01391	0.00541
	(0.01941)	(0.01788)	(0.01363)	(0.01464)
N	11,484	44,699	111,408	51,032
Pre-Treat Mean Wage	10.41	15.39	21.30	22.48
		Panel III: Hispanic		
		(a) Employment		
RML	0.01415	0.01790*	0.00455	-0.00704
	(0.01935)	(0.00833)	(0.00494)	(0.01052)
N	84,816	139,996	281,791	117,252
Pre-Treat Mean Employment	0.324	0.703	0.754	0.633
		(b) Log (Hourly Wage)		
RML	0.00343	0.00592	0.00316	-0.00570
	(0.01265)	(0.01304)	(0.00776)	(0.01095)
N	27,370	94,493	192,011	65,720
Pre-Treat Mean Wage	10.98123	15.48655	20.13252	21.08916

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels (a) is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels (b) is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions whose outcome variable is log(wages) also control for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

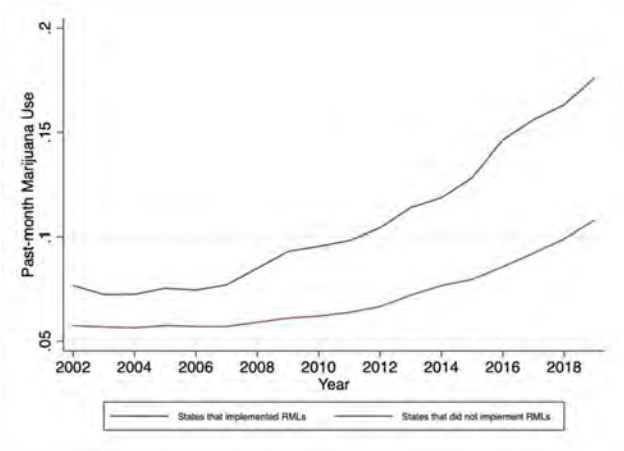
Table 10. Heterogeneity in Effects of RMLs on Labor Market Outcomes by Whether Recreational Dispensary Open

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML with Dispensary Open	-0.00567	-0.00932	-0.00218	-0.00269
	(0.00959)	(0.00540)	(0.00352)	(0.00409)
RML without Dispensary Open	0.00219	0.00412	0.00548*	0.00320
	(0.01082)	(0.00540)	(0.00261)	(0.00548)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treat Mean Employment	0.3607743	0.7210386	0.7872089	0.6670107
			Panel II: Log (Hourly Wage)	
RML with Dispensary Open	0.00424	-0.00392	-0.00488	0.00692
	(0.00836)	(0.00690)	(0.00653)	(0.00559)
RML without Dispensary Open	-0.00122	0.00793	-0.00425	0.00241
	(0.00888)	(0.01162)	(0.00665)	(0.00808)
N	179178	577900	1441121	839772
Pre-Treat Mean Hours	10.74045	17.7371	25.92837	27.32262

***p<.001 **p<.01 *p<.05

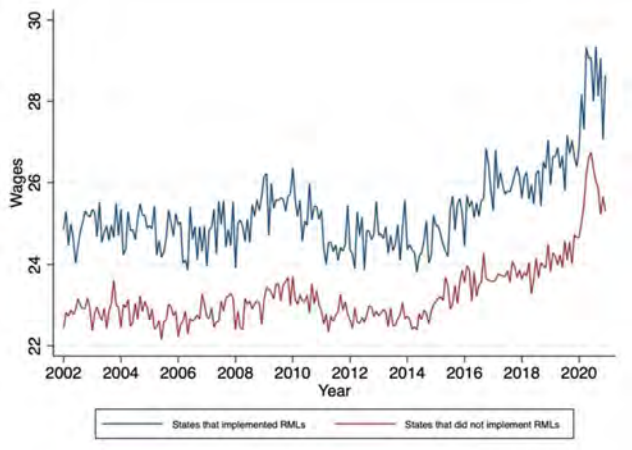
Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Appendix Figure 1A. Prevalence of Prior Month Marijuana Use, by Whether State RML Adopted

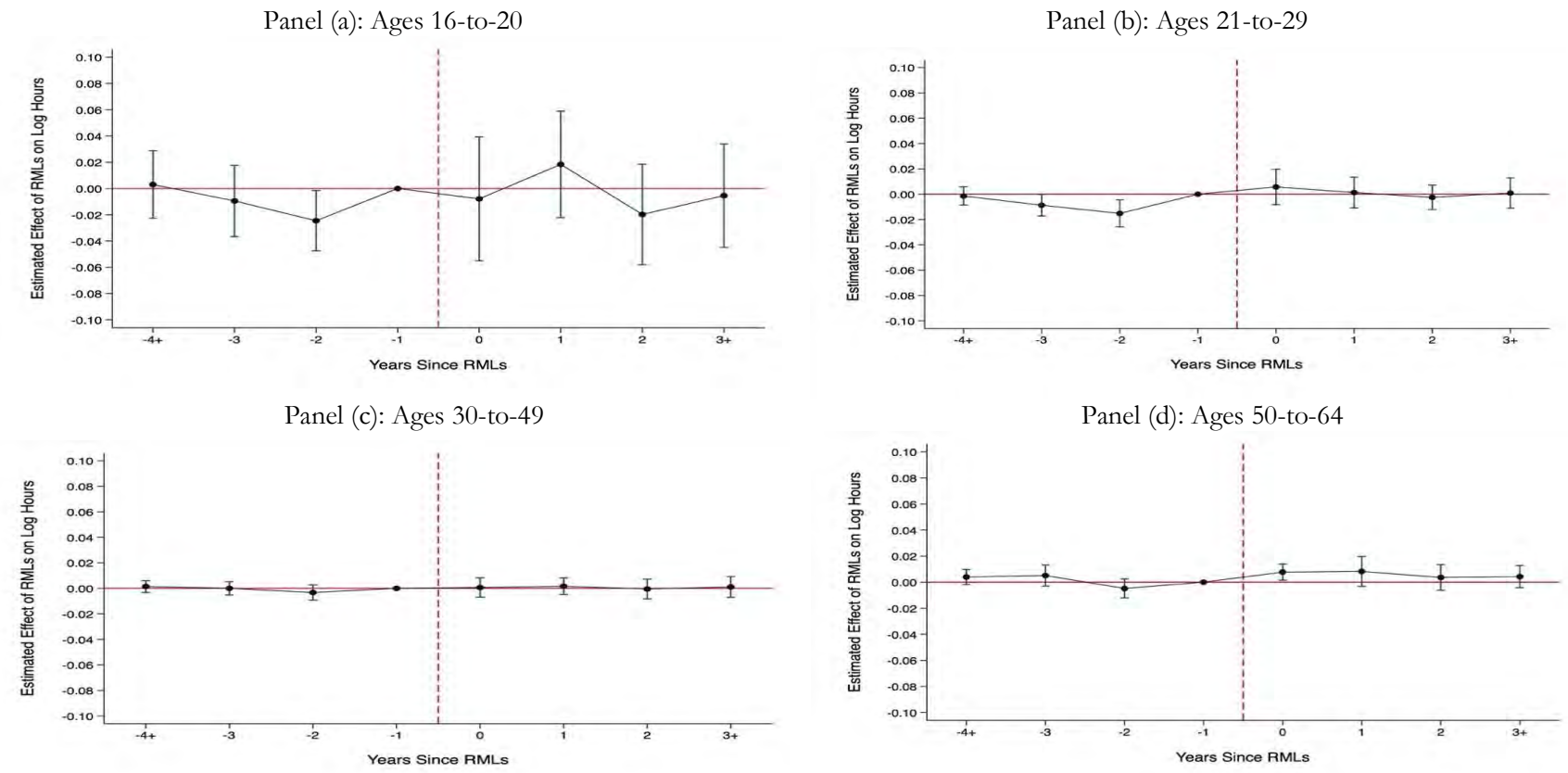


Appendix Figure 1B. Employment-to-Population Ratio, by Whether State RML Adopted

Appendix Figure 1C. Average Wages, by Whether State RML Adopted



Appendix Figure 2. Event-Study Analysis of RMLs and Log (Hours of Work) Among Workers, Using TWFE Estimates

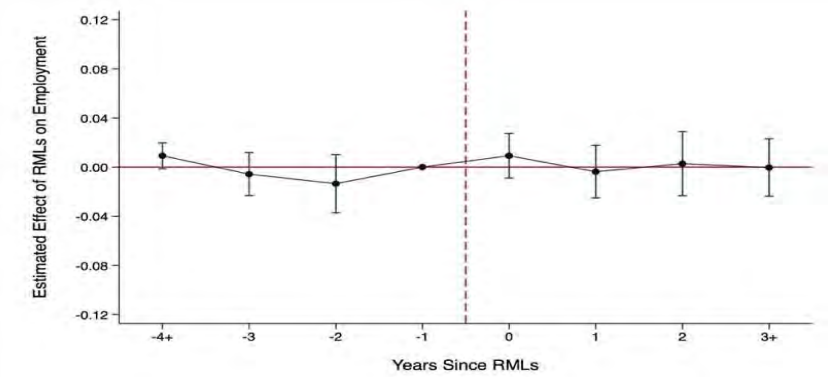


Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent, whether weekly working hours vary and the industry classification code. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

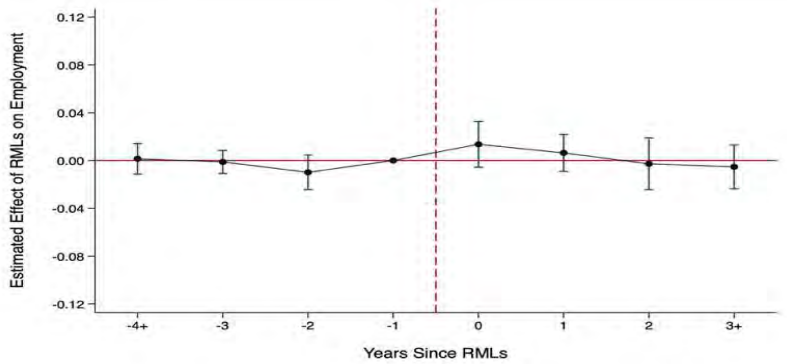
Appendix Figure 3. Event-Study Analysis of RMLs and Employment, Using TWFE Estimates, by Age Group and Gender

Panel I: Males

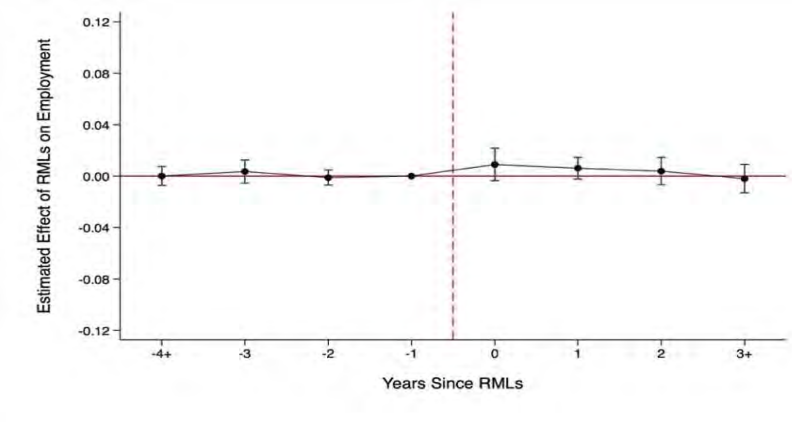
Panel (a): Ages 16-to-20



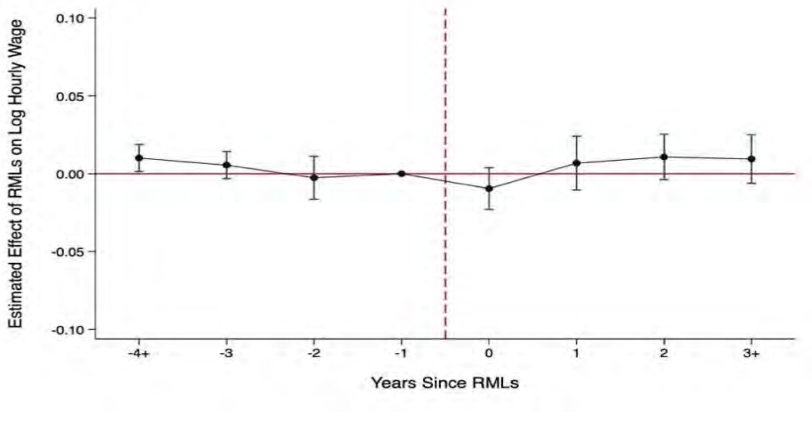
Panel (b): Ages 21-to-29



Panel (c): Ages 30-to-49

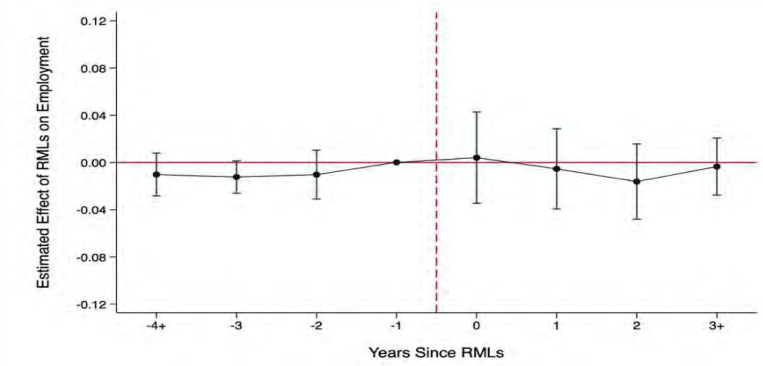


Panel (d): Ages 50-to-64

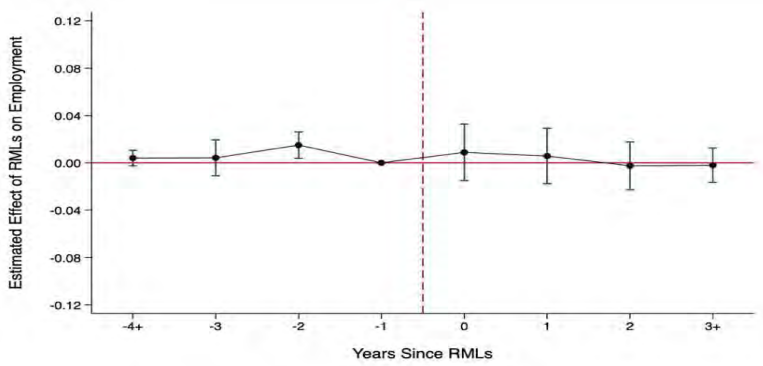


Panel II: Females

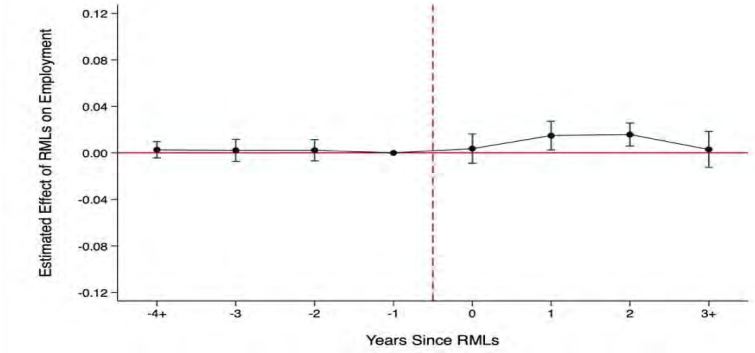
Panel (a): Ages 16-to-20



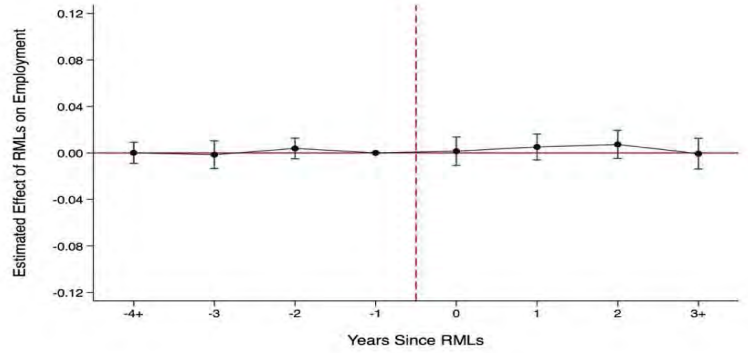
Panel (b): Ages 21-to-29



Panel (c): Ages 30-to-49



Panel (d): Ages 50-to-64

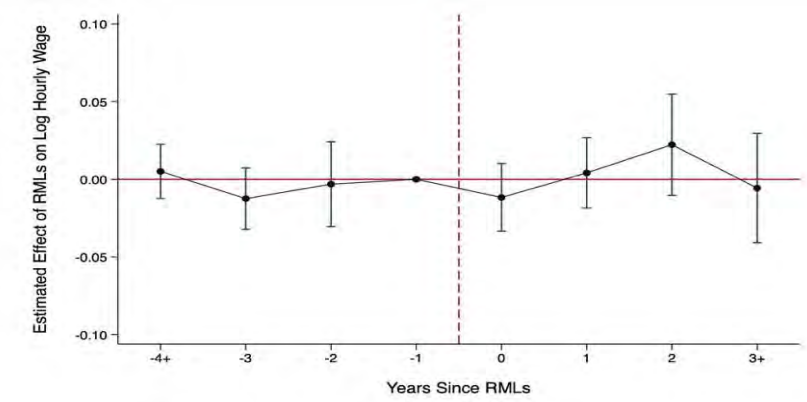


Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. All models include state and year fixed effects, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

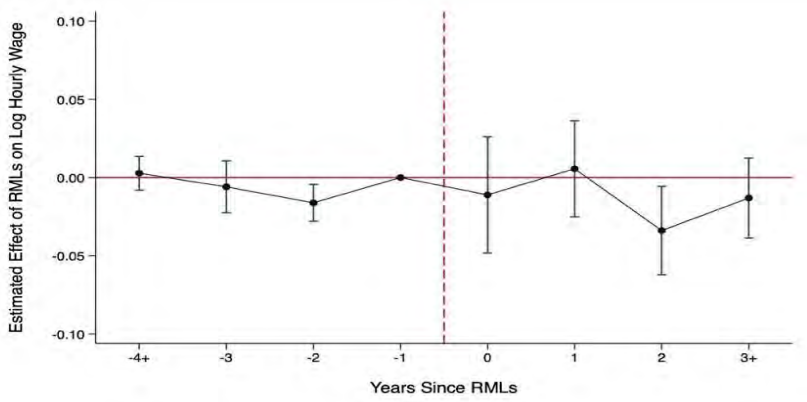
Appendix Figure 4. Event-Study Analysis of RMLs and Wages, Using TWFE Estimates, by Age Group and Gender

Panel I: Males

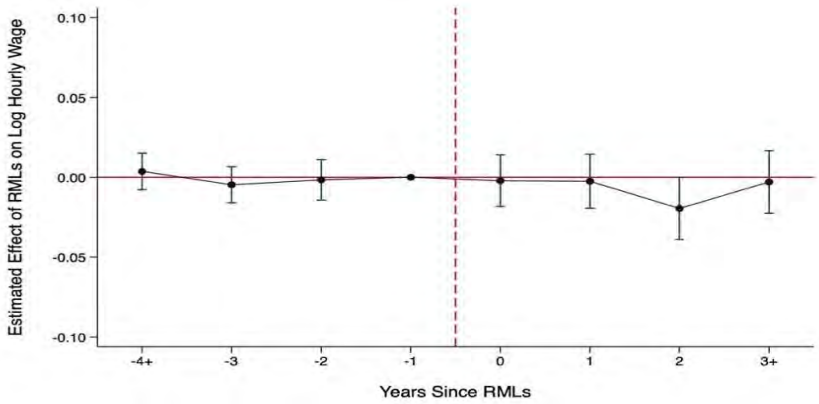
Panel (a): Ages 16-to-20



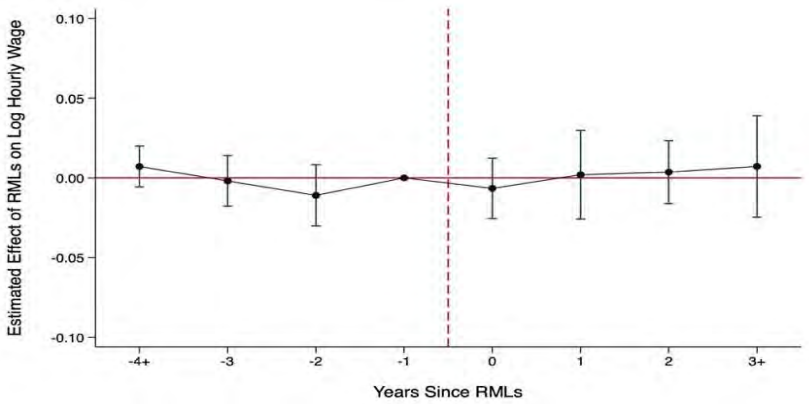
Panel (b): Ages 21-to-29



Panel (c): Ages 30-to-49

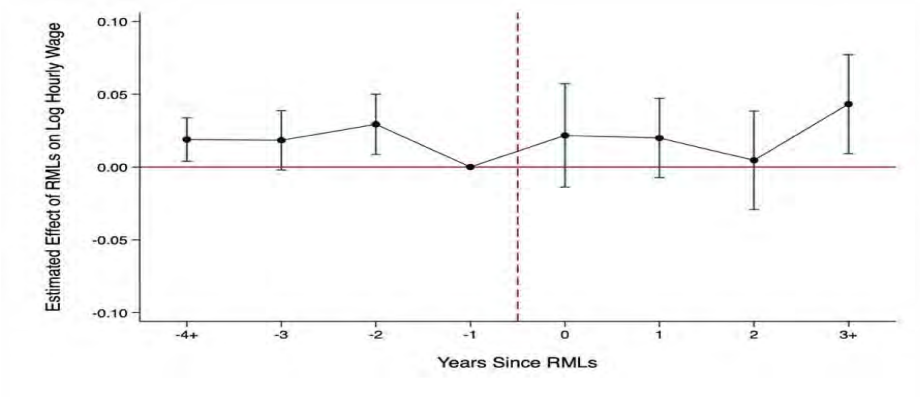


Panel (d): Ages 50-to-64

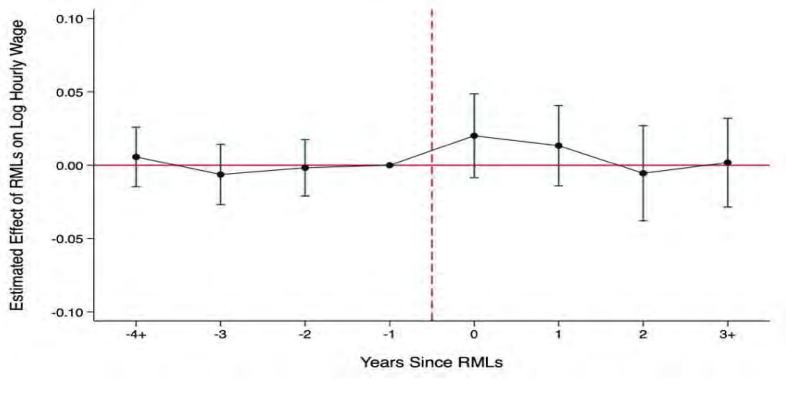


Panel II: Females

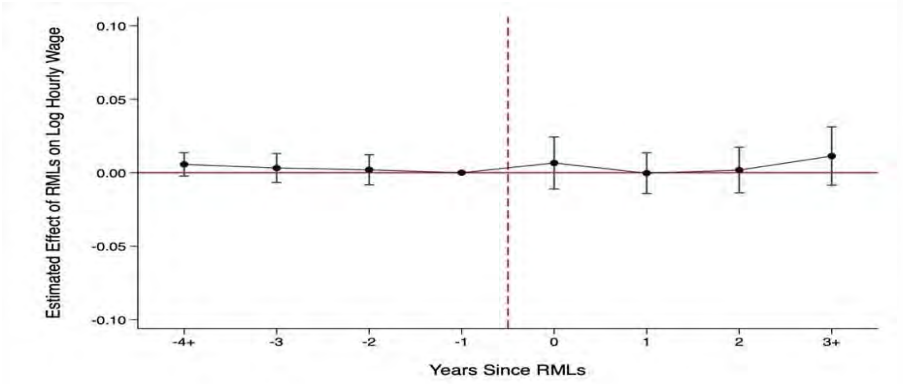
Panel (a): Ages 16-to-20



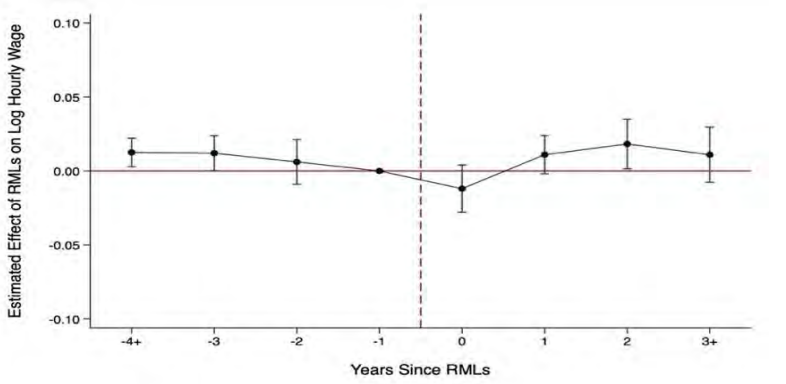
Panel (b): Ages 21-to-29



Panel (c): Ages 30-to-49



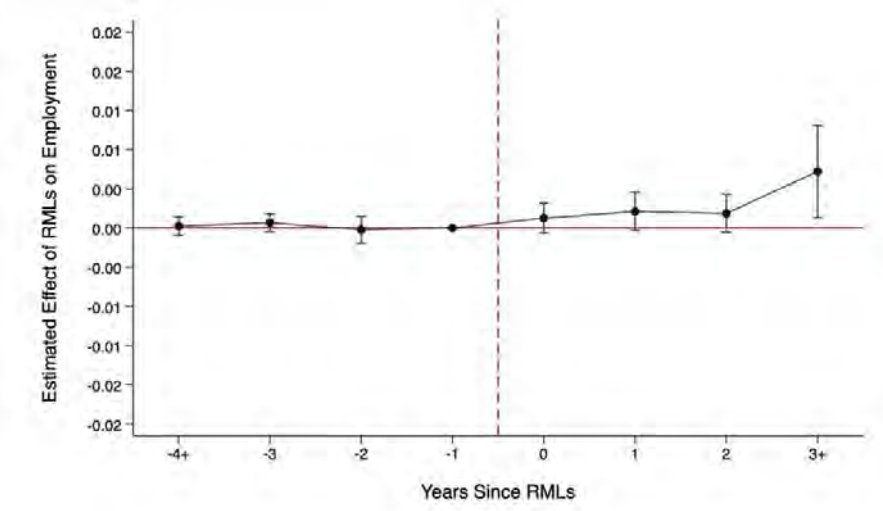
Panel (d): Ages 50-to-64



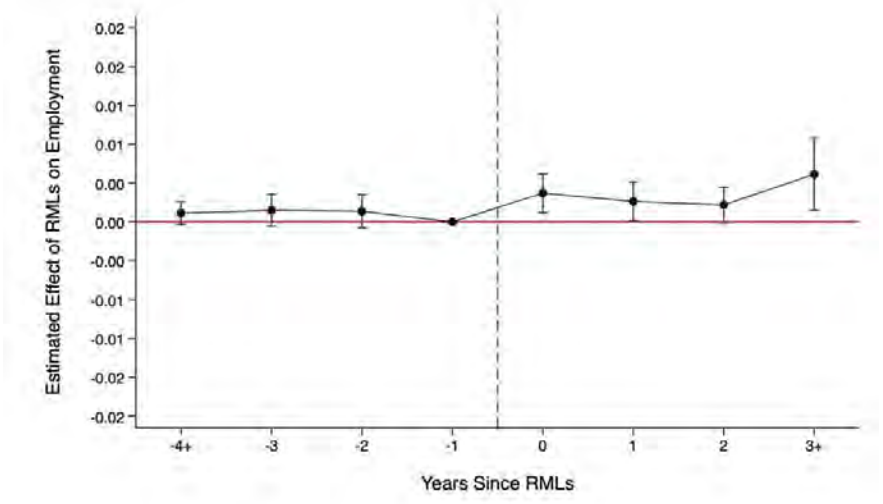
Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent, whether the worker is paid hourly and the industry classification code. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

Appendix Figure 5. Event Study Analysis of the Effects of RMLs on Employment in the Agriculture Sector, Using TWFE Estimates

Panel (a) Ages 30-to-49



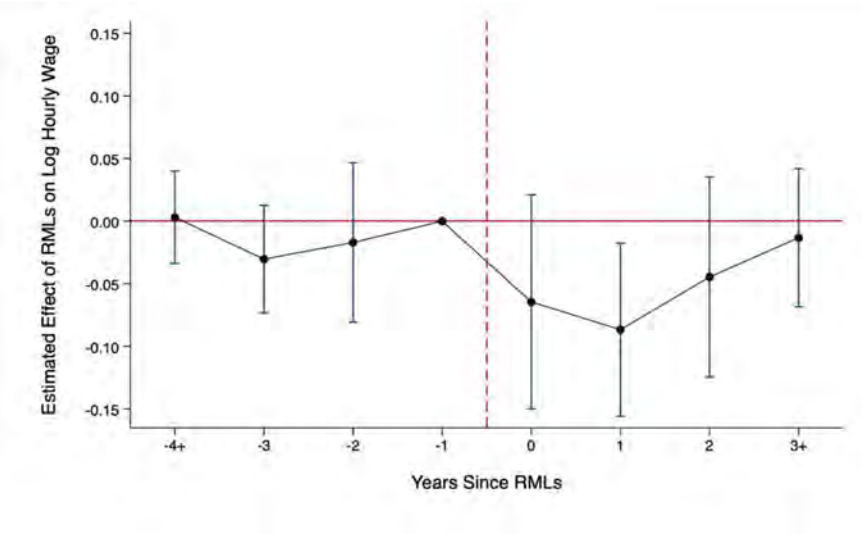
Panel (b): Ages 50-to-64



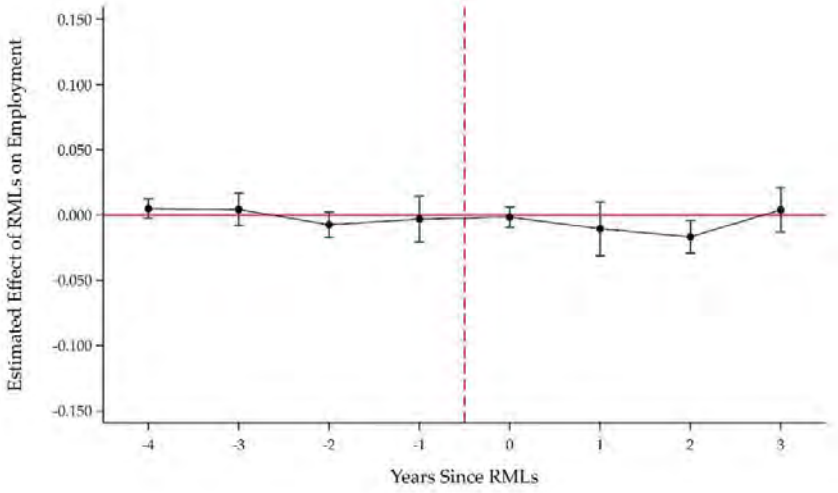
Note: Event studies are estimated through OLS regressions that include state fixed and year fixed. The sample in panel (a) is comprised of adults ages 30-to-49 who were employed at the time of interview and the sample in panel (b) is comprised of adults ages 50-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent, whether the worker is paid hourly and the industry classification code. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, cumulative Covid cases and deaths, Democratic governor, and per capita income. Vertical bars plot 95% confidence intervals.

Appendix Figure 6. Event Study Analysis of the Effects of RMLs on Log (Wages) Among Mining Workers, Using TWFE and Callaway and Sant'Anna Estimates

Panel (a) TWFE, Estimates



Panel (b): Callaway and Sant'Anna Estimates

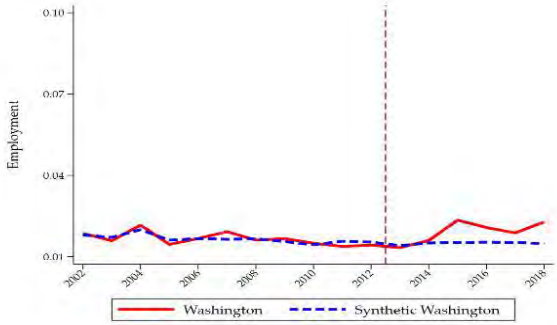


Note: Event studies are estimated through TWFE and Callaway Sant' Anna. All models include state fixed, year fixed, medical marijuana laws, and marijuana decriminalization laws. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. Vertical bars plot 95% confidence intervals.

Appendix Figure 7. Synthetic Control Estimates of Effect of RMLs on Agricultural Employment

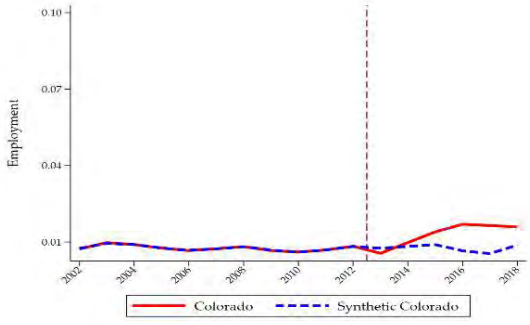
Panel (a): Washington

RML Effect = 0.004 (p-value = 0.235)



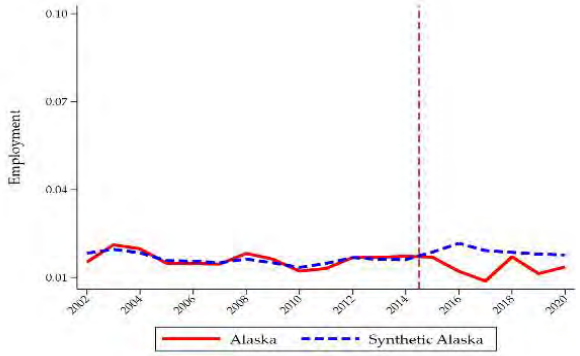
Panel (b): Colorado

RML Effect = 0.006** (p-value = 0.020)



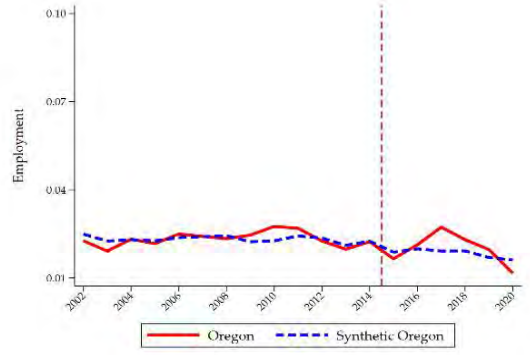
Panel (c): Alaska

RML Effect = -0.006 (p-value = 0.176)



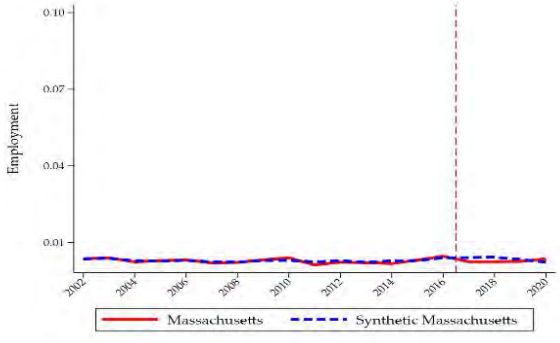
Panel (d): Oregon

RML Effect = 0.002 (p-value = 0.510)



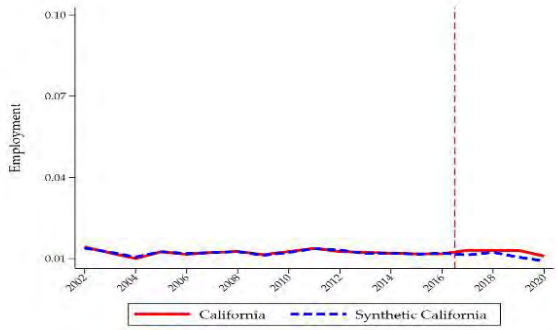
Panel (e): Massachusetts

RML Effect = 0.001 (p-value = 0.314)



Panel (f): California

RML Effect = 0.002** (p-value = 0.020)



Note: Each treatment (RML) state's synthetic control was generated as a linear combination of donor states that generated the most similar pre-treatment trends in employment.

Appendix Table 1A. First Stage Summary Statistics

	Ages 18-and-older		Ages 18-to-25		Ages 26-and older	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Prior Month Adult Marijuana Use	0.080	0.033	0.194	0.055	0.060	0.031
Prior Year Adult Marijuana Use	0.128	0.043	0.317	0.067	0.096	0.042
N	918		918		918	

Appendix Table 1B. Summary Statistics

	Ages 16-to-64		Ages 16-to-20		Ages 21-to-29		Ages 30-to-49		Ages 50-to-64	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Employment	0.695	0.460	0.358	0.479	0.721	0.448	0.787	0.409	0.667	0.471
Female	0.507	0.500	0.492	0.500	0.501	0.500	0.508	0.500	0.516	0.499
Race	2.113	0.760	2.103	0.808	2.103	0.814	2.110	0.780	2.129	0.668
Years of School	13.266	2.750	11.246	1.587	13.308	2.352	13.618	2.840	13.466	2.881
Age	39.427	13.893	17.944	1.428	25.002	2.581	39.598	5.783	56.568	4.265
Age-Squared	1,747.5	1,112.6	324.043	51.410	631.78	129.20	1601.45	458.16	3,218.1	484.951
Marital Status	0.516	0.500	0.021	0.144	0.273	0.446	0.642	0.479	0.672	0.469
RMLs	0.065	0.247	0.060	0.237	0.067	0.251	0.064	0.245	0.067	0.249

MMLs	0.362	0.481	0.355	0.479	0.367	0.482	0.356	0.479	0.369	0.483
Decriminalization Laws	0.379	0.485	0.377	0.485	0.385	0.487	0.378	0.485	0.375	0.484
ACA Medicaid Expansion	0.233	0.423	0.225	0.417	0.237	0.426	0.222	0.415	0.249	0.432
Beer Tax	0.317	0.285	0.315	0.282	0.315	0.284	0.318	0.286	0.316	0.285
Cigarette Tax	0.093	0.269	0.093	0.269	0.095	0.272	0.091	0.265	0.095	0.272
E-cigarette Tax	0.117	0.494	0.111	0.482	0.119	0.498	0.114	0.491	0.121	0.500
Tobacco-21 Law	0.094	0.292	0.090	0.286	0.096	0.294	0.091	0.288	0.097	0.297
Naloxone Access Law	0.411	0.482	0.402	0.481	0.418	0.483	0.396	0.479	0.430	0.484
Good Samaritan Law Drugs	0.235	0.417	0.224	0.411	0.238	0.420	0.225	0.412	0.250	0.426
Good Samaritan Law Alcohol	0.074	0.257	0.069	0.249	0.076	0.261	0.070	0.252	0.078	0.265
PDMP	0.169	0.364	0.162	0.357	0.171	0.365	0.161	0.356	0.183	0.375
Minimum Wage	8.467	1.217	8.442	1.199	8.480	1.231	8.451	1.220	8.492	1.209
Max Earned Income Tax Credit	0.096	0.189	0.093	0.186	0.097	0.192	0.095	0.189	0.096	0.188
Stay at Home	0.012	0.102	0.011	0.101	0.012	0.104	0.011	0.101	0.012	0.104

Covid Cases	3,970.3	35,707	3,801.7	3420.6	4054.7	3,6592	3,912.9	35,796.3	4,059.5	35,518.7
Covid Deaths	66.191	558.688	63.792	555.024	67.322	563.334	64.876	557.519	68.233	558.630
Democratics	0 .455	0.496	0.451	0.495	0.455	0.496	0.455	0.496	0.458	0.496
Per capita income	5,1044.5	8,388.3	0845.6	8295.339	5,1121.3	8443.7	50,953	8,338.4	51,199.6	8,454.1
N	4,825,765		489,832		825,719		2,038,745		1,471,469	
Real Wages	23.894	18.001	10.850	6.132	17.930	12.504	26.165	18.415	27.527	20.180
Hourly Paid Workers	0.588	0.492	0.930	0.256	0.695	0.460	0.533	0.499	0.527	0.499
Usual Work Hours	38.658	10.507	25.722	12.404	37.376	10.306	40.218	9.419	39.779	9.931
Industry	8.184	2.480	8.338	2.235	8.214	2.433	8.134	2.534	8.217	2.468
N	3,037,971		179,178		577,900		1,441,121		839,772	

Appendix Table 2. Effective Dates of Recreational Marijuana Laws and Recreational Dispensary Openings

State	Effective Date	Recreational Dispensary Opening
Alaska	2/24/2015	10/29/2016
Arizona	11/30/2020	
California	11/9/2016	1/1/2018
Colorado	12/10/2012	1/1/2014
D. C.	2/26/2015	2/26/2015
Illinois	1/1/2020	1/1/2020
Maine	1/31/2017	10/9/2020
Massachusetts	12/15/2016	11/20/2018
Michigan	12/6/2018	12/1/2019
Nevada	1/1/2017	7/1/2017
Oregon	7/1/2015	10/1/2015
Vermont	7/1/2018	
Washington	12/6/2012	7/8/2014

Source: Anderson and Rees (2021)

Appendix Table 3. TWFE Estimates of the Relationship Between RMLs and Prior Year Adult Marijuana Use

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel I: All Adults			
RML	0.0425***	0.0529***	0.0515***	0.0514***	0.0523***	0.0320***
	(0.00928)	(0.00578)	(0.00604)	(0.00604)	(0.00593)	(0.00608)
N	918	918	918	918	918	918
Pre-Treatment Mean of MJ Use	0.120	0.120	0.120	0.120	0.120	0.120
			Panel II: Younger Adults			
RML	0.0411***	0.0485***	0.0476***	0.0460***	0.0478***	0.0422*
	(0.00884)	(0.00999)	(0.0108)	(0.0113)	(0.0104)	(0.0165)
N	918	918	918	918	918	918
Pre-Treatment Mean of MJ Use	0.304	0.304	0.304	0.304	0.304	0.304
			Panel III: Older Adults			
RML	0.0437***	0.0538***	0.0522***	0.0523***	0.0530***	0.0305***
	(0.00942)	(0.00574)	(0.00598)	(0.00598)	(0.00598)	(0.00537)
N	918	918	918	918	918	918
Pre-Treatment Mean of MJ Use	0.0892	0.0892	0.0892	0.0892	0.0892	0.0892
Sociodemographic Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Substance Use Policies?	No	Yes	Yes	Yes	Yes	Yes
Social Welfare Policies?	No	No	Yes	Yes	Yes	Yes
Covid Controls?	No	No	No	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2019 National Survey of Drug Use and Health (NSDUH). Estimates in column (1) include controls for state and year FE, medical marijuana laws (MMLs), marijuana decriminalization or depenalization laws (MDLs), percentage black and Hispanic, and share of population with a college degree or higher. Column (2) adds controls for substance use policies, including cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, and beer tax. Column (3) adds controls for social welfare policies, including ACA Medicaid expansions, the higher of the state or federal minimum wage, maximum Earned Income Tax Credit refundable credit and Democratic governor. Column (4) adds state-level macroeconomic controls, including per capita income. Column (5) adds COVID controls which include new cases, deaths and shelter in place orders. The sample in Panel I is comprised of individuals ages 18-and-older. The sample in Panel II is comprised of individuals ages 18-to-25. The sample in Panel III is comprised of individuals ages 26-and-older. All regressions are weighted and standard errors are corrected for clustering at the state level.

Appendix Table 4. Exploration of Effects of RMLs on Self-Employment vs Employed by Others

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
		Panel I: Self- Employment		
RML	0.00039	-0.00004	-0.00227	-0.00228
	(0.00126)	(0.00127)	(0.00201)	(0.00139)
N	489,832	825,719	2,038,745	1,4714,69
Pre-treatment Mean Employment	0.006	0.029	0.081	0.096
		Panel II: Employed by Others		
RML	-0.00339	-0.00474	0.00261	0.00163
	(0.00933)	(0.00524)	(0.00285)	(0.00380)
N	489,832	825,719	2,038,745	1,471,469
Pre-treatment Mean Employment	0.355	0.692	0.706	0.571

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 5. Exploration of Earnings Effects for Hourly Paid Workers and Non-Hourly Paid Workers

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
	Panel I: Log (Wages) for Hourly Paid Workers			
RML	0.00314	-0.00032	-0.00637	0.00219
	(0.00516)	(0.00697)	(0.00634)	(0.00590)
N	167,184	403,662	779,692	449,724
Pre-Treat Mean Employment	10.47	14.88	19.71424	20.66574
	Panel II: Log (Wages) for Non-Hourly Paid Workers			
RML	0.03181	0.00253	-0.00320	0.00535
	(0.08839)	(0.01753)	(0.00910)	(0.01011)
N	11,994	174,238	661,429	390,048
Pre-Treat Mean Wage	14.30443	24.25327	33.03229	34.71641

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent, whether weekly working hours vary and the industry classification code. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 6. Robustness of Estimates in Table 3 to Use of Age-Specific Unemployment Rate as Macroeconomic Control

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	-0.00086	-0.00401	0.00233	-0.00026
	(0.00749)	(0.00414)	(0.00233)	(0.00346)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	0.00805	0.00605	0.00151	0.00923
	(0.00718)	(0.00712)	(0.00547)	(0.00491)
N	179,178	577,900	1,441,121	839,772
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.33
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p < .001 **p< .01 *p < .05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and age group specific unemployment rate[36]. Panels II also controls for whether weekly working hours vary and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

[36] Age group specific unemployment rates are calculated as the unemployment rate for the entire population minus the unemployment rate of the age group considered.

Appendix Table 7. Sensitivity of Effects of RMLs on Labor Market Outcomes to Dropping 2020 (Using only 2002-2019 CPS Data)

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	0.00055	-0.00164	0.00333	0.00130
	(0.00941)	(0.00462)	(0.00284)	(0.00407)
N	470,133	792,106	1,955,673	1,403,582
Pre-Treatment Mean Employment	0.362	0.722	0.788	0.668
			Panel II: Log (Wages)	
RML	0.00149	-0.00304	-0.00258	0.00563
	(0.00646)	(0.00856)	(0.00636)	(0.00501)
N	172863	555416	1383521	801998
Pre-Treatment Mean Hourly Wage	10.699	17.651	25.841	27.253
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether weekly working hours vary and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 8A. Sensitivity of Estimates in Table 3 to Inclusion of Lagged MML Effects and the Opening of Medical Marijuana Dispensaries

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	-0.00023	-0.00363	0.00211	-0.00037
	(0.00957)	(0.00548)	(0.00314)	(0.00470)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	-0.000171	-0.00411	-0.00867	0.00248
	(0.00672)	(0.00804)	(0.00583)	(0.00592)
N	179,178	577,900	1,441,121	839,772
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.33
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana, 1 to 3 years MMLs lags, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 8B. Sensitivity of Estimates in Table 3 to Inclusion of Controls for State Laws that Legalize Access to CBD Oil

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
			Panel I: Employment	
RML	-0.00289	-0.00449	0.00043	-0.00017
	(0.00871)	(0.00485)	(0.00294)	(0.00391)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.361	0.721	0.787	0.667
			Panel II: Log (Wages)	
RML	0.00232	0.00072	-0.00490	0.00528
	(0.00674)	(0.00804)	(0.00596)	(0.00505)
N	179,178	577,900	1,441,121	839,772
Pre-Treatment Mean Hourly Wage	10.74	17.74	25.93	27.33
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample in Panels I is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. The sample in Panels II is comprised of adults ages 16-to-64 who were employed at the time of interview. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana, 1 to 3 years MMLs lags, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Panel II also controls for whether the worker is paid hourly and the industry classification code. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 9. Heterogeneity in Effects of RMLs on Employment in the Agriculture Sector, by Age

	Ages 16-to-20	Ages 21-to-29	Ages 30-to-49	Ages 50-to-64
	(1)	(2)	(3)	(4)
RML	0.00003	0.00000	0.00282*	0.00188*
	(0.00083)	(0.00105)	(0.00108)	(0.00090)
N	489,832	825,719	2,038,745	1,471,469
Pre-Treatment Mean Employment	0.0069	0.0086	0.0103	0.0115
Controls				
State and Year Fixed Effects?	Yes	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2020 Current Population Survey Outgoing Rotation Groups. The sample is comprised of adults ages 16-to-64 who provided information on current employment at his/her main job. All models include state and year fixed effects, gender, age, age squared, years of school, and marital status of the respondent. State level observable controls include medical marijuana laws, marijuana decriminalization laws, ACA Medicaid expansions, cigarette tax, e-cigarette tax, statewide Tobacco-21 law, naloxone access laws, Good Samaritan laws, prescription drug monitoring programs, minimum wage, maximum Earned Income Tax Credit refundable credit, beer tax, shelter in place orders, new Covid cases and deaths, Democratic governor, and per capita income. Regressions are weighted and standard errors are clustered at the state level.

Appendix Table 10. TWFE Estimates of the Relationship Between RMLs and Prior Month Adult Marijuana Use by Whether Recreational Dispensary Open

	(1)	(2)	(3)
	Ages 18 and Older	Ages 18-to-25	Ages 26 and Older
RML with Dispensary Open	0.0438***	0.0497***	0.0431***
	(0.00499)	(0.00889)	(0.00510)
RML without Dispensary Open	0.0204***	0.0258***	0.0196***
	(0.00281)	(0.00606)	(0.00304)
N	918	918	918
Pre-Treatment Mean of MJ Use	0.0725	0.184	0.053
Controls			
State and Year Fixed Effects?	Yes	Yes	Yes
Observable Controls?	Yes	Yes	Yes

***p<.001 **p<.01 *p<.05

Notes: Estimates are generated via ordinary least squares (OLS) using data drawn from the 2002 to 2019 National Survey of Drug Use and Health (NSDUH). All models include state and year FE, medical marijuana laws (MMLs), marijuana decriminalization or depenalization laws (MDLs), percentage black and Hispanic, good Samaritan alcohol and drug laws, naloxone and PDMP laws, the higher of the state or federal minimum wage, EITC, ACA expansion, beer, e-cig, and cigarette taxes, per capita income, new Covid cases and deaths, and shelter in place orders. Regressions are weighted and standard errors are clustered at the state level.