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Is Access to Medical Marijuana a Disamenity?

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Abstract

Based on panel data for US states for the period 2000-2015 we find significant evidence that medical marijuana laws reduce the percentage of families with children living in a state where the law was passed. This suggests that the legalization of medical marijuana can be a source of disamenities and produce unintended effects in terms of household decisions.

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1. Introduction

We study whether states that passed laws to provide access to marijuana use for medical purposes also suffer from unintended effects in terms of household patterns. It may be claimed that these laws may change family migration patterns at the state level by providing incentives to move out of states with enacted marijuana laws or even make couples re-evaluate expected family size even if when not relocating to other states. In spite of this being a first-order externality it has not been studied in the literature, especially given the fact there is considerable research that shows that medical marijuana laws (MMLs) while intended to benefit individuals for medical reasons, can spillover to other non-medical uses. For instance, there is a growing empirical evidence of a positive impact of MMLs on adult use (Pacula *et al*. 2015) and, in particular, on teenagers' marijuana initiation (Wen *et al*. 2015). Furthermore, there is evidence of increased marijuana-related arrests and admissions to rehabilitation facilities (Chu 2014), which also has the potential of producing spillovers to other areas (e.g., Anderson *et al*. 2013).

The reasons why medical marijuana laws may negatively impact the size of households are at least three. First, there may still be a strong prejudice that marijuana is a gateway to harder drugs. While the passing of MMLs may foster a more favorable support for marijuana consumption in general, the notion that marijuana is a "gateway drug" is still a controversial and highly debated issue in the academic literature (Millhorn *et al*. 2009) and in the news.[1] Because of the spillover effects on recreational use that contribute to the realization of negative health and social outcomes, the concern that marijuana can be a "gateway drug" also applies to medical marijuana. Second, marijuana has historically been associated with high violent crime, which brings about safety issues to families. (for a review, see Macleod *et al*. 2004). There is evidence that marijuana consumption is positively association with property and income-producing crime (Pacula and Kilmer 2003), while it may be negatively correlated with homicide and assault rates (Morris *et al*. 2014). Third, there may be mistrust to the fact that marijuana use may spill to other groups, attracting undesirable individuals from certain segments of the society. As a result, couples that seek to form families may not be so inclined to move to states with easier marijuana access. In fact, it may be possible that couples living in states with enacted marijuana laws may be inclined to migrate out of the state. In addition, couples with no interest in having children may select themselves to moving to such states or even yet, families with children may decide to move away from such states. In all, the ultimate impact would be the same namely the size of the family in states with enacted marijuana laws would tend to decrease.

2. Data

We use the most restrictive outcome variable possible to study our question namely, the percent of families with own children under the age of eighteen, which comes from the American Community Survey at the state level. From this source, we also use these controls:

[1] Discussions appeared on both the Washington Post and the New York Times: https://www.washingtonpost.com/news/wonk/wp/2016/01/06/the-real-gateway-drug-thats-everywhere-and-legal/?utm_term=.cc8cf9fb6c15 and https://www.nytimes.com/roomfordebate/2016/04/26/is-marijuana-a-gateway-drug/marijuana-has-proven-to-be-a-gateway-drug, both accessed on 04/24/2017. The National Institute on Drug Abuse also reports findings consistent with the idea of marijuana being a gateway drug. https://www.drugabuse.gov/publications/research-reports/marijuana/marijuana-gateway-drug, accessed on 04/24/2017.

unemployment rate, educational attainment, and racial composition as well as beer excise taxes from the Tax Foundation to deal with potential coincidence of MML implementation (Wen *et al*. 2015). We use the state-level annual panel data for 2000 to 2015. Variables are described in Table 1.

Table 1 Description of variables

Variable	Mean (S.D.)	Description
	A. Outcome Variables	
% families with children	45.221 (3.274)	Percentage of families with own children under age 18
Average number of own children	0.868 (0.093)	
Number of families/1000	1466.611 (1564.646)	Absolute N. of families, thousands
	B. Medical Marijuana Law Variables	
MML initial year	0.025 (0.154)	Indicator for the first effective year of state MMLs
MML indicator	0.252 (0.435)	Indicator for having a MML in a given year
	C. Economic and Demographic variables	
Migration rate	-0.175 (10.686)	Net migration rate
Total population	5872 (6594)	Total population by state-year, thousands
Unemployment rate (%)	6.459 (2.439)	State unemployment rate
% high school graduates	29.944 (4.208)	Percentage of adults with a high school degree
% people with college experience	21.238 (3.263)	Percentage of adults with college experiences
% college graduates	24.960 (3.697)	Percentage of adults with a bachelor's degree
% people with graduate degrees	10.064 (3.474)	Percentage of adults with graduate degrees
% White	78.419 (13.857)	Percentage of White ethnicity
% African-Americans	11.035 (11.271)	Percentage of African-American ethnicity
% Indian	1.526 (2.748)	Percentage of Indian ethnicity
% Asians	4.577 (4.458)	Percentage of Asian ethnicity
% Pacific	.3156 (1.364)	Percentage of Pacific ethnicity
% Hispanic	9.706 (9.681)	Percentage of Hispanic origin
% Other races	3.160 (3.155)	Percentage of other origin
Beer excise tax ($)	0.285 (0.245)	State beer excise tax per gallon

Note: A variable named MML initial year is one in a given year if medical marijuana is legalized in the first half of the year; if medical marijuana is legalized in the second half of the year, MML initial year becomes one in the next year.

3. Empirical Strategy

We apply difference-in-differences (DID) as follows:

$$Y_{st} = \alpha + \sum_{k=-3}^{K=4} \beta_k MML_{stk} + \mathbf{X}_{st}\gamma + \nu_s + \omega_t + \varepsilon_{st} \quad (1)$$

where s indexes states and DC, and t indexes years. Y_{st} is our outcome variable, and $\mathbf{X}_{st}$ is a vector of covariates. ν_s and ω_t are state and year fixed effects, respectively. Our independent variable of interest is MML_{st}, which is an indicator for the effective year of MMLs where subscript k indicates either k years before the first effective year or k years after the effective

year. Our treatment dummies for MMLs come from Wen et al. (2015) and additional sources.[2] By adding the contemporary MML indicator as well as its leads and lags as seen in (1), we investigate dynamic responses to MMLs.

As it is well known, a key assumption for unbiased DID estimates is equal preexisting trends in outcome variables between MML states and non-MML states. Without anticipation effect, this assumption would be supported by $\beta_k = 0$ for $k < 0$. However, the anticipation effect is likely to exist, so we interpret β_k for $k < 0$. We also include state and year fixed effects. In all regressions we control for total population for each corresponding year and state. Standard errors are clustered at the state level.

4. Results

Table 2 reports an event-study of 'percent of families with children' to MMLs. We: (a) show the full sample without controlling for the states that also legalized recreational use of marijuana -columns 1 and 2;[3] (b) remove observations for states with recreational use -columns 3 and 4, (c) keep states from (b) but restrict sample to 2000-2011 -columns 5 and 6, and (d) use the full sample including a dummy equal to one for states since the passing of the legalization of recreational use and zero otherwise -columns 7 and 8. We show results with and without state-specific time trends. We include linear state-specific time trends in order to correct for potential bias in case unobservables may be correlated with the timing of MMLs.[4]

We find a negative and significant impact of MMLs on the percentage of families with children for specifications including state-specific time trends. MML states do not show significantly different time trend from non-MML states before implementation confirming DID validity. However, our results also show a significant anticipation effect one year before MMLs were enacted. The MMLs effect tends to increase over time, but it stabilizes after the fourth year. Results across all specifications show that MMLs decrease the percent of families with children by 0.6 to 0.7 percentage points the year before the law is passed up to 1.4 to 1.7 percentage points the third year after the law was passed.

Table 3 shows the effect of the passing of the law obtained by estimating the model presented in equation (1) where instead of including dummy variables modeling how the treatment effects develops in time, $\sum_{k=-3}^{K=4} \beta_k ML_{stk}$, we include only one dummy variable taking value equal to one for States that passed the law from the year the law became effective and the following years, ML_{st}. This allows us to estimate the overall effect of the legalization of medical marijuana. We find that overall the legalization of medical marijuana decreases the presence of families with children by 0.4 to 0.9 percentage points. This result is robust for all the set of sample specifications, (a) through (d), used before. As for the dynamic results, Table 2, we prefer the specification that controls for state with recreational marijuana law.

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[2] Additional data come from http://norml.org and http://medicalmarijuana.procon.org.

[3] Colorado and Washington in 2012, Alaska and Oregon in 2015.

[4] It should be noticed that adding state-specific trend may remove variation that could be useful to identify a policy that varies by state-year. Wolfers (2006) suggests caution using panel-specific trends in difference-in-differences analysis because this may lead to misleading results since such trends may pick up the effects of a policy when such effects may develop in time and not just preexisting trends.

Table 2 Event-Study: Medical Marijuana Laws on Percentage of Families with Children

Sample	Full sample		No states legalizing recreational marijuana		Year < 2012		Full sample controlling for state with recreational marijuana law	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MML	-0.205	-0.196	-0.307	-0.189	-0.161	-0.167	-0.217	-0.197
3-year lead	(0.218)	(0.212)	(0.212)	(0.226)	(0.262)	(0.231)	(0.218)	(0.212)
MML	-0.290	-0.367	-0.383*	-0.374	-0.066	-0.124	-0.302	-0.368
2-year lead	(0.223)	(0.252)	(0.221)	(0.266)	(0.283)	(0.302)	(0.223)	(0.253)
MML	-0.682**	-0.627**	-0.727***	-0.593*	-0.672*	-0.529	-0.700**	-0.628**
1-year lead	(0.270)	(0.307)	(0.244)	(0.325)	(0.391)	(0.398)	(0.268)	(0.307)
MML	-0.728**	-0.719**	-0.864***	-0.752**	-0.459	-0.340	-0.752***	-0.721**
initial year	(0.274)	(0.326)	(0.270)	(0.352)	(0.429)	(0.419)	(0.276)	(0.329)
MML	-0.880**	-0.853**	-1.085***	-0.895**	-0.716	-0.369	-0.908**	-0.855**
1-year lag	(0.348)	(0.395)	(0.346)	(0.406)	(0.451)	(0.569)	(0.349)	(0.398)
MML	-0.914**	-0.944	-1.211***	-1.081*	-0.837*	-0.530	-0.946**	-0.947
2-year lag	(0.381)	(0.569)	(0.386)	(0.624)	(0.484)	(0.822)	(0.383)	(0.574)
MML	-1.571***	-1.477***	-1.703***	-1.402***	-1.647***	-1.130	-1.603***	-1.481***
3-year lag	(0.373)	(0.480)	(0.352)	(0.518)	(0.484)	(0.717)	(0.376)	(0.489)
MML	-1.537***	-1.131**	-1.669***	-0.968	-1.425***	-0.897	-1.562***	-1.141**
4-year lag+	(0.369)	(0.554)	(0.379)	(0.625)	(0.451)	(0.820)	(0.368)	(0.567)
State time trends	N	Y	N	Y	N	Y	N	Y
Observations	816	816	752	752	612	612	816	816
R-squared	0.867	0.904	0.867	0.907	0.799	0.839	0.867	0.904

Note: All regressions include controls in Table 1 and state and year fixed effects. Regressions control for total population by state/year. The dummy variable denoting more than 3 years before the law went into effect is excluded to avoid perfect collinearity. Standard errors in parentheses are clustered at the state level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. R-squared is the R-squared for the within estimator.

Table 3 Impact of Medical Marijuana Laws on Percentage of Families with Children

Sample	Full sample		No states legalizing recreational marijuana		Year < 2012		Full sample controlling for state with recreational marijuana law	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MML	-0.771***	-0.439*	-0.905***	-0.509**	-0.624**	-0.024	-0.786***	-0.439*
	(0.219)	(0.250)	(0.216)	(0.252)	(0.289)	(0.259)	(0.221)	(0.252)
State time trends	N	Y	N	Y	N	Y	N	Y
Observations	816	816	752	752	612	612	816	816
R-squared	0.861	0.901	0.862	0.905	0.789	0.836	0.861	0.901

Note: All regressions include controls in Table 1 and state and year fixed effects. Regressions control for total population by state/year. Standard errors in parentheses are clustered at the state level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. R-squared is the R-squared for the within estimator.

In the introduction we argued that households may be affected by MMLs because they may react by changing migration patterns, e.g., moving out of states with enacted marijuana laws or even by re-evaluating expected family size even if when not relocating to other states. To

evaluate the first claim,[5] we re-estimate equation (1) by including migration rate among other explanatory variables for our preferred specification, i.e., controlling for state with recreational marijuana laws. Data for migration rate also come from the American Community Survey (ACS) and cover the period 2005-2015 (data before 2005 are not available). Results reported in Table 4 and 5, column (1) and (2), are consistent to those included in Table 2 and 3. However, controlling for migration rate reduces the effect of MMLs in the year preceding the law became effective. This indicates that part of the anticipation effect is indeed due to outflow migration of families with children.[6] We also estimate the effect on the absolute number of families. Results are presented in Table 4 and 5, column (3) and (4). We find no evidence that the legalization of medical marijuana affected the total number of families, over time or overall. This could indicate that either while some families with children leave, families without children move to the legalizing states, so the net effect is zero, or that families in legalizing states have fewer children that in non-legalizing states. We investigate the latter next.

Table 4 Event-Study: Medical Marijuana Laws on the percentage of families with children (controlling for migration rate), the absolute number of families/1,000, and the average number of own children within a family; controlling for state with recreational marijuana law

	Percent of families with children		Absolute number of families/1,000		Average number of own children within a family	
	(1)	(2)	(3)	(4)	(5)	(6)
MML	-0.183	0.267	-12.605	-2.466	-0.016**	-0.004
3-year lead	(0.197)	(0.255)	(8.409)	(4.446)	(0.007)	(0.007)
MML	-0.291	0.213	-12.834	-1.894	-0.019**	-0.006
2-year lead	(0.241)	(0.391)	(9.218)	(6.297)	(0.008)	(0.007)
MML	-0.444**	0.259	-5.971	1.856	-0.035***	-0.017*
1-year lead	(0.212)	(0.439)	(9.505)	(7.807)	(0.008)	(0.010)
MML	-0.910***	-0.010	-7.750	1.244	-0.034***	-0.015
initial year	(0.238)	(0.477)	(11.933)	(8.776)	(0.008)	(0.010)
MML	-1.027**	0.064	5.168	7.211	-0.041***	-0.021*
1-year lag	(0.384)	(0.478)	(10.594)	(8.504)	(0.009)	(0.012)
MML	-1.063**	0.143	1.928	5.355	-0.045***	-0.025*
2-year lag	(0.402)	(0.732)	(14.676)	(9.521)	(0.010)	(0.013)
MML	-1.595***	-0.380	0.698	0.441	-0.048***	-0.027**
3-year lag	(0.367)	(0.774)	(14.175)	(9.958)	(0.008)	(0.012)
MML	-1.521***	-0.007	10.662	2.101	-0.054***	-0.029**
4-year lag+	(0.422)	(0.928)	(15.808)	(11.373)	(0.009)	(0.012)
Migration rate	-0.003	-0.012**				
	(0.007)	(0.005)				
State time trends	N	Y	N	Y	N	Y
Observations	561	561	816	816	816	816
R-squared	0.839	0.906	0.912	0.961	0.775	0.844

Note: All regressions include controls in Table 1 and state and year fixed effects. Regressions control for total population by state/year. Standard errors in parentheses are clustered at the state level. * p < 0.1, ** p < 0.05, *** p < 0.01. R-squared is the R-squared for the within estimator.

[5] We thank a referee for suggesting this additional analysis.

[6] Including state-specific time trend the change in the percentage of families with children is explained mostly by migration. It should be noticed though that adding state-specific trends asks a lot to the data and because migration rate is not available for the entire sample period we lose considerable statistical power.

Table 5 Impact of Medical Marijuana Laws on the percentage of families with children (controlling for migration rate), the absolute number of families/1,000, and the average number of own children within a family; controlling for state with recreational marijuana law

	Percent of families with children		Absolute number of families/1,000		Average number of own children within a family	
	(1)	(2)	(3)	(4)	(5)	(6)
MML	-0.837***	-0.275	8.081	7.698	-0.031***	-0.009
	(0.231)	(0.167)	(5.408)	(8.204)	(0.006)	(0.006)
Migration rate	-0.004	-0.013**				
	(0.007)	(0.005)				
State time trends	N	Y	N	Y	N	Y
Observations	561	561	816	816	561	561
R-squared	0.835	0.904	0.932	0.908	0.754	0.839

Note: All regressions include controls in Table 1 and state and year fixed effects. Regressions control for total population by state/year. Standard errors in parentheses are clustered at the state level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. R-squared is the R-squared for the within estimator.

We estimated the effect of MMLs on the average number of children in the family. Table 4 and 5, column (5) and (6) present the results. We find evidence that legalizing marijuana decreased the number of children. The effect, although small, becomes stronger in time stabilizing between 0.03 and 0.05 fewer children after four years from the legalization.[7] Together with the other results this suggests that families decided to migrate out of legalizing states before legalization became effective and those remaining had fewer children. This confirms our initial intuition that was expressed in the first paragraph of the manuscript.

5. Conclusions

We find evidence that medical marijuana laws reduce the share of families with children in states with such legislation and thus provide evidence that they may be a source of disamenity and produce unintended effects in household decisions.

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[7] Controlling for migration yields similar results.

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