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ARTICLE

Lobbying, learning and policy reinvention: an examination of the American States' drunk driving laws

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Abstract

Scholars have consistently shown that learning of successful policies in other states leads to higher likelihood of policy adoption. This study extends this finding two ways. First, policy learning can also lead to more comprehensive adoption of successful policies. Second, the effect of policy learning on policy comprehensiveness is conditional on lobbying by interest groups, an alternative source of information about policy success. To test these hypotheses, we conduct a directed dyad-year analysis using a dataset on American state drunk driving regulations from 1983 to 2000. The results show that more comprehensive policy adoption by states is positively related to policy success in other states when lobbying by Mothers Against Drunk Driving (MADD) is relatively low. Moreover, lobbying by MADD increases policy comprehensiveness when policy success is relatively low. This study advances the literature by examining the conditional effects of lobbying on the relationship between policy learning and policy reinvention.

Keywords drunk driving law; lobbying; policy diffusion; policy learning; policy reinvention

Introduction

Policy diffusion studies have found consistently that policy success is positively associated with state adoption of policy innovations, which provides evidence for policy learning (Volden 2006; Gilardi and Füglister 2008; Gilardi *et al.* 2009; Shipan and Volden 2014; Butler *et al.* 2015; Nicholson-Crotty and Carley 2016). While many policy diffusion studies treat policies being diffused as an undifferentiated whole, policy reinvention scholars argue that policies can be changed by later adopters in the diffusion process (Clark 1985). This critical difference raises the question of whether policy learning works as a mechanism of policy reinvention. Mooney and Lee (1999) propose that policy success can influence policy

reinvention. Nonetheless, empirical tests of this proposition have been absent in the literature.

Moreover, both policy diffusion and policy reinvention studies have examined internal and external factors of the policy-making process. Yet, except for a few cases (e.g. Boushey 2010; Garrett and Jansa 2015), less is known about how such nongovernmental actors as interest groups interact with policymakers to influence policy adoption. Equipped with resources to collect policy-relevant information, both interest groups and policymakers have ideas about whether to adopt a policy and what policy to adopt. Interest groups can lobby policymakers by making political contributions or providing policy-relevant information. In addition to influencing policy adoption, this may change the incentives and strategies for policymakers to learn about policy innovations in other states. While several studies have examined the roles of interest groups in the policy diffusion process (Balla 2001; Haider-Markel 2001; Garrett and Jansa 2015), it remains unclear whether interest groups influence policy reinvention and to what extent interest groups may change the calculus of policy learning by policymakers.

This study investigates the impact of policy learning on policy reinvention and how lobbying moderates this impact. We focus on one key dimension of policy reinvention, policy comprehensiveness. In the policy diffusion process, lobbying by interest groups can change the incentives of policymakers to learn and what information to learn. Interest groups can change legislators' incentives to learn by making political contributions or providing policy-relevant information. Moreover, this policy-relevant information can change the composition of information that policymakers may obtain from lobbying or their own learning. As lobbying increases, legislators' learning of policy success information can have either a stronger or weaker impact on policy reinvention. The empirical tests with state policies on driving under influence (DUI) show that learning of policy success from other states leads to more comprehensive adoption when lobbying by Mothers Against Drunk Driving (MADD) is relatively low. Lobbying by MADD increases policy comprehensiveness when policy success in other states is relatively low.

This study enhances our understanding of policy-making processes in several ways. First, it provides empirical evidence that policy learning works as a mechanism for policy reinvention as well as policy diffusion. Information about policy success not only influences the adoption of a single policy but also changes in the policies being diffused. By focusing on a substantively different policy issue, state drunk driving laws, this study extends the external validity of previous findings of policy learning as a mechanism of policy diffusion. Second, it shows that interest groups influence policy reinvention. This adds to the previous finding that interest groups influence policy diffusion (Balla 2001; Haider-Markel 2001; Garrett and Jansa 2015). Third, it shows that interest groups do interact with policymakers in policy diffusion processes. Lobbying by interest groups substitutes for learning of policy success information in other states by policymakers. This indicates that the influence of interest groups constitutes an important condition under which policy learning occurs. This also suggests that interest groups play a significant role in determining whether and how states serve as "policy laboratories" (Volden 2006; Karch 2007).

Previous research

Policy reinvention is a process in which later adopters make changes to a policy innovation. Rogers (2003, 180) defined policy reinvention as "the degree to which an innovation is changed or modified by the user in the process of its adoption and implementation." A key dimension of the change is how a policy shrinks or expands in its scope. As Rice and Rogers (1980, 501) put it, "an innovation is often really a bundle of components; it is possible to adopt some components and change or reject others." In many policy reinvention studies, the dependent variable is a characteristic such as the "comprehensiveness" or "intensiveness" of policies being diffused (Clark 1985; Glick and Hays 1991; Hays 1996a; Kim and Jennings 2012). Policy comprehensiveness can also be interpreted as the degree of stringency or generosity of policies. Scholars have examined the factors that move policy reinvention toward or away from comprehensiveness. Among these factors are public support (Mooney and Lee 1999) and level of controversy of policy issues (Hays 1996b). Nonetheless, there has been no empirical investigation of the effects of policy learning on policy reinvention.

Previous studies on policy learning and policy diffusion have focused on the effects of policy success (Volden 2006; Gilardi and Füglister 2008; Gilardi *et al.* 2009; Shipan and Volden 2014; Butler *et al.* 2015; Nicholson-Crotty and Carley 2016). They consistently find that policy success of earlier adopters is positively correlated with policy diffusion. This correlation indicates the existence of policy learning, which by itself is unobservable. As Shipan and Volden (2014, 360) argued, "the clearest evidence of learning arises when the *success* of policies helps to determine whether or not they spread from one government to another." In addition, this literature has recently converged to examine the conditional effects of policy learning on policy diffusion. While scholars have focused on such conditions as ability to learn (Shipan and Volden 2014; Nicholson-Crotty and Carley 2016), this study examines lobbying by interest groups as an alternative source of policy-relevant information for policymakers.

Interest groups have been found to influence policy diffusion. Boushey (2010) proposes a conceptual framework in which interest groups may promote policy diffusion through venue shopping and issue framing. Policy diffusion occurs when interest groups within a network mimic successful strategies of others. Treating interest-group networks as the vector of policy diffusion, this framework does not address specifically the interaction between interest group behaviours and learning by policy makers. In addition, empirical studies show that national professional associations (Balla 2001) and campaign by interest groups (Haider-Markel 2001) increase states' adoption of policy innovations. Garrett and Jansa (2015) show that interest groups play a central role in policy diffusion networks by providing model legislation. These studies identify the provision of policy information or expertise as a mechanism through which interest groups influence policy diffusion. However, they do not examine how this mechanism interacts with policy learning.

Learning and policy reinvention

Policy learning is a key mechanism of policy diffusion (Shipan and Volden 2008). Theoretically, policy learning starts with a policy experiment that reveals information about the relation between a policy and its consequences. Callander (2011)

modelled learning as a process of searching by trial and error. Policymakers typically have imperfect knowledge about how policies map into outcomes. Specifically, "they know which policies are more likely to produce liberal (or conservative) outcomes even if they do not know which policies do produce outcomes in that direction" (Callander 2011, 646). To know the realized outcomes of a policy, policymakers must experiment with that policy. Whether successes or failures, the policy experimentation reveals invaluable information about policy outcomes. This information becomes a public good so that other policymakers who have not experimented can learn it.

By policy experiment, policymakers can accumulate factual knowledge about how a policy maps into its consequences. This helps them know more about the mapping, but never everything about the mapping (Callander 2011). It is impossible for policymakers to pin down the causal effect of a policy on a *single* outcome, no matter whether they experiment with that policy. If multiple policy innovations generate the same or similar outcomes (Shipan and Volden 2014), policymakers who have not experimented can at best learn which bundle of policy components are correlated with which group of policy outcomes.

Thus, the output of policy learning is policy reinvention in the form of multiple policy components. Because it is infeasible for policymakers to learn the exact outcome of a policy, it is unrealistic to model the output of policy learning as the adoption of a single policy. Though many studies measure the output of policy learning with a binary variable of policy adoption, that variable captures indirectly multiple policy changes (Volden 2006; Gilardi and Füglister 2008; Gilardi *et al.* 2009; Boehmke 2009b; Shipan and Volden 2014; Kreitzer 2015). This is consistent with the proposition that policy learning happens at the aggregate level of a group of policy components instead of any single policy component. Moreover, conceptualizing the output of policy learning as policy reinvention has the advantage of explicitly modelling multiple policy changes.

If policymakers learn from policy innovations to adopt successful policy components, policy success will have a positive effect on policy reinvention. Observing which set of policies is associated with better outcomes, policymakers can "see which set of policies is most likely to be effective at home and then adopt only those policies" (Shipan and Volden 2014, 361). Given that the output of policy learning is to adopt a larger number of successful policy components, policies will become more comprehensive in the diffusion process (Hays 1996b; Mooney and Lee 1999). Thus, the first hypothesis follows.

Policy Learning Hypothesis: *Policies become more comprehensive over time when earlier adoptions show policy success.*

Lobbying and policy learning

Lobbying is attempts by interest groups to influence policy making. If lobbying succeeds, it should influence policy reinvention in the direction preferred by interest groups. Previous studies (Balla 2001; Haider-Markel 2001; Garrett and Jansa 2015) have found that interest groups influence policy diffusion. In parallel, interest groups may influence the comprehensiveness of policy reinvention if they can influence the adoption of individual policy components. It depends on the policy preferences of interest groups whether lobbying increases or decreases policy

comprehensiveness. If interest groups prefer legislators to adopt more policy components, lobbying should increase policy comprehensiveness. If interest groups prefer legislators to adopt fewer components because they stand against the policy, successful lobbying should decrease policy comprehensiveness. Thus, the Lobbying Hypothesis follows.

Lobbying Hypothesis: *Lobbying increases policy comprehensiveness if interest groups lobby for the policy and decreases policy comprehensiveness if interest groups lobby against the policy.*

As Grasse and Heidbreder (2011) summarize, interest groups play three roles in influencing policy making, including political contributors, information providers and legislative subsidizers. Each role has significant implications for interaction between lobbying by interest groups and policy learning by legislators in the policy diffusion process. First, interest groups make political contributions to legislators in exchange for favourable policies or access to legislators. According to one view, a political contribution is to "buy" legislative votes (Langbein and Lotwis 1990; Stratmann 1991; Stratmann 1998; Stratmann 2002). Another view, in contrast, maintains that a political contribution is to "buy" access to legislators (Austen-Smith 1995; Lohmann 1995; Cotton 2012). Access then allows interest groups to provide policy-relevant information to influence legislative decisions.

In either case, interest groups can influence policy learning by legislators. On one hand, if political contributions do exchange for favourable policies, they can substitute for policy learning by legislators. If legislators have decided to adopt a policy under the influence of political contributions, they would have weaker incentives to learn from policy innovations in other states. At one extreme, if political contributions dictate adoption of a policy by legislators, policy learning would become irrelevant because legislators would adopt that policy as preferred by interest groups regardless of policy success in other states. This suggests that information about policy success in other states should have smaller impact on policy reinvention as the influence of political contributions becomes stronger. On the other hand, if political contributions only exchange for access to a legislator, they should influence policy learning indirectly through their impact on informational lobbying. Existing models of lobbying generally predict that political contributions increase lobbying by interest groups (Austen-Smith 1995; Lohmann 1995; Cotton 2012). Thus, the impact of political contributions on policy learning depends on how informational lobbying influences policy learning.

Second, in conventional models of informational lobbying, an interest group provides policy-relevant information to persuade legislators to adopt its favoured policies. These models share the same proposition that interest groups provide information to inform legislators, to update their policy beliefs, or to change their policy preferences (Austen-Smith 1993; Austen-Smith and Wright 1994; Bennedsen and Feldmann 2006; Schnakenberg 2017). Lobbying is thus persuasion with information provision. If this proposition holds, informational lobbying can influence policy learning by legislators through changing their incentives to learn and what to learn. Indeed, as Karch (2007, 32) argues, legislators often face time constraints in policy diffusion and prefer the information from interest groups, which "generate large returns on minimal time investments." Like political contributions, information provided by interest groups can substitute for information

search by legislators. If interest groups succeed in convincing a legislator to adopt a policy they prefer, that legislator should have weaker incentives to learn from policy success in other states on their own. When informational lobbying has a predominant impact on policy adoption, policy learning by legislators themselves would become redundant because they would have known whether they want to adopt a policy and what that policy will be.

This does not necessarily, however, lead to less importance of policy success information. Unlike political contributions, informational lobbying provides legislators with an alternative source of policy-relevant information to their own information search. Even if they reduce their own information search, legislators may still obtain policy success information from lobbying by interest groups. To the extent that policy success information is used by interest groups to persuade legislators, it can become either more or less important for policy reinvention. Both informational lobbying and policy learning can provide legislators with multiple types of information. Interest groups may provide legislators with policy success information along with other information about a policy. For example, they may provide such information as the level of constituent support and distribution of costs and benefits for a policy. Similarly, besides policy success, policymakers may learn about the desitability of policy goals or the viability of policy instruments, and political or policy outcomes of policy innovations (Gilardi 2010). If it happens that interest groups manage to convince legislators with predominantly policy success information, policy success should have larger impact on policy reinvention as informational lobbying increases. On the other hand, if policy success information only constitutes a small proportion in informational lobbying, policy success should become less important in policy reinvention as informational lobbying increases.

Third, while the models of informational lobbying treat lobbying as persuasion, Hall and Deardorff (2006) model lobbying as legislative subsidy. To make progress on multiple policy issues at a time, legislators maximize utility under the budget constraints of information, service or expertise. For legislators, interest groups serve as a "service bureau" or "adjuncts to staff" by providing issue-specific, customized information on a policy issue. Legislators' budget constraints are thus relaxed and they are induced to make more progress on that policy issue than on others.

In the model of lobbying as legislative subsidy, interest groups can provide policy-relevant information or resources to obtain such information as preferred by legislators. In either case, legislators can choose how much to learn about policy success as they prefer when additional resources become available due to lobbying. These additional resources may increase or decrease learning of policy success by legislators. If legislators prefer more information about policy success but have no sufficient resources to learn without the legislative subsidy from lobbying, they should learn more about policy success when their budget constraints are relaxed by lobbying. Consequently, policy success information should have a larger impact on policy reinvention as lobbying increases. On the other hand, if legislators prefer less policy success information and a balanced bundle of multiple types of policy information, they may diversify their information bundle by reducing the proportion of policy success information with additional resources from lobbying. This may reflect the possibility that, without lobbying, policy success information is essential for legislators while other information is too "expensive" to obtain under

Table 1. Three modes of lobbying and legislators' learning of policy success

Modes of Lobbying	Interaction with Policy Learning	Learning of Policy Success
Political contributions	As contributions become more influential, policy learning becomes less relevant	Less
Information provision	Interest groups provide mostly policy success information to legislators	More
	Interest groups provide mostly other information than policy success to legislators	Less
Legislative subsidy	Receiving legislative subsidy, legislators learn more about policy success	More
	Receiving legislative subsidy, legislators learn less about policy success	Less

Source: Authors' summary.

their budget constraints. In this case, policy success information should have a smaller impact on policy reinvention as lobbying increases.

Therefore, lobbying can influence both legislators' incentives for policy learning and what information to learn in policy diffusion process. Table 1 summarizes the three modes of lobbying, interaction with policy learning and effects on the role of policy success in policy reinvention. Specifically, information about policy success in other states can become more important for policy reinvention in two cases. First, per the models of informational lobbying as persuasion, interest groups may provide mainly policy success information to persuade legislators and thus make such information more important for policy reinvention. Since political contributions can increase informational lobbying, this may reflect both a direct effect of informational lobbying and an indirect effect of political contributions. Second, in the model of lobbying as legislative subsidy, legislators can choose to learn more about policy success as more resources become available. Thus, lobbying and policy learning reinforce each other. The Lobbying, Learning and Conditional Hypothesis A follows.

***Lobbying, Learning and Conditional Hypothesis A*:** *Policy success has a stronger effect on policy comprehensiveness when lobbying is relatively high; lobbying has a stronger effect on policy comprehensiveness when policy success is relatively high.*

Under other conditions, the three groups of lobbying models imply that policy success information can become less important in policy reinvention. If political contributions succeed in exchanging for policies favoured by interest groups, legislators should learn less about policy success information or any policy-relevant information. Per models of informational lobbying as persuasion, policy success information should become less important if interest groups convince a legislator to adopt their favoured policies with a bundle of information in which policy success information is marginal. In the model of lobbying as legislative subsidy, legislators can choose to learn less of policy success information and more of other

information to diversify their information mix given additional resources to learn from lobbying. Therefore, lobbying and policy success are substitutes for each other. The Lobbying, Learning and Conditional Hypothesis B follows.

Lobbying, Learning and Conditional Hypothesis B: *Policy success has a stronger effect on policy comprehensiveness when lobbying is relatively low; lobbying has a stronger effect on policy comprehensiveness when policy success is relatively low.*

State DUI laws and MADD

This study uses state DUI laws as an empirical setting to test the three hypotheses of lobbying, learning and policy reinvention. The data on these DUI laws come from the "State Health Policy Research Dataset: 1980–2010," a data set released by the Interuniversity Consortium for Political and Social Research (Macinko *et al.*, 2014). The data contain information of the year when states adopted alcohol and drunk driving laws from 1980 to 2010. Using this data set, Macinko and Silver (2015) found that first-time and second-time adoptions of DUI laws by a state are affected by its neighbouring states' adoption. This effect may result from either policy diffusion or similar responses to regional policy problems (Volden *et al.* 2008). Focusing on policy learning, the current study is in a better position to examine the diffusion of state DUI laws.

In the framework of policy reinvention, each state DUI law is treated as a policy component of the whole state DUI policy. Multiple policy components show the range of policy measures that state governments take to regulate drunk driving behaviour, such as minimum fines, zero tolerance laws and minimum prison time. Each policy component is coded as a dummy variable; 1 indicates adoption and 0 indicates the lack of adoption. Each policy component is assigned equal weight. From 1982 to 2000, more states have adopted each policy component. Table A1 in Appendix 1 shows the eight components of state DUI policy and corresponding variable names.

To test the Lobbying and Learning Hypotheses, this study focuses on lobbying by MADD on DUI policies. Since 1980, MADD has been lobbying for stricter DUI legislation and is recognized as one of the major forces behind almost all important state DUI laws (Fell and Voas 2006). While other organizations, such as Students Against Driving Drunk and Alliance Against Intoxicated Motorists, also lobby for DUI regulation, MADD remains "the most prominent and powerful" among them (Marshall and Oleson 1994). Since these organizations belong to the same coalition with MADD, focusing on MADD[1] alone might underestimate the overall impact of interest groups advocating for DUI regulation.

On the other hand, interest groups in the alcohol industries, such as National Beer Wholesalers Association and American Beverage Institute, may lobby against

1. While it would be ideal to study lobbying activities of multiple interest groups, comparable data as that for MADD are not available.

DUI laws (Marshall and Oleson 1994). In fact, the industry actively lobbied against legislation to reduce the allowable blood alcohol content through national legislation in 1998 (Washington Post 1998). Nonetheless, MADD manages to some degree to avoid antagonizing the vested interests in alcohol industries by framing drunk driving as a problem of individual choice by drunk drivers. This contributed to cooperative relationships between MADD and the interest groups in alcohol industries, especially in the 1980s and 1990s. For example, in 1983, MADD accepted donations from Anheuser-Busch, a large beer manufacturer (Marshall and Oleson 1994). This implies that interest groups in alcohol industries are sometimes unlikely to conduct "counteractive lobbying" (Austen-Smith and Wright 1994) against MADD. To the extent that such lobbying exists, focusing on MADD[2] may overestimate the impact of interest groups lobbying for DUI regulation. Data on lobbying by alcohol industry interests are unavailable, but the inclusion of a measure of alcohol consumption at the state level provides some indicator of the alcohol stake.

Between 1982 and 2000, the number of MADD local chapters has increased by about six times, from 52 to 328. Over time, MADD has accumulated information and expertise to lobby policymakers on DUI policies, suggesting that it may have played the roles of information providers and legislative subsidizers. First, MADD started its "Rating the States" program in 1991 to provide a letter-grade score for states on multiple aspects of DUI policies (Russell *et al.* 1995). The program has helped states to learn how they compare with others and prompted states to adopt stricter DUI policies. Second, MADD has hired Gallup to conduct national surveys of public attitudes on drunk driving since 1992 and thus obtained first-hand information on DUI policies. Third, MADD frequently serves on policy task forces or gives testimony in the legislative process of DUI policies (Russell *et al.* 1995). Fourth, in 1995, MADD "began holding Public Policy Institutes to train state public policy liaisons in DUI issues and legislative 'how-to' techniques" (Mero 2009, 142).

Econometric method and model

Recently, analysts have widely used dyad-year models in policy diffusion studies (Volden 2006; Gilardi and Füglister 2008; Gilardi 2010; Shipan and Volden 2014; Carley *et al.* 2016; Nicholson-Crotty and Carley 2016). The dyad-year approach has three advantages (Volden 2006). First, it allows one to explicitly incorporate the characteristics of policy being diffused, such as policy success. Second, dyad-year models can be used to study the diffusion of multiple policy components (Boehmke 2009b). Third, it allows researchers to control for variables measuring similarities or differences between two states in addition to the characteristics of adopting states and states being emulated.

In this study, we use a dyad-year count model. The dependent variable is a count of the number of policy components adopted by states. It is not unusual to measure the dependent variable as an interval variable in a dyad-year model. For example, Shipan and Volden (2014) measure their dependent variable as the amount of movements made by state A towards state B in adopting laws to limit

2. Similarly, data suitable for a diffusion study are not available for interest groups lobbying against DUI laws.

youth smoking. The model is estimated as a fixed-effect panel model at the level of dyads of states and year. We use a linear model because nonlinear models failed to converge to estimates.[3] The model is specified as follows:

$$Y_{ijt} = \alpha + X_{ijt}\beta + V_{it}\gamma + W_{jt}\delta + \mu_{ij} + \lambda_t + \epsilon_{ijt}$$

In the model, i, j and t indicate the state emulating others, the state being emulated and time. Y_{ijt} is the relational outcome variable, the number of policy components adopted by states. X_{ijt} is a vector of measures of the dyad characteristics, particularly the similarities between the two states. V_{it} is a vector measuring the characteristics of the first state in the dyad, or the state emulating the other one. W_{jt} is a vector measuring the characteristics of the second state in the dyad, or the state being emulated. The key explanatory variable of interest, policy success, belongs to W_{jt}. Furthermore, μ_{ij} is the fixed effects of dyads of states, and λ_t is the fixed effects of year. Finally, ϵ_{ijt} is an error term, and β, γ and δ represent the vectors of coefficients to be estimated.

The fixed effects of dyads of states are to account for the time-invariant factors within each pair of states over time. For example, the effects of neighbouring states on policy adoption can be controlled in this way. Year-fixed effects are also controlled to account for common factors that influence all states in a year. For example, the influence of federal government was present for the 0.08 BAC per se laws (Fell and Voas 2006) and can be controlled by year fixed effects as it was the same for all states in a year. The standard errors are clustered by dyads of states because the error terms of the regression equation are possibly interdependent for each pair of states.

The dyad of state A and state B differs from the dyad of state B and state A. This is because our hypothesis states that one state learns from the other whose policy is successful, but not the other way around. The unit of analysis is each pair or dyad of states. Given 18 years of data between 1983 and 2000, there will be 44,100 observations (50 states × 49 potentially emulated states × 18 years). In a dyad-year model, the states that have adopted a policy component provide opportunities to be emulated. Boehmke (2009a) pointed out that users of dyad-year models should limit the sample to cases where learning is possible to avoid spurious findings of policy diffusion. The sample in this study is thus limited to the cases where policy learning is possible. Specifically, state B must have a policy component in year $t-1$ for policy learning by state A to become possible, no matter whether state A adopts that policy component in year t. This reduces the number of observations to 33,674 in the final sample.

Dependent variable

The dependent variable is *policy comprehensiveness*, a key feature of policy reinvention. Previous studies used issue-specific measures of policy comprehensiveness that are not generalizable (Glick and Hays 1991; Kim and Jennings 2012). This study uses a generalizable approach; a policy becomes more comprehensive when it encompasses more distinct components under the core policy goal. Nonetheless, there might be ambiguities in the differences between an independent policy and a policy component of that policy. The distinction to be made is the existence of a common policy goal for all policy components. To achieve the common policy

3. See the Appendix 2 for a discussion of the choice between linear versus nonlinear models.

goal, different policy components expand the occasions where the policy may apply. Thus, the comprehensiveness of policy reinvention can be measured by a score from coding the number of distinct policy components.

The variable *policy comprehensiveness* is constructed in the following way. Because the unit of analysis is dyad-year, or pairs of states by year, this variable is constructed by comparing any state A and state B. For each of the eight policy components, if state A adopts one in year t that has been adopted by state B in year $t-1$, it is coded 1, otherwise 0. As in Nicholson-Crotty and Carley (2016), a one-year lag accounts for the time for state A to collect and act on information on policies adopted by state B. Next, *policy comprehensiveness* is created by adding up the eight dummy variables; thus there are nine possible values from 0 to 8. This variable measures how many policy components one state adopts which were previously adopted in other states. The bigger the value of policy comprehensiveness, i.e. the more policy elements a state has adopted, the more stringent the DUI policy that the state adopts in the direction of emulating those states which have already adopted them.

Key independent variables

The independent variable of interest is *policy success*. Many previous studies measure policy success by focusing on intended policy goals (Volden 2006; Gilardi *et al.* 2009; Shipan and Volden 2014). For example, Volden (2006) constructed a dummy variable of policy success from the uninsured rate of poor children in the Children's Health Insurance Program. In the same spirit, the success of DUI policies in this study can be measured by alcohol-related fatalities in driving accidents. Presumably, one of the core policy goals of DUI laws is to improve traffic safety by reducing the occurrence of and damage from alcohol-related fatal accidents. Thus, a state DUI policy succeeds in achieving its goal if alcohol-related fatalities decrease in a year.

To measure policy success, we use two indicators of alcohol-related fatalities in this study. The first is the *total fatality rate*, i.e. the percentage of alcohol-related deaths among total deaths in driving accidents. The data are released by the Fatality Analysis Reporting System of National Highway Transportation Safety Administration (NHTSA, 2014). Per NHTSA, a fatal crash is defined "as alcohol-related or alcohol-involved if at least one driver or nonoccupant (such as a pedestrian or pedal cyclist) involved in the crash is determined to have had a blood alcohol concentration (BAC) of .01 gram per deciliter (g/dL) or higher. Thus, any fatality that occurs in an alcohol-related crash is considered an alcohol-related fatality" (NHTSA, website). Note that legal intoxication is not required (usually .08). The second is the *driver fatality rate*, which is the number of alcohol-related deaths of drivers in driving accidents per one thousand people. The data for the *driver fatality rate* come from the same source and share the same definition as that of the *total fatality rate*.

For both indicators of policy success, a one-year lag is taken to mimic the time needed for such data to be available for policy making.[4] If policy success has a

4. The NHTSA data used to measure policy success for the last year are made available in this year. This suggests that a one-year lag is appropriate. An alternative specification is to lag all independent variables for one year, as in Carley *et al.* (2016). The results are robust when adopting this approach.

positive effect on policy comprehensiveness as hypothesized, these two indicators should have negative signs because more fatalities signify less policy success. To facilitate interpretation, the indicators are recoded by multiplying by −1. They both should have positive signs if the Policy Learning Hypothesis holds because larger values of the reverse coded fatality rates mean lower fatalities, more success, and hence higher levels of policy comprehensiveness.

To examine the effects of lobbying on policy reinvention, a measure of lobbying by the interest group, MADD, is in place. The variable *MADD* is measured as the number of MADD chapters per 1 million drivers[5] (Eisenberg 2003). The data come from an original collection by Eisenberg (2003) for the years between 1982 and 2000. A larger number of MADD local chapters indicates a stronger presence in a state, and thus, potentially stronger lobbying efforts. For example, MADD may make more political contributions or provide more policy-relevant information to legislators in states where it has more local chapters. Furthermore, in states with more local chapters, MADD may conduct more grassroots lobbying by mobilizing their members to contact legislators. This measure of MADD lobbying is imperfect; it fails to capture the variation of size and time commitments of local chapter members (Eisenberg 2003). However, there are no longitudinal data to track lobbying activities of MADD over two decades and the number of chapters should be correlated with lobbying activity. As an imperfect measure, the variable *MADD* may underestimate the impacts of MADD's lobbying on states' adoption of DUI policies.

The variable *MADD* should have a positive effect on *policy comprehensiveness* if MADD succeeds in lobbying for more stringent DUI policies as argued in previous studies (Fell and Voas 2006). To test the Lobbying and Policy Learning Hypotheses, interaction terms between *MADD* and the two indicators of policy success are included. If lobbying increases the effect of policy learning on policy comprehensiveness, the interaction terms should have positive signs. If lobbying decreases the effect of policy learning, the interaction terms should have negative signs.

Control variables

The control variables include political, policy-specific, economic and demographic factors. The political variables controlled are as follows. *Citizen liberalism*: This is an indicator constructed for the active electorate in each state, ranging from 0 to 100 on a conservative-liberal continuum (Berry *et al.* 1998). To facilitate interpretation of coefficients, it is rescaled to from 0 to 1. Given the morality elements of alcohol use and drunk driving, conservatives usually take tougher policy attitudes against it than liberals do (Reinarman 1988). Hence, conservative ideology is expected to lead to more comprehensive adoption of these regulatory policies.

Partisan control: This is a variable to measure the effects of state partisan politics on DUI policies, drawn from Klarner (http://www.indstate.edu/polisci/klarnerpolitics.htm). It equals −1 when there is unified Republican control of state legislatures and governor's office, equals +1 when there is unified Democratic control, and equals 0 otherwise. Compared to divided government, unified party control should make it easier for a party either to adopt or reject a DUI regulation. Based

5. An alternative way is to scale the number of MADD chapters by population. The correlation between the size of population and the number of drivers by state and by year is about 0.99 in the sample. Thus, this is unlikely to change the results.

on their ideological positions, Democratic Party control may lead to less comprehensive adoption of DUI policies than Republican Party control. *Legislative professionalism*: This is measured with the Squire Index (Squire 2007). A more professional legislature is in a better position to generate policy-relevant knowledge for innovation on its own and has weaker incentives to learn from others. On the other hand, a higher level of legislative professionalism indicates stronger ability for a state legislature to learn from others (Shipan and Volden 2014), which may lead to more comprehensive adoption of DUI policies.

The policy-specific control variables are as follows. *Total fatality rate* and *driver fatality rate:* These two indicators of policy outcomes are controlled to measure the effects of DUI policies in prior years in state A. Consistent with other control variables for state A, they are not lagged. If more success of previous policies encourages state A to adopt more comprehensive policies as in a "positive feedback," these two variables should have positive effects on *policy comprehensiveness*. On the other hand, less success of previous policies signifies severer policy problems and thus may motivate more comprehensive policy adoption. If so, these two variables should have negative effects. *Ln of highway mileage*: This is the miles of highway in a state in natural log form. States with longer highways are more likely to care about and regulate driving safety issues such as drunk driving, and thus to adopt more comprehensive DUI laws. *Ln of miles of travel per capita*: This is the total annual vehicle miles of travel per state, standardized by state population. Longer distance of travel should increase demand for drunk driving regulations and comprehensiveness of DUI laws.

Alcohol tax per capita: This is the alcohol tax collected in real value, standardized by state population. States collecting more alcohol taxes may regulate drunk driving more stringently as higher taxes imply negative attitudes of policymakers and the public toward drunk driving. On the other hand, heavier alcohol taxes may discourage drunk driving and thus decrease the demand for such regulations. Therefore, the sign of the effect of this variable is unclear. *Alcohol consumption per capita*: This is annual alcohol consumption measured in gallons of ethanol, standardized by state population. More alcohol consumption means more potential drunk driving accidents and thus higher demand for drunk driving regulations.

The economic and demographic variables controlled in the model are as follows. *GDP per capita:* This is gross domestic product (GDP) of all industries in a state, standardized by state population and measured in millions of dollars. As found by Walker (1969), wealthier states are more likely to innovate and less likely to learn from others. On the other hand, they are more likely to be emulated by other states. Therefore, in addition to the GDP per capita of adopting states, GDP per capita in the states being emulated is included to measure the characters of leader states.

Evangelical Protestant: This is the estimated proportion of state population that is evangelical Protestant by state by year. Gracey (2015) generated this estimate using the multilevel regression with poststratification method based on pooled, individual-level religiosity data of about 200 survey-years. The National Association of Evangelicals was very active in advocating for more severe punishments for drunk driving in the 1980s (Reinarman 1988). Hence, this variable is expected to be positively correlated with policy comprehensiveness of state DUI regulations. Nonetheless, the data[6] for the variable *Evangelical Protestant* are only available

6. Moreover, the data for this variable are missing for years 1990, 1991, 1994 and 1995.

between 1987 and 2000. As a robustness check, the model is estimated with and without control for this variable.

To measure the similarities between state A and state B, absolute differences are taken for two variables. *Ideological difference:* This is the absolute difference between the scores of government ideologies of state A and state B. Government ideology is measured by a score ranging from 0 to 100 that shows average ideological tendency of state elected officials along a conservative-liberal continuum (Berry *et al.* 2010). The score is rescaled to from 0 to 1 to facilitate interpretation of results. Previous studies found ideological distance between two states reduces the likelihood of policy learning (Butler *et al.* 2015). Thus, the variable *ideological difference* should have a negative effect on *policy comprehensiveness*. *Difference of population size:* This is the absolute difference between total populations of state A and state B, measured in millions. Walker (1969) found that states with larger population sizes are more likely to become leader states that are emulated by smaller states. This indicates that differences of population sizes between two states should be positively correlated with policy learning. On the other hand, similarities in population sizes of two states imply similarities in policy problems and potentially applicable solutions, which may promote policy learning between them. Thus, the sign of the effect of this variable is unclear. Table A2 in Appendix 3 shows the summary statistics for all the variables.

Results of the estimation

Table 2 shows the effects of policy success and lobbying by MADD on *policy comprehensiveness*.[7] In columns (1) and (2), policy success is measured by *total fatality rate*. In columns (3) and (4), policy success is measured by *driver fatality rate*. The variable *Evangelical Protestant* is controlled in columns (1) and (3) but omitted in columns (2) and (4).

The interpretation of two constitutive variables is complicated by the inclusion of their interaction term. As Brambor *et al.* (2006) point out, one should not "interpret constitutive terms as unconditional marginal effects" (p. 71). Based on the results in column (1) of Table 2, the marginal effect of *total fatality rate* conditional on *MADD* is $0.418–0.026 \times MADD$. Similarly, the marginal effect of *MADD* conditional on *total fatality rate* is $-0.006–0.026 \times$ *total fatality rate*. The coefficient of *total fatality rate, 0.418,* shows the marginal effect of this variable only when *MADD* equals 0. Since the variable *MADD* ranges from 0 to 21 in the sample, this is an extreme case. By the same logic, the coefficient of *MADD, −0.006,* shows the marginal effect of *MADD* only when *total fatality rate* is 0. In the sample, *total fatality rate* ranges from −0.55 to −0.12, and thus 0 is out of the sample range.

To interpret the marginal effect of *total fatality rate* or *MADD*, one must fix the other constitutive term at certain levels. For example, when fixing the value of *MADD* at its sample mean of about 4.78, the marginal effect of *total fatality rate* is about 0.29 and statistically significant at $p = 0.01$. In other words, for a state with an average number of MADD chapters per one million drivers, the marginal effect

7. We provide the results of the model without interactions in Table A3 in Appendix 4. Of the two constitutive variables of the interaction terms, one policy success indicator – *total fatality rate* is positive and statistically significant ($p = 0.01$), consistent with the policy learning hypothesis.

Table 2. Lobbying, policy success and policy comprehensiveness

Variables	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
Learning: policy success in state B				
Total fatality rate	0.418***	0.263***		
	(0.080)	(0.096)		
Driver fatality rate			0.398*	0.668**
			(0.236)	(0.328)
Lobbying				
MADD	−0.006**	−0.012***	−0.001	−0.005***
	(0.003)	(0.003)	(0.002)	(0.002)
Lobbying and learning				
Total fatality rate × MADD	−0.026***	−0.041***		
	(0.009)	(0.009)		
Driver fatality rate × MADD			−0.054	−0.110***
Internal factors of state A			(0.038)	(0.041)
Evangelical Protestant		0.052		0.072*
		(0.037)		(0.039)
Citizen liberalism	−0.031	−0.170***	−0.022	−0.172***
	(0.047)	(0.059)	(0.047)	(0.060)
Partisan control	0.021***	0.018***	0.018***	0.010*
	(0.004)	(0.005)	(0.005)	(0.006)
Legislative professionalism	−0.162***	−0.425***	−0.163***	−0.429***
	(0.044)	(0.057)	(0.044)	(0.056)
Total fatality rate	0.529***	1.094***		
	(0.057)	(0.098)		
Driver fatality rate			0.736***	1.319***
			(0.235)	(0.374)
Ln of highway mileage	−0.201***	−0.416***	−0.196***	−0.393***
	(0.041)	(0.057)	(0.042)	(0.058)
Ln of miles of travel per capita	0.219***	0.337***	0.249***	0.362***
	(0.036)	(0.047)	(0.036)	(0.047)
Alcohol consumption per capita	0.006	0.131***	0.011	0.166***
	(0.023)	(0.028)	(0.024)	(0.029)
Alcohol tax per capita	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita	−1.166**	2.157**	−0.998*	1.410
	(0.593)	(0.918)	(0.597)	(0.933)
Relationship between states A and B				
Ideological difference	−0.042	−0.027	−0.036	−0.022
	(0.027)	(0.030)	(0.027)	(0.031)
Difference of population size	0.013***	0.008*	0.013***	0.009**
State B as leaders	(0.003)	(0.004)	(0.003)	(0.004)
GDP per capita	0.472	0.014	0.739	−0.004
	(0.735)	(0.837)	(0.738)	(0.857)
Constant	2.215***	4.664***	1.519*	3.587***
	(0.822)	(1.084)	(0.850)	(1.100)
Dyad fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	32,948	17,986	32,948	17,986
R^2	0.065	0.053	0.063	0.044
Number of dyads	2,342	2,235	2,342	2,235

Robust standard errors in parentheses, clustered by dyads of states.
MADD = Mothers Against Drunk Driving.
***p < 0.01, **p < 0.05, *p < 0.1.

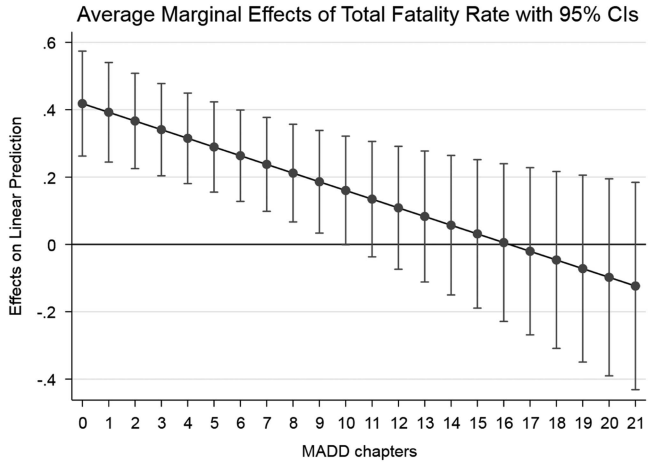

Figure 1. Marginal effects of policy success (total fatality rate) conditional on lobbying (Mothers Against Drunk Driving (MADD) chapters).

of the variable *total fatality rate* is about 0.29. This indicates that if the alcohol-related fatality rate in state B decreases by 10 percentage points, state A adopts about 0.028 more DUI regulations. Since the standard deviation of *policy comprehensiveness* is about 0.38, this change amounts to about 7% of 1 SD.

Figure 1 shows the marginal effect of policy success as measured by *total fatality rate* on policy comprehensiveness at various levels of *MADD* with 95% confidence intervals. The marginal effect of *total fatality rate* statistically differs from zero ($p = 0.05$) when the number of MADD chapters per one million drivers is smaller than about 10. Within this range, the marginal effect of *total fatality rate* is positive and decreases as *MADD* increases. When *MADD* increases beyond 10, the marginal effect of *total fatality rate* continues to decrease but does not reach statistical significance ($p = 0.05$). This suggests that *total fatality rate* has a positive effect on policy comprehensiveness when the number of MADD chapters per one million drivers is relatively low. This is consistent with the Policy Learning Hypothesis. Moreover, as *MADD* increases, the marginal effect of *total fatality rate* decreases. This is consistent with the Lobbying, Learning, and Conditional Hypothesis B in that lobbying decreases the effects of policy learning on policy reinvention.

To interpret the marginal effect of *MADD* on *policy comprehensiveness*, one may fix the value of *total fatality rate* at its sample mean. In the sample, the average level of *total fatality rate* is about −0.32. The marginal effect of *MADD* is about 0.002 but is not statistically significant at $p = 0.1$ level. To the extent that the proxy for lobbying captures MADD's lobbying activities, this indicates that lobbying by MADD is ineffective in advocating for more comprehensive DUI laws when there is an average level of policy success in other states. Figure 2 shows the marginal effect of *MADD* at various levels of *total fatality rate* with 95% confidence intervals. When *total fatality rate* is between −0.55 and −0.4, the marginal effect of *MADD* is positive and statistically differs from zero at $p = 0.05$. Note that a larger value of the reversely coded *total fatality rate* indicates more successful policies. Thus, this indicates that *MADD* is effective in lobbying for stricter DUI laws when policies in other states are less successful. This is consistent with the Lobbying Hypothesis in

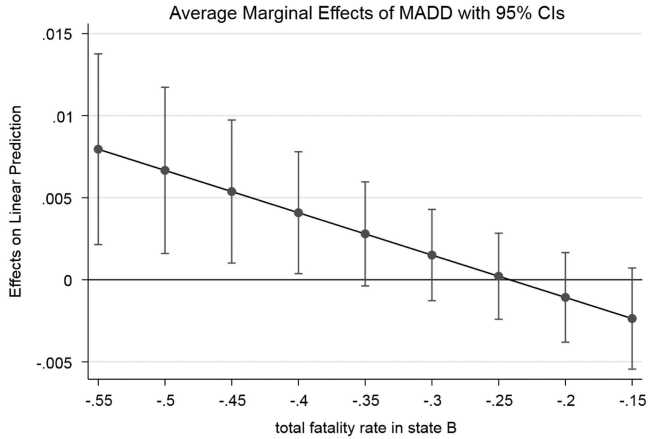

Figure 2. Marginal effects of lobbying [Mothers Against Drunk Driving (MADD) chapters] conditional on policy success (total fatality rate).

that lobbying increases policy comprehensiveness. Furthermore, the marginal effect of *MADD* on *policy comprehensiveness* decreases when the reversely coded *total fatality rate* increases or when policies in state B become more successful. As *total fatality rate* increases beyond −0.4, or policies become more successful, the marginal effect of *MADD* continues to decrease and becomes statistically insignificant at $p = 0.05$. This is consistent with the Lobbying, Learning, and Conditional Hypothesis B in that policy success decreases the effect of lobbying on policy reinvention.

When controlling for the variable *Evangelical Protestant* in column (2), both *total fatality rate* and its interaction with *MADD* remain the same in sign and statistical significance ($p = 0.01$). This indicates that the results of policy learning and its interaction effects with lobbying are robust with additional control of religious preferences of state population over DUI policies. Columns (3) and (4) show an additional robustness check with an alternative measure of policy success, *driver fatality rate*. As shown in column (3), the variable *driver fatality rate* has a positive and statistically significant effect ($p = 0.1$) on *policy comprehensiveness*, while its interaction with *MADD* has a negative but statistically insignificant effect. When controlling for *Evangelical Protestant* in column (4), both effects remain the same in signs, increase in sizes, and become statistically significant at $p = 0.01$ level. Therefore, the results in columns (1) and (2) are robust with alternative measures of policy success. Results are stronger with religion measured in the model.

The effects of control variables remain largely consistent across models. First, the variable *Evangelical Protestant*, as shown in column (4), has a positive effect ($p = 0.1$) as expected. Second, the three variables measuring political features of state A have statistically significant effects on *policy comprehensiveness*. *Citizen liberalism* reaches statistical significance ($p = 0.01$) when controlling for *Evangelical Protestant*. This indicates that, as expected, liberal citizen ideology is associated with less comprehensive adoption of DUI laws, controlling for religion and other factors. *Partisan control* has a positive and statistically significant effect ($p = 0.05$) in each model. This implies that Democratic unified control of government is correlated with more comprehensive adoption of DUI laws. The divergence

between these two effects indicates that government party control is incongruent with citizen ideological preference. *Legislative professionalism* has a negative and statistically significant effect ($p = 0.01$) in each model. This indicates that more professional legislatures are correlated with less comprehensive policy reinvention, as found by Hays (1996b).

Third, all policy-specific variables show statistically significant results. Both indicators of policy success for state A are positive and statistically significant ($p = 0.01$) in each model. This suggests that successes of previous policies are positively correlated with comprehensive policy reinvention. This might reflect two possibilities. First, states learn from their own experiences of successful policies. Second, learning from own experiences and learning from other states complement each other. Policymakers may be encouraged by successes of past policies to search for more successful policies elsewhere if their own policies are relatively less successful compared to others'.

The variable *Ln of highway mileage* shows a negative and statistically significant effect ($p = 0.01$) across models. This indicates that longer highways are associated with less comprehensive adoption of DUI regulations. The variable *miles of travel per capita* shows a positive and statistically significant effect ($p = 0.01$) across models. Hence, demand for DUI regulations increases when more people travel on the highways in a state. As expected, both alcohol consumption and alcohol tax show positive and statistically significant effects ($p = 0.01$) on *policy comprehensiveness* across models, especially when controlling for religion. The variable *GDP per capita* for state A has a negative sign as expected in columns (1) and (3), but it turns positive in column (2) when controlling for religion.

Fourth, for the two variables measuring the relationship between state A and state B, only *Difference of population size* shows statistically significant effect on *policy comprehensiveness*. The positive sign of this variable indicates that states of similar sizes are less likely to learn from each other. This may result from states with less population learning from more populous states like New York or California (Walker 1969).

Discussion and conclusion

In this study, the focus of policy diffusion shifts to policy reinvention, operationalized as policy comprehensiveness. Policy learning as a mechanism of policy diffusion applies similarly, if not better, to policy reinvention. In addition, the interaction between lobbying and policy learning is investigated both theoretically and empirically. Lobbying by interest groups can change the incentives and content of learning by policymakers. Policy learning by policymakers themselves would become less necessary if interest groups succeed in swinging policies in their favour by making political contributions or providing information. Moreover, policy-relevant information from lobbying represents an alternative for information search by policymakers themselves. These interactions may increase or decrease learning about policy success information by policy makers.

The empirical tests support the proposition that learning from states with successful policies makes it more likely for states to adopt more comprehensive policies. Specifically, with indicators of outcomes showing that DUI laws in other states succeed in achieving intended policy goals, states tend to adopt more of those laws when lobbying by MADD is low. Focusing on a new policy issue from a different theoretical perspective, this extends previous findings that policy success

increases policy diffusion (Volden 2006; Gilardi and Füglister 2008; Gilardi *et al.* 2009; Shipan and Volden 2014; Butler *et al.* 2015; Nicholson-Crotty and Carley 2016). In addition to the ability to learn (Shipan and Volden 2014; Nicholson-Crotty and Carley 2016), policy learning is conditional on influence of interest groups.

With MADD as an interest group in state DUI policies, the empirical results indicate that lobbying increases policy comprehensiveness when policy success is relatively low. This indicates that MADD succeeds in lobbying for more stringent DUI regulation, consistent with the public image of MADD as a significant force shaping state DUI laws. Moreover, this suggests that lobbying by MADD is conditional on policy learning by policymakers themselves. Lobbying is more likely to succeed when policymakers are less likely to rely on policy success elsewhere because previous policy innovations are not that successful. The conditional effect of policy learning on lobbying in policy reinvention extends the previous finding that interest groups can increase policy diffusion (Balla 2001; Haider-Markel 2001; Garrett and Jansa 2015).

The empirical results show a relatively small effect of policy success as measured by the effect of alcohol-related fatality rates on policy reinvention. Even so, in the long run, as lobbying by interest groups varies across states, policy success may make substantial differences in policy reinvention. Alternatively, the small size of the effect might result from measurement errors of policy success, which might be improved in future studies. In addition, the finding that lobbying substitutes for policy learning about policy success can be explored further. It is not readily clear whether this generally improves or impedes policymaking in a democracy. In the case of DUI policy, the welfare implication can be positive assuming that MADD transmits citizen policy preferences beyond public opinion and provides an alternative for policy makers to obtain policy-relevant information at lower costs.

This study contributes to the literature by integrating two pathways of policy diffusion, including learning and interest group influence, and applying them to policy reinvention. While the theoretical framework outlines possible mechanisms through which lobbying may influence policy learning, the empirical tests do not differentiate among them. Future research can disentangle these mechanisms to help understand how specific modes of lobbying shape policy learning. In addition, future research may examine cases where it is feasible to study lobbying by multiple interest groups on both sides of a policy issue. More broadly, future research can examine other dimensions of policy reinvention beyond policy comprehensiveness and the varied conditions under which success makes a difference.

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Data Availability Statement. Replication materials are available at https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/Z6EZG3.

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