Exploring Changes in State Interest Group Systems:
Replications and Extensions of the ESA Model

Thomas T. Holyoke
Department of Political Science
California State University, Fresno
2225 East San Ramon, MS MF19
Fresno, California 93740-8029
tholyoke@csufresno.edu

August, 2019

Prepared for presentation at the Annual Meeting of the American Political Science Association, Washington, DC, 2019

Abstract

How have interest group populations in the fifty states changed in the 21st Century so far, and have factors like population growth, changing state ideology, economic performance, legislative professionalism, personal wealth, and shocks like the Great Recession shaped these changes? Using new data on state interest groups originally gathered by the National Institute for Money in State Politics, which I cleaned and introduced at last year, combined with several other measures of state politics, economic performance, and demographic change, I study these questions. With data covering the years 2006 to 2015 allowing for cross-state, as well as time-series, analysis, I explore the extent to which change in economic, political, and social variables lead to changes in state interest group systems, some of which replicates Gray and Lowery's work. Their work holds-up well in the replications, but new extensions are also explored, including a new "capacity" term for the ESA model.

Replication is generally understood to be a fundamental requirement of scientific research (Leavitt 2001, 42; Johnson, Joslyn, and Reynolds 2001, 26). Empirical findings cannot be considered definitive, and theories cannot have been proven, until multiple researchers independent of each other have found similar results using different, though analogous, data. This is true of political science, though it has been argued that replication of other researcher's work is often a low priority for scholars eager to propose and test their own theories, and journals may well have a bias against publishing mere replications (Neuliep and Crandall 1993). Replications have appeared in some subfields, such as studies of the ideological leanings of members of Congress (e.g., Carson et al. 2004; Anderson and Habel 2009), but in interest group politics it is largely non-existent. Yet without replication, it is difficult to know how robust any set of findings are, or put any faith in those findings since underlying methodologies might turn out to be flawed (e.g., Kashin, King, and Soneji 2015).

One reason is that finding or creating new data sets similar to those used in earlier research is very difficult in the interest groups and lobbying subfield. And, of course, using the same data as earlier scholars would most likely produce the exact same results, at least if the same estimation methods are used. However, with new data becoming available on the number and type of lobbying organizations in the American states, it is possible to replicate and even further extend the work of the most prominent scholars in the field of state interest group politics – that of Gray and Lowery. In this paper, I use new data to replicate some of their earlier and most fundamental findings using many of the same independent variables and statistical models, along with some other types of estimation methods. I find their results hold-up fairly well. I then extend their work with some new ideas and approaches, including a new term for their ESA model on capacity, which also exhibits a density dependence effect on the number of interest groups in a state.

Replicating ESA

Research on interest groups in state political systems goes back at least as far as Belle Zeller's work on state legislatures (1954), with important subsequent work from Morehouse (1981), Zeigler (1983), Hunter, Wilson, and Brunk (1991), Thomas and Hrebenar (e.g., 1992; 2004), Newmark and Nownes (2017), and Strickland (2019a). The most extensive work, though, is by Virginia Gray and David Lowery. Their approach to studying state interest group populations has largely been through the application of population ecology, a concept originating in evolutionary biology to explain species development and diversity. While their approach, culminating in their 1996 book *Population Ecology of Interest Representation*, has started to be applied in studies of interest groups in Washington, DC (e.g., Nownes and Lipinski 2005; Dusso 2010) and other nations (e.g., Halpin and Jordan 2009; Fisker 2013; Berkhout 2015), it dominates the study of interest groups and lobbying in American state politics. So much so that its core findings are now taken as givens. While important work is being done as extesions of their ecological approach, these are only as good as the basic model, and there has been some criticism of population ecology (see Loomis 2015). Since replication is a hallmark of science, it is worth re-testing the application of their population ecology model with new data on state interest groups.

Early Work and the ESA Model

Identifying the best model for replicating their original work is not easy, partially because their earliest work on interest groups predates the application of population ecology. Starting with a largely economic outlook, Lowery and Gray's (1993) first paper on interest group density (that is, the total number of groups in a state) conceived of group formation as a function of economic strength, using a dependent variable of group numbers divided by gross state product (GSP).

Independent variables were GSP, its square, and its cube, predicting these would reveal a curvilinear effect of economic size on group numbers. Such a curvilinear effect was found, deduced from simple GSP being positive and significant while GSP-squared was significant but negative (GSP-cubed largely failed to perform). GSP also figured prominently as an independent variable in their next paper on group system diversity (Gray and Lowery 1993), along with Herfindahl-style measures of state economic concentration in ten policy areas. Size of the economy (GSP alone) increased group diversity while economic concentration led to less.

A year or two later, Gray and Lowery fit these findings into the framework of population ecology using the Energy Stability Area (ESA) model, the components of which became a way to classify the independent variables used (see Lowery and Gray 1996). "Area" refers to the resources necessary for group formation, "energy" the intensity of interest potential interest group members had for advocacy, and "stability" the durability of the political system from disruptive change. Since their 1996 paper studied group density in ten distinct domains of policymaking, their independent variables were largely idiosyncratic to those domains, rather than being general variables applicable across domains.

In subsequent work, though, including their own replications (e.g., Lowery, Gray, and Cluverius 2015), and in summaries they have written of their work (e.g., Lowery and gray 2007; 2015), they again rely heavily on GSP and its square to capture "area" and the curvilinear effect that resources have on group formation, which they now refer to as "density dependence." For "energy" they often rely on the Ranney index of party competition, arguing that greater political uncertainty from this competition should have a depressing effect on interest group formation. Oddly, "stability" does not prominently appear in these studies.

Replicating the ESA Model

The discussion so far is about identifying appropriate independent variables for a replication analysis, along with new, comparable data on state interest groups from Holyoke (2019). This data was originally collected from the states themselves by the National Institute for Money in State Politics, a nonprofit specializing in collecting and disseminating data on state campaign contributions and lobbying.[1] As part of this work, the Institute also compiled data on the political organizations that employ lobbyists, which results in lists of interest groups active in each state.[2] One of the advantages of this data is that it is available for, and comparable across, all states for ten consecutive years, 2006 to 2015.

To be as faithful as possible to the original Gray and Lowery models, I use as dependent variables counts of the total number of interest groups in a state, as well as groups divided by GSP.[3] For independent variables, I use GSP and GSP-squared to capture the resources available (ESA's "area" term), which should exhibit the curvilinear density dependence effect.[4] I also use the four-year folded Ranney index to measure "energy" as the level of competition between the two major parties, which should have a negative effect.[5] Since there is no consistent "stability" variable in the Gray and Lowery literature, I include a variable measuring a shock to long-term economic stability – the Great Recession. A recession variable is coded 1 for 2008 and should have a negative, or lack-of-stability, effect. Also following Gray and Lowery, I code a dummy variable 1 if the observed state is Florida.

I estimate both dependent variables with a variety of statistical models, all of which account for time since these are time-series, cross-sectional data sets. Some were used by Gray and Lowery, but not all. Specifically, since the groups-by-GSP variable is linear, I estimate it with OLS regression using panel-corrected standard errors (see Beck and Katz 1995), and then with another regression model using random-effects to control for unmeasured state-to-state differences (see Clark and Lizner 2015). I also try a hierarchical model where unseen state-to-state differences are controlled for by estimating a unique slope for each state so that the coefficients report "within state" effects (see Rabe-Hesketh and Skrondal 2012).[6] For the count variable of interest groups in each state, I use a negative binomial time-series model following a Poisson distribution, as well as the regression model with panel-corrected standard errors and the hierarchical model. Individual models for each year are also estimated, which Gray and Lowery frequently did, but since they do not produce significantly different results from those presented in Table 1, they are not shown.[7]

---- Table 1 ----

The results are largely, but not entirely, consistent across models, and consistent with Gray and Lowery's findings. Gross state product is positive, while its square is negative, reinforcing their finding of a density dependence limit on group population size due to finite resources, but only in models where the dependent variable is a count of all groups. In the groups-by-GSP models, the signs are reversed. The Ranney index is also insignificant in all models, though the sign is negative. Whether these suggest a concern for the arguments made regarding the use of population ecology and ESA to explain state interest group populations, however, will wait until more tests are done (see below). The recession dummy is also insignificant, though this was not an original Gray and Lowery term.

Stepping Beyond Simple Replication

Even within the basic ESA framework, there may be other variables substitutable for those just used and which might provide a test of the robustness of the population ecology approach. As substitutes for GSP in the "area" term, I try per capita individual income and median income because the more spending power individuals have, the more they might spend on forming or joining interest groups, but these variables, and their squares, fail to perform.[8] Sheer individual spending power apparently does not lead directly to new group formation, perhaps because, as Berry (1999) and King and Walker (1992) point out, many groups are funded by a few big contributors, foundation grants, and even government grants. In some cases, group "dues" are so small that increases or decreases in income may not have a noticeable effect on individual willingness to pay to join interest groups.

---- Table 2 ----

Another kind of resource that is essential for interest groups is people. Even for non-membership groups, more people mean more individuals who might contribute money to the maintenance of an organization, their sheer numbers having an effect even if per capita and median income do not. As seen in Table 2, state population and its square perform as expected in the models where the dependent variable is the total count of groups.[9] More people in a state support more lobbying organizations, but only up to a point. While some people will join more than one group, there are only so many people and some will never join any. Surprisingly, but consistent with findings in Table 1, the signs for these variables are reversed when using the groups-divided-by-GSP dependent variable.[10]

For "energy" I continue to use the Ranney index, but while its sign is consistently negative it is only significant in one model. I therefore try alternative energy terms measuring partisan conflict such as the percentage of Democratic control of state legislatures and a dummy variable coded 1 if the state was unified under the Democrats.[11] Both fail to perform, suggesting that, in these years at least, partisanship is not a driving factor of group formation. Since this part of ESA is supposed to capture interest in advocacy because the government might be inclined to enact new policy, or threaten existing policy, I try a per capita measure of state spending.[12] A decrease in spending, or even its failure to increase, might alarm enough people to form new interest groups, or its increase might excite them enough to mobilize. Which it is, it turns out, is hard to tell as the measure, seen in Table 2, is significant but negative when the dependent variable is groups divided by GSP, but positive and (mostly) significant with the total count of interest groups. All that can be concluded for now is that state spending matters more than partisan politics.

For "stability," I continue to use the recession dummy (still failing to perform), but I also add per capita long-term state debt.[13] If this part of ESA is meant to capture political and economic systems' continuity, then many might see growing debt as a long-term threat to cherished public programs or tax breaks. This variable's performance, though, is mixed, not being significant in two models, negative and significant in one, and positive in two others. Given that it is more positive than negative, it may be fair to say that fear of limits in future government activity from increasing debt may spurring the formation of new groups. Perhaps because severe limits means somebody's ox might get gored, and no interest, or potential interest, wants to be the ox.

Gray and Lowery also tested their ESA variables within specific policy areas, or sectors of the economy, which is also worth replicating (Lowery and Gray 1996). In place of state population as the "area" term, I use employment data collected from the U.S. Bureau of Labor Statistics and aggregated into categories conforming to the North American Industry Code System (NAICS) created by the U.S. Department of Commerce. I also use squared versions of these variables in a series of models where each dependent variable is the number of lobbying organizations in each of 15 sectors.[14] The other variables used are the Ranney index, and the recession and Florida dummies. For each sector, a random-effects regression model, a panel-corrected standard errors regression model, and a hierarchical model are estimated.

There are too many results to present here, but in 78% of models the unsquared area terms (number of sector employees) are significant and positive and the squared terms are significant and negative. Only 22% of the time is the Ranney index significant, though the sign is always negative. For a further test, I collected annual state spending on transportation programs, health care (Medicaid), social services, and education (Kindergarten through a four-year college degree), and estimated models using the counts of groups in those sectors along with sector employees as the area term and state spending as the energy term.[15] The results, not shown, still only show area and area-squared terms being influential, positive and then negative. Spending and debt only show effects in the health care policy domain.

---- Figure 1 ----

Arguably, Gray and Lowery's original variables appear to perform better than the alternatives tried here, at least when using counts of groups as dependent variables. The exception is state population and, in the case of specific sectors the number of employees, which perform well. This makes it interesting to further explore the notion of density dependence on group formation, which, following Lowery, Gray, and Cluverius (2015), I do by studying changes in the polynomial curves appearing in scatter plots of total interest groups and state GSP for each year. There appears to be a small negative change, meaning a sharper bending of the curve, from 2006 to 2008, perhaps as the Great Recession was felt in the states, but then a significant rebound by 2015. To see this, I graph in Figure 1 the curves for 2006, 2008, and 2015, and the small contraction in the limit on group numbers by 2008 can be seen, but is clearly blown away in the years afterwards.

Extensions and Interactions

Alternative Variables and Interactions

Starting to move outside the scope of Gray and Lowery's work, it is worth asking whether results differ depending on how "interest group" is defined? This requires re-thinking the dependent variable. They standardized the number of groups from one state to another by dividing them by GSP, but the results above also suggest that groups in a state are a function of its population. I therefore create a new dependent variable that is standardized by dividing total lobbying organizations in a state by its population. I also distinguish membership-based groups from all organizations that lobby. In other words, I separated professional interest groups from businesses, nonprofit organizations, and hospitals and universities (what Salisbury 1984 called "institutions"), something Gray and Lowery and others have also done (e.g., Lowery et al. 2004; also see Witko and Newmark 2005; Brasher and Lowery 2006). To distinguish membership-based political groups, where collective action barriers need to be overcome, from other organizations that generally do not have anything recognizable as members, I rely on the coding employed in Holyoke (2019).

I then re-estimate the basic ESA model (from Table 1) using this new groups per capita dependent variable, with GSP, its square, the Ranney index, and the Florida and recession dummies as independent variables. In both cases I used hierarchical models with all years pooled together. The results are not shown because in both cases only GSP is significant, though its square is not, and this remains the case when I use the other statistical models seen in Table 1. Re-estimating the models with the variables seen in Table 2 is more successful, including state population and its square. Indeed, the results are similar to those in Table 2. Still, estimating the effects of population-based independent variables on a dependent variable standardized by population may not be a fair test, so new variables for ESA's "area" term are needed.

It may not be true of all organizations since many in the data set do not have dues-paying members, but higher levels of personal income in a state may make it easier, and thus more likely, for people to join *membership* groups, or at least contribute to them. I therefore take another shot at using each state's per capita income as an alternative area term in the new models. Another potential variable, though, might be education. People with a higher level of education may be more aware of trends in state politics which concern them, and are more willing to support the formation of new interest groups. I therefore collect data on the number of people with bachelor's degrees in each state for each year, which is then divided by state population for a per capita measure of college education.[16]

For "energy" terms, I continue to use the Ranney index because while it rarely achieved statistical significance at the conventional 0.05 level in the earlier models, it often does so at 0.10, and so may still hold some promise. I also include two new variables. The first is annual government revenue because, similar to state spending, a state with flush coffers may attract more attention from people in more interest groups desiring more state programs, or even tax breaks (believing the state has too much money).[17] The second alternative energy term I use is per capita state employees, which arguably captures a state's capacity for public programs, and even be thought of as a measure of lobbying targets.[18] Finally, I again use the recession dummy as a "stability" term, but I also include the state political ideology measure developed by Berry et al. (1990). Furthermore, since both of these variables are really statewide effects, instead of using them to directly estimate the number of groups, I indirectly do so by using them to estimate the steepness of the unique slope for each state in the hierarchical model.

In the initial estimations with these new variables (not shown), both of the new area terms (income per capita and bachelor's degrees per capita) are squared, but neither squares are significant. In the case of per capita income, adding the squared term also renders the independent effect insignificant when it was otherwise significant in the membership groups-only model. Perhaps only state GSP and population exhibit curvilinear density dependence effects, but in any case the squared terms are eliminated from the models presented in Table 3. Unsurprisingly, per capita income is only significant and positive in the model where the dependent variable is membership groups. Bachelor's degrees per capita, however, is positive and significant in both models, and so too (for a change) is the Ranney index. State ideology also has an effect, where a state with a standard deviation increase in its liberalness will see a corresponding effect on origin point of its slope (all independent variables at 0) of 155.96 (for all organizations) and (a surprising) 4,853.38 for membership-based groups. Debt, however, has almost no effect at all.

---- Table 3 ----

These results suggest that greater political awareness, as potentially measured by education, and more competition between state parties, might actually have an interactive effect. Table 3 shows such an effect, but it is surprisingly negative (there is no significant interaction between per capita income and any of the "energy" terms). To get a better sense of this, I estimate the marginal effect of the number of bachelor's degrees on state interest group sizes given all values of the Ranney index using the results from the membership-based groups model. The results are graphed in Figure 2 and show what appears to be a small effect. When there is no party competition (the index is 0), an increase in degrees leads to only 1.6 more groups. Consider, though, that when the analysis is re-run using just the total number of membership groups and degrees without per capita adjustments, an increase of 1,000 degrees leads to a predicted increase of 16 interest groups. Yet this education effect is entirely wiped out as party competition increases, falling to nearly zero.

---- Figure 2 ----

I do not graph the reverse, party competition effect for all values of the education variable, but when nobody in a state has a degree (a hypothetical circumstance), there is only a small marginal party competition effect on the number of interest groups. At more realistic levels of degrees awarded, though, the party effect is entirely negative, rapidly depressing the number of groups in a state. In other words, states with both high levels of university education and party competition are predicted to have fewer membership-based interest groups. College graduates in those states may still want to be politically involved, but competition between the parties is likely attracting all of their attention. Only when party competition is very low do they gravitate more towards organized interest groups. Put in ESA terms, the energy term is depressing the effect of the area (the resources) term.

Mobilization and Counter-Mobilization

There may be a different way to think about ESA's energy term that is worth exploring, and perhaps also provides a test of Truman's (1951) argument that interest groups tend to mobilize in response to perceived threats, such as from competing interests. The state interest group data comes coded by group type, distinguishing between trade or professional associations, representing businesses and white-collar professions, and citizen or public interest groups representing factions of the population based on their passions to change or defend public policy. Public interest groups and associations do not always compete with each other over policy outcomes, and sometimes they compete amongst themselves (Holyoke 2011), but within some policy domains there appear to be starker divides between these two types that might be exploited for an analysis of mobilization in response to perceived threats. Specifically, I study this in the policy sectors of business (including manufacturing, wholesale, and retail), construction, energy, finance, health, and transportation.

In each of these six sectors, I model association numbers as a function of public interest group numbers, rather than the reverse. Many associations appeared in the late 19th and early 20th centuries (Walker 1983), and continued to grow in numbers even into the 21st Century (Holyoke 2014). Since public interest groups tended to form in the 1960s and 70s (Berry 1999), it makes more sense to argue that more associations mobilized as a response to the emergence of public interest groups than the reverse. This is especially true in these sectors as the public interest groups in many cases were mobilizing specifically to change policy, thus threatening mobilized and un-mobilized business and professional interests (Vogel 1989; Waterhouse 2014).

To do this, I divide the number of associations by GSP to standardize it, as in the early Gray and Lowery models, but keep public interest groups as a simple count variable. If new associations are mobilizing as a response to a perceived public interest group threat, then would-be association leaders likely sound the alarm to potential members by emphasizing the sheer numbers of these new, competing groups. I also use the number of employees in each sector and its square as areas terms, the Ranney index (since it performed well in the prior analysis), and state revenue as other energy terms. Finally, I continue to use Berry's state ideology and state debt to estimate unique state slopes in hierarchical models. The results are in Table 4.

---- Table 4 ----

In all six sectors, the number of public interest groups has a positive effect on the size of trade and professional association communities. This is not clear evidence of Truman's claim, but it does suggest that there are more business and professional associations in economic sectors where there are also more public interest groups likely competing with them over policy. It is also interesting to note that of the area terms used here, employees (who could be members of these associations) and their squares generally have the expected directions (positive and negative respectively), but are not always statistically significant. It may be that density dependence in terms of potential members does not always manifest in every policy or economic sector. It may also be worth exploring the interaction between the number of public interest groups and these employees, to see if greater threats from competing interest groups provides enough "energy" among associations and potential associations to overcome the limits of resources provided by potential members. That is a question for future research.

A "Capacity" Term for ESA?

Finally, are there other classes of variables potentially influencing the size of interest group populations beyond the three components of ESA? A line of research, which Gray and Lowery themselves have contributed to, suggests there may be - the policy capacity of state governments. Research in sociology finds that interest groups and social movements often form after political leaders signal their interest in enacting new policies and programs addressing previously ignored social and economic problems (e.g., Tilly 1978; Meyer and Staggenborg 1996). Some political science research has found evidence that work on new government programs inspires lobbying in support of those programs (e.g., Baumgartner, Gray, and Lowery 2009; Baumgartner et al. 2011). I do not go as far as to argue that proactive governments drive more group formation, merely that greater ability of the state to enact wider ranging policies, and support more public programs, may inspire more political entrepreneurs to create lobbying organizations.

I identify five variables that, when combined, arguably capture government capacity. One is legislative professionalism, measured by the Squire index for various years, as legislatures with larger staff and longer sessions are likely to handle more policies and programs (see Squire 2017). A second is the number of state government employees, which was used earlier as a possible "energy" term. A third is state revenue, more of which is often required to support more state programs.[19] A fourth is a measure of whether the state government is unified under the Democratic Party, also used in earlier analyses. Finally, states with legal or constitutional debt limits may be less able to spend more money, so I include a dummy variable coded 1 for states with such limits, an effect which should be negative on any measure of government capacity.[20] I then use a factor analysis to uncover the common dimension under the five variables and it becomes my measure of state capacity.[21]

---- Table 5 ----

Since a state government's capacity can only extend so far, it, like ESA's area terms, should ultimately have a limiting effect, potentially revealed when squared terms are included in the models. Unfortunately, the models cannot handle the squares of both the capacity term and area terms like state population or GSP, so only the government capacity square is used here. Energy is again measured with the Ranney index, bachelors degrees per capita, and per capita income, and stability measured with state ideology and state debt. The Florida dummy is also included, and the results are in Table 5. In the three models used, the new capacity term is positive and significant while its square is negative and significant. The state's ability to add and support new programs and policies does appear to be associated with the formation of new lobbying organizations, including membership-based groups, but only up to a point. As government reaches its limit, so too does lobbying organization populations.

---- Figure 3 ----

Finally, rather than use limited space to comment on the other independent variables' performances, which are more or less consistent with other models in this paper, it is worth trying to compare the three measures of density dependence: the two area measures of GSP and population and the new "capacity" measure. How intense of a limit have they placed on group formation over the years in this study? I create scatterplots of each measure with overall group numbers for every year, and then plot polynomial curves for every year. Next, I identify the coordinates of each curve's right-hand endpoint, the final points where curves start to flatten out (or even decline). I then create three scatter plots, ten endpoints plotted for each measure, and graph a new curve through them. If a density dependence effect loosens from one year to the next, the height of a later year's curve should rise from the prior year, which means a steeply rising curve in a scatterplot of endpoints suggesting a loosening density limit. If the year-to-year effect does not ease up, the curve should be fairly linear and not rise much at all. Figure 3 shows these curves, and it is GSP whose annual endpoints are a sharply rising curve, showing that its limiting effect reduced dramatically from 2006 to 2015. On the other hand, both state population and capacity remained as hard limits on the number of interest groups over the years.

Take Aways and Future Research

Replication of earlier research should be more than just re-estimating the same models used originally, even if new, comparable data is being used. As important as it is to test the robustness of prior findings with new data, it is arguably even more important to push that research agenda forward. I hope to have done both here, not only replicating past work on state interest group populations using the population ecology ESA model, but pushing that work forward with new independent variables and new ideas. Table 6 summarizes the performance of the independent variables used in this work with the four principle dependent variables, some of which captures the original ESA models of Gray and Lowery. Overall, their early work holds up quite well when re-estimated with the new data from the National Institute for Money in State Politics. Specifically, their choice to use population ecology to study group populations remains effective, and their early models relying heavily on gross state product as the key independent variable capturing density dependence holds up, though in this replication some results reversed from what would be expected when the interest group dependent variable divided by GSP. The Ranney index of party competition, acting as a measure of energy in the political arena, does not hold up as well, but this is a small matter since much of their achievements rest with the concept of resources and density dependence, including in their own work on group niches (see Gray and Lowery 1997).

---- Table 6 ----

There are four value added take-aways from my work here. One is the substitution of state population for GSP as a measure of crucial resources needed for group formation. Especially for membership-based groups, but to some extent for all types, members and supporters are essential, perhaps even more so than state economic performance (which is what GSP captures). Exhibiting the same density dependence effect as GSP, it may even be a more stringent limit on the number of groups a state can support. It is also important to explore more interactions between variables within ESA terms, which is my second take-away. I found one between education and political competition, both of which are energy terms. Future research should really focus on interactions between energy and area, or energy and stability.

Exploring mobilization and counter-mobilization was only one example of the potential of the new state interest group data from the Institute with the coding of groups by organizational type and economic or policy sectors. A more nuanced analysis of counter-mobilization might find a way to incorporate a broader expanse of time, distinguishing between older associations and new associations mobilized in response to the emergence of more public interest groups. Other uses of the group-type coding may also be possible. Finally, the classic components of ESA may not be all there is when it comes to studying group population sizes and diversity. Here I explored a "capacity" term referring to the ability of governments to encourage, and ultimately limit, the formation of new interest groups. Should the model be ESAC? Are there other terms capturing classes of variables? This would be especially fruitful future research.

Table 1: Replication estimates of Gray and Lowery's ESA model

Variable	Random effects Groups by GSP	Panel-corrected Groups by GSP	Hierarchical Groups by GSP	Negative binomial Total groups	Panel corrected Total groups	Hierarchical Total groups
Gross state product	–0.99*** (0.21)	–1.33*** (0.08)	–0.99*** (0.16)	0.01*** (0.00)	2.68*** (0.12)	2.39*** (0.20)
Gross state product squared	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	–0.01*** (0.00)	–0.01*** (0.00)	–0.01*** (0.00)
Four-year folded Ranney index	–44.37 (48.76)	–10.86 (25.83)	–44.33 (38.88)	–0.06 (0.06)	5.50 (35.33)	–55.63 (57.46)
Florida dummy	241.51*** (61.73)	329.41*** (19.16)	241.72 (221.32)	0.88** (0.31)	1263.22*** (133.86)	1330.04*** (259.68)
Recession dummy	3.17 (10.21)	2.19 (34.46)	3.17 (21.63)	0.02 (0.03)	11.44 (40.28)	13.92 (32.63)
Constant	784.70*** (80.46)	817.91*** (27.58)	784.81*** (50.92)	2.89*** (0.10)	327.14*** (23.99)	414.03*** (64.10)
Wald χ^2	46.11***	927.08***	48.19***	75.97***	2796.38***	433.01***
N	490	490	490	490	490	490

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.005$

Table 2: Replication estimates with the substitution of new variables

Variable	Random effects for groups by GSP	Panel-corrected standard errors for groups by GSP	Poisson estimation for total interest groups	Panel-corrected standard errors for total interest groups	Hierarchical model for total interest groups
Population	–0.72*** (0.12)	–0.77*** (0.04)	0.01*** (0.00)	1.44*** (0.06)	1.41*** (0.15)
Population-squared	0.01*** (0.00)	0.01*** (0.00)	–0.01*** (0.00)	–0.01*** (0.00)	–0.01*** (0.00)
Four-year folded Ranney index	–32.39 (46.19)	23.46 (22.85)	–0.12*** (0.01)	–25.69 (39.20)	–101.46 (58.35)
Florida dummy	392.16*** (65.22)	411.83*** (25.68)	0.20 (0.37)	965.25*** (119.88)	990.47*** (292.88)
Per capita state spending	–0.04* (0.02)	–0.06*** (0.01)	0.00*** (0.00)	0.00 (0.01)	0.07*** (0.02)
Recession dummy	8.03 (10.32)	6.15 (40.97)	–0.01 (0.00)	–5.12 (51.66)	–3.20 (32.92)
Per capita state debt	0.02 (0.01)	0.03*** (0.01)	–0.01*** (0.00)	0.05*** (0.01)	0.02 (0.02)
Constant	900.73*** (87.11)	882.82*** (30.42)	6.00*** (0.07)	131.11*** (38.03)	97.56 (85.67)
Wald χ^2	59.33***	1049.81***	1375.42***	5458.73***	343.41***
N	490	490	490	490	490

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.005$

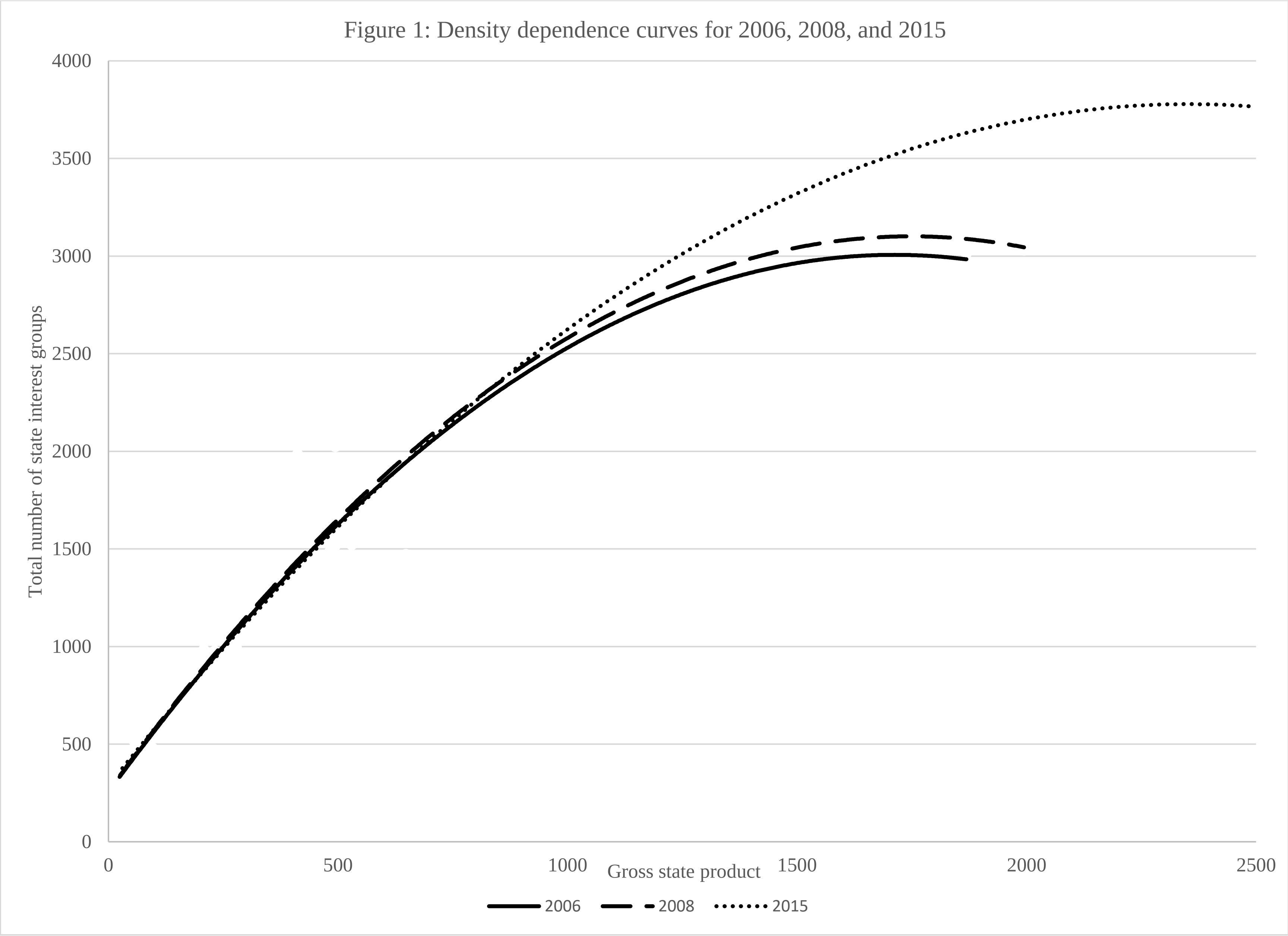

Figure 1: Density dependence curves for 2006, 2008, and 2015
Total number of state interest groups
4000
3500
3000
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
Gross state product
2006
2008
2015

Table 3: Estimates of all lobbying organizations and member-based groups

Explanatory variable	All organizations per capita	Interest groups per capita
Per capita income	0.01 (0.01)	0.07* (0.03)
Bachelor's degrees per capita	0.37*** (0.08)	1.59*** (0.41)
Ranney index	971.34* (416.02)	4603.97* (2099.93)
Bachelor's degrees x Ranney index	–0.38*** (0.10)	–1.71*** (0.51)
State revenue	–0.03* (0.01)	–0.17*** (0.06)
State employees per capita	0.07*** (0.02)	0.22* (0.09)
Effect of political ideology on state slopes	155.96 (58.34)	4853.38 (1771.06)
Effect of state debt on state slopes	0.01 (0.01)	0.00 (0.00)
Constant	150.87 (476.63)	1043.38 (2408.45)
Wald χ^2	163.38***	79.93***
N	490	490

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.005$

Figure 2: Marginal effect of the number of bachelor's degrees per capita in a state on the number of interest groups for all values of the Ranney index

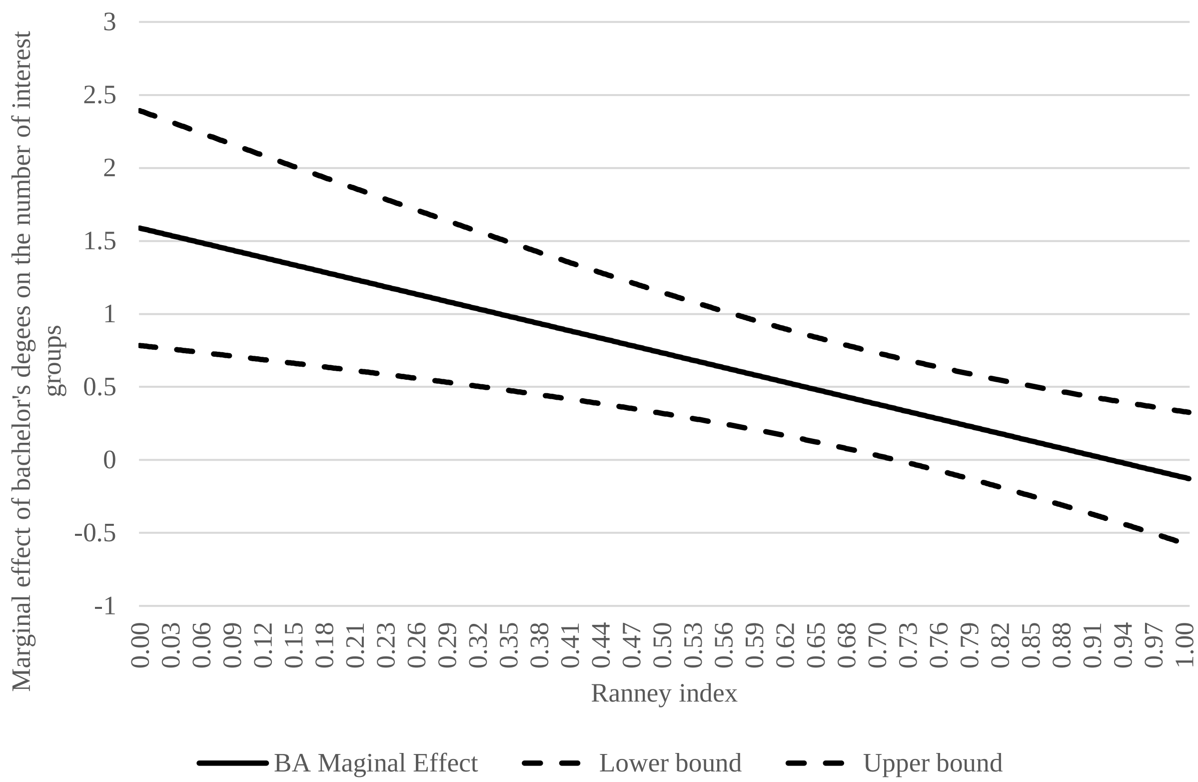

Table 4: Estimates of advocacy group formation on association mobilization

Explanatory var.	General business	Construction	Energy	Finance	Health	Transportation
Sector employment	110.06* (53.22)	–27.81 (47.16)	1232.59* (484.96)	713.52** (274.55)	–24.71 (279.58)	152.81 (80.01)
Sector employment squared	–66.55* (32.57)	106.43 (176.44)	–35162.59* (14052.42)	–4460.25* (1794.94)	66.07 (819.78)	–521.67 (298.68)
Ranney index	–0.36 (2.12)	0.88 (0.95)	–0.98 (1.35)	–2.13 (1.32)	–0.37 (2.50)	–0.37 (0.89)
Advocacy groups	0.39*** (0.13)	0.53*** (0.12)	0.18*** (0.06)	0.41** (0.15)	0.19*** (0.05)	0.38*** (0.09)
State revenue	–0.00*** (0.00)	–0.00*** (0.00)	–0.00*** (0.00)	–0.00*** (0.00)	–0.00*** (0.00)	–0.00*** (0.00)
Constant	7.52 (8.01)	11.31*** (1.80)	9.23*** (2.90)	8.59* (3.75)	30.53*** (10.38)	6.03** (2.32)
Ideology effect on slopes	0.19	0.09	0.02	0.09	0.12	0.05
Debt effect on slopes	0.00	0.00	0.00	0.00	0.00	0.00
Wald χ^2	25.71***	30.10***	27.15***	39.69***	26.18***	34.81***
N	490	490	490	490	490	490

* $p < 0.05$ ** $p < 0.01$ *** p 0.005

Table 5: Estimating total state interest groups with a "capacity" term

Explanatory variable	Count model	Regression model	Hierarchical model
Government capacity	0.61*** (0.03)	711.21*** (169.86)	602.62*** (122.17)
Government capacity squared	–0.06*** (0.00)	–42.10*** (14.00)	–38.87* (16.98)
State population	0.00 (0.00)	0.21 (0.19)	0.36** (0.13)
Ranney index	–0.10*** (0.01)	–70.87 (48.44)	–71.61 (57.64)
Bachelor's degrees per capita	0.00*** (0.00)	0.04*** (0.01)	0.02* (0.01)
Florida	0.79* (0.34)	1485.66*** (106.09)	1377.15*** (292.04)
Per capita income	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
State ideology	0.00*** (0.00)	1.27 (0.76)	–
State debt per capita	–0.00*** (0.00)	–0.04 (0.03)	–
Constant	6.19*** (0.06)	197.21 (104.56)	215.36 (125.22)
Wald χ^2	1945.59***	6268.49***	379.74***
N	490	490	490

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.005$

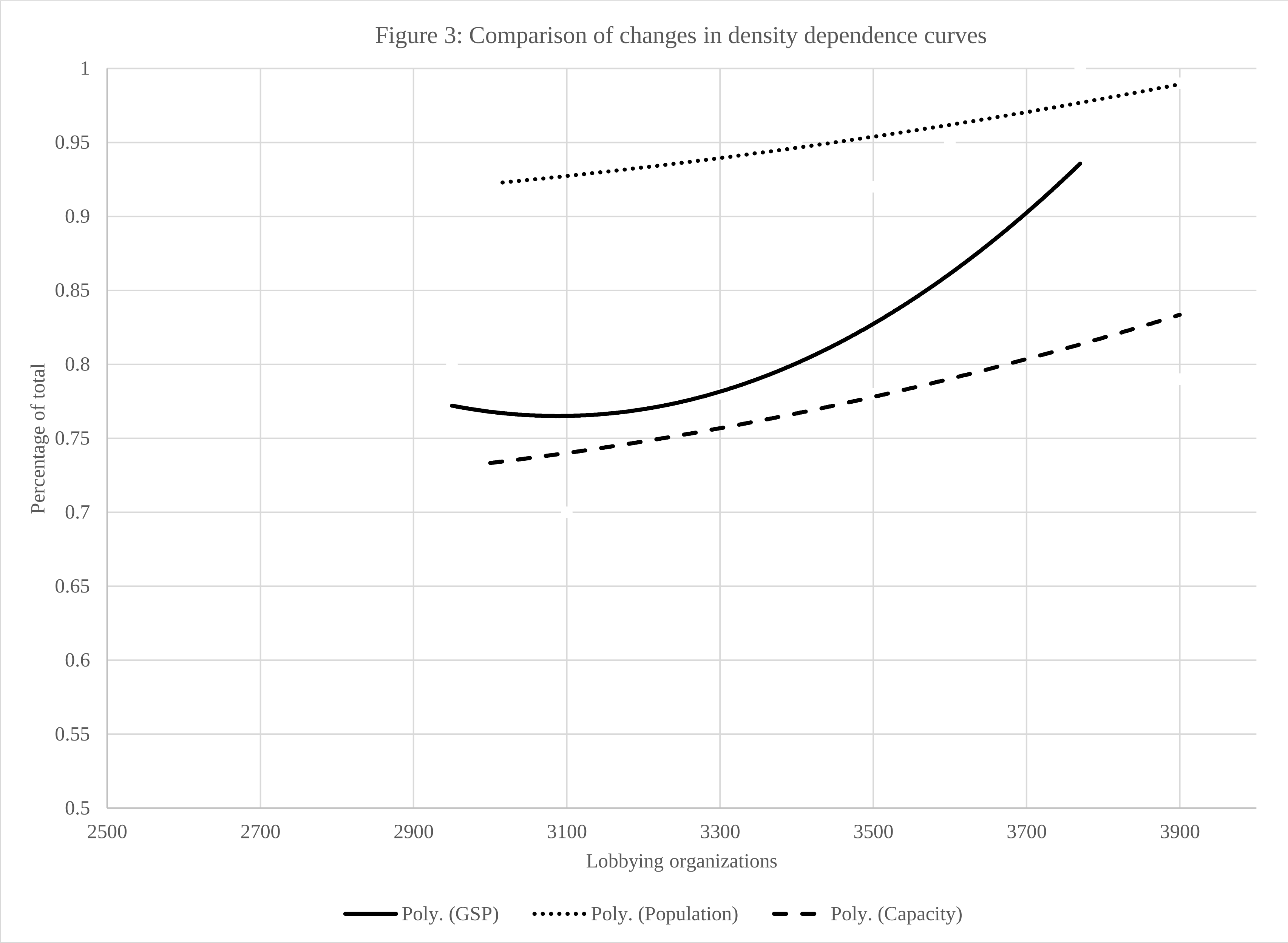
Figure 3: Comparison of changes in density dependence curves
Percentage of total
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
2500
2700
2900
3100
3300
3500
3700
3900
Lobbying organizations
Poly. (GSP)
Poly. (Population)
Poly. (Capacity)

Table 6: Summary of independent variable performance by dependent variable

Independent variable	All groups by GSP	Count of all groups	All groups per capita	Membership groups per capita
Gross state product	negative	positive	positive	positive
Gross state product-squared	positive	negative	no	no
State population	negative	positive	positive	positive
State population-squared	positive	negative	negative	negative
Ranney index	no	no	positive	positive
Percentage of Democratic control	no	no	no	no
Florida dummy	positive	positive	positive	positive
Recession dummy	no	no	no	no
State government capacity	negative	positive	positive	–
State government capacity-squared	positive	negative	negative	–
State spending	negative	positive	no	no
State debt	positive	positive	positive	positive
Per capita income	no	no	no	positive
Median income	no	no	no	no
Bachelor degrees per capita	no	no	positive	positive
State revenue	pos./neg.	no	negative	negative
State employees	no	negative	positive	positive
State political ideology	positive	positive	positive	positive

References

Andserson, Sarah, and Philip Habel. 2009. "Revisiting Adjusted ADA Scores for the U.S. Congress, 1947 – 2007." *Political Analysis* 17(Winter): 83 – 88.

Baumgartner, Frank R., Virginia Gray, and David Lowery. 2009. "Federal Policy Activity and the Mobilization of State Lobbying Organizations." *Political Research Quarterly* 62(September): 552 – 567.

Baumgartner, Frank R., Heather A. Larsen-Price, Beth L. Leech, and Paul Rutledge. 2011. "Congressional and Presidential Effects on the Demand for Lobbying." *Political Research Quarterly* 64(March): 3 – 16.

Beck, Nathaniel, and Jonathan N. Katz. 1995. "What to do (and not to do) with Time-Series Cross-Section Data." *American Political Science Review* 89(September): 634 – 647.

Berkhout, Joost. 2015. "Interest Organization Demography Research in Europe," in *The Organizational Ecology of Interest Communities*, eds. David Lowery, Darren Halpin, and Virginia Gray, pp. 37 – 60. London: Palgrave-Macmillan.

Berry, Jeffrey M. 1999. *The New Liberalism: The Rising Power of Citizen Groups.* Washington, DC: Brookings Institution Press.

Brasher, Holly, and David Lowery. 2006. "The Corporate Context of Lobbying Activity." *Business and Politics* 8(1): 1 – 23.

Carson, Jamie L., Michael H. Crespin, Jeffrey A. Jenkins, and Ryan J. Vander Wielen. 2004. "Shirking in the Contemporary Congress: A Reappraisal." *Political Analysis* 12(Spring): 176 – 179.

Clark, Tom S., and Drew A. Linzer. 2015. "Should I Use Fixed or Random Effects?" *Political Science Research and Methods* 3(2): 399 – 408.

Dusso, Aaron. 2010. "Legislation, Political Context, and Interest Group Behavior." *Political Research Quarterly* 63(March): 55 – 67.

Fisker, Helene M. 2013. "Density Dependence in Corporative Systems: Development of the Population of Danish Patient Groups." *Interest Groups & Advocacy* 2(June): 119 – 138.

Gray, Virginia, and David Lowery. 1993. "The Diversity of State Interest Group Systems." *Political Research Quarterly* 46(March): 81 – 97.

Gray, Virginia, and David Lowery. 1996. *The Population Ecology of Interest Representation.* Ann Arbor: University of Michigan Press.

Gray, Virginia, and David Lowery. 1997. "Life in a Niche: Mortality Anxiety among Organized Interests in the American States." *Political Research Quarterly* 50(March): 25 – 47.

Halpin, Darren R., and Grant Jordan. 2009. "Interpreting Environments: Interest Group Response to Population Ecology Pressures." *British Journal of Political Science* 39(April): 243 – 265.

Holbrook, Thomas. M., and Raymond. J. La Raja. 2018. "Parties and Elections," in *Politics in the American States,* eds. V. Gray, R.L. Hanson, and T. Kousser, pp. 57-97. Thousand Oaks: Sage.

Holyoke, Thomas T. 2011. *Competitive Interests: Competition and Compromise in American Interest Group Politics.* Washington, DC: Georgetown University Press.

Holyoke, Thomas T. 2014. *Interest Groups and Lobbying: Pursuing Political Interests in America.* Boulder: Westview Press.

Holyoke, Thomas T. 2017. "Interest Group and Lobbying Research in a Higher Level Context: Two Tests of Integrating Multiple Layers of Analysis." *American Politics Research* 45(September): 887 – 902.

Holyoke, Thomas T. 2019. "Dynamic State Interest Group Systems: A New Look with New Data." *Interest Groups & Advocacy* https://doi.org/10.1057/s41309-019-00058-9.

Hunter, Kenneth G., Laura Ann Wilson, and Gregory G. Brunk. 1991. "Societal Complexity and Interest-Group Lobbying in the American States." *Journal of Politics* 53(May): 488 – 503.

Johnson, Janet Buttolph, Richard A. Joslyn, and H.T. Reynolds. 2001. *Political Science Research Methods*, 4th edition. Washington, DC: Congressional Quarterly Press.

Kashin, Konstantin, Gary King, and Samir Soneji. 2015. "Explaining Systematic Bias and Nontransparency in U.S. Social Security Administration Forecasts." *Political Analysis* 23(Summer): 336 – 362.

King, David C., and Jack L. Walker. 1992. "The Provision of Benefits by Interest Groups in the United States." *Journal of Politics* 54(May): 394 – 426.

Leavitt, Fred. 2001. *Evaluating Scientific Research.* Upper Saddle, NJ: Prentice Hall.

Loomis, Burdett A. 2015. "Beyond Metaphor: Populations and Groups, Interests, and Lobbyists." In *The Population Ecology of Interest Communities,* eds. David Lowery, Darren Halpin, and Virginia Gray, pp. 249 – 262. London: Palgrave-Macmillan.

Lowery, David, and Virginia Gray. 1993. "The Density of State Interest Group Systems." *Journal of Politics* 55(February): 191 – 206.

Lowery, David, and Virginia Gray. 1996. "The Population Ecology of Gucci Gulch, or the Natural Regulation of Interest Group Numbers in the American States." *American Journal of Political Science* 39(February): 1 – 29.

Lowery, David, and Virginia Gray. 2007. "Interest Organization Communities: Their Assembly and Consequences" in *Interest Group Politics,* 7th edition, eds. Allan Cigler and Burdett Loomis. Washington, DC: Congressional Quarterly Press, pp. 130 – 154.

Lowery, David, Virginia Gray, Jennifer Anderson, and Adam J. Newmark. 2004. "Collective Action and the Mobilization of Institutions." *Journal of Politics* 66(August): 684 – 705.

Lowery, David, Virginia Gray, and John Cluverius. 2015. "Temporal Change in the Density of State Interest Communities, 1980 to 2007." *State Politics & Policy Quarterly* 15(May): 263 – 286.

Meyer, David S., and Suzanne Staggenborg. 1996. "Movements, Countermovements, and the Structure of Political Opportunity." *American Journal of Sociology* 101(May): 1628 – 1660.

Morehouse, Sarah M. 1981. *State Politics, Parties, and Policy.* New York: Holt, Rinehart, and Winston.

Neulip, J., and R. Crandall. 1993. "Reviewer Bias Against Replication Research." *Journal of Social Behavior and Personality* 8(1): 21 – 29.

Newmark, Adam J., and Anthony J. Nownes. 2017. "It's All Relative: Perceptions of Interest Group Influence." *Interest Groups & Advocacy* 6(October): 215 – 230.

Nownes, Anthony J., and Daniel Lipinski. 2005. "The Population Ecology of Interest Group Death: Gay and Lesbian Rights Interest Groups in the United States, 1948 – 1998." *British Journal of Political Science* 35(April): 303 – 319.

Rabe-Hesketh, Sophia, and Anders Skrondal. 2012. *Multilevel and Longitudinal Modeling Using Stata.* College Station: Stata Press.

Salisbury, Robert H. 1984. "Interest Representation: The Dominance of Institutions." *American Political Science Review* 78(March): 64 – 76.

Squire, Peverill. 2017. "A Squire Index Update." *State Politics & Policy Quarterly* 17(4):361-71.

Strickland, James. 2019a. "America's Crowded Statehouses: Measuring and Explaining Lobbying in the U.S. States." *State Politics & Policy Quarterly* https://doi.org/10.1177/15324400198294008.

Strickland, James. 2019b. "A Paradox of Political Reform: Shadow interests in the U.S. states. *American Politics Research* 47(July): 887 – 914.

Thomas, Clive S., and Ronald J. Hrebenar. 1992. "Changing Patterns of Interest Group Activity: A Regional Perspective," in *The Politics of Interests: Interest Groups Transformed,* ed. Mark P. Petracca, pp. 150 – 174. Boulder: Westview Press.

Thomas, Clive S., and Ronald J. Hrebenar. 2004. "Interest Groups in the States," in *Politics of the American States,* 8th edition, eds. Virginia Gray and Russell L. Hanson, pp. 100 – 128. Washington, DC: Congressional Quarterly Press.

Tilly, Charles. 1978. *From Mobilization to Revolution.* Reading, MA: Addison-Wesley.

Truman, David B. 1951. *The Governmental Process.* New York: Knopf.

Vogel, David. 1989. *Fluctuating Fortunes: The Political Power of Business in America.* New York: Basic Books.

Walker, Jack L. 1983. "The Origin and Maintenance of Interest Groups in America." *American Political Science Review* 77(June): 390 – 406.

Waterhouse, Benjamin C. 2014. *Lobbying America: The Politics of Business from Nixon to NAFTA.* Princeton: Princeton University Press.

Witko, Christopher, and Adam J. Newmark. 2005. "Business Mobilization and Public Policy in the US States." *Social Science Quarterly* 86(June): 356 – 367.

Zeigler, L. Harmon. 1983. "Interest Groups in the States," in *Politics in the American States,* 4th edition, eds. Virginia Gray, Herbert Jacob, and Kenneth Vines, pp. 97 – 132. Boston: Little, Brown.

Zeller, Belle. 1954. *American State Legislatures*, 2nd edition. New York: Thomas Y. Cromwell.

---

[1] Information regarding the Institute can be found at http://www.followthemoney.org/.

[2] This data and supporting information regarding it is available at http://www.fresnostate.edu/socialsciences/polisci/fac-staff/full-time/holyoke.html.

[3] Dividing groups by GSP distorts the data, artificially deflating the number of groups so that they range from 0.67 to 34.33 when the original count is from 100 to 4000. Since this leads to unnaturally low, and impossible to interpret, coefficients in regression models, I partially correct it by multiplying groups-divided-by-GSP by 100. Now it ranges from 67.46 to 3433.33 and is still standardized. The mean is 531.59 and standard deviation is 317.88. For the raw count variable of lobbying organizations in a state, the mean is 1035.22 and the standard deviation is 776.45.

[4] Data on state GDP from the U.S. Bureau of Economic Analysis at https://www.bea.gov/data/gdp/gdp-state. The mean is 287.35 and the standard deviation is 352.57.

[5] Ranney Index data for 2006 to 2012 is from Carl Klarner at https://dataverse.harvard.edu/dataset.xhtml?persistentId=hdl:1902.1/22519. Data for 2013 to 2015 came from Holbrook et al. (2018). Because the index is used in marginal effect analyses, to make interpretation easier, it was re-scaled from 0.66 to 1.00 to 0 to 1.00 with a mean of 0.61 and a standard deviation of 0.25.

[6] Holyoke (2017) argues that hierarchical models are an effective way to study group population data, especially if the study also focuses on choices made at the individual group or lobbyist level.

[7] Results are available on request.

[8] Both of these variables come from the U.S. Census Bureau.

[9] State population data comes from the U.S. Census Bureau. Because population numbers are large relative to the dependent variable, the coefficients are vanishingly small in regression equations. To solve this problem I divide state population by 10,000. Thus, each coefficient is the increase in the number of state interest groups for a standard population increase of 10,000 rather than 1. The same adjustment is reflected in the square of this variable. The adjusted population variable's mean is 605.10 and its standard deviation is 662.74.

[10] I was not able to estimate hierarchical models as they fail to converge when I included population and its square.

[11] Percentage of Democratic control comes from the number of Democratic legislators in each state house, which comes annual editions of *The Book of the States.* From this source I also found the partisan affiliation of each state governor and used this to code the unified government variable. Nebraska is excluded because it has a unicameral, nonpartisan legislature.

[12] This data comes from annual editions of *Fiscal Survey of the States* published by the National Association of State Budget Officers. It is divided by population for a per capita measure, so the variable's new mean is 2,240.31 and standard deviation is 1,468.66.

[13] This data comes from the Census Bureau and is divided by state population for a per capita measure. Because this produces very small coefficients, I increase the values by multiplying it by 1,000,000,000. Its new mean is 2,849.80 and standard deviation is 1,973.12. Later in the paper I use debt not adjusted per capita, but still increased in value for more interpretable coefficients. Its mean is 15.94 and standard deviation is 21.00.

[14] See Holyoke (2019) for details on the sectors.

[15] Again, this data comes from the *Fiscal Survey of the States.*

[16] Degree data comes from the National Institute for Education Statistics at the U.S. Department of Education. The adjusted variable's mean is 3,689 and its standard deviation is 2,352.

[17] From the *Fiscal Survey of the States.* The variable is in 2000 values; its mean is 10,032.59 and standard deviation is 12,373.59.

[18] This data comes from the U.S. Census Bureau and is divided by state population for a per capita figure. The mean is 15,475.32 and the standard deviation is 6,807.32.

[19] Like state spending, this measure comes from the *Fiscal Survey of the States* by the National Association of State Budget Officers.

[20] The variable was coded using information on debt limits found in *Budget Processes of the States* published annually by the National Association of State Budget Officers.

[21] The eigenvalue of the factor is 2.38. Legislative professionalism loads at 0.77, state employees at 0.93, state revenue at 0.96, and then, far below, unified government loads at 0.05 and debt limit at 0.08. The last two have negative coefficients when regressed on the dimension, which is unexpected for unified government.