The Thermostatic Model of Responsiveness in the American States*

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Does the thermostatic model of responsiveness characterize the relationship between opinion and policy in the states? Using a unique dataset on state spending preferences on education and welfare, I find evidence of *dynamic policy representation* and *dynamic public*. As state support for spending on education or welfare increases, so too does actual state expenditures. As state expenditures on education or welfare increase, state preferences for additional spending decreases. Furthermore, the relationship between opinion and policy is conditional. States that are highly professionalized are more responsive compared to those that are less professionalized. And, the public is more likely to respond to policy actions on issues that are salient. The results provide a more nuanced understanding about the degree of dynamic representation and responsiveness in the states and the thermostatic model, more generally.

*A previous version of this paper was presented at the Annual Meetings of the American Political Science Association in Toronto, Canada, Sept. 3-6, 2009. This paper was awarded the State Politics and Policy Section’s “Best Graduate Student Paper” at the 2009 APSA Meeting. I would like to thank Eric Plutzer, Michael Berkman, Christopher Zorn, and Frank Baumgartner for helpful discussions during the development of this paper.
A growing body of work reveals that public opinion and policy often exhibit a dynamic relationship characterized as a thermostat (Wlezien 1995, 2004; Soroka and Wlezien 2004, 2005; Johnson et al. 2005; Eichenberg and Stoll 2003; Erikson, MacKuen and Stimson 2002). The *thermostatic model of policy responsiveness* posits that policy changes follow changes in public opinion; however, public opinion also reacts to policy changes across time. The result is a reactive system of governance where public opinion and policy constantly adjust and readjust to each other over time.

The thermostatic model has been used to explain the dynamic relationship between spending preferences and expenditures in the United States (e.g., Wlezien 1995), the United Kingdom, and Canada across a variety of issues including defense, education, health, and welfare (e.g., Soroka & Wlezien 2010). To date, however, we know much less about whether the thermostatic model characterizes the dynamic relationship between public opinion and policy in the American states (but see Johnson et al. 2005). In fact, most state-level research has been cross sectional (e.g., Erikson, Wright, and McIver 1993) or has used a few points in time (Johnson et al. 2005; Camobreco and Barnello 2008) no doubt because of the methodological challenges to measuring state opinion over time (but, see Pacheco 2012).

I build upon the seminal work of previous scholars by using a unique dataset containing yearly estimates of state preferences on education and welfare spending and linking these measures to state expenditures. I first ask whether, theoretically, it makes sense for the thermostatic model to characterize the relationship between opinion and policy in the states. I theorize that the first part of the model, *dynamic policy representation*, should exist in the states to the same extent as the national level. Consistent with the model, I find that state policy expenditures follow state preferences. Furthermore, I find that states with highly
professionalized legislatures are more responsive to opinion, no doubt because they are better able to gauge the wants of residents. The second part of the model, *dynamic public responsiveness*, is more theoretically complex due to federalism. In general, however, I find that state preferences respond to state expenditures as expected, even after controlling for federal expenditures. Moreover, the public responds more to issues that are highly salient.

These results have several implications. First, I provide additional evidence that the impact of public opinion on policy is causal at the subnational level. To give just one example, I estimate that if support for education spending increases by 5 percentage points, spending per person increases by $1,800 in the following year. Consistent with the thermostatic model, I find that the causal relationship between public opinion and policy is a two-way street for education and welfare expenditures, but that the effects of state policy on opinion are much smaller compared to the effects of opinion on state policy. While these effects are small, they do suggest that sustained changes in policy have meaningful impacts on public opinion over the long run; and, that differences in state trends in public opinion are partly due to differences in state policies. Finally, by using the cross-sectional variation across the states on institutional factors and citizen characteristics, I show that various aspects of the thermostatic model are contingent on other factors.

**The Thermostatic Model of Policy Responsiveness**

The dynamic relationship between public opinion and policy has been of interest to scholars since at least the 1960s (e.g. Miller and Stokes 1963), yet it is recently that scholars have had the methodological capacity to empirically examine how preferences are translated into policies over time. This research shows that the dynamic relationship between opinion and policy can be described as a thermostat, whereby the public is the thermostat and policymakers
the furnace or air condition unit (Wlezien 1995; 1996; Soroka and Wlezien 2010). According to this model, policies follow opinion; however, opinions also react to policies across time, similar to a thermostat. When policy output increases, the public’s preferences for more policy output decrease; when policy output decreases, the public’s preferences for more policy output increase. The result is a reactive system of governance where public opinion and policy constantly adjust and readjust to each other over time. The thermostatic model of representation is consistent with the traditional view of policy responsiveness (Downs 1957) whereby elected officials enact policies based on changing opinions for fear of being ousted at the next election cycle. In addition, citizens react in a collective, rational way to the actions of government officials; the mass public is characterized as being reasonably well informed about what policymakers are doing, which is necessary for a representative democracy (Wlezien and Soroka 2010).

Theoretically, the thermostatic model of policy responsiveness has two moving parts. The first part suggests that the public has a measureable influence over policy changes; *dynamic policy representation* exists. Second, policy changes have an impact on public opinion; *dynamic public responsiveness* exists. Below I consider whether the same dynamics exist in the states.

**Dynamic Policy Representation in the American States**

In a responsive democracy, changes in mass opinion should induce policy changes in the same direction. Elections serve as the main connection between preferences and elites (Key 1966; Miller and Stokes 1963; Mayhew 1974; Fiorina 1981). Electoral turnover accounts for the fact that the public elects elites who are in line with their policy preferences who then enact similar policies. For instance, a liberal public elects Democrats who then enact liberal policies. At the same time, however, elected officials catch wind of changing opinion and adjust their behavior accordingly because they are motivated by re-election; this is political expediency.
Both of these mechanisms—electoral turnover and political expediency—explain the relationship between public opinion and policy at the national level (Erikson, MacKuen, and Stimson 2002). More formally, Soroka and Wlezien (2010) represent dynamic policy representation at the national level as follows,

$$\Delta P_t = \alpha + \beta_1 R_{t-1} + \beta_2 G_{t-1} + \mu_t$$

where policy changes ($P_t$) are influenced by mass preferences ($R_{t-1}$) and party control ($G_{t-1}$) in the previous year and where $\alpha$ and $\mu_t$ represent the intercept and error term, respectively. If policy representation occurs as suggested by the thermostatic model, the coefficient on mass preferences ($\beta_1$) should be positive and statistically significant, which is exactly what scholars find (e.g., Wlezien 1995; Erikson, MacKuen, and Stimson 2002).

Should we expect dynamic policy representation to occur in a similar way at the state level? First, it is helpful to rewrite Equation 1 to correspond to policy changes across the states. More formally,

$$\Delta P_{t,s} = \alpha + \beta_1 R_{t-1,s} + \beta_2 G_{t-1,s} + \mu_{t,s}$$

where policy changes at time $t$ in a particular state, $s$, ($P_{t,s}$) are influenced by mass preferences in state, $s$ ($R_{t-1}$) and party control in state, $s$ ($G_{t-1}$) in the previous year and where $\alpha$ and $\mu_{t,s}$ represent the intercept and error term, respectively. Should state preferences have a positive influence over policy changes in the states? The answer depends on whether elections are tools that state electorates use to influence policy and whether state political elites adjust their behavior in order to be re-elected. To the first point, liberal state electorates tend to elect state parties that are liberal (regardless of partisanship) while conservative state electorates produce parties that are conservative (Erikson, Wright, and McIver 1993). Once in office, liberal parties enact more liberal policies. Hence, there is evidence, albeit cross-sectional, that state residents
elect officials who are likely to influence the ideological direction of state policies (Erikson et al. 1993). Secondly, state officials are largely constrained by the preferences of state residents. Whether public opinion and policy are measured as global indicators (e.g., Erikson, Wright, and McIver 1993) or on specific policies (e.g., Hill, Leighley and Hinton-Andersson 1995; Norrander and Wilcox 1999; Johnson et al. 2005), state policies reflect the preferences of state citizens. Correspondingly, I expect the following hypothesis concerning dynamic policy representation at the state level:

**H1: Changes in state opinion should induce state policy changes in the same direction; the coefficient on \( R_{t-1,s} \) in Equation 2 should be positive and statistically significant.**

Hypothesis 1 applies to the states generally; however, some states may be more responsive to changing preferences compared to others. Because elections are the mechanism linking opinion to policy, responsiveness should depend on state *institutional characteristics.* Two institutional characteristics that increase policy responsiveness include the presence of the initiative and legislative professionalism. Initiatives are a form of direct democracy where citizens can directly propose laws and policies to the legislature. Several studies have shown that initiatives heighten policy responsiveness to public opinion on a variety of issues including abortion (Areceneaux 2002; Bowler and Donovan 2004; Gerber 1999), government spending (Matsusaka 2004), the death penalty (Gerber 1996), and minority rights policies (Gerber and Hug 2002). Why does the presence of initiatives increase policy responsiveness? One theory is that legislators take into account public opinion when drafting legislation in anticipation of future initiatives (Gerber 1996). Hence, the mere “threat” of an initiative is enough for elected officials to respond to changing levels of public opinion. Another theory is that initiatives give legislators more accurate information about voter preferences (Romer and Rosenthal 1979; Matsusaka...
The presence of initiatives, thus, gives legislators an extra information source from which to gauge changing public opinion. Consequently, I expect the following:

**H2**: Changes in state opinion should induce greater changes in state policy in states with initiatives; the coefficient on $R_{t-1,s}$ in Equation 2 should be larger in states with initiatives.

Legislative professionalism also has been shown to increase policy responsiveness. Professional legislatures are those in which legislators meet in unlimited session, are paid well, and are provided with superior staff resources and facilities (Squire 1992). These increased resources allow professional legislators to have more contact with their constituents (Squire 1993), monitor changing preferences better, and, therefore, be more attentive to constituent concerns (Maestas 2000). Hence, legislative professionalism increases the policy responsiveness to public opinion, again, because it allows legislators to monitor and react quicker to changing public opinion through political expediency. Legislative professionalism also creates an environment that attracts highly skilled politicians who vie for elected office; individuals seeking office in professional legislators are more likely to be “career” or professional politicians (Berkman 1994; Squire 1992) who have ambitious long term goals of higher office (Maestas 2000; 2003). Consequently, I expect the following:

**H3**: Changes in state opinion should induce greater changes in state policy in highly professionalized states; the coefficient on $R_{t-1,s}$ in Equation 2 should be larger in highly professionalized states.

To summarize, the first part of the thermostatic model, dynamic policy representation, suggests that mass preferences influence the direction of policy changes over time. Applying this to the state level, the expectation is that changes in state public opinion will be followed by congruent changes in state policy (**H1**). The effect that public opinion has on state policy
changes is expected to increase with two institutional factors including the presence of an initiative (H2) and legislative professionalism (H3). In the next section, I explain the second part of the thermostatic model, dynamic public responsiveness.

**Dynamic Public Responsiveness in the American States**

According to the thermostatic model, preferences should react negatively to policy. As policy runs in a particular direction, the more the public should demand policies in the opposite direction. The mechanisms of public responsiveness rest on the acquisition and availability of political information. Public opinion may respond to policy almost immediately as political information is transmitted by majority and opposition groups (Jacobs and Shapiro 2000; Zaller 1992; Stimson 1991; MacKuen, Erikson, and Stimson 1992). And, while the public may not know the specifics about policy changes, they will be informed enough to understand the direction and scope of the change, particularly if the policy is salient (Page and Shapiro 1992; Erikson, Wright, and McIver 2002; Burstein 2003). This is exactly what Erikson, MacKuen, and Stimson (2002) find; the mass public responded to legislative activity virtually immediately.

More formally, we can depict the public’s preference for more or less policy—its relative preference \( R_t \)— as the difference between the public’s preferred level of policy \( P^* \) and the level it actually gets \( P \) (Soroka and Wlezien 2010):

\[
\text{Eq. 3} \quad R_t = P^*_t - P_t
\]

Because we typically do not observe the public’s preferred level of policy \( P^* \), we rewrite the model as follows (Soroka and Wlezien 2010 28):

\[
\text{Eq. 4} \quad R_t = \alpha + \beta_1 P_t + \beta_2 W_t + u_t
\]

where relative preferences \( R_t \) are influenced by policy \( P_t \) and other exogenous factors \( W_t \) and where \( \alpha \) and \( \mu_t \) represent the intercept and error term, respectively. Furthermore, if public
responsiveness exists and is consistent with the model, the feedback coefficient ($\beta_1$) should be negative and statistically significant.

Applied to the state level, Equation 4 can be rewritten as follows:

Eq. 5  \[ R_{t,s} = \alpha + \beta_1 P_{t,s} + \beta_2 W_{t,s} + \mu_{t,s} \]

where relative preferences in state, $s$, ($R_t$) are influenced by policy in state, $s$, ($P_{t,s}$) and other exogenous factors in the state or nation ($W_{t,s}$) and where $\alpha$ and $\mu_{t,s}$ represent the intercept and error term, respectively. Should we expect dynamic public responsiveness to occur at the state level?

Here, the expectations are less clear. Theoretically, public responsiveness may not be fully functional at the state level because federalism creates a system of shared government responsibility, making it more difficult for citizens to have informed preferences about what different levels of government should do or have done in the past (Soroka and Wlezien 2010). As the “mixing” of intergovernmental responsibilities increases, the harder it is for the public to clearly hold one level of government accountable (e.g., Wlezien and Soroka 2010). There is some evidence that this may be the case in regards to the thermostatic model. Soroka and Wlezien (2010) find that the feedback coefficient (e.g., $\beta_1$, in Equation 5) increases as the percentage of total spending in a given domain that comes directly from the national government increases. For instance, preferences towards spending on welfare in the United States were more responsiveness to federal expenditures on welfare compared to the responsiveness of preferences towards spending on education, which is primarily a function of the states (Soroka and Wlezien 2010).

On the other hand, there is empirical evidence at the individual level that people hold different levels of government responsible for the policies over which they have primary
responsibility (e.g., Cutler 2004; Niemi et al. 1995; Arcenaux 2005). For instance, Schneider (2008) finds that citizens’ attitudes about the intergovernmental responsibilities of disaster response coincide with how the response system is supposed to function. Atkeson and Partin (1995) find that voters hold governors responsible for the state economy, but not the national economy while senators are held accountable for the national economy and not the state economy. And, in a recent article, Wlezien and Soroka (2010) show that Canadian provincial preferences for more welfare spending responded equally to both federal and provincial welfare spending. Hence, in general, previous research suggests that dynamic public responsiveness should exist at the state level, even if dampened due to federalism. In other words:

**H4: Changes in state policies should induce changes in state preferences in the opposite direction; the coefficient on $P_{t,s}$ in Equation 5 should be negative and statistically significant.**

Nonetheless, the extent of public responsiveness to state policies may rest on factors that influence the clarity of the policy signal from governments and the acquisition of that signal by state residents. First, the policy signal should be strongest in domains that are highly salient to the public. At a basic level, salient issues are those that the public cares about and, consequently, likely to pay attention to in the news (Brody 1991) or during campaigns (Ferejohn and Kiklinksy 1990). These issues are also likely to form the subject of political debate (Graber 1989) and candidates are likely to pay more attention to public opinion on these issues (Hill and Hurley 1999). The implications for dynamic public responsiveness are straightforward: a relatively large number of people are expected to respond thermostatically to policies that are especially salient, while few citizens will be aware of policy changes in non-salient domains (Wlezien and Soroka 2010).
Consequently, I expect the following:

\[ H5: \text{Public responsiveness to state policies will be higher in salient domains; the coefficient on } P_{t,s} \text{ in Equation 5 will be larger (in the negative direction) for highly salient policies.} \]

Second, public responsiveness should be higher in states where residents are more aware of or better able to receive the policy signal. One factor that influences political attentiveness and sophistication more broadly is educational attainment; at the individual level, educational attainment is positively associated with political information acquisition (Mondak 1995), political knowledge (Delli Carpini and Keeter 1989), and political interest (Brady, Verba, and Schlozman 1995). We should expect the same relationship at the aggregate; the more educated a public is the more sophisticated and responsive to what policy makers are actually doing at various levels of government. Consequently,

\[ H6: \text{Public responsiveness to state policies will be higher in states that are highly educated; the coefficient on } P_{t,s} \text{ in Equation 5 will be larger (in the negative direction) in highly educated states.} \]

Overall, the second part of the thermostatic model suggests that policy influences preferences. Applied to the states, the expectation is that state policies produce incongruent changes in state public opinion (\(H4\)). The effect that state policy has on changes in state opinion, absent from national policy, depends on the saliency of the issue (\(H5\)) and the educational sophistication of state residents (\(H6\)).

**Testing the Thermostatic Model in the States on Education and Welfare Policies**

For the remainder of the paper, I test the hypotheses outlined above concerning the thermostatic model in the states using expenditure and public opinion data on education and
public welfare. To date, the thermostatic model has primarily been tested using expenditure data (Wlezien 1995) or other composite measures of policy activity (Erikson, MacKuen, and Stimson 2002); hence, it is appropriate to perform state level analyses using similar data. Furthermore, because education and welfare vary in saliency, I can test H5 by comparing the feedback coefficients. Finally, state preferences towards spending on education and welfare are widely available, making it practical to reliably and validly measure state opinion over time as I describe below.

Measuring Policy Changes in Education and Welfare Spending

The policy measures are based on yearly state expenditures on education and public welfare taken directly from the State and Local Government Finance Data Query System provided by the Urban Institute’s Tax Policy Center. The dataset covers the time period from 1977-2000 and is adjusted for inflation and state population (e.g., the measures are in constant 1999 dollars and per capita, in thousands). Figures 1 and 2 show how per capita spending on

1 The education expenditures variable captures all direct expenditures by state and local governments on education (code E24) including institutions of higher education (Census codes 16 and 18), programs primarily for training and education of the handicapped, blind, or deaf and adults (Census code 21), aid to private schools (Census code 19) and elementary and secondary education spending (Census code 12). The welfare expenditures variable captures all direct expenditures by state and local governments on public welfare (code E90) including welfare institutions (Census code 77), administration of welfare programs (Census code 79), cash payments under Federal categorical assistance programs (e.g., SSI/TANF) (Census code 67), cash payments to individuals contingent on need other than federal programs (Census code 68), and payments made directly to vendors (Census codes 74 and 75).
education and welfare, respectively, has changed over time in select states across the four regions. As illustrated in Figure 1, changes in the amount of money spent on education vary both across time and states, although there is commonality in the trends. States tend to vacillate between increasing and decreasing spending towards education with some states (e.g., Pennsylvania) exhibiting larger “ups and downs” compared to other states (e.g., Texas).

Similarly, the direction of changes in spending is not always uniform; in the mid-1990s, several states (e.g., Alabama, California) increased their education spending while others (e.g., Massachusetts, Colorado) decreased their spending on education during the same time frame. Figure 2 shows a similar pattern for changes in state spending on welfare. Simple descriptive statistics suggest that the majority of the variance in changes in spending is within states for both education (97%) and welfare (98%).

Measuring Dynamic Public Opinion on Education and Welfare Spending

The challenges involved with measuring dynamic state public opinion, particularly from national surveys, are well documented (e.g., Erikson et al. 1993). Recent statistical innovations in small area measurement, however, have made it possible to obtain reliable and valid measures of state opinion over time (e.g., Park, Bafumi, and Gelman 2005; Lax and Phillips 2009). Pacheco (2011) shows that scholars can reliably and validly estimate yearly measures of state public opinion by using multilevel regression, imputation, and post-stratification (hereafter referred to as MRP) coupled with a small moving average, such as a three or five year pooled time frame. More importantly, by comparing state ideology and partisanship estimates with exit poll data, Pacheco (2011) shows that the MRP technique is able to capture relative changes in
opinion across the states, particularly in the most populated states.\(^2\) Others have used this technique to measure changes in state opinion on specific issues, such as anti-smoking policies (Pacheco 2012).

I follow the guidelines outlined by Pacheco (2011) and combine responses across various national survey organizations to measure dynamic public opinion on education and welfare spending using the MRP approach on a five year pooled time frame.\(^3\) Specifically, I take the difference between the percentage who favored an increase in education (or welfare) spending and the percentage of state residents who favored a decrease in education (or welfare) spending using the General Social Survey, National Election Survey, Gallup polls, CBS/NYT polls, and

\(^2\) I depart from Pacheco by combining various polling organizations, as I explain below. This opens up the possibility that the observed dynamics are artificial, resulting from “house effects” or question wording. The five year average deflates the possibility that house effects are causing changes in one particular year. I also only use survey questions asked in identical ways to minimize the effects of question wording. Finally, a comparison of frequencies across survey organizations in particular years shows that there are minimal differences across organization (see Tables A2 and A3 in the Supplemental File). Thus, I am confident that changes in education or welfare preferences across the states are not artificially caused by survey differences.

\(^3\) I use the full model specification with gender, age, race, education, and state as covariates as suggested by Pacheco (2011). See Pacheco (2011; 2012) for a detailed explanation of this method.
Roper polls.⁴,⁵ A total of 84,928 individuals were surveyed on education spending from 1973-2004.⁶ A total of 62,958 respondents were interviewed about their preferences towards welfare spending from 1972-2004.

By taking the difference between the percentage of residents who stated that we are spending “too little” and the percentage saying we are spending “too much”, I am able to infer

⁴ I use the MRP technique separately for each measure prior to taking the difference. For instance, I first use MRP to measure the percentage of state residents who favor an increase in education (or welfare) spending out of those who favored a decrease in spending or who wanted spending to be kept about the same. I then use the MRP technique to measure the percentage of state residents who favor a decrease in education (or welfare) spending out of those who favored an increase in spending or who wanted spending to be kept about the same. I then take the difference between these two measures.

⁵ Few questions specifically mention the national government and none capture preferences at the state level. I follow the lead of others (e.g., Berkman and Plutzer 2005; Brace et al. 2002) and assume these questions capture a broader ideology about government spending. Furthermore, the lack of state polls that asks about state level spending consistently across time warrants use of national level surveys, even if the questions asked were not specifically about state government.

⁶ For much of the data, the five year pooled time window is consecutive. For example, to get estimates for 1975, individual level data from 1973, 1974, 1975, 1976, and 1977 were used. No individuals were asked about education or welfare spending in 1995, 1997, or 1999; hence, estimates for 1994 include the following years: 1992, 1993, 1994, 1996, and 1998. All pooled time frames have balanced data, but the later years have a larger amount of smoothing.
the direction of state spending preferences, which is exactly how others have measured public preferences towards spending (see Wlezien 1995; Soroka and Wlezien 2010). More specifically, these measures of net support pick up meaningful shifts in the direction as well as the magnitude of state spending preferences; the greater the net support, the greater the increase in spending state residents want relative to other points in time (Soroka and Wlezien 2010).

The aggregate public opinion data cover the 50 states from 1975-2000 for education and from 1974-2000 for public welfare, although the exact time series trends varies across states. For instance, the data for Alaska starts in 1988 because of missing data on the public opinion measure whereas California has valid data throughout the time period. Figure 3 depicts how net support for spending on education has changed over time in select states across the four regions. Support for spending on education is high; regardless of state or year, the majority of state residents prefer an increase in education spending and net support for education spending has generally increased over time. This is consistent with previous work on public attitudes towards education spending (e.g., Berkman and Plutzer 2007) as well as how attitudes towards education spending at the national level have changed over time (Page and Shapiro 1995; Soroka and Wlezien 2010). It is clear, however, that the baseline level of support as well as the rate at which net support has increased varies across states. For instance, in the 1980s, Minnesota residents increased net support for education spending at a much higher rate compared to other states.

7 All states are missing on both public opinion measures in 1995, 1997, and 1999 because questions were not asked about education or welfare spending in these time periods. These gaps limit our ability to make inferences about dynamic relationships between public opinion and policy, which require continuous time series. I follow the lead of others and interpolate using data from adjacent years (Soroka and Wlezien 2010).
Figure 4 illustrates how net support for spending on welfare has changed over time in select states across the four regions. Support for spending on welfare is relatively low, particularly in comparison to education. Regardless of state or year, the majority of state residents prefer a decrease in welfare spending (e.g., the value on the measure is always negative). Interestingly, net support for welfare spending exhibits a cyclical pattern over time, waxing and waning between relative values of net support for additional spending. This is generally consistent with previous work on how attitudes towards welfare spending at the national level have changed over time (Page and Shapiro 1995; Soroka and Wlezien 2010).

Similar to Figure 3, Figure 4 shows that there is large heterogeneity across the states in the baseline level of support as well as the rate at which net support for welfare spending has changed over time. 8

**Results: Dynamic Policy Representation in the States on Education and Welfare**

I first investigate whether net support for spending on education and welfare influences state expenditures; in other words, I test $H_1$. Recall that $H_1$ suggests that net support for spending in the previous year should have a positive influence on state expenditures, after accounting for party control. Consequently, I include a measure of democratic strength measured as a sum of percentages of state house and senate that are Democrats plus 100 if the governor is a Democrat (Bailey and Rom 2004). Next, I test whether the extent of policy representation is conditional on institutional factors via an interaction between the preferences variables with the presence of the initiative (e.g., $H_2$) and legislative professionalism (e.g., $H_3$).

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8 Basic descriptive statistics show that the there is ample variation in spending preferences within states. Thirty-three percent of the variance in education preferences and 46% of the variance in welfare preferences is within states, respectively.
The expectations are that initiative states and states that are highly professional will be more responsive to public opinion; the coefficient on the preferences variables will be larger for initiative states and those that are highly professionalized. I measure whether states have the initiative with a dummy variable and use Squire’s (1992) measure of professionalism.\footnote{To ease statistical interpretation, the professionalism measure is standardized to range from 0 to 1.}

Given the times series cross sectional (TSCS) nature of the data, I estimate the models using ordinary least squares (OLS) regression with panel corrected standard errors (PCSE) to account for state heterogeneity and include a lagged dependent variable to account for serial correlation. I also include state fixed effects to account for state differences not fully captured by the model.\footnote{I am able to include state fixed effects with the initiative and legislative professionalism variables even though both are non-time varying since they are interacted with the preferences variable, which is time varying.} Scholars have noted that OLS regression with a lagged dependent variable, PCSEs, and fixed effects is a valid approach to modeling the dynamics of TSCS models (e.g., Beck and Katz 1995; Beck and Katz 2011). To ease statistical interpretation, all variables are mean centered; see Table A4 for summary statistics on all variables.

Table 1 shows the results from estimating an OLS model on changes in per capita state spending on education and public welfare across time. As shown in Table 1, Model 1 for both education and welfare show empirical support for $H1$; as net support for education or welfare spending increases, states spend more money on these issues. This is consistent with the thermostatic model and evidence that dynamic policy representation generally exists in the states. More specifically, the preferences variable for education suggests that a 5 percent
An increase in net support for education spending (about 2 standard deviations above the mean change) results in an increase of $1,800 spent per person on education in the following year.\textsuperscript{11} A similar increase for welfare spending results in an increase of $700 spent per person on welfare in the following year.

More importantly, in results available upon request, the addition of the opinion variables to a state fixed effects model increases the R-squared substantially (by 14 points for education and by 4 points for welfare), suggesting that within changes in state opinion contribute more to explaining changes in education and welfare expenditures than cross-sectional differences across the states. Additionally, there is evidence that state expenditures are responding to specific opinion on spending rather than a general ideology; when added to the models, state ideology is not significant for education and, while significant for welfare ($\beta=18.04^*$), does not change the substantive conclusions.

As shown in Model 2, policy representation is not conditioned by initiatives as expected in $H2$.\textsuperscript{12} However, Model 3 shows that policy representation is conditional on legislative professionalism, which provides empirical support for $H3$. For education expenditures, a 5 percent increase in net support for education spending results in an increase of $1,850 spent per person on education.\textsuperscript{11}

\textsuperscript{11} I also estimated the models on the 15 largest states, where observations are abundant and changes in the public opinion estimates are the most reliable. Results are nearly identical, although the coefficient on the opinion variables are higher ($\beta=.43^{***}$ for education and $\beta=.18^{***}$ for welfare).

\textsuperscript{12} Results are similar when using a variable that captures the number of initiatives used in states over time as opposed to the dummy variable. Conclusions are similar when performing the analyses on the 15 largest states.
person on education for states that are not professionalized (e.g., they have a score of 0 on the professionalism variable), however this increases an additional $1,050 spent per person as for the most professional states. For welfare expenditures, a 5 percent increase in net support for welfare spending results in an increase of $700 spent per person on welfare for those states that are not professionalized. This increases an additional $850 for the most professional states.

Overall, the results from Table 1 provide empirical support for $H1$ and $H3$. Consistent with the thermostatic model, dynamic policy representation exists in the states for education and welfare expenditures. Furthermore, states that are highly professionalized are more responsive to the changing preferences of state residents. Representation is not conditional on whether a state has initiatives, as suggested by $H2$.

**Results: Dynamic Public Responsiveness in the States to Education and Welfare**

Next, I test the second part of the thermostatic model, dynamic public responsiveness. Specifically, I test $H4$, which suggests that as state expenditures on education or welfare increase (decrease), state net support for more spending will decrease (increase). The dependent variable is net state support for education or welfare spending. I include three measures in the models that I believe are associated with net state support for spending to account for exogenous factors (e.g., $W_{ts}$ in Equation 5). First, I include a measure of the unemployment rate; the expectation is that as unemployment increases preferences for additional spending in education will decrease, while preferences for additional spending on welfare will increase (Soroka and Wlezien 2010). Second, I include a measure of federal expenditures on education and welfare (in constant 1999 dollars; in billions). As suggested by $H4$, state support for additional spending will be responsive to state expenditures even after controlling for federal expenditures. Finally, to
control for systemic influences on state preferences, I include linear and squared counter variables.

I test whether the public is more responsive to salient issues \((H5)\) by comparing the feedback coefficients for education and welfare. Empirically, it has been difficult for scholars to measure saliency across issues (Wlezien 2005; Yeager et al. 2012). One option that is popular in the agenda-setting literature is the “most important problem” (MIP) survey question (Baumgartner and Jones 1993). This question asks the public to name the “most important problem facing the country”; issues that receive a higher percentage of positive responses in the aggregate are more salient than others. Using this approach, defense, health, crime, and welfare generally receive more responses compared to other issues, such as education, environment, or foreign aid (Soroka and Wlezien 2011 101), although issue saliency does vary across time (e.g., Smith 1985). Consequently, I expect for the feedback coefficient to be larger for welfare compared to education.

Finally, I test whether public responsiveness is conditional on education, as suggested by \(H6\), by including an interaction between the state expenditures variables and the percentage of state residents that have a college degree or higher. As before, I estimate an OLS with PCSEs, a lagged dependent variable, and state fixed effects. All variables are centered at their mean values to ease statistical interpretation (see Table A4 for descriptive statistics). Results are shown in Table 2.

As shown in Model 1 for education and welfare in Table 2, there is empirical support for \(H4\); the feedback coefficient for both education and welfare expenditures is statistically significant and negative, suggesting that net state support for more spending responds negatively to actual state expenditures, even after controlling for federal expenditures. For every additional
$75,000 spent on education per capita by the states (which is about 2 standard deviations above the mean state spending on education per year), net state support for additional spending on education decreases by about 1.5%. For every additional $50,000 spent per capita by the states on welfare (which is about two standard deviations above the mean state spending on welfare per year), net state support for additional spending on welfare decreases by 3%. While these effects seem small, they are large if yearly consecutive changes occur in state per capita spending, which is often the case as shown in Figures 1 and 2. Furthermore, a comparison of the feedback coefficients suggests that state preferences respond more negatively towards welfare compared to education, which supports the saliency hypothesis (H5). Similar to findings from Soroka and Wlezien (2010), the feedback coefficient to expenditures is stronger for the welfare domain precisely because welfare is a highly salient issue among state residents (101-102).

Interestingly, state preferences for education and welfare spending respond also to federal expenditures, albeit in different directions. As shown in Model 1 for education, net state support for additional spending on education responds negatively to federal per capita spending on education. For every $6 billion spent on education at the federal level (which is about 2 standard deviations about the mean), net state support for additional spending decreases by 1.5%; this is equivalent in magnitude to the public’s response to state expenditures. However, in Model 1 for welfare preferences, net state support for additional spending responds positively to federal expenditures. For every $16 billion dollars spent on welfare at the federal level (about 2 standard deviations about the mean), net state support for additional spending increases by about
3%; this is equivalent in magnitude, but in the opposite direction, to the public’s response to state expenditures on welfare.¹³

What accounts for the fact that state preferences respond negatively to federal expenditures on education but positively to federal expenditures on welfare? Here, there are two possibilities. First, the results may be an artifact of multicollinearity. The federal welfare expenditures variable is highly correlated with the state welfare expenditures variable ($r = .57$) and fails to reach statistical significance when the state welfare expenditures variable is excluded from the analysis ($β=.14$, $p$-value=.24). Additionally, when analyses are conducted on the 15 largest states, the federal welfare expenditures variable is unrelated to state opinion ($β=.21$, $p$-value=.26). In analyses where state and federal expenditures on welfare are combined into a standardized scale (alpha’s reliability coefficient=.72), the spending coefficient is negative and statistically significant ($β=-1.23$***), which is consistent with the thermostatic model.

If not an artifact of multicollinearity, the results may have to do with what people think certain levels of government ought to do. The federal government has different policy priorities compared to states (e.g., Peterson 1981; Baumgartner and Jones 1992). In particular, the federal government is much more focused on redistributive policies, such as public welfare, compared to developmental programs, such as education. In this sense, state residents may be responding to these different policy priorities; always wanting less federal dollars spent on developmental programs (e.g., education) and more federal dollars spent on redistributive programs (e.g., welfare). This second scenario requires a lot of survey respondents, especially given the

¹³ Results are nearly identical for education when the analysis is restricted to the 15 largest states. The federal welfare expenditures variable fails to reach statistical significance, however, when the analysis is restricted to the 15 largest states.
question wording, which does not distinguish between different levels of governmental spending. If true, respondents would need to explicitly distinguish their preferred levels of government spending both by level of government and by policy area. Given the complexity of this second scenario, I am confident that the results are an artifact of the statistical analyses.

Finally, the results in Model 2 in Table 2 suggest that the feedback coefficient is conditional on the education level of state residents, although in the opposite direction as expected. For education, the model suggests that as states spend more money on education, state net support for more spending on education decreases less in highly educated states. Results for welfare spending are consistent, although only significant at the .15 level. The results may be due to the policy preferences of highly educated residents as opposed to their ability to receive policy signals. There is evidence at the individual level, for instance, that highly educated people are more supportive of spending on education (Berkman and Plutzer 2005). Hence, the significant interaction term in Model 2 for education may be picking up the policy priorities of these residents, as opposed to their reception of the policy signal.

Overall, the results in Table 2 suggest that state preferences for additional spending for education or welfare are responsive to actual state expenditures in these same domains, as is consistent with the thermostatic model of policy responsiveness, even after accounting for spending at the federal level. Additionally, the feedback coefficient is larger for welfare spending, which suggests that the degree of dynamic public responsiveness is dependent on the saliency of the domain. Finally, there is weak evidence that dynamic public responsiveness depends on the educational level of the public, albeit in the opposite direction as predicted. These results are small and more likely picking up policy preferences of educated residents as opposed to their ability to receive policy signals from the state.


**Discussion and Conclusion**

The goal of this paper is to test if the thermostatic model characterizes the dynamic relationship between opinion and policy in the American states. Generally, I find that the thermostatic model of policy responsiveness characterizes the dynamic relationship between public opinion and policy on education and welfare expenditures. Consequently, a major implication of these findings is that dynamic responsiveness is alive and well at the sub-national level. State attitudes perform remarkably well at explaining differences in state policy changes over time, even after controlling for other important factors, such as government control. At the same time, differences in state policies help explain, at least somewhat, why there are variations in how state residents change their attitudes over time. This suggests that previous cross-sectional studies that have identified a correlation between state policies and public opinion are not spurious; public opinion and policy exhibit a significant reactive relationship over time at the sub-national level, at least in relation to education and welfare expenditures.

Yet, while these findings support the existence of dynamic responsiveness at the sub-national level, they also highlight the value of using variations in state institutional, political, or demographic variables and in issue characteristics to fine tune theories of responsiveness explored at the national level. For instance, I find that dynamic policy representation is conditional on the legislative professionalism of states; in particular, representation is higher in states that are highly professionalized. This suggests that the degree of dynamic policy representation at the national level may depend on the institutional variations that occur over time. Additionally, the degree of dynamic public responsiveness is dependent on the saliency of the issue domain, which suggests that for the least salient issues the public may not respond at all to policy changes.
All of these findings suggest that the thermostatic model is more complex than originally thought. Policy representation is conditional on institutional factors suggesting that certain interests are less represented in particular states. On the other hand, public responsiveness is conditional on the saliency of the issue. People are more likely to receive a policy signal on issues that are highly salient. The implication is that policymakers are less likely to pay attention to the public on issues that are not as important (e.g., Hill and Hurley 1998). Furthermore, citizens appear to have rational opinions in regards to education and welfare expenditures that are influenced differently by policy activity at different levels of government.

The merit of this paper lays not only in its application of dynamic models of responsiveness to the sub-national level, but also to the questions it poses for future research. How might the thermostatic model differ across other issues; how might state public opinion react to policy changes on morality issues, which are traditionally of high salience? Does public opinion react differently to episodic policy changes compared to incremental policy changes, such as expenditures? What do survey respondents think about when answering questions dealing with expenditures at vague levels of government? Are there policies that state residents may respond more to at the state level compared to the federal level? By answering questions like these, scholars can begin to more fully understand the complex relationship between public opinion and policy over time. And, in so doing, we can better understand when and how democratic governance occurs at the sub-national level and how this compares to democratic governance at the federal level.
Works Cited


Table 1: Pooled Time Series Cross Sectional Analysis of Changes in Per Capita State Expenditures on Education and Welfare

<table>
<thead>
<tr>
<th></th>
<th>State Education Expenditures (N=1,104)</th>
<th>State Welfare Expenditures (N=1,097)</th>
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<td>-.08 *</td>
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<td></td>
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<td>(.04)</td>
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<tr>
<td>Welfare Expenditures (t-1)</td>
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<tr>
<td>R-squared</td>
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Note: State fixed effects are included, but not shown due to space. All variables are centered at the overall mean. Panel corrected standard errors are in parentheses. *p-value<.10, **p-value<.05, ***p-value<.01 with a two tailed test.
Table 2 Pooled Times Series Cross Sectional Analysis on Net Support for Spending on Education and Public Welfare

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<td>M1: Dynamic Public Responsiveness</td>
<td>M2: Conditional on State Education</td>
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<td>- .02 ***</td>
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Note: State fixed effects are included, but not shown due to space. Panel corrected standard errors are in parentheses. *p-value<.10, **p-value<.05, ***p-value<.01 with a two tailed test.
Figure 1 Changes in Per Capita Spending on Education in Select US States 1977-2000
Figure 2 Changes in Per Capita Spending on Public Welfare in Select US States 1977-2000
Figure 3 Preferences for Education Spending in Select US States, 1975-2000
Figure 4 Preferences for Welfare Spending in Select US States, 1975-2000