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# Partisan Determinants of Federal Highway Grants\*

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**Abstract:** Using data from the Department of Transportation's Federal Highway Administration, we examine whether political ideology and political alignment affect how much a state receives in per-capita highway funding. For the period 1994 – 2008, we find evidence that Republican-dominated House of Representatives delegations received more highway funding per capita compared with Democratic delegations, especially in states with below average urban population shares. Overall, the distribution of highway spending during this time period appears to have been determined by political, rather than deterministic, considerations. In a way, it is consistent with how the Interstate Highway System has distributed Republican voters to rural areas.

**Keywords:** Federal Highway Administration, grants, political alignment, political ideology

**JEL Codes:** D7, D72, H54

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## 1. INTRODUCTION

In the years following the Great Recession, the unprecedented low interest rate environment led to calls, from prominent economists, to increase federal spending on public infrastructure projects.<sup>1</sup> However, as public choice theory predicts, the amount of spending allocated by Congress and the distribution of that spending is often decided, not by an objective “need” or criteria, but is rather based on political interests. Existing studies of distributive politics that analyze federal highway spending have not focused on the interaction between demographic

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<sup>1</sup>For example, Summers (2014) argues for increased public investment as a way to increase aggregate demand. In a New York Times op-ed, Krugman (2014) argues for increased public transportation investment for similar reasons.

characteristics and political determinants of federal highway spending. However, findings by Chen and Rodden (2013) and Nall (2015), that Republican voters are more likely than Democratic voters to live in rural areas and this geographic sorting was facilitated by the Interstate Highway System, illustrate that the interplay between the political determinants and demographic characteristics of highway funding is a topic that should be given more scrutiny.

In this paper, we use Federal Highway Administration data from 1994 – 2008 to examine how political ideology and political alignment impact the distribution of federal highway grants. Our results show that Republican legislators in the House of Representatives are associated with more highway spending per capita compared with Democratic delegations. However, when the amount of spending associated with a Republican delegation is conditioned on urban population share, we see that this funding advantage diminishes as a state's population becomes more urban. This finding is not only consistent with the geographic partisan sorting described by Chen and Rodden (2013) and Nall (2015), but provides a potential channel for the “Republican taste effect” for transportation spending observed by Albouy (2013).

Interestingly, the relationships between highway funding and variables directly related to the quality of highway infrastructure limit us from saying that funding is directed towards states that demonstrate the most need. In particular, increased interstate congestion is only associated with more funding per capita at relatively low levels of congestion; conditional on relatively high levels of congestion, additional congestion is actually associated with decreased funding per capita. Furthermore, there is no statistically significant relationship between the number of deficient bridges and funding per capita. Overall, these results not only demonstrate that political ideology and alignment are important determinants of highway funding, but that the funding followed as the Interstate Highway System delivered Republican voters to rural areas.

In the next section, we review the previous literature on the determinants of transportation funding. In Section 3 we discuss how our study is motivated and state the hypotheses that will be tested in this paper. In Section 4 the data used to test those hypotheses are discussed. The empirical model is outlined in Section 5, which is followed by a presentation and discussion of the results in Section 6. Section 7 concludes.

## 2. PRIOR ANALYSIS OF TRANSPORTATION SPENDING POLITICS

Much of the existing literature examining highway funding is concerned with whether federal funding acts as a complement to or a substitute for state and local spending. In an early analysis, Phelps (1969), using data from 1951 to 1966, estimated that a one dollar per capita increase in federal grant spending led to more than \$4 of additional state or local highway capital stock per capita. Concerned with the effect that federal highway grants had on state and local highway spending, Meyers (1987) showed that an additional dollar from the federal government displaced \$0.63 cents of own-source state highway funding and also led to \$1.50 more non-highway spending. Similarly, Goel and Nelson (2003) found evidence that states diverted highway user fees to general purpose expenditures and systematically devoted less money to the highway budget. Several authors (see Congleton and Bennett

(1995), Gamkhar (2000, 2003), Goel and Nelson (2003), and Bruce et al. (2007)) have shown that federal highway funding tends to increase state and local highway funding, thus finding evidence of a “fly paper” effect. Nguyen-Hoang (2015) studied the effect that earmarking highway projects had on state highway spending and found that more earmarked projects relative to trend was not correlated with more highway spending. Conversely, a decrease in the number of earmarked projects relative to trend was associated with a decline in state highway funding.

Few of these authors have examined how factors such as political interests, alignment, or ideology are related to highway spending. Congleton and Bennett (1995) found that in the 1980s, the median voter model was better able to explain state highway spending as compared to models focused solely on special interest explanations or models that combined these explanations.<sup>2</sup> Gamkhar and Ali (2007) found evidence that having a House delegation member on the House Public Works committee was worth approximately \$35 more per capita in federal highway demonstration grants. Additionally, they controlled for the seniority of a state’s House delegation, however, this variable was not statistically significant across all regression specifications.<sup>3</sup> Bruce et al. (2007) found evidence that states with a Republican governor or a Republican majority in the state legislature tended to have a negative effect on state level transportation spending. In a study limited to counties in North Carolina, Walden and Eryuruk (2012) followed Congleton and Bennett (1995) and tested a median voter model, a special interest model, and an additional political model. From the political model, the authors found that counties with more voters registered to the governor’s party received relatively more highway construction funding. The common link between these studies is that they focus on how state governments distribute highway funding. Conversely, we will examine how political ideology and alignment influence the amount of federal highway grants that are distributed to the states.

More recently, Albouy (2013) examined how political alignment and ideology impacted the distribution of Department of Transportation grants and found that states with a larger share of Republicans in their House of Representatives delegations received more grants than those represented by Democrats. An important contribution made by Albouy is the use of a regression discontinuity design to identify Republican preferences for certain types of spending. However, it is important to point out that the regression discontinuity design only identifies these preferences with respect to Republican Senate delegations. The result that is important for our paper, that Republican House of Representative delegations receive more transportation spending compared to Democratic delegations, is estimated using a state fixed-effects model. As Albouy makes clear, it is not practical to use a regression discontinuity design to identify the partisan spending preferences in the House.<sup>4</sup> A contribution of our paper is to examine what might explain why Republican delegations are associated with more transportation grants per capita. As we discuss in the sections that follow, Republican

<sup>2</sup>Recent work by Hall and Pokharel (2017) found that the median voter model continues to outperform the special interest model with 2013 state-level data.

<sup>3</sup>The empirical specification in Gamkhar and Ali (2007) controls for regional, rather than state fixed-effects.

<sup>4</sup>Whereas each state has two senators, the number of House members ranges from one at-large member – Alaska, Delaware, Montana, North Dakota, South Dakota, Vermont, and Wyoming – to fifty-three representatives in California. Furthermore, the unit of observation is the state, meaning that there are not enough degrees of freedom to include an appropriate control function.

delegations are more closely associated with Federal Highway Administration grants, which is a large component of Department of Transportation grants. Furthermore, we find evidence to support theories that, holding other things constant, Republicans representing states with a smaller urban population share benefit disproportionately compared to Democrats. In the next section, we discuss in more detail the theories that motivate the empirical model. In addition, we will discuss previous research that will guide our selection of the variables that will be considered.

### 3. MOTIVATION AND HYPOTHESES

In the existing literature on transportation politics, several authors studied whether political alignment and political ideology are important determinants of the distribution of federal transportation spending. Adding to this body of literature, this study aims to better incorporate the role that demographics plays in how federal transportation spending is allocated to the states. In particular, we explore reasons why the Republican taste effect, identified by Albouy (2013), exists. Chen and Rodden (2013) pointed out that in most states, Democratic voters are disproportionately concentrated in larger cities. Building upon these findings, Nall (2015) showed that this geographic segregation of Republican and Democratic voters was facilitated by the Interstate Highway System. Specifically, Nall showed that the Interstate Highway System allowed suburban areas of the U.S. to become more Republican. Thus, in light of the geographic sorting, the expectation is that, holding other things constant, Democratic legislators will be more concerned with the transportation needs of urban voters while Republican legislators should be more inclined to direct highway funding to rural voters.

This paper also explores the role played by political alignment in the distribution of federal highway grants. Based on previous research, our expectation is that, holding other things constant, states with more House or Senate members in the party of the president or the chamber majority and states where the governor is a member of the same party as the president should receive more highway funding. These alignment hypotheses are informed by prior research. Since Albouy (2013) is the only study that examined how political alignment at the federal level influences the distribution of federal transportation grants, we expand our literature review to include prior research concerning various categories of federal grant spending, not just transportation grants. Hoover and Pecorino (2005) found evidence that states with more House members in the majority received more federal grant spending per capita. They also showed that having more legislators in the party of the president was worth more federal grant spending as well.<sup>5</sup> Both Larcinese et al. (2006) and Berry et al. (2010) showed that more House members in the party of the president was worth more total federal spending.<sup>6</sup> Lastly, our expectations for how alignment between the governor and the president should influence transportation grants is informed by Hoover and Pecorino (2005)

<sup>5</sup>More recently, Hankins et al. (2017) confirmed that alignment with the president matters for a state's share of federal grant spending. However, the number of House members in the majority was not a statistically significant determinant.

<sup>6</sup>Specifically, both Larcinese et al. (2006) and Berry et al. (2010) followed Levitt and Snyder Jr. (1995) and studied all federal spending that exhibited relatively higher year-on-year variation. However, a significant component of this spending was federal grant spending.

and Larcinese et al. (2006). Both found evidence that a state receives more funding per capita when the governor and the president are in the same party compared to when they are not. Hoover and Pecorino (2005) only found this relationship mattered for federal procurement spending, whereas Larcinese et al. (2006) found the effect with respect to high-variation spending.

Apart from examining how political ideology and alignment are related to the distribution of federal highway grants, we will examine various political characteristics that describe both state congressional delegations and the politics of the states in general. The idea is to not only account for characteristics that have been shown to influence the amount of federal funding received by a state, but to also incorporate political characteristics that could be related to political ideology and alignment.

A large body of literature exists on how congressional committees influence the federal bureaucratic decisions on states. A seminal work by Weingast and Moran (1983) showed theoretically why the directors of federal bureaucracies have incentives to respond to the wishes of committee members. Much of this empirical literature relates to federal funding. For example, Garrett and Sobel (2003) found that Federal Emergency Management Agency (FEMA) expenditures were relatively higher in states with congressional representation on committees overseeing FEMA. Young and Sobel (2013) found no evidence that states represented on the House and Senate Appropriations Committees received more funding per capita out of distributions from the 2009 American Recovery and Reinvestment Act (ARRA). More recently, Hall et al. (2015) found that congressional districts with representatives sitting on the House Transportation and Ways and Means Committees were able to receive larger airport subsidies through the Essential Air Service program. Most relevant to our paper, Gamkhar and Ali (2007) found little evidence that committee membership influences the allocation of federal highway demonstration grants. In particular, membership on the House Committee on Transportation and Infrastructure was significantly related to grants per capita. However, membership on both the House and Senate Appropriations Committees and the Senate Public Works committee were statistically insignificant.

The previous literature gives us reason to expect that a legislative delegation's tenure matters for transportation funding. While Levitt and Poterba (1999) found no evidence that states with more senior representatives received more federal funding per capita, Crain and Tollison (1977), Mathews et al. (2011), and Young and Sobel (2013) all found a positive correlation between federal spending per capita and the tenure of a state's House delegation. Longer-serving representatives and senators have the ability to exploit established political relationships in order to secure more federal funding. Consistent with the previous literature, we focus on the average tenure of a state's House and Senate delegations as opposed to absolute or relative tenure.<sup>7</sup>

Finally, we consider the possibility that the sitting president has incentive to direct spending to politically important states. Even after controlling for alignment between a

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<sup>7</sup>We conduct regressions using the relative tenure of each state's House and Senate delegations. Following Mathews et al. (2011), relative tenure measures the average tenure of each state's House and Senate delegation in a given year relative to the chamber average in a given year. Neither House nor Senate relative tenure is statistically significant at the 0.05 level and the primary results are qualitatively similar. These results are available upon request.

state's House or Senate delegation and the president, it is still possible that a sitting president would want to direct spending to a state that might be important in the next election. For example, Wright (1974) found that states with more electoral votes per capita received more spending per capita from New Deal programs. However, even if a state has a large number of electoral votes, a sitting president might have little incentive to placate voters in that state if the chances of winning it are low. Garrett and Sobel (2003) develop a measure of electoral importance that weights the number of electoral votes in a state by a measure of closeness of the previous presidential election. Using this measure, they found that electorally-important states were more likely to receive a presidential disaster declaration following a natural disaster. However, Young and Sobel (2013) did not find a correlation between the electoral importance of a state and the amount of expenditures per capita a state was allocated through the ARRA. We will control for the electoral importance of a state using a measure adopted from Pavlik (2017), which will be discussed in the next section.

#### 4. DATA

We test the ideology hypotheses discussed in the previous section using the percentage of each state's House and Senate delegation belonging to the Republican Party. Table 1 provides summary statistics of all variables and Table 2 lists the source of each variable. These data are taken from the Biographical Directory of the U.S. Congress. Alignment with the president is measured both by the percentage of a state's House delegation that belongs to the party of the president and the percentage of a state's Senate delegation belonging to the party of the president. Alignment with the majority is similarly measured as the percentage of a state's House and Senate delegation in the majority party. Data used to create the alignment variables are also collected from the Biographical Directory of the U.S. Congress. Alignment between each state's governor and the sitting president is created using data from various editions of the Book of the States.

The House and Senate committee membership data used to measure the number of legislators from each state serving on the House and Senate Appropriations Committees, the House Transportation and Infrastructure Committee, and the Senate Environment and Public Works Committee are collected from Stewart and Woon (2017). House and Senate tenure data is collected from McKibbin (1997), the Biographical Directory of the U.S. Congress, and Albouy (2013).

Finally, the political importance of each state is measured using the formula:

$$\text{Political Importance}_{i,t} = (\text{Election Closeness}_{i,t} \times \text{Electoral Votes}_{i,t}) (\text{S.D. of Rep. Votes})_i. \quad (1)$$

The construction of this variable follows Pavlik (2017). Election Closeness is calculated as:

$$1 - 4(\text{Percent Votes For Rep. Candidate}_{i,t} - 0.50)^2 \quad (2)$$

where  $i$  is the state index and  $t$  is the year index. Larger values of Election Closeness indicate a more competitive state presidential election, with a value of 1 implying that the percentage

**Table 1:** Summary Statistics

Variable	Mean	SD	Min	Max
FHA Grants to States	145.61	95.12	46.78	719.78
Republican Share in House	0.54	0.31	0	1
Republican Share in Senate	0.52	0.41	0	1
House Share with President	0.50	0.31	0	1
Senate Share with President	0.50	0.41	0	1
House Share in Majority	0.56	0.31	0	1
Senate Share in Majority	0.54	0.41	0	1
House Appropriations	1.02	1.44	0	7
Senate Appropriations	0.25	0.46	0	2
House Transportation	1.37	1.61	0	9
Senate Public Works	0.35	0.48	0	2
Avg. House Tenure	8.47	4.52	0	33.83
Avg. Senate Tenure	11.68	11.67	0	40.50
Governor with President	0.47	0.50	0	1
Political Importance	0.57	0.46	0.12	2.72
Urban Interstate Congestion	4.06	1.25	0.80	7.22
Non-Working Bridges	0.09	0.09	0.0004	0.41
Urban Pop. Share	0.67	0.15	0.30	0.99
Median Household Income (thousands of dollars)	50.48	7.77	34.23	72.69
Percent Elderly	12.66	1.86	4.60	18.60
State Unemployment Rate	4.8	1.19	2.20	8.90

Note: FHA Grants to State stands for Federal Highway Administration payments per capita. Republican Share in House and Republican Share in Senate stand for the percentage of Republicans in the House or Senate delegation, respectively. House Share with President and Senate Share with President stand for the percentage of a House or Senate delegation, respectively, in the president's party. House Share in Majority and Senate Share in Majority stand for the percentage of a House or Senate delegation, respectively, in the chamber majority. House and Senate Appropriations stand for the number of legislators in a state's House and Senate delegation sitting on the Appropriations Committee, respectively. House Transportation stands for the number of representatives in a state's House delegation sitting on the Transportation and Infrastructure Committee. Senate Public Works stands for the number of senators in a state's Senate delegation sitting on the Environment and Public Works Committee. Avg. House Tenure and Avg. Senate Tenure stand for the average tenure of a House or Senate delegation, respectively. Governor with President stands for alignment between a state's governor and the president. Political Importance is an index of a state's political importance adopted from Pavlik (2017). Urban Interstate Congestion is measured as millions of miles traveled per urban interstate mile. Non-Working Bridges are measured as deficient bridges per square mile. Urban Pop. Share is the share of a state's population living in an urban area. Median Household Income is measured in 2008 dollars. Percent Elderly measures the proportion of a state's population aged 65 and older. State Unemployment Rate measures each state's unemployment rate.

of votes going to the Republican and Democratic candidate were equal. Conversely, if either party were to win 100 percent of the votes in a state's presidential election, Election Closeness would equal zero. Electoral Votes measures the number of Electoral College votes that a state

**Table 2:** Data Sources

Variable	Source
FHA Grants to States	Federal Highway Administration
Republican Share in House	Biographical Directory of the U.S.
Republican Share in Senate	Biographical Directory of the U.S.
House Share with President	Biographical Directory of the U.S.
Senate Share with President	Biographical Directory of the U.S.
House Share in Majority	Biographical Directory of the U.S.
Senate Share in Majority	Biographical Directory of the U.S.
House Appropriations	Stewart and Woon (2017)
Senate Appropriations	Stewart and Woon (2017)
House Transportation	Stewart and Woon (2017)
Senate Public Works	Stewart and Woon (2017)
Avg. House Tenure	McKibbin (1997), Albouy (2013), & Biographical Directory of the U.S.
Avg. Senate Tenure	McKibbin (1997), Albouy (2013), & Biographical Directory of the U.S.
Governor with President	Book of the States
Political Importance	The American Presidency Project
Urban Interstate Congestion	Federal Highway Administration
Non-Working Bridges	Federal Highway Administration
Urban Pop. Share	Federal Highway Administration
Median Household Income (thousands of dollars)	Bureau of Labor Statistics
Percent Elderly	U.S. Census Bureau, Statistical Abstract of the U.S.
State Unemployment Rate	Bureau of Labor Statistics

is worth in the most recent presidential election. Finally, S.D. of Rep. Votes<sub>*i*</sub> measures the standard deviation of the Republican candidate's vote percentage in each state over the period 1994–2008.<sup>8</sup> A smaller standard deviation implies that voters in a state consistently vote for one party or the other, while a larger standard deviation implies that voters in that state might be more easily swayed across presidential elections. Thus, a state with an easily-swayed electorate that was competitive in the last presidential election and worth a large amount of electoral votes would be more important than a state worth relatively few electoral votes with hard-to-win elections and an electorate dedicated to either party. The data used to construct Political Importance is collected from The American Presidency Project.

We use several variables to control for the characteristics and usage of each state's highway system. Holding other things constant, we might expect states with more urban interstate

<sup>8</sup>Pavlik (2017) uses the percent of votes won by the Democratic candidate and the standard deviation of votes won by the Democratic candidate in her measure of political importance. Since our variables of interest are the percent of Republicans in a state's House and Senate delegation, we develop this variable around votes won by the Republican candidate.



congestion to request (and receive) more highway funding. Thus, the variable Urban Interstate Congestion is measured as millions of miles traveled on the urban interstate system per mile of urban interstate. We include a measure of the number of structurally deficient bridges per square mile. Scaling non-working bridges by a state's area is intended to account for the possibility that larger states will have more deficient bridges simply due to having more miles of highway infrastructure. If FHA grants are allocated based on need, then one would expect the contemporaneous relationship between funding and the number of structurally deficient bridges to be positive. Both of these variables are collected from the Federal Highway Administration's website. Finally, urban interstate needs are also captured by including urban population share, which is measured as a state's urban population as a percentage of its total population.<sup>9</sup> Urban population share is also collected from the Federal Highway Administration.<sup>10</sup>

Finally, we include each state's median household income, the percentage of each state's population that is considered elderly, which is defined as being 65 years old or older, and the state's unemployment rate. Median household income and unemployment data are collected from the Bureau of Labor Statistics while elderly population is collected from various editions of the Statistical Abstract of the U.S. These time-varying controls are meant to control for economic and demographic factors that could be related both to the variables of interest and the amount of FHA grants a state receives. For example, including median household income controls for the possibility that wealthier states will demand more government services from their representatives, regardless of party, while including the unemployment rate helps control for state-specific economic performance that could be related to both the demand for government spending and the preferences of voters. By including the percentage of the population that is elderly we are controlling for the potential impact that the age composition of a state's population might have on both the ideology of legislators and the demand for government services.

#### 4.1. EMPIRICAL MODEL

Equation 3 presents the regression model used to test the hypotheses discussed in Section 3 with the primary alignment and ideology variables written out:

$$\begin{aligned} \text{FHA Grants}_{it} = & \mu H_{it} + \delta P_{it} + \tau X_{it} + \beta_1 \text{Urban Pop Share}_{it} \\ & + \beta_2 \text{Republican Share House}_{it} + \beta_3 \text{Republican Share Senate}_{it} \\ & + \beta_4 \text{House Share With President}_{it} + \beta_5 \text{Senate Share With President}_{it} \\ & + \beta_6 \text{House Share Majority}_{it} + \beta_7 \text{Senate Share Majority}_{it} \\ & + \alpha_i + \gamma_t + \epsilon_{it} \end{aligned} \quad (3)$$

<sup>9</sup>Obviously,  $1 - \text{Urban Pop Share}$  is a state's rural population share.

<sup>10</sup>Specifically, urban population share for each state is available in Table PS-1 in various editions of the Highway Statistics Series. The Federal Highway Administration collects this data from the U.S. Census Bureau. There are two issues that need to be addressed. Urban population share was unavailable for the years 1994 and 2005. For 1994 we simply use the data from 1995. For 2005 we interpolate between 2006 and 2004 for each state. In unreported results, we conduct our own interpolation between decennial census years. The results remain qualitatively similar and are available upon request.

FHA Grants is federal highway spending per capita by state. FHA distributions for a given year are authorized by Congress during the previous year. For example, appropriations made in 2008 were passed by the 2007 Congress. To account for the budgetary lag, we lead the variable FHA Grants by one year.<sup>11</sup> The vector  $H$  includes Urban Interstate Congestion as well as the square of this variable and Non-Working Bridges. The vector  $P$  includes political variables measuring the number of legislators from a state's legislative delegation serving on the House and Senate Appropriations Committees, the House Transportation and Infrastructure Committee, and the Senate Environment and Public Works Committee, the governor-president alignment, average Senate delegation tenure, average House delegation tenure, and political importance. The vector  $X$  includes the additional economic and demographic controls measuring median household income, percent of the population considered elderly, and the unemployment rate. Both federal highway spending and median household income are expressed in 2008 dollars.

There are several time invariant state-specific characteristics that could be related both to the amount of FHA grants a state receives and to the characteristics of a state's legislative delegation. These include proximity to Washington D.C. as well as proximity to states that may be served by the same federally funded roadways. This last point is important because legislators from adjacent states may work together to ensure adequate funding levels. Since a given state's position relative to adjacent states is fixed, the effects of these networks, as well as other state-level fixed effects, are absorbed by the term  $\alpha_i$ .<sup>12</sup> Additionally, year fixed-effects are absorbed by including the term  $\gamma_t$ . The final term,  $\epsilon_{it}$ , represents the error term. Standard errors are clustered at the state level.

The political ideology hypothesis discussed in Section 3 is tested using interaction terms. Recall that Republican delegations are expected to direct more highway funding to areas with a smaller urban population share compared to Democrat delegations. By interacting urban population share with the percentage of Republicans in a state's House and Senate delegations, respectively, we can estimate the change in highway funding per capita for Republican House or Senate delegations relative to a Democrat delegation conditioned on the urban population share. Similarly, a comparison can be made between a Republican House or Senate delegation in a state with average urban population share compared to an above average share (urban states) and a below average share (rural states). Thus, Equation 3 will be augmented with the following interaction terms:

$$\beta_8 \text{Urban Pop. Share} \times \text{Republican Share House} \quad (4)$$

and

$$\beta_8 \text{Urban Pop. Share} \times \text{Republican Share Senate.} \quad (5)$$

Then, the equations of interest becomes the marginal effect of a Republican House or Senate delegation conditional upon Urban Population Share:

<sup>11</sup>In unreported results, we use a regression specification with the political variables, discussed below, lagged by one year. The results are qualitatively similar and are available upon request.

<sup>12</sup>Kuminoff et al. (2010) argue that where spatial networks such as those discussed above are a concern, a spatial fixed-effects (state fixed-effects in this case) model is preferred to a spatial lag model.

$$\frac{\delta(\text{FHA Grants}|\text{Urban Pop. Share})}{\delta \text{Republican Share House}} = \hat{\beta}_2 + \hat{\beta}_9 \text{Urban Pop. Share} \quad (6)$$

$$\frac{\delta(\text{FHA Grants}|\text{Urban Pop. Share})}{\delta \text{Republican Share Senate}} = \hat{\beta}_3 + \hat{\beta}_9 \text{Urban Pop. Share.} \quad (7)$$

## 5. RESULTS

Table 3 shows the results from the estimation of the baseline version of equation 3.<sup>13</sup> In Column 2 (Model 2), we account for the possibility of nonlinearities in the relationship between FHA grants and urban highway usage by including the quadratic of Urban Interstate Congestion. When the relationship between FHA grants and urban interstate congestion is restricted to be linear, we show no statistically significant relationship. However, the coefficient on the quadratic term in Column 2 is negative and statistically significant at the five percent level. Thus, *ceteris paribus*, FHA grants per capita increases at a decreasing rate in areas where urban congestion is higher than average. The results presented in Column 2 also help us understand why the coefficient on Urban Interstate Congestion in Column 1 (Model 1) is statistically insignificant. At relatively low levels of urban congestion, the marginal effect is positive and statistically significant. However, at higher levels of urban congestion, the marginal effect is actually negative and statistically significant. In other words, in states that already experience a relatively high level of urban congestion, additional congestion is correlated with less FHA funding per capita.

The estimated coefficient on Non-Working Bridges is not statistically significant. In fact, the standard errors are large relative to the point estimate, which is likely due to a lack of within-state variation. This lack of variation is the result of scaling the number of non-working bridges variable by the area of each state, as we discussed in Section 3. The point estimate on Urban Population Share is not statistically significant. However, as we discuss below, this is not the end of the story for urban population share. It will play an important role when we examine how political ideology matters for federal highway funding.

Surprisingly, neither the average tenure of a State's House or Senate delegation appear to be associated with federal highway funding. Moreover, we find no evidence that states with more representatives or senators on committees overseeing transportation and infrastructure issues receive more FHA grants per capita. Finally, the political importance of a state is not statistically related to FHA grants per capita, indicating that if presidents actually attempt to influence voters through increased federal expenditure, there is no evidence that it is accomplished through federal highway grants. The inclusion of the interaction terms discussed in Section 4 help us tell a more interesting story about how political ideology and demographic characteristics matter for highway funding.

The results from the regression specifications including the interaction terms are presented in Table 4. However, because we are now using interaction terms constituting two continuous variables, the interpretation of the marginal effects are best made using Figures

<sup>13</sup>Regression estimation was conducted using the *reghdfe* package from Correia (2016).

**Table 3:** Partisan Determinants of Federal Highway Grants: Baseline Results

	(1) FHA Grants	(2) FHA Grants
Urban Interstate Congestion	-1.625 (9.302)	93.45** (39.91)
Urban Interstate Congestion <sup>2</sup>		-10.20** (3.820)
Non-Working Bridges	49.95 (233.8)	40.22 (215.1)
Urban Pop. Share	-13.25 (29.65)	-28.46 (31.78)
Republican Share in House	32.69*** (12.10)	30.13** (11.65)
Republican Share in Senate	-7.034 (7.466)	-5.184 (7.148)
House Share with President	2.326 (9.845)	2.775 (9.443)
Senate Share with President	8.486* (4.665)	6.750 (4.281)
House Share with Majority	2.718 (8.995)	1.962 (8.775)
Senate Share with Majority	1.102 (2.959)	1.111 (2.807)
House Appropriations	-0.851 (2.264)	-1.191 (2.255)
Senate Appropriations	2.964 (5.501)	2.783 (5.109)
House Transportation	-0.751 (1.808)	-1.015 (1.755)
Senate Public Works	0.0862 (4.426)	1.583 (4.672)
Avg. House Tenure	-0.160 (0.885)	-0.140 (0.765)
Avg. Senate Tenure	-0.282 (0.499)	-0.229 (0.495)
Governor with President	8.012* (4.143)	7.242* (3.86)
Political Importance	-88.86* (52.61)	-18.71 (56.96)
Observations	750	750
Adjusted R <sup>2</sup>	0.906	0.909

Note: \*p < .10, \*\* p < .05, \*\*\* p < .01. Parentheses contain standard errors that are clustered at the state level. All regressions include state and year fixed-effects. The variables median household income, the percentage of the population aged 65 and older, and the state unemployment rate are included in all regressions. Full results are available upon request.

**Table 4:** Partisan Determinants of Federal Highway Grants:  
The Role of Population Share

	(3)	(4)
	FHA Grants	FHA Grants
Urban Interstate Congestion	-0.897	99.34**
	(9296)	(38.73)
Urban Interstate Congestion <sup>2</sup>		-10.75***
		(3.696)
Non-Working Bridges	62.05	54.27
	(223.1)	(202.8)
Urban Pop. Share	49.67	45.60
	(39.06)	(37.89)
Republican Share in House	64.90**	69.32**
	(30.78)	(31.88)
Urban Pop. Share × Repub Share House	-52.47	-64.38
	(55.79)	(58.15)
Republican Share in Senate	45.88*	56.28**
	(24.14)	(24.44)
Urban Pop. Share × Repub Share Senate	-77.34**	-89.63**
	(35.73)	(36.29)
House Share with President	1.733	2.099
	(9.627)	(9.177)
Senate Share with President	9.890**	8.316*
	(4.569)	(4.274)
House Share with Majority	1.532	0.558
	(8.797)	(8.565)
Senate Share with Majority	1.838	1.962
	(2.889)	(2.726)
House Appropriations	-0.762	-1.092
	(2.150)	(2.118)
Senate Appropriations	3.679	3.623
	(5.331)	(4.899)
House Transportation	-0.606	-0.871
	(1.808)	(1.779)
Senate Public Works	0.388	2.022
	(4.507)	(4.689)
Avg. House Tenure	-0.109	-0.0745
	(0.873)	(0.746)
Avg. Senate Tenure	-0.277	-0.223
	(0.488)	(0.482)
Governor with President	8.206*	7.439*
	(4.206)	(3.927)
Political Importance	-78.59	-2.975
	(49.27)	(51.83)
Observations	750	750
Adjusted R <sup>2</sup>	0.906	0.910

Note: \*p < .10, \*\* p < .05, \*\*\* p < .01. Parentheses contain standard errors that are clustered at the state level. All regressions include state and year fixed-effects. The variables median household income, the percentage of the population aged 65 and older, and the state unemployment rate are included in all regressions. Full results are available upon request.

1 and 2.<sup>14</sup> While the results from Table 3 implied that a Republican House delegation was worth more FHA funding per capita than a non-Republican delegation, Figures 1 and 2 show that this advantage might go away as a state becomes more urban. In particular, the estimated marginal effects calculated from Column 4 of Table 4 imply that a Republican House delegation is worth less FHA funding per capita as the share of the state's population becomes more urban.

Our interpretation of this finding is that the Republican funding advantage shown in Table 3 and identified by Albouy (2013) might only be true for states with a lower-than-average urban population share. In states with a larger urban population share, a Republican delegation is not associated with any more funding than a non-Republican delegation. The idea that Republicans reward states with a larger rural population share makes sense in light of the stories of geographic political sorting told by Chen and Rodden (2013) and Nall (2015).

A few additional results from Table 4 are worth pointing out. First, the share of senators in the party of the president becomes statistically significant when the quadratic of Urban Interstate Congestion is absent and statistically insignificant when this variable is added. Overall, the interpretation of this variable remains mixed. Interestingly, the interaction between Urban Population Share and Republican Share in the Senate is statistically significant in both Columns 3 and 4. However, the marginal effect associated with the share of Republican senators in a state's delegation is statistically insignificant for all but the maximum and minimum values of Urban Population Share. At best, we can only say that a state with a Republican delegation and the lowest observed urban population share receives a significantly larger amount of FHA funding per capita compared to a state with a Republican delegation and the highest urban population share.

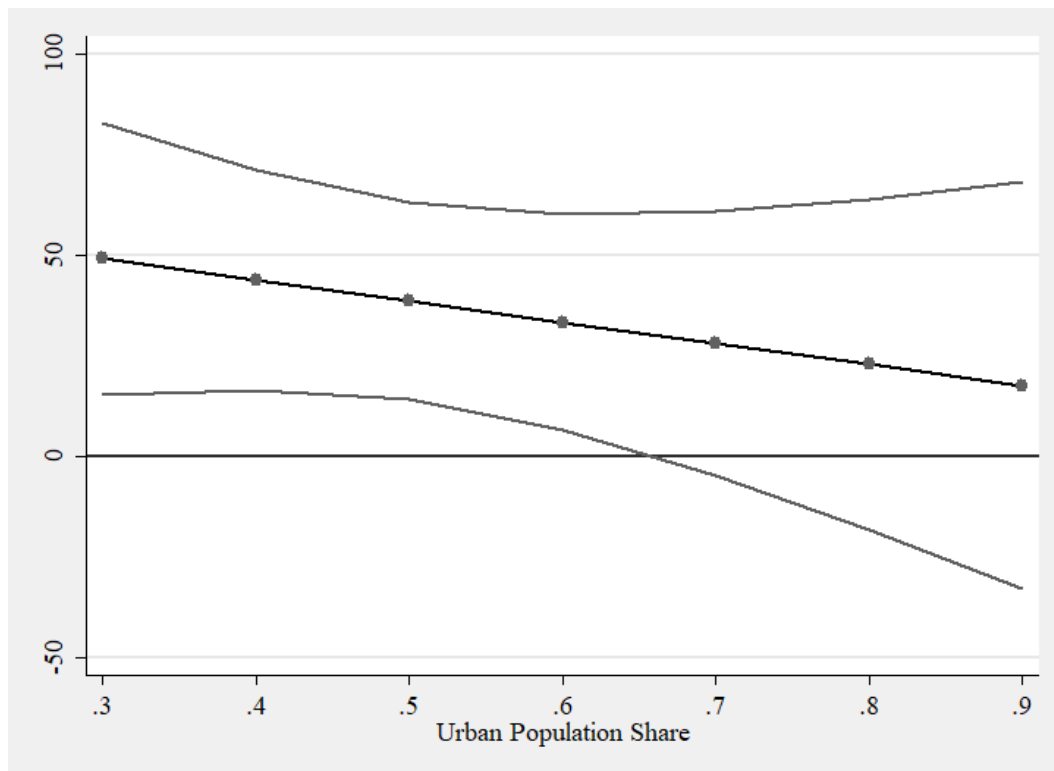
The failure to show any meaningful relationship between the percentage of Republican members of a state's Senate delegation and FHA grants could be related to the geographic differences in the structure of House and Senate representation. The geographic sorting and intentional gerrymandering discussed in Chen and Rodden (2013) is likely less of a concern at the Senate level than at the House level. Whereas Republicans at the House level are more likely to serve rural areas, a Republican senator will represent both rural and urban areas. Thus, the political value of the marginal dollar of highway spending will be lower to the Republican senator than it will be for the Republican House member.

## 6. CONCLUSION

This work investigated whether political ideology and political alignment play a role in the allocation of federal highway spending over the period 1994 to 2008. Our findings reveal that the association between Republican House of Representatives delegations and transportation funding discovered by Albouy (2013) is strongest in rural states. This result is consistent across several regression specifications. Recent trends in geographic partisan sorting, as

<sup>14</sup>As noted by Brambor et al. (2006), when continuous interaction terms are used, the marginal effect and its statistical significance cannot be assessed using the point estimates and standard errors on individual variables that are shown in a standard table of regression output.

**Figure 1: Marginal Effect of Republican House Delegation Conditional on Urban Population Share (includes only linear term for Urban Interstate Congestion)**

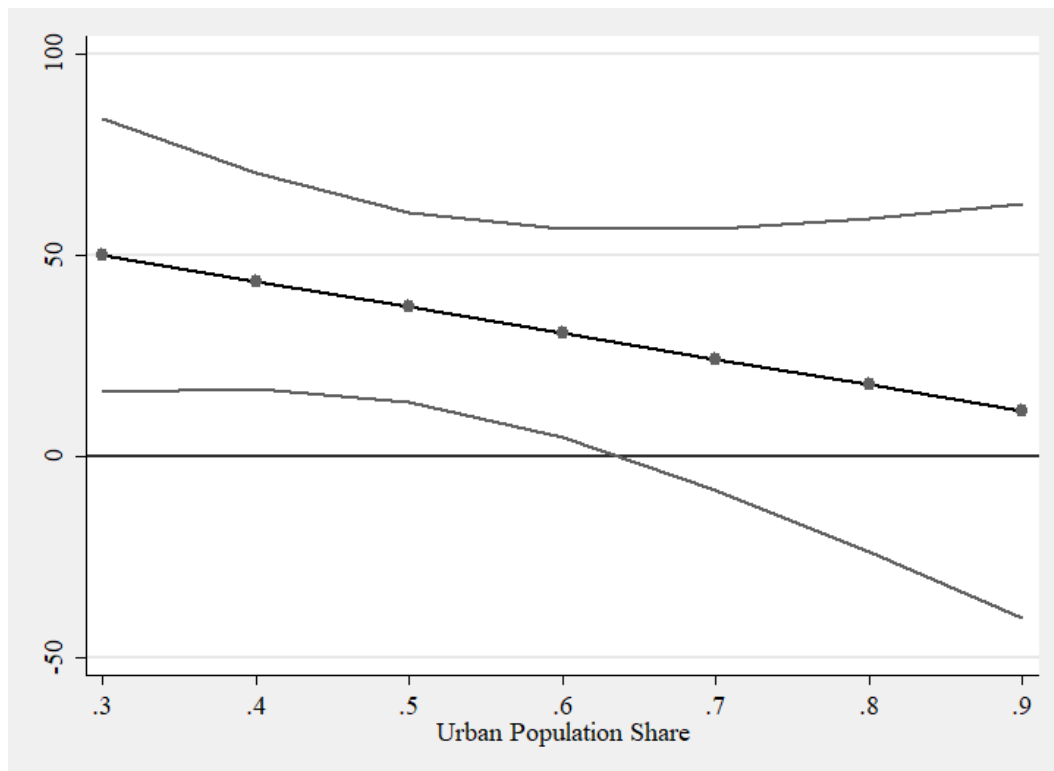


Note: The vertical axis is measured in dollars per capita. The horizontal axis, read from left to right, measures the range of urban population shares. Error bands represent 95% confidence intervals. Marginal effects computed from regression coefficients in Column 3 of Table 4.

discussed by Chen and Rodden (2013), have resulted in Republican voters who are more likely to live in rural areas. As Nall (2015) shows, this sorting was facilitated by the development of the Interstate Highway System. Thus, Republican House delegations continue to reward areas with lower-than-average urban population shares, where Republican voters are more likely to live.

Interestingly, our estimates provide little evidence that highway funding is associated with common transportation problems such as urban interstate congestion or having bridges in need of repair. These findings reveal the importance of political considerations in the federal highway funding process. When highway funding is seen as a political tool, the allocation of this funding is likely to be diverted to where the political need, rather than the infrastructure need, is greatest.

**Figure 2: Marginal Effect of Republican House Delegation Conditional on Urban Population Share (includes linear and quadratic term for Urban Interstate Congestion)**



Note: The vertical axis is measured in dollars per capita. The horizontal axis, read from left to right, measures the range of urban population shares. Error bands represent 95% confidence intervals. Marginal effects computed from regression coefficients in Column 4 of Table 4.

## REFERENCES

- Albouy, David. (2013) "Partisan Representation in Congress and the Geographic Distribution of Federal Funds," *Review of Economics and Statistics*, 95(1), 127–141.
- Berry, Christopher R., Barry C. Burden, and William G. Howell. (2010) "The President and the Distribution of Federal Spending," *American Political Science Review*, 104(4), 783–799.
- Brambor, Thomas, William R. Clark, and Matt Golder. (2006) "Understanding Interaction Models: Improving Empirical Analyses," *Political Analysis*, 14(1), 63–82.
- Bruce, Donald, Deborah A. Carroll, John A. Deskins, and Jonathan C. Rork. (2007) "Road to Ruin? A Spatial Analysis of State Highway Spending," *Public Budgeting & Finance*, 27(4), 66–85.
- Chen, Jowei and Jonathan Rodden. (2013) "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures," *Quarterly Journal of Political Science*, 8(3), 239–269.



- Congleton, Roger D. and Randall W. Bennett. (1995) "On the Political Economy of State Highway Expenditures: Some Evidence of the Relative Performance of Alternative Public Choice Models," *Public Choice*, 84(1-2), 1-24.
- Correia, Sergio. (2016) "Linear Models with High-Dimensional Fixed Effects: An Efficient and Feasible Estimator," *Working Paper*. Last Accessed August 2019 at: <http://scorreia.com/research/hdfe.pdf>.
- Crain, W. Mark and Robert Tollison. (1977) "The Influence of Representation on Public Policy," *The Journal of Legal Studies*, 6(2), 355-361.
- Gamkhar, Shama. (2000) "Is the Response of State and Local Highway Spending Symmetric to Increases and Decreases in Federal Highway Grants?," *Public Finance Review*, 28(1), 3-25.
- Gamkhar, Shama. (2003) "The Role of Federal Budget and Trust Fund Institutions in Measuring the Effect of Federal Highway Grants on State and Local Government Highway Expenditure," *Public Budgeting & Finance*, 23(1), 1-21.
- Gamkhar, Shama and Hamid Ali. (2007) "Political Economy of Grant Allocations: The Case of Federal Highway Demonstration Grants," *Publius: The Journal of Federalism*, 38(1), 1-21.
- Garrett, Thomas A. and Russell S. Sobel. (2003) "The Political Economy of FEMA Disaster Payments," *Economic Inquiry*, 41(3), 496-509.
- Goel, Rajeev K. and Michael A. Nelson. (2003) "Use or Abuse of Highway Tax Revenues? An Economic Analysis of Highway Spending," *Applied Economics Letters*, 10(13), 813-819.
- Hall, Joshua and Shree Baba Pokharel. (2017) "Does the Median Voter or Special Interests Determine State Highway Expenditures? Recent Evidence," *Atlantic Economic Journal*, 45(1), 59-69.
- Hall, Joshua, Amanda Ross, and Christopher Yench. (2015) "The Political Economy of the Essential Air Service Program," *Public Choice*, 165(1-2), 147-164.
- Hankins, William, Gary A. Hoover, and Paul Pecorino. (2017) "Party Polarization, Political Alignment, and Federal Grant Spending at the State Level," *Economics of Governance*, 18(4), 351-389.
- Hoover, Gary A. and Paul Pecorino. (2005) "The Political Determinants of Federal Expenditure at the State Level," *Public Choice*, 123(1-2), 95-113.
- Krugman, Paul. (2014) "Ideology and Investment," *The New York Times*. Available online in November 2015 at [http://www.nytimes.com/2014/10/27/opinion/paul-krugman-ideology-and-investment.html?\\_r=0](http://www.nytimes.com/2014/10/27/opinion/paul-krugman-ideology-and-investment.html?_r=0).
- Kuminoff, Nicolai V., Christopher F. Parmeter, and Jaren C. Pope. (2010) "Which Hedonic Models can We Trust to Recover the Marginal Willingness to Pay for Environmental Amenities?," *Journal of Environmental Economics and Management*, 60(3), 145-160.
- Larcinese, Valentino, Leonzio Rizzo, and Cecilia Testa. (2006) "Allocating the U.S. Federal Budget to the States: The Impact of the President," *The Journal of Politics*, 68(2), 447-456.
- Levitt, Steven D. and James M. Poterba. (1999) "Congressional Distributive Politics and State Economic Performance," *Public Choice*, 99(1-2), 185-216.
- Levitt, Steven D. and James M. Snyder Jr.. (1995) "Political Parties and the Distribution of Federal Outlays," *American Journal of Political Science*, 39(4), 958-980.
- Mathews, Michelle B., Taylor P. Stevenson, and William F. Shughart. (2011) "Political

- Arithmetic: New Evidence on the 'Small-state Bias' in Federal Spending," *Journal of Public Finance and Public Choice*, 29(1–3), 55–79.
- McKibbin, Carroll L.. (1997) "Roster of United States Congressional Officeholders and Biographical Characteristics of Members of the United States Congress, 1789-1996, tenth ICPSR ed," Inter-University Consortium for Political and Social Research: Ann Arbor, MI.
- Meyers, Harry G.. (1987) "Displacement Effects of Federal Highway Grants," *National Tax Journal*, 40(2), 221–235.
- Nall, Clayton. (2015) "The Political Consequences of Spatial Policies: How Interstate Highways Facilitated Geographic Polarization," *The Journal of Politics*, 77(2), 394–406.
- Nguyen-Hoang, Phuong. (2015) "Volatile Earmarked Revenues and State Highway Expenditures in the United States," *Transportation*, 42(2), 237–256.
- Pavlik, Jamie Bologna. (2017) "Political Importance and its Relation to the Federal Prosecution of Public Corruption," *Constitutional Political Economy*, 28(4), 346–372.
- Phelps, Charlotte D.. (1969) "Real and Monetary Determinants of State and Local Highway Investment, 1951-66," *The American Economic Review*, 59(4), 507–521.
- Stewart, Charles and Jonathan Woon. (2017) Congressional Committee Assignments, 103<sup>rd</sup> to 114<sup>th</sup> Congresses (1993–2017). Available online in April 2018 at [http://web.mit.edu/17.251/www/data\\_page.html](http://web.mit.edu/17.251/www/data_page.html).
- Summers, Larry H.. (2014) "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound," *Business Economics*, 49(2), 65–73.
- Walden, Michael L. and Gunce Eryuruk. (2012) "Determinants of Local Highway Spending in North Carolina," *Growth and Change*, 43(3), 462–481.
- Weingast, Barry R. and Mark J. Moran. (1983) "Bureaucratic Discretion or Congressional Control? Regulatory Policymaking by the Federal Trade Commission," *Journal of Political Economy*, 91(5), 449–468.
- Wright, Gavin. (1974) "The Political Economy of New Deal Spending: An Econometric Analysis," *The Review of Economics and Statistics*, 59(1), 30–38.
- Young, Andrew T. and Russell S. Sobel. (2013) "Recovery and Reinvestment Act Spending at the State Level: Keynesian Stimulus or Distributive Politics?," *Public Choice*, 155(3–4), 449–468.