Claiming Credit in the U.S. Federal System: Testing a Model of Competitive Federalism

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Based on the assumption that lawmakers can only claim credit for public goods they produce, models of intergovernmental political competition predict that states with less ability to pay for public goods will respond more favorably to the price effect of federal grants. We offer the alternative assumption that confusion over proper credit assignment allows state lawmakers to claim credit for federal production. This produces the expectation that lawmakers in states with low ability to pay will be more likely to let federal money supplant own source spending, assuming that they will be able to continue claiming credit even as their share of production decreases. We test these competing assertions in data on transportation production in the American states between 1971 and 1996.

Intergovernmental political competition has become an increasingly popular way for scholars to conceptualize the joint provision of public goods by both state and national governments in the U.S. federal system (see, e.g., Bednar 2007; Cremer and Palfrey 2000; Bailey and Rom 2004; Eskridge and Ferejon 1994; Dye 1990). An important feature of this theoretical approach to federalism is that legislators at both the state and federal levels compete over the credit for provision of goods to citizens, while at the same time trying to avoid the blame associated with increased taxation. The idea traces its intellectual heritage through Grodzins's (1966) conception of ''marble cake'' federalism to recent mathematical models of the occurrence and impact of governmental competition in the production of public goods (Volden 2005, 2007).

Two of the key assumptions of this formal work are that citizens accurately ascribe both blame and credit.[1] In other words, recent models are premised on the assertion that citizens know what they pay in taxes to each level of government and hold the appropriate level accountable for increases. They also assume that citizens know and care what proportion of a public good is provided by each level of government and allocate credit for that provision appropriately. While originally conceptualized in terms of goods provided simultaneously but independently by

different levels of government, models incorporating these assumptions have been extended to include the joint provision of public goods via grants-in-aid. The assumption generates the empirical prediction that states which have trouble producing goods on their own will respond favorably to increased federal grant monies in order to avoid a reduction in the already small level of relative credit they are able to claim.

This essay challenges the latter assumption that citizens accurately ascribe credit for the proportion of goods provided by each level of government. It argues that evidence for the assumption in the literature is decidedly mixed and, more importantly, that models premised upon it may generate inaccurate predictions about the behavior of state-level policymakers. We offer an alternative assumption that low levels of citizen information and the structural realities of the U.S. federal system may create confusion over proper credit assignment and allow state lawmakers to claim credit for federal production. A competitive federalism model that incorporates this assumption produces the expectation that states with low ability to pay for the production of public goods will be more likely to let federal money supplant own source spending, assuming that citizens will not properly assign credit for production.

This article tests the competing assertions discussed above in an analysis of transportation infrastructure expenditures in the American states over a twenty-five-year period. The findings confirm that states with low capacity for raising additional revenue respond less favorably to federal grants. The final section of the article discusses the implications of the findings for models political competition in intergovernmental relations and for other prominent strains of federalism research.

Intergovernmental Competition in the Literature

Though some scholars had noted interdependent relationships among levels of government in the production of public goods before 1966 (See for example Anderson 1955), it was in that year that Morton Grodzins claimed that ''no important activity of government in the United States is the exclusive province of one of the levels.'' He also intimated that no matter which level provided the largest share of a particular good, the other would always attempt to assert its political will, either through control of ''fundamental'' implementation decisions in the case of state and local governments or through money in the case of the national government (Grodzins 1966: 8–9).

Before reviewing the literature that followed Grodzins', it is important to note that we are focused in this article on the competition between state and national governments in the U.S. federal system and not on competition among state governments. That second topic has produced rich literatures on interstate

competition and cooperation, races to the bottom in welfare provision, races to the bottom and the top in environmental regulation, and on a host of other subjects (see, for example, Zimmerman 1996, 2002; Woods 2006; Bailey and Rom 2008). These works offer tremendous insights into the relationship between states, and the impact of those relationships on policy decisions, and there is undoubtedly an argument for integrating those insights with those from work on vertical competition in the U.S. federal system. However, in the interest of parsimony and brevity, we will focus exclusively on the latter from this point on.

We can return then to the literature on state/federal relations. Following Grodzins's conceptualization of the ''marble cake,'' a small army of scholars have debated the reasons for and the implications of the different roles played by state and national governments in the production of various public goods. They have attempted to explain both the observed and the normatively appropriate balance of redistributive and distributive policies promulgated by each level of government (See for example Oates 1968; Peterson 1981; Arnold 1990; Rivlin 1992). They have explored the role of diseconomies of scale and fiscal disparities in the decentralized production of public goods (See, for example, Ostrom and Whitaker 1974; Schneider 1986). They have examined the ways in which the electoral motivations of national, state, and local lawmakers influence the distribution, character, and effectiveness of public good production via grants-in-aid (see, e.g., Gramlich 1977; Chubb 1985a, 1985b; Rich 1989; Stein 1981). Obviously, the work cited above represents only a small sample of the large literature concerned with public goods production by national and subnational governments during this period, but it nonetheless gives an accurate picture of the tremendous diversity of questions and approaches contained within it.

Peterson (1995) distilled this vast and sometimes disconnected literature into what he identified as two theories of joint production in the U.S. federal system, which he termed functional and legislative federalism. A functionalist perspective, according to the author, predicts that each level of government will expand production in those areas where it is most efficient or effective, while diminishing production in areas where the other level has greater ''competence.'' Alternatively, Peterson argues that a legislative theory of federalism assumes that production of public goods at all levels of government is driven by the electoral needs of lawmakers. Both state and federal lawmakers attempt to distribute goods to citizens when they are able to claim electoral credit for doing so. The author provides some evidence that changes in the American political landscape have made the latter an increasingly accurate description of joint production in the federal system, which he suggests may lead to significant overproduction by lawmakers seeking electoral benefit. Nonetheless, he concludes that the theories may ultimately be complementary and able to be combined into a ''unified'' theory of American federalism.

The most recent work in this area has attempted to do just that, combining functionalist and legislative perspectives in a mathematical model of intergovernmental competition in the U.S. federal system. Combining insights from previous scholarship, Volden (2005) develops a model which captures four ''stylized facts'' regarding joint production by state and national governments. Namely, involvement by different levels of government in different issue areas varies over time, the more efficient level of government often does take the lead in the production of a particular good, the less efficient level rarely completely cedes an issue area and instead contributes some degree of own-source production, and finally, that there is significant variation among the states in their ability and desire to respond to changes in federal production. The interaction of federal and state officials is modeled as a noncooperative game where politicians at different levels compete with one another to determine the policy course in a particular area and to claim credit for the goods provided. This competition helps to determine the production by each level, including the decision to leave production to the other level or to produce goods jointly.

The original model was intended primarily to explain instances of independent joint production, but Volden (2007) extends it to include grants-in-aid. The model allows strategic national and subnational actors the choice of no production, individual production, joint independent production, or joint production through the grant-in-aid system. The federal government is the first mover in this conception, deciding not to produce, produce independent of state effort, or incentivize state production. States respond to these decisions, deciding the quantity of the good they wish to produce independently, whether or not to accept a grant offered by the federal government, and the amount of the good to produce in response to accepted grant funding.

Taken together, these models generate a set of propositions about decisions by state and national actors regarding the degree of cooperation with the other level of government in the production of public goods. Any comprehensive test of the full model would be exceedingly difficult, and is beyond the scope of this project. Instead, we focus on testing the proposition explicitly related to the joint provision of public goods via the grant-in-aid system. More specifically, we are interested in the degree to which state responses to grant funds betrays a belief by lawmakers that they can only claim credit for the portion of a public good that they produce.

As a baseline of sorts, intergovernmental competition models suggest that, when a good or a portion of a good are independently produced by a state spending decisions are a function of internal factors including the ability to raise revenue, the marginal cost of producing the good, and the demand for the good among the citizenry (Volden 2005). When a good (or a portion of a good) is produced jointly by the state and national governments via the grant-in-aid system, the models suggest that state spending on a good increases in response to an increase in federal

grants targeted at the production of that good. This is, of course, identical to the expectation offered by the literature on the fiscal impact of federal grants (see, e.g., Oates 1968; Chubb 1985b; Hines and Thaler 1995; Nicholson-Crotty 2004).

The real contribution of recent models is the related assertion that a state's response to federal money will be moderated primarily by its desire to claim electoral credit. More specifically, Volden (2007) proposes that the impact of an increase in grant money will be larger when the marginal cost of providing the good is lower within a state and when the state has limited ability to raise revenue via taxation. This last expectation is most directly related to the need to claim credit with voters for the production of public goods. Volden (2007) states that:

> Those governments that have difficulty raising taxes on their own will respond very favorably to the grant, increasing good provision greatly. This is because they were previously limited in their level of good provision due to their inability to raise taxes effectively. If they wish to receive a substantial portion of credit upon receipt of the grant, they cannot cut back own-source spending too dramatically

In other words, even when states cannot obviously afford to do so, they will substantially increase own source spending in response to federal grants in order to continue claiming some electoral credit for the increased public good production.

Before moving on, it is important to justify the focus on electoral credit in these models, rather than any number of other motivations we might imagine for state lawmakers. While it is true that politicians might spend own-source monies in response to federal grants in order to create jobs or attract businesses that benefit from good roads competitive federalism focuses on electoral credit, because of Peterson's (1995) assertion that all public production is ultimately designed to produce electoral credit. Beginning with the assumption that lawmakers are primarily reelection seeking, all of the other motivations for increasing own-source production become endogenous to that goal. Models of competitive federalism, including Peterson (1995), Volden (2005, 2007), and this one, assume therefore that observed spending decisions by state lawmakers are ultimately intended to produce or preserve credit with the electorate that can further their electoral goals.

Thinking About the Division of Credit

The key proposition noted above grows directly out of the assumptions that voters have full information regarding spending at the state and federal level and that they accurately assign credit for goods provision based on those criteria. Thus, lawmakers considering the provision of a public good that is already being provided in part by another level of government can only receive credit for the proportion that they pay for (Volden 2005). Similarly, when federal production is

accomplished via grants-in-aid "the credit for good provision is divided in proportion to the size of the grant and the total spending by the subnational government" (Volden 2006: 11).[2] A necessarily related, though unstated, assumption in these models is that state-level political actors believe this to be true and act accordingly.

This section argues that the assumption regarding accurate credit assignment finds only mixed support in the literature. It also suggests that the assumption may generate inaccurate expectations when the general propositions discussed above are distilled into testable hypothesis regarding the behavior of state-level lawmakers. Finally, it generates competing hypotheses based on the alternative assumption that voters have limited information regarding the relative provision of goods by different governments, that the structure of federal systems creates further opportunities for inaccurate credit ascription, and finally, that politicians know this and act accordingly.

The assertion that voters accurately ascribe electoral credit and blame is based primarily on a federalist perspective on vote choice (see Stein 1990), which holds that voters understand the different responsibilities and circumstances of different levels of government and, therefore, hold them accountable for different things. More specifically, it is premised on Atkeson and Partin's (1995) finding that state-level politicians are held electorally accountable for the health of the state's economy, while senatorial candidates from the state are not.

Evidence regarding the information voters have and the consequences for elected officials is, however, mixed. On the one hand, there is evidence that citizen preferences regarding which level of government should be responsible for a particular policy generally reflect actual policy efforts of federal, state, and local government as measured by spending (Schneider and Jacoby 2003, 2008). Additionally, Konisky (2010) demonstrates that people seem to match their choice of government to the actual scale of the problem, suggesting that they have some accurate sense of which issues transcend local or state borders and which do not, as well as an ability to use the size of the problem to choose the most proximal level of government to deal with it.

There is also some evidence that citizens expect politicians at different levels of government responsible for different issues and that politicians respond to these expectations. Specifically, Atkeson and Partin (2001) find that citizens are more likely to hold governors responsible for "development" issues like economic performance and education, while placing more responsibility on senators for diffuse issues like national defense and helping the poor. Most interestingly, the authors find that politicians respond by emphasizing the issues for which they are most likely to be held responsible in their campaigns.

Finally, research suggests that citizens are able to accurately hold elected officials accountable even when they have very low levels of information about the behavior

of those officials. Indeed, there is a relatively long line of work suggesting that members of Congress pay an electoral price for ''ideological extremity'' in their roll-call votes (see, e.g., Johannes and McAdams 1981; Erikson and Wright 1993; Brady et al. 1996; and Jacobson 1996). Canes-Wrone, Brady, and Cogan (2002) demonstrate that voting in a manner that is ''out of step'' with district preferences can cost even safe incumbents their seats in the next election. These findings hold despite the recognition that voters likely know very little about the behavior of their representative because they can use cues from political elites, information about extreme voting provided by challengers, or a simple ideological rank-ordering of candidates as an information shortcut which allows them to hold incumbents with extreme voting records accountable (See Popkin 1991; Erikson 1971; Downs 1957).

There is also evidence, however, that Americans have very little policy-specific information, that they inaccurately ascribe credit and blame for goods production, and that confusion over which level of government produces a good may influence the behavior of actors in federal systems. For example, Carpini and Keeter (1996) report that only 14 percent of respondents in a nationally representative sample knew the current unemployment rate, and less than 25 percent knew (within 5 percentage points) the proportion of the total federal budget spent on education. Even when asked about general trends in the level of common public goods, few citizens are well informed. Gilens (2001) reports that, at the time the data used in his study were gathered, only 12 percent of respondents knew that the crime rate had declined in previous decade.

In addition to generally low levels of knowledge regarding the levels of and expenditures on public goods, there is also evidence that citizens do not accurately ascribe credit for the provision of such goods. Lyons, Lowery and DeHoog (1992) demonstrate that citizens make a high percentage of errors attributing credit for services to different local governments. Thirty percent of respondents from the metro where services were provided by multiple entities attributed the delivery of at least one major service to a government other than the one that provided it. Almost 10 percent of the sample gave credit to the wrong government for one-third of the total number of services they received. Even more telling perhaps, is that fact that almost 40 percent of respondents gave a government credit for something that was not provided by ''any'' of the local governments.[3]

Finally, there is reason to believe that federal systems create confusion among voters regarding goods provision by different levels of government and that this confusion incentivizes opportunistic behavior by lawmakers. Bednar (2007) argues that jointly produced policy outcomes are often evaluated by citizens not on the basis of contributions by individual participants, but on a ''threshold'' basis, whereby everyone involved is rewarded so long as overall levels of production are satisfactorily high. She suggests that lawmakers seeking electoral credit have

incentives to become involved in these types of production even if it is not necessarily the most efficient use of their time or resources. This is particularly true in federal systems, which the author argues creates an additional ''problem of credit assignment and opens a window of opportunity for the politically ambitious to claim responsibility for favorable outcomes.'' Bednar's (2007) argument is primarily intended to explain federal ''encroachment'' into traditional areas of state production. The logic applies equally well, however, to a joint state/federal production scenario where states can receive credit, even at minimal levels of own source production, so long as overall production stays above some minimally acceptable threshold and there is confusion over proper credit assignment.

The evidence discussed above does not consistently support for the assertion that U.S. citizens are well informed about the governments responsible for producing public goods or that lawmakers can only claim credit for their share of that production. Volden (2007) suggests that the results of competitive federalism models built around this assumption hold so long as credit moves in the same direction as actual supply. However, the evidence that citizens are wrong regarding the direction that things like crime and unemployment are trending suggests that even this weak condition may not hold. Additionally, the information shortcuts that uninformed voters can use to hold Members of Congress responsible for their votes cannot automatically be assumed to be present in federalism-related decision-making, which is likely to be more complex, less transparent, and less salient than roll-calls (see Canes-Wrone, Brady, and Cogan 2002).

At the very least, the mixed evidence regarding the assumption of full information and the ability to claim credit only for own source production makes it reasonable to consider an alternative set of assumptions and empirical predictions. We suggest that models of intergovernmental competition could begin with the assumption that citizens know or care very little about the proportion of services provided by each level within the federal system, the structure of which can create additional confusion over proper credit ascription. We can combine that with Bednar's (2007) assertion that citizens use a threshold method to assess the total production of public goods, with higher values being acceptable and lower levels being unacceptable, regardless of what share of the total each level of government is responsible for producing. We suggest, therefore, that when there is confusion over credit assignment and the total level of production is acceptable, state lawmakers can continue claim credit for public goods even when their own share of that production is shrinking relative to the national government.

Based on this approach, the response to federal grant money by state lawmakers could look very different than it does in recent formal models of competitive federalism. As noted above, those models predicts that state spending will go up in response to federal grants and that the impact will be larger in states with limited ability to raise additional revenues. This is because these states are able to produce

less on their own and cannot risk losing additional electoral credit by diverting own source funds away from production being stimulated by federal money. Alternatively, our assumption suggests exactly the opposite prediction. Own source spending will be positively correlated with to federal grants, as the consistent finding in the "fly paper" literature would suggest, but the impact will grow "smaller" as the recipient government's ability to raise tax revenue decreases. Lawmakers in these states, facing significant fiscal constraints, will be most likely to allow federal dollars to supplant rather than supplement own source spending and simply claim credit for goods being produced by the national government.

Before moving on, it is important to answer the logical question of why, if they are able to claim credit for federal production, all states would not simply free ride on federal production, regardless of their ability to raise revenue? The answer lies in the restrictions placed on grant monies by the national government. The vast majority of federal grants are designed to supplement rather than to replace state-level production of targeted public goods (Nice 1987). Researchers have suggested that matching requirements and other conditions are a good way to ensure that these ambitions are realized (see Gramlich 1977). Nonetheless, volumes of studies have demonstrated that, regardless of conditions placed by the federal government, some state-level funds are diverted into the production of private goods, in the form of lower taxes, or other public goods preferred by a state's lawmakers (Nicholson-Crotty 2004; Hines and Thaler 1995; Bradford and Oates 1971). Still, the federal government does monitor grantee behavior, and recipients must be careful not to treat federal monies as excessively fungible, lest they become the target of investigations and risk reductions in funding (Chubb 1985b; GAO 1996).

Data, Variables, and Methods

We test the competing hypotheses discussed above in an analysis of state-level transportation infrastructure spending between 1971 and 1996. More specifically, we test whether state lawmakers responded to increases in federal grant dollars during that period as if they were able to claim credit for a portion of roadway improvements funded by the national government. The analysis discussed below focuses on transportation for a variety of reasons. First, it is a classic jointly produced public good. In the average state, the state government funds approximately 50–70 percent of roadway operation, maintenance, and construction through gas taxes, licensure revenues, and bonds. The federal government typically provides about 20–30 percent of state transportation revenues through grants administered by the Federal Highway Administration.[4] The small remaining percentage of expenditures comes from a variety of other sources including local contributions, charges for services, and investment income.

The national government helps to produce a wide variety of transportation projects via FHWA funds, including those under the Interstate Maintenance Program, the National Highway System Program, the Surface Transportation Program, the Highway Bridge Replacement and Rehabilitation Program, the Congestion Mitigation and Air Quality Control Program, and numerous others.[5] These are matching grants that require an 80–90 percent match from the states, depending on the type of project.

Beyond being a widely recognized public good that is jointly produced by state and national governments, transportation is an appropriate place to focus the analysis because it has characteristics that suggest it should not bias results toward either of the competing assumptions discussed above. On the one hand, highway construction is a highly sought after distributive good, which gives national legislators significant incentive to claim credit for their role in its production when they campaign for reelection among subnational constituencies. Additionally, information about the portion of major roadway projects funded with national, state, and local dollars is readily available to interested citizens on Department of Transportation websites and on signs posted at construction sites in a majority of states. Thus, citizen information about the production of this public good may be relatively high.

There are also reasons to believe that confusion regarding proper credit assignment may be a problem in transportation production. Highway funds are ''passed up'' to the national government via federal gas taxes collected in each state. That money is then reallocated to state projects via the Highway Trust Fund. Thus, citizens may rightfully have questions about the level of government that is primarily responsible for building the roads in their state. Despite our belief that transportation production offers an appropriate place to test competing models of competitive federalism, it is only a single policy area and it will be important for future research to replicate the findings discussed below in other issue areas.

The primary dependent variable in this analysis is the annual change in inflation adjusted own-source state spending on transportation infrastructure within a state. The measure is comprised of disbursements from current revenues or loans for construction, maintenance, interest and principal payments on highway bonds, transfers to local units, transactions by state toll authorities, and miscellaneous expenditures. The figure excludes amounts allocated for collection expenses, non-highway purposes, and mass transit. The measure includes only state monies and does not, therefore, reflect federal grants or contributions from local governments. As a robustness check, we also estimate a model using the change in own-source transportation expenditures per capita. The descriptive statistics for both dependent variables, and all others described below, are presented in table 1.

The key independent variables reflect the changing federal contribution to transportation production within a state, the ability of a state to raise additional

Table 1 Descriptive statistics

	Obs.	Mean	SD	Min.	Max.
Annual change in state transportation expenditure (1000s)	1250	34.7568	114.4817	−587	883
Annual change in state transportation expenditure per capita	1250	7.094011	59.14676	−527.0216	730.8783
Annual change in federal transportation grants (1000s)	1250	9.580063	56.97527	−357	635
Annual change in federal transportation grants per capita	1250	2.1601	16.74972	−11.9189	14.67691
Annual change in Vehicle Registrations (1000s)	1250	74.7744	193.202	−1649	2782
TEL index	1300	4.369231	6.47948	0	30
Marginal cost	1300	0.1086	0.044027	0.0243825	0.334802
Population (1000s)	1300	4693.683	5012.468	313	31858
Citizen ideology	1300	45.66512	18.01703	0	100
Intergovernmental revenue	1300	2539.593	4518.033	33	48759

revenue via taxation, and the interaction of the two. We measure the relative proportion of transportation infrastructure produced by the federal government with an indicator of the annual change in inflation adjusted grant dollars administered to the state by the Federal Highway Administration.[6]

We measure the ability of a state to raise revenue with an indicator of tax and expenditure limits (TELs) in each state for each year.[7] Thirty-one states have adopted such limits and they can place a significant fiscal constraint on states. TELs vary dramatically by state, however, ranging from nonbinding disclosure requirements to mandatory formulaic (typically based on population or inflation) caps on allowable increases in taxes, tax rates, and/or expenditures (Joyce and Mullins 1991). Not surprisingly, given such variation, studies that model TELs as a dichotomous phenomenon, or who model each type of limit (e.g., spending, revenue, etc.) individually, often find little or no impact on state spending (see, for example, Cox and Lowery 1990; Kousser, McCubbins, and Moule 2008). Alternatively, research recognizing the significant differences in the restrictiveness of limits across the states has found that more restrictive TELs have a significantly larger negative impact on state-level taxing and spending than do relatively less restrictive policies (Knight 2000; Poulson 2005).

Recognizing the variation in TELs, we employ an index developed by Amiel, Deller, and Stallmann (2009) that captures six dimensions of limits, including (i) the type of TEL; (ii) if the TEL is statutory or constitutional; (iii) the presence

of growth restrictions (based on population or inflation; (iv) the method of TEL approval; (v) the presence of legislative or popular override provisions; and (vi) exemptions for certain types of taxes and categories of expenditure. States without limits are coded as a 0 and the measure, therefore, ranges from 0 to 30, with higher values representing more restrictive limits.[8] This measure captures some of the ''loopholes'' that Kousser, McCubbins, and Moule (2008) suggest can allow state-level lawmakers to circumvent TELs, and it has been demonstrated to correlate negatively with state-level expenditures on economic development (Stallmann and Deller forthcoming). Analyses in the data used herein suggest that it is also negatively correlated to the annual difference in state generated revenue, the annual difference in state-level total expenditures, and the annual difference in state-level transportation-related expenditures.[9]

Finally, the analyses include measures capturing the multiplicative interactions between federal dollars and the TEL index. If our assumptions are correct, then the interaction should be significant and negatively signed. This would indicate that increased severity of this fiscal constraint decreases the amount of own source spending in response to federal grants.

The analysis also controls for the elements of ''functional federalism'' included in models of intergovernmental competition. It includes an indicator of the need for transportation infrastructure, measured as the change in the number of vehicles registered within a state in the previous year.[10] The measure should be positively correlated with own source state spending.

The model also includes a measure designed to control for the marginal cost of increasing production of transportation infrastructure. We focus here on the marginal political costs.[11] Because states are required to maintain balanced budgets, an increase in production of one good necessarily requires a tradeoff in the production of another (Nicholson-Crotty, Theobald, and Wood 2006). We suggest that the degree to which lawmakers are able to make these tradeoffs depends in large part on the percentage of available resources already going toward the production of a given good. In other words, citizens in a hypothetical state where expenditures on healthcare do not comprise the largest part of the budget may be more likely to tolerate an increase in Medicaid services, all else being equal, than are those in a state where other services have already been cut in order to sustain the program. Thus, we capture the marginal political costs of increasing production of transportation, by including an indicator of the percent of total expenditures allocated to that function in the previous year.[12] The measure should be negatively associated with own-source state spending on transportation infrastructure.

The set of variables outlined above obviously represents a very parsimonious reduced form model of state-level production meant to capture only those influences suggested by formal models of intergovernmental political competition. We also present a model which includes a set of prominent alternative explanations

for state spending found in the state policy and budgeting literature, including state political ideology (Berry et al. 1998), political competition coded as a 1 if either party controls less than 55 percent of the seats in the state's legislature, revenue from local governments, and population.

The models discussed below are cross-sectional time series analysis. We need to estimate fixed effects for state in order to control for the differences in input costs associated with road construction in different states, the differing mix of interstate and other projects and the resultant difference in overall match rate across the states, and other potential but unmeasured influences on state-level production. However, key independent variables including the measures of TELs are relatively time-invariant, making the traditional fixed effects estimator inefficient. As an alternative, we employ Plumper and Troeger's (2007) vector decomposition approach, which provides efficient estimates for time-invariant variables in panel data with unit fixed effects.[13] The estimator allows for corrections for heteroskedastic error variance.[14]

Findings

Table 2 presents three analyses of state-level expenditures on transportation infrastructure between 1971 and 1996. The first column tests the model described above using the TEL restrictiveness index as the primary independent variable and in the interaction with federal grants. The second column includes the additional control variables discussed above. The third column presents a robustness check by using annual change in state transportation expenditures per capita as an alternative dependent variable.

In each of the three models, the change in federal transportation grants is significant and positively related to own-source expenditures. Because the models are interactive, the substantive size of the impact is not interpretable independently. We can note, however, that the interaction term is significant and in the expected direction in each model.

Turning to the primary model in column 1, we see that the interaction is negative and significant suggesting that states with more stringent TELs spend less own-source revenue in response to an increase in federal grants. The coefficients indicate that states without TELs increase own-source funding by $0.66 for each increase in allocation from the Highway Trust Fund. This is below, but relatively close to what we would expect given the 80 percent match rate in the average state. The findings also suggest however, that the state response drops substantially in states with restrictive TELs. In states with the least constraining limits, the response to an additional dollar of federal money is $0.62. At the mean level of restrictiveness, however, it drops to $0.59 and in the most restrictive states,

Table 2 Own-source state response to changes in federal transportation grants

	Model 1	Model 2 (w/Controls)	Model 3 (w/per capita expenditure measures)
Change in federal transportation grants	0.659***	0.651***	0.835***
	(0.069)	(0.069)	(0.114)
Change in car registrations	0.038**	0.043**	0.023***
	(0.016)	(0.017)	(0.008)
Capacity to generate revenue	−0.429	−1.094**	−0.952***
	(0.442)	(0.464)	(0.231)
Revenue capital × federal grants	−0.010*	−0.010*	−0.035***
	(0.005)	(0.006)	(0.012)
Marginal cost	−942.139***	−938.883***	−665.426***
	(79.049)	(92.881)	(50.548)
Population		0.009***	
		(0.001)	
Citizen ideology		−0.239	
		(0.172)	
Political competition		16.172**	
		(7.389)	
Intergovernmental revenue		−0.000	
		(0.001)	
Intercept	135.791***	102.753***	83.634***
	(9.731)	(14.977)	(5.901)
R^2	0.25	0.26	0.19
F (probability)	64.91 ($p<0.000$)	39.91 ($p<0.000$)	43.63 ($p<0.000$)
N	1200	1200	1200

Note: ***$p<0.01$, **$p<0.05$, *$p<0.1$.

a \$1 increase in federal highway money produces only a \$0.36 increase in own-source expenditure.[15]

We can also examine the impact of TELs on state response to federal grants by graphing the marginal effects, which allows for an examination of the impact of federal spending across the range of the TEL measure, with other variables held at their central values. This is presented in figure 1. The solid line represents the change in the marginal effect, while the dashed lines are the 95 percent confidence interval around that estimate. The figure suggests that the impact of a dollar of federal spending on own-source expenditures decreases by 50 percent across the range of the TELs variable. Even more interesting, it suggests
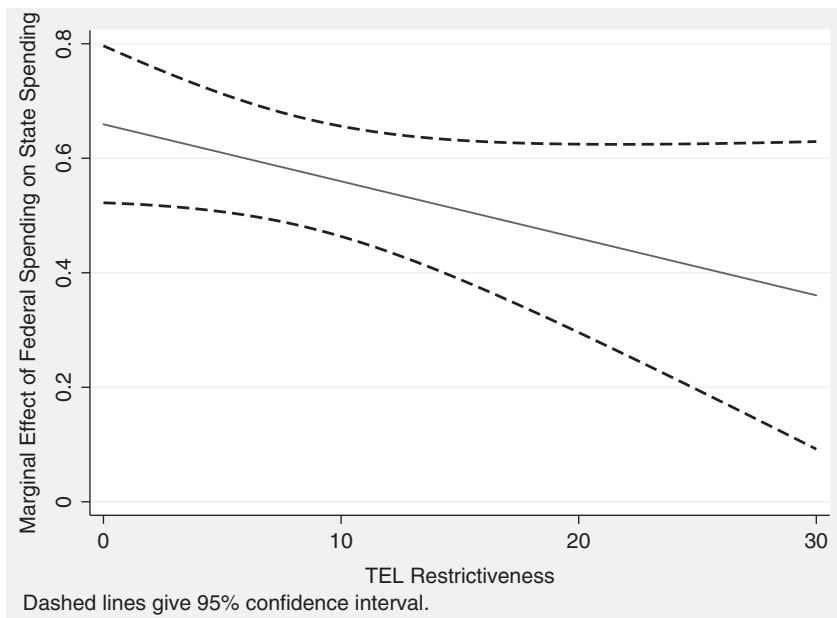
Figure 1 Marginal effect of federal grants on own-source spending at different levels of TEL restrictiveness.

that TELs significantly moderate the impact of federal grants at all values of TELs variable.

Before moving on to the model presented in the second column, it is important to take a moment to discuss the remainder of the findings as they relate to the formal presentation of competitive federalism. The annual change in registered vehicles, used as measure of "functional federalism" or the need for a public good, was positive and significant. Substantively, the coefficient suggests that each additional registered vehicle produces an increase of almost $40 in own-source spending.

The indicator of marginal cost of an increase in transportation production, here proxied with the proportion of total expenses already being devoted to transportation, was negative and significant. This suggests that states where the marginal cost is higher are less likely to increase spending. Substantively, the coefficient indicates that a move from 1 SD below to 1 SD above the mean in marginal cost decreases the change in own source spending by almost three-fourths of a standard deviation.

The model in Column 3 suggests that the negative impact of a state's inability to raise additional revenue on its response to federal grants remains essentially unchanged when controls for ideology, competition, intergovernmental revenue,

and population are added to the model. Though, interestingly, the main effect for the measure of TELs becomes significant and the moderating impact of TEL restrictiveness on state response grows when other explanations for own-source spending are held constant. The coefficients on the control variables suggest that states where the legislature is more closely divided among the parties are more likely to increase spending than are those where one party dominates. Larger states also increase spending to a larger degree than do smaller states.

Finally, the third column tests the robustness of the findings by modeling an alternative dependent variable. Specifically, it operationalizes state transportation spending as own-source spending per capita. In this model, the measure of federal grants is also per capitized in order to make the impacts comparable with other models. Those impacts are similar to the ones presented in the second columns, though it is interesting to note that the impact of fiscal constraints on own-source spending is significant and substantially larger than in the first model. The interaction between TELs and the change in per capita federal transportation grants is negative and significant, indicating that the own-source response to those funds is lower in states with more restrictive TELs. Substantively, the results suggest that an additional $1 per capita in grant funding produces a $.83 response in states with no limits, but only a $0.62 response in states with TELs of average restrictiveness.

Discussion and Implications

The assumption that lawmakers can claim credit only for the public goods that they pay for has important implications for the expectations that models of intergovernmental competition generate regarding the behavior of state-level policy makers. As Volden (2007) notes, ''if they wish to receive a substantial portion of credit..., then they {states} cannot cut back on own source spending too dramatically.''

The findings from the analysis herein suggest, however, that, at least in the case of transportation policy, that empirical expectation is not supported. No matter how the state's ability to raise additional revenue is operationalized, what control variables are included, or whether actual or per capita allocations are considered, the credit claiming incentive does not induce states to increased federal production more aggressively when they are limited in their ability to increase own source production. Instead, they appear to do the opposite, reducing their own spending when increases in federal production correspond with limited ability to raise revenue via taxation. In other words, they respond not as if they can receive credit only for the proportion of transportation infrastructure that they actually pay for, but instead as if they can free-ride on national government production.

We have suggested that this is exactly the behavior we should expect. As a review, we developed the following three-part argument, drawing heavily on Bednar (2007). First, the federal system, along with often low levels of policy information among citizens, creates confusion over proper credit ascription for public goods. Second, citizens use a threshold method to assess the total production of public goods, with higher values being acceptable and lower levels being unacceptable, regardless of what share of the total each level of government is responsible for producing. Bringing these together we argue that, when there is confusion over credit assignment and the total level of production is acceptable, state lawmakers can continue claiming electoral credit and/or avoiding electoral blame for goods production even if their share of that production is shrinking.

Implications

One of the promises of a theory of competitive federalism is that it may help to clarify some long-standing areas of confusion in the study of state-federal relations (Peterson 1995). One such area deals with the potential for asymmetric responses to federal grants by states—a positive relationship between state spending and grants when the latter are going up, but not when they are going down (Oates 1999). The empirical support for this supposition has, however, been mixed (Gamkhar and Oates 1996; Gamkhar 2000).

Applying the logic of the adapted model of competitive federalism tested above to the question of grant asymmetries yields some unique testable hypothesis regarding asymmetric response. If we assume that production in the previous year is a reasonable proxy for the threshold of acceptable production in the current year, when federal grants go up, state lawmakers can maintain the previous year's level of total production while contributing fewer own-source dollars.[16] In this case, states that have difficulty raising revenue should be particularly likely to take a free ride on national government production allowing them continue claiming the same credit for transportation "and" divert scarce resources into other public goods. Alternatively, when federal money decreases, states must choose to replace that funding with own-source dollars or accept lower total production and the reduced credit that comes with it. In this case, even states facing fiscal constraints should be more likely to replace lost federal dollars with own source, thus producing the often observed asymmetry, rather than garner less credit. Thus, the model suggests that previous studies may have inconsistently observed asymmetries, because they failed to model the important moderating impact of fiscal constraint in responding states.

Beyond asymmetrical response, the findings discussed above and the theoretical assumptions that underlie them have implications for the study of fiscal federalism more generally. Competitive federalism models offer an alternative to existing

approaches, which model fund-diversion in federal grant programs as a function of restrictions placed on grantees, monitoring by grantors, or goal congruence between these parties. Competitive federalism directly interjects an electoral motivation and suggests that the need to claim electoral credit or avoid electoral blame will influence how states spend grant money. This assertion is as important as it is obvious, but it has not been adequately tested empirically.

The adapted competitive federalism model tested herein suggests that, at least in transportation production, states that face significant constraints in their ability to raise revenue are most likely to divert own-source funds away from the programs targeted by federal grants. Though it obviously requires confirmation in other policy areas, the findings suggests that we might add fiscal capacity to the list of variables that we believe influence state-level responses to the grant-in-aid system.

The findings also suggest implications related to one of the primary normative concerns raised by models of political competition in the federal system. While the functional elements of the theory suggest that production will be limited by tax efficiency, need, and marginal cost differentials among the levels of government, the legislative components of the theory are less optimistic. Instead, they suggest that national and subnational lawmakers will produce ever greater levels of jointly produced goods in an attempt to claim electoral credit for their provision. Volden (2005) suggests that overproduction can be avoided, but only in those instances where the federal government is clearly the more efficient provider of the good and states with heterogeneous preferences choose to augment federal production at different levels.

In addition to this protection against over-supply of jointly produced goods and the resulting engorgement of government at all levels, the assumption that credit can be shared among levels suggests a natural check on government growth, at least in some states. The federal government may increase production in an attempt to claim electoral credit, but the states may not have to follow suit in order to reap the same benefits. If credit can be shared, then electoral incentives will not drive state governments, particularly those facing fiscal constraints, to grow in response to federal growth. This is consistent with research demonstrating that, while increases in state-level expenditures and administrative personnel granger cause increases in the same variables at the national level, the opposite does not seem to be true (Meier and Bohte 2000).[17]

This contingency does not, of course, protect against government growth among states with significant ability to raise additional revenue. These states may respond to federal grants very favorably, increasing the overall level of production and, thus the overall level of electoral credit available. This can obviously lead to substantial overproduction and government growth, but given the significant fiscal constraints

faced by most jurisdictions, the number of states that are in a position to contribute to this overproduction at any given time may be relatively small.

Conclusion

MacDonald (2003) argues that, depending on whether we adopt a "instrumentalist-empiricist" mindset or a "scientific-realist" approach, rational choice theory is useful either because it generates parsimonious and testable hypotheses about the observable world, or because it allows us to construct models of unobservable processes. Recent mathematical models of intergovernmental competition, and the previous textual theorizing that they reflect, are valuable for both reasons. They help us infer an electoral motivation, which lawmakers will not often admit to, and they help us to distil specific testable predictions from the remarkable complexity of joint public good production within the U.S. federal system.

However, the accuracy of the testable predictions produced by these models, and indeed by all rational choice models is inexorably tied to the accuracy of initial assumptions (Green and Shapiro 1994). We have suggested here that the predictions about the behavior state-level actors in the federal system generated by formal models of intergovernmental competition, while parsimonius and testable, may be inaccurate because those models begin with assumptions regarding the credit awarded for public goods provision which are inaccurate, at least in some policy areas. The empirical findings from our analyses confirm that these models and their assumptions should be examined carefully and tested empirically. Of course, we wish to emphasize once again that it is necessary to do so across multiple policy before drawing conclusions about the robustness of the challenge we offer to these models herein.

Notes

1. For an exception, see Bednar (2007) whose model allows credit to be assigned inaccurately.
2. Volden (2007) suggests that the results of the model remain substantively unchanged with some variation in the accuracy of credit assignment, but only if changes in credit assignment are in the same direction as changes in goods provision.
3. For instance, they attributed street lighting to the city government, even though it was actually provided by a private neighborhood association.
4. The Highway Trust Fund (HTF) was originally created by the Highway Revenue Act of 1956 and has been reauthorized numerous times. Recent examples of such authorization acts have included the 1991 Intermodal Surface Transportation Efficiency Act and the 1998 Transportation Equity Act for the 21st Century. Each year, states are "authorized" to obligate funds under the auspices of these multi-year federal authorizations.

Federal-aid highway funds for individual programs are apportioned by formula using factors relevant to the particular program. After those computations are made, additional funds are distributed so that each State receives an amount that ensures some degree of return on its contributions to the Highway Account of the HTF. The guaranteed rate of return has varied over time. States are also increasingly augmenting their funds via innovative financing programs, including State Infrastructure Banks, Credit Leveraging, and others (see http://www.fhwa.dot.gov/reports/fifahiwy/ffahappn .htm).

5. For a complete catalogue of programs, see http://www.fhwa.dot.gov

6. Information on highway expenditures and vehicle registrations gathered from the various years of the U.S. Federal Highway Administration's *Highway Statistics, Annual,* and the U.S. Census Bureau's *U.S. Statistical Abstract.* Available at http:// www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm and http://www.census.gov/compendia/ statab/

7. It is possible that TELs reflect, not an exogenous constraint on a state's ability to raise revenue, but rather an endogenous preference among state lawmakers and citizens to spend less. This ''demand side'' explanation for the relationship between limits and revenue generating capacity would make the interpretation of findings more challenging. It raises the possibility that lawmakers in high TEL states spend less in response to federal grants, not because they cannot spend more, but because doing so allows them to curry another type of electoral favor with constituents. I thank an anonymous reviewer for this suggestion. We check the robustness of the findings to different operational decisions by substituting the tax effort measure developed by the ACIR and Tannenwald et al. 1999, as well as the annual change in that measure, for the measure of state revenue generating capacity. The findings reported below remain substantively unchanged and, thus, we have some confidence that the observed spending patterns represent, at least in part, the need and ability to claim electoral credit that we describe in the theoretical portion of the article. Obviously, however, more research is necessary to ensure that the finding holds across issue areas and to sort out the veracity of potential alternative interpretations of the findings.

8. For a detailed discussion of the indices, see Amiel, Deller, and Stallmann (2009). The indices themselves and the data used to construct the indices can be downloaded at: http://www.aae.wisc.edu/pubs/sps/ under staff paper no. 536.

9. Models estimated as vector decomposition fixed effects panel regressions, robust standard errors, and total population added as a control.

10. The minimum and maximum values for this variable, listed in table 1, appear somewhat extreme. However, they are accurate. The drop of 1,649,000 vehicles took place in Pennsylvania between 1976 and 1977. The increase of 2,872,000 vehicles was in California between 1995 and 1996.

11. Constructing an accurate measure of the different input or real dollar costs of road construction (e.g., labor costs, materials, competitiveness of contracting practices, etc.) in all fifty states over a twenty-five-year period would be almost impossible. As noted below, this variation across states is accounted for in the analysis via the inclusion of state fixed effects.

12. Intergovernmental competition models suggest that it is the state's tax efficiency and arginal costs relative to the federal government that drive choices about production. However, because the national government's values on these variables in each year are constant across states, it is sufficient to simply include the state's value in the model.

13. Plumper and Troeger (2007) have, at this time, quit circulating the do file for the estimation of the Vector Decomposition model, though they have not suggested that the estimator produces unreliable or biased coefficients. Given that the results are unchanged if we estimate a traditional fixed effects model, we are confident that they are robust.

14. Wiggins and Poi (2003) suggest that the easiest way to diagnose unequal error variance in panel data is to estimate two panel generalized least squares models, one fitting heteroskedactic errors and one not, and then to compare the likelihoods via a likelihood ratio test. We do so and the test produces a chi-squared statistic of 1208 ($p < 0.0000$), which suggests the existence of heterokedacticity.

15. This is the mean level of restrictiveness among states that have TELS, which gives the variable a value of 6.

16. Within the constraints imposed by the structure of the grant-in-aid system.

17. Meier and Bothe (2000) do find some relationship between national grants and state-level spending totals similar to the one identified by Garand (1988), but they appear at only a three-year lag. The absence of the relationship both before and after this singular lag, at the very least suggests caution when interpreting those original findings regarding the relationship between national and state growth.

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