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Do intergovernmental grants create ratchets in state and local taxes?

Russell S. Sobel · George R. Crowley

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Abstract A large literature on the 'flypaper effect' examines how federal grants to states at time period t affect state spending (or taxes) at time period t. We explore the fundamentally different question of how federal grants at time period t affect state tax policy *in the future*. Federal grants often result in states creating new programs and hiring new employees, and when the federal funding is discontinued, these new state programs must either be discontinued or financed through increases in state own source taxes. Government programs tend to be difficult to cut, as goes Milton Friedman's famous quote about nothing being as permanent as a temporary government program, suggesting that it is likely that temporary federal grants create permanent (future) ratchets in state taxes. Far from being purely an academic question, this argument is why South Carolina's Governor Mark Sanford attempted to turn down federal stimulus monies for his state. We examine both the impact of federal grants on future state budgets and how federal and state grants affect future local government budgets. Our findings confirm that grants indeed result in future state and local tax increases of roughly 40 cents for every dollar in grant money received in prior years.

Keywords Federal grants · Ratchet effects · State tax policy

JEL Classification H77 · H71 · H81

R.S. Sobel
Department of Economics & Finance, School of Business, College of Charleston, 66 George Street, Charleston, SC 29424, USA
e-mail: sobelrs@cofc.edu

G.R. Crowley (✉)
Manuel H. Johnson Center for Political Economy, Sorrell College of Business, Troy University, Troy, AL 36082, USA
e-mail: grcrowley@troy.edu

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"Nothing is so permanent as a temporary government program."
Nobel Laureate Milton Friedman (*The Yale Book of Quotations*, 2006)[1]

1 Introduction

As the opening quote from Nobel Laureate Milton Friedman illustrates, government programs can be hard to discontinue once they are created. The many New Deal programs still in existence seem to fit into this category.[2] In his book, *Crisis and Leviathan*, Higgs (1987) even proposes a ratchet theory of government growth in which temporary government programs that are enacted in response to major crisis events become permanent, thereby providing an explanation for historical government growth.[3] Most recently, the federal stimulus response to the financial crisis has brought about a large increase in federal government spending accompanied by a host of new government programs that may linger much longer than anticipated.

A significant amount of the recent expansion in government spending has been carried out through a major increase in federal grants to states and local governments for new 'shovel ready' projects. If these temporary programs are hard to eliminate in the future, their permanence will require states and localities eventually to raise their own taxes to fund these programs once the federal funds are gone. Far from always being an unintended consequence, some federal grants are made with the intention that states will pick up funding the program in the future. In 2010, for example, the city of Morgantown, West Virginia, along with 39 other cities, began receiving federal funding for the hiring of two new police officers for three years, after which time the city will have to fund these new permanent full-time positions using own source revenue.

Other dynamic representative agent models of government behavior would suggest that government would smooth citizen's consumption and we would not observe permanent changes in government spending as the result of current grants. After all, if the previous level of spending and taxes were optimal from the perspective of citizens there would be no political support for future tax increases. Ultimately, whether current grants result in permanent changes in spending is an empirical question. However, given the dozens of models of government behavior from both the public finance and public choice literatures there is no one clear model to adopt or assume. We do not try to see which model is correct. Our paper is an effort to estimate whether there are effects or not, and many models would be consistent with either finding. In addition, we take no stance on whether any particular result would be optimal or suboptimal; perhaps the increases, if they occur, are desired by citizens.

[1] The original Friedman quote appears both in the October 27th, 2993 issue of the *Cleveland Plain Dealer* and in the book he coauthored with his wife Rose D. Friedman, *Tyranny of the Status Quo* (Harourt Brace Jovanovich, San Diego, CA, 1984, pg. 115). Variants of this quote have also been attributed to President Ronald Reagan and Utah Senator Wallace F. Bennett. Reagan's quote is "We have long since discovered that nothing lasts longer than a temporary government program," appearing in *Ronald Reagan: The Great Communicator* (Harper Perennial, New York, NY, 2001, pg. 59). Bennett's quote is "It is an age-old Washington axiom that there is nothing so permanent as a temporary government program," appearing (somewhat ironically given the topic of our paper) in a government committee review of federal grants to states (*Periodic Congressional Review of Federal Grants-in-aid*, published by United States Congress, Senate, Committee on Government Operations, 1964, pg. 15).

[2] See Higgs (1987), Chap. 8, for a discussion of the many remaining 'institutional legacies' of the New Deal programs.

[3] The 'leviathan' model of government is one that assumes the objective of government is to maximize its size, see Brennan and Buchanan (1977, 1978, 1980).

The general empirical question of whether federal grants to states do indeed cause subsequent state (or local) tax increases is the topic we explore in this paper. The implications are important because if this is the case, then the recent federal fiscal stimulus should not only be predicted to cause a permanent ratchet upward in federal spending, but also a permanent ratchet in the size of state and local governments in the United States. Far from being purely an academic question, this argument is in practice why South Carolina's Governor Mark Sanford attempted to turn down part of the federal stimulus monies for his state. Referring to when the temporary federal stimulus funding runs out two years in the future, he states:

> "Who helps us then? Do we raise taxes… or do we just summarily end programs… [o]r are we to plan on yet another round of stimulus windfall from Washington in two years… The easiest of all things would be to take and simply spend all of Washington's well-intended stimulus efforts—but in our case it would guarantee opportunities lost that I don't think our state can afford." South Carolina Governor Mark Sanford "Prudence on Stimulus in State's Best Interest," *Myrtle Beach Sun-News*, April 6, 2009.

More recently, New Jersey Governor Chris Christie voiced similar concerns when he turned down federal grant money that was to be used to build a tunnel under the Hudson River.

Much work has been done on the effect of intergovernmental grants on total government size (see, for example, Grossman 1989a, 1989b, 1990; Grossman and West 1994) and there is a rather large literature examining how federal grants at time period t affect state or local spending (or taxes) during the same time period t (i.e., the 'flypaper effect' literature). That literature asks whether federal grants tend to truly expand state spending (that is, 'stick'), or whether recipients instead use some of the funding to offset current taxes or to fund other programs through reallocations of fungible resources *in the period of the grant*. We discuss this literature in our paper because it will be important to account for it in our empirical analysis; however, what we seek to answer in this paper is a separate but related question unaddressed in the current literature: How do current federal grants at time t affect state and local tax policy *in the future*? Our analysis attempts to answer this question using data on state revenue measures and federal grants, as well as a sample of local governments in Pennsylvania. Our results do indeed confirm the hypothesis that federal grants result in future increases in state and local taxes and own source revenue. Thus, our findings add to the relatively underdeveloped empirical literature on the path-dependence of government growth.

We will proceed as follows. Section 2 will discuss the reasons why temporary government programs tend to have permanence and theories of path-dependence in government spending. Section 3 will review the literature on the 'flypaper effect' because our estimation will require that we control for this in the empirical model. Section 4 discusses our data and presents our empirical results. Section 5 examines whether grants from different federal agencies tend to differ in their impact on future taxes. Section 6 examines the impact of federal grants on individual tax rates and revenue sources for state governments, Sect. 7 explores the impact of federal and state grants on local own source revenue, and Sect. 8 concludes.

2 Nothing is so permanent as a temporary government program

While one can find quotes from several notable individuals, such as the paper's opening quote by Milton Friedman, that *state* the observation that temporary programs tend to be-

come permanent, it is worthwhile to briefly address the reasons why this may occur from the academic literature. Collectively, these theories fall under the umbrella of path-dependent theories of government growth.

In the broadest sense, there are two general categories of models of government action: the public-interest view and the public choice view. First, the naive public-interest view considers government as simply an agent of the citizens, doing exactly what maximizes their welfare. This literature generally employs mathematical models in which a benevolent social planner maximizes social welfare through the choice of taxing and spending levels. Within this framework there is only a weak possibility that temporary grants lead to future expenditure obligations. Dynamic representative agent models of government behavior would suggest that government would smooth citizen's consumption and we would not observe permanent changes in government spending as the result of current grants. If the previous level of spending and taxes were optimal from the perspective of citizens there would be complete smoothing and no permanent changes. The only possibility for future consequences under the public interest view may be in the case of the grants that help to cover the up-front fixed costs of starting a new program which then make it optimal for a smaller level of maintenance costs to be continued (such as constructing a new road using a federal grant, and maintaining it using future state own source funding).

The second strand of literature, the public choice view, offers a richer set of possible explanations for why temporary government grants may create permanent effects. In contrast to the public-interest view, the public-choice view recognizes that government spending and tax decisions are made within the context of political institutions that are influenced by the individual interests and incentives faced by voters, elected politicians, and the government employees who run the programs.[4] Within this public-choice view, there are generally two categories of theories—interest group theories and ratchet effect theories—as to why temporary grants may cause permanent effects, although one could argue these two theories really fall under the same umbrella as both rely on a similar political dynamic.

The first recognizes the fact that all government spending programs create their own new political constituency, in that the government employees and private recipients whose incomes depend on the program, and their families, will use political pressure to fight against any discontinuation of the program (see Musgrave 1981; Cullis and Jones 1998: Chap. 14). Olson (1982) argues that the entrenchment of special interests leads to continual increases in government size as expenditures are targeted toward private interests. Several studies show that interest groups and other political factors are key determinants of federal grants to state and local governments (see, for example, Holcombe and Zardkoohi 1981; Grossman 1994). Regardless of the overall necessity or efficiency of the program, there are always individuals who benefit from government spending, and in fact these pecuniary gains to factor owners are often the primary justification for legislative support for particular government projects (see Weingast et al. 1981).[5] Niskanen's (1971, 2001) extensive work on bureaucracy provides a further explanation of how the incentives facing political agents lead them to support keeping government programs regardless of efficiency considerations.

The second, although arguably similar, theory for permanent effects under the public choice view—the ratchet effect—is detailed in the book *Crisis and Leviathan* by Higgs (1987). In that book Higgs proposes a ratchet theory of government growth in which tempo-

[4]For evidence that political factors influenced the allocation of stimulus funds in the recent American Recovery and Reinvestment Act see Young and Sobel (2011).

[5]For evidence that this problem is inherent in the U.S. constitutional structure, see Holcombe (1991, 1992).

rary government programs that are enacted in response to major crisis events become permanent, thereby providing an explanation for historical government growth. Higgs (1987) discusses reasons why increases ('ratchets') in government spending do not entirely fade through time. He points to ideological change in addition to "the politics of entrenched bureaucrats, their clients, and connected politicians" (Higgs 1987: 73). In this manner, even the clients and politicians who fund these programs become a force arguing for the continuation of temporary programs. Peacock and Wiseman (1961) find a similar effect of war on spending in the United Kingdom, claiming that while government tax and expenditure policy remains relatively stable during 'settled times,' periods of 'disturbance' (such as war) lead to an increase in overall government size. Following the crisis, "new ideas of tolerable tax levels emerge" and government size is permanently increased (Peacock and Wiseman 1961: xxiv). These theories are similar to the interest group theories although some of the arguments also tend to be that new spending programs can create ideological change among the citizenry (as voters begin to accept a larger scope of government action) and therefore deserve to be listed somewhat separately from the pure interest group models.

Theories of government spending ratchets have been tested empirically, though that avenue of research is relatively underdeveloped. Holcombe (1993, 2005) finds ratchets in federal expenditures, but concludes they are but one of several explanations for the growth of government. Rasler and Thompson (1985) find evidence of war-related increases in spending leading to permanently larger government. Higgs (1987) presents several 'critical episodes' in American history where crisis spending led to permanent increases in the size and scope of government.

In summary, however, it is important to be clear that in some cases the future state financing of the program is not an unintended consequence, but is rather part of the explicit design of the federal grant. The federal grants mentioned earlier in the introduction that helped cities hire new police officers for three years were *designed* with the intention of requiring local financing in the future. This type of effect could be present under either view of the political process discussed above.

In addition, different government grants are indeed different, and some may be more likely to result in the creation of permanent programs than others under either view of the political process. Funds to repave an *existing* highway, for example, do not as obviously require a commitment of future resources, and even if the funding was to build a new road, the permanent future costs would be only on the maintenance of the road (a much smaller amount than the cost of grant funded construction). Similarly, some programs tend to create a larger interest group vested in the continuation of the program than others, or end up benefitting groups who are simply more politically powerful and are thus better able to achieve political support for continuation of the program financed by higher own source taxes. Thus, the expectation for our empirical testing is that we should see the impact of $1 in government grants creating somewhat less than $1 in future tax increases as only part of the spending may become permanent. Because it is impossible to break out data on federal grants into which funding is temporary versus permanent, we simply note that our dataset uses all federal grants and that therefore we need to interpret the results with this in mind.

More importantly, if the federal grant does not expand state spending by the full amount of the grant *in the period of the grant*, this will be important to consider in specifying our empirical model. The reason is that if a federal grant of $100 only increases net state spending by only $40, then only $40 in future tax increases will be required to fund the program annually. This discussion is the subject of our next section.

3 The flypaper effect

Formal economic models in the traditional fiscal federalism literature make a clear prediction about the impact of federal grants on state spending in the year of the grant (see, for overviews, Hines and Thaler 1995; Bailey and Connolly 1998).[6] Analogous to economic models of food stamps given to individuals, fungibility of existing resources can allow the recipient to make adjustments which can partially offset or reallocate the external grant funding. For example, at the extremes, a state could chose to expand spending by the entire amount of the grant, or alternatively could choose to keep total spending levels the same, and simply cut own source taxes by the amount of the grant—essentially rebating the grant to citizens.

According to this traditional economic theory, a federal grant to a state should act identically to a pure cash transfer to the state's citizens. Because the propensity to spend on state government out of income has been estimated to be roughly 5 % to 10 %, the literature's theoretical prediction is that $100 in federal grants should increase state spending by only roughly $5 to $10 dollars, with the rest being returned to citizens through tax reductions relative to what taxes would have been without the grant. The impact on state or local debt is generally ignored because state and local governments are almost always subject to balanced budget constraints, and we as well do not examine state or local debt.

The literature actually differentiates two different types of grants, lump-sum grants and matching grants. To be precise, the discussion in the paragraph above was for the case of a lump-sum grant. Matching grants, in which the federal government matches the amount spent by a state on a program, are theoretically expected to have a more stimulating impact on current spending because they create a substitution effect in addition to the above income effect. Matching grants effectively lower the tax price of the program to state citizens during the period of the grant, and therefore also result in an increase in quantity demanded of state government beyond the income effect's 5 % to 10 %.

Despite this clear theoretical prediction, the large empirical literature on the topic consistently finds that federal grants increase state spending by more than this theoretical prediction, and the term 'flypaper effect' has been used to describe this phenomenon. The literature's estimates vary widely, and the two papers previously cited both have tables listing the estimates from a long list of other papers. Excluding the few outliers on each end, generally the large cluster of estimates tends to be in the 30 % to 70 % range, with a median estimate around 45 %. Thus, the existing empirical literature concludes that if the federal government gives a $100 grant to a state in year t, the state's spending will rise by approximately $45 in year t, and taxes will be reduced by approximately $55 in year t.

Following these studies and the widespread acceptance of the flypaper effect as an anomaly in the fiscal federalism literature, a number of papers have sought to explain it. These papers typically rely on some type of imperfection not considered in more straightforward models to derive the violation of fungibility. For example, Hamilton (1986) presents a model that explains the flypaper effect as owing to the deadweight loss of taxation. Aragón (2010) extends this model to include other costs associated with enforcing and collecting tax revenues. Other models have explained the flypaper phenomenon with models including uncertainty, imperfect information, and bureaucracy (see for example, Courant et al. 1979; Oates 1979; Turnbull 1998; Filimon et al. 1982).

[6] In this section we provide only a brief summary of the main arguments in this rather large literature. See Hines and Thaler (1995) and Bailey and Connolly (1998) for excellent overviews and summaries of this large empirical literature and the theoretical expectations.

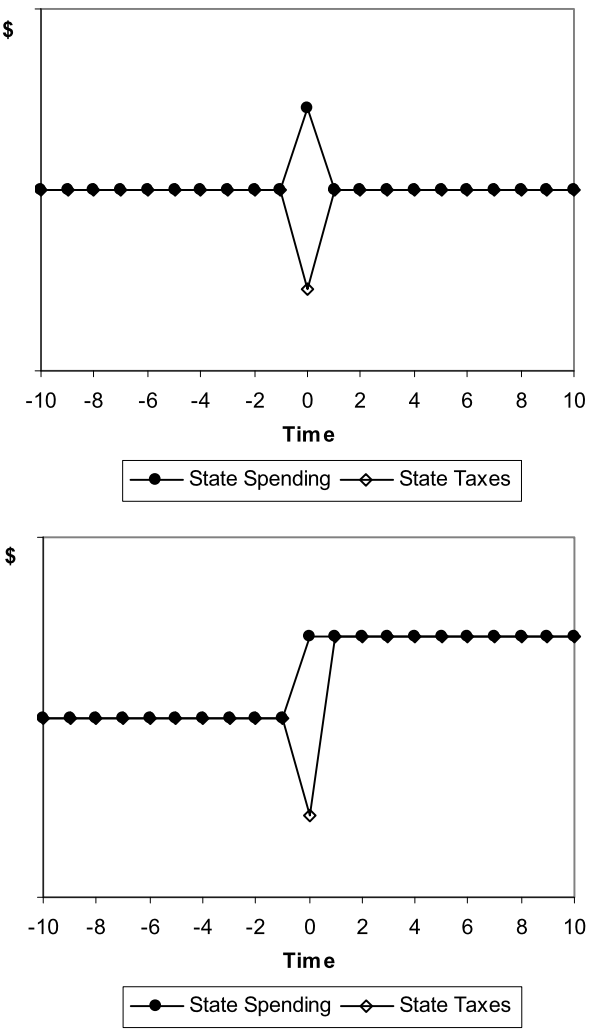

Fig. 1 The effect of federal aid on state finances. (**a**, *top*) The impact of a one-time grant at time zero, for a program that is cut after the grant disappears, based on a flypaper estimate of 0.45. (**b**, *bottom*) The impact of a one-time grant at time zero, for a program that is made permanent after the grant disappears and is funded out of state own source taxes, based on a flypaper estimate of 0.45

While the flypaper effect is a hotly debated area in the public finance literature, for our purposes we simply need an average estimate so that we can control accurately for this effect when estimating the effect of federal grants on *future* state taxes. The reason why this is important to consider is that if a temporary one year $100 federal grant increases state spending only by $45 in the year of the grant (with the other $55 going to tax reductions), then even if this program continues into the future we should expect to see future taxes rise by only $45 in response to this $100 federal grant. That is, the maximum increase in future taxes is determined by the size of the flypaper effect.[7]

Because of the complexity of this idea, Figs. 1a and 1b attempt to show how a one-period federal grant would impact both state spending and taxes under two scenarios. First, Fig. 1a

[7]Nearly all states operate under some sort of balanced budget rule. As such, an analysis of state revenues (as we carry our here) is essentially the same as an analysis which uses state expenditures.

shows the impact for a grant program that was indeed temporary, and was discontinued after the end of the federal funding. Using the median estimate of the flypaper effect from the literature (0.45), Fig. 1a shows that spending rises by 45 % of the grant amount, while taxes are reduced by 55 % of the grant amount in the period of the grant (period 0 in the figure). In the future periods, spending and taxes return to the old levels. If this were the case in the actual data, we would get estimates of the effect of the federal grant on state *taxes* that showed a -0.55 in the period of the funding, and because the program disappears the estimate on lagged grants would be zero.

In Fig. 1b we show how this differs if, alternatively, the program is continued fully into the future and financed by an increase in state taxes. If this were the case in the data, we would get estimates of the effect of the federal grant on state taxes that showed a -0.55 in the period of the funding, and because the program continues, the estimate on lagged grants would be $+0.45$ (which, as we discuss below, is mathematically equal to one plus the same period *tax* effect of -0.55 from above). There is the possibility that only part of the program remains permanent, and in this case (not illustrated), the long-run effect would be greater than zero but less than the full $+0.45$ amount.

Thus, the majority of the empirical flypaper effect literature contains clear predictions about the sizes of our coefficients. First, in the year of the grant, we should expect to see state own source taxes *reduced* by approximately 30 to 70 cents (the range from the literature's estimates). Second, in the subsequent years, once the grant is gone, if federal grants do create ratchets at the state level, and the program becomes permanent, we should expect to see state own source tax *increases* of approximately 30 to 70 cents (if fully continued, or less if not).

Specifically in terms of our coming empirical model:

$$\begin{aligned} \textit{Current State Revenue} = \alpha + \beta_1 * \textit{Current Federal Grants} \\ + \beta_2 * \textit{Previous Federal Grants} + \varepsilon \end{aligned} \tag{1}$$

we should expect the impact of current grants on current taxes to be in the range -0.3 to -0.7 because of the flypaper effect, and the coefficient on previous federal grants to be in the range $+0.3$ to $+0.7$ if the grants do create permanent programs that result in states having to raise internal revenue for their continued operation. The coefficients would roughly follow the pattern $\beta_2 - \beta_1 = 1$ if there are permanent effects and this relationship would not hold if there are no permanent effects. For example, if the estimated current (same) period impact of the federal grant on state taxes represented by β_1 is -0.7 (implying tax reductions of 70 cents per dollar and thus a spending increase of the other 0.3), the maximum future tax increase *if the program is fully continued* would be $+0.3$. Importantly, we do not impose this restriction and our estimates could follow any pattern, but if they fit this relationship it would be consistent with the presence of permanent effects. In practice, we will estimate this model using several different measures of state revenue and taxes, and in addition we will examine a multitude of lag structures for previous federal grants, and two-way fixed effects.

4 Data and empirical results

We test the effects of federal grants on future state revenue using a balanced panel of the 50 U.S. states and annual data for 1995 through 2008. Data on federal grants to states comes from annual issues of the *Federal Aid to States Report* published by the U.S. Census Bureau. We use this source because it contains data both on total federal aid as well as data on

Table 1 Summary statistics

Variable name	Mean	Standard deviation
State Variables		
Total Federal Aid	3574847.10	4180921.71
Department of Agriculture Aid	213799.03	246964.57
Department of Education Aid	288052.38	365898.73
Department of Health and Human Services Aid	2045520.75	2551574.91
Department of Housing and Urban Development Aid	355236.31	471877.60
Department of Transportation Aid	387171.25	378911.65
All Other Departments Aid	584816.39	2152988.43
Total Own Source Revenue	8938835.67	10199828.66
Total Tax Revenue	6594359.79	8112677.41
Personal Income Tax Revenue	418010.65	704042.20
Corporate Income Tax Revenue	416434.90	687550.60
General Sales Tax Rate	5.30	1.00
Cigarette Tax Rate	73.88	56.86
Beer Tax Rate	0.25	0.21
Total Federal Aid Per Capita	689.43	266.48
Population	5.70	6.24
Per Capita Personal Income	16.52	2.67
Proportion 65+	0.13	0.02
Proportion 5–17	0.18	0.01
Pennsylvania County Variables		
Total Federal Aid	7148449.75	21208147.89
Total State Aid	14593204.79	34458943.56
Total State and Federal Aid	21741654.54	55102780.39
Total Own Source Revenue	43571966.27	64514635.71

grants broken down by specific federal government department. Our data on state revenue are from the U.S. Census Bureau's *Annual Survey of State Government Finances*. We adjust all aid and revenue variables for inflation using the Consumer Price Index. Summary statistics for all variables used in this paper can be found in Table 1. A complete list of variable descriptions and data sources can be found in Appendix 1.

Our panel data allows for the estimation of two-way fixed effects models. The use of two-way fixed effects controls for all factors that are either specific to a state through time (such as a given state having a smaller budget due to not having an income tax, for example) or common across all states in a given time period of data (such as a national economic recession, for example) and is preferable to attempting to control for a host of other factors that can affect own source revenue.[8] We also enter demographic controls, including the state's population, real per capita personal income, and the proportion of the state's population that is age 5–17 and 65+. We estimate our fixed effect regressions with ordinary least squares, clustering the standard errors at the state level. After incorporating several

[8]We experimented with the inclusion of state-specific time trends in addition to our fixed effects. Our results (presented in Appendix 3) did not change in any meaningful way.

Table 2 The effect of federal aid on state own source revenue

	Dependent variable: total own source revenue					
	1	2	3	4	5	6
Total Federal Aid (t)	−1.3159**	−0.8582**	−0.8903*	−0.9493*	−0.8881*	−0.7643***
	(0.517)	(0.427)	(0.473)	(0.510)	(0.460)	(0.289)
Total Federal Aid ($t-1$)	1.7141***	0.2954	0.4828	0.5922	0.5279	
	(0.349)	(0.349)	(0.441)	(0.454)	(0.403)	
Total Federal Aid ($t-2$)		1.4294***	0.7342***	0.7426***	0.7386***	
		(0.146)	(0.151)	(0.094)	(0.094)	
Total Federal Aid ($t-3$)			0.6328***	0.1096	0.1599	
			(0.062)	(0.198)	(0.164)	
Total Federal Aid ($t-4$)				0.5899***	0.2385**	
				(0.187)	(0.107)	
Total Federal Aid ($t-5$)					0.5018	
					(0.308)	
$\sum$ Total Federal Aid ($t-1$ through $t-5$)						0.4033***
						(0.046)
Adjusted R^2	0.995	0.997	0.997	0.997	0.997	0.997
Number of Observations	400	400	400	400	400	400

Note: All models include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

lags of our federal aid variable our number of usable observations becomes 400, spanning the period 2001–2008.

Our basic empirical model is one in which we use state own source revenue as the dependent variable, and our independent variables of interest are current and previous federal grants.[9] Our biggest challenge is formulating the best lag structure for previous federal grants. We begin by including only current period federal grants and a one year lag, and then add additional lagged federal grants one period at a time.[10] We present the results of this exercise in Table 2.

As can be seen in Table 2, the problem with adding too many lags is that multicollinearity becomes an issue because of the high degree of correlation in a state's level of federal grants through time (generally around a 0.99 correlation coefficient on these lags in our data).[11] This is witnessed in our estimates by some lags that were previously significant (like lag 3) becoming insignificant as additional lags are included. We also estimated our model including each lag separately to check that each was significant when included alone (which they are), and these results are summarized in Appendix 2. Given the limited time span of our

[9] A panel unit root test confirmed that our dependent variable is stationary, thus we carry out our analysis in levels.

[10] We have adjusted for the difference between federal and state fiscal years in the data by pre-lagging federal funds by one year.

[11] More formally, VIF statistics show a very high level of multicollinearity amongst our variables in all of our models containing lags.

panel of data we are unable to get the model to consistently run and provide estimates using more than five lags as too many periods get excluded from the data.[12]

In an attempt to overcome the multicollinearity issue we also construct a single variable that is the (sum) total of federal grants during the five years prior to the current year. This is presented in the final column of Table 2. This is our 'cleanest' specification and interestingly also produces some of the most reasonable estimates based on our prior expectations. Not only is the single coefficient on the cumulative total fairly representative of the average coefficient on the individual lags in the previous columns, but more importantly the estimates in this final specification roughly satisfy the linear relationship $\beta_2 - \beta_1 = 1$ that was anticipated from the literature [$+0.4033 - (-0.7643) = 1.1676$], and we cannot statistically reject the hypothesis that the sum is indeed one.[13]

Most importantly, however is the fact that the estimates suggest a full permanent programmatic effect with future taxes being roughly the amount required permanently to expand spending by the amount caused initially by the federal grant. In all specifications there is a clear positive effect of federal grants on the future tax levels in a state, even going back in time up to five or more lags. These results seem to confirm our hypothesis.

Table 3 shows estimates similar to Table 2 but using a different dependent variable, state tax revenue. This differs from state own source revenue by excluding state non-tax sources of revenue (such as user fees). Again in Table 3 the results show a similar trend as in Table 2 with the additional lags being significant, but some multicollinearity affecting the results as too many additional lags are included. In our preferred sum specification (in the final column), we again get estimates right in line with our predictions that meet the rough $\beta_2 - \beta_1 = 1$ linear relationship. In the final column of Table 3 this is $+0.3104 - (-0.6785) = 0.9889$, which is again not statistically different from one using standard critical test levels.

Taken as a whole, the estimates from Tables 2 and 3 suggest that each dollar of federal grants in period t causes an expansion in current (same) period state spending of between 0.24 and 0.32 (in the lower range of the previous flypaper literature estimates, and this is calculated as $1 - \beta_1$), and then subsequently results in states raising taxes by between 0.31 and 0.40 (this is simply β_2) which is precisely the amount required permanently to continue all of the state programs created through the initial federal grants.

Our results would seem to be most supportive of theories proposing that temporary increases in government spending create permanent ratchet effects on the size of government, in line with the arguments proposed by Higgs (1987). As he explains, what may at the outset be designed as a temporary program immediately creates an interest group—those who benefit from the government spending through employment or contracts, for example—that has a vested interest in seeing the program continue into the future. Once in place, these interests seem to be able to put enough pressure on the political funding process to get the programs continued into the future. Further, the expanding scope of government during the time of crisis contributes to a shift in ideology, with citizens accepting the greater role of the state moving forward. In other words, these temporary increases in the range of governmental action become generally accepted (by citizen voters) as legitimate functions of government. We believe this is more plausible than the hypothesis that the temporary programs create future obligations, such as in the case of road maintenance after a road is built, simply due

[12] Both the AIC and BIC statistics indicate that our specifications with five lags are preferred to those with fewer lags.

[13] One can back out the implied flypaper effect coefficients (on spending) from our regressions (on taxes) for comparison with previous literature by calculating $1 - \beta_1$, which is 0.2357 in the final specification.

Table 3 The effect of federal aid on state tax revenue

	Dependent variable: total tax revenue					
	1	2	3	4	5	6
Total Federal Aid (t)	−1.1319**	−0.8034*	−0.8253*	−0.8809*	−0.8081*	−0.6785**
	(0.501)	(0.428)	(0.459)	(0.505)	(0.450)	(0.285)
Total Federal Aid ($t-1$)	1.3613***	0.3432	0.4708	0.5741	0.4976	
	(0.390)	(0.338)	(0.409)	(0.448)	(0.394)	
Total Federal Aid ($t-2$)		1.0258***	0.5522***	0.5601***	0.5554***	
		(0.090)	(0.066)	(0.109)	(0.122)	
Total Federal Aid ($t-3$)			0.4311***	−0.0623	−0.0025	
			(0.073)	(0.236)	(0.201)	
Total Federal Aid ($t-4$)				0.5564**	0.1384	
				(0.267)	(0.124)	
Total Federal Aid ($t-5$)					0.5968*	
					(0.303)	
$\sum$ Total Federal Aid ($t-1$ through $t-5$)						0.3104***
						(0.073)
Adjusted R^2	0.994	0.995	0.995	0.996	0.996	0.996
Number of Observations	400	400	400	400	400	400

Note: All models include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

to the size of the estimated effect. In the latter case, we should have seen only a partial continuation, whereas our results suggest a full continuation of the new level of spending.

As discussed in Knight (2002), Singhal (2008), and elsewhere, the potential for endogeneity is a serious concern for studies of federal grants to states. Specifically, state fiscal policy (here, the amount of revenue raised by the state) and the amount of federal grants transferred to the state may both be driven by some omitted variable. Instrumental variable (IV) estimation is generally used to alleviate these concerns. We choose two IVs that are likely correlated with federal grants to a given state but also exogenous. We follow the strategy of Knight (2002) and use measures of state political power at the federal level. Our measures include the percentage of the seats on the U.S. House Appropriations Committee held by a state's representatives (to capture a state's political power in the federal legislature) and a measure of a state's electoral votes weighted by the closeness of the previous presidential election (which captures the relative political importance of a state).[14] We also include five lags of each of these variables as additional IVs in place of our lagged federal grants variables.

Table 4 presents the results of our IV estimation of our primary specifications (those including the current federal grants and the sum of the previous five years of grants variables) for both own source revenue and total tax revenue. These original results are found in the final column of Tables 2 and 3. We estimate the model using both generalized method

[14] Specifically, we multiply each state's electoral votes by one minus the percentage margin of victory. In other words, for a given set of electoral votes states characterized by closer contests are given more weight.

Table 4 The effect of federal aid IV estimation

	Dependent variable			
	Total own source revenue GMM	Total own source revenue 2SLS	Total tax revenue GMM	Total tax revenue 2SLS
Total Federal Aid (t)	−0.4957***	−0.4293	−0.5743***	−0.5590**
	(0.121)	(0.362)	(0.092)	(0.242)
$\sum$ Total Federal Aid ($t-1$ through $t-5$)	0.4429***	0.4475***	0.3683***	0.3653***
	(0.030)	(0.061)	(0.022)	(0.061)
Instrumental variable tests				
Total Federal Aid (t)				
Instrument F-test (p-value)	4.42	4.42	4.42	4.42
	(0.000)	(0.000)	(0.000)	(0.000)
$\sum$ Total Federal Aid ($t-1$ through $t-5$)				
Instrument F-test (p-value)	5.17	5.17	5.17	5.17
	(0.000)	(0.000)	(0.000)	(0.000)
Overidentification test (p-value)	9.91	9.91	12.52	12.52
	(0.449)	(0.449)	(0.252)	(0.252)
Second Stage R^2	0.813	0.817	0.731	0.728
Number of Observations	400	400	400	400

Note: All models (first and second stage) include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %. Instrumental variables include the percentage of seats on the U.S. House Appropriations Committee held by the state's representatives, the number of electoral votes held by the state weighted by the closeness of the previous presidential election, and five years of lagged values of each

of moments (GMM) and two-stage least squares (2SLS) techniques. Importantly, the current federal grants variable remains negative and of a magnitude similar to our previous results for both the total own source revenue and tax revenue specifications, and is statistically significant in three of the four specifications. Similarly, the previous grants variable remains positive, statistically significant, and of similar magnitude as well in all specifications. Most importantly, the previously observed relationship of $\beta_2 - \beta_1 = 1$ is unaffected by the change in estimation. Using our GMM results, we see a relationship between the coefficients of $+0.4429 - (-0.4957) = 0.9386$ for total own source revenue and $+0.3683 - (-0.5743) = 0.9426$ for total tax revenue, neither of which is statistically different from one. Our instrument F-test results indicate that our instruments are valid, and our model passes the overidentification test as well.

While this should be obvious based on our discussion of Figs. 1a and 1b, it is worth clarifying that this is not simply a case where the grant is used to cut taxes in the current period and then taxes are raised back to their previous levels after the grant. The grant results in permanently larger state government spending that must be financed by permanently higher levels of own source taxation. Because of how it is specified, our estimate of future tax increases is the marginal amount by which future taxes are higher than they would have been without the grant ever taking place, meaning that the true tax increases in the year the grant disappears are larger than this estimate as taxes must be increased both to replace the

Table 5 The effect of federal aid by department

	Dependent variable	
	Total own source revenue	Total tax revenue
Total Federal Aid (t)	−0.8953**	−0.7667*
	(0.419)	(0.429)
$\sum$ Dept. of Agriculture Grants ($t-1$ through $t-5$)	1.4183	0.7846
	(0.977)	(1.275)
$\sum$ Dept. of Education Grants ($t-1$ through $t-5$)	0.3624*	0.3198
	(0.214)	(0.210)
$\sum$ Dept. of Health and Human Services Grants ($t-1$ through $t-5$)	0.3036***	0.2798***
	(0.053)	(0.061)
$\sum$ Dept. of Housing and Urban Development Grants ($t-1$ through $t-5$)	1.3123	0.9675
	(0.871)	(0.904)
$\sum$ Dept. of Transportation Grants ($t-1$ through $t-5$)	0.4958	0.5982
	(0.490)	(0.5211)
$\sum$ Grants from all other agencies ($t-1$ through $t-5$)	0.2100	−0.2845
	(0.1981)	(0.210)
Adjusted R^2	0.997	0.996
Number of Observations	400	400

Note: All models include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

one-year partial tax cut in the period of the grant and additionally to fund the expansion in programmatic spending.

5 Grant analysis by department

Federal grants to states are given through individual federal government agencies. The five agencies which provide the largest amount of grants are the Department of Health and Human Services (accounting for 57.0 % of grants), Department of Transportation (11.3 % of grants), Department of Housing and Urban Development (10.1 % of grants), Department of Education (7.7 % of grants), and Department of Agriculture (5.9 % of grants).[15] Combined, these five largest grant areas account for 92 % of all federal grants. In this section we explore the question of whether grants from different government agencies tend to have different degrees of permanence or, more precisely, different degrees of impact on future state taxes.

In this specification we break up our prior federal grant variable into six new variables, one for each department/agency and then a sixth variable that includes the dollar amount for all other grants (the remaining 8 % of grants). We run the regressions for both total state own source revenue and total state tax revenue. The results are presented in Table 5.

[15] Percentages are for federal grants to state and local governments for federal fiscal year 2008.

Our current federal aid variable remains negative and statistically significant in both specifications. Grants from the Department of Health and Human Services have a long-run impact of 0.30 in own source revenue and 0.28 in tax revenue. Department of Education grants have a long-run effect of 0.36 in the own source revenue specification. All of these estimates are roughly in the range suggested by the linear flypaper rule, and the results imply that virtually the entire bump in program spending continues into the future to be financed through state internal taxes.

The coefficients for the other departments are not statistically different from zero. At face value, these results seem to indicate that grants from the Department of Agriculture, Department of Housing and Urban Development, and Department of Transportation have little to no long-run effect on states. We are unsure why the results from some agencies are different from the other results. Whether grants from these departments truly carry less long-run burden on states, or whether this is a spurious estimate due to the multicollinearity among the grants is unclear. One possible explanation is that the relative age of certain departments could play a role in the differences in long run effects. The Department of Agriculture, for example, is one of the oldest cabinet-level agencies in the federal government. Thus, the apparent absence of long run effects of grants from the Department could be due to their longstanding history of grants to states. In other words, since the Department of Agriculture has been involved in the creation of programs at the state level for over 150 years, any permanent increases in the size of state government attributable to grants from the agency may have occurred before the time period covered by our dataset.[16]

6 Individual revenue source estimations

In this section we attempt to more precisely test our hypothesis by examining directly the effect of federal grants on individual state tax *rates*. Based on the results of the last section, we return to a combined variable reflecting total grants rather than breaking it out by agency.

For each state we are able to collect individual tax rates for the state sales tax, the state cigarette tax, and the state beer tax. Most state personal and corporate income taxes have bracket structures with different rates, and some use different measures of the tax base (such as federal tax liability) making it impossible to use one specific tax rate, so in an effort to include them we have instead used state personal and corporate income tax revenue rather than rates.[17] The results of our estimations are summarized in Table 6.

With the exception of the personal and corporate income taxes, which are measured in dollars of revenue (like our previous regressions), the other coefficient estimates in the tax rate specifications are not directly comparable to the other estimates, nor are they interpreted in the same way because they reflect the change in the tax rate itself, rather than revenue, caused by grants. If indeed states, for example, indeed raise their sales tax rates to fund a program begun by a federal grant, the change in the tax rate is what is estimated. Actually, in the rate specifications we have converted federal grants from raw dollars to dollars per capita to match better with the rate variable, so this influences the interpretation as well. Thus, these

[16] We thank the editor for this insight.

[17] Regressions using the top marginal tax rate as the dependent variable yielded insignificant results. Importantly, income tax revenues can be increased in a variety of ways other than changing the top marginal tax rate, including manipulation of deductions, exemptions, and tax brackets. Given our significant findings using income tax revenue, the results suggest one (or some combination) of these alternative mechanisms is being used to raise future revenue in response to the federal grant.

Table 6 The effect of federal aid on individual state revenue sources

	Dependent variable				
	Personal income tax revenue	Corporate income tax revenue	General sales tax rate	Cigarette tax rate	Beer tax rate
Total Federal Aid (t)	−1.818***	−0.3742*	−0.0000	−0.0140	−0.0002**
	(0.371)	(0.223)	(0.000)	(0.027)	(0.000)
$\sum$ Total Federal Aid ($t-1$ through $t-5$)	0.2196***	0.0480***	0.0000	0.0030	0.0001
	(0.045)	(0.018)	(0.000)	(0.009)	(0.000)
Adjusted R^2	0.312	0.529	0.945	0.779	0.961
Number of Observations	344	368	360	400	396

Note: All models include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

coefficients will be extremely small, but in the end we are looking for confirmation that the current (same) period impact is negative, followed by a significant and positive impact in the future (shown by the coefficient on summed previous grants).

The results from all five individual revenue sources have the correct signs, but only three of the five tax sources have results that are significant, the beer tax rate and both personal and corporate income tax revenue. Given that the personal income tax is the major source of state government revenue, it is comforting that our results hold when examining this revenue source directly. Although it is disappointing that we cannot see the results being more significant for state sales taxes, which are also a major revenue source, this may simply imply states rely more on income taxes and other revenue sources when adjusting to changes in federal aid.

7 Do federal and state grants create ratchets in local taxes?

In theory, this permanent impact of grants should also apply at the local level. Local governments not only receive grants from the federal government, but also from state government as well. Here we examine whether federal and state grants to localities have similar impacts on future local taxes.

We focus our analysis of local governments on a case study of counties in Pennsylvania for which we were able to obtain detailed grant information. Our data cover 63 counties annually over the period 1997 to 2004. The panel includes federal and state aid as well as data on total own source revenue for each county. After including lagged federal and state aid data, our Pennsylvania county panel consists of 252 total observations and spans the period 2001 to 2004. Aid and revenue variables are again adjusted for inflation using the Consumer Price Index. Summary statistics, descriptions, and sources for these variables can also be found in Table 1.

As before, we employ a two-way fixed effects model. Again, the use of fixed effects helps control for omitted variables which are either constant through time for all counties or specific to a single county. Since our data on Pennsylvania counties contain substantially fewer years than our state-level data we must use fewer lags in our models.

For our local analysis we focus only on total own source revenue and do not specifically attempt to model individual taxes. For states, tax revenue is 71 % of all own source revenue,

Table 7 The effect of federal and state aid on Pennsylvania county own source

	Dependent variable: total own source revenue					
	1	2	3	4	5	6
Total State and Federal Aid (t)	−1.1751**	−1.0400***	−0.9802**	−1.1629**	−1.0044***	−0.8838***
	(0.474)	(0.368)	(0.419)	(0.464)	(0.334)	(0.300)
$\sum$ Total State and Federal Aid ($t-1$ through $t-2$)	0.3068**					
	(0.130)					
$\sum$ Total State and Federal Aid ($t-1$ through $t-3$)		0.1396**				
		(0.058)				
$\sum$ Total State and Federal Aid ($t-1$ through $t-4$)			0.0844			
			(0.0690)			
$\sum$ Total State Aid ($t-1$ through $t-2$)				0.4062		
				(0.256)		
$\sum$ Total State Aid ($t-1$ through $t-3$)					0.4623**	
					(0.233)	
$\sum$ Total State Aid ($t-1$ through $t-4$)						0.2619
						(0.282)
$\sum$ Total Federal Aid ($t-1$ through $t-2$)				0.2323*		
				(0.128)		
$\sum$ Total Federal Aid ($t-1$ through $t-3$)					−0.1089	
					(0.091)	
$\sum$ Total Federal Aid ($t-1$ through $t-4$)						−0.1382
						(0.170)
Adjusted R^2	0.971	0.970	0.970	0.971	0.971	0.970
Number of Observations	252	252	252	252	252	252

Note: All models include county and year fixed effects. Robust standard errors (clustered at the county level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

but for our local governments in the sample, tax revenue accounts for only 43 % of all own source revenue. Local governments rely much more heavily on non-tax revenue sources such as license and user fees and the total own source revenue would include these but tax revenue would not.

We begin our analysis by including current and lagged grant variables that reflect the total grants received by the county (combined state and federal grants). We will then break this into two variables to see if we can find differences in the effect of state versus federal grants on county taxation. The first three columns of Table 7 show the results of our estimations using combined grants to county governments in Pennsylvania. We show how the results change as we change the length of the historical sum. The first column, for example, contains a variable that is two periods of lagged grants, while the second column of results is for three periods of grants, and so forth.

The results in the first three columns of Table 7 for combined grants are again similar to the results we found when examining the impact of grants on state taxes. During the period of the grant, counties lower taxes/fees, and then in the future raise taxes and other sources of revenue to continue the operation of the programs. The results are roughly identical to what

was found before for states, with the exception that the current period impact is larger, and the decay appears to be faster over the long run.[18]

The remaining columns break up grants into federal and state. Interestingly, when split the state grants seem to show more permanence, while the federal ones show less. In fact, in some of the specifications, the lagged federal grant variable becomes negative and insignificant. We are unsure why this is the case, but note this is clearly why in the combined grant variable it begins to diminish, as by itself the state variable doesn't decline as much as additional lags are added. In theory there is no reason why state and federal grants should function differently. We do note that the federal grants are much smaller than state grants to local governments. Approximately three-fourths of all grants to local governments come in the form of state grants (in our sample). So the state results are relatively more important. In addition, we are examining county governments in one state only, and it is unclear if these results would hold up for other levels of local government (cities or school districts, for example), or for other states.

Nonetheless, when we examine either the combined grants or the state grants, the results for local governments seem to mirror our results from earlier. For every $100 in grants, local governments eventually raise revenue by between $23 and $46 to support the continued operation of these programs.

8 Conclusion

While a vast previous literature has examined the impact of federal grants on state and local spending, this previous literature focuses exclusively on the impact of the grant in the period it is received. We depart from this literature by examining the impact of federal grants on state and local tax policy in future periods.

Our results clearly demonstrate that grant funding to state and local governments results in higher own source revenue and taxes in the future to support the programs initiated with the federal grant monies. Our results are consistent with Friedman's quote regarding the permanence of temporary government programs started through grant funding, as well as South Carolina Governor Mark Sanford's reasoning for trying to deny some federal stimulus monies for his state due to the future tax implications. Most importantly, our results suggest that the recent large increase in federal grants to state and local governments that has occurred as part of the American Recovery and Reinvestment Act (ARRA) will have significant future tax implications at the state and local level as these governments raise revenue to continue these newly funded programs into the future. Federal grants to state and local governments have risen from $461 billion in 2008 to $654 billion in 2010. Based on our estimates, *future* state taxes will rise by between 31 and 40 cents for every dollar in federal grants states received today, while local taxes will rise by between 23 and 46 cents for every dollar in federal (or state) grants received today. Using our estimates, this increase of $200 billion in federal grants will eventually result in roughly $80 billion in future state and local tax and own source revenue increases. This suggests that the true cost of fiscal stimulus is underestimated when the costs of future state and local tax increases are overlooked.

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[18] In theory, the maximum coefficient on the current period is one, and in the table some of the coefficients are greater than one; however, none of these are significantly different from one at traditional levels.

Appendix 1: Variable descriptions and data sources

Variable name (Source)	Description
State Variables	
Total Federal Aid (1)	Real total federal aid to states, in thousands, years 1995–2008
Department of Agriculture Aid (1)	Real total Dept. of Agriculture aid to states, in thousands, years 1995–2008
Department of Education Aid (1)	Real total Dept. of Education aid to states, in thousands, years 1995–2008
Department of Health and Human Services Aid (1)	Real total Dept. of HHS aid to states, in thousands, years 1995–2008
Department of Housing and Urban Development Aid (1)	Real total Dept. of HUD aid to states, in thousands, years 1995–2008
Department of Transportation Aid (1)	Real total Dept. of Transportation aid to states, in thousands, years 1995–2008
All Other Departments Aid (1)	Real federal aid to states, in thousands, for those departments not itemized, years 1995–2008 (Total federal aid—total aid from all departments itemized above)
Total Own Source Revenue (2)	Real total revenue raised in state, in thousands, years 2001–2008 (Total Revenue—Intergovernmental Revenue)
Total Tax Revenue (2)	Real total tax revenue, in thousands, years 2001–2008
Personal Income Tax Revenue (3)	Real total 'individual income' tax revenue, in thousands, years 2001–2008
Corporate Income Tax Revenue (3)	Real total 'corporate net income' tax revenue, in thousands, years 2001–2008
General Sales Tax Rate (4)	General sales tax rate, expressed as percentage (e.g. 6 % = 6), years 2001–2008
Cigarette Tax Rate (4)	Cigarette tax rate, cents per 20-pack, years 2001–2008
Beer Tax Rate (4)	Beer tax rate, dollars per gallon, years 2001–2008
Total Federal Aid Per Capita (1, 6)	Real per capita federal aid, in dollars, years 1995–2008 ((Total Federal Aid*1000)/State Population)
Population (6)	State population, in millions, years 1995–2008
Per Capita Personal Income (7)	Per capita real personal income, in thousands, years 1995–2008
Proportion 65+ (3)	Proportion of the state's population age 65 or over, years 1995–2008
Proportion 5–17 (3)	Proportion of the state's population age 5–17, years 1995–2008
Consumer Price Index (5)	Consumer Price Index, base year 1982–1984
Pennsylvania County Variables	
Total Federal Aid (8)	Real total federal grants, in dollars, years 1997–2004
Total State Aid (8)	Real total state grants, in dollars, years 1997–2004
Total State and Federal Aid (8)	Real total grants from state and federal government, years 1997–2004 (Total Federal Aid + Total State Aid)
Total Own Source Revenue (8)	Real total revenue raised in county, in dollars, years 2001–2004 (Total Revenue − Total State and Federal Aid)

Sources:
(1) U.S. Census Bureau, *Federal Aid to States Report*
(2) U.S. Census Bureau, State Government Finances, "Annual Survey of State Government Finances"
(3) U.S. Census Bureau, *Statistical Abstract of the United States*
(4) Tax Foundation, "State Sales, Gasoline, Cigarette, and Alcohol Tax Rates by State, 2000–2010"
(5) Bureau of Labor Statistics, "Consumer Price Index History Table"
(6) U.S. Census Bureau, Population Division, Population Estimates
(7) U.S. Bureau of Economic Analysis, Personal Income Summary
(8) Pennsylvania Department of Community and Economic Development, County Financial Statistics

Appendix 2: Statistical significance of individual lags

Specification	Dependent variable: total own source revenue				
	1[a]	2	3	4	5
Total Federal Aid (t)	−1.3159**	−0.7128**	−0.4591*	−0.3689	−0.2472
	(0.517)	(0.273)	(0.237)	(0.284)	(0.270)
Total Federal Aid ($t-1$)	1.7141***				
	(0.349)				
Total Federal Aid ($t-2$)		1.5879***			
		(0.157)			
Total Federal Aid ($t-3$)			1.3075***		
			(0.092)		
Total Federal Aid ($t-4$)				1.2427***	
				(0.076)	
Total Federal Aid ($t-5$)					1.5967***
					(0.193)
Adjusted R^2	0.994	0.997	0.996	0.996	0.995
Number of Observations	400	400	400	400	400

Note: All models include state and year fixed effects and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

[a] Column 1 above is identical to Column 1 in Table 2

Appendix 3: Primary specification including state-specific year trends

	Dependent variable	
	Total own source revenue	Total tax revenue
Total Federal Aid (t)	−0.6939***	−0.6273***
	(0.205)	(0.185)
$\sum$ Total Federal Aid ($t-1$ through $t-5$)	0.7379**	0.6840**
	(0.290)	(0.314)
Adjusted R^2	0.998	0.997
Number of Observations	400	400

Note: All models include state and year fixed effects, a year trend variable specific to each state, and the following control variables: state population, real per capita personal income, proportion of the population age 5–17, and the proportion of the population age 65+. Robust standard errors (clustered at the state level) in parentheses: * indicates statistical significance at the 10 % level, ** at 5 %, *** at 1 %

References

Aragón, F. M. (2010). *The flypaper effect and costly tax collection*. Mimeo.

Bailey, S. J., & Connolly, S. (1998). The flypaper effect: identifying areas for further research. *Public Choice*, *95*, 335–361.

Brennan, G., & Buchanan, J. (1977). Towards a tax constitution for Leviathan. *Journal of Public Economics*, *8*, 255–274.

Brennan, G., & Buchanan, J. (1978). Tax instruments as constraints on the disposition of public revenues. *Journal of Public Economics*, *9*, 301–318.

Brennan, G., & Buchanan, J. (1980). *The power to tax: analytical foundations of a fiscal constitution*. Cambridge: Cambridge University Press.

Courant, P. N., Gramlich, E. M., & Rubinfeld, D. L. (1979). The simulative effects of intergovernmental grants: or why money sticks where it hits. In P. Mieszkowski & W. H. Oakland (Eds.), *Fiscal federalism and grant-in-aid* (pp. 5–21). Washington: Urban Institute.

Cullis, J., & Jones, P. (1998). *Public finance and public choice* (2nd ed.). New York: Oxford University Press.
Filimon, R., Romer, T., & Rosenthal, H. (1982). Asymmetric information and agenda control: the bases of monopoly power in public spending. *Journal of Public Economics*, *17*, 51–70.
Grossman, P. J. (1989a). Federalism and the size of government. *Southern Economic Journal*, *55*, 580–593.
Grossman, P. J. (1989b). Fiscal decentralization and government size: an extension. *Public Choice*, *62*, 63–69.
Grossman, P. J. (1990). The impact of federal and state grants on local government spending: a test of the fiscal illusion hypothesis. *Public Finance Quarterly*, *18*, 313–327.
Grossman, P. J. (1994). A political theory of intergovernmental grants. *Public Choice*, *78*, 295–304.
Grossman, P. J., & West, E. G. (1994). Federalism and the growth of government revisited. *Public Choice*, *79*, 19–32.
Hamilton, J. (1986). The flypaper effect and the deadweight loss from taxation. *Journal of Urban Economics*, *19*, 148–155.
Higgs, R. (1987). *Crisis and Leviathan: critical episodes in the growth of American government*. Oxford: Oxford University Press.
Hines, J. R., & Thaler, R. H. (1995). Anomalies: the flypaper effect. *Journal of Economic Perspectives*, *9*, 217–226.
Holcombe, R. G. (1991). Constitutions as constraints: a case study of three American constitutions. *Constitutional Political Economy*, *2*, 303–328.
Holcombe, R. G. (1992). The distributive model of government: evidence from the Confederate constitution. *Southern Economic Journal*, *58*, 762–769.
Holcombe, R. G. (1993). Are there ratchets in the growth of federal government spending? *Public Finance Quarterly*, *21*, 33–47.
Holcombe, R. G. (2005). Government growth in the twenty-first century. *Public Choice*, *124*, 95–114.
Holcombe, R. G., & Zardkoohi, A. (1981). The determinants of federal grants. *Southern Economic Journal*, *48*, 393–399.
Knight, B. (2002). Endogenous grants and crowd-out of state government spending: theory and evidence from the Federal Highway Aid Program. *American Economic Review*, *92*, 71–92.
Musgrave, R. (1981). Leviathan cometh—or does he? In H. Ladd & T. N. Tiedman (Eds.), *COUPE papers on public economics: Vol. 5. Tax and expenditure limitations* (pp. 77–120). Washington: The Urban Institute.
Niskanen, W. A. (1971). *Bureaucracy and representative government*. Chicago: Aldine-Atherton.
Niskanen, W. A. (2001). Bureaucracy. In W. F. Shughart II & L. Razzolini (Eds.), *The Elgar companion to public choice* (pp. 258–270). Northampton: Edward Elgar.
Oates, W. E. (1979). Lump-sum grants have price effects. In P. Mieszkowski & W. H. Oakland (Eds.), *Fiscal federalism and grant-in-aid* (pp. 23–30). Washington: Urban Institute.
Olson, M. (1982). *The rise and decline of nations*. New Haven: Yale University Press.
Peacock, A. T., & Wiseman, J. (1961). *The growth of government expenditures in the United Kingdom*. Princeton: Princeton University Press.
Rasler, K. A., & Thompson, W. R. (1985). War making and state making: governmental expenditures, tax revenues, and global wars. *American Political Science Review*, *79*, 491–507.
Singhal, M. (2008). Special interest groups and the allocation of public funds. *Journal of Public Economics*, *92*, 548–564.
Turnbull, G. K. (1998). The overspending and flypaper effects of fiscal illusion: theory and empirical evidence. *Journal of Urban Economics*, *44*, 1–26.
Young, A. T., & Sobel, R. S. (2011). Recovery and Reinvestment Act spending at the state level: Keynesian stimulus or distributive politics? *Public Choice*. doi:10.1007/s11127-011-9876-x.
Weingast, B. R., Shepsle, K. A., & Johnsen, C. (1981). The political economy of benefits and costs: a neoclassical approach to distributive politics. *Journal of Political Economy*, *89*, 642–664.