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Changing Needs, Sticky Budget: Evidence from the Geographic Distribution of US Federal Grants

Valentino Larcinese[†], Leonzio Rizzo[‡] and Cecilia Testa[§]

Abstract

Most US federal grants are allocated through arguably obsolete formulas, leading fast growing states to contend that they are not receiving their fair share of such grants. We examine this issue by analyzing the allocation of formula and non-formula grants during the period 1978-2008. We find that states with fast growing populations are penalized in the allocation of formula grants, whereas for non-formula grants population dynamics does not play a significant role. The estimated losses are sizeable and heavily concentrated among the three fastest growing states, Nevada, Arizona and Florida. Nevertheless, the majority of the US states benefits from formula allocation, thus providing a plausible explanation for the status quo bias in budgetary formulas.

JEL codes: D72, H61, H77

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"An old formula is a good formula. If you write a new formula, particularly if you do not have what Mr. Nixon called sweeteners, you open up a Pandora's box of political regional rivalries".[1]

1 Introduction

The vast majority of US federal grants to the states is allocated through formulas (GAO 2009).[2] Therefore, not surprisingly, the design of such formula represents a powerful tool through which states' representatives try to bring the "bacon" home (Levitt and Snyder 1995).[3] Another striking feature of formulas is their long lasting life. The statutory matching formula of Medicaid, which is the largest formula grant program, has basically remained the same since 1965. The Federal Highway program (the second largest formula program) is still administered via the formulas legislated in 1956.

The status quo can be advantageous for states that already receive a generous share of the federal pie. In such cases, rules reducing the flexibility of the budget can serve pork-barrel objectives by preventing spending reallocations. As a result, formulas can represent a powerful instrument for preserving the status quo. The issue of status quo bias in formula legislation is clearly spelled out in the opening statement by Senator Bob Packwood (chairman of the Committee of Finance, one hundred fourth Congress) in a Senate Hearing on Medicaid distribution formula.[4] In the same Senate hearing, the failure of the Medicaid formula to respond to the needs of the states is

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[1] Testimony by Richard P. Nathan (director, Nelson A. Rockefeller Institute of Government) before the Senate Committee on Finance, one hundred fourth Congress, first session, July 27, 1995.

[2] Between 1983 and 2008, spending on formula grants amounts on average to 70% of total federal aid.

[3] For a comprehensive survey of the literature on the economic and political determinants of intergovernmental transfers see Solé-Ollé and Sorribas-Navarro (2008) and Weingast (2009).

[4] The opening statement of 'Medicaid Distribution Formula, S. HRG. 104-846' by Senator Bob Packwood reads as follows: 'I am well aware that when it come to formulas, in Senators' -or Representatives'-home State and turf is often infinitely more important than substance. And matters get decided not on merits but on whether you can figure out a formula that will get you 30 states in the Senate (...) But unfortunately if two or three of those states that you lose are New York and California it gives you many problem in the House when the formula division comes up.'

acknowledged.[5] But as of today - when the reform of Medicaid proposed in the 'Medicaid Improvement and State Empowerment Act' is among the most hotly debated issues in Congress - the issue of the funding formula remains open.[6] The same holds true for the Federal Highway program, for which recent legislation - known as the 'Highway Fairness and Reform Act of 2011' - introduced by Sen. Hutchinson (Texas), proposes that states should be allowed to opt out of the Federal Highway program to circumvent the negative effects of the formula penalizing states with fast growing needs.

The controversy surrounding the reform of Medicaid and the Federal Highway program, which between 1978 and 2008 represent on average respectively 30% and 10% of total federal aid, is neither new nor unique. As pointed out by a recent report issued by the United States Government Accountability Office (GAO 2009), about 84% of federal aid is allocated through formulas, which in various ways prevent reallocations of the federal budget in response to the changing needs of the states. The latter are often associated with rapidly growing population and, according to the same report, "grant funding may be affected less or entirely unaffected by changes in population" because of specific formulas prescriptions such as hold harmless provisions, caps, floors and ceilings. The two most important formula programs (Medicaid and the Federal Highway programs) provide emblematic examples of such restrictions. Moreover, formula based allocations typically rely on outdated population data (GAO 1990), which penalize states where the population changes at a fast pace.

Several representatives of fast growing states have repeatedly voiced their concerns about the negative consequences of budgetary inertia: "sticky" budgets fail to respond to the rapidly changing needs associated with their fast growing population. The dissatisfaction of fast growing

[5] According to the report 'Wide disparities seen in the States Medicaid programs demonstrate that the formula is not working as intended. For example, during the fiscal year 1994, the number of people covered by the Nevada Medicaid program represents 81% of the poor population, while Vermont population covered by Medicaid equalled 139% of its poverty population.' (Medicaid Distribution Formula, S. HRG. 104-846, page 3). Another report by GAO (2007) also emphasizes that current Medicaid financing rules often widen differences in funding ability among states.

[6] The full text of legislation introduced in the Senate (S.1013) and House (H.R. 2013) in May 2011 is available from the library of congress (http://thomas.loc.gov).

states with the existing mechanism of federal budget allocation culminated with legislation - known as the "Fair share act"-introduced in Congress between 1989 and 1993 by the representatives of Florida, Arizona and California.[7] Yet, these concerns seem to have gone unaddressed, as shown by the recent debate surrounding the approval of the stimulus package under the "American Recovery and Reinvestment Act of 2009", which once again is reported to have penalized fast growing states in the allocation of important spending programs.[8]

Does budgetary inertia penalize fast growing states? Although widely debated among legislators and policy practitioners, this issue has been surprisingly overlooked by the scholarly literature on federal budget allocation to the states. This paper aims at filling this gap, by empirically investigating whether fast growing states are disadvantaged in the allocation of formula grants and quantifying the size of such loss. To that end, we use Census data on per capita federal grants allocations to the states during the period 1978-2008, which allows us to isolate formula and non-formula programs, in particular the two most important formula items, Medicaid and The Federal Highway program.

Before empirically investigating the link between population dynamics and spending, it is important to clarify the relationship between spending per capita and population. As shown by Alesina and Wacziarg (1998), when publicly provided goods exhibit a certain degree of non-rivalness, the per capita cost of their provision decreases with population size, thus implying an inverse relationship between optimal per capita provision and population. However, as we formally show in the theoretical framework outlined in section 2, when the financing of quasi-

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[7] The text of the bill introduced in the House and Senate explicitly states "The Congress finds that there are significant shifts in the United States population between each decennial census; use of decennial census in allocating Federal funds to States unfairly penalizes States where the population is growing, and because the intent of Federal grant programs is to distribute funds fairly to States based on their relative population, it is more appropriate to use annual population estimates produced by the Bureau of the Census for these purposes. (Fair share act of 1989, 1992 and 1993. source: The library of Congress, http://thomas.loc.gov/).

[8] Fast growing states rank at the bottom in the allocation of transportation funds per capita in the stimulus package (The Wall Street Journal, Who gets what from the stimulus package, January 27, 2009, http://online.wsj.com/public/resources/documents/info-STIMULUS0109.html, accessed on April 10, 2009). As highlighted by Mark Foster (chief financial officer for the North Carolina Department of Transportation) in a recent interview, "The infrastructure here clearly hasn't kept up with population growth (...). Typically, what you find is that a lot of Southern states are donors, and those in the Midwest and Northeast are recipients." (source: N.C. falls on short end for stimulus, Charlotte Observer, Thursday, Mar. 12, 2009: http://www.charlotteobserver.com/597/story/591251.html, accessed on April 10, 2009).

public goods is governed by formulas, then under (over) provision occurs if the actual population is larger (smaller) than the one used by the formula. Therefore, besides an inverse relationship between spending per capita and population size due to the partial non-rivalness of publicly provided goods, we will also observe a negative relationship between spending per capita and population dynamics due to formulas. As a result only by estimating the separate effects of population size (scale effect) and population dynamics (change effect), we can establish if fast growing states are "unfairly" penalized in the allocation of the budget. To this end, in our empirical analysis, we use an index of population dynamics, along with state population, which allows us to separate the change effect from the scale effect.

Our empirical investigation provides strong evidence of a negative relationship between population dynamics and per capita federal aid to the states, which is mainly driven by formula programs such as the Federal Highway and all other formula programs excluding Medicaid. For the latter we do not find evidence of a population dynamics effect. On the other hand, the dynamics of income per capita has a negative, significant impact on state per capita allocations. Since, during the period we consider, Federal Highway and other formula programs (except Medicaid) represent on average a combined 57% of grants allocated by formula, we conclude that states whose population grows fast tend to be penalized on the majority of formula grants.

We also find that the distortions associated with population dynamics tend to be permanent, unevenly distributed across states and, for the most penalized states, sizeable. The budgetary gains and losses implied by our estimates are such that 17 of the 48 US continental states -whose population grows faster than the US average - lose federal grants to the advantage of the remaining 31 states that grow at a slower pace. The most penalized state of the federation (Nevada) suffers on average a loss equivalent to 41 percent of the state average per capita federal aid allocated by formula, and the loss is as high as 39 percent for the Federal Highway program. The distribution of budgetary losses is quite uneven among losing states, since the three fastest growing states (Nevada, Arizona and Florida) bear almost 76% of the total loss, whereas gains - which benefit the majority of the states - appear more evenly distributed. States on the losing side are a minority both in the Senate and in the House, which can partially explain the lack of responsiveness from Congress to the requests of fast growing states penalized by formula allocations.

The remainder of the paper is organized as follows. Section 2 describes the main features of formulas. Section 3 analyzes the relationship between per capita spending and population. Section 4 reports descriptive evidence of the relationship between population dynamics and federal spending. Section 5 outlines the empirical model and presents our main results. In section 6 we carry out several robustness checks and Section 7 concludes.

2 Federal grants: formulas and budgetary inertia

Federal aid to the US States is by and large administered by formulas legislated in Congress. Between 1983 and 2008, spending on formula grants amounts on average to 70% of total federal aid. This include the two largest federal programs - Medicaid and the Federal Highway Program - representing respectively 45% and 15% of grants allocated by formula during the same period.
One advantage of formulas is that they reduce arbitrariness in the allocation of the federal budget. However, their effectiveness in promoting a ‘fair’ distribution of federal funds has been increasingly questioned by legislators and policy practitioners. The most controversial aspect of formulas is the rigidity they induce in budgetary allocations. In particular, as pointed out by a recent report (GAO 2009), formulas tend to reduce the responsiveness of the budget to the changing needs of the states with rapidly growing population for two reasons. First, yearly allocations are typically determined using outdated population data.[9] Second, formulas can prevent budgetary adjustments because of rigidities embedded in their design. Those include hold-harmless provisions, which guarantee that the funds allocated to a state will be no less than

[9] In a testimony (26 February, 2008) to Congress concerning State Children’s Health Insurance program (SCHIP), the governor of Georgia Sonny Perdue states that “The current funding formula is also flawed because it hurts fast growing states, like Georgia, by lagging behind by as much as four years in factoring in quickly changing population numbers. In our 2007 fiscal year, the federal government was using population numbers from 2004, 2003 and as far back as 2002. Georgia has grown by almost a million peoples since 2002. We need data that is reflective of the actual population and need.” (source: http:\\gov.georgia.gov accessed on April 20 2008).

a specified proportion of a previous year's funding.[10] If a population change results in a decrease in funding below some minimum amount, then the hold harmless provision would raise the amount to the fixed minimum level. At the same time, the amount of the increase would be deducted from the funding of other states not affected by the hold-harmless provision. In an analogous way, caps impose a limit on the size of an annual increase as a proportion of a previous year's funding so that, if a population change produces an increase in funding above a certain amount, the cap would limit its effect. Floors and ceilings operate in a slightly different way, but have similar implications: if a change in population reduces funding below the floor, a state would be guaranteed the amount specified by the floor, whereas if the allocation exceeds the ceiling, the state cannot receive more than the ceiling amount. The two largest formula programs - Medicaid and the Federal Highway - are affected by these sorts of rigidities. Take the example of Medicaid. The share of Medicaid spending financed by federal government - the so called Federal Medical Assistance Percentage (FMAP) - is determined according to a statutory matching rate computed according to the following formula: $(1-0.45)(\text{state income per capita/ US income per capita})^2$. The FMAP are computed 1 year before the fiscal year in which they are effective, using a 3-year average of the most recently available income per capita data from the Department of Commerce (GAO 2007). Moreover for Medicaid, the statutory rate of state spending reimbursed by federal government (FMAP) operates under floor and ceiling restrictions (with a statutory minimum and maximum of respectively 50% and 83%).

The Federal Highway program, which consists of several programs which are mainly allocated by formula taking into account various measures of 'needs', such as vehicle miles, lane miles and population (U.S. Department of Transportation 2007), is also subject to statutory state minimum spending constraints. For example, the annual apportionment from the Highway Trust Fund to the Surface Transportation Program is subject to statutory 0.5 percent minimum rate for states

[10] For example, a 100% hold-harmless provision is currently in place for the Title I education program and the WIC (Women, Infant and Children). For a detailed report on formula programs see CNSTAT (2003).

having less than a specified threshold of qualifying roads, vehicle miles travelled on those roads, and taxes paid into the fund (GAO 2009)

The above described features of formulas lead to several important questions. Do formulas distort allocations in favour of states with limited population dynamics? Are the distortions mainly due to the use of outdated population data or to other formulaic rigidities, such as hold harmless provisions, caps, ceiling and floors restrictions? To address these issues, first we illustrate with a simple theoretical model how formulas can distort allocations. Next, we empirically assess whether fast growing states are disadvantaged in the distribution of federal grants and explore which mechanisms are the most likely drivers of budgetary inertia.

3 Expenditure per capita and population

Publicly provided goods often exhibit a certain degree of rivalness (quasi-public goods), which affects their provision. As shown by Alesina and Wacziarg (1998) (henceforth AW), the optimal provision of non-rival goods implies a negative relationship between spending per capita and population size, which stems from the presence of fixed costs and the resulting economies of scale associated with the provision of public goods. To illustrate the relationship between optimal spending per capita and population, we carry out a very simple exercise extending AW to allow for (i) a different degree of rivalness in the publicly provided goods and (ii) a financing rule that may introduce inertia in spending by linking current spending to past population levels.

As in AW consider a country composed of $N > 1$ identical individuals with constant elasticity of substitution utility functions, $U = \left[C^{\alpha} + \left(\frac{G}{f(N_t) * N_t} \right)^{\alpha} \right]^{1/\alpha}$, where C is private consumption, $\frac{G}{f(N_t) * N_t}$ is the amount of publicly provided good consumed by an individual and N_t is the population of period t, with t = {0, 1}. The function $f(N_t)$, with $\frac{1}{N_t} < f(N_t) < 1$, expresses the degree of rivalry of G. In particular, the assumption $\frac{1}{N_t} < f(N_t) < 1$ captures the quasi-public nature of the good.[11] The government at t=1 chooses the level of provision of the quasi-public good by maximizing the following objective function:

$$U_g = \left[C^{\alpha} + \left(\frac{G}{\gamma f(N_t) * N_t} \right)^{\alpha} \right]^{1/\alpha} \qquad (1)$$

where:

$$\alpha \leq 0$$

$$\frac{1}{N_t} < f(N_t) < 1$$

$$f' > 0$$

$$\gamma = \frac{N_0}{N_t} \qquad (2)$$

Notice that, the only difference between the individual utility and the government objective function is given by the parameter γ: this creates a wedge between the preferences of the government and those of the representative individual because the government, instead of using the current population level (N_t) in its objective function, uses the past value (N_0). The parameter γ is thus a reduced form representation of the various factors that can create 'inertia' in spending. Clearly, if the population does not change ($N_0 = N_t$), then the use of a funding rule based on past population has no effect because γ=1. On the other hand, when population grows ($N_t > N_0$), then γ<1, thus implying that the individual consumption of the publicly provided good taken into account in the government maximization (i.e. $\frac{G}{f(N_t) * N_0}$) is larger than the actual individual consumption (i.e. $\frac{G}{f(N_t) * N_t}$). The opposite holds if the population decreases (γ>1).

Assume that each individual is endowed with an exogenous income Y and pays a lump-sum

[11] If $f(N_t) = \frac{1}{N_t}$, we are in the pure public good case, whereas when $f(N_t) = 1$, the good is private.

tax, which is used to finance the provision of the quasi-public good $\frac{\mathrm{G}}{\mathrm{N}_t}$. The individual budget constraint is then given by:

$$C = Y - \frac{\mathrm{G}}{\mathrm{N}_t} \tag{3}$$

The maximization of the government objective function (1) taking into account the budget constraint (3) leads to the following per capita provision of the quasi-public good:

$$\frac{G^*}{N_t} = Y\left[1+\left(\frac{N_t}{N_0}\frac{1}{f(N_t)}\right)^{\frac{\alpha}{\alpha-1}}\right]^{-1} \tag{4}$$

From equation (4) we can notice that expenditure per capita depends negatively on the population growth captured by the term $\frac{N_t}{N_0}$ (change effect) and on the degree of non rivalness, $\frac{1}{f(N_t)}$ (scale effect). Notice that when population does not grow ($N_t = N_0$), then individual and government preferences coincide. In this case, the maximization of the government objective function leads to the per capita provision $\frac{G^{**}}{N_t} = Y\left[1+\left(\frac{1}{f(N_t)}\right)^{\frac{\alpha}{\alpha-1}}\right]^{-1}$,which as in AW depends negatively on the non-rivalness of the provided good. On the other hand, if $N_t > N_0$, the financing rule based on past population produces a per capita provision $\frac{G^*}{N_t} < \frac{G^{**}}{N_t}$, since $\frac{N_t}{N_0} > 1$: *the larger is the population growth (i.e. the larger is* $\frac{N_t}{N_0}$*), the larger is the distortion induced by the funding formula, for given non-rivalry level* $f(N_t)$. Finally, it is instructive to consider two polar cases. If we face a pure public good ($f(N_t) = \frac{1}{N_t}$)with $N_0 = N_t$, we obtain the same optimal per capita spending of AW, i.e. $\frac{G^*}{N_t} = Y\left[1+(N_t)^{\frac{\alpha}{\alpha-1}}\right]^{-1}$: per capita expenditure is negatively related to the actual population. On the other hand, *if the good is private* ($f(N_t) = 1$) and $N_t > N_0$, then the optimal provision is $\frac{G^*}{N_t} = Y\left[1+\left(\frac{N_t}{N_0}\right)^{\frac{\alpha}{\alpha-1}}\right]^{-1}$: *per capita expenditure is negatively related to the actual population index*. Moreover, in this last case, when $N_t = N_0$, the optimal per capita provision becomes $\frac{G^*}{N_t} = \frac{1}{2}Y$, which is independent of population.

To sum up, our simple theoretical framework shows that a funding rule based on past (rather than current) population, decreases (increases) per capita provision when population grows (decreases) beyond the amount that would be justified by the partial non-rivalness of the publicly provided good. Notice that, for simplicity we have illustrated the working of a formula distorting allocations by linking current provision to past population. The same sort of inefficiency would arise under any other formula that prevents allocations from reflecting actual population levels via other mechanisms (such as state minimum, floors and ceiling restrictions).

The implication of our simple theoretical model for federal spending (per capita) in the US states is that population size may have a negative effect on per capita spending (as long as publicly provided goods are partially non-rival), but population dynamics should not affect spending unless some funding mechanism (like formulas) implies that current provisions do not correctly reflect current population, letting the population dynamics term $\frac{N_t}{N_0}$ (change effect) emerge in (4) distinctly from $\frac{1}{f(N_t)}$ (scale effect). From an empirical point of view, identifying these two determinants is very important to understand the extent to which expenditure does not match the different needs due to population growth.[12] Next we analyze the empirical relationship between per capita grants allocations and population across US federal states to disentangle the effect of population size (scale effect) from its dynamics (change effect).

[12] Our simple set-up with one jurisdiction can be easily extended to incorporate two symmetric jurisdictions i={1,2}, each providing a local public good G_i with positive spillovers on the other jurisdiction. In this case the optimal provision of local public good ($G_1 = G_2 = G$) becomes:

$$\frac{G^*}{N_t} = Y\left[1+(1+\beta)^{\frac{\alpha}{\alpha-1}}\left(\frac{N_t}{N_0}\frac{1}{f(N_t)}\right)^{\frac{\alpha}{\alpha-1}}\right]^{-1},$$

where β>0 denotes the positive spillover (i.e. the share of public good provided in one jurisdiction enjoyed by the other). Notice that without spillover (β=0) the optimal per capita provision coincides with the one provided in equation (4). Thus, without spillovers, our simple theoretical framework with one jurisdiction captures the same features of a set-up with multiple jurisdictions. On the other hand, the presence of spillovers (β>0) reduces the optimal provision of local public good within each jurisdiction. Since the sign of the spillover effect goes in the same direction of the population index, by omitting spillover effects from our empirical analysis, we may overestimate the extent to which fast growing states are penalized in the allocation of the federal budget. However, as it turns out, the inclusion of spillovers as a further control variable does not affect our main results. For the interested reader, the estimation results are reported in Table A1 of the online appendix.

4 Population dynamics and federal grants in the US states

During the period we consider (1978-2008), US states vary substantially in their demographic characteristics.[13] This is particularly true for population dynamics. To capture the latter, we construct an index of population dynamics by dividing the population of every year, N_t, by the population of the first year of our sample, N_0, and then multiplying it by 100. Hence, in the base year (1978) the index (*index_pop*) is equal to 100 for all states, and in subsequent years it measures the deviation of the state population from the base year. In the upper panel of Figure 1, we present the geographic distribution of the average *index_pop* for the 48 US states during the period 1978-2008. It is clear that states display very distinct patterns, and population growth is heavily concentrated in the West and Southwest, and in three states to the Southeast (Florida, Georgia and North Carolina).

How does federal aid respond to population dynamics? Some preliminary insight can be gained by constructing for spending in grants an index analogous to *index_pop*, which is given by the ratio of state grants per-capita in any given year and the grant per-capita of the base year (1978), multiplied by 100. In the lower panel of Figure 1 we represent the average grant spending index by state during the period 1978-2008. The negative correlation between the upper and lower panels of Figure 1 is quite striking: states with the fastest growing population are typically characterized by the slowest growth of real per-capita grants. This type of evidence - though quite suggestive - is not sufficient to conclude that fast growing states are unfairly penalized in the allocation of federal grants. Remember that for quasi-public goods the optimal per capita provision is inversely related to population size. However, if allocations are affected by inertia, then rapidly growing population can lead to sub-optimal per capita allocations. It is therefore important to separate scale effects due to population size, from change effects due to population dynamics. The existence of a negative relationship between spending per capita and population

[13] See summary statistics in Table 1.

size would simply indicate the existence of non-rivalry in the publicly provided goods. On the other hand, a negative relationship between spending per capita and population dynamics would imply that allocations are distorted because they do not reflect actual population levels.

5 Grants allocations and population dynamics

The purpose of this section is to use regression analysis to investigate whether states with a fast growing population are penalized by the budget allocation process. To this end, as indicated by our theoretical model, we need to disentangle the effect of population size (scale effect) from its dynamics (change effect), where the latter is captured by the population index (*index_pop*). Hence, our first step is to estimate the following regression:

$$GRANT_{st} = \beta index\_pop_{st} + \gamma Population_{st} + \vartheta Z_{st} + \delta T_{st} + \eta_s + \xi_t + \varepsilon_{st} \quad (5)$$
$$s = 1,...48; t = 1978,...2008;$$

where $GRANT_{st}$ is real per-capita grant expenditure (outlays) in state *s* at time *t*, Z_{st} and T_{st} are respectively vectors of socio-economic and political control variables, whereas η_s and ζ_t represent respectively the state and year fixed effects.[14] Consistently with our theoretical analysis, our key explanatory variable in this specification is the state population dynamics index (*index_pop*). Since we also control for the state population level (Population), the coefficient of *index_pop* allows us to estimate the effect of population dynamics (change effect) independently of the population of the states (scale effect).

[14] Z_{st} includes real income per capita, unemployment rate, percentage of poor, percentage of non-white population, percentage of elderly and percentage of children. T_{st} consists of federal and state political variables that could influence the allocation of federal grants (Larcinese, Rizzo, and Testa 2006). The federal political variables include the share of votes for the incumbent president at the last election, the extent of 'swing voting', measured by the standard deviation of democratic vote (as a share of the total of democratic and republican vote) in the last three presidential races, and a measure of election closeness, namely the average distance between the two main presidential candidates in the past three elections. The state political variables comprise the share of democratic representatives in the Senate and the House of each state, the governor's party affiliation, age, term limit status and whether she belongs to the same political party of the President, of the majority party in the House, and in the Senate. The Summary statistics of all variables are reported in Table 1.

The focus of our empirical analysis is on the allocation of total grants, formula and non-formula grants and the two major formula programs, Medicaid and the Federal Highway Program. The data on formula and non-formula grants, Medicaid and the Federal Highway program are Census data from the Consolidated Federal Fund Report (CFFR), which contains data on federal grants allocation to the states on an obligation base, starting from 1983.

Since the distinction between formula and non formula grants is not readily available from the CFFR, to identify formula programs we have used the information provided by the Catalogue of Federal Domestic Assistance (CFDA). Formula grants are defined in the CFDA as "allocations of money to States or their subdivisions in accordance with distribution formulas prescribed by law or administrative regulation, for activities of a continuing nature not confined to a specific project". Both formula and non-formula programs in the CFDA are identified by the same codes used in the Consolidated Federal Fund Report (CFFR) . Hence, by matching the information from the CFDA with the spending data from the CFFR, we have classified federal aid into two categories, formula and non-formula grants. Table 2 provides descriptive statistics of formula and non-formula programs by state. The amount of funds allocated by formula is on average always larger than the corresponding non-formula amounts for all states (except Wyoming). During the period 1983-2008, 70% of federal aid is allocated via formulas (see Table 2). Non-formula grants consist mainly of project grants which provide funding for specific projects (such as fellowships, scholarships, research grants, training grants, planning and construction grants) for fixed or known periods.

In Table 3 we report our baseline estimates. In Columns (1) and (2) we use total grants as a dependent variable. The difference between the two is that in column (1) we use data from various editions of the Statical Abstract covering the period 1978-2008, while in column (2) we use 1983-2008 data from the CFFR. Columns (3) and (4) distinguish between formula and non-formula programs.

The main pattern emerging from our estimations reported in Table 3 is that population dynamics is key to explain the allocation of formula programs, whereas non-formula are not affected. We also find that scale effects do not generally play a significant role, as a mostly insignificant coefficient of the population term indicates.[15] These results hold independently of whether we use or not fixed effects in our specification (see Table 3A and 3B). In particular, the coefficient of *index_pop* is negative and statistically significant for formula grants (Table 3A, column 3), whereas for non-formula programs (Table 3A, column 4) we do not find a statistically significant effect. However, it should be noted that the introduction of fixed effects improves the significance of the *index_pop* coefficient for formula grants (Table 3B, column 3), as well as for total grants, for which we find a statistically significant effect of population dynamics (Table 3B, columns 1-2). This suggests that the estimated negative impact of population dynamics for overall grants is primarily due to formula-based programs, and that excluding fixed effects generates a downward bias in the estimated coefficients.

In the last column of Table 3, we carry out a falsification exercise using federal transfers to individuals from the Food Stamp Program, which is the closest to a pure private good and is not allocated by formula. In this case, we expect not to observe any effect of population, neither in terms of scale nor in terms of change. Our estimates (with and without fixed effects) confirm our expectation that population does not affect the allocations of Food Stamps to the states.

6 Robustness checks

The estimated coefficients of Table 3 (with and without fixed effects) show that population dynamics plays a crucial role in explaining the allocation of formula grants to the states since fast growing states receive significantly less than shrinking ones. However, besides factors that limit the responsiveness of spending to population dynamics, budgetary inertia might also be related to other factors.

In particular, population dynamics may not be the only variable to which spending does not respond promptly, because allocations may also react slowly to the change of other important

[15] This suggest that goods and services financed by grants are characterized by a substantial degree of rivalness. This finding is consistent with the results of Larcinese, Rizzo, and Testa (2009), which find evidence of a scale effect in defence spending only.

economic and demographic variables such as income per capita, poverty rates, population age and ethnic group composition. If the growth of these variables is correlated with population dynamics, their omission may constitute a problem for the identification of the population dynamics effect.

To take into account these concerns, in the first three columns of Table 4 we repeat the baseline regressions of Table 3 by adding as further control variables several new indexes (that have been constructed analogously to *index_pop*) measuring the dynamics of income per capita, the share of poor, of non-white ethnic groups, of population aged between 5 and 17, and above 65 years.

As we can see from the results reported in Table 4 (columns 1-3), the conclusions we reached in Table 3 are not altered by the inclusion of further indicators. In particular, the coefficient of *index_pop* remains not significant in the non-formula regression (column 3), whereas the estimated *index_pop* coefficient for total grants (column 1) and formula programs (column 2) remains negative, statistically significant and sizeable. As before, we do not find evidence of a statistically significant scale effect.

Having established the existence of a fundamental difference between formula and non-formula programs, we move next to the analysis of the two most important formula programs, Medicaid and Federal Highway.[16]

In column 4 of Table 4 we report the results for the Federal Highway regression: the estimated coefficient of *index_pop* confirms the existence of a negative and statistically significant relationship between population dynamics and Federal Highway spending.

The results concerning Medicaid are quite different. As we can see from the estimated coefficients reported in column (5) of Table 4, there is no statistically significant relationship between Medicaid and population dynamics. This is not surprising if one takes into account that the share of Medicaid spending financed by federal government is determined according to a

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16 In the Federal Highway regression we add to the other controls used in all regressions also the number of driving licences per capita, which is a standard control variable used in the literature (Knight 2002).

statutory matching rate (FMAP) computed according to the following formula: (1-0.45)(state income per capita/US income per capita)^2. Thus, *index_pop* could only have a very indirect impact via the income per capita used in the FMAP formula. On the other hand, income dynamics has a positive and significant coefficient, implying that states whose income grows fast are advantaged in the allocation of Medicaid federal funds. As we will explain later, this is problematic given that the goal of Medicaid should be to provide more funds to states that are less able to fund it with their own resources.

Notice also that the only other instance of a significant estimated effect of income dynamics occurs for formula programs (Table 4, column 2). However, once we exclude Medicaid from formula programs (Table 4, column 6), the coefficient of income dynamics for Non-Medicaid spending is not significant any more, thus implying that the effect of income dynamics in formula grants is driven by Medicaid. On the other hand, the coefficient of population dynamics for Non-Medicaid spending remains significant. If we consider an even more restrictive class of formula programs (Other Formula), which excludes both Medicaid and the Federal Highway from the overall formula programs (Table 4, column 7) *index_pop* is still negative, but not significant. If we drop the two outliers Louisiana and Mississippi for 2006 (characterized by a disproportionate increase of federal funds in 2006 since heavily affected by the Katrina hurricane in 2005) the coefficient becomes significant at 10% level (Table 4, column 8).[17] From these regressions we can safely conclude that, with the exception of Medicaid, population dynamics has a negative and statistically significant impact on formula programs.[18]

[17] Significance improves for all the other regressions if we drop Louisiana and Mississippi for 2006 (see Table A2 in appendix); the same happens for regressions in Table 3 (not reported, available from the authors upon request).

[18] In Table A1 of the online appendix we also report a specification showing that our results are robust if we include (i) a lagged dependent variable to account for the fact that budgetary provisions tend to be determined by marginal changes to previous ones, (ii) the mean of the transfers received by the neighbouring states to account for the possibility that its own transfers are affected by neighbour's externality transfers, (iii) the state tax base per capita to account for the fact that states with growing population may need less federal transfers because they have a growing tax base and (iv) population density, which may might matter for how rival the goods are. All regressions in table A.1 are IV where, following the methodology of Besley and Case (1995), neighbours'' spending has been instrumented by using neighbours' political, demographic and econonomic variables.

6.1 Population updating and formulaic rigidities

As previously explained, the negative relationship between per capita spending and population dynamics may be driven by (a) the use of outdated population data within formulas and (b) formulaic rigidities due to rules such as hold-harmless provisions, caps, floors and ceilings.[19] Distinguishing between these two types of inertia is important because the first originates from a pure information problem, which may be addressed when updated data become available from Censuses. The second does not allow instead the use of the most recent information on population, even if available. This implies that distortions in spending tend to be permanent and, hence, cumulate over time. In the following we try to empirically assess the importance of the two channels of inertia, by using the fact that new Census information becomes available every ten years. If the use of outdated population data were the only source of inertia, then the distortion would be corrected in correspondence of each census year, and the negative effect of population dynamics would become evident over time in years between censuses. Hence, we construct a population index by census decade (*index_pop_decade*), measuring population growth with respect to the population of the last census. At the same time, if rigidities embedded in the formulas' structure play a role independently of the use of outdated data, then the cumulative effect of population dynamics - captured by our index of population dynamics with respect to the first year of the sample - should still have a significant effect on spending.

To assess the relative importance of the two channels of inertia, we re-estimate the regression of Table 4, using *index_pop_decade* alone (Table 5A, columns 1-5) and then in conjunction with our original population index (Table 5A, column 6-10). As we can see, the negative effect of our original population index remains significant, whereas the index measuring the effect of dynamics within each census decade is never significant. Even though the update of population

[19] In a testimony (26 February, 2008) to Congress concerning State Children's Health Insurance program (SCHIP), the governor of Georgia Sonny Perdue states that "The current funding formula is also flawed because it hurts fast growing states, like Georgia, by lagging behind by as much as four years in factoring in quickly changing population numbers. In our 2007 fiscal year, the federal government was using population numbers from 2004, 2003 and as far back as 2002. Georgia has grown by almost a million peoples since 2002. We need data that is reflective of the actual population and need." (source: http:\\gov.georgia.gov accessed on April 20 2008).

data may not be sufficient to completely eliminate the distortion in spending, the release of census data might still attenuate the cumulative effect of inertia captured by *index_pop* during the census year and its aftermath. For this reason we carry out a further robustness check by introducing in the specification of Table 5A an interaction term between *index_pop* and a dummy variable that is equal to one during the census year and the year after the census, and zero otherwise. However, as we can see from the estimated coefficients reported in Table 5B, the interaction term *index_postcensus* is never significant.

7 Suboptimal formulas?

Our analysis suggests that formulas are explicitly designed to reduce the responsiveness of budgetary allocations to states' population growth. This finding raises two important questions. First, why should legislators devise formulas with this specific intent? Second, how harmful is this rigidity for the states? Concerning the first issue, the non-rival nature of certain publicly provided goods might provide a rationale for the disconnect between spending and population growth: in the case of pure public goods, an increasing number of people can be served at no additional cost, it is thus not optimal to increase total spending when population grows. The construction of an integrated federal highway system could well constitute a case of public good provision. But, more generally, the rationale behind a formula should depend on the nature of the good provided. Given that most publicly provided goods and services are unlikely to be pure public goods, our simple theoretical model indicates that formulaic rigidities could lead to under-provision. For two specific formula programs - Medicaid and the Federal Highway - we have more precise information on their goals to evaluate the optimality of current formulas. The Medicaid program was established in 1965 to provide proportionately more Federal funds to the States with high poverty rates and weak tax bases so as to reduce differences among states in their ability to fund Medicaid services.[20] For that purpose, its financing was based on a matching

[20] See Medicaid distribution formula: hearing before the Committee on Finance, United States Senate, One Hundred Fourth Congress, first session, July 27, 1995, Volume 4.

formula (still in place), whereby states with lower per capita incomes receive higher rates of federal reimbursement for program costs. However, as pointed out in a recent report by the GAO (2007), formula seems not to be serving well such programmatic goals, since state disparities are instead widening. According to the same report, two factors play an important role in explaining this outcome. First, the Medicaid formula relies only on state income per capita, which does not accurately measure either states' total available resources or the cost of providing healthcare to people in need and the size of population in need. For example, the cost of provision is typically related to population age, i.e. the cost of serving the elderly is usually higher. Second, the before mentioned 'floor' and 'ceiling' provisions tend to benefit states that based on their income per capita should receive less than the 'floor'. Interestingly, our empirical results confirm these formula flaws. In particular, the fact that states whose income grows faster are advantaged in the allocation of Medicaid funds is consistent with the inertia due to the floor and ceiling restrictions of the funding formula, which prevent the necessary adjustment to the changing income of the states. We also find that the amount of federal transfers for Medicaid are not significantly related to the states' shares of elderly and poor, thus suggesting that federal allocations do not reflect well the cost of serving population in need.[21]

The financing of the Federal Highway Program is also problematic. The program formula (also still in place) was legislated in 1956 with the goal of funding the building of an Interstate Highway System. Hence, the limited responsiveness of funds to state population changes may be justified by the public nature of the infrastructure being built at the time. However, as pointed out by Sen. Hutchison 'The existing funding formula is no longer serving the best interests of each state or American motorists. With the Interstate Highway System long complete, our transportation mission should evolve to maintaining and improving this valuable infrastructure. We must add highway capacity in areas where population and commercial growth is exceeding what our infrastructure can withstand. Likewise, our funding structure must change to meet these

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[21] We find only a positive significant effect of the share of poor on Medicaid in table 3B, but the effect is not robust (estimated coefficients not reported, available from the authors upon request).

shifting priorities.[22] In other words, the current formula - tailored to the public nature of a federal highway system construction - is not well suited to the maintenance and upgrading of the states' infrastructure that is subject to congestion.

Although the Medicaid and Federal Highway formulas seem problematic in many respects, it is not obvious that in general the rigidities embedded in formula must be harmful to the states. Many programs are financed by both federal and state spending, and local spending itself may respond slowly to population (Bradbury, Ladd, Perrault, Reschovsky, and Yinger 1984). As a result, it might well be the case that federal spending is sluggish just because federal funds adapt to the inertia in states' spending. If this is the case, we should, first, observe that state spending is negatively related to population dynamics and, second, that this stickiness is not caused by federal transfers. To verify if total state spending is also sticky, we estimate the effect of the population index over state spending per capita. If we do not control for federal transfers (Table 6, column 1), we find that, in fact, state spending is also inversely related to population dynamics as indicated by the negative coefficient of *index_pop* significant at 5% level. However, once we control for federal transfers, the coefficient of *index_pop* loses its significance (Table 6, column 2), meaning that stickiness in state expenditure is entirely due to the transfers. Since the OLS estimates including federal grant as an explanatory variable can evidently suffer from endogeneity bias (Knight 2002), in column 3 of Table 6, we instrument grants per capita with presidential politics explanatory variables that we used in Tables 3-5, and again the coefficient of *index_pop* remains not significant. Hence, we conclude that the stickiness of federal transfers constrains state spending, thus preventing its adjustment to population growth.

8 Gainers and losers

In Table 7 we report the average gains and losses (in 1983 USD) of federal funds for the 48 states implied by our estimates of the *index_pop* coefficient reported in Table 4. These have been

[22] Sen. Hurchison, Press Release (feb 2, 2011), accessed on April 19 2012 from: http://hutchison.senate.gov/?p=press_release&id=11

computed by comparing, for each state, the predicted federal grants per capita implied by the average *index_pop* in the state during the period 1978-2008, with the federal grant per capita that the state would receive if its *index_pop* were equal to the US average during the same period.

Nevada, Arizona and Florida, with a population growth over the period 1978-2008 equal to 1.9, 1.5 and 1.3 times the US average, lose on average respectively 41%, 19% and 16% of their average grant per capita. The size of the losses for the three fastest growing states is respectively 37%, 14% and 11% of their average formula grant per capita. For the remaining States, gains and losses for total grants and formula grants are much lower. On the other hand, if we consider the Federal Highway programs, losses are higher. The three fastest growing states lose 39% (Nevada), and 27% (Arizona) and 22% (Florida) of their average federal highway spending. States such as Texas and California, lose both 4% of their average spending, whereas New York gains about 3%.[23]

Notice that least populated states in the North-East are advantaged in the allocation of federal grants if compared to populous states such as California, Texas and Florida. These patterns conform to a claim made by Lee (1998) and Lee and Oppenheimer (1999) that the large states are also those that grow faster and vice-versa. Since less funds are necessary to obtain the same increase in per capita grants in a smaller than in a larger state (Lee 1998, Knight 2004, Hauk and Wacziarg 2007), then senators and congressman who need to build winning coalitions to bring federal grants to their constituents will typically ask smaller states to enter the coalition in order to minimize the cost of obtaining political allies. In this view, population growth and population size can be reduced to a single dimension. In reality, however, large states and fast growing states do not coincide, which means that the bargaining process over formula-allocated grants cannot be reduced to one dimension.

Overall, we estimate that 17 of the 48 US continental states - whose population grows faster than the US average - lose federal grants (across all the different categories we have analyzed) to the

[23] Notice that if population migrates toward states providing more local public goods and services, our estimates might be biased downward, i.e. we might underestimate the negative effect of population growth on spending.

advantage of the remaining states that grow at a slower pace. That the losses are concentrated in a minority of states may explain the persistence of the status quo. Not surprisingly, as discussed in the Introduction, "fair share acts" legislative proposals tend to originate from representatives of fast growing states. These states are obviously a minority in the Senate and their overall representation in the House amounts today to 208 congressmen, which is still a minority, although not by a large margin. Thirty years ago, however, after the 1980 Census, these same states only had 165 representatives. At current population growth rates, we are probably very close to reaching a tipping point, where fast growing states will have a majority, at least in the House. Hence, we expect that in a not-so-distant future stronger pressures will emerge in Congress to revise the formulas to better capture the needs of fast growing states.[24]

In a trivial sense if state rankings in population growth remain broadly the same for a long period of time then fast growing states will also end up being the largest, therefore obtaining adequate representation in the House to re-balance formulas in their favour.[25] But it seems clear that it may take many decades to generate the political conditions for this to happen. And in any event the equal representation principle governing the Senate will still make any change difficult to achieve. The large number of veto players characterizing American politics remains probably an important reason why changes to the status quo are hard to implement (Tsebelis 2002).

9 Conclusions

Fast growing states are disadvantaged in the allocation of federal grants, in particular those allocated by formulas. As their population increases, spending does not adjust sufficiently to

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[24] It is worth noting that fast growing states tend to have more Republican Congressmen than the average US state, particularly in the Senate. In the period we study, average yearly representation per state is fairly balanced (close to 50% Republican and 50% Democrat in both House and Senate). However, the 17 states penalized by a fast growing population are decidedly more Republican on average (54-46 in the House and 64-35 in the Senate). This higher-than-average party homogeneity could, in principle, favour the formation of a coalition around this theme when fast growing states will have a majority in the House.

[25] For some interesting empirical findings on the 'rebalancing role' of the House see Knight (2008) and Hauk and Wacziarg (2007), which by analyzing the progression of appropriation bills throughout the entire legislative process find that small states are advantaged in the Senate version of the bill, whereas this advantage disappears in the House version.

guarantee them their fair share of the federal pie. We quantify the effect of this inertia and show that it is sizeable. For example, we estimate that Nevada, the fastest growing state, incurs a yearly loss of 41% of its overall grant budget. Formulas impose a constraint on the budgetary process, which prevents the spending adjustments necessary to address the changing needs of states with pronounced population dynamics.

What drives this budgetary inertia? Our simple theoretical framework shows that 'sluggish spending' cannot be the outcome of pure social surplus maximization. At the same time, our empirical analysis highlights that, although several fast growing states are penalized by existing rules, the majority of the states is on the winning side. In other words, a majority of the US states seems to benefit from rules limiting the flexibility of the budget, and this suggests that distributive politics might provide an alternative explanation for why such rules persist. Hence, a political economy approach, calling into question the institutional arrangements and the political process behind grant allocation, may be a fruitful avenue for future research on the causes of the observed misallocation of resources. In terms of our simple model, the government funding rule (summarized by the parameter γ) could be endogenized as the outcome of simple majority voting, within a framework where individuals have heterogeneous preferences and the preferences of the median voter dictate the parameter γ in the government objective function. The exact solution to a model of this sort would depend on a number of institutional details, for example on whether the 'pivotal legislator' represents the median state (as in the Senate) or the median voter with respect to the overall voting population. In any event, there is no reason to expect such a solution to coincide with (or even be close to) the social surplus maximizing one.

This raises an intriguing question on the optimality of formula-based as opposed to discretionary spending programs. While formulas might be a useful instrument to reduce arbitrariness and promote a fair distribution of the federal pie, they can also simply perpetuate a status quo, which turns out to be advantageous for a majority. Since the revision of such formulas cannot be isolated from the political process, they may become a further instrument through which the battle for pork is fought. It is then surprising that the literature on grant allocation has focussed mostly on the size of states, and therefore on the well known issue of small state over-representation in Senate, while entirely neglecting the important distributive consequences of population growth. More work is needed to shed lights on these important issues that we leave to further research.

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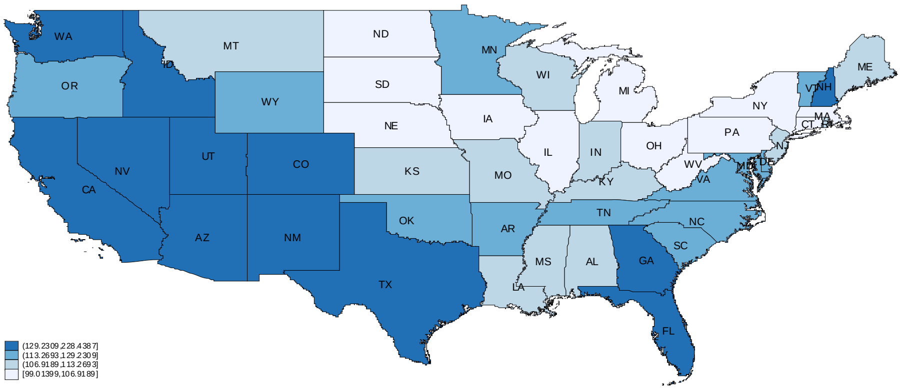
Figure 1
Geographic distribution of population and grant dynamics

Average Population Index by State 1978-2008



Average Grants Index by States 1978-2008

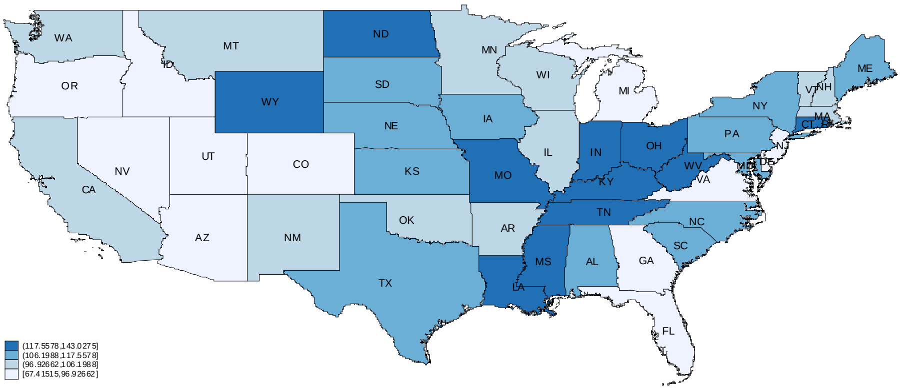


Table 1. Summary statistics of the variables used in the regressions.

Variable	Obs	Mean	Std. Dev.	Min	Max
Grants*	1488	585.1408	246.2884	231.4986	2735.17
Neighbors Grants*	1488	585.1425	195.6725	293.833	1400.096
Population*	1488	5.379959	5.721312	0.425	36.75667
Neighbors Population*	1488	5.407687	2.65528	0.6625	11.85747
index_pop *	1488	120.9177	30.31507	95.2168	390.4159
index_inc *	1488	118.211	18.60607	79.17033	185.8971
income per capita*	1488	14.61854	2.884165	8.601129	26.82024
unemployment*	1488	5.768884	1.994388	2.2	18
Neighbors unemployment*	1488	5.744896	1.640014	2.4	13.36
total gasoline consumption*	1488	11560.58	1570.282	6381.688	20784.61
density*	1488	175.7534	244.6535	4.376931	1173.332
% of non-white population*	1488	16.94158	10.97261	0.999225	50.99974
% aged above 65*	1488	12.36603	1.793444	7	19
Neighbors % aged above 65*	1488	12.30398	1.054138	8.6	14.441
% of poor*	1488	13.10588	3.89355	2.9	27.2
% in schooling age (5-17)*	1488	19.07383	1.854084	15.45129	26.58378
licences per capita*	1488	0.685267	0.052965	0.511227	0.9087127
democratic governor*	1488	0.510081	0.500066	0	1
age governor*	1488	53.66129	7.737423	33	78
termlimit governor*	1488	0.250672	0.433546	0	1
President-Governor aligned*	1488	0.405914	0.491233	0	1
Senate-Governor aligned*	1488	0.458333	0.498428	0	1
House-Governor aligned*	1488	0.525538	0.499515	0	1
presvote*	1488	0.546584	0.06885	0.343509	0.7796518
Neighbors persvote*	1488	0.547434	0.054393	0.35491	0.69565
standard deviation of democratic vote*	1488	0.054033	0.02858	0.001693	0.2218355
% dem state house*	1457	0.56123	0.174087	0.128571	0.9809524
% dem state senate*	1457	0.563568	0.180804	0.085714	1
closevote*	1488	0.855013	0.103042	0.440696	0.9999079
index_% of poor*	1488	107.1831	19.43579	37.78502	187.4345
index_% in schooling age (5-17)*	1488	83.56978	6.973356	67.1795	102.2453
index_% aged above 65*	1488	111.1283	10.45067	87.5	153.9649
index_% of non-white population*	1488	178.9016	84.14071	89.66601	500.5084
Formula**	1248	451.7713	190.6657	154.2411	2002.703
No Formula**	1248	190.4441	103.896	78.86939	1328.135
Medicaid**	1248	207.1689	113.9843	15.59727	643.9247
Federal Highway**	1248	69.5088	38.90158	19.73433	373.8915
Grants (CFFR) **	1248	642.2154	253.1622	246.0437	2735.629
Non Medicaid **	1248	244.6024	99.66625	98.37959	1521.768
Other Formula**	1248	175.0936	75.42218	71.46728	1147.876
Food Stamps **	1248	43.30423	18.48562	7.392407	120.5975
Neighbors Formula**	1248	450.5458	162.6144	190.1676	1076.818
Neighbors No Formula**	1248	191.4914	59.21234	103.3354	562.8586
Neighbors Medicaid**	1248	207.5705	101.0611	35.25427	520.0713
Neighbors Federal Highway**	1248	68.86592	25.63438	28.54545	244.4732
Neighbors Non Medicaid **	1248	242.9753	73.0056	114.6678	700.1401
Neighbors Other Formula**	1248	174.1094	57.42581	72.03433	514.4904
index_pop decade***	1392	104.6172	6.182848	92.66666	158.7554
total state expenditure***	1392	2004.587	575.4049	892.9687	4430.952

Notes: Figures are based on annual data for continental US states for the year 1978 2008 (*), 1983-2008 (**) and 1980-2008 (***), inclusive. All the monetary variables are expressed in real terms, divided by the Consumer Price Index (CPI) 1982-84 taken from the Statistical Abstract of the United States. We do not include non continental states (Hawaii, District of Columbia and Alaska).

Data source: US Census and for the total gasoline consumption EIA (US Energy Information Administration).

Table 2. Formula and non Formula grants (1983-2008).

State	Formula Grants *mean, real per capita 1983 USD*	Non Formula Grants *mean, real per capita 1983 USD*	Formula grants *average share*	Non Formula grants *average share*
AL	425.733	168.028	0.717	0.283
AR	482.702	128.779	0.789	0.211
AZ	379.185	144.673	0.724	0.276
CA	424.806	192.661	0.688	0.312
CO	307.274	194.022	0.613	0.387
CT	473.947	203.633	0.699	0.301
DE	427.995	172.322	0.713	0.287
FL	312.256	109.400	0.741	0.259
GA	390.634	126.786	0.755	0.245
IA	389.013	151.896	0.719	0.281
ID	406.781	140.587	0.743	0.257
IL	378.697	156.610	0.707	0.293
IN	373.353	108.937	0.774	0.226
KS	361.364	123.893	0.745	0.255
KY	486.094	146.108	0.769	0.231
LA	621.241	213.340	0.744	0.256
MA	513.470	356.708	0.590	0.410
MD	387.838	255.293	0.603	0.397
ME	579.491	192.738	0.750	0.250
MI	415.482	152.134	0.732	0.268
MN	418.614	167.204	0.715	0.285
MO	425.474	147.856	0.742	0.258
MS	588.543	206.054	0.741	0.259
MT	574.733	272.873	0.678	0.322
NC	401.175	152.693	0.724	0.276
ND	597.834	305.497	0.662	0.338
NE	420.146	138.956	0.751	0.249
NH	375.587	173.106	0.685	0.315
NJ	416.940	145.849	0.741	0.259
NM	575.161	294.077	0.662	0.338
NV	273.455	149.493	0.647	0.353
NY	704.456	242.781	0.744	0.256
OH	416.089	140.713	0.747	0.253
OK	426.236	151.743	0.737	0.263
OR	414.601	194.516	0.681	0.319
PA	451.387	170.568	0.726	0.274
RI	602.717	261.969	0.697	0.303
SC	433.409	123.910	0.778	0.222
SD	541.720	270.433	0.667	0.333
TN	469.389	155.044	0.752	0.248
TX	369.205	118.974	0.756	0.244
UT	358.225	165.782	0.684	0.316
VA	296.268	134.989	0.687	0.313
VT	614.023	240.684	0.718	0.282
WA	400.910	192.091	0.676	0.324
WI	401.489	156.460	0.720	0.280
WV	591.236	179.369	0.767	0.233
WY	588.647	649.086	0.476	0.524
US	*451.771*	*190.444*	*0.703*	*0.297*

Table 3. OLS regressions. Dependent variables: federal grants (real per capita, 1983 USD) by spending category.

3A. Between regressions

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Grants	Grants (CFFR)	Formula	Non-formula	Food stamp
population	-7.8980	-6.2209	-3.2772	-2.9437	-0.2835
	(5.142)	(5.221)	(2.347)	(3.422)	(0.253)
index_pop	-1.2453	-1.5155	-1.0957*	-0.4198	-0.0880
	(1.253)	(1.101)	(0.495)	(0.722)	(0.057)
Other Controls					
licences per capita	no	no	no	no	no
Socio-economic[1]	yes	yes	yes	yes	yes
Political[2]	yes	yes	yes	yes	yes
Constant	yes	yes	yes	yes	yes
State fixed effects	no	no	no	no	no
Year fixed effects	no	no	no	no	no
Observations	1,457	1,222	1,222	1,222	1,222
R-squared	0.5378	0.5911	0.7711	0.3769	0.9013

3B. Regressions with state and year fixed effects

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Grants	Grants (CFFR)	Formula	Non-formula	Food stamp
population	3.0850	-7.0109	-5.5241	-1.4868	0.5272
	(5.270)	(11.823)	(7.547)	(5.322)	(0.431)
index_pop	-1.6446**	-1.2967*	-1.2260**	-0.0707	-0.0119
	(0.422)	(0.520)	(0.378)	(0.208)	(0.022)
Other Controls					
licences per capita	no	no	no	no	no
Socio-economic[1]	yes	yes	yes	yes	yes
Political[2]	yes	yes	yes	yes	yes
Constant	yes	yes	yes	yes	yes
State fixed effects	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes
Observations	1,457	1,222	1,222	1,222	1,222
R-squared	0.8608	0.8699	0.8973	0.7877	0.9131

Notes: Robust standard errors in parentheses ***p<0.01, ** p<0.05 * p<0.10. We do not include non continental states (Hawaii, District of Columbia and Alaska) and Nebraska, whose Legislature is unicameral and non-partisan. (1) Socio-economic controls: income per capita, unemployment rate, % over 65 year olds, % in schooling age (5-17), % of non-white population, % poor. (2) Political controls: democratic governor, age governor, term limit governor, President-Governor aligned, Senate-Governor aligned, House-Governor aligned, share of votes for the incumbent President, standard deviation of democratic vote, close vote, % democratic in the state house, % democratic in the state senate.

Table 4. OLS regressions with controls for the dynamics of socio-economic variables. Dependent variables: federal grants (real per capita, 1983 USD) by spending category.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Grants	Formula	Non-Formula	Highway	Medicaid	Non-Medicaid	Other Formula	Other Formula (*)
population	6.2159	-0.2921	-1.7650	2.1318	-6.0454	5.7533	3.6281	4.0304
	(5.005)	(7.715)	(4.617)	(1.452)	(3.550)	(4.948)	(3.853)	(2.915)
index_pop	-1.5838**	-0.9310*	-0.1778	-0.2316**	-0.2868	-0.6442*	-0.4145	-0.3603*
	(0.503)	(0.380)	(0.217)	(0.078)	(0.188)	(0.278)	(0.214)	(0.144)
index_% of poor	0.6781	0.3085	0.2413	-0.0758	0.3104	-0.0019	0.0740	0.1986
	(0.555)	(0.480)	(0.469)	(0.137)	(0.371)	(0.361)	(0.272)	(0.160)
index_% in schooling age (5-17)	3.6680	-10.1181	8.4332	-17.0649**	-11.3039	1.1858	18.2831	3.5059
	(25.047)	(27.404)	(26.006)	(5.280)	(12.739)	(21.725)	(18.551)	(9.705)
index_% aged above 65	7.1070	-4.4241	7.6505*	-0.0968	-2.1383	-2.2858	-2.1898	-1.5643
	(7.806)	(3.382)	(3.201)	(1.256)	(2.497)	(2.378)	(1.498)	(1.086)
index_% of non-white population	-0.1611	-0.0280	-0.0645	-0.0282	-0.0363	0.0083	0.0373	0.0708
	(0.173)	(0.173)	(0.126)	(0.036)	(0.131)	(0.090)	(0.067)	(0.056)
index_income	10.5091	13.0001**	-1.3516	1.8539	8.9076**	4.0925	2.2610	-0.1948
	(5.780)	(3.958)	(3.849)	(0.981)	(1.855)	(3.050)	(2.368)	(1.288)
Other Controls								
licences per capita	no	no	no	yes	no	no	no	no
Socio-economic[1]	yes	yes	yes	yes	yes	yes	yes	yes
Political[2]	yes	yes	yes	yes	yes	yes	yes	yes
Constant	yes	yes	yes	yes	yes	yes	yes	yes
State fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,457	1,222	1,222	1,222	1,222	1,222	1,222	1,220
R-squared	0.8650	0.9055	0.7925	0.8251	0.9341	0.7471	0.7013	0.8513

Notes: Robust standard errors in parentheses ***p<0.01, ** p<0.05 * p<0.10. We do not include non continental states (Hawaii, District of Columbia and Alaska) and Nebraska, whose Legislature is unicameral and non-partisan. (*) The two outliers Louisiana and Mississippi in 2006 (the year after the hurricane Katrina) are dropped from the sample. (1) Socio-economic controls: income per capita, unemployment rate, % over 65 year olds, % in schooling age (5-17), % of non-white population, % poor. (2) Political controls: democratic governor, age governor, term limit governor, President-Governor aligned, Senate-Governor aligned, House-Governor aligned, share of votes for the incumbent President, standard deviation of democratic vote, close vote, % democratic in the state house, % democratic in the state senate. (3) socio-economic indexes: index_% of poor, index_% in schooling age (5-17), index_% aged above 65, index_income.

Table 5A. OLS regressions with control for population index by Census decade. Dependent variables: federal grants (real per capita, 1983 USD) by spending category.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Grants	Formula	Highway	Non-Medicaid	Other Formula (*)	Grants	Formula	Highway	Non-Medicaid	Other Formula (*)
index_pop						-1.3700**	-0.9961*	-0.2247**	-0.5975*	-0.3363*
						(0.492)	(0.373)	(0.075)	(0.250)	(0.130)
index_pop_decade	-3.6293	-2.2122	-0.2424	-1.6672	-0.8767	-2.7050	-1.5403	-0.1534	-1.4306	-0.7444
	(1.855)	(1.116)	(0.180)	(0.938)	(0.456)	(1.627)	(0.940)	(0.169)	(0.871)	(0.418)
population	-0.8489	-2.5833	1.1172	2.5564	2.2619	5.1867	1.8050	2.0477	5.0306	3.6533
	(9.077)	(7.089)	(1.692)	(5.519)	(3.311)	(6.840)	(5.825)	(1.408)	(4.635)	(2.759)
Other Controls										
licences per capita	no	no	no	no	no	yes	no	no	no	no
Socio-economic[1]	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Political[2]	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Socio-economic indexes[3]	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
State fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1,363	1,363	1,222	1,222	1,220	1,363	1,363	1,222	1,222	1,220
R-squared	0.8673	0.9274	0.8213	0.7448	0.8494	0.8711	0.9300	0.8253	0.7491	0.8526

Notes: Robust standard errors in parentheses ***p<0.01, ** p<0.05 * p<0.10. We do not include non continental states (Hawaii, District of Columbia and Alaska) and Nebraska, whose Legislature is unicameral and non-partisan. (*) The two outliers Louisiana and Mississippi in 2006 (the year after the hurricane Katrina) are dropped from the sample. (1) Socio-economic controls: income per capita, unemployment rate, % over 65 year olds, % in schooling age (5-17), % of non-white population, % poor. (2) Political controls: democratic governor, age governor, term limit governor, President-Governor aligned, Senate-Governor aligned, House-Governor aligned, share of votes for the incumbent President, standard deviation of democratic vote, close vote, % democratic in the state house, % democratic in the state senate. (3) socio-economic indexes: index_% of poor, index_% in schooling age (5-17), index_% aged above 65, index_income.