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Do Small States Get More Federal Monies? Myth and Reality About the US Senate Malapportionment*

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Abstract

We analyze the relationship between senate malapportionment and the allocation of the US federal budget to the states during the period 1978-2002. A substantial literature originating from the influential paper by Atlas et al. (1995), using a within estimation methodology finds that small and overrepresented states get significantly larger shares of federal funds. Revisiting the econometric specification used by the current empirical research, we show that the number of senators percapita is inappropriate to capture malapportionement in regressions using broad federal programs, and that the results obtained with this indicator are extremely non-robust to reasonable specification changes. In particular, senators percapita have a significant impact on federal spending only in regressions containing state fixed effects. Furthermore, the coefficients estimated using the within methodology are statistically different across states and, therefore, cannot be used to assess spending differentials between states. The magnitude and significance of those coefficients suggest a within state-specific inverse relationship between broad spending categories and population which is not systematically related to the size of the states and seems more compatible with incrementalist theories of budget allocation.

JEL codes: D72, H61, H77

keywords: federal budget, malapportionment, small state advantage, overrepresentation

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The equality of representation in the Senate is another point, which, being evidently the result of compromise between the opposite pretensions of the large and the small States, does not call for much discussion. (Madison 1788)

1 Introduction

The US constitution mandates a different type of representation for federal states in the two branches of Congress. Members of the House are assigned proportionally to population and regularly reapportioned in response to demographic changes. In the Senate, the principle of equal representation prescribes that each state must be represented by two senators. In the intent of the founding fathers of the US constitution, the double representation principle should balance the interests of the small and big states. The combination of proportional and equal representation, together with the House proposal power on budgetary matters, should grant adequate consideration to the interests of all states, independently of their population size.[1] In fact, Ansolabehere et al. (2003) provide a formal model showing how the attribution of proposal power to the lower house may indeed counterbalance the malapportionment in the upper house leading to an equal distribution of per-capita government expenditure.[2]

Despite the proclaimed virtues of the double representation system, the current empirical literature provides large support for the existence of a small state advantage in the allocation of the US federal budget.[3] In particular, the pioneering and very influential work of Atlas et al. (1995) (henceforth AGHZ), analyzing biennial data between 1972 and 1990, finds a strongly significant relationship between per-capita representation in the US House and Senate and per-capita federal spending. They introduce in the empirical literature a measure of state

[1] In relation to the risk of overrepresentation of the small states, Madison writes: "The large States, therefore, who will prevail in the House of Representatives, will have nothing to do but to make reapportionments and augmentations mutually conditions of each other; (...) These considerations seem to afford ample security on this subject (...) Admitting, however, that they should all be insufficient to subdue the unjust policy of the smaller States, or their predominant influence in the councils of the Senate, a constitutional and infallible resource still remains with the larger States(...) . The House of Representatives cannot only refuse, but they alone can propose, the supplies requisite for the support of government. They, in a word, hold the purse (...) (Madison 1788). For a critical view on Senate representation in the US constitution see Dahl (2002).

[2] See Knight (2005) for an empirical investigation of the impact of the proposal power of individual congressional representatives, such as committee members, over spending at the district level.

[3] The actual process through which Senate overrepresentation could generate a bias in federal budget allocation might be related to the process of congressional bargaining. Since less funds are necessary to obtain the same increase in percapita expenditure in a smaller than in a larger state, senators who need to build winning coalitions to bring federal spending to their constituents will typically ask smaller states to enter the coalition to minimize the cost of buying political allies (Lee (1998); Knight (2004)).

overrepresentation (the number of representatives per capita) which has become very common and has inspired a number of subsequent works. Lee (1998), using Bickers and Stein (1991) data on domestic outlays from 1983 to 1990, finds evidence of overspending in small states for non-discretionary distributive programmes that are allocated via formulas determined by the Congress. Hoover and Pecorino (2005), considering a different time period (1983-1999) and a broad range of spending aggregates, find that states' representation in the Senate is positively related with total per-capita outlays as well as with procurement, grants, wages and pensions.[4] Finally, Knight (2004) does not find strong effects of Senate overrepresentation on aggregate spending, although he does on earmarked projects: the effect is particularly strong if the earmark comes from the Senate.[5] Hauk and Wacziag (2007), using the authorizations from the 2005 Highway Bill, confirm the existence of an overrepresentation effect on transportation earmarks.

The evidence provided by existing studies rises some fundamental questions about the US bicameralism. According to the estimates of AGHZ, in 1990 the difference in total real per-capita spending due to overrepresentation between the most overrepresented (Wyoming) and the most under-represented (California) states is equivalent to approximately one third of the total spending of Wyoming.[6] The estimated coefficients of senators percapita found from other empirical studies point to similar magnitudes (Wright (1974); Wallis (1998); Larcinese et al. (2006)).

In this paper we reconsider the hypothesis that small states receive more federal funds and argue that the results of previous empirical research are extremely non-robust to specification changes. We illustrate a number of findings that are at odds with the idea that small states have an advantage in spending allocation. First of all, by using the same indicator of AGHZ, we find no evidence of a bias in favor of small states in cross section regressions.[7] Only when considering within-state variation, the number of senators per capita becomes statistically significant.[8] The second puzzling result is that the effects of overrepresentation are particularly strong on spending aggregates, such as direct payments to individuals,[9] that are less politically

[4] They, however, find a negative impact of House representation.

[5] At district level, Ansolabehere et al. (2002) analyze the effect of unequal representation prior to 1960 and the equalizing impact on state transfers to counties following the court-ordered redistricting in the 1960s.

[6] AGHZ estimate that the difference is equal to 1148$ in 1990 dollars.

[7] This is consistent with previous findings by Lee (1998) and Knight (2004).

[8] Previous studies that find a strong small state advantage all use fixed effects models. Recent examples are Hoover and Pecorino (2005) and Larcinese et al. (2006).

[9] Direct payment to individuals include mainly entitlement programs such as social security, retirement

manipulable at the state level.[10] Third, if we omit the AGHZ indicator from our regressions and analyze the estimated fixed effects (which should then contain the overrepresentation effect) we discover that, after controlling for socio-demografic indicators, the larger states receive more funds than the average.

Building on these findings, we show that the AGHZ indicator does not identify the effect of malapportionment: this remains at the moment a fundamentally unidentifiable effect, at least on large spending aggregates. The coefficient of senators per capita should represent, in the interpretation of AGHZ, a constant relationship between overrepresentation and the spending received by each state. We show that this relationship is not constant across states and that the equations estimated by most empirical researchers impose therefore a restriction which is not supported by a standard F-test. This means that equalizing the number of senators per capita, and controlling for other relevant socioeconomic variables, would not be sufficient to eliminate spending differentials: these are, therefore, independent of both overrepresentation and observable socioeconomic factors. What the current literature interprets as the effect of malapportionment may be instead the consequence of different state specific trends in federal spending: this would explain why the effect is only found in fixed effects models.

Our results are compatible with behavioural "incrementalist" theories of budgeting (Wildavsky 1964), which claim the current spending to be largely predetermined by past budget allocation. The inertia in the budget process implies that the growth (decrease) in population is typically not compensated by a proportional increment (decrease) in federal spending, thus determining a decrease in spending per-capita in states with a fast-growing population and an increase in states where the population decreases or grows slowly. In fact, we find a remarkable inverse pattern between per-capita expenditure and population growth rates which has nothing to do with a state being large or small. All together, our results suggest that the inverse relationship between federal spending and population found by previous studies using broad spending categories hides an important heterogeneity of patterns at state level which does not provide evidence on small states' advantage in the federal budget allocation.[11]

benefits and health care programs.

[10] See Atlas et al. (1995) and Hoover and Pecorino (2005).

[11] Panel studies using very specific spending aggregates might not be affected by those shortcomings as long as the programs analyzed may be less likely to display the state-specific relationship with senators percapita that we find for large spending aggregates. However, our analysis suggests that a careful investigation is necessary to obtain a correct interpretation of the estimated coefficients in fixed effect type regressions.

2 Some puzzling results

Population size varies considerably across US states and so does per-capita Senate representation. Table 1 reports an index of Senate and House overrepresentation by state during the period 1978-2002. Under or overrepresentation is determined by comparison with a fair representation given by the ratio between the total members of the House (or Senate) and the total US population in a given year.[12] States are ordered by average population in the period 1978-2002 (starting with the smallest) and obviously smaller states are overrepresented in the Senate. In the House, however, this phenomenon is negligible and not correlated with the population size of a state. Table 1 also reports average federal spending per capita by state in the period considered, showing that there is no clear pattern linking Senate overrepresentation and spending. This can be seen graphically in Figure 1, where the states are ordered along the horizontal axis according to their average population in the period considered, while on the vertical axis we report average per capita outlays.

A well established procedure introduced by AGHZ to estimate the effect of overrepresentation is to regress federal outlays on per capita representation (i.e. the ratio of the number of House or Senate members over the population, per state). AGHZ find a positive impact on spending of per capita representation in both the Senate and the House. However, the effect of the House has never been confirmed by any of the subsequent studies. This should not be surprising since the number of House representatives is readjusted periodically in accordance with demographic changes. Indeed, looking at Table 1, there is no clear pattern in the relationship between House representation and the malapportionment index. For this reason, in the following we will focus on the Senate. All our estimations have been replicated by also including House representatives per capita, with two main conclusions.[13] First, all the results we find on Senate overrepresentations are not affected by the introduction of House representatives percapita. Second, consistently with other studies, the coefficient of House representatives per capita is sometimes positive, more often negative, and never statistically significant at any ac-

[12] More specifically, define N_{st} as the population of state s in year t and $USpop_t$ as the total US population (in the 48 states considered) in year t. Then the overrepresentation index in year t for the Senate is given by $\frac{2}{N_{st}}/\frac{96}{USpop_t} = \frac{USpop_t}{48*N_{st}}$, while for the House is $\frac{hm_{st}}{N_{st}}/\frac{432}{USpop_{st}}$, where hm_{st} is the number of House representatives of state s in year t and 432 is the total number of representatives when Alaska and Hawaii are excluded. A value of 1 means that the state representation is perfectly equal to the national average, while an index above (below) 1 means overrepresentation (underrepresentation). Table 1 reports state-level averages of this index for the period 1978-2002.

[13] The detailed results are available from the authors upon request.

ceptable level. The rather peculiar result of AGHZ concerning the House representation remains puzzling and should probably only be considered a sampling accident.

Focussing on Senate overrepresentation, the standard procedure amounts to estimating the following equation:

$$\begin{aligned} FEDEXP_{st} &= \alpha_s + \beta_t + \gamma * SP_{st-1} + \boldsymbol{\theta}\mathbf{Z}_{st} + \epsilon_{st}, \\ s &= 1, ...48; \quad t = 1978, ...2002; \end{aligned} \tag{1}$$

where $FEDEXP_{st}$ is real per-capita federal expenditure (outlays) in state s at time t, α_s and β_t represent respectively the state and year fixed effects, SP stands for *senators per capita*, and Z_{st} is a vector of socioeconomic control variables.[14]

We estimate equation 1 using Census data for the US States during period 1978-2002. Compared to previous studies, this is the longest period ever considered.[15] Summary statistics are reported in table 2. In Table 3, we report our estimates of equation (1). We start with a simple regression of real federal spending per capita on senators per capita and then progressively include year dummies, socioeconomic control variables and, finally, state fixed effects. Only the introduction of state fixed effects renders the coefficient of senators per capita significant. Hence, similarly to AGHZ, we find that the impact of senators per capita is large and statistically significant when state fixed effects are included. The magnitudes are also relatively similar. The significance of SP, however, disappears if the fixed effects are removed.[16] Analogously, SP is far from significant when using the between estimator (column 5). Therefore, the estimation of the overrepresentation effects relies entirely on the variation of senators percapita within states over time, while the between variation seems to play no role despite the large differences of states percapita representation in the Senate.

[14] A lag occurs between the appropriation of federal funds and the moment when funds are actually spent. This is relevant when estimating the effect of particular institutional and political variables, since current federal outlays have normally been appropriated in past budgetary years (Larcinese, Rizzo, and Testa 2006). Delays should therefore be taken into account by introducing lagged values for SP, as well as for any other political variable, since past policy makers are responsible for current outlays.

[15] Census data for most spending categories are available starting from 1978, the exceptions being grants (available from 1977) and procurements and salaries (available only from 1982 onwards). AGHZ use biennial data from the Almanac of the American politics for some spending outlays starting from 1973, however those data cannot be matched with census data.

[16] The same result can be obtained from yearly cross-section regressions. These estimates are not reported but are available from the authors upon request. These results are consistent with Knight (2004) who also finds a very modest impact of overrepresentation in cross-section regressions.

In Table 4 we report the estimates obtained for all the spending aggregates that are available from the Statistical Abstract of the United States, considering specifications both with and without fixed effects (but always including year dummies and socioeconomic control variables). Once again, introducing the state fixed effects makes a big difference for the sign and significance of senators per capita. For the specification without fixed effects, only in the grants equation the coefficient of senators per capita comes with the expected positive and significant sign. In all the other cases, the coefficient has the "wrong" negative sign and, in the case of procurement and defense spending, it is even statistically significant. When state fixed effects are introduced, the impact of senators per capita becomes positive in all the equations and it is statistically significant in the case of direct payments to individuals, salaries and grants. In this last case, the coefficient has almost been doubled by the introduction of state fixed effects. While direct payments, salaries, and grants are all significantly explained by the number of senators per capita, the same does not apply to defense[17] and to procurement spending.[18] These, however, are outlays that are at least as likely to be subject to political pressures as direct payments, salaries, and grants . While the current literature tends always to report fixed effects estimates only, it is worth noting that the results on the effect of overrepresentation are generally not found in cross-section regressions. Although there are obviously good reasons to include state fixed effects, the fact that the results vanish in cross-section regressions (with the exception of grants) is rather puzzling.

Finally, we estimate equation (1) without the SP indicator. In this case we expect the effect of malapportionment to be incorporated in the fixed effects. Figure 2 plots the estimated fixed effects versus the average state population (1978-2002).[19] The picture is rather different from what one would expect if overrepresentation had any sizeable effect. In fact, after controlling for socioeconomic indicators, larger states appear to receive disproportionately more funds than smaller states.

Overall this is a rather puzzling picture, from which any definitive conclusion should be considered very premature. These are, however, the foundations upon which the common

[17]Our results are different from AGHZ who find a significant impact of senators percapita on defense. If we run our regression only for the period 1978-1990, we also find a significant effect. However, the significance disappears in the larger sample.

[18]Similarly to Hoover and Pecorino (2005) we find that the coefficient of over-representation in the procurement equation is positive and significant. This result, however, is not robust to clustering the standard errors at the state level.

[19]Using average population is a meaningful exercise since the ranking of the various states in population terms is relatively stable over the period considered.

wisdom on the effects of malapportionment is usually based.

3 Reconsidering the basic specification

To cast new lights on the estimation of overrepresentation effect on federal spending, we reconsider the basic specification used by the existing literature, rewriting the basic equation (1) as follows (for simplicity we omit the time dummies and the lags in the overrepresentation indicator and report explicitly the coefficient of the population):

$$\frac{y_{st}}{N_{st}} = \alpha_s + \gamma * \frac{2}{N_{st}} + \delta N_{st} + \boldsymbol{\theta} \frac{z_{st}}{N_{st}} + \epsilon_{st}, \tag{2}$$

Now y_{st} is total federal spending in state s at time t, N_{st} is the total population, z_{st} represents absolute values of variables that in equation (1) appear instead in per capita and percentage terms. The overrepresentation indicator is simply given by the number of senators divided by N_{st}. If we multiply both sides by N_{st} we obtain

$$y_{st} = \alpha_s N_{st} + 2\gamma + \delta N_{st}^2 + \boldsymbol{\theta} z_{st} + N_{st}\epsilon_{st} \tag{3}$$

In this equation the overrepresentation is captured by the constant term (2γ). Hence, any factor that induces a positive constant term in the total spending regression (equation 3) would be interpreted as overrepresentation in percapita spending regression (equation 2). It is obvious that the factors that can possibly enter in the constant term are very numerous and there is no reason to believe that overrepresentation should even be the most relevant of them. Therefore equation (2), with or without fixed effects, cannot identify the impact of overrepresentation on spending. Moreover, equation (3) imposes a common intercept for all the states (2γ), while allowing for a differentiated impact of the population via α_s. Specification (3) is therefore appropriate only if we believe that the population is the sole source of state specific variation in total federal spending. If, as reasonable, we believe that this is not the case, then a better specification would be one that includes states fixed effects (denoted by γ_s):

$$y_{st} = \alpha_s N_{st} + 2\gamma_s + \delta N_{st}^2 + \boldsymbol{\theta} z_{st} + N_{st}\epsilon_{st} \tag{4}$$

from which our equation of federal spending per-capita would be specified as

$$\frac{y_{st}}{N_{st}} = \alpha_s + \gamma_s * \frac{2}{N_{st}} + \delta N_{st} + \boldsymbol{\theta} \frac{z_{st}}{N_{st}} + \epsilon_{st} \tag{5}$$

Like equation (1), equation (5) does not enable us to identify overrepresentation; however, it allows us to separate the impact of other state-specific factors (α_s) from the potentially state specific impact of having different per capita representation in the senate (γ_s). This point is very important because from our previous analysis we know that (a) overrepresentation is only relevant when within state variation is considered and (b) previous studies use the *within* regressions to estimate the spending differentials *between* states due to overrepresentation. The estimated coefficients in the within regressions capture the relationship between overrepresentation and spending within a state, over time and only if this relationship is the same in each state, can those coefficients also be used to make comparisons across states. Hence, to estimate states' spending differentials due to overrepresentation in the fixed effects type regressions it is crucial to verify whether the γ_s coefficients are not statistically different between states.

The main results from the estimation of equation (5) are easily summarized. First, with a simple F-test we can formally reject the hypothesis that $\gamma_s = \gamma \; \forall s$. Moreover, by plotting γ_s against the average state population (Fig. 3), it is also evident that there is no clear pattern in their magnitude. Only for grants we find significant below-average coefficients for large states, while for salaries the estimated coefficients (when significant) are mainly positive and larger states appear to benefit from increases in overrepresentation more than small states. The case of salaries provides a further clarification of our point: since all the significant state-specific coefficients in the salaries equation are positive, it is not surprising to find that, if we impose a common γ to all states, the resulting estimate would be positive (Table 4, column 8). This result, however, hides an important heterogeneity in such effects and tells us nothing about the consequences of malapportionment.

Since the coefficient of senators per capita varies from state to state, between-states comparisons that use the aggregate coefficient γ can be misleading. One of the most striking conclusions of AGHZ is that, in 1990, Wyoming received \$1148 per-capita more than California due to overrepresentation in the Senate. This magnitude is derived by using the estimated coefficient $\widehat{\gamma}$, which is supposed to hold constant across states. Our analysis, however, shows that the individual γ_s are very different and therefore can only be used to analyze the evolution of spending with respect to senators percapita within a state, over time. This delivers much smaller magnitudes for changes in the number of senators per capita. More importantly, however, since the γ_s are different across states, it makes little sense to interpret $\widehat{\gamma}$ as an estimate of the impact of overrepresentation: even equalizing the number of senators per capita across states, and accounting for all the other variables included in the regressions, the differentials in spending would persist.

4 State-specific trends in federal spending

It is possible to provide a different and more plausible interpretation of the AGHZ results. Real federal spending per capita has increased substantially during the period we consider and displays a clear upward trend. Such trend, however, is also substantially different from state to state[20] and appears to be highly related to the different population dynamics. A simple graphical analysis can illustrate the inverse relationship between spending per capita and state population quite effectively. We construct an index that represents the ratio between real spending per capita in each state and average real spending per capita in the total of the 48 states we consider. We fix this index to 100 in 1978: hence, an increase in the index above 100 means that the state receives a higher spending share compared to 1978. We construct an analogous index for the population of each state. The evolution of the spending and of the population indices over time, reported in Figure 4, shows a remarkable degree of divergence: an above average increase in population is almost always mirrored by a below average increase in federal spending per capita. For example, California and Texas are two underrepresented states with growing population and correspondingly decreasing federal spending per capita. Pennsylvania and Ohio are also heavily underrepresented, but with a decreasing population: they display an increase in the federal spending index, i.e. an above average growth in spending. Coming to the overrepresentated states, Wyoming displays a rather interesting pattern: its population is growing fast until the mid-eighties, with its share of spending per capita decreasing

[20] We estimated the state trends for federal outlays percapita over the period 1978-2002. In most states the trend is positive and significant at 5% or 1% levels. In five states only (California, Missouri, Nevada, New Hampshire, and Utah) the estimated trend is not significant. For states where a positive trend is observed, the implied growth rate of federal outlays varies considerably, with estimated coefficient values in the range 25.91-173.18 (with a standard deviation of 45.38). Also, the correlation coefficient between senator per-capita and the trend variable is almost always bigger than 0.95. The analysis of state trends for other spending variables also confirms that the various budgetary aggregates follow very different time patterns across the US states. These results are available from the authors upon request.

correspondingly. Once, however, the population of Wyoming decelerates its growth compared to national average, its share of spending per capita starts increasing. Utah has an increasing population and a decreasing share of spending. West Virginia, another small state, has instead a decreasing population and receives increasing shares of spending. Nevada is an overrepresented state with the fastest growing population in the US: its spending index is constantly below its even level, although not as much as its population growth would suggests, indicating that federal spending is somehow adjusted to increasing needs, although not enough to keep the pace that would be required to maintain a constant index.

These results suggest that the process of federal budget allocation to the states can be well captured by incrementalist theories (Wildavsky 1964). These posit that the budget in each year is determined by small-scale marginal changes of past budgetary provisions, since the temporal, financial and cognitive resources available in each year do not allow a rigorous re-examination of the current budget and the possibility to analyze a vast range of alternatives. The consequent inertia in spending allocation creates disadvantages for states with a fast growing population. Moreover, according to our analysis, the inverse relationship between spending and population varies from state to state. This finding is not surprising if one considers the diversity of federal spending patterns across states. Table 4 summarizes the composition of spending by state over the period 1982-2002, showing a substantial degree of heterogeneity.[21] The influence that individual states can exert on federal programs may explain both this heterogeneity as well as the state-specificity of the coefficient of senators per capita. States enjoy substantial discretion in promoting outreach or restricting access to welfare programs such as, for example, health care, unemployment benefits or education, that may be fully or partially federally funded.[22] Furthermore, state characteristics may themselves require the allocation of federal funds to spending items that, by formula, adjust differently to population.[23] Finally, for some programs,

[21] For example, while in California, the average share of direct payments to individuals and grants during the period 1982-2002 amounts to respectively 51% and 17% of the federal budget, in Wyoming, during the same period, only 35% of federal spending is allocated to direct payments while 26% is spent in the form of grants. This heterogeneity is also present in the broad sub-categories which include quite different spending items. For example, for direct payment to individuals, which represent the largest spending category of the federal budget, if we consider direct payments other than retirement and social security, the share of spending programs such as medicare and its subcomponent vary substantially across states.

[22] For example, on medicaid - which is one of the largest entitlement programs jointly funded by federal and state goverments - states have discretionarity in increasing access to other groups besides the ones automatically eligible and in excluding some types of immigrants.

[23] Productive activities that become state specific, because of physical or technological constraints, may substantially bias the composition of federal spending toward budget categories that react differently to population changes. To illustrate the importance of those state-specific spending patterns, it may be worth noting, for

such as matching grants, where states actively seek to attract federal monies, preferences for various spending categories as well as ability to secure funds may vary substantially across states implying that they will not necessarily obtain the same amount of funds even if they face similar population dynamics. As a consequence, when large spending aggregates are analyzed, the state specific inverse relationship between spending and population, that appears to have little to do with overrepresentation as such, may explain why the various γ_s are very different from each other.

5 Conclusions

According to a vast empirical literature originated with the seminal work by Atlas et al. (1995), small states, that are overrepresented in the Congress, are the main beneficiaries of federal largesse. For obvious reasons, this phenomenon is claimed to be particularly strong for the Senate, where states are represented by the same number of senators independently of their population size.

In this paper we have reconsidered congressional overrepresentation by focussing on the econometric specification used in the existing literature. Evidence of small state advantage is usually found in regressions that include state fixed effects, and not in cross sectional studies. Although including fixed effects is crucial to avoid omitted variable problems, an identification strategy based on within state variation can be problematic, since the dynamics of malapportionment crucially depend on variations in the population size of the various states. These typically display different demographic patterns, with expenditure adjusting slowly to such changes. Using senators per capita as a measure of overrepresentation is equivalent to imposing a common intercept in the total federal spending equation. A positive coefficient can then be interpreted in many ways and the impact of malapportionment remains unidentified. Moreover, imposing a unique coefficient of senators per capita, i.e. a common intercept in the total spending equation, represents an inappropriate specification: a simple F-test shows that the states have different coefficients of senators per capita. This means that variation in spending due to overrepresentation can only be compared within a state and not across states. As

example, that in North Dakota agricultural assistance amounts to nearly 70% of direct payments other than retirement and disability, due to the importance of the agricultural sector in this state, while Virginia, which is one of the states with the highest concentration of defense investments, displays a record high spending in salaries mainly due to military personnel.

a consequence, spending differentials associated with senators percapita would not disappear even if we could equalize percapita representation in the senate. They have little to do with malapportionment and must be explained by different factors related to population dynamics and other state-specific trending variables. On a more general note, estimates derived from fixed effects regressions should be used with caution when making statements that relate to variation in the cross-section.

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Table 1: Average population, overrepresentation, and spending in the period 1978-2002

state	population (millions)	Senate overrepresentation	House overrepresentation	Federal spending per capita (real 1983 thousands USD)
WY	0.480	10.844	1.205	3.144
VT	0.558	9.305	1.034	2.726
ND	0.651	7.995	0.888	3.807
DE	0.677	7.692	0.855	2.731
SD	0.715	7.254	0.956	3.329
MT	0.836	6.210	1.097	3.340
RI	0.993	5.227	1.162	3.297
ID	1.080	4.838	1.075	2.862
NH	1.082	4.820	1.071	2.673
ME	1.204	4.310	0.958	3.212
NV	1.302	4.376	0.839	2.810
NM	1.553	3.364	1.041	4.437
NE	1.618	3.207	1.069	2.969
UT	1.812	2.904	0.896	2.738
WV	1.851	2.815	1.113	3.020
AR	2.419	2.146	0.954	2.856
KS	2.511	2.066	1.053	3.093
MS	2.639	1.966	1.092	3.249
IA	2.856	1.820	1.126	2.736
OR	2.942	1.772	0.945	2.635
OK	3.235	1.605	1.070	2.975
CT	3.260	1.592	1.061	3.632
CO	3.499	1.499	0.963	3.170
SC	3.523	1.477	0.985	2.897
KY	3.781	1.372	1.004	2.910
AZ	3.805	1.418	0.802	3.046
AL	4.121	1.259	0.979	3.227
LA	4.323	1.201	1.011	2.873
MN	4.439	1.170	1.040	2.617
MD	4.757	1.093	0.972	4.447
WA	4.945	1.060	0.961	3.383
WI	4.977	1.043	1.043	2.375
TN	5.017	1.036	1.013	3.080
MO	5.194	0.999	1.020	3.721
IN	5.671	0.915	1.036	2.440
MA	6.014	0.863	1.032	3.664
VA	6.199	0.840	0.970	4.595
GA	6.663	0.789	0.909	2.795
NC	6.803	0.767	0.971	2.504
NJ	7.826	0.663	1.015	2.793
MI	9.447	0.549	1.059	2.444
OH	10.978	0.473	1.078	2.652
IL	11.711	0.443	1.060	2.561
PA	11.978	0.433	1.084	3.054
FL	12.854	0.412	0.893	3.160
TX	17.447	0.300	0.917	2.695
NY	18.125	0.286	1.071	3.104
CA	29.102	0.180	0.944	3.176

Table 2: Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Obs.	
Population (in millions)	overall	5.20	5.48	0.43	35.12	N =	1200
	between		5.47	0.48	29.10	n =	48
	within		0.81	-1.60	11.21	T =	25
Senate overrepresentation	overall	0.97	0.99	0.06	4.71	N =	1200
	between		1.00	0.07	4.18	n =	48
	within		0.13	0.16	2.25	T =	25
House overrepresentation	overall	1.76	0.24	0.92	2.90	N =	1200
	between		0.14	1.42	2.09	n =	48
	within		0.20	0.96	3.03	T =	25
Federal Spending percapita	overall	3.08	0.61	1.79	5.68	N =	1200
	between		0.50	2.37	4.60	n =	48
	within		0.35	1.53	4.91	T =	25
Direct Payments to individuals	overall	1.58	0.33	0.80	3.53	N =	1200
	between		0.18	1.12	2.07	n =	48
	within		0.28	0.73	3.45	T =	25
Grants	overall	0.52	0.17	0.23	1.39	N =	1200
	between		0.12	0.34	0.95	n =	48
	within		0.12	0.26	1.04	T =	25
Salaries	overall	0.41	0.19	0.08	1.38	N =	1008
	between		0.19	0.17	1.22	n =	48
	within		0.05	0.06	0.57	T =	21
Procurements	overall	0.48	0.36	0.09	2.34	N =	1008
	between		0.33	0.15	1.58	n =	48
	within		0.16	-0.16	1.58	T =	21
Defense	overall	0.54	0.36	0.06	2.51	N =	1200
	between		0.34	0.11	1.99	n =	48
	within		0.15	-0.19	1.33	T =	25
Income (real 2000 USD)	overall	13.95	2.52	8.60	24.07	N =	1200
	between		1.96	10.33	19.52	n =	48
	within		1.61	9.24	18.80	T =	25
% Unemployment	overall	5.97	2.11	2.20	18.00	N =	1200
	between		1.19	3.58	9.41	n =	48
	within		1.75	1.36	15.26	T =	25
% aged above 65	overall	12.26	1.84	7.00	19	N =	1200
	between		1.72	8.30	17.9	n =	48
	within		0.7	9.77	14.3	T =	25
% in schooling age (5-17)	overall	19.39	1.86	1.55	26.58	N =	1200
	between		1.36	16.76	24.67	n =	48
	within		1.3	16.05	24.74	T =	25

Note. *All spending variables and income are expressed in real 2000 USD. For clarity, state population is reported in millions. However, the coefficients in the regressions refer to this variable divided by 1,000,000,000,000. Analogously, unemployment, aged and schooling are reported in percentages here but used as shares in the regressions. All the variables have been taken (or constructed) from the Statistical Abstract of the United States.*

Table 3: OLS regressions with real federal outlays per capita as dependent variable

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	federal spending	federal spending	federal spending	federal spending	federal spending
senators per capita	0.0239	0.0409	0.0186	0.7036	0.0089
	(0.40)	(0.68)	(0.23)	(7.69)***	(0.09)
income			-0.0022	-0.0786	0.0008
			(0.06)	(2.33)**	(0.01)
share of unemployment			-1.4844	0.3875	-2.2027
			(0.50)	(0.30)	(0.29)
state population			-12.4005	-67.7994	-12.8143
			(1.01)	(3.72)***	(0.7)
share aged above 65			-3.1013	10.3895	-4.270599
			(0.62)	(3.10)***	(0.7)
share in schooling age (5-17)			-8.5116	-8.3337	-9.0375
			(1.65)	(3.33)***	(0.92)
Constant	3.0526	3.6986	5.5007	4.9081	5.5299
	(29.67)***	(33.25)***	(2.89)***	(4.31)***	(1.68)
Year Dummies	no	yes	yes	yes	between est.
State Fixed Effects	no	no	no	yes	between est.
Observations	1200	1200	1200	1200	1200
Overall R-squared	0.0016	0.2178	0.2561	0.9177	0.1127

Robust t statistics in parentheses from standard errors clustered by state (except in column 5).
** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 4: OLS regressions with aggregates from the Statistical Abstract
A: without state fixed effects

	(1)	(2)	(3)	(4)	(5)
Dep. Variable	**direct payments to individuals (1978-2002)**	**grants (1978-2002)**	**salaries (1982-2002)**	**procurement (1982-2002)**	**defense (1978-2002)**
senators per capita	-0.0018	0.0979	-0.0049	-0.0960	-0.0983
	(0.17)	(5.23)***	(0.18)	(2.85)***	(2.49)**
income	-0.0130	0.0021	-0.0152	0.0220	0.0079
	(1.87)*	(0.31)	(1.44)	(0.97)	(0.31)
share of unemployment	2.6744	1.9982	-2.4802	-1.5815	-4.7857
	(5.34)***	(5.04)***	(2.08)**	(0.81)	(2.23)**
state population	-1.6145	3.3834	-3.63	-9.963	-5.7420
	(0.94)	(1.01)	(1.00)	(1.23)	(0.66)
share aged above 65	7.1531	0.9234	-5.4869	-7.5364	-7.3647
	(9.37)***	(1.02)	(2.59)**	(2.79)***	(2.14)**
share in schooling age (5-17)	-4.0966	0.1552	-3.2370	-3.1462	-5.8696
	(3.96)***	(0.19)	(1.54)	(1.21)	(1.49)
Constant	1.9254	0.2949	2.0474	2.0715	2.6502
	(5.26)***	(1.08)	(2.59)**	(2.10)**	(1.81)*
Year Dummies	yes	yes	yes	yes	yes
State Fixed Effects	no	no	no	no	no
Observations	1200	1200	1008	1008	1200
R-squared	0.8463	0.6617	0.2447	0.2346	0.2456

B: with state fixed effects

	(6)	(7)	(8)	(9)	(10)
Dep. Variable	**direct payments to individuals (1978-2002)**	**grants (1978-2002)**	**salaries (1982-2002)**	**procurement (1982-2002)**	**defense (1978-2002)**
senators per capita	0.3202	0.1591	0.1235	0.2030	0.0411
	(3.50)***	(3.47)***	(3.07)***	(1.81)*	(0.75)
income	-0.0313	-0.0071	0.0006	-0.0645	-0.0581
	(2.73)***	(0.99)	(0.12)	(1.56)	(1.79)*
share of unemployment	1.3605	0.8382	0.0139	-1.5041	-1.9838
	(2.45)**	(2.93)***	(0.05)	(1.17)	(1.88)*
state population	-44.0607	-9.4037	-20.8916	-27.1538	-22.2525
	(3.73)***	(1.65)	(4.24)***	(0.98)	(1.13)
share aged above 65	5.6735	2.8024	-0.5620	1.2149	-0.0305
	(2.39)**	(3.37)***	(0.51)	(0.29)	(0.01)
share in schooling age (5-17)	-2.4088	-0.8387	0.0550	-3.5949	-3.4263
	(2.38)**	(1.55)	(0.08)	(1.96)*	(2.56)**
Constant	2.2716	0.4618	0.4706	1.9188	2.2096
	(5.42)***	(2.20)**	(2.29)**	(1.64)	(2.18)**
Year Dummies	yes	yes	yes	yes	yes
State Fixed Effects	yes	yes	yes	yes	yes
Observations	1200	1200	1008	1008	1200
R-squared	0.9101	0.9193	0.9635	0.8647	0.8937

Robust t statistics in parentheses from standard errors clustered by state.
** significant at 10%; ** significant at 5%; *** significant at 1%*

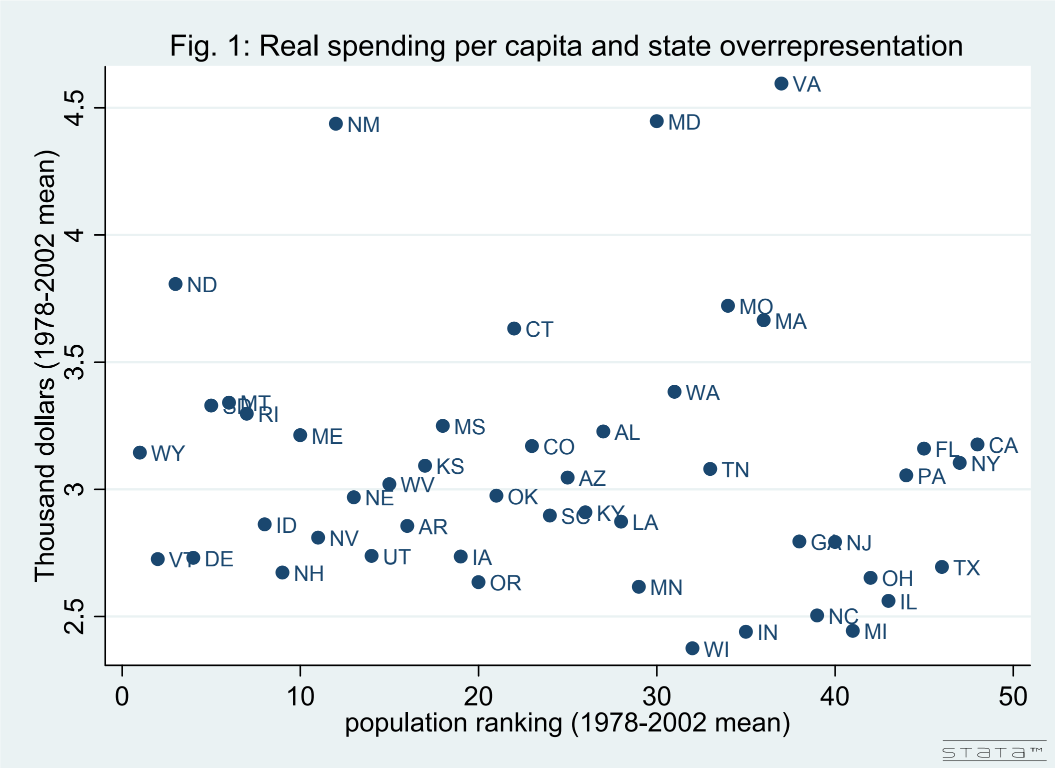
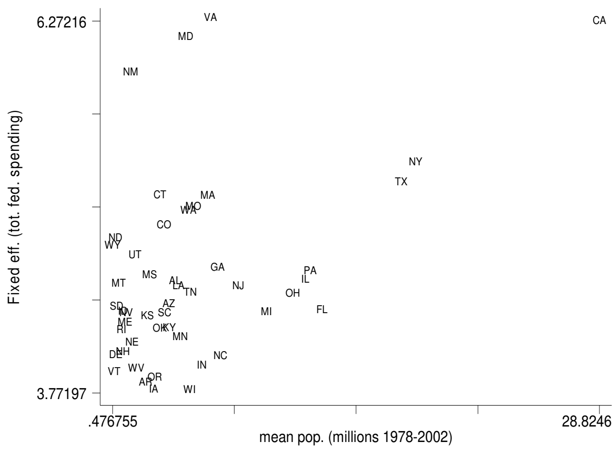
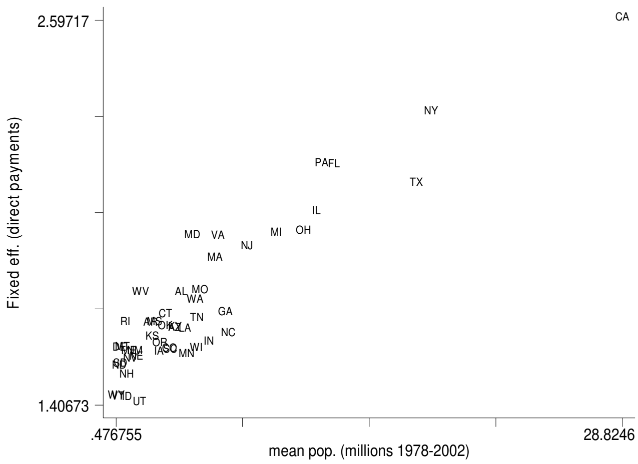


Fig. 1: Real spending per capita and state overrepresentation
Thousand dollars (1978-2002 mean)
2.5
3
3.5
4
4.5
0
10
20
30
40
50
population ranking (1978-2002 mean)
VA
NM
MD
ND
CT
MO
MA
WA
SD
MT
RI
MS
AL
ME
CO
CA
FL
WY
KS
TN
NY
PA
AZ
WV
NE
OK
SC
KY
LA
ID
AR
GA
NJ
NV
VT
DE
UT
IA
TX
NH
OH
OR
MN
IL
NC
IN
MI
WI

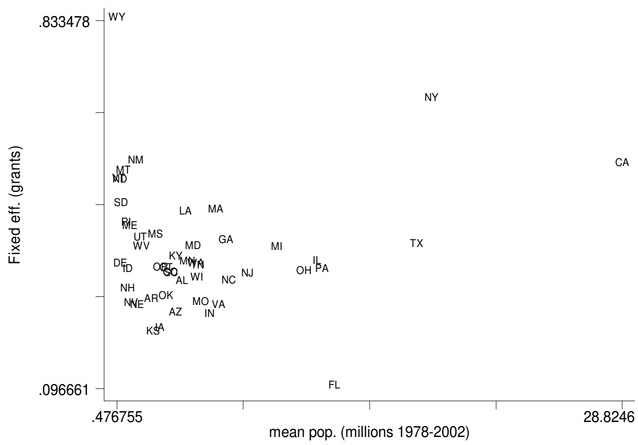
Figure 2: Estimated fixed effects (from equations without senators per capita) and average state population (1978-2002)



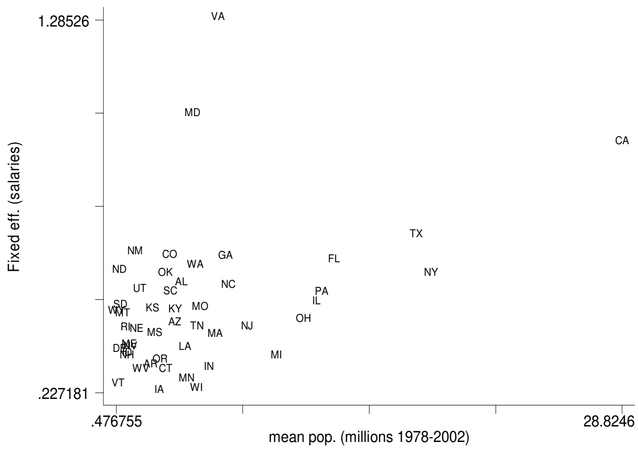
Total Federal Spending



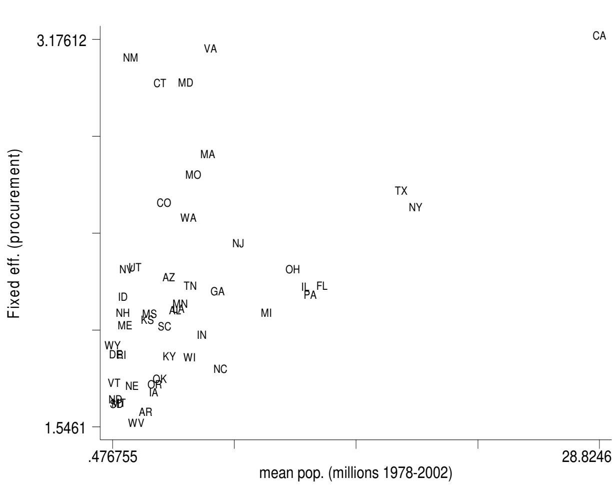
Direct Payments to Individuals



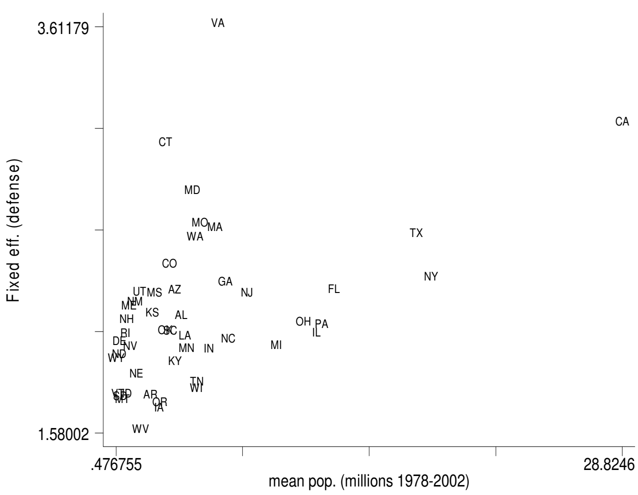
Grants



Salaries

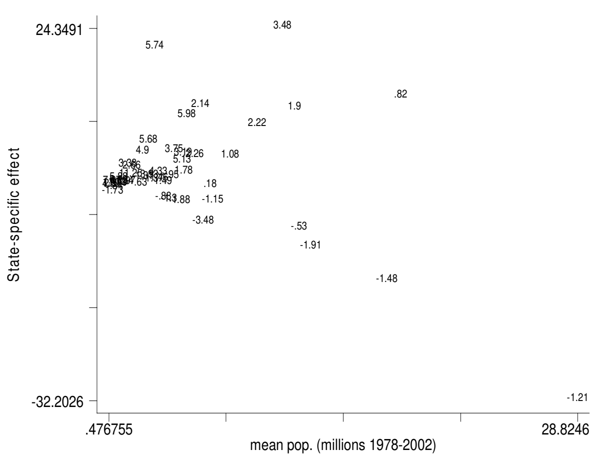


Procurement

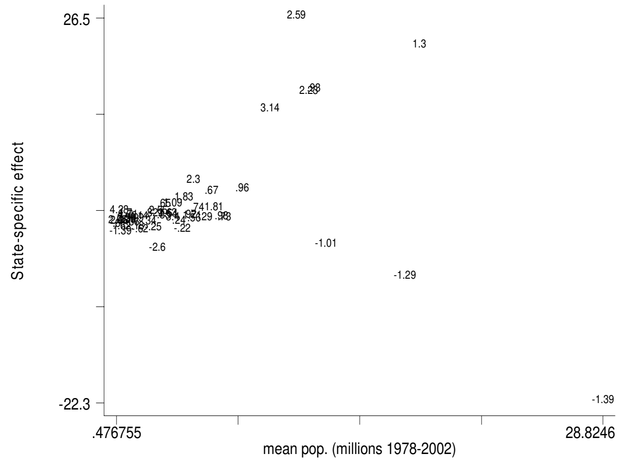


Defense

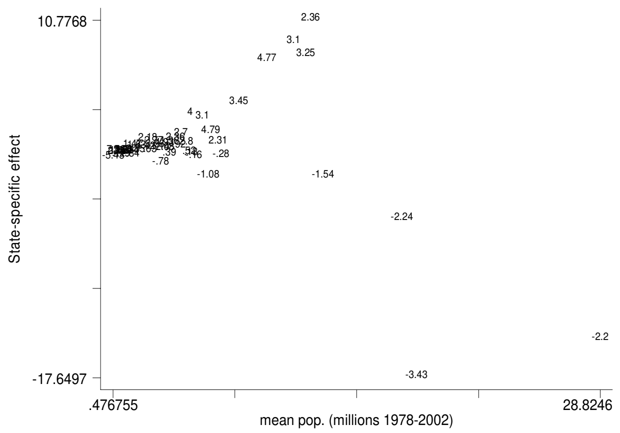
Fig. 3: State-specific effects of senators per-capita (T-ratios of coefficients are reported in the graphs)



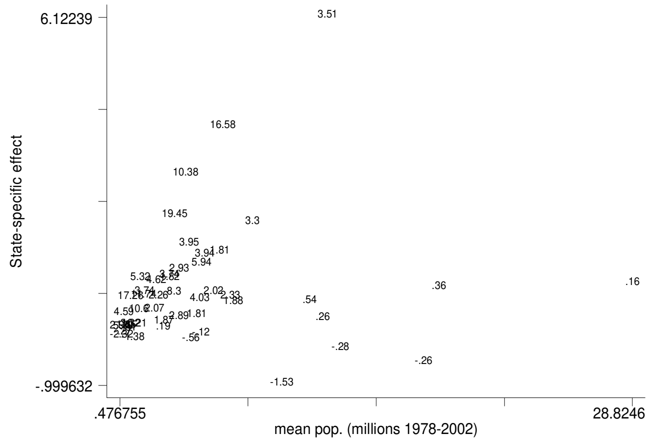
Total Federal Spending



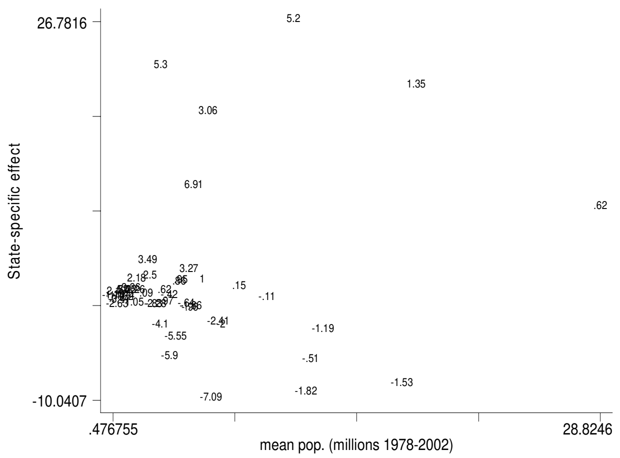
Direct Payments to Individuals



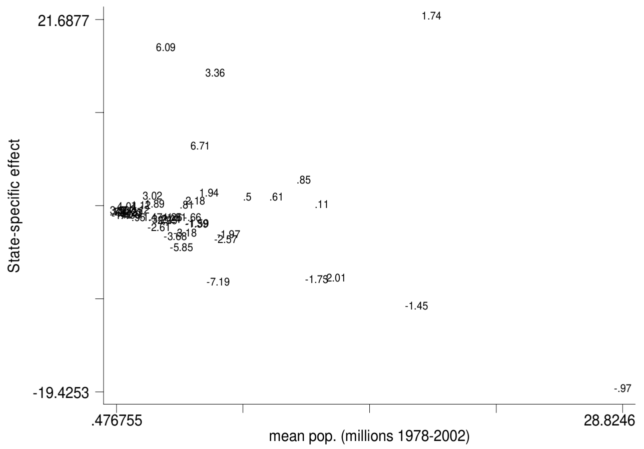
Grants



Salaries



Procurement



Defense

Fig. 4: State shares of population and state shares of federal spending (1978=100)

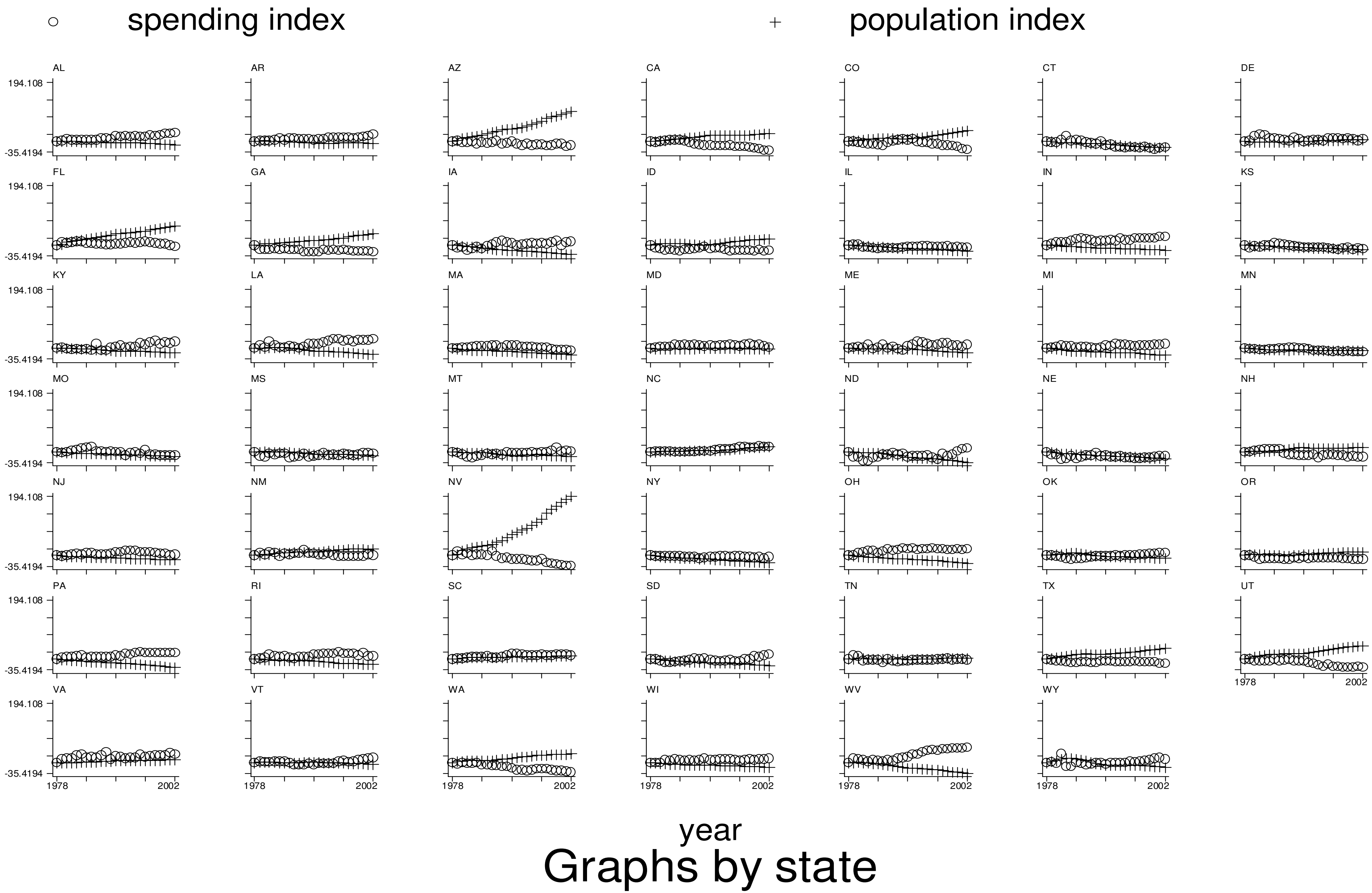


Fig. 5: Federal outlays by spending categories (mean shares 1982-2002)