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Abstract

Remarkably different population dynamics within the US imply that fast growing states are characterized by rapidly changing needs that should be reflected in the allocation of the federal budget. At the same time, budgetary rules preventing major reallocations of the budget, may unfairly penalize fast growing states. To shed lights on this question, in this paper we empirically investigate the relationship between population and the allocation of the US federal budget to the states during the period 1978-2002. States may receive different amounts of spending because of different population sizes (*scale effect*) or pure population dynamics (*change effect*), independently of their size. Using an estimation methodology that allows us to separate the scale from the change effect, we find that population dynamics - rather than population scale - is responsible for a significant inverse relationship between total per-capita spending and population. The importance of population dynamics is confirmed when we analyze more specific spending items, such as direct payments, grants and salaries, whereas for defense and procurement spending we find evidence of scale effects. Altogether our results indicate that fast growing states are penalized in the allocation of the federal budget. The loss of spending for these states is sizeable and could compensated by redistributing federal funds from winning states with lower population dynamics.

JEL codes: D72, H61, H77
keywords: federal budget, redistribution, population dynamics, budgetary inertia.

"Throughout America's history, there have been some years that appeared to roll into the next without much notice or fanfare. Budgets are proposed that offer some new programs or eliminate an initiative, but by and large continuity reigns"(President Barak Obama, 2009).[1]

1 Introduction

The US federal budget allocates every year a sizeable amount of resources - amounting to about 20 percent of the US GDP - to federal spending to finance direct payments to individuals and provide goods and services administered by both federal and state governments. Given the non-negligible amount of tax payers resources involved, the federal budget has typically attracted considerable attention by scholars as well as by the press and the public at large. The sharing of federal resources across spending programs and geographic entities has been widely studied,[2] and particular attention has been devoted the analysis of the determinants of federal budget allocations to the states.[3] According to standard welfare economics, federal resources should be allocated to different states in order to maximize an aggregate social welfare function. Thus, the distribution of funds should basically depend on the needs of the various states which, in empirical terms, should be captured by state economic and demographic variables. In fact, these are important explanatory variables of the cross-states differences in federal budget allocation, even in empirical investigations that focus on the influence of political (as opposed to economic) variables in the determination of the budget. In particular, one robust empirical finding of the literature on federal budget allocation is the existence of a negative relationship between federal per capita spending and state population: large states tend to receive less per capita funds as compared to small ones. This finding has received considerable attention due to the fact that small states are over-represented in the Senate,[4] suggesting that unequal congressional representation may distort the allocation of the budget. However, as long as the provision of goods and services is characterized by economies of scale associated with the population size, the fact that small states receive higher per capita spending may also be consistent with a social welfare maximizing approach (Ohls and Wales (1972), Wallis (1998)). Since an increase in state

[1] President's Message, A New Era of Responsibility, Renewing America's Promise, Office of Management and Budget

[2] For an overview of the supply and demand side determinants of federal spending see Stein (1981)

[3] The literature on federal budget allocation to the States is vast, for an overview see Larcinese et al. (2006). For European countries a very recent interesting study has been conducted for Spain (Solé-Ollé and Sorribas-Navarro (2008)).

[4] For and overview of the literature on congressional malapportionment see Hoover and Pecorino (2005).

population is simultaneously associated with increased needs, potentially larger economies of scale and decreased per capita representation in the Senate, observing a negative relationship between per capita spending and population makes it difficult to draw some clear conclusion on the criteria governing federal budget allocation.

One interesting stylized fact - which has surprisingly been overlooked by the existing literature - seems, nevertheless, particularly at odds with the notion of aggregate welfare maximization. Several representatives of fast growing states have repeatedly voiced their concerns about the unfair mechanism of budget allocation which - according to them - falls short from taking into account the increased needs of their states. The dissatisfaction of fast growing states with the existing mechanism of federal budget allocation culminated with several pieces of legislation - known as the "Fair share act"- introduced in Congress between 1989 and 1993 by the representatives of Florida, Arizona and California[5]. Yet, these concerns seem to have gone unaddressed, as shown by the very 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.[6]

Are fast growing states unfairly penalized in the allocation of the federal budget? In this paper we address this question by focussing on the analysis of inter-temporal dynamics of population and federal budget allocation to shed new lights on the fundamental question of how well federal spending reacts to the changing needs of the federal states. This is a challenging question because federal funds adjusts to population trough different channels. First, states may receive different amounts of spending because they differ in their population sizes (*scale effect*). Second, independently of their size, their spending allocation can vary because of pure population dynamics (*change effect*). For example, more populous states may receive less per-capita spending because of economies of scale in the provision of goods and services. On the other hand, an inverse relationship between spending per capita and population can also

[5] 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/).

[6] 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).

be observed - independently of the size of the states - whenever yearly changes in per capita spending do not appropriately reflect yearly changes in population. In this case, fast growing states, independently of their size, could see a decline of per capita spending because budgetary provisions do not adequately respond to population trends. Therefore, when we observe an inverse relationship between spending and population it is difficult to understand whether this is due to scale effects or to pure population dynamics irrespective of the size of the states. To address this problem, we try to disentangle change and scale effects in a standard spending regression. To this end, we construct a scale-independent index of population dynamics that - used as a further explanatory variable along with the usual population term - allows us to estimate the change effect and provide new evidence on the relevance of population dynamics as opposed to scale economies. In particular, we show that, scale effects and population dynamics both affect spending, but their role varies substantially across spending categories. Starting with total per-capita spending, we find an increasing and concave relationship between spending and population, and a negative significant coefficient for our scale independent index of population. Once we analyze more specific spending items, we uncover that the concave relationship between spending and population is entirely driven by defense and procurement spending, which are typically characterized by large fixed components. On the other hand, for direct payments to individuals, grants and salaries, we do not find any significant scale effect, whereas population dynamics plays a significant role since fast growing states are penalized in the allocation of all spending categories (except defense). Hence, our estimates indicate that fast growing states are penalized in the allocation of the federal pie independently of whether they are large or small. This last result is particularly intriguing and provides support towards the concerns voiced by fast growing states complaining about the unfair treatment of their states in the allocation of the federal budget. In fact, according to our estimates, the budgetary loss for fast growing states is sizable. We estimate that between 1978 and 2002, the fastest growing state of Nevada looses 27 percent of its budget, followed by Arizona with a loss of 14 percent, and Florida of 10 percent. Overall, during the period 1978-2002 we find that 18 states loose together a cumulative 2800 USD per-capita, equivalent to about 5 percent of their overall budget, to the advantage of the remaining 30 states for which this amount is equal to roughly 3 percent of their overall budget.

The factors that can be responsible for this important distortion are numerous and can be traced back to the way the budget allocations are actually determined. First, reallocations of funds are limited by the lack of information available for the drafting of the yearly budget.[7] For example, several programs rely on outdated census data to distribute funds across states.[8] Second, for formula programs, the responsiveness of the budget to population changes is often substantially reduced by specific rules, such as for example "hold harmless provisions" (which guarantee fixed shares of past allocations) and upper and lower bound limits to specific formula components. Third, for programs with an entitlement nature, the response of yearly budget allocation to population dynamics is also affected by its demographic components. For any given increase in population, entitlement spending per capita decreases in States where the population growth is concentrated among social groups not qualifying for entitlements and viceversa. Our results on specific spending aggregates are consistent with these mechanisms of budgetary inertia since fast growing states are penalized in the allocation of federal grants, in which formulas play a primary role, as well as in the distribution of direct payments to individuals, which consist mainly of entitlements.[9] However, since other factors correlated with population dynamics may be responsible for the estimated relationship between spending and our population index, to correct for potentially important omitted variable bias, we also carry out several robustness checks. First, we include lagged spending to control for other sources of budgetary inertia. Second, we add an interaction term between population dynamics and the party of the president to account for changes in spending priorities and resulting budget composition during the period we consider. Our main results remain robust to the alternative specifications, since we find that fast growing states are penalized in the allocation of all spending items (except defense). Once we introduce lagged spending, the size of the population index coefficient is reduced, implying a lower bound for the estimated loss to about 12 percent for the fastest growing state (Nevada) and to about 2.5 percent on average for the 18 loosing states. As for the impact of the party of the president, we find that fast growing states are more penalized in the allocation of grants when the president is republican. This seems consistent with the change in budget composition observed under republican administrations placing more emphasis on defense as opposed to grants.

Our analysis reveals that a substantial degree of inertia reins in the allocation of the budget

[7]As posited by a voluminous literature of behavioral "incrementalist" theories of budgeting originated with Wildavsky (1964), the limited temporal, financial and cognitive resources available in each year do not allow a rigorous re-examination of the current budget which is then determined by marginal changes to past budgetary allocations.

[8]For an official report see "Federal Formula Programs: outdated population data used to allocate most funds" (GAO 1990).

[9]This last finding provides a plausible explanation for the inverse relationship between population and direct payments to individuals, solving one of the most striking puzzles associated with the literature on malapportionment which predicts a large and significant impact of overrepresentation on this hardly targetable spending item.

implying 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. Therefore, the procedures that make public spending not sufficiently responsive to population changes are responsible for important distortions in budgetary allocations to the states.

2 Federal spending and population in the US states

Population size varies considerably across US states. Table 1 reports *the average population* by state during the period 1978-2002.[10] Besides very large differences in their population size, the US states are also characterized by remarkably different population changes during the period we consider. To describe the population dynamics of the states independently of their size, we construct a *scale independent* index of population change dividing the population of every year by the population of a given base year (1978). Hence, in 1978 the index ($POPIND$) is equal to 100 for all states, and in all the other years the index will measure the deviation of the state population from the same base year. The pattern for all states during the entire period is reported in Figure 1. In the upper panel of Figure 2 we report instead the average index for our 48 US states during the period 1978-2002. As we can see, states display very distinct patterns. Moreover, large, medium or small states can be equally found among the fastest growing as well as the slowest growing states. For example, among the three fastest growing states, we have Nevada with an average population of 1.2 million during the period 1978-2002, Arizona with 3.7 million and Florida with 12.7 million. Similarly, among slow-growing states we have New York with an average population of 18 million, as well as Connecticut with 3.2 million and North Dakota with 0.6 million.

Rapidly changing population is typically associated with rapidly changing needs that should be reflected in the allocation of the federal budget to the states. How does federal spending respond to the changing needs of the states associated with population dynamics?

To compare the evolution of spending across states, as we did for population, we construct an index of federal spending change given by the ratio of the state spending per-capita in any given year and the spending per-capita of the base year (1978). In the lower panel of Figure 1 we represent the average spending index by state during the period 1978-2002. The inverse symmetry between the upper and lower panels of Figure 2 is quite striking: the states with the

[10] Like most of literature on the allocation of US federal spending, we focus on the 48 contiguous states.

fastest growing population are typically characterized by the slowest growth of real per-capita spending.

If rather than considering the average, we focus on the evolution over time of spending and population at state level, we obtain a similar picture. A simple graphical analysis can illustrate the relationship between spending per capita and state population quite effectively. We construct two indices that capture for each state the evolution over time of their respective spending and population shares (of the US total).[11] An increase in an index above 100 means that the state has a higher share of the US total compared to its 1978 share. The evolution of these two indices over time, reported in Figure 3, 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, and this pattern is independent of the size of the states since it can be observed, for example, in populous states like California and Texas as well as in “small” Nevada.

3 Determinants of federal budget allocation: the role of population

This preliminary analysis suggests that while some states grow fast in terms of population, spending does not seem to grow at a similar pace. Quite to the contrary, states with little population dynamics seem to enjoy more sustained growth of their spending per capita. This type of evidence - though very suggestive - is not however sufficient to conclude that fast growing states are unfairly penalized in the allocation of the budget. Although fast growing population is typically associated with increased needs, if economies of scale are present in the provision of goods and services, spending does not necessarily need to grow at the same pace of population in order to satisfy increased needs. More formally, changes in the population of the states imply changes in their per capita federal budget allocations via two main channels. First, states may receive different amounts of spending because they differ in their population sizes (*scale effect*).[12] Second, independently of their size, their spending allocation can vary because

[11] For spending we construct a size invariant index by dividing the state per capita spending in each year by its value in 1978. We also construct an analogous index for the overall spending in the United States. The ratio between the state spending index and its corresponding US index will then describe the relative change of spending in a state compared to the US average. We then construct an analogous index for the population of each state by dividing our previously computed scale independent index of population by its corresponding US index.

[12] Differences in spending per capita due to the *scale effect* may arise not only because of economies of scale in the provision of goods and services financed by the federal spending, but also because small states are

of pure population dynamics (*change effect*). Hence, unless one controls for scale effects, the relationship between spending and population dynamics cannot be properly estimated.

The existence of scale effects is typically assessed in the existing literature by introducing in a standard spending regression a linear population term together with its square (to control for non-linearities). This amount to estimating the following:

$$\begin{aligned} FEDEXP_{st} &= \alpha_s + \beta_t + \gamma * Population + \delta Population^2 + \boldsymbol{\theta}\mathbf{Z}_{st} + \epsilon_{st}, \\ s &= 1, ...48; \quad t = 1978, ...2002; \end{aligned} \tag{1}$$

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, and Z_{st} is a vector of socioeconomic control variables.

In table 3 (columns 1-6), we report the result of our estimations using Census data for the US States during the period 1978-2002 on total real per capita spending (outlays) and its sub-components, i.e. direct payments to individuals, grants, salaries, procurement and defense, as defined in the Statistical Abstract of the United States.[13] In the upper panel of Table 3, we report the estimations of the specification with a linear population term that as we can see, has a negative coefficient, although it is significant only in the grants and procurement regressions. Once we include also the quadratic population term (table 3b) we find that the relationship between population and spending (which is now significant for all the spending categories) varies substantially by spending item: for direct payments and grants we find a convex relationship, whereas for defense and procurement it is concave. This explains why when we analyze total spending we do not find a significant relationship. A U-shaped relationship between per-capita spending and population is typically observed in the presence of economies of scale associated with population size: as population increases, initially spending does not need to grow at the same pace to serve increased needs, however - beyond a certain population level - spending per capita needs to grow. On the other hand, for investment spending with large fixed components, an inverse U-shape typically indicates a period of growth of investments: when population grows so do investments and, because of the fixed component, the increase in the stock of investments generates an increase in per-capita spending which is reversed once the investment growth decelerates.

over-represented represented in the Senate, as claimed by the literature on Congressional malapportionent.

[13] The summary statistics for population and real federal outlays per-capita by spending categories are reported in Table 2.

This prima facie evidence suggests that scale effects may be relevant to explain the allocation of federal spending to the states. However, interpreting the coefficient of population as a pure scale effect is clearly problematic because the estimated relationship may also be due to pure population dynamics, irrespective of the size of the states. To illustrate this point, let us now turn to the analysis of the evolution of the US total (as opposed to per-capita) spending and its subcomponent during the period 1978-2002. As we can see in Figure 4a, real total US spending increases during the entire period. However, if we analyze its subcomponents, we will see very different patterns. Apart from total direct payment to individuals, the other spending categories follow a clear non-monotone pattern. In particular, defense and procurement spending display a marked increase until the mid eighties, followed by a marked decrease in the subsequent decade. Given the large investment component typically included in these spending categories, the period of increased investment followed by a reversal can provide a plausible explanation for the inverse U-shaped relationship estimated in the per-capita spending regressions reported in columns (5)-(6) of Table 3b. At the same time, from Figure 4a we can see that grants follow a completely inverse pattern as compared to defense and procurement. If we analyze the shares of these three spending categories over the total spending (Figure 4b) we can notice a remarkable change in the composition of the US spending: the changes of the absolute *levels* for these spending categories are mirrored by a change of their *shares* of total spending with a substantial shift of spending composition over time. The share of total spending devoted to grants decreases until the mid-eighties, whereas this trend is reversed thereafter. Given these changes in spending composition, when we observe an inverse relationship between grants per-capita and population at state level we cannot conclude that economies of scale alone justify this relationship. Another plausible explanation is that grants do not grow at a sufficient pace to compensate the increased needs associated with population growth. If this is the case, given that states have very different population dynamics, this change of spending priorities can have very different effects at state level, with fast growing states being particularly penalized.

Since population scale and change can both affect spending, to disentangle the impact of scale independent population dynamics from that of scale effects, we proceed by introducing our scale independent measure of population dynamics as a further explanatory variable in our regressions and analyze the effect of POPIND on total federal spending and its subcomponent. For some spending categories, such as defense, there is no reason to expect that population growth should play any particular role. For formula programs, such as grants – where population is an important input – fast growing states are typically penalized by formulas that impose restrictions on yearly funding changes, as well as by the use of outdated population data. The same can be said of salaries if spending in personnel to provide public goods and services does not grow at the same pace as the overall population growth. Direct payments to individuals could also be affected by different population dynamics as long as population growth may disproportionately concern individuals not qualifying as recipients. For example, since states with an above average population growth tend to have a much slower growth in their share of individuals aged above 65,[14] then fast growing states would be penalized in the allocation of entitlements per capita consisting for a substantial part of retirement spending.[15]

The results of our estimations, reported in Table 4 (columns (1)-(6)), show that the scale independent measure of population change is key to explain federal budget allocation to the states. The coefficient of $POPIND$ is always negative and - except that for defense spending - significant. This implies that fast growing states are penalized in the allocation of the federal budget, independently of their size, across all spending categories (except defense). On the other hand, the coefficient of the linear and quadratic *population* terms varies depending on the spending program. For direct payments, grants and salaries - once we control for the scale independent population change - population scale is not any more a significant explanatory variable. This is not surprising given that for formula programs, such as grants – where population is an important input – fast growing states are typically penalized by formulas that impose restrictions on yearly funding changes, as well as by the use of outdated population data. On the other hand, for spending items such as defense and procurement spending - which are typically characterized by a fixed investment component - scale effects remain significant.

This analysis leads to some important conclusions. States whose population grows faster are penalized in the budget allocation independently of whether they are large or small: this suggests that the budget fails to respond to population changes at an adequate pace to compensate for increased needs. The implied redistributive effect of population dynamics on federal spending across states is sizeable. In Table 5 we report the average gains and losses (in 1983 USD) implied by our estimates of the change effect reported in the column (1) of Table 4. These have been computed by comparing, for each state, the predicted federal spending per capita

[14]Nevada, for example, has a total population in 2002 which is three times its population in 1978, while its population above 65 is only 1.22 times the 1978 figure.

[15]Moreover, since entitlements include several important types of welfare benefits paid to persons, other disproportionate changes in the share of non-recipients may decrease the amount transferred percapita at the state level. For example, one of the most important welfare benefits is the the Aid to Families with Dependent Children (AFDC) program. The resources devoted to this program declined in real terms from the late 1960s through the 1990s. The Food Stamp and Medicaid programs grew in the early 70s causing the sum of these two and the AFDC to rise, but declining then in real terms after the mid-1970s. There is weak evidence that the decline of these programs is justified by the introduction of other substitutes (Moffitt (1990); Ribar and Wilhelm (1994)) and one explanation is that the decline in participation rates may play an important role (Moffitt (2003)). The analysis of participation rates and population dynamics for more specific spending programs goes beyond the scope of this paper, but it could be an interesting avenue for future research.

implied by the average $POPIND$ in the state during the period 1978-2002, with the federal spending per capita that the state would receive if its $POPIND$ was equal to the US average during the same period. The fastest growing state, Nevada, is the most penalized. Its average per-capita loss during the period 1978-2002 is around 780 USD, or about 27% of its average budget. Next, we find Arizona with an average loss of 14% and Florida with a loss equivalent to 10% of its average budget. Overall, during the period 1978-2002, we find that 18 states loose out in terms of spending shares. Their total loss, during the period amounts to about 5% of their overall budget. This loss, amounting to about 5% of their overall budget during the period 1978-2002, is redistributed to the remaining 30 states that gain on average about 3% of their budget during the same period. This implies that because of different population dynamics, a sizeable amount of federal funds is redistributed from states with fast growing population to states with low population dynamics.

3.1 Budgetary inertia and allocation federal funds to the States

Our analysis reveals that population dynamics play a crucial role in explaining the allocation of federal budget to the states and that fast growing states receive significantly less than shrinking ones. This suggests that changing needs associated with rapid population shifts are not followed by adequate changes in budgetary provisions. This effect is particularly strong for grants where formulas introduce important elements of budgetary inertia. For several formula based program programs, hold-harmless provisions guarantee to the states a given share of past spending irrespective of any variation in their circumstances.[16] Similarly, upper and lower limits in specific formula inputs constrain the outcome that would be generated by the basic formula.[17] Finally, the use of outdated population data in formulas penalizes states whose population grows fast.[18] However, the limited response of spending to population dynamics introduced by formulas is not the unique factor generating budgetary inertia. As pointed out by incrementalist theories

[16] 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).

[17] For example, the Title I education program state expenditure per pupil is restricted to a range between 80% and 120% of the national average per pupil expenditure. In the special education program no children may receive more than 40% of the average per pupil expenditure in US public elementary and secondary school. Other important programs subject to limits are the Federal Highway Program and Medicaid.

[18] In a recent 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).

(Wildavsky (1964) ; Davis et al. (1966); Dempster and Wildavsky (1979)), the complexity of the budget implies that new provisions are determined mainly by marginal changes to previous ones suggesting that past budgets should be important in explaining current ones. Given that - besides population - many other factors determine the allocation of the budget, the budgetary inertia may well be driven by the failure of the budget to adapt to other changing characteristics of the states. If these are characteristics are correlated with population dynamics, by not controlling for other sources of budgetary inertia, we may over-estimate the effect of population dynamics on spending. To address this potential omitted variable bias problem, we re-estimate our regression introducing lagged spending as a further explanatory variable. The results, reported in Table 6, show that lagged spending is a very significant explanatory variables across all spending categories. Nevertheless, even after we control for other possible sources of budgetary inertia, we find that our results on the coefficient of POPIND are pretty robust. When we add the lagged spending term, the sign of the POPIND coefficient sign remains the same across all spending regressions and it looses significance only in the salary regression. At the same time, when we control for other sources of budgetary inertia, the size of the POPIND coefficient is reduced, implying that - while fast growing states are penalized in the allocation of the budget - other sources of budgetary inertia are at play. In Table 7 we report the estimated budgetary gains and losses (computed analogously to the Table 5) using the estimated coefficients of Table 6 (column (1)).

Finally, as we have seen, the composition of spending varies substantially over the period we consider. In particular, throughout the eighties, spending on grants is reduced to the advantage of defense and procurements. Therefore, it is legitimate to ask whether the loss of spending in states with fast growing population is only a consequence of the change in spending priorities observed under the years of republican administration or whether this is a more general feature of the budget process which fails to respond to rapidly changing needs. If fast growing states are disadvantaged by the change in spending priorities associated with the president's political orientation, this should be reflected in a different coefficient of POPIND under republican as opposed to democratic presidents. Moreover, if the change of spending composition this is the only driver of the estimated relationship between spending and population dynamics, the spending differentials associated to population dynamics should disappear during the years of democratic administration. To disentangle the effect of the presidential party on the relationship between spending and population dynamics, we introduce in our regression an interaction term between the variable POPIND and dummy variable which is equal to one when the president is republican and zero when the president is democratic. As we can see, from the estimation results reported in Table 8, once we introduce the interaction term, we find that fast growing states are disadvantaged in the allocation of most spending categories under the years of both republican and democratic administration. This implies that in general the budget fails to adequately respond to population dynamics. However, for grants, the loss associated with population dynamics is larger when the president is a republican, implying that political factors may indeed exacerbate the lack of responsiveness of the budget to the changing needs of the states.

4 Conclusions

Our analysis reveals that fast growing states are disadvantaged in the allocation of the federal budget. As their population grows, spending does not adjust sufficiently to guarantee them their fair share of the federal pie. This happens independently of their size, since small, fast growing states are not less penalized that large ones. The disadvantage experience by states with a fast growing population may in part be due to the difficulties of collecting and processing all the information necessary to guarantee to every state a fair share of the budget. However, even when such information is available, budgetary rules and formulas, whose determination is not isolated from the political process, can prevent fair reallocations of the budget. The recent reform of Title I education programs provides an emblematic example. To meet the increased education needs of fast growing states, decennial census data on population have been replaced by biennial census estimates. At the same time, senators of shrinking and slow growing states have managed to obtain the implementation of a 100% “hold harmless provision” that, in the absence of any significant increase in annual appropriations, has *de facto* neutralized the use of updated data, preventing the reallocation of funds toward more needy states. This shows how Congressmen are actively engaged in bargaining over the federal budget allocation to bring bacon home, and how rapid shifts in population can create an important divide between the interests of fast growing as opposed to shrinking or slow growing states. The redistributive effects associated with large population shifts open an important avenue for future research on the allocation of the federal budget to the states. Understanding how budgetary provisions for specific items are negotiated within Congress when large population changes occur, and whether they are affected by institutional and political features, such as committee representation, party politics and electoral considerations, are very fundamental questions that we leave for further investigation.

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Table 1: average population, population index and real per-capita outlays by state (1978-2002).

State	*population (millions)*	*POPIND*	*federal spending per-capita (1983 US dollars)*
AL	4.1048	110.5512	3226.9880
AR	2.4085	111.6332	2855.5990
AZ	3.7470	160.3490	3045.8440
CA	28.8246	130.5002	3176.2870
CO	3.4654	129.3159	3169.9430
CT	3.2539	104.6128	3632.2290
DE	0.6737	115.9882	2730.5160
FL	12.6848	148.4131	3159.5490
GA	6.6006	131.2843	2794.6940
IA	2.8569	98.2817	2735.8130
ID	1.0717	122.4833	2862.0110
IL	11.6909	104.5587	2561.0430
IN	5.6577	105.2879	2439.7470
KS	2.5040	106.9934	3092.6320
KY	3.7689	108.3467	2909.5040
LA	4.3077	108.4592	2872.7280
MA	6.0055	104.2180	3664.4100
MD	4.7333	114.6826	4447.2590
ME	1.1997	110.2810	3212.4810
MI	9.4346	102.8954	2443.5940
MN	4.4213	110.3159	2616.8170
MO	5.1793	107.1686	3721.1720
MS	2.6298	109.9754	3249.1200
MT	0.8330	107.1612	3340.4950
NC	6.7536	122.1098	2504.0060
ND	0.6512	99.7148	3806.9880
NE	1.6162	103.1485	2968.6470
NH	1.0729	124.4964	2672.9010
NJ	7.8072	106.9901	2792.9610
NM	1.5394	127.8483	4437.0930
NV	1.2759	195.4310	2809.7740
NY	18.1167	102.4030	3103.6670
OH	10.9669	102.5938	2652.0360
OK	3.2190	113.8405	2974.5960
OR	2.9199	119.9697	2635.2370
PA	11.9712	101.5089	3054.3910
RI	0.9906	106.5258	3297.2180
SC	3.4986	121.4149	2896.5960
SD	0.7144	103.6807	3329.3680
TN	4.9895	115.7882	3079.8390
TX	17.2680	133.1808	2694.8670
UT	1.7906	137.6520	2738.4050
VA	6.1577	119.7341	4595.3450
VT	0.5552	114.5993	2725.5940
WA	4.8959	130.3823	3383.4480
WI	4.9643	106.2753	2374.7850
WV	1.8515	99.4733	3020.2950
WY	0.4768	112.8437	3144.0620

Table 2: Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Population	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
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

Table 3: OLS regressions by spending categories. Dependent variable: real percapita outlays

	(1)	(2)	(3)	(4)	(5)	(6)
Table 3a	total spending	direct payments	grants	salaries	defense	procurement
population	-0.0786	-0.0604	-0.0546	-0.0016	-0.0942	-0.0230
	(1.07)	(1.23)	(2.74)***	(0.17)	(2.00)*	(0.40)
income per-capita	-0.0006	-0.0170	-0.0069	0.0063	0.0317	0.0364
	(0.02)	(1.05)	(1.06)	(0.99)	(1.77)*	(1.80)*
unemployment	0.0045	0.0084	0.0026	0.0030	-0.0029	-0.0097
	(0.48)	(2.07)**	(1.39)	(1.79)*	(0.44)	(1.67)
age over 65 (percentage)	12.2563	5.2215	1.2060	-0.0510	2.9835	0.7227
	(3.71)***	(2.68)**	(0.84)	(0.08)	(0.69)	(0.24)
age 5-17 (percentage)	-3.4208	-2.9117	-0.7046	0.2773	3.9998	0.7806
	(1.20)	(1.69)*	(1.05)	(0.89)	(2.04)**	(0.70)
Other controls(1)	YES	YES	YES	YES	YES	YES
Observations	1200	1200	1200	1008	1008	1200
R-squared	0.9452	0.9567	0.9540	0.9863	0.9314	0.9437
Table 3b	total spending	direct payments	grants	salaries	defense	procurement
population	-0.0821	-0.1207	-0.0548	-0.0422	0.0766	0.0710
	(0.96)	(2.74)***	(2.50)**	(1.96)*	(2.27)**	(1.32)
popsquare	0.0006	0.0018	0.0010	0.0005	-0.0021	-0.0020
	(0.35)	(2.27)**	(2.53)**	(1.28)	(3.63)***	(2.12)**
income percapita	-0.0583	-0.0205	-0.0015	0.0025	-0.0593	-0.0671
	(1.54)	(1.56)	(0.19)	(0.49)	(1.88)*	(1.70)*
unemployment	-0.0050	0.0102	0.0068	-0.0016	-0.0213	-0.0186
	(0.38)	(1.87)*	(2.47)**	(0.47)	(2.08)**	(1.58)
age over 65 (percentage)	9.7016	4.2038	1.9514	-0.8713	1.5732	2.4852
	(2.12)**	(1.79)*	(1.68)*	(0.66)	(0.52)	(0.58)
age 5-17 (percentage)	-7.7822	-2.4688	-0.9010	0.1007	-2.9521	-3.4301
	(3.03)***	(2.47)**	(1.69)*	(0.14)	(2.36)**	(1.72)*
Other controls(1)	YES	YES	YES	YES	YES	YES
Observations	1200	1200	1200	1008	1200	1008
R-squared	0.9011	0.9029	0.9143	0.9612	0.8989	0.8660

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

(1) Other controls include: state and year fixed effects and a constant term.

Table 4: OLS regressions by spending categories. Dependent variable: real percapita outlays

	(1) total spending	(2) direct payments	(3) grants	(4) salaries	(5) defense	(6) procurement
population	0.1663	-0.0261	-0.0043	-0.0062	0.1000	0.1715
	(3.06)***	(0.72)	(0.28)	(0.26)	(2.59)**	(3.05)***
popsquare	-0.0035	0.0002	0.0002	-0.0001	-0.0025	-0.0036
	(3.87)***	(0.38)	(0.77)	(0.24)	(3.82)***	(3.85)***
POPIND	-0.0097	-0.0037	-0.0020	-0.0013	-0.0009	-0.0037
	(6.79)***	(2.63)**	(7.05)***	(2.62)**	(1.41)	(5.92)***
income per-capita	-0.0837	-0.0301	-0.0067	-0.0004	-0.0616	-0.0752
	(2.58)**	(2.73)***	(0.95)	(0.09)	(1.97)*	(1.92)*
unemployment	-0.0014	0.0116	0.0075	-0.0010	-0.0209	-0.0171
	(0.11)	(2.15)**	(2.79)***	(0.33)	(2.04)**	(1.44)
age over 65 (percentage)	11.5380	4.9036	2.3249	-0.6154	1.7458	3.1992
	(3.34)***	(2.09)**	(2.75)***	(0.51)	(0.57)	(0.78)
age 5-17 (percentage)	-7.5358	-2.3749	-0.8509	0.2192	-2.9289	-3.0994
	(3.22)***	(2.44)**	(1.79)*	(0.34)	(2.30)**	(1.86)*
Other controls(1)	YES	YES	YES	YES	YES	YES
Observations	1200	1200	1200	1008	1200	1008
R-squared	0.9228	0.9136	0.9257	0.9647	0.8995	0.8733

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

(1) Other controls include: state and year fixed effects and a constant term.

Table 5: Average federal spending percapita and population index: 1978-2002					
state	population index *(average)*	average population *(millions)*	average spending *percapita (real 1983 USD)*	predicted difference: *percapita (real 1983 USD)* [1]	predicted difference: *share of average spending*
NV	195.4310	1.302	2809.774	-770.707	-0.274
AZ	160.3490	3.805	3045.844	-428.754	-0.141
FL	148.4131	12.854	3159.549	-312.412	-0.099
UT	137.6520	1.812	2738.405	-207.521	-0.076
TX	133.1808	17.447	2694.867	-163.940	-0.061
GA	131.2843	6.663	2794.694	-145.454	-0.052
CA	130.5002	29.102	3176.287	-137.811	-0.043
WA	130.3823	4.945	3383.448	-136.662	-0.040
CO	129.3159	3.499	3169.943	-126.267	-0.040
NH	124.4964	1.082	2672.901	-79.291	-0.030
NM	127.8483	1.553	4437.093	-111.963	-0.025
NC	122.1098	6.803	2504.006	-56.028	-0.022
ID	122.4833	1.080	2862.011	-59.669	-0.021
SC	121.4149	3.523	2896.596	-49.255	-0.017
OR	119.9697	2.942	2635.237	-35.168	-0.013
VA	119.7341	6.199	4595.345	-32.872	-0.007
DE	115.988	0.677	2730.516	3.641	0.001
TN	115.788	5.017	3079.839	5.590	0.002
MD	114.683	4.757	4447.259	16.366	0.004
VT	114.599	0.558	2725.594	17.178	0.006
OK	113.841	3.235	2974.596	24.575	0.008
WY	112.844	0.480	3144.062	34.291	0.011
AR	111.633	2.419	2855.599	46.089	0.016
AL	110.551	4.121	3226.988	56.637	0.018
ME	110.281	1.204	3212.481	59.270	0.018
MS	109.975	2.639	3249.120	62.249	0.019
MN	110.316	4.439	2616.817	58.930	0.023
MO	107.169	5.194	3721.172	89.607	0.024
LA	108.459	4.323	2872.728	77.028	0.027
MT	107.161	0.836	3340.495	89.680	0.027
KY	108.347	3.781	2909.504	78.124	0.027
RI	106.526	0.993	3297.218	95.873	0.029
KS	106.993	2.511	3092.632	91.316	0.030
CT	104.613	3.260	3632.229	114.520	0.032
MA	104.218	6.014	3664.410	118.367	0.032
NJ	106.990	7.826	2792.961	91.347	0.033
SD	103.681	0.715	3329.368	123.605	0.037
WI	106.275	4.977	2374.785	98.315	0.041
ND	99.715	0.651	3806.988	162.261	0.043
NE	103.149	1.618	2968.647	128.792	0.043
NY	102.403	18.125	3103.667	136.059	0.044
IN	105.288	5.671	2439.747	107.939	0.044
IL	104.559	11.711	2561.043	115.047	0.045
PA	101.509	11.978	3054.391	144.774	0.047
OH	102.594	10.978	2652.036	134.199	0.051
MI	102.895	9.447	2443.594	131.260	0.054
WV	99.473	1.851	3020.295	164.616	0.055
IA	98.282	2.856	2735.813	176.230	0.064

Table 6: OLS regressions by spending categories. Dependent variable: real percapita outlays

	(1) total spending	(2) direct payments	(3) grants	(4) salaries	(5) defense	(6) procurement
LAG	0.6032	0.9117	0.6971	0.7447	0.6871	0.5812
	(13.17)***	(10.64)***	(16.16)***	(6.68)***	(11.95)***	(11.74)***
population	0.0553	-0.0062	-0.0085	-0.0020	0.0307	0.0666
	(2.37)**	(0.62)	(1.51)	(0.31)	(2.43)**	(2.66)**
popsquare	-0.0013	0.0001	0.0002	-0.0000	-0.0008	-0.0014
	(3.40)***	(0.32)	(1.88)*	(0.20)	(3.53)***	(3.32)***
POPIND	-0.0043	-0.0005	-0.0005	-0.0003	-0.0003	-0.0017
	(6.82)***	(1.76)*	(3.32)***	(1.31)	(1.54)	(4.96)***
income per-capita	-0.0459	-0.0082	-0.0050	-0.0012	-0.0255	-0.0267
	(3.64)***	(2.71)***	(1.57)	(0.90)	(3.81)***	(2.56)**
unemployment	0.0029	0.0064	0.0031	-0.0012	-0.0079	-0.0070
	(0.50)	(4.17)***	(2.86)***	(1.04)	(2.02)**	(1.43)
age over 65 (percentage)	4.3132	0.2039	0.3256	-0.0965	0.4150	1.7419
	(2.41)**	(0.37)	(0.99)	(0.29)	(0.42)	(1.09)
age 5-17 (percentage)	-2.4375	-1.0799	-0.6978	-0.0140	-0.5479	-0.9640
	(2.04)**	(3.21)***	(3.42)***	(0.09)	(1.16)	(1.53)
Other controls[(1)]	YES	YES	YES	YES	YES	YES
Observations	1152	1152	1152	960	1152	960
R-squared	0.9547	0.9768	0.9611	0.9845	0.9515	0.9214

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

(1) Other controls include: state and year fixed effects and a constant term.

Table 7: Average federal spending percapita and population index: 1978-2002					
state	population index	average population	average spending	predicted difference:	predicted difference:
	(average)	*(millions)*	*percapita (real 1983 USD)*	*percapita (real 1983 USD)1*	*share of average spending*
NV	195.431	1.301571	2809.774	-357.2994	-0.127
AZ	160.349	3.805082	3045.844	-198.7704	-0.065
FL	148.4131	12.85406	3159.549	-144.8343	-0.046
UT	137.652	1.8115	2738.405	-96.2067	-0.035
TX	133.1808	17.44669	2694.867	-76.0023	-0.028
GA	131.2843	6.662679	2794.694	-67.4325	-0.024
CA	130.5002	29.10155	3176.287	-63.8892	-0.020
WA	130.3823	4.945402	3383.448	-63.3566	-0.019
CO	129.3159	3.499288	3169.943	-58.5375	-0.018
NH	124.4964	1.081874	2672.901	-36.759	-0.014
NM	127.8483	1.553357	4437.093	-51.9058	-0.012
NC	122.1098	6.802737	2504.006	-25.9746	-0.010
ID	122.4833	1.080303	2862.011	-27.6624	-0.010
SC	121.4149	3.523462	2896.596	-22.8346	-0.008
OR	119.9697	2.941658	2635.237	-16.3039	-0.006
VA	119.7341	6.198634	4595.345	-15.2392	-0.003
DE	115.9882	0.6773708	2730.516	1.6881	0.001
TN	115.7882	5.017103	3079.839	2.5916	0.001
MD	114.6826	4.757035	4447.259	7.5875	0.002
VT	114.5993	0.5580989	2725.594	7.9637	0.003
OK	113.8405	3.235347	2974.596	11.3929	0.004
WY	112.8437	0.4795856	3144.062	15.8974	0.005
AR	111.6332	2.419093	2855.599	21.367	0.007
AL	110.5512	4.121348	3226.988	26.2567	0.008
ME	110.281	1.204269	3212.481	27.4775	0.009
MS	109.9754	2.63941	3249.12	28.8586	0.009
MN	110.3159	4.439112	2616.817	27.3199	0.010
MO	107.1686	5.194464	3721.172	41.5418	0.011
LA	108.4592	4.323184	2872.728	35.71	0.012
MT	107.1612	0.8358573	3340.495	41.5755	0.012
KY	108.3467	3.7813	2909.504	36.2183	0.012
RI	106.5258	0.9928206	3297.218	44.4466	0.013
KS	106.9934	2.511134	3092.632	42.3338	0.014
CT	104.6128	3.259734	3632.229	53.0913	0.015
MA	104.218	6.014421	3664.41	54.8751	0.015
NJ	106.9901	7.826324	2792.961	42.3486	0.015
SD	103.6807	0.7153968	3329.368	57.3031	0.017
WI	106.2753	4.976871	2374.785	45.5788	0.019
ND	99.71484	0.6511379	3806.988	75.2241	0.020
NE	103.1485	1.6184	2968.647	59.7081	0.020
NY	102.403	18.12533	3103.667	63.0768	0.020
IN	105.2879	5.670804	2439.747	50.0406	0.021
IL	104.5587	11.71057	2561.043	53.3357	0.021
PA	101.5089	11.97805	3054.391	67.1169	0.022
OH	102.5938	10.97753	2652.036	62.2147	0.023
MI	102.8954	9.446822	2443.594	60.8519	0.025
WV	99.47327	1.851198	3020.295	76.3157	0.025
IA	98.28172	2.856067	2735.813	81.7	0.030

Table 8: OLS regressions by spending categories. Dependent variable: real percapita outlays

	(1) total spending	(2) direct payments	(3) grants	(4) salaries	(5) defense	(6) procurement
LAG	0.6029	0.9109	0.6956	0.7437	0.6880	0.5803
	(13.20)***	(10.44)***	(16.10)***	(6.67)***	(11.87)***	(11.60)***
population	0.0547	-0.0063	-0.0087	-0.0017	0.0311	0.0679
	(2.35)**	(0.63)	(1.57)	(0.26)	(2.45)**	(2.70)***
popsquare	-0.0013	0.0001	0.0002	-0.0000	-0.0008	-0.0014
	(3.40)***	(0.33)	(1.92)*	(0.23)	(3.53)***	(3.35)***
POPIND	-0.0042	-0.0005	-0.0005	-0.0003	-0.0004	-0.0018
	(6.75)***	(1.93)*	(2.99)***	(1.35)	(1.45)	(4.88)***
POPIND x REP	-0.0004	-0.0001	-0.0002	0.0001	0.0004	0.0003
	(1.36)	(0.37)	(3.86)***	(1.44)	(0.81)	(1.40)
income per-capita	-0.0461	-0.0082	-0.0051	-0.0011	-0.0253	-0.0265
	(3.66)***	(2.67)**	(1.59)	(0.84)	(3.71)***	(2.54)**
unemployment	0.0029	0.0064	0.0031	-0.0012	-0.0078	-0.0070
	(0.50)	(4.17)***	(2.85)***	(1.04)	(2.00)*	(1.42)
age over 65 (percentage)	4.2307	0.1953	0.2937	-0.0768	0.4893	1.8353
	(2.37)**	(0.36)	(0.89)	(0.23)	(0.49)	(1.13)
age 5-17 (percentage)	-2.4233	-1.0790	-0.6915	-0.0219	-0.5588	-1.0041
	(2.02)**	(3.20)***	(3.35)***	(0.14)	(1.17)	(1.57)
Other controls(1)	YES	YES	YES	YES	YES	YES
Observations	1152	1152	1152	960	1152	960
R-squared	0.9547	0.9769	0.9612	0.9845	0.9516	0.9215

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

(1) Other controls include: state and year fixed effects and a constant term.

Figure 1: State Population Index (base year: 1978)

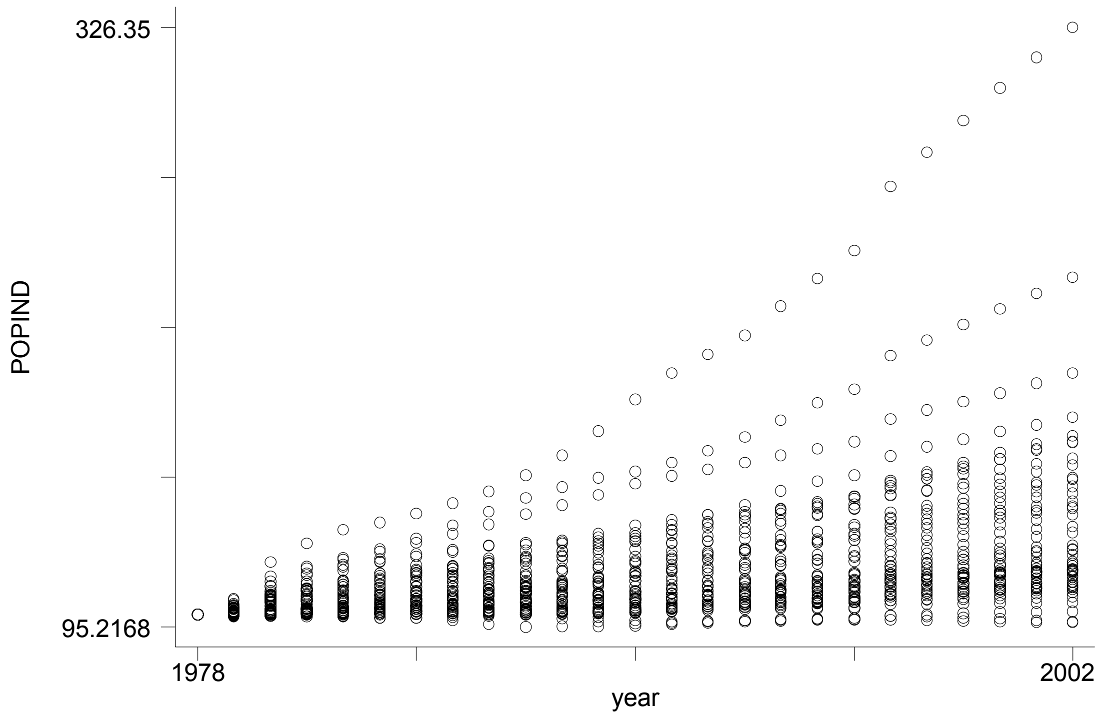

Figure 2: Average population and spending indexes by state (1978-2002)

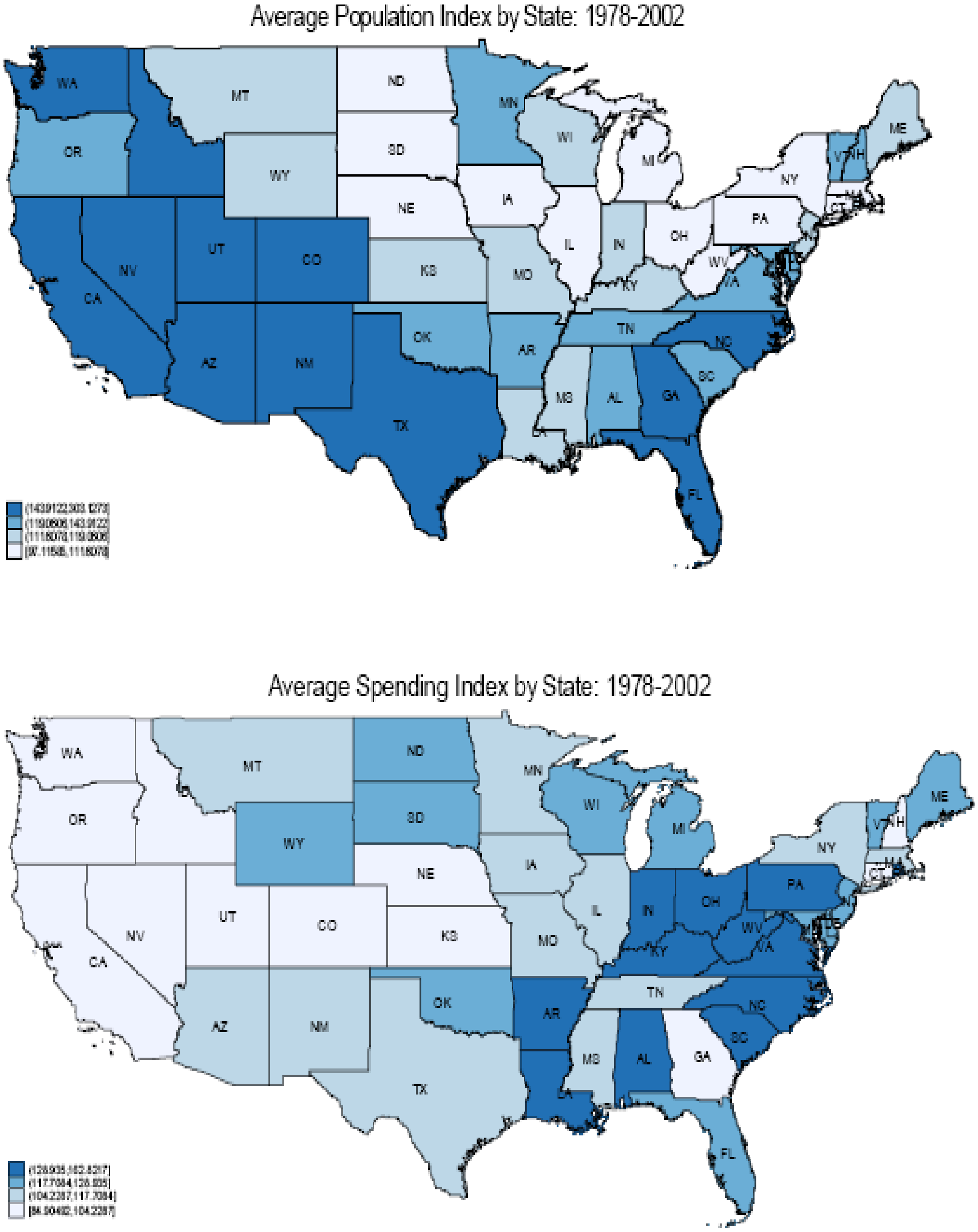

Fig. 3a: State shares of population and state shares of federal spending (1978=100)

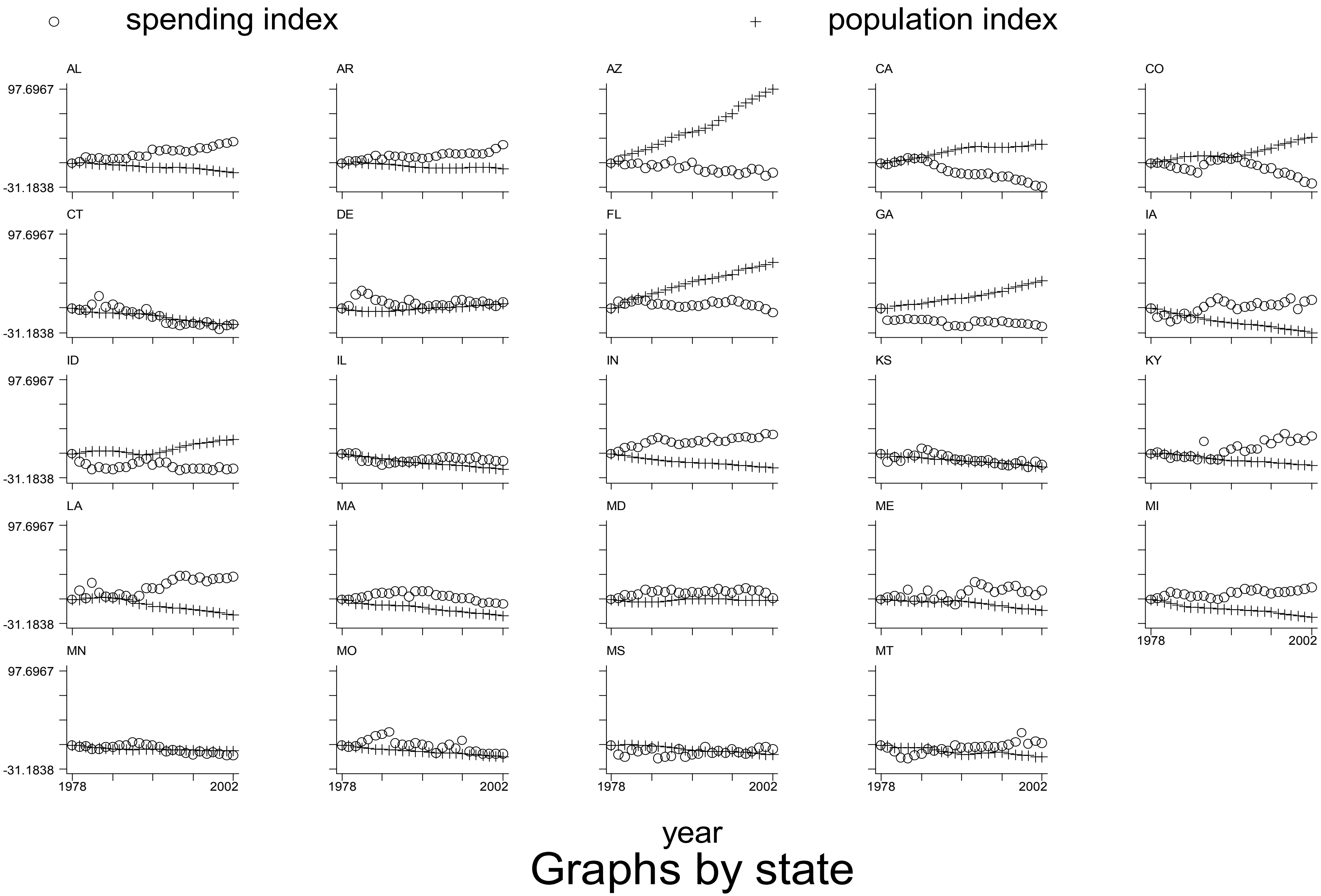

Fig. 3b: State shares of population and state shares of federal spending (1978=100)

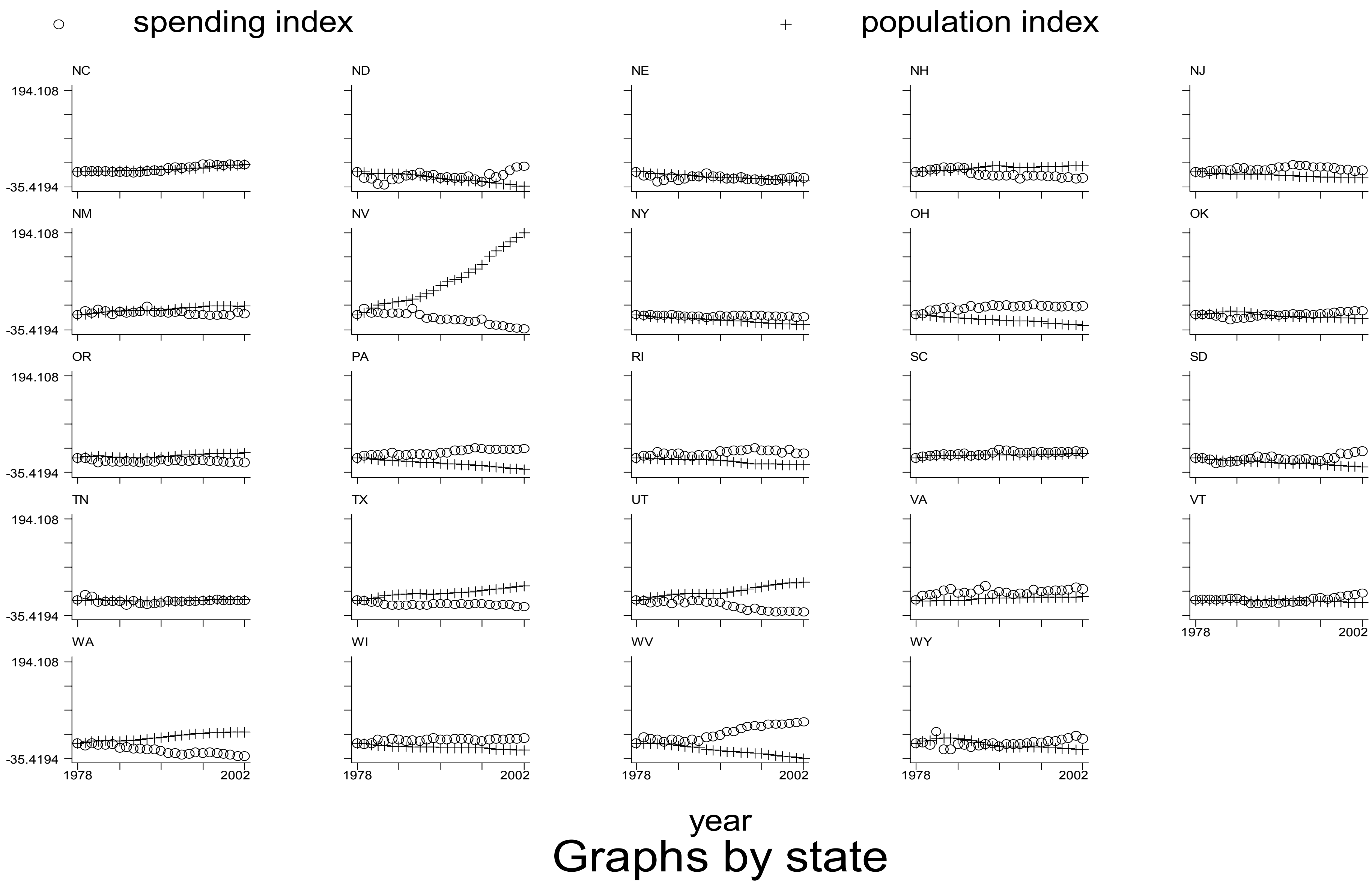

Figure 4a: US yearly real spending (outlays by spending categories in real 1983 USD)

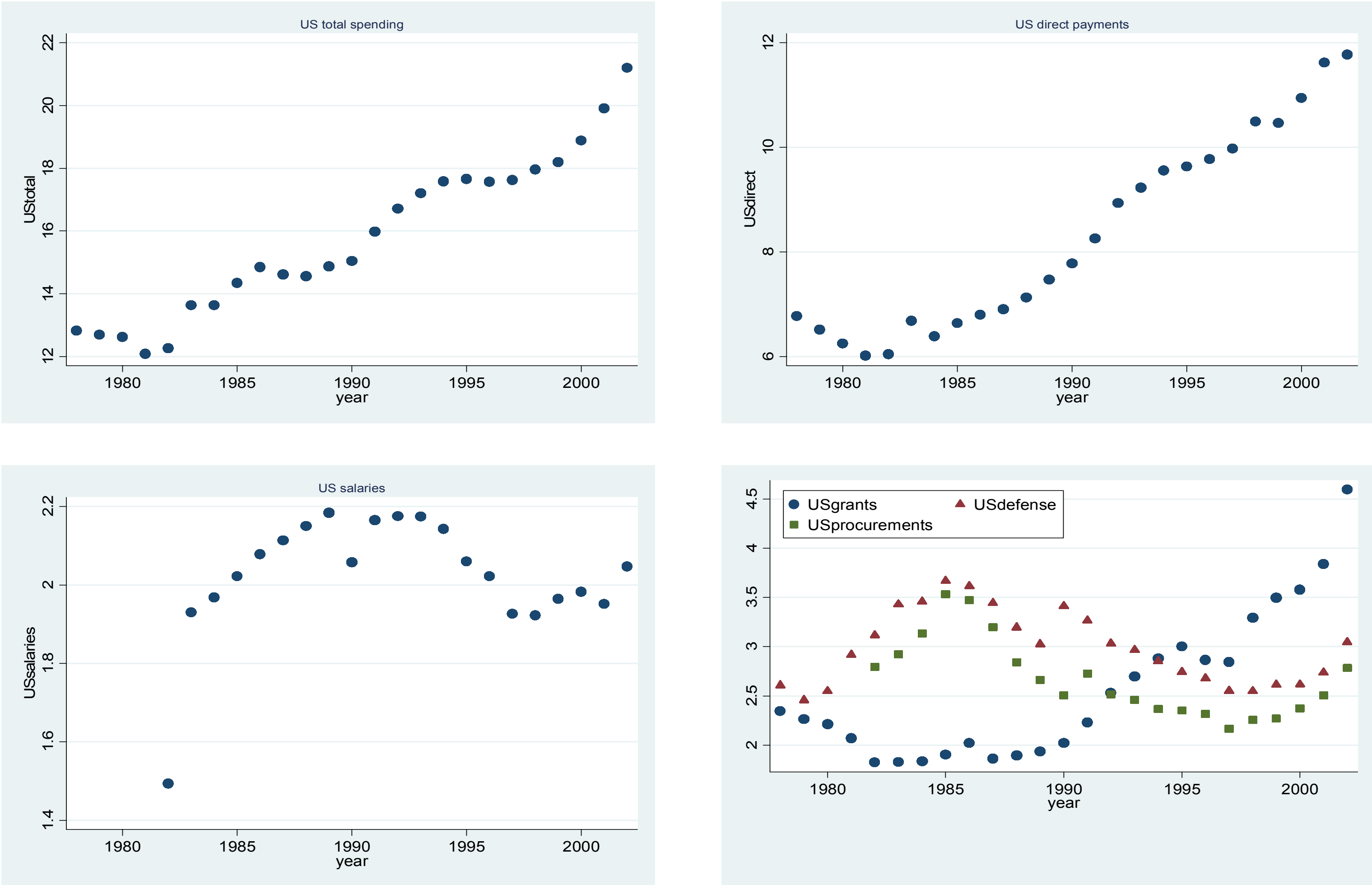

Figure 4b: US yearly spending shares by spending categories