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Trending economic factors and the structure of Congress in the growth of government, 1930–2002

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Abstract We investigate the role of Congress in the growth of federal public expenditure since 1930, building on the work of Kau and Rubin (Public Choice, 113:389–402, 2002). The model incorporates majority party strength and the extent of party control of Congress in addition to the median ideological position of elected representatives. We first provide estimates of the relative importance of the state of Congress and of trending supply and demand-side economic factors in the evolution of federal spending. The resulting models are then used to simulate the consequences of the radical and historically unprecedented shift to the right of Congress in 1994/95.

Keywords Public expenditure · Congress · Ideology · Majority party strength · Party control · Female labor force participation · Stationary versus trending variables

JEL Classification H1 · H3 · H5 · H6

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1 Introduction

For most of the last century, empirical work on the size and growth of the public sector in a mature democracy emphasized the determinants of the demand for public services.[1] Research on the role of supply-side factors in public sector growth was given a major impetus by the seminal work of Brennan and Buchanan (1980) and Kau and Rubin (1981, 2002).[2] Brennan and Buchanan established the Leviathan model, which focuses exclusively on the size of potential tax bases as the only important constraint on government size, and Kau and Rubin independently showed that a similar framework (which also allows for demand) could be adapted for empirical research. These contributions have had a substantial impact on the political economy of fiscal policy over the last two decades.

Kau and Rubin (2002) suggest that as least 50% of the growth of all government spending in the United States over the 1930 to 1993 period can be attributed to entry of women into the labor force where they expand the supply of taxable activity, and they argue that little explanatory power can be assigned to demand factors.[3] Demand is represented in their work by D-Nominate, an index of the median ideological position of legislators in Congress constructed by Poole and Rosenthal (1996), and by income.[4] The use of a measure of the ideological position of legislators, an innovative step in its own right, and the starting point for this paper, is based on the reasonable view that demands for public spending are only effective if they are acted upon by elected representatives.

In this paper we continue the integration of the structure of Congress into explanations of public expenditure that they initiated, in two ways: we incorporate the role of majority party strength in addition to the median ideological position of legislators using indexes recently constructed by Aldrich et al. (2004, 2007); and we consider the importance for spending of the degree to which the branches of Congress are unified under the same party. We then use the resulting model to reassess the importance of trending economic factors relative to the role of politics for growth of the federal government since 1930.[5]

We also apply the extended framework to consider the level and the defense/non-defense composition of federal government spending and, to a lesser extent, to model the consolidated national public sector that was the only measure of spending considered by Kau and Rubin. And finally, we use the model to conduct simulations designed to uncover the consequences for spending of the shift to the right of Congress in 1994/95, a sea change which Grofman et al. (2001) describe as the most dramatic of the modern era.

We do not propose a different basic approach to the modeling of the size of government, but rather build on the Kau/Rubin framework by incorporating additional dimensions of Congressional structure, while paying close attention to the differences in the nature of economic and political factors and to the robustness of our results.

[1] The relevant literature is reviewed by Higgs (1987), Mueller (2003), Borcherding et al. (2004), and Tridimas and Winer (2005).

[2] This work followed Baumol's contribution (1967) on the relationship between productivity in the public sector and the size of government. West (1991) synthesizes the work of Baumol and Kau and Rubin.

[3] de Cavalcanti and Tavares (2006) also find substantial effects of female participation on public spending relative to GDP in a panel of developed and less developed countries over the period 1960–1999.

[4] See also Poole (2005). For extensive discussion of the role of ideology, see Hinich and Munger (1994).

[5] Of course the role of political institutions has been extensively investigated in the comparative context in contemporary empirical work, including notably Persson and Tabellini (2003). Our focus here is on the role of variation in aspects of the stable legislative institution of one mature democracy.

Since the Kau-Rubin (2002) dataset for 1930 to 1993 is no longer available—the authors looked for it at our request, but it had been disposed of—we construct an analogous one that includes DW-Nominate, the highly correlated successor to D-Nominate, and do so for the longer period ending in 2002.[6] We also employ as an alternative measure of the left-right ideology of members of Congress, the 'real' ADA index of Groseclose et al. (1996), which is available from 1947 to 1999. These authors have adjusted ADA scores to remove the effects of changes in the mean and variance of legislator positions over time due to idiosyncrasies in the selection of Congressional bills used as a basis for classifying voting behaviour.

The paper proceeds as follows. In section two we present a simple economic model of government spending and then extended it to incorporate selected features of congressional structure. Because that structure relates most directly to federal spending, we emphasize the modeling of this level of government in the empirical work rather than of all government spending which was investigated by Kau and Rubin. It turns out not to matter much which measure one considers, an intriguing stylized fact that is discussed further in what follows.

In section three we consider selected aspects of the data, emphasizing the fact that economic determinants of government spending have strong trends, while political factors tend to be stationary or without trend. This basic and, in our view, neglected difference in the nature of economic and political processes turns out to be one of the keys to the interpretation of our results. We then present empirical models of federal and (to a lesser extent) consolidated government spending, and consider what part of the growth of government can be attributed to changes in female labor force participation, to income effects and to changes in the ideological positions of members of Congress.

The defense/non-defense composition of federal spending is studied in section four, as it is possible that different factors may influence these major components. Simulations designed to uncover the effects of the dramatic shift to the right of Congress in the mid-1990s are presented in section five, and section six concludes the main text. Finally, because the original Kau-Rubin data are no longer available, an attempt to reproduce their results with the new data set is briefly presented in Appendix A.

2 A basic model of government size: Supply, demand and the structure of Congress

The essential idea underlying the Kau-Rubin model is illustrated in Fig. 1, which is based on West (1991) and Usher (1986). Here the demand for public services G is shown as linear, with mid-point M below which demand is inelastic. The price of public goods P_G is equal to their (assumed) constant marginal resource cost MC, while total social marginal costs including excess burden, compliance and evasion costs of taxation, $P_G + SC$, is shown as upward sloping.

Kau and Rubin hypothesize that declines in the full social costs of taxation have driven the growth of government in the twentieth century. Supply side developments they consider important include: entry of women into the labor force where they can then be much more easily taxed; declines in the extent of self-employment making it harder to avoid or evade taxes; and increasing computerization which they think shifts the power to enforce compliance to government. In their view, these factors all lead to downward shifts in the full marginal cost of government as shown in the figure.

Under the pressure of political competition and following a decline in the full cost of taxation, government expands supply to meet demand and consequently, as shown, the quantity

[6] The new dataset is available at http://www.carleton.ca/~winers.

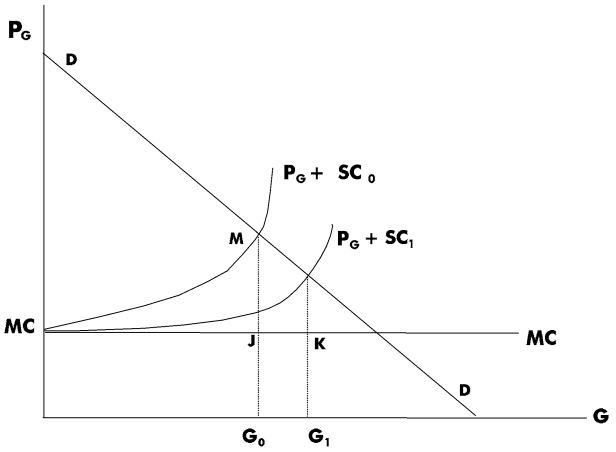


Fig. 1 Supply (and demand) in the growth of government

of public services increases from G_0 to G_1 while conventionally measured public expenditure grows by the area G_0 JK G_1. It is the effect on measured public spending that Kau and Rubin try to assess empirically.

It is interesting to contrast this explanation for government growth with Baumol's (1967) supply-side explanation. Baumol suggests that increases in the marginal cost of government relative to that for private goods, due to the public sector's relatively intensive use of labor and slower productivity advance, will increase the size of government. In Fig. 1 this could be shown by considering an upward shift of the MC curve, which would lead to a *decrease* in the quantity of public goods in contrast to the Kau-Rubin supply shift. As before however, conventionally measured expenditure still increases if—as West's survey indicates—demand for public services is inelastic.

In both of these cases, outward shifts of demand due to growing incomes will also lead to increases in the size of the public sector. Thus, the model in Fig. 1 suggests that with the passage of time, there are good reasons for government spending to rise as a result of both demand and supply factors.

2.1 Integrating the structure of Congress

As indicated in the course of our discussion, Kau and Rubin represent supply forces in their empirical work by three variables, stated here along with their mnemonics used later in specifying estimating equations: the female labor force participation rate (*Female participation*); the rate of self-employment (*Self-employment*); and the percentage of households with a computer (*Computers*).

Demand is represented by two factors that shift the demand curve in Fig. 1. The first is of course real income (*Real income per capita*). Kau and Rubin (2002) used aggregate real GNP as their income variable (see Appendix A). But since we model real per capita expenditure, it makes more sense to us to use a per capita income variable.

The second factor accounting for demand is the ideological position of members of Congress in the House and Senate, as represented by the median of the first dimension of the Poole-Rosenthal (1996) DW_Nominate index (*DW_House, and DW_Senate*). It is fair to say that the Poole-Rosenthal index of ideological positioning of members of Congress represents one of the most important advances in the empirical study of that body over the last two or three decades. As far as we are aware, Kau and Rubin were the first to use it to model

public expenditure. The argument for doing so, to recall, is that the decisions emerging from the legislature will depend to some degree on the ideological makeup of those elected to it. They hypothesize that, given the level of economic activity, a more conservative or Republican Congress will favor a lower level of spending than will a more Democratic one. In this way they explicitly bring the legislator as a representative of the electorate into the analysis of public policy.

Parenthetically, it should be noted that what is meant by 'conservative' here is perhaps best understood in the context of the issues that the parties decide to contest from year to year. The Poole-Rosenthal measure of ideology is not designed to reflect the long run evolution of views about the general role of government in society, from the limited place it was held in the eyes of the founding fathers, as described in historical studies of public expenditure by Higgs (1987) and Holcombe (2002), to the expanded role it came to assume in public affairs after the New Deal.

In addition to reconsidering the roles of supply and demand factors using new and more up to date time series, we continue the integration of congressional structure into explanations of the growth of government Kau and Rubin began. First, we integrate the organization of parties in the legislature into the analysis. Recent work on the importance of majority party strength in Congress includes Krehbiel (1998), Cox and McCubbins (2007) as well as Aldrich et al. (2007), among others.[7] The latter authors provide a measure of party strength based on the Poole-Rosenthal work that is eminently suitable for use in the present context. A party's strength, as they define it, grows with the difference between its members' ideological median and that of the opposition, and it also grows with the degree of intra-party homogeneity. Their measure of party strength is outlined in more detail below.

Aldrich et al. (2004, p. 9) argue that *whatever* the median member's ideology, "as a majority party becomes (more powerful, that is) more distinct from its rival and more homogeneous within, it is expected that the members of that party will tend to empower leadership with institutional powers that will allow party outcomes to move away from the floor median and towards the party median". The logic of collective action (Olson 1965) provides one foundation for this argument: a change in the organization of a majority party brought about in part by its increased ideological homogeneity will tend to make it easier for members to agree on what it (and they) should do. In particular, more homogeneity reduces the principal-agent problem for individual members, allowing majority party members to delegate their legislative power to their leaders who then become more powerful (Aldrich et al. 2004, p. 3).[8]

Party strength as Aldrich and his colleagues define it may push spending in the same direction as does a change in the median legislator's ideological position, or it may counteract it. For example, if one expects that a move to the right in the median position of legislators will lead to a reduction in government spending, and this conservative shift occurs—as it clearly did, for example, in 1994/95—a concurrent increase in Republican party strength when they are in the majority may reinforce the trend towards reduced spending, *assuming* that the strengthening of a majority party (for a given chamber ideological median) does in fact simply lead to a movement towards the majority party's ideological median. On the other hand, if a strengthened Republican party in this example tends to favor *more* (and, perhaps, different) spending rather than less for a given chamber median, the two developments may work in opposite directions. This could occur because a more homogeneous party is

[7] We return to Krehbiel's work in a later section. See also Rohde (1991), and Aldrich and Rohde (2000).

[8] For related analyses of party organization, see Cox and McCubbins (2007) and Aldrich (1995).

better able to reach agreement about what money should be spent on, and may be better able to press its demands in this respect in Congress.

To construct an index of party strength, Aldrich et al. devise chamber-specific 'conditional party government' indexes as they call them, which will be referred to below as *CPG_House and CPG_Senate*. (The adjective 'conditional' implies that a party's strength is not independent of the characteristics of its members.) These indexes are based on a factor analysis of four partisan differences in the Congress as measured by the Poole-Rosenthal DW-Nominate data. These four components are drawn from the DW-Nominate indexes of legislator ideal point positions in *two* dimensions. They are: the extent of intra-party heterogeneity; of intra-party homogeneity; of overlap between ideal point positions of the two parties' members; and of the predictability of ideal point locations from knowledge of party affiliation. For details, see Aldrich et al. (2007, data available upon request). The CPG index of majority party strength is the single or first factor derived from their principal component analysis using these four components.

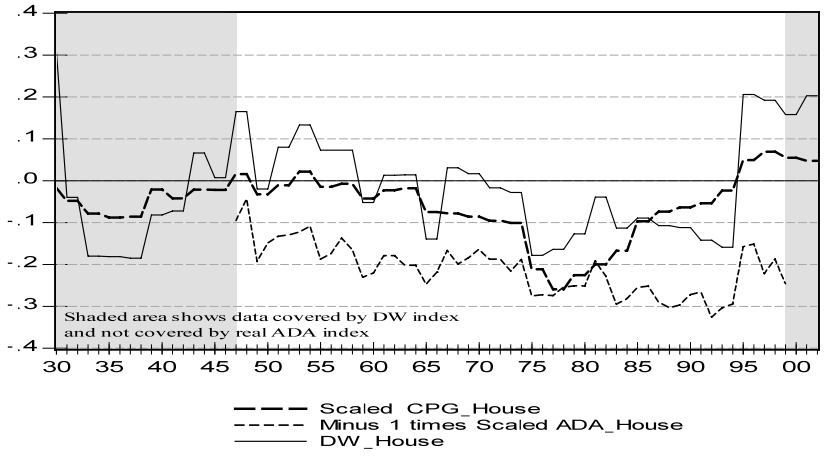
The *CPG* index for either chamber increases when the majority party becomes ideologically more homogeneous, as measured by the dispersion of DW-Nominate scores, and it also increases when differences between parties in their median ideological positions grow. In other words, *CPG* rises with within-party homogeneity and with between-party differences in ideological positions. These indexes are graphed in Figs. 2a and b for the House and Senate respectively, along with corresponding (scaled) median DW-Nominate indexes for the first dimension.

Note the obvious downward trend in majority party strength in the House after the Second World War, which bottoms out in the mid to late 1970s, and the consequent reversal for the rest of the period. This corresponds with the decline of Democratic strength over the McCormack and Albert speakerships, and Tip O'Neill's contribution to the turn-around. The historically high levels of party strength under Republican speakers Newt Gingrich and Dennis Hastert after 1994 also stand out.

It should also be pointed out that despite the fact that the measures of party strength shown in Figs. 2a and b are based on various elements of DW_Nominate indexes, the simple correlation between *DW_House* or *DW_Senate* and their conditional party government (*CPG*) counterparts is not high. The simple correlation between *DW_House* and *CPG_House* over our sample period, 1930 to 2002, is 0.699, and that between *DW_Senate* and *CPG_Senate* is −0.004. The cross chamber correlations are modest. These variables represent different processes.

A second extension addresses the question of whether or not unified control of the government by one or the other party complements the roles of ideology and party strength. We had previously hypothesized that an ideological swing to the right, for example, may be expected to lead to reduced spending overall (and, perhaps, also to a change in its composition—a matter to be discussed later). So, too, may an increase in party strength by the Republicans when they are in a majority. But, for a given median ideological position, does increased Republican control of the branches of government also lead to a reduction in the size of government? And, for the Democrats, should we expect things to work in the opposite direction, with greater Democratic control implying greater overall government spending?

The obvious answer might appear to be yes. But there are countervailing hypotheses. In particular, Mayhew (1991) in his work on divided government has argued that periods of divided government may actually be periods of great government activity as parties seek to reach compromise on major public projects, such as the national highways. Relatedly, McCubbins (1991) has offered the possibility of stalemate (a bilateral veto game) under



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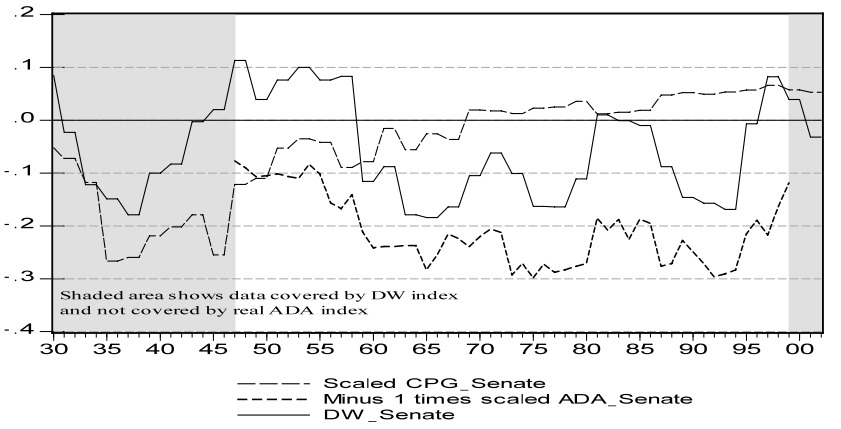

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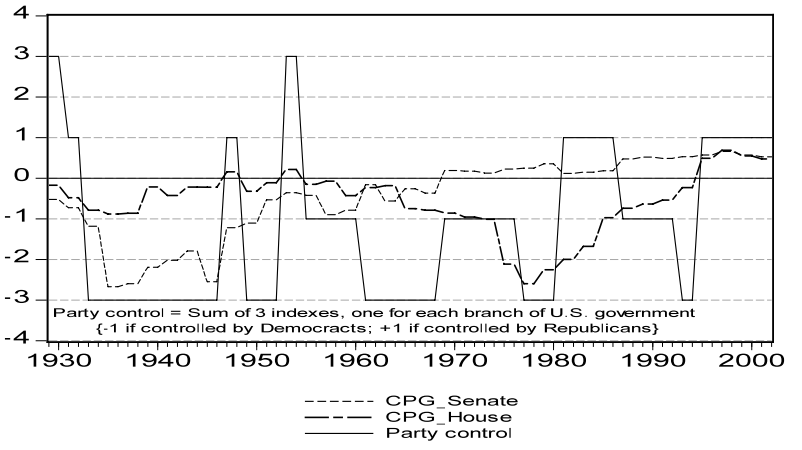

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Fig. 2 **a** Indexes of ideology and party strength: U.S. House, 1930–2002. **b** Indexes of ideology and party strength: U.S. Senate, 1930–2002. **c** Indexes of majority party strength (CPG) and party control 1930–2002

divided government in which each party receives support for the projects its constituencies favor, thus leading to a greater increase in the size of government during periods of divided government than at other times. Additionally, one may argue simply that every party wants to spend more on favored constituencies, and that this will be easier the more the three branches of government are unified under its control. *Ceteris paribus* then, do Republicans spend less (or Democrats more) when their control over the various branches of Congress increases? The models we offer will allow us to shed some light on this theoretical puzzle.

To incorporate the degree of partisan control of the branches of Congress, we use the index *Party control* which is the sum of three indicators, each of which is either -1 denoting Democratic control of a chamber or the presidency, or $+1$ indicating Republican control. (See Fig. 2c.) An increase in this index, which varies between $+3$ and -3, indicates that overall Republican control of both chambers and the presidency is increasing, while a value of (say) -3 indicates complete control of the three branches by the Democrats. We also experimented with a party-neutral index of control, *Undivided,* which is 1 if all branches are controlled by the same party and 0 otherwise. But since this index does not perform any better than *Party control*, nor contradict results for the latter, its coefficients are not recorded in the following tables and are only briefly commented on below.

2.2 A basic estimating equation for federal government expenditure

We are now ready to state the basic estimating equation for (the log of) real gross federal public expenditure per capita. This model encompasses Kau-Rubin as well as the additional dimensions of Congressional structure introduced above:

$$\begin{aligned} \textit{Federal spending} = {} & c_1 \cdot \textit{Female participation} + c_2 \cdot \textit{Self-employment} + c_3 \cdot \textit{Computers} \\ & + c_4 \cdot \textit{Real income per capita} + c_5 \cdot \textit{DW\_House} + c_6 \cdot \textit{DW\_Senate} \\ & + c_7 \cdot \textit{CPG\_House} + c_8 \cdot \textit{CPG\_Senate} + c_9 \cdot \textit{Party control} \\ & + c_{10} \cdot \textit{WWII} + c_{11} \cdot \textit{WWIIAftermath} + c_{12} \cdot \textit{Korea} + c_{13} \cdot \textit{Nine-eleven} \\ & + c_{14} \cdot \textit{Year} + c_{15} \cdot \textit{Constant} + \textit{Error}. \end{aligned} \tag{1}$$

Analogous equations to (1) that use only House, or only Senate congressional variables are also estimated, along with similar equations for federal defense and non-defense spending as well as for all government (consolidated) spending.

As indicated in Table 1, all explanatory economic variables are used in log form. Expected signs in (1) for the variables introduced earlier are: $c_1 > 0, c_2 < 0, c_3 > 0$, $c_4 > 0, c_5 < 0, c_6 < 0, c_7 =?, c_8 =?$ and $c_9 =?$ with the question marks indicating that there are conflicting hypotheses concerning the effects of majority party strength and divided Congress. The signs on the DW-Nominate indexes follow from the fact that *DW_House* and *DW_ Senate* vary from -1 (indicating an extreme liberal stance), to $+1$ (indicating a very conservative perspective on legislative issues), and those for the CPG party strength indexes take into account that a CPG index increases algebraically when party strength does.

Equation (1) also includes dummy variables related to wars to insure that estimates are not biased by war-related events, specifically: a shift in the spending equation during the Second World War (*WWII*); allowance for the possibility of an upward jump in spending after the war, also referred to as a Peacock-Wiseman (1967) displacement effect (*WWIIAftermath*); a dummy for the Korean War in the early 1950s; and one to allow for the aftermath

Table 1 Mnemonics. Estimation uses the natural log of the following variables unless noted otherwise. Dummy variables are not used in log form. Notation used by Kau and Rubin (2002) is indicated in brackets where appropriate. The dataset including detailed sources is found at www.carleton.ca/~winers

Agriculture (A)	Percent employment in agriculture
ADA_House	Median score of the real ADA index for legislators, House. Not logged
ADA_Senate	Median score of the real ADA index for legislators, Senate. Not logged
Average_ADA	= (ADA_House + ADA_Senate)/2
Average_CPG	= (CPG_House + CPG_Senate)/2
All government spending (AFSR)	Real per capita, gross all government (consolidated) spending, 2000 base year Federal grants to lower level governments are netted out
Computers (T)	Percent of household with a computer
CPG_House *CPG_House_Dem* *CPG_House_Repub*	Index of majority party strength in the House (conditional party government) Suffix 'Dem' or 'Repub' denotes value of CPG for periods in which Democrats or Republicans control chamber, = 0 otherwise. Not logged
CPG_Senate *CPG_Senate_Dem* *CPG_Senate_Repub*	Index of majority party strength in the Senate (conditional party government) Suffix 'Dem' or 'Repub' denotes value of CPG for periods in which Democrats or Republicans control chamber, = 0 otherwise. Not logged
DW_House (HOU)	1st dimension of DW-Nominate scores for the median member in the House. Not logged. Log form = log(1+ DW_House)
DW_Senate (SEN)	1st dimension of DW-Nominate scores for the median member in the Senate. Not logged. Log form = log(1+ DW_Senate)
Farm income (FR)	Net farm income as percent of GDP
Federal spending	Real per capita (total) gross federal expenditure, 2000 base year
Federal defense spending	Real per capita gross federal defense expenditure, 2000 base year
Federal non-defense spending	Real per capita gross federal non-defense expenditure, 2000 base year. Computed as federal spending less federal defense spending. This component includes interest payments to persons
Female graduates (CF)	Number of females 25 years and older with college degree/number of females 25 years and older
Female income (FI)	Real mean income of full time female workers
Female participation (FP)	Female labor force participation rate (number of females in civilian labor force/number of females in civilian noninstitutional population), percent
Korea	= 1 for 1950 to 1953, = 0 otherwise
Miles of road (MR)	Miles of paved road, thousands
Nine-eleven	= 1 from 2001 to end of sample; = 0 otherwise
Party control	Index of control of Congress by one party. Varies from −3 to 3. Sum of 3 indexes, one for each chamber and the presidency {−1 if chamber or presidency is controlled by Democrats; +1 if controlled by Republicans}. Not logged. A party neutral analogue discussed in the footnotes is: *Undivided* = 1 if all branches controlled by the same party; = 0 otherwise
Real GDP (GNP)	Real GDP, billions of chained dollars, 2000 base year
Real income (I)	Real per capita GDP
Self-employment (SE)	Self-employment rate (full time workers), percent
Urbanization (U)	Urbanization as percent of population in urban areas
Vietnam	= 1 for 1967 to 1975; = 0 otherwise
WWII (DW)	Dummy for World War II; = 1 for 1942–1946, = 0 otherwise
WWIIAftermath	= 1 if year = 1947 and beyond, = 0 otherwise
Year	Time trend
"< 1947" *and* "1947+"	Suffix denoting a variable defined for the period before 1947 (<), or from 1947 on (+), = 0 otherwise

of the dramatic events of September 2001 (*Nine-eleven*).[9] The coefficients on all of these dummy variables are expected to be positive. A time trend is also allowed for, of unpredictable sign, and in some equations, selected coefficients are allowed to shift after the war in a manner to be indicated later.

A role for these dummy variables and the time trend is suggested by the nature of equation residuals when these variables are not included. Note that we do not include a dummy for the Vietnam war in the basic equation. (One is included later when the defense/non-defense composition of federal expenditure is considered.) The reason is that the Nominate indexes serve nicely as proxies for the Vietnam war in the total federal spending equations, as is suggested by Figs. 2a and b. Adding the Vietnam dummy, which is never significant in the total federal spending equations, does not improve equation residuals, nor affect our conclusions in any substantive fashion.

Equation (1) and it variants are supplemented by four additional equations as in Kau and Rubin's work. These explain *Female participation*, *Self-employment*, *Farm income* and the degree of *Urbanization*, making a five-equation simultaneous system that is estimated by three-stage least squares. These additional equations, along with the original Kau-Rubin expenditure equation, are given in Appendix A. In addition to estimating this system, we also estimate (1) and its variants by two-stage methods and by least squares. In all cases, the five-equation system is used to specify instrumental variables, and Newey-West robust standard errors are used when appropriate.

Before turning to a brief discussion of some important features of the data and then the estimation, there are two further aspects of the estimating equations that deserve highlighting. First, since congressional structure bears in the first instance on spending by the *federal* government, our work focuses on the explanation of public spending at this level, as well as on its defense/non-defense composition. In contrast, the dependent variable used by Kau and Rubin included all government (consolidated) spending.

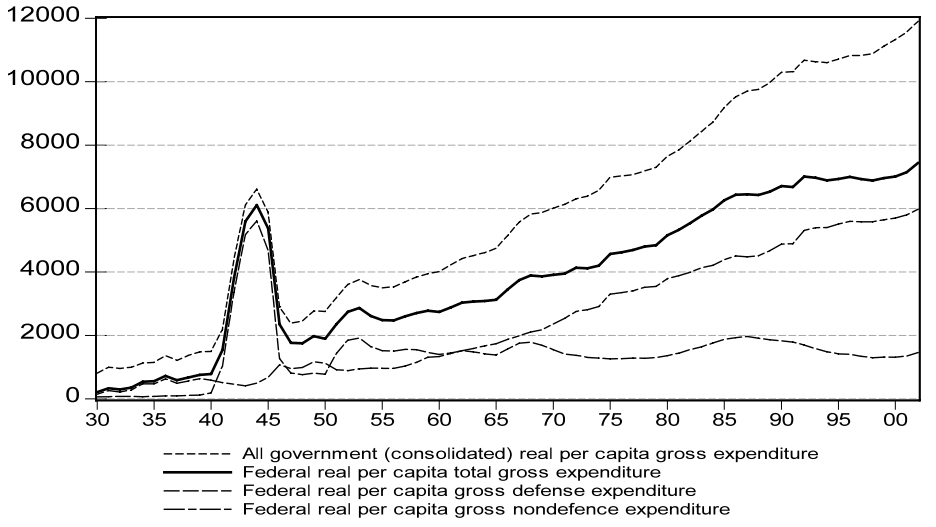
It turns out not to matter much for the general fit of the estimating equations which measure of government spending is used. Even a quick look at the time series for various measures of public expenditure graphed in Fig. 3a suggests why this fact should not be surprising. The simple correlation between real per capita consolidated spending and its federal counterpart over the period 1930 to 2002 is evidently high (it is 0.985), and the movement of the series over time is similar as can be seen in the figure.[10] We shall return to this matter below.

Second, it should be acknowledged that the representation of supply and demand in (1) is not unambiguous. Women entering the labor force will likely demand services they used to provide at home, such as early schooling, and income may proxy the size of the income tax base—a supply side factor—as well as lead to demands for public services. Moreover, when women enter the work force they must necessarily increase measured income, further confounding supply and demand. These problems of making a precise distinction between supply and demand are present in virtually all studies of government growth: we do not attempt to resolve them here, and we regard the spending equation as a semi-reduced form, where the key issues to be investigated are the relative importance of trending economic factors and the structure of Congress.[11]

[9] Kau and Rubin only used a time trend and a dummy for the Second World War.

[10] This correlation exists despite that fact that the relative size of federal and non-federal public sectors is not constant.

[11] On the former issue concerning women, see Lott and Kenny (1999). On the latter—identifying supply versus demand—see Ferris and West (1996) who try to econometrically identify demand and supply, and Kenny and Winer (2006) who use real GDP as an indicator of the income tax base in a model of taxation.



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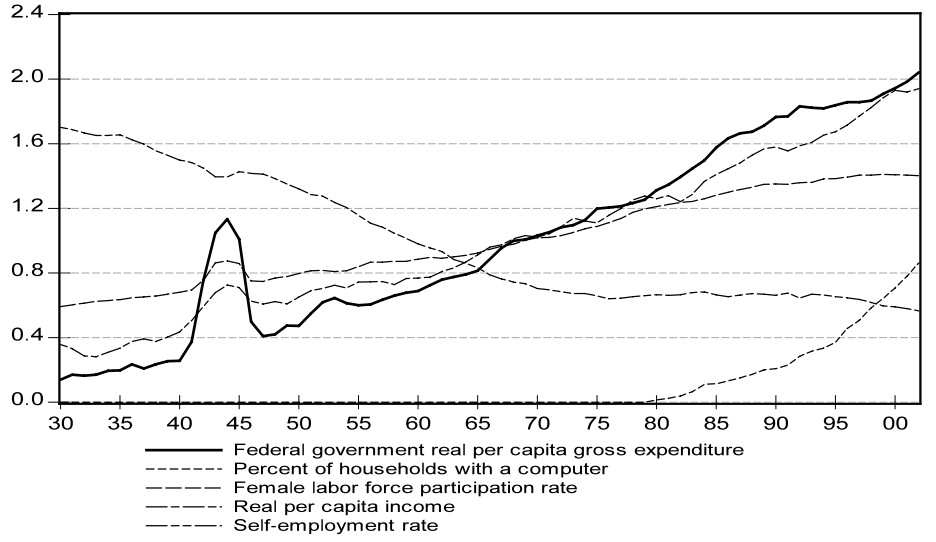

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Fig. 3 **a** Real per capita government spending, 1930–2002. **b** Selected mean-standardized variables 1930–2002

3 Data and estimation results

To complement the graphs of the political variables discussed earlier, Fig. 3b charts important (mean-standardized) economic variables appearing in the estimating equations, and Table 2 and a correlation matrix in Appendix B provide selected descriptive statistics for both political and economic time series. Several features of these data warrant attention.

The first of these features concerns the fact that the measurement of female labor force participation from 1930, a key factor in the present study, is not straightforward. From 1930

Table 2 Descriptive statistics, 1930 to 2002 and other selected time periods

	All govt real per capita spending	Federal real per capita spending	Federal real per capita *defense* spending	Federal real per capita *non-defense* spending	DW_House	DW_Senate	ADA_House	ADA_Senate	CPG_House	CPG_Senate	Real GDP	Real per capita GDP	Female labor force participation	Self employment
Mean	5897	3956	1441	2515	−0.018	−0.055	36.96	36.71	−0.58	−0.45	3967	18 149	42.79	12.05
Mean for Kau/Rubin (2002) period, 1930–1993	5168				−0.041	−0.063					3256	16 114	40.44	12.69
Mean from Kau/Rubin (2002, p. 398) for 1930–1993	3210				1.02	1.05					1471	5394	39.29	12.71
Median	5870	3891	1420	1879	−0.028	−0.083	35.32	38.54	−0.426	−0.258	3399	17 290	40.3	9.6
Maximum	11 901	7446	5613	5985	0.309	0.113	56.97	52.24	0.691	0.66	10 083	34 934	60	20.7
Minimum	816	211	63	148	−0.185	−0.184	7.69	13.46	−2.595	−2.665	634	5056	25.2	6.88
% Change, 1930–2002 (or 1947–1999)	1358	3427	2208	4498	−34	−138	158 (1947–99)	54 (1947–99)	−377	−201	1175	444	137	−68
(Begin − End)/ Mean, as in K/R (2002, p. 400)	1.88				5.89	2.13					2.38	1.57	0.8	1.15
Standard deviation	3349	2211	987	1889	0.12	0.094	10.75	11.48	0.77	0.99	2714	8529	11.3	4.65
ADF (levels)	−0.29		−5.29	1.76	−2.17	−2.56	−3.18	−2.23	−1.17	−1.14	4.12	1.3	−0.34	−2.14
ADF (1st difference)	−6.43		−6.34	−7.71	−7.65	−8.37	−7.47	−7.35	−8.38	−8.39	−4.68	−5.49	−6.62	−3.42
Observations	73		73	73	73	73	53	53	73	73	73	73	73	73

Notes: ADF = adjusted Dickey-Fuller statistic with constant term only, using Akaike criterion and automatic lag length selection (maximum lag = 4). MacKinnon (1996) ADF critical value at 1% = −3.53; at 5% = −2.90; at 10% = −2.59

to 1940 inclusive, only the two census estimates of female labor force participation exist. In the U.S. Census of Population data for 1930, the female participation rate (ages 15+) is 24.8, and in the Census of 1940 (for ages 14+) it is 25.8. Yearly estimates of this variable are presented in the *Current Population Surveys* only beginning with this publication in 1940. Moreover, in both sources, different age groups are used from time to time to define the relevant populations. We have interpolated (geometrically, from the center out) to produce our estimates of *female participation* between 1930 and 1940 and have adjusted the result for changes in age coverage of the raw data.[12]

Are these data adequate? Just as is the case with the computed figures for the 1929 to 1940 period illustrated in Fig. 3b, a measure of the *total* civilian noninstitutional labor force participation rate rises steadily from 40.4 to 42.2 suggesting a steady rise in the labor force participation rate of women for these years.[13] On the other hand, unemployment rates rise dramatically during these years, perhaps indicating that labor force participation may not adequately capture the financial status of women (or of men). Caution is warranted, and we estimate our equations for the post-war years as well as for the entire period from 1930.

Another important matter, one that leaps out at the observer of the data graphed in Figs. 2a to 3b, is that the economic variables exhibit strong trends or, in other words, are integrated of order 1, except for *Federal defense* which is stationary or I(0), facts confirmed by the Adjusted Dickey-Fuller statistics in Table 2. On the other hand, the political variables shown in Fig. 2 are, if not I(0), then more nearly so, especially as indicated in the table for *DW_Senate* and *ADA_House*. Because of this difference in the order of integration of these economic and political factors, it is reasonable to expect developments in ideological positioning and majority party strength to have mainly transitional or shorter run effects on the evolution of government spending over the decades. We shall also return to this important issue in empirical political economy later.[14]

Finally, it is evident from Fig. 3b and the correlation matrix in Appendix B that we must remain cognizant of the correlation between the economic factors, especially female participation and real income. We do so by using different time periods for estimation purposes, and by comparing models with and without real income included.

3.1 Results using DW_Nominate indexes, 1930–2002

We now turn to the results of estimating (1) and selected variations along with the auxiliary equations specified in Appendix A. To conserve space, only the estimates of the federal government spending equation are recorded in the main tables. One equation for all government spending is also reported (in column 3b) for comparison with the other equations.

Three estimation methods are used to insure robustness: three-stage system estimation, two-stage and ordinary least squares. The OLS results in column 5 of Table 3 are especially interesting since a graph of the equation residuals and the Adjusted Dickey-Fuller statistics suggests that the equation can be considered a cointegrating or longer run relationship, at least when the four main economic variables alone are considered to be endogenous. This is useful because, as noted earlier, women who enter the labor force can raise the potential

[12] These adjustments are described in the data spreadsheet referred to earlier.

[13] These figures refer to the total civilian noninstitutional labor force from Bureau of Census Table HS-29, divided by total population from Table HS-2. See also U.S. Bureau of the Census, Table HS-30 (www.census.gov/statab/hist. Table 02HS00300.xls).

[14] Lopez and Ramirez (2004) and Erikson et al. (2006) have also considered the time series properties of selected U.S. political factors.

size of the income tax base only if female labor force participation increases aggregate measured income. Thus the model contains within it a reason why female participation and real incomes are simultaneously determined.

In the following discussion, we consider the results by variable taking all methods of estimation and alternative specifications of the basic model into account. Here the statistical significance of the various factors is emphasized. An investigation of the relative quantitative importance of economic factors and congressional structure will be presented in a later section.

It is evident from Table 3 that *Female participation* is indeed significantly associated with increased government spending. This is true even for the OLS estimation in column 5 and in column 6 (which omits real income), where the estimated equations may be considered cointegrating relationships. Note that the omission of real income, which will likely lead to an overestimate of the true effect of female participation, still leaves the coefficient equal to about one-half of what it is in the key Kau-Rubin results (see column 2 in Table 7) while the results for the political variables are generally the same.[15]

Self-employment does not have its expected negative and significant coefficient. *Computers* enters negatively and sometimes significantly, indicating, if anything, that contrary to the Kau-Rubin model, increasing computerization shifts power to the taxpayer and not to the tax collector. It seems just as reasonable to find that increases in home computer use increase the ability of taxpayers to avoid and evade, as to expect that on balance computerization shifts power to the tax collector.

Real income is significant in some specifications and median chamber ideological positioning is almost always significant with the expected sign. The coefficient of real income is always positive, and is significant in 2 of the 5 columns including the OLS results in column 5, though like the coefficient on female participation, estimates of the size of the coefficient are not uniform. This feature of the results is likely due in part to correlation of the economic variables, as illustrated by the difference in results between column 5 and column 6 where income is omitted.

A 'leftward' movement in the median ideological position of representatives—that is, a decline in the DW-Nominate indexes—for both the House and Senate almost always indicates, as expected, that government size increases (except in 2 of 18 cases where the coefficient is also insignificant). The results in this table do not establish clearly in which chamber the effect is stronger.

As for majority party strength: looking across the columns, the size and significance of coefficients on *CPG* (in columns 1 and 3) indicate that stronger parties *in the House*, *whether Democrat or Republican*, lead to more spending, and that *the opposite* is generally true for the Senate. (Judging by the results in columns 4 to 6, the positive effect of party strength in the House appears to be stronger after 1947 than before the war.) The absolute size of the effect also tends to be much stronger in the House than in the Senate for any given specification (look down the columns for comparable House and Senate CPG coefficients). This aspect of the results is consistent with the greater importance of changes in the ability of majority parties in the House to deal with collective action problems in budgeting negotiations. Constituencies in the House are much smaller than in the Senate and, hence, are more heterogeneous (across constituencies) with respect to the nature of voters and of elected representatives.

[15]The main exception here concerns DW_House before 1947. Its coefficient in column 6 is positive and insignificant, while the coefficient is negative and significant in column 5. Dropping *Self-employment* from the various equations here and below in addition to *Real income* does not substantially alter our results.

Table 3 Explaining federal (and *All Government*) real per capita spending, 1930–2002. Various estimation methods: Newey-West HAC standard errors used where appropriate

	3SLS		3SLS		2SLS	OLS	OLS
	House	Senate	Both chambers		Both chambers, with time shifts	Both chambers, with time shifts	Both chambers, with time shifts
			Federal	*All Govt*			
	(1)	(2)	(3a)	(3b)	(4)	(5)	(6)
	9.98	3.07	12.26	6.07	8.58	2.75	4.21
Female participation	(2.81)***	(3.64)***	(3.89)***	(4.52)***	(1.82)*	(2.96)***	(4.50)***
Self-employment	0.19	1.86	−0.06	−0.35	0.29	0.07	−0.36
	(0.27)	(3.76)***	(0.08)	(0.96)	(0.39)	(0.16)	(0.87)
Computers	−0.23	−0.22	−0.20	−0.06	−0.25	−0.09	−0.09
	(2.36)**	(3.53)***	(1.92)*	(1.35)	(1.22)	(1.05)	(0.72)
Real income per capita	0.83	1.65	0.29	0.30	0.67	1.89	
	(1.28)	(5.34)***	(0.42)	(1.00)	(0.69)	(2.56)**	–
DW_House	−1.09		−0.41	−0.18			
	(3.11)***		(1.00)	(0.94)			
DW_House (< 1947)					−1.52	−1.12	0.31
					(1.37)	(2.01)**	(0.32)
DW_House (1947+)					0.32	−0.25	−0.11
					(0.55)	(0.90)	(0.31)
DW_Senate		−0.72	−1.00	−0.64			
		(2.34)**	(1.63)	(2.27)**			
DW_Senate (< 1947)					−1.07	−0.62	−1.75
					(0.39)	(0.39)	(0.82)
DW_Senate (1947+)					−1.26	−0.36	−0.45
					(1.52)	(1.32)	(1.87)*
CPG_House_Dem	0.35		0.36	0.17			
	(2.62)***		(3.27)***	(3.58)***			
CPG_House_Repub	0.92		0.86	0.36			
	(2.31)**		(2.54)**	(2.46)***			
CPG_Senate_Dem		−0.11	−0.19	−0.05			
		(2.72)***	(2.71)***	(1.72)*			
CPG_Senate_Repub		0.07	−0.16	0.0002			
		(0.79)	(1.04)	(0.003)			
CPG_House (< 1947)					0.49	0.23	0.51
					(1.42)	(0.86)	(1.25)
CPG_House (1947+)					0.30	0.11	0.15
					(1.62)	(1.79)*	(2.06)**
CPG_Senate (< 1947)					−0.13	0.08	−0.10
					(0.72)	(0.63)	(0.84)
CPG_Senate (1947+)					−0.11	−0.05	−0.16
					(0.75)	(0.49)	(0.14)
Party control	−0.02	0.01	0.01	0.01			
	(1.28)	(0.73)	(0.50)	(1.19)			
Party control (< 1947)					0.003	−0.11	−0.11
					(0.03)	(1.75)*	(1.15)
Party control (1947+)					0.03	0.02	0.02
					(1.97)*	(2.12)**	(2.36)**
WWII	0.002	0.64	−0.12	0.18	0.28	0.63	1.03
	(0.005)	(4.20)***	(0.40)	(1.33)	(0.51)	(2.60)**	(4.53)***
WWIIAftermath	0.32	0.54	0.57	0.29	0.43	0.40	1.01
	(1.78)*	(4.10)***	(2.78)***	(3.15)***	(0.70)	(0.96)	(3.07)***

Table 3 (*Continued*)

	3SLS House	Senate	3SLS Both chambers		2SLS Both chambers, with time shifts	OLS Both chambers, with time shifts	OLS Both chambers, with time shifts
			Federal	*All Govt*			
	(1)	(2)	(3a)	(3b)	(4)	(5)	(6)
Korea	−0.12	−0.13	−0.02	−0.01	0.10	0.04	0.14
	(1.38)	(1.80)*	(0.20)	(0.19)	(1.18)	(0.66)	(2.05)**
Nine-eleven	0.26	0.003	0.25	0.11	0.42	0.13	0.17
	(0.91)	(0.03)	(1.01)	(1.02)	(1.53)	(2.65)**	(2.47)**
Year	−0.10	−0.004	−0.12	−0.06	−0.07	−0.04	−0.03
	(2.38)**	(0.26)	(3.34)***	(3.60)***	(1.69)*	(3.27)***	(1.16)
Constant	−33.69	−24.05	−35.92	−14.16	−28.44	−19.38	−.6.56
	(5.13)***	(6.47)***	(5.63)***	(4.78)***	(2.02)*	(3.34)***	(2.27)**
OBSV.	73	73	73	73	73	73	73
ADJ R^2	0.94	0.97	0.92	0.98	0.96	0.99	0.98
D.W.	1.02	0.82	1.26	1.14	1.59	1.82	2.01
L.M. (P-Value)					0.00	0.68	0.47
ADF (residuals): 1 lag (4 lags)						− 5.58* (−5.09)	−6.61** (−4.94)

Notes: Absolute value of t-statistics in brackets. (***)(**)(*) = significant at (1%)(5%)(10%); D.W. = Durbin-Watson; L.M. = P-value for (obsv × R^2) from auxiliary regression to test for serial correlation with lag length 2; ADF = Adjusted Dickey-Fuller statistics using Akaike criterion and maximum lag length 1 (or 4). MacKinnon (1996) critical value for cointegration with 4 (or 8) variables, a constant and time ($n = 73$): at 5% = −4.63 (−5.64); at 10% = −4.30 (−5.49)

We shall see that these results for party strength are similar to those in equations which make use of ADA indexes in place of the Nominate data. They are all new to the literature.

Party control generally is significant only in the post war period (in columns 4, 5 and 6). When it is significant after the Second World War, the positive coefficient indicates that increasing control by the Republicans is associated with *more* spending, not less, contrary to McCubbins (1991). A similar result with respect to total expenditure arises if one uses the partisan-neutral index *Undivided* that indicates when the three branches of government were completely unified. In that case, the resulting coefficient always indicates that undivided government is associated with more spending, though the coefficient is never statistically significant.[16]

Finally, we note that a comparison of columns 3a and 3b confirms that it does not matter much for the general fit of the spending equation whether one uses federal or all government expenditure as the dependent variable. While not reported here, estimation of the remaining columns using all government spending leads to the same general conclusions as are reported above. There are reasons for this: aggregating public expenditure across the 50 states blunts the consequences for estimation of the sometimes wide differences in state electorates and governments, and federal mandates backed by judicial interpretation along with the growing importance of federal grants in state budgets effectively inserts federal politics into state legislatures. [17]

[16]The largest Newey-West t- statistic is 1.4 in the experiments we conducted. This result refers to the coefficient on the party-neutral index *Undivided* instead of *Party control* in the models of column 5 of Table 3, and column 4 of Table 4.

[17]Federal grants grew from about 1% of state-local gross spending in 1930 to about 18% in 2002.

3.2 Using the real ADA indexes, 1947–1999

The results of using real ADA indexes instead of DW-Nominate over the 1947–1999 period are recorded in Table 4. This estimation serves as a check on the robustness of the conclusions reached so far, both because ADA scores measure ideological position in a different manner, and because these data restrict the estimation to a different time period. For comparison purposes, column 2 of the table reports estimation for the same sample using the DW-Nominate data.

Unlike DW-Nominate scores, which are based in part on the assumption that if a legislator's preferences change, they do so smoothly and by the same amount each period, real ADA scores impose no restrictions on how preferences of legislators may change over time. A second advantage of ADA scores is that they are comparable across chambers of Congress while, strictly speaking, DW-Nominate scores are not. For this reason column 5 of the table reports on the use of averages of the ADA scores for House and Senate. A disadvantage of this data is that ADA scores are not as precise in discriminating among ideological positions of legislators with similar but not identical views.

Chamber medians of the two types of ideology measures are well correlated, as Figs. 3a and b illustrate. For the House, the simple correlation for 1947 to 1999 is about 0.79 and for the Senate it is about 0.87, and these series exhibit the same peaks and valleys. Both indexes also identify the 1994 election as embodying the biggest conservative shift in Congress since the election of 1948, as pointed out by Groseclose et al. (1996) and Grofman et al. (2001). On this account, we should not expect general results in the two tables to differ. And in fact, a comparison of columns 1 and 2 of Table 4 shows that *ADA_House* and *ADA_Senate* perform more or less the same way as do the corresponding *DW_House* and *DW_Senate* indexes in terms of signs and significance of the estimated coefficients. Moreover, the restriction of the sample to the period after the Second World War does not appear to alter the general conclusions reached earlier.

In Table 4, *Female participation* always has positive and significant coefficients, as before, although the size of the coefficients are much reduced. *Computer* use again has a negative effect on government size, though its coefficient is never significant here. In contrast to Table 3, *Self-employment* now has its expected, significantly negative coefficient, indicating that self-employed people are, at least in the post-war period, harder to tax.

Real income has a negative coefficient, and is always insignificant, in contrast to its positive sign in Table 3. It is hard to imagine why the negative coefficient is sensible, and we suspect that collinearity of variables in the shorter time period covered by the ADA data plays a role here.[18]

Results with regard to the role of majority party strength and party control of Congress also echo those in Table 3. As before, majority party strength in the House (*CPG_House*) leads to an increase in government spending and, consistent with Table 3, *CPG_Senate* coefficients are smaller than those for the House (and are also insignificant). Moreover, the effect of *Party control* is again to increase spending; that is, as the Congress is increasingly unified under the Republicans, government size increases, with three of five coefficients significant and with a uniform sized coefficient in four of these equations.[19]

[18] We note that using the ADA indexes in log form (in the specification otherwise indicated in column 4) results in a positive but insignificant coefficient on real income.

[19] And as before, using the partisan-neutral index *Undivided* results in positive but non-significant coefficients (the largest t-statistic is about 1.3).

Table 4 Explaining federal real per capita spending using real ADA indexes, 1947–1999. Various estimation methods, Newey-West HAC standard errors used where appropriate

	3SLS	3SLS (DW_Nominate)	2SLS	OLS	OLS (AVERAGE_ADA)
	(1)	(2)	(3)	(4)	(5)
Female participation	5.00 (3.44)***	5.30 (3.34)***	4.68 (4.36)***	1.52 (3.72)***	1.58 (4.05)***
Self-employment	−0.59 (1.86)*	−0.42 (0.13)	−0.88 (4.10)***	−0.42 (2.92)***	−0.41 (4.13)***
Computers	0.02 (0.22)	−0.08 (1.15)			
Real income per capita	−0.32 (0.82)	−0.04 (0.10)	−0.55 (1.41)	−0.15 (0.53)	−0.10 (0.38)
ADA_House	0.001 (0.70)		0.003 (2.37)**	0.003 (2.97)***	
ADA_Senate	0.003 (1.67)*		0.0008 (0.69)	0.0005 (0.32)	
Average_ADA					0.004 (2.59)**
DW_House		−0.16 (0.78)			
DW_Senate		−0.53 (2.09)**			
CPG_House	0.10 (1.47)	0.14 (2.24)**	0.14 (3.19)***	0.04 (2.58)**	
CPG_Senate	0.05 (0.92)	0.04 (0.83)	0.09 (1.07)	0.09 (1.21)	
Average_CPG					0.07 (2.45)**
Party control	0.008 (1.29)	0.02 (2.13)**	0.01 (1.18)	0.01 (2.00)*	0.02 (2.17)**
Korea	0.06 (1.43)	0.05 (1.22)	0.12 (1.80)*	0.12 (2.55)**	0.14 (3.21)***
	−0.04	−0.04	−0.04		

Table 4 (*Continued*)

	3SLS	3SLS (DW_Nominate)	2SLS	OLS	OLS (AVERAGE_ADA)
	(1)	(2)	(3)	(4)	(5)
Year	(2.83)***	(2.27)**	(2.02)*		
Constant	−4.33	−9.49	−0.39	4.90	4.15
	(0.83)	(1.71)	(0.08)	(3.03)***	(2.71)***
OBSV.	53	53	53	53	53
ADJ R^2	0.96	0.96	0.97	0.98	0.98
D.W.	0.99	1.05	1.33	1.25	1.35
L.M. (P-Value)			0.00	0.01	0.04
ADF (residuals): 1 lag (4 lags)				−4.87 (−2.41)	− 4.69 (−2.51)

Notes: See Notes to Table 3. Absolute value of t-statistics in brackets. (***)(**)(*) = significant at (1%)(5%)(10%). D.W. = Durbin-Watson. L.M. = P-value for (obsv × R^2) from auxiliary regression to test for serial correlation with lag length 2; ADF = adjusted Dickey-Fuller statistic using Akaike criterion and maximum lag length 1 (or 4). MacKinnon (1996) critical value for cointegration with 4 (or 8) variables, a constant and time ($n = 53$): at 5% = −4.71 (−5.98); at 10% = −4.36 (−5.60)

As a general comment on the role of Congress in the results in Tables 3 and 4, it may be noted that some observers would not be surprised by them. As David Stockman, budget director under Ronald Reagan, once lamented: "there are no real conservatives in Congress." (quoted in Higgs 1987, p. 255). Indeed, some political economy scholars of a conservative persuasion such as Higgs (1987, p. 255), assert that the (supposedly conservative) Reagan administration "Never had a strong commitment to fundamental change." Higgs (1987, pp. 255–256) calls attention to "massive transfer programs..., (and) the continued subsidies to, bailouts of, and protection from competition for farmers, timber companies, auto, steel, textile, footwear and apparel producers, shipping companies, commercial banks, and countless others...".

3.3 The relative quantitative importance of selected factors

It is always necessary to study the quantitative importance of key factors as well as their statistical significance. Table 5 presents calculations of the quantitative effects of *Female participation*, *Real income* and median ideological positions based on equations in which DW_Nominate and real ADA indexes are used in log form, so that their coefficients too are elasticities. We do not use the CPG party strength indexes in this way however, as adding a constant to transform them to strictly positive time series and then taking logs results in different series and leads to unsatisfactory results. Instead, we consider the importance of majority party strength using simulations in the next section.

The total percentage change in real federal spending per capita for the 1930 to 2002 period is 3427%, and of all government spending is 1358%. Tables 5a and b show the proportion of these changes that can be attributed to the factors considered here.[20]

[20]For the purpose of making these quantitative estimates, percent changes are defined as (end value − beginning value)/mean value. If the denominator is the beginning value, numbers reported below tend to be larger.

Table 5 **a** Contributions of selected factors to change in federal government size, 1930–2002. Proportionate change in variables defined as: (end value − beginning value)/mean value. **b** Contributions of selected variables to change in all government size, 1930–2002. Proportionate change in variables defined as: (end value − beginning value)/mean value

a

Log form of models in Table 3: Proportion of change in Federal spending of 3427% due to:	3SLS Log form of Col. 3a, Table 3. 1930–2002 (1)	2SLS Log form of Col. 4, Table 3. 1930–2002 (2)	OLS Log form of Col. 5, Table 3. 1930–2002 (3)	OLS. Log form of Col. 4, Table 4. 1947–1999 (Using ADA) (4)
Female participation rate	0.293	0.21	0.064	0.032
Real income per capita	0.012	0.029	0.086	0.002
(1 + *DW_House*) *and* (1 + *DW_Senate*) *One coefficient for each chamber for entire sample*	0.004			
(1 + *DW_House*) *and* (1 + *DW_Senate*) *Separate coefficients for* < 1947 *and* 1947+		0.038	0.02	
ADA_ House and ADA _Senate One coefficient for each chamber for entire sample				0.002
ADF (residuals): 1 lag (4 lags)			−5.62** (5.10*)	−5.21* (2.40)
L.M. (P-Value)			0.64	0.002

Notes: See Notes to Tables 3 and 4. (***)(**)(*) = significant at (1%)(5%)(10%). By log form, it is meant that DW-Nominate indexes are used in the form: log (1 + DW). Changes in these indexes refer to (1+ the DW index)
CPG indexes are not used in log form
All columns use DW-Nominate indexes except column 4 which uses real ADA indexes
Change in female participation rate/mean, 1930–2002 = +0.80
Change in real income per capita/mean, 1930–2002 = +1.57
Change in (1+ *DW_House*)/mean, 1930–2002 = −0.082 (= −0.321 for 1930–1946; = +0.038 for 1947 and after)
Change in (1+ *DW_Senate*)/mean, 1930–2002 = −0.124 (= −0.699 for 1930–1946; = −0.153 for 1947 and after)
ADF: = Adjusted Dickey-Fuller statistics using Akaike criterion and maximum lag length 1 (4)
MacKinnon (1996) critical value for cointegration with 7 variables and a constant ($n = 53$): at 5% = −5.36; at 10% = −5.00

Female participation has a large effect that varies considerably with the estimating equation, from about 3% to 29% for federal spending, and from 16% to 30% of all government spending. The most robust results are likely those based on the OLS estimation, shown in the last column of the tables. Here the 3% role for federal spending and 16% percent for all spending is very much less than that found by Kau and Rubin (2002). *Real income* can account for between 0.2% and 8.6% of federal spending and about 3% to 11% of all government spending. Ideology has effects that vary too, from 0.4% to 3.8% for the federal level, and from 0.6% to 7.6% for all government.

Table 5 (*Continued*)

b

Log form of models in Table 3: Proportion of change in *All govt. spending* of 1358% due to:	3SLS. Log form of Col. 3b, Table 3 for All govt. spending, 1930–2002 (1)	2SLS. Log form of Col. 4, Table 3 for All govt. spending, 1930–2002 (2)	OLS. Log form of Col. 5, Table 3 for All govt. spending, 1930–2002 (3)
Female participation	0.304	0.316	0.159
Real income per capita	0.032	0.053	0.109
(1 + *DW_House*) *and* (1 + *DW_Senate*) *One coefficient for each chamber for entire sample*	0.006		
(1 + *DW_House*) *and* (1 + *DW_Senate*) *Separate coefficients for* < 1947 *and* 1947+		0.076	0.054
ADF (residuals): lag 1 (lag 4)			−6.03** (−5.20*)
L.M. (P-Value)			0.64

Notes: See Notes to Table 5a

While these results confirm the importance of female labor force participation, it should be noted that in the OLS equation for the federal sector (in column 3 of Table 5a), and for the total government sector (in column 3 of Table 5b), the combination of the effects of income and median ideological position of legislators (10.9% at the federal level and 16.3% for the total government sector) are greater than the effect attributed to female participation in each case. So in these results demand, as expressed through the legislature, matters too.

It is also important to see that there is another way to assess the quantitative role of the factors considered here. The results in Tables 5a and b indicate that trending economic factors, whether on the supply or on the demand side, are in all cases an order of magnitude more important than movements in median ideological position in explaining the evolution of public expenditure. The relevance of this perspective is reinforced by the fact that the effects attributed to ideology in the tables are an order of magnitude greater when coefficients on the indexes of ideology are distinguished by time compared to the situation when just one coefficient is allowed for the whole sample. This is what we should expect in the present context of a factor (such as a DW-Nominate index) that does not exhibit a dominant trend over the whole sample period.

4 Congress and the composition of federal expenditure

To complete the estimation, we briefly consider results for the defense/non-defense composition of federal spending in Table 6. These equations are harder to fit than before, especially for defense which is a stationary variable (see Table 2), and we make use only of the longer time series from 1930 that relies on DW-Nominate as the index of ideology. We also include a dummy variable for the *Vietnam* war, which was omitted from the equations for total

spending for reasons discussed earlier. We note that inclusion of this dummy variable does not affect our general conclusions.

In the following discussion, we focus on the implications of the structure of Congress for the composition of spending, leaving other aspects for investigation by the reader. Turning to Table 6 then, it can be seen that a leftward ideological move in the House over the sample as a whole leads to increased spending with a non-defense bias. However, inspection of columns where pre- and post-Second World War periods are distinguished reveals a bias in favor of defense that occurs at the same time as the House moves to the left before the Second World War. (Consider the coefficients on *DW_House* < 1947 in columns 2 and 4.) A defense bias also existed in the Senate before 1947 for moves to the left: in this case, the coefficient on *DW_Senate* (< 1947) in column 4 is actually positive and much large than in the corresponding defense results in column 2. For the period after 1947, all coefficients on *DW_House* and *DW_Senate* are negative, insignificant, and larger in absolute value in the defense equations than in the non-defense ones.

For both Democrats and Republicans, increased party strength in the House leads to more spending as in previous results, but now with a pro-defense bias. This effect appears stronger after 1947 than before. (The coefficients on CPG_House (< 1947) are insignificant, while those of CPG_House (1947+) are significant.) Also, as in Table 3, majority party strength in the Senate tends to lead to reduced spending, here with a pro-defense bias which occurs for both Democratic and Republican majorities.

Party control is significant only in the OLS estimations, in columns 2 and 4, indicating in these cases that as Republican control increased, non-defense spending before the war declined, and defense spending after the war grew.

Taking results for both chambers into account, one can say that the results in Table 6 generally show that ideological moves to the left and increased party strength in the House tended to lead to more defense and non-defense spending, with an emphasis on the latter in the case of *DW_House*. In the Senate, the same developments are more clearly associated with pro-defense changes in composition. A reasonable guess at what lies behind these results is the fact that Senators are more involved with, and held accountable for, matters of defense and international affairs than are representatives in the House. In addition, Senators are more able to capitalize on the benefits of defense spending, much of which has a regionally specific economic impact that spills over any single House district. Such reasoning is not novel, but it is reassuring that the results for the defense/non-defense composition of spending are generally consistent with it.

5 Forecasting the effects of the shift of Congress to the right in 1994/95

We are now in a position to forecast the effect on federal expenditure of the dramatic shift to the right in Congress that occurred in 1994/95, a change that is larger than in any other period of post-war congressional history as judged by movements in the DW-Nominate indexes. To do so, we use the OLS equation from Table 3 (column 5), the 2SLS equation from Table 3 (column 4), and the OLS model from Table 4 (column 4) that uses the real ADA indexes, to forecast what would have happened after 1995 if Congress remained fixed at its 1994 state.

Figure 4a is based on using DW-Nominate indexes and shows what happens when we first forecast with *DW_House* and *DW_Senate* alone fixed at their 1994 levels, while Fig. 4b shows the effect on federal spending of freezing all aspects of congressional structure. A comparison of Figs. 4a and b illustrates the quantitative importance of taking changes in party strength and party control into account when constructing a counterfactual in addition to median ideological positions. Comparing the forecast in Fig. 4b to the predicted

Table 6 Federal defense and non-defense real per capita spending, 1930–2002. Various estimation methods: Newey-West HAC standard errors used where appropriate

	Federal Defense Spending		Federal Non-defense Spending	
	3SLS	OLS	3SLS	OLS
	(1)	(2)	(3)	(4)
Female participation	19.47	3.94	5.92	−1.27
	(3.31)***	(1.31)	(3.29)***	(1.33)
Self-employment	0.72	−1.02	−0.16	0.66
	(0.37)	(0.068)	(0.23)	(1.29)
Computers	−0.30	−0.17	−0.17	0.02
	(1.49)	(0.65)	(2.17)**	(0.32)
Real income per capita	1.17	3.96	−0.98	−0.05
	(0.92)	(1.49)	(2.05)**	(0.08)
DW_House	−0.35		−0.85	
	(0.45)		(2.85)***	
DW_House (<1947)		−2.30		−1.82
		(1.64)		(3.37)***
DW_House (1947+)		−0.99		−0.22
		(0.93)		(0.56)
DW_Senate	−1.66		0.04	
	(1.43)		(0.09)	
DW_Senate (<1947)		1.02		3.60
		(0.29)		(4.37)***
DW_Senate (1947+)		−0.28		−0.13
		(0.31)		(0.36)
CPG_House_Dem	0.56		0.16	
	(2.50)**		(2.15)**	
CPG_House_Repub	0.90		0.69	
	(1.50)		(3.45)***	
CPG_SENATE_Dem	−0.19		−0.31	
	(1.51)		(6.13)***	
CPG_SENATE_Repub	−0.05		−0.54	
	(0.16)		(4.80)***	
CPG_House (<1947)		0.59		0.14
		(0.63)		(0.80)
CPG_House (1947+)		0.41		−0.20
		(1.99)*		(2.51)**
CPG_Senate (<1947)		0.27		−0.30
		(0.69)		(2.83)***
CPG_Senate (1947+)		−0.03		−0.08
		(0.10)		(0.76)
Party control	0.02		−0.007	
	(0.61)		(0.48)	
Party control (<1947)		−0.14		−0.08
		(1.15)		(1.84)*

Table 6 (*Continued*)

	Federal Defense Spending		Federal Non-defense Spending	
	3SLS	OLS	3SLS	OLS
	(1)	(2)	(3)	(4)
Party control (1947+)		0.04		0.008
		(1.86)*		(0.72)
WWII	0.01	0.99	−0.64	−0.13
	(0.02)	(1.24)	(3.72)***	(0.76)
WWIIAftermath	1.52	0.63	0.26	0.68
	(3.90)***	(0.46)	(1.84)*	(2.16)**
Korea	−0.16	0.06	0.10	−0.02
	(0.70)	(0.35)	(1.24)	(0.25)
Vietnam	0.003	−0.26	0.12	0.19
	(0.02)	(1.29)	(1.66)*	(2.72)***
Nine_eleven	0.27	0.30	0.08	−0.18
	(0.58)	(2.20)**	(0.58)	(1.84)*
Year	−0.23	−0.13	0.007	0.07
	(3.33)***	(4.32)***	(0.31)	(4.30)***
OBSV.	73	73	73	73
ADJ R^2	0.78	0.94	0.96	0.99
D.W.		1.44		1.70
L.M. (P-Value)		0.00		0.00
ADF (residuals): lag 1 (lag 4)		−5.87* (−3.80)		−4.43 (−4.35)

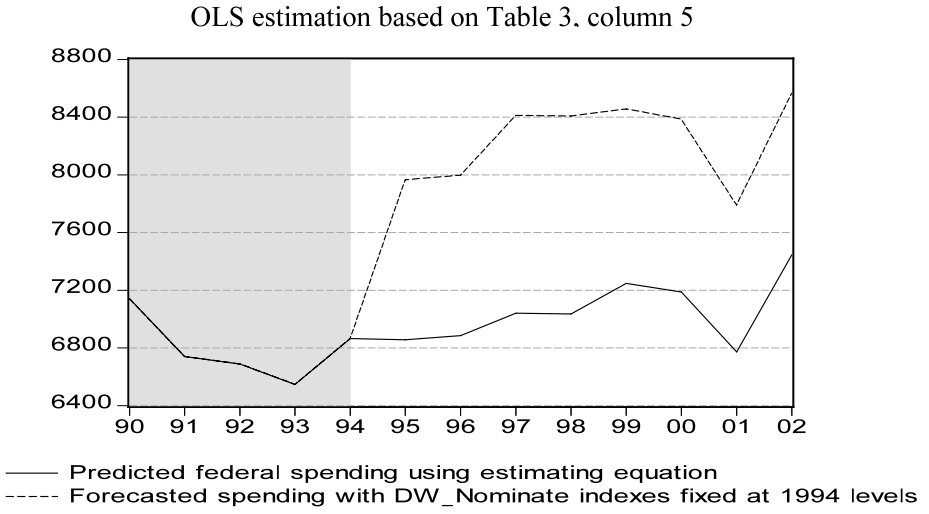
Notes: See Notes to Table 3

value from the estimating equation also shown there reveals how congressional structure as a whole influenced the post-1994 level of public expenditure.

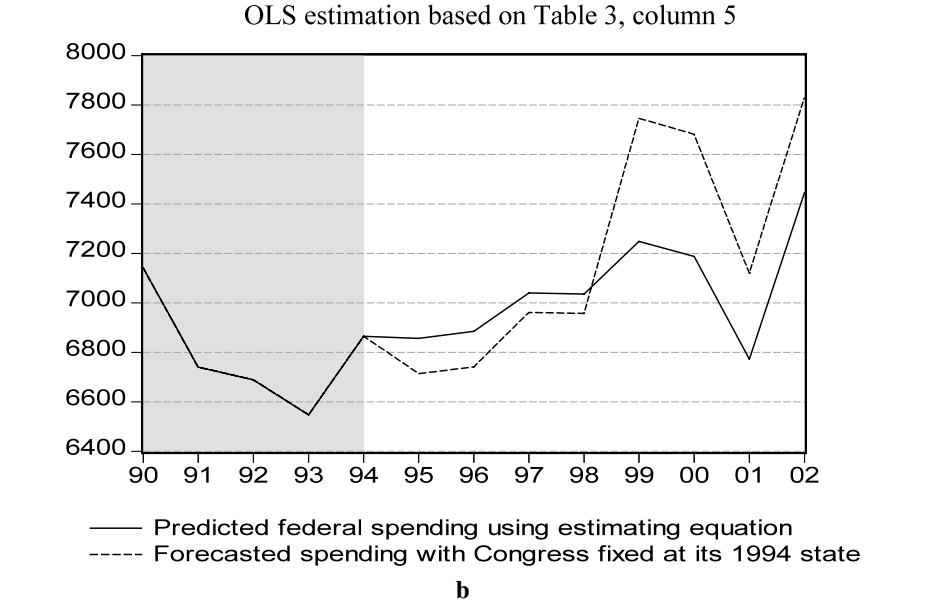
The simulation in Fig. 4a illustrates that if the ideological swing to the right in 1994/95 is the *only* change in Congress that is removed from the data, federal spending would have been higher by about US $1100 per capita in 1995. This effect becomes somewhat larger after a few years and then erodes, but remains substantial in the simulation. However, when majority party strength and party control are also fixed at their 1994 levels in Fig. 4b—that is, when Congress as a whole is fixed at its 1994 state—it can be seen that the effect of the change in the ideological position of legislators is blunted by the effects of the changes in other factors. Indeed, initially spending even falls in the counterfactual relative to the predicted value from the estimating equation, and other events take over later on including the Nine-eleven shock as well as the underlying consequences of trending economic factors.

The same sort of result is apparent in Figs. 4c and d which use different estimation methods and indexes of median chamber ideological position. In these cases, comparison of the predicted values with the counterfactuals indicates that changes in congressional structure as a whole after 1994 have modest and transitional consequences for federal spending. While not shown, the same is true in comparable experiments using equations for all government spending.

The small overall effects of changes in factors representing congressional structure here are partly due to the fact that median ideological position, majority party strength and party control of Congress evolve in somewhat different ways and exert sometimes opposing ef-



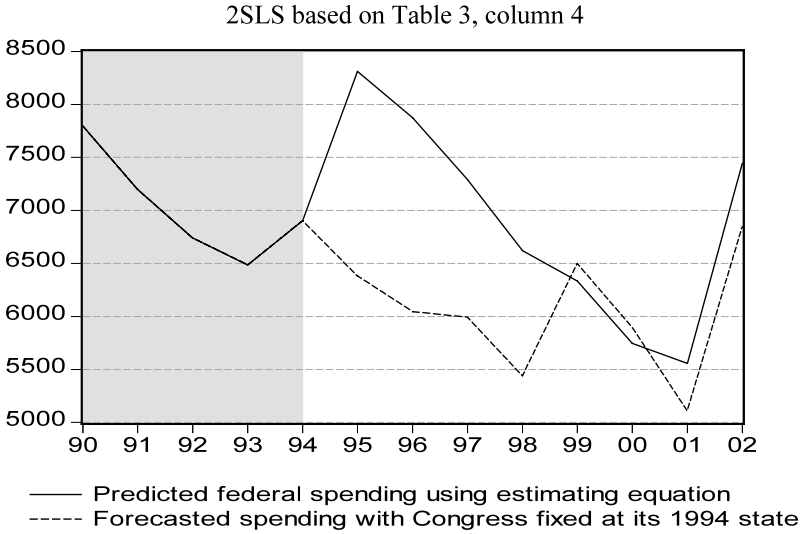
a



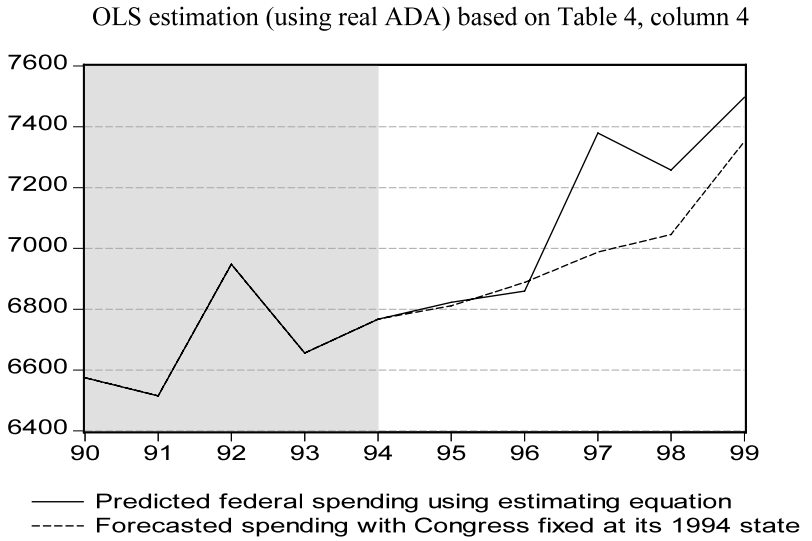
b

Fig. 4 **a** Forecasts with median DW_Nominate indexes fixed at 1994 levels. **b** Forecast with all congressional indexes fixed at 1994 levels. **c** Forecast with all congressional indexes fixed at 1994 levels. **d** Forecast with all congressional indexes fixed at 1994 levels

fects on spending decisions. Partly they are due to the fact that spending and the economic factors exhibit strong trends, while the political variables, being more or less stationary in the historical data, tend to have transitory effects on longer run developments.



c



d

Fig. 4 (*Continued*)

6 Conclusions

Attempts to explain the size of government in a mature democracy with stable political institutions must include both 'supply' side factors as well as those on the 'demand' side. Government growth in such a democracy will also depend on changes (at least over shorter horizons) in the composition and operation of the legislature, as well as on major events

like a world war that changes society and with it the public sector. A balanced view will encompass both supply and demand side mechanisms, as well as institutional constraints and the consequences of substantial shocks.[21]

The empirical work of Kau and Rubin (1981, 2002) has had the effect of reminding students of government of the relevance of supply in the face of a literature in which demand-oriented explanations have dominated for most of the twentieth century. However, while this contribution is to be welcomed, we have shown that the estimates of the role of supply they made are likely too large. Our guess is that between 3% and 6% of the growth of the federal government can be attributed to this factor, and this may be reduced by using a more comprehensive model than has been estimated here.

Estimates of the effect of female participation on the total, consolidated public sector we have made are larger; perhaps about 15% of total government growth could be explained in this way. But we also note that, as shown in Appendix A, our attempt to replicate the original Kau-Rubin results using our data set over the period they investigated produces either incorrect signs or at most a much smaller positive effect of female participation on total government spending. Moreover, there remains some doubt that our model—like that of Kau and Rubin—which makes no use of institutional details at the state/local level can fully capture the processes involved there.[22]

On the whole, our work paints a complicated picture of public sector growth. First, while our point estimates of income elasticities, like those in much of the literature, are not robust to alternative specifications, it is clear that the effects of strongly trending economic factors like real income as well as labor force participation do matter quantitatively.[23]

Second, it seems clear that the structure of Congress also plays an important role, at least over shorter horizons. Our work sheds light on conflicting viewpoints about the role of Congress and, in particular, whether it is which party controls the House or Senate that matters most for public spending, whether the issue is simply whether or not government is divided, and whether it is the chamber-wide median ideological position of members of Congress that matters most.[24]

As expected, we confirm that leftward movements of the chamber-wide median ideological positions of legislators in the Senate and in the House (especially) lead to increased federal spending. But simple extrapolations of this fact to the consequences of changes in

[21] Kenneth Arrow (personal communication February 15, 2006) has also drawn our attention to the possible importance of the extent to which legislation puts into place some 'non-discretionary' spending that can be expected to grow over time, like the enactment of Social Security during the New Deal or Medicare during the Great Society period.

[22] As a rough check on the results, one can ask if the economic aggregates are consistent with it: could the increase in women's earnings since 1930, if taxed at a reasonable rate, fund as much as, say, 10% of government growth? The answer is yes. Total real government spending (real per capita spending times population) in 1930 was about 101 billion, and in 2002 it was 3411 billion, an increase of about 3311 billion. Using female labor force participation times total civilian labor force to roughly estimate total female full time workers in 1930 and multiplying the result by average real income of *full time* female workers (all of which overstates female income in 1930 and thus understates the increase over time), indicates that real income of full time female workers in 1930 was very roughly 139 billion. In 2002 using actual total female labor force participation of 67 400 thousand, the same calculation gives total wages of 2464.3 billion, an increase since 1930 of about 2325 billion. If women paid for 10% of the increase in total government over the period, they would have paid additional taxes (*of all kinds*) of about 331 billion, or about 14% of the estimated increase in their earnings since 1930.

[23] For other reasons for variation in estimated income elasticities, see Tridimas and Winer (2005).

[24] It should be noted that problems with attributing importance among the economic factors due to correlation does not appear to affect conclusions about the role of the political factors considered.

majority party strength and of party control of Congress may be misleading. It appears that given the median position of legislators in Congress, a stronger majority party favors and is able to increase federal spending, and that this effect is enhanced when the Republicans have greater control over Congress despite their reputation as the party of small government. That the effect of majority party strength in the House is stronger than in the Senate is consistent with the logic of collective action. The group to be organized is larger and more heterogeneous in the House, so that logic should bite more deeply there.

Thus for the Republicans we find what is essentially a curvilinear result, at least for the post—Second World War House of Representatives, where a more conservative median initially leads to a decline in spending, but growth in the strength of a Republican majority, and more unified Republican control of the branches of government are associated with increases in spending that match historical levels.

Changes in the nature of the median legislator and in party strength therefore have opposing effects on the level of spending from time to time. Partly as a result of this, and partly because the state of the legislature tends to move first one way and then another over the decades while public spending and the relevant economic factors exhibit strong trends, changes in the nature of Congress appear to be an order of magnitude less important than economic trends in the evolution of federal public expenditure since 1930. We see this difference in the role of economic and political factors showing up in our simulations of the consequences of the unprecedented shift to the right in Congress in 1994/95, which (when combined with other developments) even initially had a small effect, and was in any case soon overtaken by other events.

The general implications of the different orders of integration of economic and political factors are substantial, and much remains to be done to bring this stylized fact into the main body of contemporary empirical political economy.[25] One might argue, for example, following authors such as Higgs (1987) and McCubbins (1991), that some changes in (normally stationary) political factors may have longer run consequences if there are ratchet effects. And while the work of Holcombe (1993) on ratchets in federal spending suggests the absence of such effects except perhaps after the First World War and after the Great Depression, this matter, as well as other aspects of the growth of government we have considered, remain to be studied using an explicit and fully dynamic empirical framework in which both economic and institutional political factors are prominent.

In the concluding chapter of his study of Congress, Krehbiel (1998, 227/8) asserts: "Political scientists like to say 'parties matter', and I do not disagree. The important issue... however... is not whether parties matter generally... but rather how majority-party status matters specifically, and whether it ultimately matters in ways that are predictable and *outcome consequential* (emphasis in the original)". We agree with Krehbiel on this point. Our work suggests that changes in party strength, especially in the House of Representatives, have important consequences for both the level and the composition of public expenditure.

More generally, we can say that the robust performance of the Aldrich-Rohde-Tofias measures of party strength supports their view that the operation of Congress is not simply a matter of median ideological position as indicated by DW-Nominate or real ADA scores. However, the results we have presented also show that ideological positioning, party strength and party control, while important in the short run, did not impede the long march toward bigger government in the U.S. over the last almost four score years.

[25] In this respect, see Ferris et al. (2007) who present an approach to the construction of a dynamic empirical time series model, applied to model government size in Canada from 1870 to 2000. On the wars as a ratchet in a comparative context, see Dudley and Witt (2004).

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Appendix A: Replicating Kau-Rubin (2002)

As their original data has been disposed of, and we are using a new dataset, the opportunity arises to see if the Kau-Rubin (2002) results can be replicated. This is an important exercise, one not often done in social science.

The basic Kau-Rubin estimating equation for real all government spending per capita, using the median ideological position of Senators, is as follows. (Notation they used is indicated in Table 7 and is summarized in Table 1):

$$\begin{aligned} &\textit{All government (consolidated) spending} \\ &= c_1 \cdot \textit{Female participation} + c_2 \cdot \textit{Self-employment} \\ &\quad + c_3 \cdot \textit{Computers} + c_4 \cdot \textit{Real GDP} \\ &\quad + c_5 \cdot \log\{1 + \textit{DW\_Senate}\} + c_6 \cdot \textit{WWII} \\ &\quad + c_7 \cdot \textit{Year} + c_8 \cdot \textit{Constant} + \textit{Error}. \end{aligned} \tag{A1}$$

The remaining equations in the 5-equation Kau-Rubin system, for *Self-employment, Female participation, Farm income* and *Urbanization* are stated below. Expected signs of coefficients in (A1) are: $c_1 > 0$, $c_2 < 0$, $c_3 > 0$, $c_4 > 0$, $c_5 < 0$, $c_6 > 0$, $c_7 =?$. In particular, an increase in the female participation rate is expected to lead to an increase in government size, and a smaller value of the DW-Nominate index for either chamber, indicating a leftward shift in the position of the median ideological position of Senators, should also result in more spending.

Results for the spending equation of estimating the Kau-Rubin system using three-stage least squares is presented in Table 7, and selected results for the remaining equations are given afterwards.[26] The first two columns of Table 7 repeat the results for the spending equation from page 399 of Kau and Rubin (2002). Columns 3 and 4 report our replication for the same time period, 1930–1993, using the new data set, and the last two columns use the new data for the longer period 1930–2002.

The table shows that in our replication over either time period: (i) *Female participation* generally is insignificant with the wrong (negative) sign, and is only significant once (see column 6) and then with the right (positive) sign, in contrast to the Kau-Rubin results where it is always positive and significant; (ii) as in Kau-Rubin, *Self-employment* is highly significant with the wrong (positive) sign; (iii) aggregate *Real GDP* has the right (positive) sign and is significant in all equations, in contrast to Kau-Rubin where aggregate income enters with a negative and significant coefficient.

Concerning the role of ideology, in Kau-Rubin, the D-Nominate index has a positive and significant effect in the Senate equation, and is not significant in the House equation. The coefficients also differ in size across chambers. Here, in marked contrast, both chambers

[26] All estimation was conducted using Eviews 5.1.

Table 7 Replication of the Kau-Rubin (2002) 3SLS system, 1930–1993 and 1930–2002. Equation for the log of real all government spending per capita (AFSR in Kau-Rubin)

Variable names (and Kau-Rubin 2002 notation where appropriate)	1930–1993[c]		1930–1993[d]		1930–2002[d]	
	K-R (2002) House	K-R (2002) Senate	House	Senate	House	Senate
	(1)	(2)	(3)	(4)	(5)	(6)
Female participation (FP)	7.72	8.39	−1.45	−0.11	−0.29	0.73
	(3.25)	(3.58)	(1.55)	(0.10)	(0.55)	(1.75)*
Self-employment (SE)	0.486	1.01	1.59	1.57	1.37	1.40
	(1.65)	(2.85)	(6.72)***	(6.21)***	(8.02)***	(7.87)***
Computers (T)	−0.0005	−0.049	−0.21	−0.20	−0.19	−0.18
	(0.008)	(0.856)	(5.95)***	(5.45)***	(6.62)***	(6.51)***
Real GDP (GNP)[a]	−0.93	−0.915	1.04	0.90	1.21	1.20
	(1.85)	(1.94)	(4.65)***	(4.76)***	(6.94)***	(8.79)***
Log(1 + *DW_House*)[b]	0.136		−0.39		−0.23	
	(0.579)		(2.92)***		(2.35)**	
Log(1 + *DW_Senate*)[b]		1.49		−0.31		−0.32
		(2.77)		(2.16)**		(3.57)***
Year	−1.48	−2.00	0.05	0.04	0.03	0.01
	(3.19)	(3.65)	(3.27)***	(2.17)**	(2.56)***	(1.38)
WWII (DW)	0.729	0.745	0.82	0.68	0.62	0.49
	(4.05)	(4.36)	(6.11)***	(4.46)***	(7.22)***	(6.30)***
Constant	N.A.	N.A.	−0.27	−3.56	−4.40	−7.69
			(0.10)	(1.05)	(2.58)***	(4.55)***
OBSV.	64	64	64	64	73	73
ADJ R^2			0.96	0.97	0.97	0.98

Notes: Absolute value of t-statistics in brackets. (***)(**)(*) = significant at (1%)(5%)(10%)

[a]Kau and Rubin used *real GNP* instead of *real GDP*

[b]Kau and Rubin used D-Nominate instead of the more recent and almost identical DW-Nominate

[c]Instruments include Log(1 + *DW_House*), Log(1 + *DW_Senate*), *WWII*, *Year*, and in log form: *T, MR, A, CF, F*I and r*real GDP*, where the Kau-Rubin notation is used

[d]Instruments include *DW_House, DW_Senate, WWII, Year*, and in log form: *T, MR, A, CF, FI and real GDP*

exhibit expected negative and significant coefficients on (the log of 1 plus) *DW_House* and *DW_Senate*, and the size of the coefficients is similar across chambers. From the discussion in Kau-Rubin, one can infer that either the positive sign on the coefficient of D-Nominate is mistakenly reported in their table of results, or that they reversed the definition of the variable to produce a positive coefficient. The important difference between the results in Table 7 and in Kau-Rubin (2002) is that the coefficient for the House is also significant here and that the coefficients generally do not differ much in size across chambers.

Obviously there must be differences between the data Kau and Rubin (2002) used and those we have assembled. There are reasonable ways in which one can collect the required data, especially when estimation is required, as with *Female participation* as discussed in the text, and as with *Miles of paved road* and *Females with college degrees*, both of which appear in the additional equations listed below Table 7. Reported means in Table 2 of the

text for female participation rates and self-employment rates are similar to that reported by Kau and Rubin, though of course we cannot know if higher moments of the distributions are also alike.

In addition, it should be noted that between 1993 and 2006 there have been major revisions to the National Income and Product Accounts, affecting to some degree measures of real income and of government expenditure, and indeed we see in Table 2 that reported means for total *Real GDP*, *Real income*, as well as for *All government spending* are different in our data from those reported by Kau and Rubin. (Calculated growth of government figures for 1930–93, not reported in the table, are however roughly similar.[27]) It is not possible to know with certainty what measurement or other factors are responsible for the differences in the two sets of estimation results in Table 7.

All in all, the results of using the new data set shown in Table 7 and in the remaining parts of the system of equations are substantially different than those in the Kau-Rubin (2002) paper. Indeed, it is fair to say that these results indicate that the original model is not robust and, in particular, they clearly do not support the original hypothesis about the importance of the supply-side in the growth of government. Indeed, even if one just ignores the negative elasticities in Table 7, and takes the most complementary coefficient on *Female participation* of 0.73 along with the percentage change (relative to its mean) in female participation rates over the sample of about 80%, this elasticity can explain about 4.3 percent $(0.73 \times 80)/1358$ of the 1358% increase in real per capita all government spending since 1930.

A.1 The remainder of the Kau-Rubin (2002) 3SLS system

The following estimated equations are for *Self-employment (SE)*, *Female participation (FP)*, *Farm income (FR)* and *Urbanization (U),* where the Kau-Rubin notation is in brackets. All variables are in log form except the dummy variables *YEAR* and *WWII* (= *DW* in Kau-Rubin). Additional mnemonics are found in Table 1 of the text. In these equations, *only* the Kau-Rubin notation is used except for the war dummy. The first set of results are from Kau and Rubin (2002). The second set correspond to Table 7, columns 3 and 4.

For both House and Senate, the following coefficients in the indicated (re-estimated) equations take a different sign than in the equations from Kau and Rubin. SE equation: MR; YEAR. FP equation: FI; WWII. FR equation: T. U equation: AFSR; I.

A.1.1 From Kau and Rubin (2002, p. 399). *Constant terms not reported*

House, 1930–1993

$$\underset{}{\mathrm{SE}} = \underset{(0.968)}{0.076 \times \mathrm{AFSR}} - \underset{(3.71)}{2.69 \times \mathrm{MR}} + \underset{(0.668)}{0.011 \times \mathrm{T}} - \underset{(2.67)}{2.11 \times \mathrm{U}} + \underset{(9.20)}{4.30 \times \mathrm{YEAR}} - \underset{(1.42)}{0.052 \times \mathrm{WWII}},$$

$$\underset{}{\mathrm{FP}} = \underset{(1.82)}{0.050 \times \mathrm{AFSR}} - \underset{(3.24)}{0.076 \times \mathrm{A}} + \underset{(2.43)}{0.107 \times \mathrm{CF}} + \underset{(3.87)}{0.110 \times \mathrm{FI}} + \underset{(0.325)}{0.007 \times \mathrm{FR}} + \underset{(9.30)}{0.300 \times \mathrm{YEAR}} - \underset{(9.17)}{0.074 \times \mathrm{WWII}},$$

$$\underset{}{\mathrm{FR}} = \underset{(3.10)}{0.333 \times \mathrm{AFSR}} + \underset{(6.65)}{0.646 \times \mathrm{A}} - \underset{(8.63)}{0.16 \times \mathrm{T}} - \underset{(1.91)}{0.259 \times \mathrm{YEAR}} - \underset{(1.00)}{0.042 \times \mathrm{WWII}},$$

$$\underset{}{\mathrm{U}} = \underset{(6.51)}{0.178 \times \mathrm{AFSR}} - \underset{(3.78)}{0.084 \times \mathrm{I}} + \underset{(5.75)}{1.29 \times \mathrm{MR}} - \underset{(3.99)}{0.929 \times \mathrm{YEAR}} - \underset{(5.96)}{0.051 \times \mathrm{WWII}}.$$

[27] For real all government spending per capita *(AFSR in Kau-Rubin)*, our simple percent change over the Kau-Rubin period (1930–93) is 1202%, while they report a total change of 1161%. We also note that using real income per capita instead of real GDP in (A1) does not lead to a substantial change in conclusions except that, in the House results, labor force participation now has a negative (wrong signed) coefficient that (still) misses significance at 10%.

Senate, 1930–1993

$$\begin{aligned}
\text{SE} &= 0.029 \times \text{AFSR} - 3.08 \times \text{MR} + 0.019 \times \text{T} - 1.61 \times \text{U} + 4.50 \times \text{YEAR} - 0.032 \times \text{WWII},\\
&\quad (0.428) \quad (4.84) \quad (1.29) \quad (2.36) \quad (10.79) \quad (0.983)\\
\text{FP} &= 0.049 \times \text{AFSR} - 0.076 \times \text{A} + 0.107 \times \text{CF} + 0.109 \times \text{FI} + 0.004 \times \text{FR} + 0.302 \times \text{YEAR} - 0.073 \times \text{WWII},\\
&\quad (1.78) \quad (3.24) \quad (2.44) \quad (3.88) \quad (0.193) \quad (9.40) \quad (9.15)\\
\text{FR} &= 0.336 \times \text{AFSR} + 0.649 \times \text{A} - 0.16 \times \text{T} - 0.263 \times \text{YEAR} - 0.042 \times \text{WWII},\\
&\quad (3.13) \quad (6.68) \quad (8.63) \quad (1.94) \quad (1.02)\\
\text{U} &= 0.177 \times \text{AFSR} - 0.084 \times \text{I} + 1.28 \times \text{MR} - 0.925 \times \text{YEAR} - 0.051 \times \text{WWII}.\\
&\quad (6.48) \quad (3.76) \quad (5.75) \quad (3.98) \quad (5.96)
\end{aligned}$$

A.1.2 Results for additional equations in the 3SLS system corresponding to Table 7, columns 3 and 4

House, 1930–1993

$$\begin{aligned}
\text{SE} &= 5.34 + 0.31 \times \text{AFSR} + 0.11 \times \text{MR} + 0.12 \times \text{T} - 1.23 \times \text{U} - 0.03 \times \text{YEAR} - 0.29 \times \text{WWII},\\
&\quad (2.86) \ (2.93) \quad (0.83) \quad (6.14) \quad (2.31) \quad (9.81) \quad (2.89)\\
\text{FP} &= 10.36 - 0.35 \times \text{AFSR} - 0.27 \times \text{A} + 0.15 \times \text{CF} - 0.49 \times \text{FI} + 0.30 \times \text{FR} + 0.03 \times \text{YEAR} + 0.40 \times \text{WWII},\\
&\quad (3.85) \ (3.25) \quad (3.08) \quad (3.14) \quad (2.48) \quad (3.58) \quad (3.79) \quad (4.27)\\
\text{FR} &= -7.96 + 1.42 \times \text{AFSR} + 0.06 \times \text{A} + 0.12 \times \text{T} - 0.10 \times \text{YEAR} - 0.98 \times \text{WWII},\\
&\quad (4.40) \ (4.86) \quad (0.14) \quad (1.68) \quad (3.51) \quad (3.53)\\
\text{U} &= 0.99 - 0.49 \times \text{AFSR} + 0.53 \times \text{I} + 0.32 \times \text{MR} - 0.0003 \times \text{YEAR} + 0.27 \times \text{WWII}.\\
&\quad (1.81) \ (4.78) \quad (4.80) \quad (5.84) \quad (0.29) \quad (4.02)
\end{aligned}$$

Senate, 1930–1993

$$\begin{aligned}
\text{SE} &= 4.57 + 0.28\text{AFSR} + 0.14 \times \text{MR} + 0.13 \times \text{T} - 1.03 \times \text{U} - 0.03 \times \text{YEAR} - 0.26 \times \text{WWII},\\
&\quad (2.64) \ (2.64) \quad (1.16) \quad (6.68) \quad (2.11) \quad (10.54) \quad (2.61)\\
\text{FP} &= 3.29 - 0.02 \times \text{AFSR} - 0.05 \times \text{A} + 0.21 \times \text{CF} - 0.003 \times \text{FI} + 0.04 \times \text{FR} + 0.008 \times \text{YEAR} + 0.13 \times \text{WWII},\\
&\quad (2.14) \ (0.38) \quad (0.98) \quad (5.19) \quad (0.02) \quad (0.88) \quad (1.58) \quad (2.45)\\
\text{FR} &= -7.90 + 1.41 \times \text{AFSR} + 0.07 \times \text{A} + 0.11 \times \text{T} - 0.10 \times \text{YEAR} - 0.96 \times \text{WWII},\\
&\quad (4.34) \ (4.66) \quad (0.15) \quad (1.49) \quad (3.33) \quad (3.41)\\
\text{U} &= 0.93 - 0.47 \times \text{AFSR} + 0.54 \times \text{I} + 0.29 \times \text{MR} - 0.0005 \times \text{YEAR} + 0.25 \times \text{WWII}.\\
&\quad (1.74) \ (4.60) \quad (4.93) \quad (5.53) \quad (0.49) \quad (3.76)
\end{aligned}$$

Appendix B: Correlation matrix

Selected correlations, 1930–2002*

	Female participation	Real income per capita	Self-employment	CPG_House	CPG_Senate	DW_House	DW_Senate
Female participation	1.000	0.985	−0.947	−0.096	0.831	0.075	−0.067
Real income per capita	0.985	1.000	−0.947	−0.040	0.825	0.158	−0.025
Self-employment	−0.947	−0.947	1.000	0.235	−0.875	−0.010	0.206
CPG_House	−0.096	−0.040	0.235	1.000	−0.110	0.699	0.476
CPG_Senate	0.831	0.825	−0.875	−0.110	1.000	0.165	−0.004
DW_House	0.075	0.158	−0.010	0.699	0.165	1.000	0.735
DW_Senate	−0.067	−0.025	0.206	0.476	−0.004	0.735	1.000

* Variables are in log form except for CPG and DW indexes

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