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**A REPLICATION OF “THE POLITICAL DETERMINANTS OF
FEDERAL EXPENDITURE AT THE STATE LEVEL” (PUBLIC CHOICE, 2005)**

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A REPLICATION OF “THE POLITICAL DETERMINANTS OF FEDERAL EXPENDITURE AT THE STATE LEVEL” (PUBLIC CHOICE, 2005)

Stratford Douglas¹ and W. Robert Reed^{2*}

Abstract: This paper replicates and analyses a study by Hoover and Pecorino (2005) on federal spending in US states. H&P followed on path-breaking research by Atlas et al. (1995) in which evidence was claimed in favour of the “small state effect,” namely, that since every state is represented by two senators, small states have a disproportionate influence relative to their population size. Using H&P’s data, we both replicate their results, and demonstrate strong support for the small state effect when we formally test their predictions. The contribution of this study is that we demonstrate that this empirical support vanishes when we (i) employ cluster robust standard errors rather than conventional OLS standard errors, and (ii) include a variable for population growth as suggested in a recent study by Larcinese et al. (2013). Our results lead us to conclude that there is no evidence to support the hypothesis of a “small state effect.”

Keywords: Small state effect, Representation, US Senate, Replication study

JEL Classifications: H1; H5; C1

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A REPLICATION OF “THE POLITICAL DETERMINANTS OF FEDERAL EXPENDITURE AT THE STATE LEVEL” (PUBLIC CHOICE, 2005)

I. INTRODUCTION.

This paper replicates and analyses a study by Hoover and Pecorino (2005) on federal spending in US states. H&P followed on path-breaking research by Atlas et al. (1995) that claimed evidence in favour of the “small state effect.” Since every state is represented by two U.S. senators, small states are hypothesized to have a disproportionate influence on federal spending relative to their population size. The challenge with testing this hypothesis is that there is no variation in the number of senators across states, so identification comes solely from variation in population. However, there are other reasons why population may affect the allocation of federal funds. Consequently, attributing the estimated relationship between senators per capita and state-level federal spending to the “small state effect” is problematic.

H&P suggest a way to overcome this challenge. They hypothesize that if a small state effect exists, then it should be evident in those categories of federal spending where political influence is most likely to be successful. For example, they hypothesize that federal spending on (i) procurement and (ii) grants are likely to be more influenced by senatorial intervention than federal spending on retirement programs such as Social Security. Their empirical evidence is generally supportive, leading them to conclude that political influence from senate representation influences federal spending across states.

The finding is an important one, because it suggests that the allocation of federal funding is significantly affected by constitutional political constraints rather than welfare-improving allocation schemes. Together, the H&P and Atlas et al. studies have been widely

influential in the literature. At the time of this writing, they have been cited 10 and 57 times in Web of Science, respectively.

Our study re-analyses the data underlying H&P. We confirm that we are able to closely approximate H&P's results. Further, we develop statistical tests that provide strong support for their conclusions. Nevertheless we show that two reasonable modifications cause the evidence in favour of the small state effect to vanish. First is the use of clustered robust standard errors. Second is the addition of a variable capturing population growth as suggested by Larcinese et al. (2013).

This study proceeds as follows. Section 2 presents our replication of H&P's results and provides a formal statistical test of H&P's predictions. Section 3 shows the effect on the preceding analysis of two changes: (i) using clustered robust standard errors, and (ii) including a population growth index in the variable specification. Section 4 concludes.

2. REPLICATION OF HOOVER AND PECORINO (2005).

Description of H&P's main estimating equations. H&P's main estimating equations consist of fixed effects OLS regressions where the dependent variable is state-level, per capita federal spending by budget category. A total of five federal spending categories are investigated: (i) Retirement, (ii) Other, (iii) Wages, (iv) Grants, and (v) Procurement. Each of these categories is described in detail in Table 1 of H&P. Together these 5 categories include all federal spending in states other than interest rate payments.

As their main measure of the small state effect, H&P use the variable *SENATE*, which is defined as $\left(\frac{2}{\text{State Population}} \right)$, the number of senators per capita. If small states are more effective in securing federal spending, then the sign of the coefficient of the *SENATE* variable should be positive. In other words, per capita federal spending in a state should be inversely related to its population.

Noting that identification is challenged by alternative reasons for why state spending could be inversely related to population, H&P say that evidence can be deduced by comparing the estimated effect of the *SENATE* variable *across the different budget equations*:

“A priori, we expect that grants and procurement are the spending categories which will be most sensitive to our political variables. Our expectations for grants are informed by the previous work of Lee (1998, 2000). Procurement spending would seem to be particularly sensitive to political factors, as evidenced by numerous anecdotes of intervention by congressional representatives to prevent the Pentagon from killing a weapons project produced in his or her district. Retirement and disability and other direct payments should be least sensitive to our political variables, since they are mainly determined by eligibility factors such as age and income. We expect wages and salaries to be intermediate in the degree to which political variables affect the per capita spending figures. Clearly politics plays a major role in the initial decision about where to locate federal projects and administrative offices which will generate wage and salary payments to federal employees. Because many of these location decisions have a high degree of permanence, much of the political influence may be absorbed by the state fixed effects parameters which are included in our analysis.” (H&P, page 99)

The statement above predicts the following ordering of sensitivities to senate representation across different categories:

- P1: $\beta_{SENATE, Wages} > \beta_{SENATE, Retirement}$
- P2: $\beta_{SENATE, Wages} > \beta_{SENATE, Other}$
- P3: $\beta_{SENATE, Grants} > \beta_{SENATE, Retirement}$
- P4: $\beta_{SENATE, Grants} > \beta_{SENATE, Other}$
- P5: $\beta_{SENATE, Grants} > \beta_{SENATE, Wages}$
- P6: $\beta_{SENATE, Procurement} > \beta_{SENATE, Retirement}$
- P7: $\beta_{SENATE, Procurement} > \beta_{SENATE, Other}$
- P8: $\beta_{SENATE, Procurement} > \beta_{SENATE, Wages}$

While H&P do not directly test these predictions, the predictions do inform H&P’s discussion of their empirical results. Our analysis extends beyond theirs in that we develop statistical tests for these eight predictions.

To control for state characteristics, H&P include variables for income per capita (*INCOME*), elderly share of the population (*ELDERLY*), and land area per capita

(*LANDAREA*). Political control variables include the number of electoral votes assigned to a state (*ELECTORAL*), per capita House representation (*HOUSE*), the state's share of all representatives from the same party as the current U.S. President (*HOUSEP*), the number of senators from the state belonging to the same party as the current President (*SENATEP*), the state's share of all representatives in the House's majority party (*HMAJOR*), the number of senators belonging to the majority party in the Senate (*SMAJOR*), a dummy variable indicating whether the current President won the state (*VOTE*), the absolute size of the margin of victory for the President in that state (*MARGIN*), and the interaction of these two variables (*MARVOTE*). Also included is a dummy variable to indicate whether the governor of the state belongs to the same party as the President (*GOVP*), and dummy variables to indicate if the Senate majority leader (*MAJLEADER*) or Senate minority leader (*MINLEADER*) is from the state. For their data, H&P use annual federal expenditures across all 50 states for the years 1983-1999. Independent political variables are lagged by one year to account for the fact that spending decisions made in year t are not implemented until year $t+1$.

H&P's results and our replication. TABLE 1 reproduces the main results from H&P for each of the 5 federal spending categories, plus the overall level of federal spending per capita (*SPENDING*).¹ Immediately to the right of each column are the results from our replication. Our replicated results are very close, albeit not identical, to H&P. We note that we interacted numerous times with one of the authors of the H&P study (Gary Hoover), who graciously assisted us in our replication efforts. While the original data for the H&P study are no longer available, Gary Hoover provided us with updated data that allowed us to closely match the original results. These are the data we use in our analysis.

The key variable in TABLE 1 is *SENATE*, measured in units of senators per one million population. H&P deduce evidence for the small state effect by comparing the

1. H&P's results are taken from their Table 4 (H&P, page 104).

“sensitivity” of federal spending to this variable across budget categories. Sensitivity is measured by the percentage change in the respective spending category implied by a unit change in the *SENATE* variable. This requires converting the estimated per capita expenditure impacts into percentage changes. H&P report the respective sensitivities throughout their text. To facilitate comparison, we collect these in TABLE 2.²

H&P qualitatively compare percentage changes across spending categories.³ Recall from above that they predict that *GRANTS* and *PROCUREMENT* will be most sensitive to the small state effect, *RETIREMENT* and *OTHER* least sensitive, and *WAGES* moderately sensitive. Most (but not all) of H&P’s predictions are supported by TABLE 2. On the basis of these results, H&P conclude the following:

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2. We depart slightly from H&P in the calculation of these sensitivities. They divide the coefficient by the mean value of the dependent variable at the end of the sample period (1999). This value is not reported in their paper. They do, however, report sample means for the full sample period (1983-1999). Accordingly, we use the latter to calculate the values in TABLE 2.
 3. See the following: “The coefficient implies that an increase in one senator per million population will raise per capita retirement spending by \$120. This represents 6.6% of retirement spending per capita in 1999” (p. 103). “The coefficient estimate implies that increasing senate representation by one per million population raises procurement expenditure by \$248 per capita. While this would be a very large increase in senate representation, this represents 8% of per capita procurement spending in 1999” (p. 103f.). “Our a priori expectation was that *GRANTS* category would be highly sensitive to political variables, and *SENATE* is significant in this category at the 1% level. The point estimate implies that one more senator per million population leads to an increase of about \$108 in per capita spending. This represents 10.9% of spending in this category. This is larger than the estimated 6.6% increase in retirement spending that would be caused by the same increase in representation” (p. 105). “A priori, we expected political influence to be moderately important in the *WAGES* regression. The *SENATE* variable is significant at the 1% level and implies that increasing the number of senators by one per million population increases wages and salary expenditures by \$173 per capita. This represents about 31% of total per capita wage and salary expenditure... Note, however, that in percentage terms, this is a much larger effect than we observe in retirement spending, where we do not believe that senate representation plays a true role.”(p. 106). “The category *OTHER* contains many redistributive spending programs. A priori, we do not expect our political variables to have a very strong influence in predicting these expenditures. The *SENATE* variable is not statistically significant and has a relatively small point estimate; an increase of one senator per million population raises *OTHER* spending by 6.9%. This is similar to the estimated effect on retirement spending” (p. 106).

“...we find the strongest effect in a spending category, procurement, where we expect political factors to play a large role. The next largest effect of senate representation is found in the wages and salaries spending category. Again, this is a category where we would expect politics to play at least a moderately important role. Senate representation also has an effect on grants spending ... The effects of senate representation on expenditure are much smaller for retirement spending and the category OTHER. For these categories, we would not expect, a priori, that senate representation would play an important role for spending.” (H&P, page 110)

A formal test of the small state effect. Interestingly, H&P do not provide a formal test of their predictions. Indeed, H&P’s specification presents a barrier to the formulation of a test statistic. To compare “sensitivities” across spending categories, one must divide the *SENATE* coefficients by some measure of the respective dependent variables. However, the resulting “sensitivity” values will not be scale invariant, and comparisons across spending categories will depend on the values of the dependent variables that are used.

We solve this problem by replacing the dependent variable with its natural log value. In this specification, the estimated *SENATE* coefficients represent the percentage change in the dependent variable corresponding to a unit increase in the *SENATE* variable. Unlike their H&P analogues, these measures of sensitivity are scale invariant. Differences in sensitivity are thus easily measured by differences in *SENATE* coefficients across equations. By estimating the five equations as a system using SUR, we can perform statistical tests of H&P’s predictions.⁴

While the main motivation for replacing per capita expenditures with their logged values is to facilitate hypothesis testing, this modification may be preferred in its own right. Per capita spending differs widely across states. For example, the mean, per capita

4. We use the seemingly unrelated regression command in Stata (*suest*) to perform the hypothesis testing. As all the equations use the same set of explanatory variables, the individual equation coefficients will be identical to OLS. However, SUR does exploit cross-equation correlations in the error term. This seems theoretically appropriate as common omitted variables are likely to generate correlated outcomes across the different spending categories. The system error variance matrix requires the calculation of an additional 10 elements which, given the size of the data set, should not be problematic.

PROCUREMENT spending for Oregon over the sample period is \$240, compared to \$2,593 for New Mexico. It may be more appropriate to model the impact of state level variables as generating equal percentage changes, as opposed to a fixed dollar impact that is the same across all states.

TABLE 3 reports the estimation results using logged values for the different federal spending variables. All of the explanatory variables are identical to TABLE 1. The only difference in the two tables is that the dependent variable has been logged. As in TABLE 1, each of the equations are estimated individually using fixed effects OLS. The results are qualitatively very similar. For example, the *SENATE* coefficient is statistically significant for *RETIREMENT*, *WAGES*, *GRANTS*, and *PROCUREMENT* in TABLE 1. The same coefficients are significant in TABLE3, and have the same sign as their TABLE 1 counterparts.

TABLE 4 extends the estimates of TABLE 3 to formally test Predictions P1-P8, as stated above. The values in the table are the differences in the respective *SENATE* coefficients. For example, the first entry in the table is 0.1732, which is $\hat{\beta}_{SENATE, WAGES} - \hat{\beta}_{SENATE, RETIREMENT} = 0.3003 - 0.1271$. The table has been constructed so that positive values are consistent with H&P's predictions. Note that the appropriate null hypothesis for the prediction $\beta_{SENATE, Column} > \beta_{SENATE, Row}$ is $H_0 : \beta_{SENATE, Column} - \beta_{SENATE, Row} \leq 0$. Rejection of the null supports the existence of the small-state effect.

The table provides very strong statistical support for H&P's hypotheses. Six of 8 predictions have the correct sign. All six are significant at the 10 percent (1-tailed) level. Four are significant at the 1 percent (1-tailed) level.

It bears emphasizing that H&P's test for the small state effect rests on a comparison of the estimated *SENATE* coefficients across spending categories – not on the size and significance of the coefficient in any one equation. The latter confounds the small state effect

with other channels by which population can affect federal outlays. For example, it has been noted by many (e.g., Alesina and Wacziarg, 1998; Wallis, 1998; Larcinese et al., 2013; and H&P themselves) that federal outlays may be affected by scale effects associated with the cost of providing federal services. Because smaller states must spread a fixed infrastructure investment over a smaller population base, per capita costs associated with those projects will be higher, generating a “small state effect” that is independent of senatorial influence. Any test of the small state effect that does not formally test differences in coefficients across spending categories is open to this criticism.

3. TWO ROBUSTNESS CHECKS.

Cluster robust standard errors. H&P, as Atlas et. al (1995) before them, use conventional OLS standard errors in calculating t-statistics. In contrast, it is now standard practice when working with panel data to use clustered robust standard errors to address potential serial correlation, among other things. Accordingly, we repeat the hypothesis testing of TABLE 4, this time using clustered robust standard errors rather than conventional OLS standard errors.

The results are reported in the top panel of TABLE 5. The use of clustered robust standard errors greatly affects the results. In TABLE 4, four of the positive differences were statistically significant at the 1 percent level (1-tailed test). Now none are. Whereas six of the positive differences were previously significant at the 10 percent level (1-tailed test), now only three are. OLS standard errors assume that every observation is independent of every other observation. This is unlikely to be the case in state allocations of federal spending. Unobserved factors that affect federal spending in a given state in one period are likely to also affect spending in subsequent periods. If these factors evolve over time, this will induce serial correlation. The diminished significance of the hypothesis tests in TABLE 5 indicates

that there is substantial correlation in residuals across time within states. In such cases, conventional OLS standard errors are inappropriate.

Population growth. In a recent paper, Larcinese et al. (2013) argue that another confounding factor in the relationship between federal spending in states is population growth. For a number of reasons that they discuss in their paper, federal spending may be slow to keep up with population growth. If this is the case, fast-growing states will see a decline in their per-capita spending, whereas slow-growing states will see a rise in federal per capita spending. Their argument is both theoretically appealing and empirically well supported.

If population growth is correlated with state size, and these effects differ across spending categories, then the previous tests of H&P's predictions could be impacted. Accordingly, we reestimate the specification of TABLE 3, except that we now add the population growth index suggested by Larcinese et al. (2013). *POPIND* is calculated as $\frac{POPULATION_{s,t}}{POPULATION_{s,1983}}$, where *POPIND* equals 1 for all states at the beginning of the sample period (1983). According to Larcinese et al. (2013), *POPIND* should be negatively associated with federal spending.

We report the corresponding single equation estimates in APPENDIX 1. Two results are noteworthy. First, *POPIND* is significant in three of the five spending equations at the 5 percent level (2-tailed). In all three cases, the coefficient is negative, as predicted by Larcinese et al. (2013). Second, the estimated *SENATE* coefficients are all statistically insignificant, with several of the coefficient substantially reduced in size in comparison to TABLE 3.

The bottom panel of TABLE 5 reports the corresponding tests of the small state effect. Four of the eight coefficient differences are now negative. None is statistically significant at even the 10 percent level (1-tailed). These results incorporate both best practice in calculating standard errors, and include a variable for state-level population growth. The latter variable is

both theoretically motivated and empirically supported as an important determinant of state-level federal spending. Accordingly, in our judgment, these latter results represent the best tests of the small state effect.

4. CONCLUSION.

This study replicates and analyzes research by Hoover and Pecorino (2005). H&P compare the sensitivity of different types of federal spending to a variable measuring US senators per capita for each state. Based upon previous research and their own understanding of the US political system, they hypothesize that federal spending at the state level on grants and procurement will be most sensitive to this Senate representation variable; that spending on retirement and disability and other non-retirement transfer programs will be least sensitive; and that spending on wages and salaries will be moderately sensitive. Using their data, we both replicate their results, and demonstrate strong support for the small state effect when we formally test their predictions.

The contribution of this study is that we demonstrate that this empirical support vanishes when we make two changes to the analysis: (i) we employ cluster robust standard errors rather than conventional OLS standard errors, and (ii) we include a variable for population growth suggested in a recent study by Larcinese et al. (2013). As discussed in H&P, and as we emphasize above, a proper test of the small state effect cannot depend on the senate representation variable from a single spending equation. It can only be identified by comparing coefficients across spending equations. Given that the corresponding hypothesis tests all become insignificant when we make these two changes, we conclude that there is no evidence to support the hypothesis of a “small state effect.”

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TABLE 1
Replication of Hoover and Pecorino's Table 4 Results.

VARIABLE	Dep. Variable = SPENDING		Dep. Variable = RETIREMENT	
	H&P Estimates	Replication	H&P Estimates	Replication
INCOMES	-0.153*** (-9.70)	-0.151*** (-9.62)	-0.012*** (-6.95)	-0.013*** (-6.91)
ELECTORAL	-55.94*** (-5.51)	-54.17*** (-5.35)	-9.69*** (-8.11)	-9.35*** (-7.89)
ELDERLY	7169.97** (2.09)	7391.55** (2.17)	7440.42*** (18.40)	7444.50*** (18.68)
SENATE	962.20*** (6.03)	1157.00*** (6.56)	119.78*** (6.38)	149.42*** (7.23)
LANDAREA	586.27 (0.43)	-237.20 (-0.17)	71.64 (0.44)	-100.47 (-0.60)
HOUSE	-100.59 (-0.97)	-137.11 (-1.31)	-2.14 (-0.18)	-8.53 (-0.70)
GOVP	41.72* (1.72)	39.67 (1.64)	4.30 (1.51)	3.61 (1.27)
HOUSEP	70.42 (1.51)	62.95 (0.97)	6.39 (1.16)	-2.42 (-0.32)
SENATEP	14.60 (0.77)	16.09 (0.98)	-0.76 (-0.34)	-0.02 (-0.01)
HMAJOR	29.96 (0.74)	12.73 (0.18)	-1.1 (-0.23)	-12.12 (-1.50)
SMAJOR	-0.10 (-0.01)	1.36 (0.09)	0.73 (0.31)	3.28* (1.93)
VOTE	-236.69*** (-4.82)	-235.64*** (-4.83)	-11.4 (-1.97)	-10.45* (-1.83)
MARGIN	-2332.49*** (-4.46)	-2296.01*** (-4.41)	-37.59 (-0.61)	-28.38 (-0.46)
MARVOTE	2290.86*** (4.49)	2259.31*** (4.42)	-27.75 (-0.46)	-40.02 (-0.67)
MAJLEADER	107.18 (1.27)	108.98 (1.30)	4.32 (0.44)	4.94 (0.50)
MINLEADER	43.81 (0.46)	54.93 (0.58)	12.7 (1.14)	17.97 (1.62)
Adjusted R²	0.915	0.916	0.979	0.980

TABLE 1
Replication of Hoover and Pecorino's Table 4 Results (Continued).

VARIABLE	Dep. Variable = OTHER		Dep. Variable = WAGES	
	H&P Estimates	Replication	H&P Estimates	Replication
INCOMES	-0.023*** (-3.78)	-0.022*** (-3.50)	-0.005 (-1.38)	-0.006 (-1.55)
ELECTORAL	-2.54 (-0.63)	-1.98 (-0.48)	-14.05*** (-5.56)	-14.14*** (-5.56)
ELDERLY	5570.53*** (4.05)	5882.91*** (4.28)	-7326.8*** (-8.56)	-7511.74*** (-8.80)
SENATE	81.77 (1.28)	89.85 (1.26)	173.16*** (4.35)	232.48*** (5.25)
LANDAREA	804.76 (1.47)	857.30 (1.49)	-1244.3*** (-3.65)	-1545.46*** (-4.31)
HOUSE	-57.03 (1.37)	-62.30 (-1.48)	11.78 (0.46)	4.23 (0.16)
GOVP	9.13 (0.94)	7.48 (0.77)	-16.5*** (-2.73)	-14.64** (-2.41)
HOUSEP	1.24 (0.07)	20.52 (0.78)	2.59 (0.22)	-14.21 (-0.87)
SENATEP	4.82 (0.63)	2.60 (0.39)	-3.28 (-0.69)	-1.52 (-0.37)
HMAJOR	53.71*** (3.33)	51.11* (1.83)	-43.59*** (-4.34)	-38.57** (-2.22)
SMAJOR	6.72 (0.83)	4.77 (0.81)	-8.44 (-1.69)	-9.29** (-2.55)
VOTE	-65.21*** (3.32)	-66.92*** (-3.39)	-1.2 (-0.10)	0.68 (0.06)
MARGIN	-774.72*** (-3.70)	-795.09*** (-3.77)	-396.79*** (-3.05)	-363.59*** (-2.78)
MARVOTE	1090.59*** (5.33)	1108.95*** (5.37)	419.18*** (3.30)	393.15*** (3.07)
MAJLEADER	50.65 (1.50)	42.48 (1.25)	-19.12 (-0.91)	-9.56 (-0.45)
MINLEADER	11.48 (0.30)	6.43 (0.17)	-42.41* (-1.80)	-37.45 (-1.57)
Adjusted R²	0.888	0.888	0.976	0.977

TABLE 1 (Continued)
Replication of Hoover and Pecorino's Table 4 Results.

VARIABLE	Dep. Variable = GRANTS		Dep. Variable = PROCUREMENT	
	H&P Estimates	Replication	H&P Estimates	Replication
INCOMES	-0.012*** (-3.17)	-0.011*** (-2.87)	-0.057*** (-4.87)	-0.059*** (-5.00)
ELECTORAL	-3.54 (-1.41)	-2.59 (-1.04)	-24.2*** (-3.21)	-24.34*** (-3.22)
ELDERLY	2639.55*** (3.10)	2816.33*** (3.35)	4186.66 (1.64)	3967.26 (1.56)
SENATE	108.39*** (2.74)	147.50*** (3.38)	247.55** (2.09)	245.77* (1.87)
LANDAREA	-968.22*** (-2.85)	-1237.41*** (-3.51)	2369.05** (2.33)	2471.13** (2.32)
HOUSE	37.7 (1.47)	24.57 (0.95)	-103.03 (-1.34)	-94.91 (-1.22)
GOVP	0.87 (0.14)	-1.90 (-0.32)	38.99** (2.16)	39.68** (2.20)
HOUSEP	44.77*** (3.86)	30.30* (1.89)	0.53 (0.00)	21.35 (0.44)
SENATEP	15.06*** (3.20)	16.45*** (4.07)	-5.27 (-0.37)	-5.20 (-0.43)
HMAJOR	24.68** (2.47)	-10.42 (-0.61)	-9.00 (-0.30)	28.79 (0.56)
SMAJOR	5.7 (1.14)	14.24*** (3.97)	1.65 (0.11)	-0.67 (-0.06)
VOTE	-16.68 (-1.37)	-15.29 (-1.27)	-108.36*** (-2.97)	-110.01*** (-3.02)
MARGIN	113.43 (0.88)	113.17 (0.88)	-688.1* (-1.77)	-699.90* (-1.80)
MARVOTE	20.93 (0.17)	6.75 (0.05)	568.74 (1.50)	594.00 (1.56)
MAJLEADER	4.44 (0.21)	0.15 (0.01)	78.63 (1.26)	79.71 (1.27)
MINLEADER	23.37 (1.00)	33.87 (1.44)	27.11 (0.39)	29.08 (0.41)
Adjusted R²	0.942	0.943	0.868	0.868

NOTE: The t-statistics are presented in parentheses. All regressions include state and time fixed effects.

*/**/***/*** denote significance at the 10%/5%/1% levels (2-tailed), respectively.

TABLE 2
Sensitivity of Federal Spending Categories to Senate Representation: Original and Replicated Results.

	<i>RETIREMENT</i>	<i>OTHER</i>	<i>WAGES</i>	<i>GRANTS</i>	<i>PROCUREMENT</i>
<u>H&P'S RESULTS:</u>					
<i>(1) Estimated SENATE Coefficient</i>	119.78	81.77	173.16	108.39	247.55
<i>(2) Mean of Dependent Variable</i>	1816.84	1193.41	565.01	992.29	644.65
<i>(1) ÷ (2)</i>	6.6%	6.9%	30.6%	10.9%	38.4%
<u>REPLICATION RESULTS:</u>					
<i>(1) Estimated SENATE Coefficient</i>	149.42	89.85	232.48	147.50	245.77
<i>(2) Mean of Dependent Variable</i>	1729.36	978.22	749.74	870.08	810.06
<i>(1) ÷ (2)</i>	8.6%	9.2%	31.0%	17.0%	30.3%

NOTE: TABLE 2 (upper panel) calculates “sensitivities” of federal spending categories to a unit change in the *SENATE* variable as derived from estimates in Hoover and Pecorino (2005). The lower panel performs the same calculation using estimates from the present replication. The estimated *SENATE* coefficients in the first row of each panel are taken from TABLE 1. The third row of each panel computes sensitivity values associated with a unit change in the *SENATE* variable, calculated at the sample means of the respective spending variables.

TABLE 3
FE OLS Estimation with Logged Dependent Variable.

	<i>DEPENDENT VARIABLE (all logged)</i>				
	<i>RETIREMENT</i>	<i>OTHER</i>	<i>WAGES</i>	<i>GRANTS</i>	<i>PROCUREMENT</i>
<i>INCOMES</i>	-7.04E-6*** (-6.44)	-1.15E-5*** (-1.99)	-8.35E-6 (-2.12)	-1.20E-5 (-3.24)	-3.91E-5 (-3.23)
<i>ELECTORAL</i>	-0.0051*** (-7.18)	0.0065* (1.76)	-0.0155*** (-6.07)	0.0050** (2.08)	-0.0006 (-0.08)
<i>ELDERLY</i>	4.8523*** (20.46)	9.4668*** (7.60)	-1.5959* (-1.86)	0.7043 (0.88)	9.7681*** (3.72)
<i>SENATE</i>	0.1271*** (10.33)	-0.0109 (-0.17)	0.3003*** (6.77)	0.0818** (1.97)	0.6478*** (4.76)
<i>LANDAREA</i>	-0.9834*** (-9.89)	-0.9505* (-1.82)	-1.7202*** (-4.79)	0.5638* (1.68)	-0.6351 (-0.58)
<i>HOUSE</i>	0.0066 (0.90)	0.0212 (0.55)	-0.0112 (-0.43)	0.0466* (1.89)	-0.2390*** (-2.97)
<i>GOVP</i>	0.0026 (1.54)	0.0153* (1.73)	0.0044 (0.72)	-0.0054 (-0.94)	0.0467** (2.51)
<i>HOUSEP</i>	-0.0090* (-1.99)	0.0008 (0.03)	-0.0315* (-1.93)	0.0446*** (2.92)	0.0503 (1.01)
<i>SENATEP</i>	-0.0011 (-0.93)	-0.0048 (-0.80)	-0.0012 (-0.30)	0.0167*** (4.33)	0.0130 (1.03)

	<i>DEPENDENT VARIABLE (all logged)</i>				
	<i>RETIREMENT</i>	<i>OTHER</i>	<i>WAGES</i>	<i>GRANTS</i>	<i>PROCUREMENT</i>
HMAJOR	-0.0076 (-1.58)	0.0478* (1.89)	-0.0748*** (-4.30)	0.0104 (0.64)	0.0492 (0.92)
SMAJOR	0.0011 (1.12)	-0.0016 (-0.31)	-0.0024 (-0.64)	0.0153*** (4.47)	0.0086 (0.77)
VOTE	-0.0010 (-0.29)	-0.0623*** (-3.49)	-0.0031 (-0.26)	-0.0300*** (-2.61)	-0.1219*** (-3.24)
MARGIN	0.0345 (0.95)	-0.7705*** (-4.04)	0.0083 (0.06)	-0.2029* (-1.65)	-0.7200* (-1.79)
MARVOTE	-0.0770** (-2.16)	1.0140*** (5.42)	0.2022 (1.57)	0.2295* (1.91)	0.5608 (1.42)
MAJLEADER	0.0099* (1.69)	0.0270 (0.88)	-0.0049 (-0.23)	-0.0147 (-0.75)	0.0824 (1.27)
MINLEADER	0.0228*** (3.45)	-0.0181 (-0.52)	-0.0171 (-0.72)	-0.0256 (-1.14)	0.0611 (0.83)
Adjusted R²	0.982	0.916	0.977	0.948	0.889

NOTE: The t-statistics are presented in parentheses. All regressions include state and time fixed effects. This is the same specification as TABLE 1, except that the dependent variable is now logged.

*/**/*** denote significance at the 10%/5%/1% levels, respectively.

TABLE 4
Tests of Predictions: $\beta_{SENATE2, Column} > \beta_{SENATE2, Row}$

	<i>lnWAGES</i>	<i>lnGRANTS</i>	<i>lnPROCUREMENT</i>
<i>Based on estimates from the TABLE 3 specification:</i>			
<i>LnRETIREMENT</i>	0.1732*** (2.98)	-0.0453 (-0.84)	0.5207*** (3.59)
<i>LnOTHER</i>	0.3112*** (3.77)	0.0927* (1.42)	0.6587*** (4.20)
<i>LnWAGES</i>	----	-0.2185 (2.63)	0.3475** (2.29)

NOTE #1: Predictions P1-P8 in the text imply that all the cells in the table should be positive. The appropriate null hypothesis for the prediction $\beta_{SENATE, Column} > \beta_{SENATE, Row}$ is $H_0 : \beta_{SENATE, Column} \leq \beta_{SENATE, Row}$. Rejection of the null supports the existence of the small-state effect.

NOTE #2: The numbers in the table equal the differences in the *SENATE* coefficient from a given Column regression minus the *SENATE* coefficient from the corresponding Row regression. For example, in TABLE 3, the difference in the *SENATE* coefficient in the *LnWAGES* regression minus the *SENATE* coefficient in the *LnRETIREMENT* regression is 0.1732 (= 0.3003-0.1271). The numbers in parentheses are Z statistics.

*/**/** denote rejection of the null hypothesis, $H_0 : \beta_{SENATE, Column} \leq \beta_{SENATE, Row}$ at the 10%/5%/ 1% levels (1-tailed), respectively.

TABLE 5
Tests of Predictions: $\beta_{SENATE2, Column} > \beta_{SENATE2, Row}$

	<i>lnWAGES</i>	<i>lnGRANTS</i>	<i>lnPROCUREMENT</i>
<u>TABLE 3 Specification (Cluster Robust)</u>			
<i>LnRETIREMENT</i>	0.1732 (1.20)	-0.0453 (-0.47)	0.5207** (1.69)
<i>LnOTHER</i>	0.3112* (1.58)	0.0927 (1.03)	0.6587** (2.13)
<i>LnWAGES</i>	----	-0.2185 (1.11)	0.3475 (1.07)
<u>TABLE 3 Specification + POPIND (Cluster Robust)</u>			
<i>LnRETIREMENT</i>	0.0524 (0.22)	-0.0051 (-0.00)	0.1268 (0.33)
<i>LnOTHER</i>	-0.0406 (-0.14)	-0.0981 (-0.75)	0.0338 (0.10)
<i>LnWAGES</i>	----	-0.0575 (-0.20)	0.0744 (0.17)

NOTE #1: Predictions P1-P8 in the text imply that all the cells in the table should be positive. The appropriate null hypothesis for the prediction $\beta_{SENATE, Column} > \beta_{SENATE, Row}$ is $H_0 : \beta_{SENATE, Column} \leq \beta_{SENATE, Row}$. Rejection of the null supports the existence of the small-state effect.

NOTE #2: The numbers in the table equal the differences in the *SENATE* coefficient from a given Column regression minus the *SENATE* coefficient from the corresponding Row regression. Coefficient estimates for the top panel are taken from TABLE 3. Coefficient estimates for the bottom panel are taken from APPENDIX 1. For example, the first entry in the top panel is 0.1732. This is the difference in the estimated *SENATE* coefficient, *LnWAGES* regression in TABLE 3 minus the estimated *SENATE* coefficient, *LnRETIREMENT* regression in TABLE 3. The numbers in parentheses are Z statistics.

* / ** / *** denote rejection of the null hypothesis, $H_0 : \beta_{SENATE, Column} \leq \beta_{SENATE, Row}$ at the 10% / 5% / 1% levels (1-tailed).

APPENDIX 1
Fixed Effects OLS Estimation of TABLE 3 Specification + POPIND.

	<i>DEPENDENT VARIABLE (all logged)</i>				
	<i>lnRETIREMENT</i>	<i>lnOTHER</i>	<i>lnWAGES</i>	<i>lnGRANTS</i>	<i>lnPROCUREMENT</i>
<i>LnINCOMES</i>	-2.48E-6 (-1.17)	-1.63E-5 (-1.62)	1.11E-6 (0.21)	-9.05E-6 (-1.14)	-1.86E-5 (-0.67)
<i>ELECTORAL</i>	-0.0006 (-0.28)	0.0018 (0.39)	-0.0062 (-1.03)	0.0078 (1.48)	0.0195 (0.97)
<i>ELDERLY</i>	4.6308*** (4.71)	9.7007*** (4.33)	-2.0557 (-0.71)	0.5620 (0.28)	8.7699 (1.52)
<i>POPIND</i>	-0.2299*** (-4.63)	0.2427 (1.39)	-0.4772** (-2.05)	-0.1477 (-1.02)	-1.0359** (-2.44)
<i>SENATE</i>	0.0147 (0.37)	0.1077 (0.92)	0.0671 (0.27)	0.0096 (0.10)	0.1415 (0.37)
<i>LnLANDAREA</i>	-0.8702*** (-4.75)	-1.0700 (-1.37)	-1.4853 (-1.29)	0.6365* (1.79)	-0.1252 (-0.07)
<i>HOUSE</i>	-0.0036 (-0.39)	0.0319 (0.50)	-0.0323 (-0.78)	0.0400 (1.14)	-0.2848** (-2.33)
<i>GOVP</i>	0.0052 (1.58)	0.0125 (0.89)	0.0098 (0.92)	-0.0037 (-0.42)	0.0586* (1.87)
<i>HOUSEP</i>	-0.0042 (-0.68)	-0.0043 (-0.14)	-0.0216 (-0.71)	0.0477** (2.11)	0.0719 (1.19)

	<i>DEPENDENT VARIABLE (all logged)</i>				
	<i>lnRETIREMENT</i>	<i>lnOTHER</i>	<i>lnWAGES</i>	<i>lnGRANTS</i>	<i>lnPROCUREMENT</i>
<i>SENATEP</i>	-0.0013 (-0.47)	-0.0045 (-0.44)	-0.0018 (-0.23)	0.0165** (2.36)	0.0116 (0.47)
<i>HMAJOR</i>	-0.0019 (-0.52)	0.0418 (1.16)	-0.0630* (-1.90)	0.0140 (0.69)	0.0749 (1.50)
<i>SMAJOR</i>	0.0008 (0.56)	-0.0013 (-0.19)	-0.0029 (-0.47)	0.0151** (2.61)	0.0073 (0.43)
<i>VOTE</i>	-0.0016 (-0.25)	-0.0617* (-1.83)	-0.0043 (-0.20)	-0.0304 (-1.53)	-0.1245** (-2.20)
<i>MARGIN</i>	-0.0690 (-1.04)	-0.6612 (-1.48)	-0.2066 (-0.64)	-0.2694 (-1.23)	-1.1865** (-2.02)
<i>MARVOTE</i>	-0.0194 (-0.29)	0.9532* (1.99)	0.3218 (1.35)	0.2665 (1.22)	0.8205 (1.45)
<i>MAJLEADER</i>	0.0064 (0.37)	0.0307 (0.74)	-0.0121 (-0.45)	-0.0170 (-1.19)	0.0667 (0.47)
<i>MINLEADER</i>	0.0158** (1.82)	-0.0107 (-0.12)	-0.0318 (-0.64)	-0.0301 (-1.00)	-0.0293 (0.13)
<i>Adjusted R²</i>	0.985	0.916	0.978	0.948	0.893

NOTE: Clustered robust t-statistics are presented in parentheses. All regressions include state and time fixed effects.

*/ ** / *** denote significance at the 10%/5%/1% levels (2-tailed), respectively.

APPENDIX 2
Summary Statistics.

	MEAN	MEDIAN	STD. DEV.	MIN	MAX
<i>ELDERLY</i>	0.123	0.125	0.021	0.029	0.186
<i>ELECTORAL</i>	10.7	8	9.25	3	54
<i>GOVP</i>	0.399	0	0.490	0	1
<i>GRANTS</i>	870.1	800.7	296.3	401.0	3006.0
<i>HMAJOR</i>	0.567	0.571	0.280	0	1
<i>HOUSE</i>	1.760	1.754	0.208	1.079	2.501
<i>HOUSEP</i>	0.445	0.444	0.282	0	1
<i>INCOME</i>	23,243	22,710	3,877	14,099	38,689
<i>LANDAREA</i>	0.0478	0.0124	0.1440	0.0009	1.1710
<i>MAJLEADER</i>	0.020	0	0.14	0	1
<i>MINLEADER</i>	0.020	0	0.14	0	1
<i>MARGIN</i>	0.140	0.120	0.104	0.002	0.522
<i>MARVOTE</i>	0.124	0.105	0.115	0	0.522
<i>OTHER</i>	978.2	942.5	344.8	244.1	2542.0
<i>POPIND</i>	1.086	1.050	0.127	0.889	2.145
<i>PROCUREMENT</i>	810.1	652.8	587.8	154.7	3812.0
<i>RETIREMENT</i>	1729.0	1735.0	238.4	777.8	2545.0
<i>SENATE</i>	1.038	0.594	1.040	0.061	4.448
<i>SENATEP</i>	0.995	1	0.760	0	2
<i>SMAJOR</i>	1.072	1	0.757	0	2
<i>SPENDING</i>	5,232	5,115	984.4	3,502	8,825
<i>VOTE</i>	0.782	1	0.413	0	1
<i>WAGES</i>	749.7	635.4	469.3	261.0	3127.0