Forecasting State and Local Government Spending:

Model Re-estimation

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Equation

The REMI government spending estimation assumes that the state and local government demand is driven by the regional economic condition and changes in population. When the population of a given region increases, the government spending of the region is expected to increase as well in order to maintain the same level of services. Meanwhile, the state and local government spending is restricted by the budget, which is affected by changes in economic condition. It is assumed that the state and local government spending depends on the changes in per capita GDP, population, and unobserved fixed regional effects to different extents; the state and local government spending are estimated by two separate equations.

The state government demand equation has the following form

$$SG_t^k = R_{SG}^k * \left(\frac{GDP_t^k / N_t^k}{GDP_t^u / N_t^u} \right)^{\beta} * \frac{SG_t^u}{N_t^u} * N_t^k \qquad (1)$$

The local government demand equation has the following form

$$LG_t^k = R_{LG}^k * \left(\frac{GDP_t^k / N_t^k}{GDP_t^u / N_t^u} \right)^{\Upsilon} * \frac{LG_t^u}{N_t^u} * N_t^k \qquad (2)$$

where

SG = state government expenditures in chained 2005$;

R_{SG}^{k} = regional calibration factor for state government expenditures;

LG = local government expenditures in chained 2005$;

R_{LG}^{k} = regional calibration factor for local government expenditures;

GDP = gross domestic product in chained 2000$;

N = population;

β = GDP elasticity of state government expenditures;

Υ = GDP elasticity of local government expenditures;

k = state;

t = time;

u = U.S.

A problem with the model equations is the simultaneity between the current GDP and the government expenditures. The endogeneity will cause some of the model statistics to be biased. On the other hand, it is believed that there is a time lag for the impact of economic condition changes to fully take place and for the policy makers to respond accordingly. Thus, we modified the model equations by substituting the current relative per capital GDP with the moving average of relative per capital GDP, which is a weighted average of the current and past relative per capita GDP. The new state and local government spending equations are

$$SG_t^k = R_{SG}^k * \left(GDP\_pc\_A_t^k\right)^{\beta} * \frac{SG_t^u}{N_t^u} * N_t^k \qquad (3)$$

$$LG_t^k = R_{LG}^k * \left(GDP\_pc\_A_t^k\right)^{\Upsilon} * \frac{LG_t^u}{N_t^u} * N_t^k \qquad (4)$$

where

$$GDP\_pc\_A_t^k = \begin{cases} GDP\_pc_t^k, & if\ t = 0; \\ (1-\lambda) \cdot GDP\_pc_t^k + \lambda \cdot GDP\_pc\_A_{t-1}^k, & otherwise. \end{cases}$$

$$GDP\_pc_t^k = \frac{GDP_t^k / N_t^k}{GDP_t^u / N_t^u};$$

λ = the speed of adjustment of the moving average.

Equation (3) and (4) are transformed into linear equation (5) and (6) by taking natural logarithms of both sides of the equations. Equation (5) and (6) are estimated using a fixed effects model. By using a fixed effects model, it is assumed that states share the same slope but have different intercepts, which are the unobserved state-specific factors that affects the state and local government spending.

$$\ln\left(\frac{SG_t^k / N_t^k}{SG_t^u / N_t^u}\right) = \ln\left(R_{SG}^k\right) + \beta * \ln\left(GDP\_pc\_A_t^k\right) + \varepsilon_t^k \quad (5)$$

$$\ln\left(\frac{LG_t^k / N_t^k}{LG_t^u / N_t^u}\right) = \ln\left(R_{LG}^k\right) + \Upsilon * \ln\left(GDP\_pc\_A_t^k\right) + \varepsilon_t^k \quad (6)$$

Data

State-level GDP in chained 2005 dollars is from BEA. This data source also decides our choice for the time period is from 1997-2011, because GDP data has been compiled since 1997 under NAICS system. Population numbers also came from the BEA website.

There are no direct source for government spending. But state and local government finance from Census Bureau provide data for government expenditure for both state and local government for all 50 states and DC.[1] The change of government expenditure is used as the proxy for change of government spending in our model. Government expenditure are available in fiscal year instead of calendar year. For example, the first available fiscal year in our data set is 1997-1998. When building the model, the same time period GDP corresponding to 1997-1998

[1] https://www.census.gov/govs/local

government expenditure will be the GDP in 1997. The half year time lag can, to some extent, reduce simultaneity between GDP and government expenditure, thus can minimize endogeneity problem of the model. Figure 1 and 2 show the percentage change in state and local government spending per capita over the available data time period. The 50 states and DC reveal diversified changes over the period 1997-2011. Vermont has experienced the highest increase in both state and local government spending among the 51 regions; while Alaska has highest percentage of drop in both state and local government spending.

Figure 1. Percentage change in state government spending per capita 1997-2011.

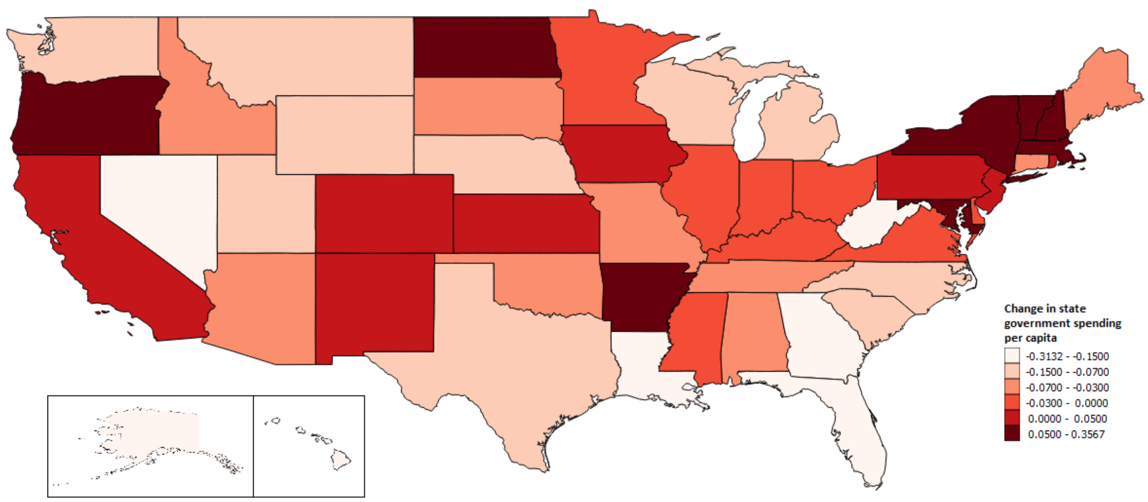
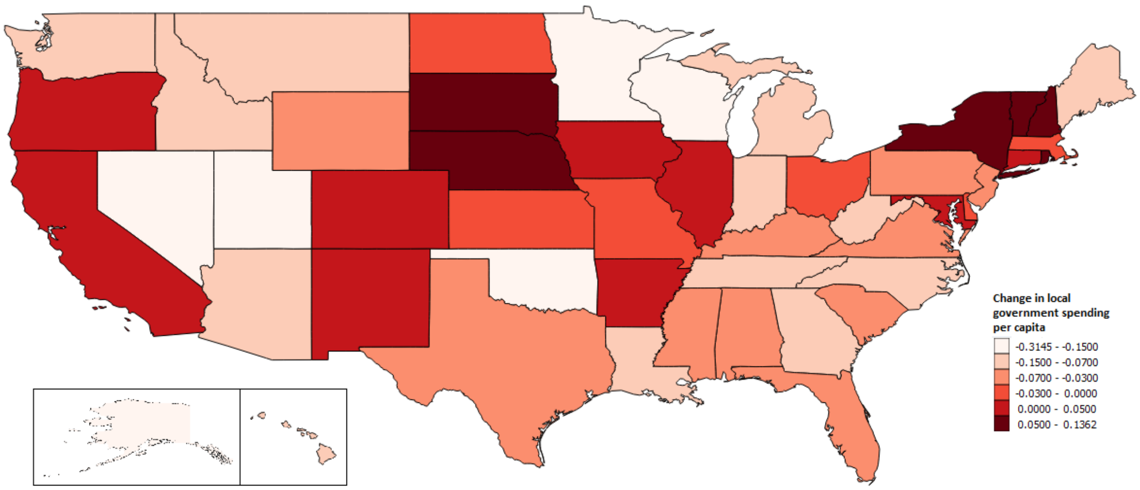


Figure 2. Percentage change in local government spending per capita 1997-2010.



The data set we use is panel data set. For state government spending model, the data set consists of 750 observations, with 50 regions and 15 time periods.[2] For the local government spending model, the data set consists of 612 observations, with 51 regions and 12 time periods. [3]

Results

A fixed effects model is used to estimate for state and local government spending respectively. The estimation results are shown in Table 1. The explanatory variable is significant at 0.01 level in both models. The per capita GDP moving average variable has a strong effect on local government spending compared to state government spending.

Table 1. Fixed Effects Estimation of New Equations.

Model	Independent Var.	Est. Coeff.	Std. Err.	t-value	N
state government spending	Beta	0.3769	0.0511	7.38***	750

[2] Observations for DC is dropped since there is no state government spending for DC.
[3] Local government expenditure for the fiscal year of 2000-2001, 2002-2003, 2010-2011 are not available.

	Constant	0.0198	0.0377	5.24***	
local government spending	Gamma	0.4979	0.0610	8.17***	612
	Constant	-0.1451	0.0035	-41.05***	

Note: *** denotes 0.01 significance level

Table 2 presents the state-specific calibration factors. For the state government spending model, Alaska has the highest calibration factor at 2.448, while Nevada has the lowest at 0.732. For the local government spending, District of Columbia has the highest calibration factor at 2.275, and Hawaii has the lowest at 0.418.

Table 2. State Calibration Factors

Region	State government spending	Local government spending
Alabama	0.995	0.923
Alaska	2.448	1.125
Arizona	0.827	0.952
Arkansas	1.031	0.664
California	1.093	1.221
Colorado	0.796	0.985
Connecticut	1.033	0.691
Delaware	1.170	0.547
District of Columbia	1.000	2.275
Florida	0.742	1.020
Georgia	0.763	0.878
Hawaii	1.364	0.418
Idaho	0.948	0.767
Illinois	0.813	0.924
Indiana	0.827	0.805
Iowa	0.971	0.871
Kansas	0.902	0.900
Kentucky	1.075	0.664
Louisiana	1.057	0.819
Maine	1.158	0.715
Maryland	0.972	0.834
Massachusetts	1.081	0.827
Michigan	1.040	0.950
Minnesota	1.082	0.974
Mississippi	1.206	0.919
Missouri	0.801	0.767
Montana	1.186	0.735
Nebraska	0.812	1.132
Nevada	0.732	0.954
New Hampshire	0.852	0.687
New Jersey	1.033	0.849
New Mexico	1.429	0.871
New York	1.263	1.453
North Carolina	0.888	0.846
North Dakota	1.167	0.756
Ohio	1.029	0.903
Oklahoma	1.002	0.748
Oregon	1.124	0.975
Pennsylvania	0.996	0.877

Rhode Island	1.208	0.721
South Carolina	1.106	0.835
South Dakota	0.857	0.714
Tennessee	0.775	0.966
Texas	0.733	0.886
Utah	0.985	0.831
Vermont	1.412	0.752
Virginia	0.856	0.809
Washington	1.032	1.003
West Virginia	1.216	0.653
Wisconsin	1.039	0.943
Wyoming	1.406	1.235