Government Spending and Economic Recovery:
A State Comparison during the Great Recession

MPP Professional Paper

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Executive Summary

In late 2007, the U.S. entered the worst recession since the Great Depression. State and local governments saw large decreases in their revenues and, due to their constitutions, were forced to balance their budgets, usually by reducing spending. The loss in state and local government spending during the recession was countered by two large federal expenditures totaling over a trillion dollars. Every state had a different amount of per capita government spending during the recession. This paper aims to answer the question: did states that, relative to other states, had high amounts of per capita government spending recover faster economically than states with low amounts of per capita government spending? Using national macro data, much of which comes from the census and the Bureau of Economic Analysis, and OLS models, I conclude that states that had high amounts of government spending, either in their capital or current budgets, recovered 5% faster in both GSP and payroll. The data also suggest that the full effect of the stimulus spending was over by 2011.

Introduction

"It's the economy stupid."

-James Carville

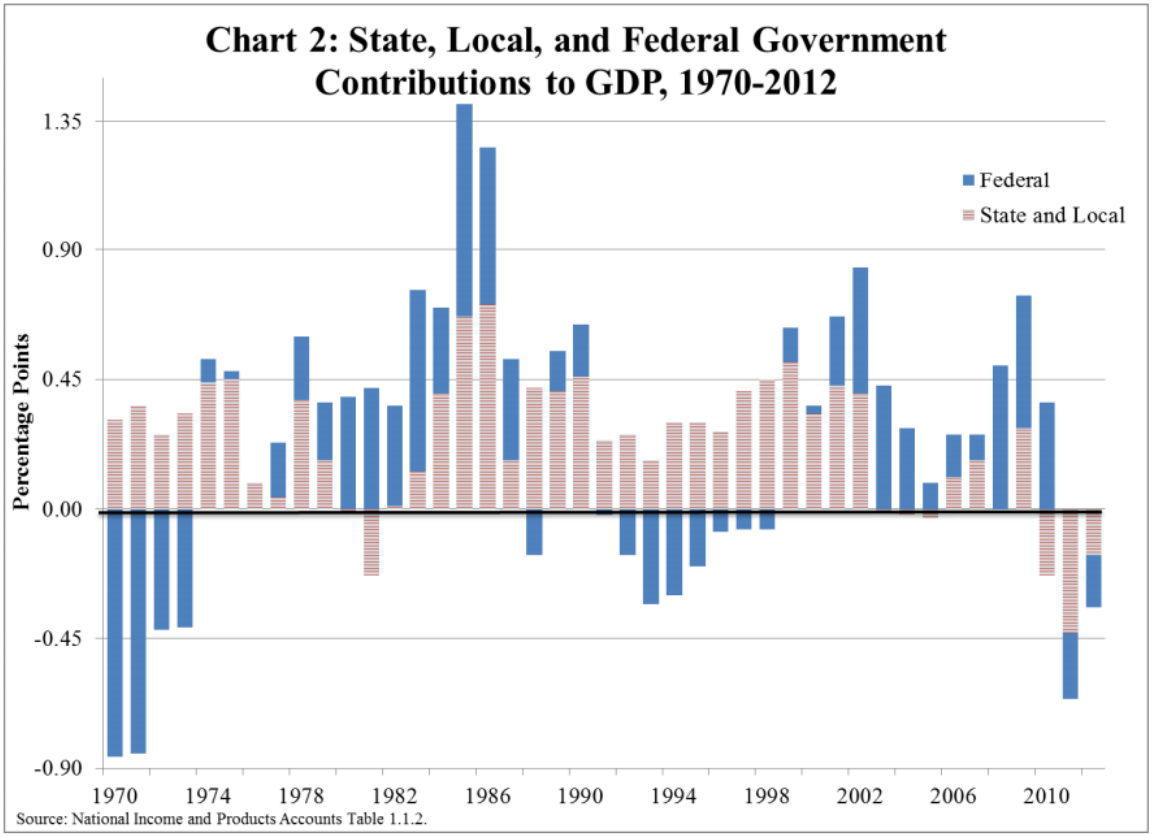
A 2013 poll by CBS News asked voters what they thought was the most important issue facing the United States today. The largest percentage, 31%, said the economy or jobs.[i] Almost every poll over the last decade has shown similar results with the economy rarely rating below 30% and frequently polling in the 40's. However, there exists a great debate amongst policy makers, politicians, and economists on how best to stimulate a sluggish economy. On one side are Keynesian economists who believe in government spending as a way to provide economic stimulus. Democrats in the federal government also tend to believe in this theory. On the

other side are classical economists who believe in minimal government intervention with subsequent low tax rates. Republicans generally support this approach.

In late December 2007, the United States faced the worst economic recession since the Great Depression. The recession was felt worldwide and included: decreases in housing values, limited credit, GDP loss, and an increase in unemployment. Different agencies in the U.S. responded differently to the recession, some with polices never seen before. The Fed, for example, responded by cutting interest rates to a record near zero.[ii]

Given the political tendencies of the two parties, one would expect conservative states to take a laissez-faire approach to the recession, while liberal states to be hands on and pass stimulus bills. However, most state and local governments are required by law to maintain balanced budgets. A 2008 National Conference of State Legislatures Report states that 43 states are constitutionally required to keep balanced budgets.[iii] According to the Quarterly Summary of State & Local Tax Revenue put out by the U.S. Census, in 2012 state and local governments received 24% of their revenue from income tax, 33% from property tax, and 21% from sales tax.[iv] When the recession hit, 8 million Americans lost their jobs, which meant less revenue from income taxes.[v] Less income and low consumer confidence also meant fewer purchases and therefore less sales tax revenue. According to Zillow, the total U.S. housing market fell by $6.3 trillion from 2007-2011.[vi] This, coupled with a record amount of foreclosures, greatly reduced property tax revenue. The result of large losses in revenue for state and local governments combined with legal requirements to keep balanced budgets meant that many state and local governments had to make dramatic reductions to their budgets. Figure 1 shows how, in 2008, state and local government spending contributed almost nothing to the national GDP.

Figure 1: State, Local, and Federal Government Contributions to GDP[vii]



Partisan division was apparent at the federal level where two stimulus packages were passed totaling $1,531 billion in government spending. The Emergency Economic Stabilization Act of 2008 spent $700 billion on distressed assets, with an emphasis on subprime mortgages as well as supplying banks with cash.[viii] The following February, the federal government passed the American Recovery and Reinvestment Act of 2009 (ARRA). The ARRA cost $831 billion and its aim was "job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization".[ix,] The ARRA was supported by a democratic president and a democratic majority in the House and Senate. Only three Republicans (one of whom soon switched parties) in the House and Senate voted for the bill.[x] Liberal economists such as Paul Krugman and Joseph Stiglitz supported a large stimulus while conservative economists such as

Edward Prescott and Gary Becker opposed the ARRA. The theories and data behind this disagreement will be further discussed in the next section of this paper.

It is impossible to know if the ARRA was a good policy response to the Great Recession. Unlike physical scientists, economists cannot rerun the experiment with different polices. It's possible that a larger stimulus would have led to a faster recovery or it's possible that the stimulus slowed down the recovery; one can never know with certainty. In other words, it is impossible to know the counter factual. However, this paper tries to answer this question by comparing the amount of government money different states spent during the recession. No two states are the same and the Great Recession affected each state differently; this paper aims to control for these differences. The models in this paper use per capita government spending to see if states that had more per capita government spending recovered their GSP and/or employment faster than those with less per capita government spending. Answering this question will help policy makers decide what course of action to take the next time a recession occurs.

Literature Review

Economics Theories

The dependent variable for this paper is economic recovery time. There are different metrics one could use to determine economic recovery time; this paper uses gross state product (GSP) as one of the determinants. There are different ways to define GDP. This paper defines GDP as consumption plus investment plus government spending plus trade balance (GDP=C+I+G+XM). Using this formula, one would predict higher government spending would lead to higher GDP.

There are different schools of economic thought. Today, the two most popular schools are Keynesian, sometimes called neo-Keynesian or New Keynesian, and free market, sometimes called the Austrian School or neoclassical. Keynesian economics relies on the Investment Saving-Liquidity Preference Money Supply (IS-LM) model.

In the short-run Keynesians believe that aggregate demand can grow by either expansionary monetary policy or expansionary fiscal policy. Expansionary monetary policy in the U.S. must be carried out by the Federal Reserve (FED) and is done by purchasing securities, lowering the federal discount rate, or lowering the reserve requirement for banks. The result of all three of these changes is to increase the money supply, which shifts the LM curve downward, which raises income, which increases aggregate demand (shown in Figure 2). Increasing government spending or cutting taxes are ways to expand fiscal policy, which shifts the IS curve to the right, which increases income, which increases aggregate demand (shown in Figure 3). The important takeaway is that Keynesian theory supports the idea that higher per capita government spending will help state economies more than lower per capita government spending.

Figure 2[xi]: Expansionary monetary policy

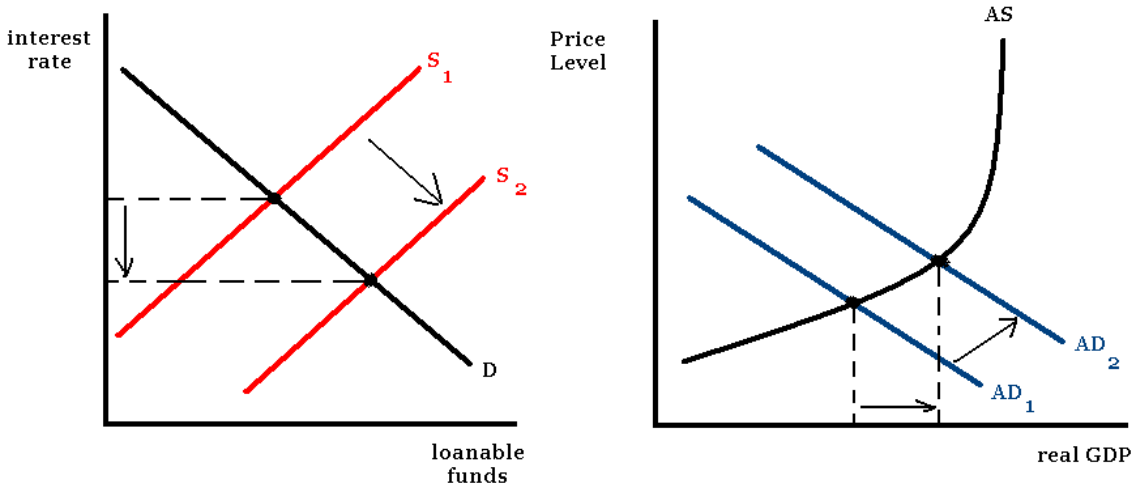
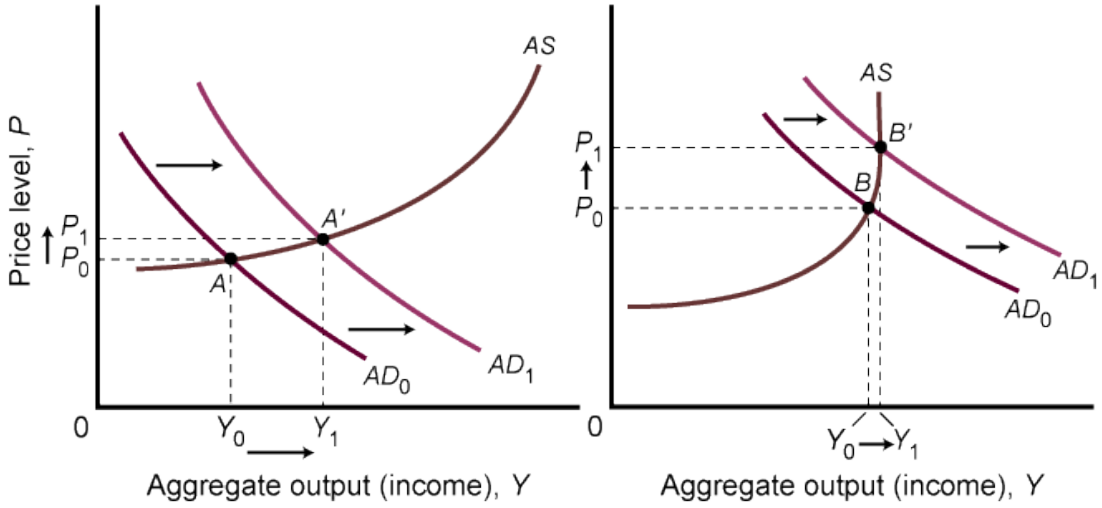


Figure 3[xii]: Expansionary fiscal policy



The other school of economic thought, neoclassical economics, focuses mostly on microeconomics; however, when it comes to macroeconomics, they believe that too much government spending can take resources away from the private sector, which will ultimately slow down an economy. They also believe that the private sector is better at using resources than the public sector. That said, neoclassical economists believe that a government stimulus will increase GSP and payroll in the short-term, however they may feel that the long-term costs out way the short-term benefits.

Econometrics Studies

Following the passage of the stimulus in 2008, economists on both sides took to the media to argue their respective cases on the pros and cons of the stimulus. On the pro-stimulus side were economists like Paul Krugman and Joseph Stiglitz who explained the importance of a large stimulus to save the economy.[xiii,xiv] On the other side were economists like Robert Barro who argued that the multiplier was less than one. Although there is disagreement about the size of the multiplier, even conservative economists believed the multiplier to be above zero, which supports the idea that, all else equal, states with more government spending would recover faster.

Now that the recession is over, some economists have tried to figure out how big the multiplier was. Ilzetski, Mendoza, and Vegh came up with a model that looked at the multiplier from 44 different countries. Between the 44 countries, the multiplier ranged from .5 to 1.5.[xv] Again, all the multipliers are above zero, which means that my study should show positive coefficients on the high spending states.

Data & Variable Explanation

The goal of this paper is to see if government spending leads to faster economic recovery. There are different ways to define government spending. The all-encompassing measure is total expenditure, which is the total amount of federal, state, and local government money spent in a given fiscal year. This metric was not used, since roughly a quarter of state's expenditures are intergovernmental expenditures, meaning that they go to other levels of the government.[xvi] Subtracting intergovernmental expenditures from total expenditures leaves direct expenditures. Direct expenditures are divided into five parts: [xvii]

- Current operation: "Direct expenditure for compensation of own officers and employees and for supplies, materials, and contractual services except any amounts for capital outlay."

- Capital outlay: "Direct expenditure for purchase or construction, by contract or government employee, construction of buildings and other improvements; for purchase of land, equipment, and existing structures; and for payments on capital leases."

- Insurance benefits and repayments: "Social insurance payments to beneficiaries, employee-retirement annuities and other benefits, and withdrawals of insurance or employee retirement contributions."

- Assistance and subsidies: “Cash contributions and subsidies to persons, not in payments for goods or services or claims against the government. For states, it also includes veterans' bonuses and direct cash grants for tuition, scholarships, and aid to nonpublic education institutions.”

- Interest on debt: “Interest on debt is the amount of money paid by the state for monies borrowed.”

Of these five I chose to use current operation and capital outlay as the independent variables. Current operation makes up approximately two thirds of the entire state budget and includes government employee salaries and almost all government services. Capital outlays were also used since it includes construction costs, which were a large percentage of the ARRA. The remaining three categories were not used since they are not areas that were greatly affected by the recession, the ARRA, or had a large effect on state economic recoveries. The census gathers all this data from the states in their State Government Finance section.[xviii]

Economic recovery is another term that can be defined with different metrics. Stock market, unemployment percentage, Gross Domestic Product (GDP), inflation percent, and poverty rate are all ways economists analyze a region’s economy. For this paper I chose to use Gross State Product (GSP) and payroll. Unemployment reached 10% in October of 2009, which is the highest rate in the U.S. since 1983.[xix] Due to the severity of unemployment, the media attention that was given to unemployment, and the ARRA goal of reducing unemployment, including unemployment was necessary. Unemployment is the percentage of people actively looking for work. It therefore does not include underemployed people, people in jobs that pay less than their previous job, and people who have given up looking for a job and dropped out of the job market. Studies have shown that all three of these phenomena happened in large numbers as a result of the Great Recession.[xx] One

way to avoid these issues is to use U6 unemployment data, which includes "marginally attached workers and those working part-time for economic reasons." Unfortunately, U6 is not available at the state level so instead payroll was used. Payroll data is from the Bureau of Labor Statistics Quarterly Census of Employment and Wages survey[xxi] and gives the amount of total wages in a state for a given year. Using this metric accounted for the unemployed, those in lower paying jobs, and people who dropped out of the workforce.

GSP was also used to evaluate the recovery of a state's economy. GSP was chosen since it does the best job of covering the entire economy of a given state. GSP should measure the strength of a state's economy and payroll should define the strength of the state's labor market. GSP data is in the same place as capital outlays and current operations in the census[xxii].

Every state economy is different and therefore the Great Recession affected every state differently. In order to accurately see if high per capita government spending states recovered better than low spending states, one must control for these differences. To accomplish this, nine covariates were included in the regressions.

Recessions can cause displacement of people. Home forecloses and job loss may force people to move. Some people in states that were hit hardest by the recession moved to states that were hit less hard. In order to control for this difference, change in population, a variable that compares the change in population from the current year to the previous year, was added.

Impoverished residents cost the government money through programs like Medicaid, food stamps, EITC, unemployment, and Welfare. States have different numbers of residents below the poverty line and the recession changed the percentage in every state differently. Data from the Census Bureau's Housing and Household Economic Statistics Division was used to control for this difference.[xxiii]

The percentage of poor people in a state is not the only way to sense its income distribution. A state's median income was also used as a covariant. It was included to control for any differences low and high-income level states might have in dealing with the recession differently. Median income data is from the census.[xxiv]

Every state runs its own Medicaid program. Every state's program is also partially funded by the federal government. One way the federal government gave states financial relief during the recession was to increase the percentage of state's Medicaid that was paid for by the federal government. Of the $831 billion 2009 federal stimulus package, $87 billion went to increase state's Medicaid.[xxv] This freed up money in states' budgets that no longer had to go towards Medicaid, but instead could go to economic stimulus. Since every state runs their Medicaid program differently, they received different per capita amounts and this needed to be controlled. Data for the number of state residents on Medicaid and the percentage the federal government paid in that state is from the Kaiser Foundation.[xxvi] Taking the number of residents on Medicaid multiplied by the federal percentage results in the total amount of federal money spent in a given state on Medicaid.

Certain industries were hit harder during the recession than others. Industries in the financial sector and construction were hit especially hard. Some states have work forces with a higher percentage of recession-hit industries, so it was important to control for these differences. I included the five largest industries to control for these differences: construction, manufacturing, retail, finance and education. Not only do these five industries have the largest wages, but they also experienced the five largest job losses during the recession.[xxvii] Data for the industries is from the Current Population Survey (CPS).[xxviii]

Methodology

When deciding which methodology to use to test the hypothesis that states that had higher per capita government spending during the recession recovered faster than those that had lower per capita spending, a few decisions needed to be made. The first issue was how to deal with time periods. The data gathered was from 2005-2012 and the official recession, according to the National Bureau of Economic Research, started in December 2007 and ended in June 2009.[xxix] Figures 4 and 5 show the national trend for the two dependent variables, GDP and unemployment. Non-recession GDP appears to stop somewhere between 2006 and 2007, bottoms out at the end of 2009, and doesn't recover until 2011. Non-recession unemployment also appears to stop somewhere between 2006 and 2007, bottoms out at the end of 2009, but as of the end of 2012 still had not recovered to pre-recession levels. Given the national trends, 2005 was used as the state's pre-recession level, 2009 was the peak of the recession or trough, and since GDP and unemployment recovered at different times, both 2011 and 2012 were used to determine economic recovery. For government spending during the recession period, 2008 through 2010 was used.

Figure 4[xxx] GDP Annual Growth Rate

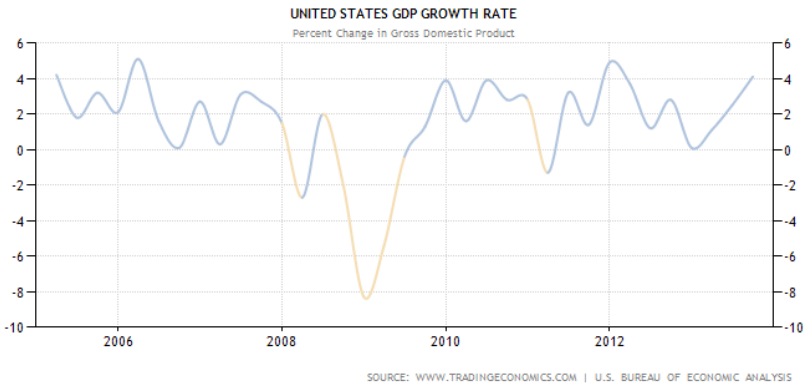
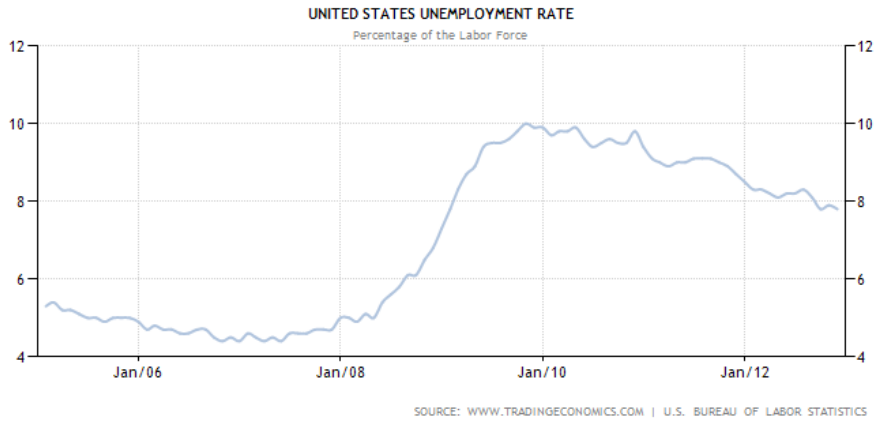


Figure 5[xxxi] Unemployment Rate



The next issue that needed to be addressed was whether economic recovery should be measured from the base year or the trough. Depending on which metric was used, the results could be very different. For example, states A and B have a pre-recession GSP of 10 and 20 respectively. During the recession, state A's GSP falls to 5 while state B's falls to 8. At the end of 2012, State A has recovered back to 9 while State B has recovered to 17.

Table 1 Economic recovery Trough vs. Prerecession

	State A	State B
Pre	10	20
Trough	5	8
Post	9	17
Post/Pre	**.9**	.85
Post/Trough	1.8	**2.125**

Comparing pre-recession to post-recession, state A recovered faster (.9>.85); however, if one compares the trough to post-recession, state B recovered faster (2.125>1.8). To deal with these potential differences, regressions were run using both time periods.

Another issue that needed to be addressed was how to deal with the independent variables, capital and current government spending. Just looking at state government per capita spending during the recession might not be an adequate measure of state government spending relative to other states. Alaska had the highest per capita government spending during the recession, but it also had the highest pre-recession per capita spending. It was possible for a high spending state during the recession to have actually spent less per capita proportional to other states. A fictional example is shown in Table 2. State A had the highest per capita spending during the recession (8 compared to 6 and 5), but of the three states it is the only one that decreased its per capita spending relative to before recession spending.

Table 2 Average spending vs. Average spending/base year spending

State	Pre Recession per Capita Spending	During Recession Per Capita Spending	Recession Spending/ Pre Recession Spending
A	10 (1)	8 (1)	.8 (3)
B	5 (2)	5 (3)	1 (2)
C	4 (3)	6 (2)	1.5 (1)

To deal with this issue, both per capita government spending during the recession and change in government spending were analyzed.

Change in government spending = 2008 through 2010 per capita spending/ 2005 per capita spending.

The last issue that had to be addressed was how to deal with 50 states. Creating a dummy for all 50 states would not be a good method for many statistical reasons, including loss of degrees of freedom and high standard errors. Instead, three groups were created. For each regression, the states were ranked highest to lowest in per capita government spending; the highest 16 states were marked as high, the middle

18 as medium and the lowest 16 as low. Comparing the coefficient on high spending states to low spending states should show the biggest difference, if a difference exists.

It should also be noted that every variable that was not a percent or median was changed to per capita in order to eliminate the differences in state populations.

Thirty-two separate ordinary least squared models (OLS) were run. There are 32 different regressions due to 5 variations:

- Independent variable variations
    - Capital vs. current budget spending
    - 2008-2010 per capita spending vs. 2008-2010 per capita spending / 2005 per capita spending
- Dependent variable variation
    - GSP vs. payroll
    - 2011 vs. 2012 as the recovery year
    - Comparing recovery from pre recession vs. recovery from trough

Each of the 32 regressions used the same covariates, which are listed below: The data section describes why these covariates were selected.

Population change: high year population/ low year population (PopC)
State poverty rate: average percentage over the time period (PR)
Federal Medicaid payments: average per capita dollar amount over the time period (MP)
Median income: average over the time period (MI)
Construction wages: average per capita over the time period (CW)
Manufacturing wages: average per capita over the time period (MW)
Retail wages: average per capita over the time period (RW)

Finance wages: average per capita over the time period (FW)
Education wages: average per capita over the time period (EW)

Depending on which independent and dependent variable was used in the regression, that particular regression may have covered a different time period than other regressions. In fact, the 32 regressions covered four different time periods, all ranging somewhere between 2005-2012. Covariates were only used from the regression's time period. For example, a regression that went from 2008-2011 only used average construction wages from 2008-2011, as opposed to a regression that went from 2005-2011, which used average construction wages from 2005-2011.

The basic function for all 32 of these regressions is the following:

EconomicRecovery = C1HighSt + C2 MediumSt + C3PopC + C4PR +C5MP +C6MI +C7CW + C8MW + C9RW + C10FW + C11EW +cons

- Economic Recovery is a combination of GSP/Payroll, 2011/2012, and trough/base
- HighSt is a dummy for the 16 highest states in a combination of capital/current budget and average spending or average spending /base year spending
- MediumSt is a dummy for the 18 middle states in a combination of capital/current budget and average spending or average spending /base year spending
- Cons is the constant

Assumptions for the Model

1. This paper assumed that all government spending from the stimulus had an equal effect on GSP and payroll. Some stimulus money may have had

a larger effect or a faster, more direct effect than other stimulus money; however, it was assumed that it all had the same effect.

2. There are four ways for an economy's GDP to grow. In this paper it was assumed that private consumption and investment were affected similarly in each state. In order words, it was assumed that residents in one state changed their consumption and investment habits as a result of the recession in a similar manner to residents in other states.

3. Covariates included in the regression dealt with any potential omitted or selection bias.

Results

Meta-Analysis

Table 3 Aggregated Results for 32 Models (Coefficient)

	Mean Coefficient	Median Coefficient	Difference from Mean
All 32	0.04995	0.03798	-
Current	0.05118	0.04517	-0.00123
Capital	0.04871	0.03798	0.00123
Average Spending	0.05698	0.06196	-0.00703
Average/Base	0.04292	0.03635	0.00703
2011	0.04933	0.03798	0.00061
2012	0.05056	0.04564	-0.00061
Payroll	0.04970	0.03635	0.00025
GSP	0.05019	0.04145	-0.00025
Trough	0.01468	0.01573	0.03526
Base	0.08521	0.08818	-0.03526

Table 4 Aggregated Results for 32 Models (p-values)

	Mean p-value	Median p-value	Difference from Mean
All 32	0.21991	0.08900	-
Current	0.28925	0.06400	-0.06934
Capital	0.15056	0.10150	0.06934
Average Spending	0.29075	0.03550	-0.07084
Average/Base	0.14906	0.09400	0.07084
2011	0.18556	0.05800	0.03434
2012	0.25425	0.11950	-0.03434
Payroll	0.20738	0.08400	0.01253
GSP	0.23244	0.08900	-0.01253
Trough	0.40200	0.29600	-0.18209
Base	0.03781	0.02200	0.18209

This section of the paper provides meta-analysis for all the regressions that were run in this paper. Since there are 32 different results it is not practical (or interesting) to discuss each result individually. Tables 3 and 4 give summary results for the 32 OLS regressions (full results can be found in the appendix). Table 3 gives the coefficient for the states that spent a high amount per capita (16 highest states) relative to the low spending states (16 lowest states) and Table 4 gives the corresponding p-values. The tables begin by giving the mean and median for the 32 regressions. As discussed in the methodology section, there are five variations that create the 32 different models. Tables 3 and 4 break down each variation, comparing the 16 models that used that method as opposed to the 16 that used the other method. The last column notes the difference of the coefficient for that particular group compared to the average coefficient for all 32 models.

The average coefficient for all 32 regressions is .05. This means that if all else is equal, states that had relatively high per capita government money spent in them during the recession recovered 5% more in GSP and payroll than states that had relatively low per capita government money spent in them during the recession.

This finding suggests that government spending does in fact decrease the effects of a recession. It should be noted that the average p-value for the 32 regressions is .22, which is higher than one would like in order to claim strong results, however the median p-value is much lower at .09, which is low enough to show significance. It should be noted that these regressions contain only 50 observations, so that getting very low p-values is not easy. It should also be noted that the p-value on the high per capita government-spending coefficient is by far the lowest p-value of all the covariates.

Current vs. Capital

There is only a .001 average difference between the current and capital coefficients. This means that government money that went towards current expenditure items stimulated the economy just as much as money that went toward capital investments. One might have expected that money spent in the current budget would have a faster stimulating effect, since money spent on capital projects would take time to see returns to the economy, but that does not seem to be the case. However, much of the capital money spent had immediate economic stimulus effects such as construction worker wages, building materials, and construction contracts.

Average Spending (2008-2010) vs. Average/Base (2008-2010/2005)

Separating states using their per capita average government spending during the recession resulted in a .014 higher mean coefficient and an even higher median difference of .026 compared to sorting states by looking at change in government spending comparing their base year to recession year spending. Going into the study, I expected the reverse finding, since change in government spending seems to be a more accurate way to look at government spending. One explanation for this difference has to do with which states are included in the two groups. When one looks at the high spending states using the per capita government spending model during the recession, a lot of progressive northeastern states are included: Connecticut, Delaware, New Jersey, Maine, New York, Rhode Island, and Vermont. Contrast this to the high spending states in the change in government spending

model and one sees more conservative states: Alabama, Kansas, Oklahoma, Montana, Tennessee, and Arizona. The difference in the coefficient might have to do with how progressive northeastern states were able to cope with the recession compared to conservative states.

2011 Recovery Year vs. 2012 Recovery Year

Using the mean coefficients from 2011 as compared to 2012 as the recovery year yielded no statistical difference (.0009). One would need more years of data (2013, 2014, etc.) to draw conclusions using different recovery years. However, if coefficients for 2013 and 2014, etc. also had no statistical difference, it might be the case that government money spent during the recession had its full economic stimulus effect already exhibited by 2011. Since most of the ARRA was designed for immediate economic stimulus, it would mean that the ARRA did a good job of accomplishing that part of its goal.

Payroll vs. GSP

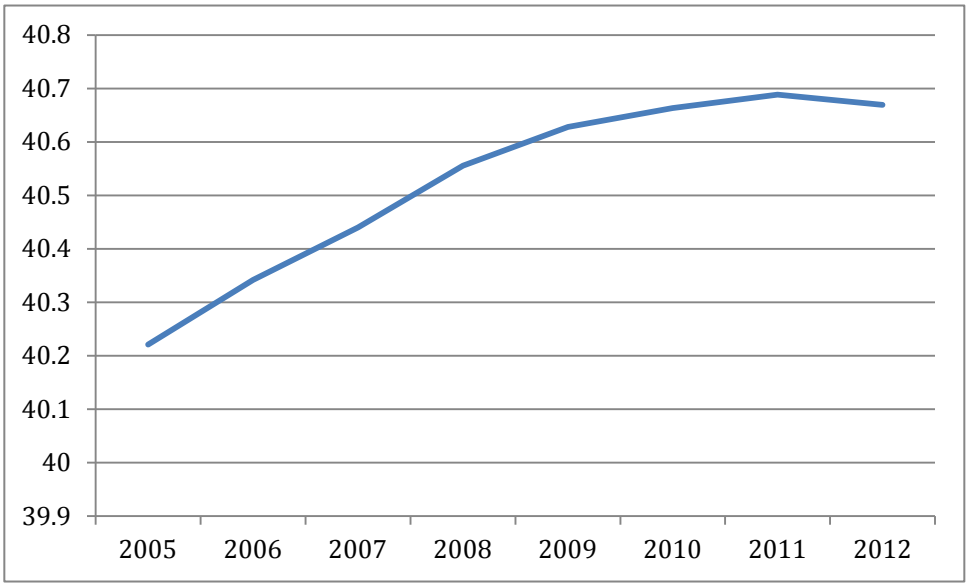
Using payroll as opposed to GSP for the dependent variable yields almost no difference. For both metrics, being a high spending state leads to a 5% increase in payroll and GSP when compared to an identical low spending state. This is an interesting finding, since GSP recovered faster than payroll. One might suspect that the government spending effect would be higher for GSP than payroll, especially when using 2011 as the recovery year, however this does not appear to be the case. This finding, paired with the previous 2011 vs. 2012 finding, further suggests that states that spent more during the recession saw the economic stimulus from this higher spending right away and did not need to wait for results.

Trough vs. Base

Comparing the recovery to the base year vs. trough year yielded by far the largest difference for the independent coefficient. Using the base year (2005) as the comparison for the recovery had a very high .085 coefficient as opposed to using the trough year (2009) which had a low .015 coefficient. The large difference in these

findings can be explained in Figure 6, which shows national per capita wages from 2005 through 2012. Comparing 2011 or 2012 to the base year reveals a large increase in payroll, however when comparing 2011 or 2012 to the trough year, there is a very small increase in wages. The base year coefficient is therefore much higher, since it needs to account for a much larger payroll increase when compared to the trough year.

Figure 6



Covariates

Table 5 Covariates

Covariates	Positive	Negative	Average p-Value
Population Change	6	26	0.51453
Poverty Level	5	27	0.40744
Federal $ on Medicaid	14	18	0.60981
Median Income	0	32	0.30131
Construction Wages	25	7	0.47772
Manufacturing Wages	20	12	0.46178
Retail Wages	26	6	0.65884
Finance Wages	15	17	0.77866
Education Wages	11	21	0.78847

Looking at the results for the covariates, the only consistent finding is the inconsistency in the covariates throughout the 32 regressions. Table 5 gives the number of times each coefficient was positive and negative for the 32 regressions as well as the average P-value. The only covariate that has consistency is the median income, which is negative in all models and has a p-value of .301 (which is still pretty high). All other covariates change signs a minimum of 5 times and have very high p-values. Due to the change in coefficient signs and high p-values, it would be unwise to draw conclusions on the effect of any of the covariates.

48 States

The two states with the highest per capita government money spent in them were Alaska and Hawaii. From 2008 through 2010, Alaska had almost 3 times more per capita current operations government spending than the average state in the continental U.S and 4 times more in capital spending. Hawaii also had more than the average continental state with twice per capita in current operations and 1.5 times in capital budgets. Since these states' spendings were significantly higher than the other 48 states, the 32 regressions were also run with Alaska and Hawaii removed from the dataset. After removing Alaska and Hawaii, there were 16 states in each government spending group. Table 6 shows the aggregate results from the 32 regressions. There is no statistical difference in the 32 regression models using 48 states compared to 50 states. The mean coefficient for all 32 regressions is different by only .002, while the median value is the same. Similarly, the mean p-value is different by only .04, and the median p-value is the same. My hypothesis as to why removing Alaska and Hawaii doesn't change the results is twofold. First, half the models use a percent change in government spending, so Alaska and Hawaii are not outliers is those cases. Second, Alaska was one of the states that recovered the fastest economically, which supports the claim that higher government spending leads to faster recovery.

Table 6 Aggregated Results with 48 states

	mean C	median C	mean P	median P
total	0.047	0.040	0.251	0.089
current	0.047	0.044	0.254	0.098
capital	0.046	0.040	0.249	0.082
average spending	0.051	0.052	0.260	0.068
average/base	0.043	0.040	0.243	0.098
2011	0.046	0.040	0.180	0.069
2012	0.048	0.044	0.323	0.132
payroll	0.045	0.040	0.287	0.082
gsp	0.049	0.042	0.215	0.093
trough	0.015	0.014	0.457	0.374
base	0.079	0.080	0.046	0.038

Finding the Best Model

The problem with meta-analysis is that it doesn't allow for meaningful interpretation or a strong predictive model. This section attempts to deal with these issues by determining a best model for both dependent variables: GSP and payroll. Of the 32 regressions, 13 of them have p-values below .05 (interestingly, the average coefficient on the large state dummy for these 13 regressions is almost double that of the average 32 regressions). Interestingly, the two models with the lowest p-values were identical in four of the five differences. They both used capital spending, average spending during the recession, 2011 as the base year, and compared the recovery to the base year. The only difference was one used GSP and the other used payroll. Results for these two models are shown in Tables 7 and 8.

Table 7 Payroll Best Model

	Coef.	p-Value	Coef.	p-Value	Coef.	p-Value	Coef.	p-Value
Large	0.096	0.001	0.101	0.001	0.099	0.000	0.088	0.000
Medium	0.039	0.163	0.039	0.152	0.038	0.136	0.046	0.049
Pc	-0.711	0.079	-0.686	0.086	-0.669	0.076		
Pv	-0.005	0.517						
Md	-0.354	0.720	-0.136	0.883				
Mi	-0.032	0.441	-0.014	0.648	-0.011	0.628		
C	-0.011	0.811	-0.005	0.917	-0.002	0.959		
M	-0.001	0.938	0.003	0.808	0.003	0.773		
R	0.054	0.461	0.065	0.368	0.060	0.349		
F	-0.004	0.705	-0.005	0.648	-0.005	0.660		
E	-0.013	0.826	-0.015	0.801	-0.014	0.802		
Cons	2.094	0.002	1.852	0.001	1.809	0.000	1.152	0.000
Obs	50		50		50		50	
Adj. R^2	0.166		0.178		0.198		0.200	
R^2	0.353		0.346		0.346		0.233	

Table 8 GSP Best Model

	Coef.	p-Value	Coef.	p-Value	Coef.	p-Value	Coef.	p-Value
Large	0.100	0.003	0.109	0.001	0.108	0.001	0.104	0.000
Medium	0.055	0.082	0.056	0.076	0.055	0.063	0.053	0.037
Pc	-0.424	0.348	-0.370	0.413	-0.348	0.414		
Pv	-0.011	0.222						
Md	-0.641	0.566	-0.174	0.869				
Mi	-0.055	0.250	-0.016	0.657	-0.012	0.650		
C	0.022	0.666	0.035	0.482	0.038	0.402		
M	-0.001	0.939	0.007	0.593	0.008	0.552		
R	0.025	0.760	0.047	0.564	0.042	0.570		
F	-0.002	0.890	-0.004	0.784	-0.003	0.804		
E	-0.034	0.613	-0.038	0.576	-0.037	0.574		
Cons	1.949	0.009	1.431	0.017	1.375	0.004	1.101	0.000
Obs	50		50		50		50	
Adj. R^2	0.138		0.126		0.147		0.229	
R^2	0.331		0.304		0.304		0.261	

Large- high spending state dummy

Medium- medium spending state dummy

Pc- population change

Pv- poverty rate

Md- federal money spent on Medicaid

Mi- median income

C- construction payroll

M- manufacturing payroll

R- retail payroll

F- finance payroll

E- education payroll

Columns 1 and 2 in Tables 7 and 8 give the coefficients and p-values for all variables using the full models. The coefficient on the large state dummy is about .1 for both models and has very low p-values of .001 and .003, respectively. This means, all else equal, a state with high government spending during the recession would recover 10 % more in both payroll and GSP than an identical state with low government spending during the recession. Another important take away is that none of the other covariates have p-values anywhere low enough to signal significance.

When coming up with a list of covariates, I thought of all variables that could be relevant in controlling for economic recovery. This does not mean that all of the covariates should be included in the final models. Table 9 shows a correlation matrix between all the covariates. The only variable that had the same sign on its coefficients in all 32 models was median income. Since median income was the only coefficient to have the same sign in all the models, it will be kept. Looking at the correlation matrix, one sees that poverty rate is highly correlated with median income. Intuitively this makes sense; states where people earn more will probably have fewer poor residents. Given the high correlation, poverty rate was taken out of the model and the results are shown in Columns 3 and 4 of Tables 7 and 8. The new models have slightly higher coefficients on the large state dummy as well as slightly lower p-values. The R^2 not surprisingly goes down in both models, however the adjusted R^2 goes up in one model and falls slightly in the other.

Table 9 Correlation Matrix

	Pc	Pv	md	Mi	C	M	R	F	E
Pc	1								
Pv	0.05	1							
Md	-0.25	0.5	1						
Mi	-0.04	**-0.83**	**-0.76**	1					
C	0.48	-0.49	-0.61	0.55	1				
M	-0.47	-0.14	0.05	0.01	-0.46	1			
R	0.02	**-0.71**	-0.44	0.69	0.57	-0.06	1		
F	-0.27	-0.33	-0.37	0.46	0.05	0.23	0.32	1	
E	-0.5	-0.4	-0.3	0.53	0.02	0.26	0.35	0.64	1

Federal spending on Medicaid is also highly correlated with medium income. This also makes sense since states with more low wage earners will likely have more residents receiving Medicaid and as a result will receive more federal dollars to pay for Medicaid. The Medicaid variable also has a p-value over .85 in both models. Results for both models without the Medicaid variable are shown in Columns 5 and 6. The coefficients on the large state dummy decreased slightly, but remained lower than the full model. P-values on the large state dummy also decreased. Interestingly, the R^2 in both models did not change at all, but the adjusted R^2s increased significantly.

Columns 7 and 8 show results for the models without any covariates. The coefficients for the large state dummy are the lowest of any of the models, but also have the lowest p-values. Not surprisingly, the adjusted R^2s are the highest on any of the models, but the R^2s are the lowest. The take away from the different models is pretty minimal, in all cases the coefficient on large government spending was close to .1 with a low p-value around .001. The R^2 and adjusted R^2s don't change much except in the model without any covariates. It should also be noted that in all the models, the p-values on the covariates were very high.

Conclusion

There may never be political or academic agreement on stimulus spending during a recession. This paper does not attempt to decipher what would have happened to the economy with no stimulus, a smaller stimulus, a larger stimulus, or estimate the multiplier for stimulus spending. This paper does however, by looking at government spending in states during the recession, support the economic theory that government spending in a recession does in fact increase payroll and GSP. Using 32 OLS models with two variations on the independent variable and three variations on the dependent variable, I found that states with high amounts of government spending recovered 5% more in GSP and payroll compared to states with low amounts of government spending. Using the best of these 32 models, the number grows to 10% with high significance. For policy makers, this information should be helpful in deciding the correct action to take during a recession. Policy makers should also be aware of potential multiplier effects of government spending, the cost of debt caused by increased spending, as well as who benefits from stimulus money.

Appendix

All 32 regression results

Variables in each model

regression	current	capital	average spending	average/base	2011	2012	payroll	gsp	trough	base
1	1	0	1	0	1	0	1	0	1	0
2	0	1	1	0	1	0	1	0	1	0
3	1	0	0	1	1	0	1	0	1	0
4	0	1	0	1	1	0	1	0	1	0
5	1	0	1	0	1	0	1	0	0	1
6	0	1	1	0	1	0	1	0	0	1
7	1	0	0	1	1	0	1	0	0	1
8	0	1	0	1	1	0	1	0	0	1
9	1	0	1	0	1	0	0	1	1	0
10	0	1	1	0	1	0	0	1	1	0
11	1	0	0	1	1	0	0	1	1	0
12	0	1	0	1	1	0	0	1	1	0
13	1	0	1	0	1	0	0	1	0	1
14	0	1	1	0	1	0	0	1	0	1
15	1	0	0	1	1	0	0	1	0	1
16	0	1	0	1	1	0	0	1	0	1
17	1	0	1	0	0	1	1	0	1	0
18	0	1	1	0	0	1	1	0	1	0
19	1	0	0	1	0	1	1	0	1	0
20	0	1	0	1	0	1	1	0	1	0
21	1	0	1	0	0	1	1	0	0	1
22	0	1	1	0	0	1	1	0	0	1
23	1	0	0	1	0	1	1	0	0	1
24	0	1	0	1	0	1	1	0	0	1
25	1	0	1	0	0	1	0	1	1	0
26	0	1	1	0	0	1	0	1	1	0
27	1	0	0	1	0	1	0	1	1	0
28	0	1	0	1	0	1	0	1	1	0
29	1	0	1	0	0	1	0	1	0	1
30	0	1	1	0	0	1	0	1	0	1
31	1	0	0	1	0	1	0	1	0	1
32	0	1	0	1	0	1	0	1	0	1

Regressions are numbered 1 through 32
A 1 indicates that the regression uses that variable
A 0 indicates that the regression does not use that variable

Coefficient and p-Values for large state dummy variable

regression	X coefficient	p
1	-0.0018695	0.896
2	0.0168729	0.175
3	0.0238946	0.019
4	0.0093307	0.391
5	0.1031774	0.004
6	0.0960258	0.001
7	0.0794925	0.004
8	0.0473935	0.107
9	0.002317	0.884
10	0.0285583	0.035
11	0.0212171	0.081
12	0.0145865	0.259
13	0.1134761	0.004
14	0.0995243	0.003
15	0.0810037	0.01
16	0.0543428	0.096
17	0.0037833	0.85
18	0.0145826	0.42
19	0.0233621	0.162
20	0.0253007	0.147
21	0.1111042	0.024
22	0.1003714	0.01
23	0.0724146	0.047
24	0.0699711	0.061
25	-0.0001086	0.996
26	0.0212139	0.294
27	0.0118906	0.525
28	0.0200092	0.298
29	0.1072672	0.036
30	0.0953648	0.02
31	0.0664478	0.086
32	0.0659867	0.092

Covariates coefficients positive/negative

regression	a sign	b sign	c sign	e sign	f sign	g sign	h sign	I sign	j sign
1	neg	neg	neg	neg	pos	pos	pos	pos	neg
2	neg	neg	neg	neg	pos	pos	pos	pos	neg
3	neg	neg	neg	neg	neg	neg	pos	pos	pos
4	neg	neg	neg	neg	neg	neg	pos	pos	pos
5	neg	neg	neg	neg	neg	neg	pos	neg	neg
6	neg	neg	neg	neg	neg	neg	pos	neg	neg
7	neg	neg	pos	neg	neg	neg	pos	pos	pos
8	neg	neg	pos	neg	pos	neg	pos	pos	pos
9	neg	pos	pos	neg	pos	pos	pos	neg	neg
10	neg	pos	pos	neg	pos	pos	pos	neg	neg
11	neg	neg	neg	neg	pos	pos	pos	neg	neg
12	neg	neg	neg	neg	pos	pos	pos	neg	neg
13	neg	neg	neg	neg	neg	neg	neg	neg	neg
14	neg	neg	neg	neg	pos	neg	pos	neg	neg
15	pos	neg	pos	neg	pos	neg	neg	pos	pos
16	neg	neg	neg	neg	pos	neg	neg	pos	neg
17	pos	neg	neg	neg	pos	pos	pos	pos	pos
18	pos	pos	pos	neg	pos	pos	pos	pos	pos
19	pos	neg	neg	neg	neg	pos	pos	neg	neg
20	neg	neg	neg	neg	pos	pos	pos	pos	neg
21	neg	neg	neg	neg	pos	pos	pos	neg	neg
22	neg	neg	pos	neg	pos	pos	pos	neg	neg
23	neg	neg	pos	neg	pos	neg	pos	pos	pos
24	neg	neg	pos	neg	pos	pos	pos	pos	neg
25	neg	pos	pos	neg	pos	pos	pos	neg	neg
26	neg	pos	pos	neg	pos	pos	pos	neg	pos
27	neg	neg	neg	neg	pos	pos	pos	neg	pos
28	neg	neg	neg	neg	pos	pos	pos	neg	neg
29	pos	neg	neg	neg	pos	pos	neg	neg	neg
30	neg	neg	pos	neg	pos	pos	pos	neg	neg
31	pos	neg	pos	neg	pos	neg	neg	pos	pos
32	neg	neg	pos	neg	pos	pos	neg	pos	neg

Covariates coefficients p-values

regression	a p	b p	c p	e p	f p	g p	h p	I p	j p
1	0.578	0.562	0.661	0.241	0.586	0.649	0.418	0.527	0.833
2	0.438	0.672	0.496	0.303	0.735	0.309	0.431	0.76	0.859
3	0.942	0.036	0.021	0.006	0.043	0.178	0.154	0.919	0.584
4	0.367	0.087	0.024	0.017	0.136	0.345	0.297	0.87	0.88
5	0.383	0.051	0.212	0.079	0.362	0.516	0.851	0.648	0.612
6	0.079	0.517	0.72	0.441	0.811	0.938	0.461	0.705	0.826
7	0.532	0.057	0.866	0.186	0.481	0.113	0.704	0.847	0.756
8	0.193	0.197	0.934	0.248	0.938	0.376	0.825	0.882	0.879
9	0.193	0.972	0.901	0.468	0.035	0.079	0.944	0.866	0.517
10	0.093	0.631	0.969	0.679	0.028	0.013	0.886	0.519	0.564
11	0.234	0.216	0.104	0.02	0.686	0.682	0.711	0.468	0.964
12	0.042	0.264	0.098	0.035	0.438	0.426	0.722	0.758	0.573
13	0.803	0.02	0.175	0.044	0.909	0.642	0.713	0.832	0.478
14	0.348	0.222	0.566	0.25	0.666	0.939	0.76	0.89	0.613
15	0.898	0.025	0.939	0.126	0.928	0.224	0.85	0.773	0.904
16	0.567	0.081	0.963	0.162	0.447	0.546	0.767	0.784	0.982
17	0.264	0.849	0.981	0.348	0.544	0.087	0.22	0.831	0.917
18	0.337	0.986	0.915	0.493	0.458	0.046	0.304	0.875	0.839
19	0.736	0.322	0.66	0.131	0.763	0.933	0.266	0.974	0.806
20	0.679	0.374	0.613	0.169	0.974	0.59	0.284	0.703	0.869
21	0.558	0.192	0.699	0.228	0.935	0.912	0.82	0.78	0.571
22	0.199	0.858	0.598	0.799	0.409	0.53	0.63	0.902	0.717
23	0.676	0.291	0.383	0.404	0.585	0.557	0.736	0.852	0.935
24	0.282	0.467	0.424	0.434	0.246	0.939	0.721	0.671	0.896
25	0.996	0.851	0.875	0.499	0.102	0.03	0.801	0.809	0.948
26	0.859	0.717	0.89	0.643	0.089	0.01	0.881	0.625	0.998
27	0.698	0.763	0.776	0.24	0.336	0.202	0.881	0.519	0.924
28	0.307	0.69	0.721	0.268	0.268	0.122	0.788	0.883	0.732
29	0.974	0.128	0.723	0.219	0.561	0.757	0.721	0.904	0.641
30	0.648	0.503	0.716	0.65	0.278	0.49	0.98	0.95	0.718
31	0.778	0.17	0.419	0.397	0.361	0.866	0.783	0.856	0.933
32	0.784	0.267	0.472	0.415	0.149	0.731	0.773	0.735	0.963

Covariate code:

A- population change
B- poverty rate
C- federal money spent on Medicaid
E- median income
F- construction payroll
G- manufacturing payroll

H- retail payroll
I- finance payroll
J- education payroll

48 State Regression Results

regression	current	capital	average spending	average /base	2011	2012	pay roll	gsp	trough	base	X coefficient	p
1	1	0	1	0	1	0	1	0	1	0	-0.003	0.825
2	0	1	1	0	1	0	1	0	1	0	0.013	0.282
3	1	0	0	1	1	0	1	0	1	0	0.026	0.010
4	0	1	0	1	1	0	1	0	1	0	0.009	0.422
5	1	0	1	0	1	0	1	0	0	1	0.082	0.024
6	0	1	1	0	1	0	1	0	0	1	0.079	0.008
7	1	0	0	1	1	0	1	0	0	1	0.069	0.013
8	0	1	0	1	1	0	1	0	0	1	0.054	0.070
9	1	0	1	0	1	0	0	1	1	0	0.007	0.673
10	0	1	1	0	1	0	0	1	1	0	0.024	0.067
11	1	0	0	1	1	0	0	1	1	0	0.020	0.102
12	0	1	0	1	1	0	0	1	1	0	0.015	0.271
13	1	0	1	0	1	0	0	1	0	1	0.107	0.008
14	0	1	1	0	1	0	0	1	0	1	0.091	0.007
15	1	0	0	1	1	0	0	1	0	1	0.080	0.012
16	0	1	0	1	1	0	0	1	0	1	0.059	0.080
17	1	0	1	0	0	1	1	0	1	0	0.010	0.602
18	0	1	1	0	0	1	1	0	1	0	0.012	0.468
19	1	0	0	1	0	1	1	0	1	0	0.024	0.150
20	0	1	0	1	0	1	1	0	1	0	0.026	1.490
21	1	0	1	0	0	1	1	0	0	1	0.091	0.068
22	0	1	1	0	0	1	1	0	0	1	0.084	0.030
23	1	0	0	1	0	1	1	0	0	1	0.061	0.094
24	0	1	0	1	0	1	1	0	0	1	0.078	0.042
25	1	0	1	0	0	1	0	1	1	0	0.009	0.690
26	0	1	1	0	0	1	0	1	1	0	0.019	0.325
27	1	0	0	1	0	1	0	1	1	0	0.009	0.626
28	0	1	0	1	0	1	0	1	1	0	0.021	0.303
29	1	0	1	0	0	1	0	1	0	1	0.103	0.047
30	0	1	1	0	0	1	0	1	0	1	0.087	0.033
31	1	0	0	1	0	1	0	1	0	1	0.062	0.113
32	0	1	0	1	0	1	0	1	0	1	0.071	0.083

Work Cited

[i] http://www.pollingreport.com/prioriti.htm
[ii] http://usatoday30.usatoday.com/money/economy/2008-12-16-fed-cuts-rates_N.htm?loc=interstitialskip
[iii] http://www.ncsl.org/documents/fiscal/statebalancedbudgetprovisions2010.pdf
[iv] https://www.census.gov/govs/qtax/
[v] http://money.cnn.com/2010/07/02/news/economy/jobs_gone_forever/
[vi] http://www.zillow.com/blog/value-us-homes-to-top-25-trillion-141142/
[vii] http://www.floatingpath.com/wp-content/uploads/2013/06/State-Local-and-Federal-Contributions-to-US-GDP.png
[viii] https://www.govtrack.us/congress/bills/110/hr1424#summary
[ix] http://www.cbo.gov/sites/default/files/cbofiles/attachments/02-22-ARRA.pdf
[x] http://www.nytimes.com/2009/01/29/us/politics/29obama.html?hp&_r=0
[xi] http://www2.yk.psu.edu/~dxl31/econ14/monetary.png
[xii] http://wps.prenhall.com/wps/media/objects/2066/2115639/chapter13/WPS_fig25_11n12.gif
[xiii] http://www.nytimes.com/2008/01/25/opinion/25krugman.html
[xiv] http://www.nytimes.com/2008/11/30/opinion/30stiglitz.html?pagewanted=all&_r=0
[xv] http://water.gov.bm/portal/server.pt/gateway/PTARGS_0_2_18757_935_233626_43/http%3B/ptpublisher.gov.bm%3B7087/publishedcontent/publish/ministry_of_finance/new_ministry_of_finance/sage_report_and_appendixes/glidepath/how_big_small_are_fiscal_multipliers.pdf
[xvi] http://www.census.gov/govs/state/historical_data_2008.html
[xvii] http://factfinder2.census.gov/help/en/american_factfinder_help.htm
[xviii] http://www.census.gov/govs/state/historical_data_2005.html
[xix] http://data.bls.gov/timeseries/LNS14000000
[xx] http://www.urban.org/UploadedPDF/412880-why-are-fewer-people.pdf
[xxi] http://www.bls.gov/cew/
[xxii] http://www.census.gov/govs/state/historical_data_2005.html
[xxiii] https://www.census.gov/cps/data/
[xxiv] http://www.census.gov/hhes/www/income/data/statemedian/
[xxv] http://www.hhs.gov/healthcare/rights/law/index.html
[xxvi] http://kff.org/medicaid/state-indicator/federal-matching-rate-and-multiplier/#note-1
[xxvii] http://www.huffingtonpost.com/2010/04/05/which-industries-lostgain_n_525504.html
[xxviii] http://www.bls.gov/cps/
[xxix] http://www.bls.gov/spotlight/2012/recession/pdf/recession_bls_spotlight.pdf
[xxx] http://www.tradingeconomics.com/united-states/gdp-growth
[xxxi] http://www.tradingeconomics.com/united-states/unemployment-rate