AN EMPIRICAL STUDY TO ASSESS THE EFFECTIVENESS OF U.S. FISCAL POLICY

A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences in partial fulfillment of the requirements for the degree of Master of Public Policy

By

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ABSTRACT

As did many advanced economies, the U.S. economy experienced severe economic problems in 2008 and 2009, and the effects continue. In response to the global financial crisis, the U.S. government relied on a large fiscal stimulus package, known as the American Recovery and Reinvestment Act of 2009 (ARRA), to restore the economy. The governments of some U.S. states also increased their spending with the same purpose. As distinct from many recent studies, which evaluate the effectiveness of fiscal stimulus packages, using cross-country panel data sets, this study examines the effectiveness of these measures, using state level economic and budgetary data and data on ARRA contributions to each state. In relation to the effect of total ARRA spending on economic growth, I find statistically and economically significant positive results in both the state fixed effect and the ordinary least square models. However, when I break down the total ARRA spending into subcategories, while I find a stronger positive effect for the tax benefits, I get statistically significant negative coefficients on the entitlements and the state budget deficits in some regressions. I also find statistically insignificant results regarding the other ARRA subcategory, the contract, grants and loans.
I would like to thank my thesis advisor Andrew Wise for his valuable help along the way and I am so grateful my beloved wife for her understanding and support through the whole process.

AHMET KURT
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I) Introduction

In response to the global financial crisis, the U.S. government relied on a large fiscal stimulus package, known as the American Recovery and Reinvestment Act of 2009 (ARRA), to restore the economy. The governments of some U.S. states also increased their spending with the same purpose. This study examines the effectiveness of these measures, using state level economic and budgetary data and data on ARRA contributions to each state. I also analyze whether there are any significant differences in the responses of state economies to the stimulus package according to their characteristics such as population, industries and per capita income levels. I think that economic conditions in the U.S. during the recent financial crisis were very suitable for implementing fiscal stimulus policies. Therefore, I expect to find that the ARRA fiscal stimulus package in the U.S. had a strong and statistically significant effect on economic growth.

By the middle of the global recession, in 2009, the world’s total GDP had fallen by 2.5 percent. The economic crisis had begun in financial sectors and then spilled over into other sectors. Governments were under enormous pressure to deal with the crisis as unemployment rates rose. Because aggregate demand had been sluggish to recover despite a huge amount of monetary easing, many countries that were capable of implementing fiscal stimulus packages applied them. These trends increased attention to a long-standing issue, the effectiveness of fiscal policies.

As did many advanced economies, the U.S. economy experienced severe economic problems in 2008 and 2009, and the effects continue. The unemployment rate rose from 4.6 percent in 2007 to 9.3 percent in 2009. Real GDP decreased by 0.3 percent in 2008 and 3.5

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1 Public Law number 111–5
percent in 2009 (IMF, 2012). In 2009, as a response to the increasing unemployment rates, the federal government initiated the ARRA, a large fiscal stimulus package. The ARRA provided $787 billion of fiscal stimulus, concentrated in 2009 and 2010 (CEA, 2011). At roughly 2 percent of GDP in 2009, 2.5 percent in 2010, and about 1 percent in 2011 and beyond, the action was the largest countercyclical fiscal action in American history (CEA, 2011).

Many recent studies have attempted to evaluate the effectiveness of fiscal stimulus packages, using cross-country panel data sets. However, the authors of these studies have encountered many problematic factors, such as different institutional structures, exchange rate regime differences, varying monetary policy responses and financial sustainability questions, which can affect an economy’s response to a stimulus package. For instance, in a country with a high debt ratio, increasing government spending may not only decrease private investment through a crowding out effect, but also may increase fiscal sustainability risks. Hence, economic agents’ expectations about that economy’s future may deteriorate and this may result in a decline in consumer spending and investment, obviously the opposite of the desired effect.

However, because I study the effect of a fiscal stimulus within the U.S., while relying on a variation between states, I do not have to account for most of these problems. Although the states have differences in some policy areas, such as tax, education and health, they almost all have the same basic institutional structure. The ratio of openness to trade\(^2\) varies among states but there is only one exchange rate regime. Commercial interest rates are almost the same across all states and the Federal Reserve’s (FED) recent monetary easing policies have attempted to support to stimulating effect of the government’s spending increases on the overall economy by keeping interest rates at low levels. Short-run interest rates are near 0 percent, and the FED has

\(^2\) I calculate this as \((\text{Export} + \text{Import})/\text{Gross Domestic Product}\).
committed itself to keep these levels until the economic recovery is clearly underway. In addition, the long-term interest rates on Treasury bonds have actually decreased, which we can use as a proxy for long-run financial sustainability risks. So the U.S. theoretically represented a perfect Keynesian environment to resort to fiscal policy to boost the economy. That’s why I expect to find a statistically and economically significant relationship in the U.S. between fiscal stimulus measures and economic growth.

Nevertheless, there is an unending dispute among economists about the effectiveness of recent fiscal policies. Neoclassical economists argue that discretionary government intervention distorts the price and wage mechanism, which prevents restoration of the full employment output level. Some researchers even state that when the spending program expires aggregate output will be lower than it could have been without fiscal stimulus (see, e.g., Strulik 2009). In contrast, Neo Keynesians claim that when there is an aggregate demand problem, the economy cannot recover by itself because of wage and price rigidities, and discretionary fiscal measures are needed to restore a full employment output level. While neo-classical economist Robert Barro has argued that peacetime fiscal multipliers\(^3\) are essentially zero, Christina Romer, Chairman of President Obama’s Council of Economic Advisers, used multipliers as high as 1.6 in estimating the job gains generated by ARRA (Ilzetzki et al., 2009). Hence, it is important to examine the effect of fiscal stimulus policies, even in the most favorable conditions, to assess whether these policies should be applied in similar conditions.

This study is structured as follows. Section II provides the background information and reviews the relevant literature. Section III focuses on the theoretical model. In section IV, I

\(^3\) Fiscal multiplier is usually defined as the ratio of a change in output (Gross Domestic Product) to an exogenous change in the fiscal (public) spending with respect to their respective baselines. Gross Domestic Product is the total value of newly produced goods and services in a particular period, usually measured annually and quarterly.
present the data and descriptive statistics. Section V explains empirical strategy and findings. Section VI summarizes and concludes the paper, give policy recommendations and suggests possible further studies.
II) Background and Literature Review:

A) Background:

Despite some variations in approaches to today’s macroeconomics world, two main intellectual traditions still dominate the discussion: the Classical tradition\textsuperscript{4} and the Keynesian tradition\textsuperscript{5}. Broadly speaking, the first school tends to believe that markets work best if left to themselves; the other tends to believe that government intervention can significantly improve the operation of an economy (Dornbusch and Fischer, 1994). In the 1970s and 1980s, the neo classical school replaced monetarists, led by Milton Friedman, who had been opposed to Keynesians in 1960s, in keeping up the argument against active government involvement. On the opposite side, third generation Keynesians have continued the disagreement with neoclassic ideas, and although they might not have shared detailed beliefs on all of the Keynesian arguments, they maintained the belief that government policy could help economic performance (Dornbusch and Fischer, 1994).

The neo classical school\textsuperscript{6} shares three basic assumptions: i) Economic agents, households and firms, maximize their economic interests by making optimal decisions; ii) Expectations are rational (i.e., people eventually understand the nature of government policy and meet appropriately in anticipation of these policies); and, iii) Markets clear (i.e., prices and wages adjust in order to equate supply and demand) (Dornbusch and Fischer, 1994). As a consequence there is no possibility for involuntary unemployment in medium and long run. However,

\textsuperscript{4} Some classical economists: Adam Smith(1723-1790), David Ricardo(1772-1823), John Stuart Mill(1806-1873).
\textsuperscript{6} Robet Lucas, Thomas Sargent, Robert Borro, Edward Prescott and many others. (Dornbusch and Fischer, 1994).
according to the neo Keynesians\(^7\), markets sometimes do not clear, even when individuals are looking out for their own interests. Both information problems and the cost of changing prices lead to some price and wage rigidities, particularly downwards, which cause macroeconomic fluctuations in output and employment (Dornbusch and Fischer, 1994). That is why neo-Keynesians are still in favor of active government policies. Today’s macroeconomists and policy makers are usually close to one of these two main camps, although they agree on some macroeconomic basics and borrow some theoretical ideas from one another.

A government has two main policy tools to intervene in the economy. The first is monetary policy, usually administered by a central bank, which is independent in the U.S. Generally, central banks can conduct monetary policy through monetary targeting (i.e., setting a money supply target and allowing interest rates to adjust), or interest rate targeting (i.e., changing the money supply to achieve a certain interest rate) (Michl 2002). Since the onset of the global financial crisis, the FED has initiated a series of large-scale asset purchases to increase liquidity in the system and used its balance sheet as a tool in an attempt to achieve its mandated objectives of full employment and price stability (Bernanke 2012). In December 2008, the FED reduced the federal funds rate target to a range of 0 to 25 basis points, effectively its lower bound (Bernanke 2012). That target range remains in place today (Bernanke 2012).

The second major economic policy tool is fiscal policy – i.e., tax and spending policy. Governments implement fiscal policies in theory to limit volatility in the economy in times of recession or expansion. For example, in addition to FED’s expansionary monetary policies in 2009, the U.S government initiated the fiscal stimulus package in 2009. It reduced taxes,\(^7\) Ben Bernanke, George Akerlof, David Romer, Olivier Blanchard, Greg Mankiw and many others. (Dornbusch and Fischer, 1994).
increased infrastructure spending, raised transfer payments and provided additional funds for state governments to help them continue their public spending on programs like Medicaid and education.

In the following sections, I discuss a framework for assessing the effectiveness of fiscal and monetary policies using the Investment-Saving and Liquidity Preference-Money Supply (IS-LM) model.

a) IS-LM model:

The IS-LM model, an elaboration of the Keynesian model first introduced by Hicks (1937), is very helpful in understanding the effects of monetary and fiscal policies (Michl 2002). The IS curve shows combinations of interest rates and levels of income such that goods markets are in equilibrium, which means that savings are equal to investments. Increases in the interest rate reduce aggregate demand by reducing investment spending and are associated with a lower output levels (Dornbusch and Fischer, 1994). That is to say, people (economic agents) tend to invest less when interest rates increase because businesses need financial capital to invest and rising interest rates make this capital more expensive. Thus the IS curve is downward sloping. The LM curve (real money balances) represents money market equilibrium, which means money supply equals to money demand. A higher level of GDP means more transactions, and hence higher demand for money, while other things are equal. Therefore, higher GDP means that the interest rate needed to match supply and demand for money must rise (Krugman 2011). In Figure 1, the x-axis represents the output (Y) [or gross domestic product (GDP)] and the y-axis denotes the interest rate (i). At the intersection of these curves, money markets and goods markets are in equilibrium.
One of the main arguments against expansionary fiscal policies is the crowding out effect. When an increase in government spending causes investment spending to fall through raising interest rates, this is called “crowding out”. Whether we observe the crowding out depends on the shape and elasticity of the IS-LM curves. When we add prices to the picture, Keynesian and Classical differences become more visible. According to classical economists, the output level is determined by the production function and is independent of price changes. So increasing aggregate demand with fiscal or monetary policies can only have short-run effects on output levels. For example, in case of expansionary fiscal policies, when price changes take place, the LM curve shifts to the left and the economy reaches full employment with higher interest rates and lower investment stocks, because additional government spending crowds out an equal amount of private investment. Figure 2 depicts the full crowding out effect. $Y^*$ denotes the full-employment output level. First, government increases spending and since the new output level is above the full employment level, the over production heats up the economy and increases wages and prices. The higher price level reduces real money balances ($LM/P$ or just $LM$). Then,
the economy returns to the full employment level at a higher interest rate (i’’). In this figure BB refers a line where the initial output level is unchanged through decreasing private investments as a response to rising interest rates. On the other hand output would increase if the initial interest rate stayed constant through the FF line. The FF curve is drawn to represent constant interest rate level.

**Figure 2 : Crowding Out**

![Graph showing IS-LM model]

c) **Liquidity trap and accommodative monetary policy:**

The other extreme case occurs when the LM curve is horizontal, a situation in which the public holds whatever amount of money is supplied at a given interest rate. In this case, monetary policy is not effective and there is no crowding out effect, since an increase in government expenditure shifts the IS curve out but does not change interest rate levels. This special case is called the liquidity trap. Some economists argue that during the financial crisis, the U.S. has been in a liquidity trap, so the crowding out effect is irrelevant (Krugman 2011). Alternatively, the money authority may accommodate an expansionary fiscal policy by increasing the money supply and shifting the LM curve out to keep the interest rate intact.
Figures 3 and 4 depict fiscal policy in a liquidity trap and accommodative monetary policy respectively. In other words, the monetary policy supports and enhances the expansionary effect of the fiscal policy by supplying more money to maintain initial interest levels. Figure 4 states that, the output level can reach and stay at the Y’’ level, if Y’’ is under the full employment level. Otherwise, price changes in the medium and long run reverse output growth.

**Figure 3: Liquidity Trap**

**Figure 4: Accommodative Monetary Policy**

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d) Open economy:

Adding exports and imports to the IS-LM model makes it more complicated but does not change the basic idea. Exports become a part of aggregate demand as an injection to the economy and imports reduce aggregate demand as a leakage. The effect of fiscal policy depends on the exchange rate regime. Since the U.S. has a flexible exchange rate regime and free capital movement, I will explain only this case. I employ the “Mundell-Fleming Model” to examine the effect of fiscal expansion. At the initial point the economy is in equilibrium, where the domestic interest rate equals the foreign interest rate. An expansionary fiscal policy shifts the IS curve to the right. If the monetary policy does not accommodate fiscal policy, the domestic interest rate rises, which leads an inflow of foreign capital and this appreciates the exchange rate. The
appreciated exchange rate reduces exports along the LM curve and the economy returns to its initial output level. However, if monetary policy accommodates fiscal policy, the LM curve moves out and a new equilibrium occurs at $Y'$. Figure 5 depicts the accommodative monetary policy in an open economy. The BB curve is drawn to represent a constant world interest rate, $i^*$.

**Figure 5: Accommodative monetary policy in an open economy**

In the U.S. case, since the FED’s expansionary monetary policy kept the domestic interest rate low, in light of Mundel-Fleming model, I deduce that this policy also curbed upward pressures on dollar and increased the effectiveness of fiscal policy.

**B) Methods to Measure a Fiscal Policy’s Effectiveness:**

As I have noted, large-scale government stimulus packages all over the world during the global financial crisis renewed the long-standing debate about the effectiveness of fiscal stimulus policies. Researchers attempted to assess the issue from different points of view. Their results varied widely in accordance with their different analytic techniques. In general, two broad methodologies were employed. The first uses a microeconomic approach, studying the effects of fiscal policy on individual consumption; the second uses a macroeconomic approach, focusing
on the overall output response (Schirokauer, 2011). My study follows the second method and looks at the overall effect.

To measure a fiscal policy’s effect on overall economic growth, most researchers have focused on the size of the fiscal multiplier. Spilimbergo, et al. (2009) defined the fiscal multiplier as “the ratio of a change in output (ΔY) to an exogenous change in the fiscal deficit (ΔG is used here as a shortcut, it could be also -ΔT referring tax cut) with respect to their respective baselines.” Recipients of additional government expenditure, households or firms, spend this new source of income for their needs, and then their additional spending also creates new revenue sources for other household or firms in an economic circular flow and so on. Hence, the total effect gets larger when households or firms spend the larger part of additional income created by expansionary fiscal policy. Eventually, for fiscal stimulus to “pay off” as a policy, the multiplier would have to be greater than one. One point of discussion here is the definition of the exogenous change in government spending. A structural deficit figure, the deficit amount if the economy maintains the full employment level, often is used as an exogenous change in the fiscal deficit, but authors use variations of this concept.

Fiscal multipliers also vary based on the time frame (t), usually quarters or years) considered. The impact multiplier measures the effect of ΔG on the output in the same time period. The peak multiplier is defined as the largest change in output at some horizon, N. (N represents the subsequent time frames used in analysis). The cumulative multiplier is the cumulative change in output over the cumulative change in fiscal expenditure at some horizon, N (Spilimbergo, et al., 2009). In my study, the fiscal multiplier term means the impact or peak multiplier, unless otherwise stated.

According to Spilimbergo, et al.(2009), there are four broad methodologies to calculate
fiscal multipliers:

“i) Model simulations. Models with an underlying IS-LM structure and little or no forward-looking behavior result in positive multipliers by construction. An increase in the deficit leads to an increase in demand, which leads to an increase in output. The multipliers are small or negative only if fiscal sustainability is in question, economic agents are forward looking, or monetary policy is not accommodative.

“ii) Case studies. The crucial point is identifying good ‘experiments’, i.e., episodes of truly exogenous fiscal expansion. A good example is the Romer and Romer (2008) study on tax policy changes. An important drawback of case studies is that the results are specific to the type of fiscal measure studied, the prevailing macroeconomic conditions at the time of implementation, etc.

“iii) Vector auto-regressions (VARs). The crucial point is again to correctly identify exogenous movement in public expenditure or taxes. As case studies, VARs give the response of the economy, taking implicitly into account the monetary policy response, and thus the effects on the interest rates (whether or not interest rates are included in the VAR).

“iv) Econometric studies of consumer behavior in response to fiscal shocks. When these focus on the response of individual consumption to the change in income, they give only the direct, partial equilibrium, effect of the fiscal measure on spending.”

There are many papers on the effectiveness of fiscal stimulus plans. Below I review some of these, which present a variety of results. The varying estimates are attributable to differences in methodology and underlying conditions, as well as data availability and the likelihood of an

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8 A comprehensive table of fiscal multipliers with their methodologies can be found at Spilimbergo, et al. p.3 (2009).
endogeneity problem. Besides, there is considerable disagreement among economists about the assumptions underlying macroeconomic forecasting models. If a model’s assumptions are flawed, then the multipliers it produces will be wrong. The magnitude of multiplier also depends on the tool being used. For instance, households may save some part of additional transfer revenues coming from new fiscal expansionary policy scheme, depending on their economic situations, so the multiplier for transfer expenditures is smaller than for other government expenditure multipliers at least in theory. As I stated above, when household or firms spend the larger part of any additional government expenditure they get, the total expansionary effect will be larger. Likewise, it also matters who receives the stimulus. For example, if tax cuts go to individuals with a lower marginal propensity to consume, this also reduces the magnitude of multiplier, while in general a decrease in income tax rates increases the magnitude of the multiplier. Hence, many studies, like mine, have placed a greater importance on the sign and statistical significance of the estimated coefficients to decide on fiscal policy effectiveness, particularly when these polices contain combinations of different fiscal policy tools such as tax cuts, transfer payments and government infrastructure expenditures.

**C) General Studies:**

Authors who have studied the effects of fiscal policies have taken many factors into consideration including country development level, exchange rate regime, public debt, budget deficit ratios and the degree of openness to trade.

For instance, Ilzetzki et al. (2009) studied 20 high-income and 25 developing/emerging countries and concluded that “For high-income countries, even after the full impact of a fiscal expansion was accounted for, output has essentially risen in the long-run by the same amount as government consumption. For developing countries, on the other hand, an additional dollar of
government consumption crowded out some other component of GDP by 21 cents in the long-run.” The authors also found that the degree of exchange rate flexibility was critical. Economies with predetermined exchange rate regimes had long-run fiscal multipliers of around 1.5, but economies with flexible exchange rate regimes had essentially zero multipliers. Finally, while relatively closed economies had long-run multipliers of around 1.6, relatively open ones had very small or zero multipliers.

Nonetheless, expansionary fiscal policies could result in different outcomes in times of massive public debt because of their negative effects on fiscal sustainability and real interest rates. A regression study on a panel of European Union countries over the last 16 years (Vranceanu and Besancenot, 2012) demonstrated that a 10 percentage point increase in the debt to GDP ratio is associated with a slowdown in annual growth rates of 0.28 percentage points and that the fiscal multiplier is adversely affected by the amount of public debt. Their result was similar to that of Reinhart and Rogoff (2010, 2012), which found a negative effect of high public debt levels and periods on economic growth.

Results also vary based on analytical approach. Employing a neoclassical growth model with U.S. data, Strulik and Trimborn (2009) concluded that a temporary increase in government spending was not only ineffective but also detrimental. They argued that even before the spending program expires, aggregate output is lower than it would have been without fiscal stimulus, particularly in the medium and long run. The underlying reason for this result, they argue, is the negative effect of fiscal policy on the private capital stock. Yet they also argue that an accompanying temporary cut of capital income tax helps to prevent the negative influence of deficit spending on economic activity. In a later study (2011), they repeat their assertion that the
output multiplier turns negative before a deficit spending program expires, at which point capital stock and output are always below their laissez-faire levels of recovery.

Similarly, Perotti (1999) argued that in periods of large public deficits and rising public debt, increased government spending could reduce consumption by triggering fears of future fiscal crises or tax increases. The nineteenth century English economist David Ricardo also argued that when individuals see an increase in government spending financed by borrowing, they realize that this will require higher taxes in the future, and they take this into account in their consumption and saving decisions. Ricardo suggested that households will cut current consumption when they recognize expansionary fiscal policies since they know that additional government outlays must be financed eventually by higher taxes; hence their after tax-income will be reduced in the long run (Motley, 1987).

An alternative theory comes from the Keynesian side: Keynesians claim that households are shortsighted or they do not care about the tax burden on future generations and, therefore, expansionary fiscal policies can increase aggregate demand (Motley, 1987).

D) U.S. Based Studies:

Measuring the effect of fiscal policy on output growth is subject to many limitations, mostly arising from the impossibility of eliminating the endogeneity problem completely. However, most modeling studies usually use the so-called narrative approach to identify and quantify countercyclical discretionary policies. The narrative approach depends on presidential reports, legislation and executive-branch documents to specify the amount of discretionary fiscal policy (Schirokauer, 2011). Then it uses macroeconomic models (equations) to estimate the

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9 The correlation between the independent variable and the error term leads an endogeneity problem. There are three main sources of endogeneity, reverse causality between dependent and independent variables, measurement error and omitted variables in a model. In my study, I think that the reverse causality between the fiscal stimulus and the economic crisis is a basic source of endogeneity problem.
effect of fiscal policies. Because this approach depends on exogenous changes and equations to estimate the fiscal multiplier, the model should yield results without omitted variable bias, at least in theory (Schirokauer, 2011). The Council of Economic Advisers (CEA) in its eighth report on ARRA, took a modeling approach and estimated that the Recovery Act raised the level of real GDP in 2010 and the second quarter of 2011, relative to what it otherwise would have been, by 2.3 and 2 percent respectively.10

The Congressional Budget Office (CBO) studied the effect of ARRA using evidence from models and historical relationships to estimate output multipliers for each of several categories of ARRA spending and tax provisions. Table 1 indicates the magnitude of these output multipliers for different ARRA categories. In addition, according to the latest CBO report, in 2009, 2010 and 2011, the stimulus package increased real GDP by between 0.4 and 1.8, 0.7 and 4.1 and 0.4 and 2.3 percent, respectively.11

Table 1: CBO estimates of ARRA multipliers by category

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Estimated Output Multipliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Estimate</td>
</tr>
<tr>
<td>Purchases of Goods and Services by the Federal Government</td>
<td>0.5</td>
</tr>
<tr>
<td>Transfer Payments to State and Local Governments for</td>
<td>0.4</td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
</tr>
<tr>
<td>Transfer Payments to State and Local Governments for Other</td>
<td>0.4</td>
</tr>
<tr>
<td>Purposes</td>
<td></td>
</tr>
<tr>
<td>Transfer Payments to Individuals</td>
<td>0.4</td>
</tr>
<tr>
<td>One-Time Payments to Retirees</td>
<td>0.2</td>
</tr>
<tr>
<td>Two-Year Tax Cuts for Lower and Middle-Income People</td>
<td>0.3</td>
</tr>
<tr>
<td>One-Year Tax Cut for Higher-Income People</td>
<td>0.1</td>
</tr>
<tr>
<td>Extension of First-Time Homebuyer Credit</td>
<td>0.2</td>
</tr>
<tr>
<td>Corporate Tax Provisions Primarily Affecting Cash Flow</td>
<td>0</td>
</tr>
</tbody>
</table>


10 Quarterly results can be found in that report starting from the second quarter of 2009.
11 Additional CBO estimates for the impacts of ARRA on unemployment rate, employment years and full time equivalent employment can be found in CBO’s last report on ARRA. http://www.cbo.gov/publication/43552.
One of the key issues in current research and policy is the size of fiscal multipliers when an economy is in recession. Auerbach and Gorodnichenko (2011) claimed that given the historical experience of the U.S. economy, their preferred estimates of the government spending multiplier was between 0 and 0.5 in expansions and between 1.0 and 1.5 in recessions. The authors also studied different kinds government expenditure and found that military spending had the largest multiplier.

In contrast, Strulik and Trimborn (2011), using a classical style model, characterized the positive effect of ARRA as only a flash in the pan, before the spending program expired; at which point they argued, aggregate output was lower than it would have been without fiscal stimulus. Their arguments depend on the assumption that economic agents know that a temporary spending program has no lasting effect on employment, but it does have a lasting effect on disposable income.

Lastly, a study by Daniel J. Wilson (2011) merits special attention since, as I do in my study, he uses state level data to estimate the jobs multiplier of ARRA. Because the level and timing of stimulus funds that a state received were potentially endogenous, Wilson exploited the fact that most of these funds were allocated according to exogenous formulary allocation criteria, such as the number of federal highway miles in a state or the youth share of its population. He concluded that ARRA spending in its first year yielded about eight jobs per million dollars spent, or $125,000 per job.

E) The U.S. Case and the Advantages of My Study:

As stated above, in response to the recent recession, the FED lowered interest rates and is determined to keep them low until the economy returns to its pre-crisis state. Whether you believe that the economy is in a liquidity trap or that the shifts in the LM curve keep interest
rates low, the fact is that interest rates in the U.S. are historically low, so that it is hard to talk about any crowding out effects. Besides, inflation (measured by the consumer price index) is still low: -0.4, 1.6 and 3.2 percent in 2009, 2010 and 2011 respectively. GDP fell by -0.3 and -3.1 percent in 2008 and 2009 respectively. Unemployment rose to 9.6 percent in 2010 from 4.6 percent in 2007 and it was 8.9 in 2011. Also, accommodative monetary policy kept U.S. interest rates low relative to interest rates abroad, so there was no upward pressure on the dollar, which helped the U.S. stay competitive internationally.

According to the Keynesian literature, fiscal policies are relatively more effective when there is a lack of aggregate demand and monetary policies are inadequate to induce economic growth. The indicators of U.S. economic performance between 2008 and 2011 show that the U.S. experienced a severe recession and that the output level was below its full employment level. In the light of Keynesian arguments, the U.S. economic conditions between 2008 and 2010 created a very strong incentive to employ fiscal expansionary policies. In addition, considering all these factors, if the Keynesians are correct, the effect of the recent fiscal stimulus plan should have been very strong. Therefore, it is important to conduct an empirical analysis of whether the fiscal stimulus package had a statistically significant effect on output growth in a very favorable macroeconomic environment for Keynesian policies. Failure to find a statistically significant effect would cast doubts on ARRA’s effectiveness and the efficiency of expansionary fiscal policies in general.

As I have noted, many recent studies have attempted to evaluate the effectiveness of fiscal stimulus packages using cross-country panel data. However, those authors analyzed the effects of fiscal stimulus packages across countries with different institutional structures, exchange rate regimes, monetary policy responses and financial sustainability conditions. These
factors affect an economy’s response to a stimulus package. For instance, in a country that has a high debt ratio, increasing government spending may not only decrease investments through a crowding out effect but also may increase fiscal sustainability risks. Economic agents’ expectations about economy’s future may deteriorate and this may result in a decline in consumer spending and investment.

In my study, however, I do not have to account for these cross-country issues. Although the states have differences in some policy areas such as tax, education and health, they almost all have the same institutional structure. The ratio of openness to trade varies among states, but there is only one exchange rate regime and the FED’s monetary policies affect the whole country, so even commercial interest rates are almost the same in all states. Thus, my cross-state approach can be more effective than studies using a cross-country approach in detecting the pure effect of fiscal policies on output growth.

I now turn to the theoretical framework explaining the causal relationship between government stimulus expenditure and economic growth.
III) Theoretical Framework

According to the simple Keynesian open economic model, gross domestic product (total output or income or GDP) in an economy can be calculated by adding up all expenditures on goods and services. This is called the expenditure approach. The expenditure approach involves counting expenditures on goods and services by different groups in the economy (Dornbusch and Fischer, 1994). The four main components are consumption expenditures by households (C), private investment spending, principally by firms (I), government purchases of goods and services (G) and net exports (exports minus imports or X - M) (Dornbusch and Fischer, 1994). Here is an equation that sums it up:

\[ \text{GDP} = C + I + G + (X - M) \]  

(1)

Each of these GDP items is defined as a function of income or autonomous factors (independent from income level) to simplify the model (Dornbusch and Fischer, 1994):

- **Y**= Income, or output level (GDP).
- **C**=Household consumption= \( C_0 + cY_d \), where \( C_0 \)=Autonomous Consumption and \( c \)=marginal propensity to consume.
- **Yd**=Disposable Income =\( Y - tY \), where \( t \)=The marginal income tax rate; it is assumed that there is only income tax in the economy.
- **I**=Investment. Normally, investment consists of three parts; autonomous investment, income sensitive investment; and interest sensitive investment. In order to simplify the model, I assume that the interest rate is constant and investment is not sensitive to income level.
- **G**=Government expenditure. It is considered as autonomous; in other words, it is not a function of income.
• NX=Net export=X-M, where
  \[ (4) \]
  X: Exports considered as autonomous;
  M: Imports considered as a function of income, and
  \[ (5) \]
  \[ \text{M= mY, where} \]
  \[ m: \text{marginal propensity to import} \]

Then, the model can be rewritten as:
\[ Y= C_0 + c(Y-tY) + I + G + X - mY \]  \[ (6) \]

One can derive the open economy autonomous expenditure multiplier from the equation above as:
\[ \alpha=[1/(1-c)(1-t) + m].^{12} \]  \[ (7) \]

\( \alpha \), or the autonomous spending multiplier is called the fiscal multiplier when one wants to measure the effect of a change in government expenditure on income (GDP).

The model indicates that there is a causal relationship between an increase in government expenditure and GDP growth. The higher the marginal propensity to consume the larger the multiplier. And the multiplier is negatively associated with the income tax rate and the marginal propensity to import. In accordance with this formula, Spilimbergo et al. (2009) summarized that the success of a stimulus package depends on three main factors:

1) Leakage should be minimal. Only a small part of the stimulus is saved or spent on imports.
2) The interest rate should not increase as a consequence of fiscal expansion. Otherwise, an increasing interest rate will crowd out some part of private investment and reduce the effectiveness of fiscal policy.

\[^{12}\text{The detailed explanation on the derivation of the fiscal multiplier can be found in Dornbusch and Fischer (1994), chapters 3,4 and 6.}\]
3) The country’s fiscal position after the stimulus must be sustainable. If this condition fails even in the short run, the fiscal policy could be contractionary.

In the next section, I explain my data sources and present the descriptive statistics of my data.
IV) Data and Descriptive Statistics

Data in my study come from four different sources: The Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), the United States Census Bureau (USCB) and the Recovery Accountability and Transparency Board (RATB). The data cover the three years from 2009 to 2011.

Data on state constant and current dollar GDP values, growth rates and industry shares of GDP come from the BEA. Data on state budget deficits, state foreign trade and population come from the USCB. Data on unemployment by state come from the BLS. Finally, American Recovery and Reinvestment Act (ARRA) data come from the RATB and the BEA. I consolidated these data at the state level to create a panel data set.

The panel data set consists of 3 years (2009-2011) and 50 states and the District of Columbia (DC). However, no state finance data are available for DC in the USCB database. There are also twelve missing observations in the industry shares because there are no agriculture and mining sector data available for DC in relevant years and for Delaware and Rhode Island in 2011. For these reasons the number of observations for some variables is less than 153.

RATB divided ARRA spending into three categories:

• Tax benefits,
• Contracts, Grants and Loans (CGL) and
• Entitlements.

The Figure 6 gives the total amount of funds paid out for each category as of February 8, 2013.
As of February 8, 2013, the sum of three categories is $784 billion. Since my study covers the years from 2009 to 2011 and 50 states plus DC but not the U.S. territories, the total ARRA spending covered by my study is $677 billion, 86% of total ARRA expenditures as of February 8, 2013. The Table 2 gives the break down of ARRA spending by main subcategories as of February 8, 2013.
Table 2: ARRA spending by subcategories through 02.08.2013\(^\text{13}\)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Funds Paid Out (Billion $)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tax Benefits</strong></td>
<td></td>
</tr>
<tr>
<td>Individual Tax Credits</td>
<td>$131.80</td>
</tr>
<tr>
<td>Making Work Pay</td>
<td>$104.40</td>
</tr>
<tr>
<td>Tax Incentives For Businesses</td>
<td>$32.60</td>
</tr>
<tr>
<td>Energy Incentives</td>
<td>$10.90</td>
</tr>
<tr>
<td>COBRA</td>
<td>$3.70</td>
</tr>
<tr>
<td>Manufacturing &amp; Economic Recovery,</td>
<td></td>
</tr>
<tr>
<td>Infrastructure Refinancing, Other</td>
<td>$7.30</td>
</tr>
<tr>
<td><strong>Total Tax Benefits</strong></td>
<td><strong>$290.70</strong></td>
</tr>
<tr>
<td><strong>Contracts Grants and Loans</strong></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>$91.85</td>
</tr>
<tr>
<td>Transportation</td>
<td>$37.11</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>$31.29</td>
</tr>
<tr>
<td>Energy / Environment</td>
<td>$28.67</td>
</tr>
<tr>
<td>Research &amp; Development / Science</td>
<td>$14.63</td>
</tr>
<tr>
<td>Housing</td>
<td>$13.88</td>
</tr>
<tr>
<td>Health</td>
<td>$11.57</td>
</tr>
<tr>
<td>Other Programs</td>
<td>$5.83</td>
</tr>
<tr>
<td>Public Safety</td>
<td>$5.40</td>
</tr>
<tr>
<td>Family</td>
<td>$4.98</td>
</tr>
<tr>
<td>Job Training / Unemployment</td>
<td>$4.73</td>
</tr>
<tr>
<td><strong>Total Funds Paid Out</strong></td>
<td><strong>$249.92</strong></td>
</tr>
<tr>
<td><strong>Total Entitlements</strong></td>
<td></td>
</tr>
<tr>
<td>Medicaid/Medicare</td>
<td>$98.10</td>
</tr>
<tr>
<td>Unemployment Insurance Programs</td>
<td>$61.16</td>
</tr>
<tr>
<td>Family Services</td>
<td>$45.68</td>
</tr>
<tr>
<td>Energy</td>
<td>$18.34</td>
</tr>
<tr>
<td>Economic Recovery Payments</td>
<td>$13.81</td>
</tr>
<tr>
<td>Housing</td>
<td>$5.65</td>
</tr>
<tr>
<td>Agriculture</td>
<td>$0.95</td>
</tr>
<tr>
<td><strong>Total Funds Paid Out</strong></td>
<td><strong>$243.69</strong></td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td><strong>$784.30</strong></td>
</tr>
</tbody>
</table>

Source: RATB

\(\text{13}\) For the more detailed breakdown and specific program names, please refer to http://www.recovery.gov/Transparency/fundingoverview/Pages/fundingbreakdown.aspx#TaxBenefits.
Contracts, Grants and Loans by state and year are available online at the RATB web site but tax benefits and entitlements by state and year are not. To find out entitlements by state and year, I used the “Agency Data Map” tabulation at the RATB web site. The total “funds paid out” figure in this table is equal to the sum of “entitlements” and “contracts, grants and loans” on the main RATB page. As this table gives the break down of the funds paid out by state, I subtracted contracts, grants and loans figures to calculate the entitlements by each state. Then, I allocated these numbers to the years using the “grants-in-aid to state and local governments” figure, produced by BEA, which is the closest number to the entitlements by year that I could find. As for tax benefits, I calculated state-level data myself using population shares of each state. Then I summed the three categories of data as total ARRA spending by state and year. Table 3 indicates the summary descriptive statistics of the main variables in my study.

Table 3: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Number of Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Nominal</td>
<td>Millions USD</td>
<td>153</td>
<td>282,564</td>
<td>338,566</td>
<td>24,247</td>
<td>1,958,904</td>
</tr>
<tr>
<td>Real GDP</td>
<td>Constant USD 2005</td>
<td>153</td>
<td>251,969</td>
<td>304,153</td>
<td>21,963</td>
<td>1,735,360</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>Percent</td>
<td>153</td>
<td>0.48</td>
<td>3.35</td>
<td>-8.98</td>
<td>9.37</td>
</tr>
<tr>
<td>State Budget Deficit</td>
<td>Millions USD</td>
<td>100</td>
<td>2,296.61</td>
<td>16,480.85</td>
<td>-54,021</td>
<td>140,475</td>
</tr>
<tr>
<td>Budget Deficit Ratio %GDP</td>
<td>Percent of GDP</td>
<td>100</td>
<td>1.92</td>
<td>3.24</td>
<td>-4.62</td>
<td>11.51</td>
</tr>
<tr>
<td>ARRA Total</td>
<td>Millions USD</td>
<td>153</td>
<td>197,641</td>
<td>276,265</td>
<td>5,834</td>
<td>2,040,075</td>
</tr>
<tr>
<td>ARRA Tax Benefits</td>
<td>Millions USD</td>
<td>153</td>
<td>195,098</td>
<td>273,970</td>
<td>5,580</td>
<td>2,026,664</td>
</tr>
<tr>
<td>ARRA Entitlements</td>
<td>Millions USD</td>
<td>153</td>
<td>1,178.90</td>
<td>1,708.55</td>
<td>-287</td>
<td>10,429</td>
</tr>
<tr>
<td>ARRA Contracts, Grants and Loans</td>
<td>Millions USD</td>
<td>153</td>
<td>1,295.16</td>
<td>1,340.15</td>
<td>121</td>
<td>7,602</td>
</tr>
<tr>
<td>Per Capita ARRA Received</td>
<td>USD</td>
<td>153</td>
<td>801.56</td>
<td>387.31</td>
<td>303</td>
<td>4,095</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>Percent</td>
<td>153</td>
<td>8.47</td>
<td>2.00</td>
<td>3.5</td>
<td>13.7</td>
</tr>
<tr>
<td>Export</td>
<td>Millions USD</td>
<td>153</td>
<td>23,613</td>
<td>35,823.19</td>
<td>562</td>
<td>249,860</td>
</tr>
<tr>
<td>Import</td>
<td>Millions USD</td>
<td>153</td>
<td>36,203</td>
<td>60,020.75</td>
<td>443</td>
<td>351,359</td>
</tr>
<tr>
<td>Openness Ratio</td>
<td>Percent</td>
<td>153</td>
<td>17.99</td>
<td>9.26</td>
<td>1.3928</td>
<td>55,5799</td>
</tr>
</tbody>
</table>

14 http://www.recovery.gov/FAQ/Pages/DownloadCenter.aspx
Table 3 Descriptive Statistics, (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Number of Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Person</td>
<td>153</td>
<td>6,064,893</td>
<td>6,797,699</td>
<td>544,270</td>
<td>37,700,000</td>
</tr>
<tr>
<td>Population Share</td>
<td>Percent in total</td>
<td>153</td>
<td>1.96</td>
<td>2.20</td>
<td>0.18</td>
<td>12.10</td>
</tr>
<tr>
<td>Agriculture Ratio</td>
<td>Percent of GDP</td>
<td>148</td>
<td>1.74</td>
<td>2.14</td>
<td>0.13</td>
<td>10.89</td>
</tr>
<tr>
<td>Mining Ratio</td>
<td>Percent of GDP</td>
<td>148</td>
<td>2.74</td>
<td>5.57</td>
<td>0.01</td>
<td>29.36</td>
</tr>
<tr>
<td>Manufacture Ratio</td>
<td>Percent of GDP</td>
<td>153</td>
<td>11.48</td>
<td>5.44</td>
<td>0.22</td>
<td>28.76</td>
</tr>
<tr>
<td>Finance and Insurance Ratio</td>
<td>Percent of GDP</td>
<td>153</td>
<td>8.24</td>
<td>5.46</td>
<td>2.46</td>
<td>38.91</td>
</tr>
<tr>
<td>Government Ratio</td>
<td>Percent of GDP</td>
<td>153</td>
<td>14.31</td>
<td>4.39</td>
<td>9.12</td>
<td>35.47</td>
</tr>
</tbody>
</table>

State Budget Deficit= Total State Expenditure – Total State Revenue  \[ (8) \]

Budget Deficit Ratio= (State Budget Deficit *100)/Nominal State GDP \[ (9) \]

Openness Ratio= [(Export+Import)*100]/ Nominal State GDP \[ (10) \]

Industry Ratios= (Nominal Industry Value in GDP * 100)/ Nominal GDP \[ (11) \]

In the following section, I introduce my empirical models and present my regression results.
V) Empirical Models and Results

The theoretical model that I explained in the Section III assumes that there is a causal relationship between an increase in government expenditure and GDP growth. I prepare a quantitative model in which GDP growth by state is the main dependent variable and fiscal stimulus expenditure by state is the main independent variable. I plan to use two alternative variables to proxy state level fiscal stimulus. The first of these is ARRA spending by state. The second is the increase in state budget deficit. My study tests whether there is any statistically significant relationship between increases in government spending and GDP growth by states in three econometric models. For each equation, I report the results of Ordinary Least Squares (OLS) and state fixed effects regressions. (I use the robust command for each regression to account for any heteroskedasticity)

A) First Regression

\[ \text{gdpgr}_i = B_0 + B_1(\text{arratotgdp})_i + B_2(\text{unemploymentrate})_i + B_3(\text{expchnggdp})_i + B_4(\text{pcincome3})_i + u_i \]  

(12)

By this regression I want to measure the total effect of ARRA on state-level GDP. The variables in the regression are:

- \( \text{gdpgr} \) is GDP growth rate;
- \( \text{arratotgdp} \) is the ratio of total ARRA expenditure by state and year to the same state’s GDP;
- \( \text{unemployment rate} \) in the relevant year is used to control for the effect of economic crises;
- \( \text{expchnggdp} \) is the ratio of annual increase in state exports to state GDP; it is also used to control for global economic crises and recovery effects;
- \( \text{pcincome3} \) is the state per capita income in thousand dollars. I use it to control for the income level differences across states; and
- \( u_i \) is the error term.
Table 4: Fixed effects and OLS regressions results for the First Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed Effects</th>
<th>t stat</th>
<th>OLS</th>
<th>t stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>arratotgdp</td>
<td>1.302**</td>
<td>2.84</td>
<td>0.851**</td>
<td>3.24</td>
</tr>
<tr>
<td>expchngdgp</td>
<td>1.282***</td>
<td>7.01</td>
<td>1.313***</td>
<td>8.31</td>
</tr>
<tr>
<td>unemploymentrate</td>
<td>-0.710</td>
<td>-0.97</td>
<td>-0.372**</td>
<td>-3.56</td>
</tr>
<tr>
<td>pcincome3</td>
<td>0.173</td>
<td>0.90</td>
<td>0.034***</td>
<td>4.09</td>
</tr>
<tr>
<td>constant</td>
<td>-4.538</td>
<td>-0.37</td>
<td>0.106</td>
<td>0.11</td>
</tr>
<tr>
<td>N</td>
<td>153</td>
<td></td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>r2</td>
<td>0.579</td>
<td></td>
<td>0.527</td>
<td></td>
</tr>
<tr>
<td>F Stat</td>
<td>23.69***</td>
<td></td>
<td>23.25***</td>
<td></td>
</tr>
</tbody>
</table>

legend: *p<0.05; **p<0.01; ***p<0.001

In accordance with theory, the ratio of total state-level ARRA expenditure to state-level GDP is positive and statistically significant at the 99 percent confidence level. 1 percentage point increase in that ratio is associated with 0.85 percentage points increase in the GDP growth rate in OLS model. This effect increases to 1.3 percentage points when I control for state fixed effects factors.

The crisis effect control variable, unemployment rate, is negatively correlated with the GDP growth. A percentage point increase in unemployment rate is associated with -0.37 percentage points decrease in the GDP growth at the 99 percent confidence level. Per capita income, on the other hand, has a small but statistically significant positive effect on the GDP growth. A thousand dollar increase in state per capita income is associated with 0.034 percentage points increase in the GDP growth at the 99 percent confidence level. However, the coefficients of unemployment rate and per capita income become insignificant when state fixed effects are taken into account. That is reasonable since each state has its own characteristics unobserved in my model affecting unemployment and per capita income levels.

In addition, the export change (increase in export as a percentage of GDP) has very
significant results in both models, which indicates that the global recovery positively affected the U.S. economic growth. A percentage point increase in the export change to GDP ratio is associated with 1.28 and 1.31 percentage points increases in GDP growth in the fixed effect and OLS models, respectively, at the 99 percent confidence level.

B) Second Regression

\[
gdpgr_i = B_0 + B_1(taxbengdp)_i + B_2(entitgdp)_i + B_3(cglgdp)_i + B_4(unemploymentrate)_i + B_5(expchnggdp)_i + B_6(pcincome3)_i + u_i
\]  

(13)

By this regression I want to measure the impact of different ARRA categories on GDP. In order to do this I introduce three new independent variables:

- taxbengdp is the ratio of ARRA tax benefits by state and year to the same year’s state-level GDP;
- entitgdp is the ratio of ARRA entitlements by state and year to the same year’s state-level GDP; and
- cglgdp is the ratio of ARRA contracts, grants and loans by state and year to the same year’s state-level GDP.

Table 5: Fixed Effects and OLS regressions results for the Second Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed Effects</th>
<th>t stat</th>
<th>OLS</th>
<th>t stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>taxbengdp</td>
<td>5.177***</td>
<td>6.54</td>
<td>1.987**</td>
<td>2.92</td>
</tr>
<tr>
<td>entitgdp</td>
<td>-7.766***</td>
<td>-3.98</td>
<td>-0.796</td>
<td>-0.46</td>
</tr>
<tr>
<td>cglgdp</td>
<td>-1.395</td>
<td>-0.76</td>
<td>-0.735</td>
<td>-0.92</td>
</tr>
<tr>
<td>expchnggdp</td>
<td>1.003***</td>
<td>5.04</td>
<td>1.295***</td>
<td>7.63</td>
</tr>
<tr>
<td>unemploymentrate</td>
<td>-0.470</td>
<td>-0.70</td>
<td>-0.384**</td>
<td>-3.55</td>
</tr>
<tr>
<td>pcincome3</td>
<td>0.298</td>
<td>1.52</td>
<td>0.037**</td>
<td>3.48</td>
</tr>
<tr>
<td>constant</td>
<td>-10.332</td>
<td>-0.82</td>
<td>0.76</td>
<td>0.73</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Fixed Effects</th>
<th></th>
<th>OLS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>153</td>
<td></td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>r2</td>
<td>0.635</td>
<td></td>
<td>0.540</td>
<td></td>
</tr>
<tr>
<td>F Stat</td>
<td>30.29***</td>
<td></td>
<td>19.29***</td>
<td></td>
</tr>
</tbody>
</table>

legend: * p<0.05; ** p<0.01, *** p<0.001
The ARRA tax benefit to GDP ratio is statistically significant at the 99 percent confidence level in both models. A 1 percentage point increase in that ratio is associated with a 1.99 percentage points increase in GDP growth rate in OLS model. This effect increases to 5.18 percentage points when the state fixed effects are controlled for. 5.18 is a huge magnitude for the tax benefit’s effect on economic growth. Although it is statistically highly significant, I think that the endogeneity problem, inherent in my study, and the way I allocated the tax benefits to the states may positively bias the magnitude. However it is clear that the individual effect of the tax benefit on economic growth is larger than the total ARRA effect in terms of both statistical significance and magnitude.

The ratio of ARRA entitlements by state and year to the same year’s GDP is insignificant in the OLS model, but it is significant in the state fixed effects model at the 99 percent confidence level. However, the sign of latter result is negative as opposed to what theory suggests. One of the reasons could be an endogeneity problem between the state-level GDP growth rate and the ARRA entitlements, because the ARRA entitlements mainly consist of federal relief to states in financial difficulty. Thus, the states most affected by the economic crisis receive more ARRA entitlement spending. It may be that the control variables and the fixed effect technique are only partly successful in controlling for the crisis effect.

The coefficient on the ratio of ARRA contracts, grants and loans by state and year to the same year’s state-level GDP is not statistically significant in both models.

As for exports, the annual export change is highly correlated with GDP growth rate in both models. Similar to the first regression, in the second regression, a percentage point increase in the export change to GDP ratio is associated with 1.00 and 1.30 percentage points increases in GDP growth in the fixed effect and OLS models, respectively. While the effect of a one
percentage point increase in export to GDP ratio decreased by 0.29 (to 1.003 in the second fixed
effect regression, from 1.296 in the first fixed effect regression) percentage points, the effect is
significant at the 99 percent confidence level in the fixed effects model.

C) Third Regression

gdpgr\_i = B_0 + B_1(budgetdefgdp)\_i + B_2(unemploymentrate)\_i + B_3(expchnggdp)\_i + B_4(pcincome3)\_i + \epsilon_i

(14)

By this regression I want to measure the effect of the state budget deficit on state-level
GDP growth and to do this I add a new variable:

- budgetdefgdp is the ratio of budget deficit to GDP.

**Table 6: Fixed effects and OLS regressions results for the Third Regression**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fixed Effects</th>
<th>t stat</th>
<th>OLS</th>
<th>t stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budgetdefgdp</td>
<td>-0.324*</td>
<td>-2.43</td>
<td>-0.209*</td>
<td>-2.32</td>
</tr>
<tr>
<td>Expchnggdp</td>
<td>1.228***</td>
<td>4.63</td>
<td>1.026***</td>
<td>4.60</td>
</tr>
<tr>
<td>Unemploymentrate</td>
<td>-0.042</td>
<td>-0.07</td>
<td>-0.250*</td>
<td>-2.38</td>
</tr>
<tr>
<td>pcincome3</td>
<td>-0.480</td>
<td>-1.60</td>
<td>0.050*</td>
<td>1.95</td>
</tr>
<tr>
<td>constant</td>
<td>22.583</td>
<td>1.27</td>
<td>-0.013</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Fixed Effects</th>
<th>t stat</th>
<th>OLS</th>
<th>t stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>150</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>r2</td>
<td>0.593</td>
<td>0.532</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Stat</td>
<td>27.91***</td>
<td>29.48***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*legend: * p<0.05; ** p<0.01; *** p<0.001

Normally an increase in the budget deficit is supposed to have an expansionary policy on
economy. However, I found that a one percentage point increase in the budget deficit to state-
level GDP ratio is associated with 0.3 and 0.2 percentage points decrease in GDP growth in the
fixed effect and OLS models, respectively, at the 95 percent confidence level. The usual suspect
in this kind of economic analysis, an endogeneity problem, could be an important reason behind
these results. Since states most affected by the economic crisis lost substantial amounts of revenue, their budgets went into deficit. Structural budget deficit figures would be helpful to eliminate the crisis effect, but most states are prohibited from running budget deficits by their constitutions or statutes, so they have limited room to run deficits to boost their economies.

According to a National Conference of State Legislatures (NCSL) Report in October 2010, 49 states must balance their budgets, with Vermont being the one exception. The same resource also reported that other authorities add Wyoming and North Dakota as exceptions, and that some authorities in Alaska contend that that state does not have an explicit requirement for a balanced budget. In addition, there are different interpretations of balanced budget requirements. For some state policymakers, the requirement of a balanced budget largely refers to the operating budget, and that excludes capital expenditures. Less attention is given to the question of whether a state’s entire budget is in balance (NCSL Report, 2010). In addition, bond finance for capital projects is generally not considered by policymakers to fall within any constraints of a balanced budget requirement (NCSL Report, 2010). Hence, under these conditions it is hard to estimate structural state budget deficits.

The coefficients on the export change to GDP ratio and unemployment rate are very close to the results that I got in the first two regressions. A percentage point increase in the export change to GDP ratio is associated with 1.23 and 1.03 percentage points increase in GDP growth in the fixed effect and OLS models, respectively, at the 99 percent confidence level.

Similarly, a percentage point increase in unemployment rate is associated with a 0.25 percentage points decrease in the GDP growth at the 95 percent confidence level in OLS model. This effect become statistically insignificant when the state fixed effects are taken into account.
A thousand dollar increase in per capita income is associated with a 0.05 percentage points increase in GDP growth at the 95 percent confidence level, similar to the first two regressions. The coefficient changes sign when the state fixed effects are considered, but, the effect becomes statistically insignificant.

I also ran additional regressions to determine whether there are any significant differences in states’ responses to the stimulus package according to their characteristics such as population, industries and ratio of openness to trade. However, none of these variables and related interaction terms with the ARRA spending items yielded statistically significant results, so I did not report them. (There was a significant result for openness to trade, but when I added the export change to GDP ratio it became insignificant.)

The following section is the final part of my study. In this section I summarize and conclude the paper, give policy recommendations and suggest possible further studies.
VI) Conclusions and Policy Recommendations

Fiscal stimulus packages are not cost-free instruments. Even if Keynesian theory works in the short run and packages increase output and decrease unemployment, sooner or later these packages must come to an end. And at the end, these measures will lead to higher public debt that someone has to pay. That is why their effectiveness is a critical policy question.

According to the Keynesian tradition, the economic conditions in the U.S. during the recent financial crisis were quite suitable for implementing fiscal stimulus policies. Therefore, I expected to find out that the ARRA fiscal stimulus package had a strongly positive and statistically significant effect on the U.S. economic growth. In relation to the total ARRA spending, I found statistically and economically significant results in both the fixed effect and the OLS models. A percentage point increase in the ratio of total ARRA spending to state-level GDP is associated with 0.85 percentage point increase in GDP growth rate in the OLS model, and this effect increases to 1.3 percentage points when I control for state fixed effects factors. These empirical results are encouraging for governments that wish to take action when they face with similar economic problems.

On the other hand, before running my regressions, I expected that the effects of contracts, grants and loans and entitlements on the GDP growth would be greater than the effects of tax benefits, since some portion of tax benefits are saved by individuals while the contracts, grants and loans and entitlements include more direct spending items. In accordance with Keynesian theory, this suggests that when a government wants to stimulate the economy, it should give more weight to direct spending instruments. However, the empirical results that I found contradict Keynesian theory. In my analysis, the contracts, grants and loans item has no significant effect on economic growth, while tax benefits have a strongly positive and
statistically significant effect in both the fixed effect and the OLS models. I also found that the ARRA entitlements were negatively associated with economic growth in the fixed effect model at a 99 percent level of confidence. I tried to control for endogeneity using control variables and the fixed effects model. However, this problem still could be an underlying reason behind my contrary results because the ARRA entitlements mainly consist of federal relief to states in financial difficulty. Thus, the states most affected by the economic crisis received more ARRA entitlement spending. Maybe the control variables and the fixed effect technique are only partially successful in controlling for the crisis effect.

Alternatively, one could also claim that since there could be many politically motivated decisions in the contract, grant and loans and the entitlements programs, they are less market oriented. However, every qualified citizen or businesses can benefit from tax reductions and, for this reason, the market mechanism works better and the allocation of resources becomes more efficient in the case of tax benefits. To me, that is why tax benefits result in more positive outcomes in terms of expansionary policies.

In addition, different items in tax benefits have different effects on economic choices of households and businesses. For instance, while individual tax credits, the largest item in the ARRA tax benefits, increased the overall spending in the economy through higher disposable income of households, making work pay, the second largest tax benefit, helped people to keep their jobs, and so they could sustain their income and spending. Individual tax cuts raised individuals’ incentives to work by increasing the opportunity cost of leisure so they have some positive behavioral aspects too. Other elements of tax credits stimulated economic growth through either improving businesses income figures and balance sheets or by incentivizing investments in specific sectors. The key factor in all of these is that the market plays a larger role
in tax benefits in comparison to entitlements or contracts, grants and loans. Given that, the empirical results in my study prove the superior effect of tax benefits over other expansionary policy measures, I think the well-designed combination of tax benefits should be the first instruments to be used in times of recession to stimulate the economy.

One problematic factor in these types of economic studies like mine is that we do not know what would happen if the current measures had not been taken. As I stated before, because the ARRA entitlements mainly consist of federal relief to states in financial difficulty, the states most affected by the economic crisis received more ARRA entitlement spending. This relationship probably led to the negative correlation between entitlement spending and economic growth. However, if the entitlement support were not given to the states, the economic downturn in these states could have been more dramatic. Even then, I believe that instead of politically motivated decisions or vague criteria of economic support, determining objective criteria for entitlements and contracts, grants and loans can give better expansionary outcomes. For instance, an independent commission of experts could decide how to allocate additional federal expenditures depending on economically specified criteria. Additionally, letting the market to play much bigger role in these policy tools would enhance their positive effect on the economic growth.

Normally an increase in the budget deficit is supposed to have an expansionary effect on the economy. However, I found that a one-percentage point increase in the budget deficit to state GDP ratio is negatively associated with the GDP growth. I think that this contradictory result is consequence of an endogeneity problem. Since most affected states by the economic crisis lost substantial amounts of revenue, their budgets went into deficit. Structural budget deficits would be helpful to eliminate the crisis effect, but most state constitutions or statutes prohibit running
budget deficits, so they have limited room to run deficits to boost their economies. In addition, the different understandings and rules about the balanced budget requirements across states kept me from estimating structural state budget deficits. In this regard, determining more specific rules about the balanced budget requirements of states and enabling them some room to create structural budget deficits in times of economic crises would help state governments to take countercyclical actions to help their economies recover.

My study tried to determine whether states’ responses to the stimulus package differ according to their characteristics such as population, industries and ratio of openness to trade. However, none of these variables and related interaction terms with the ARRA spending items yielded significant results, so I did not report them. I did detect a significant result for openness to trade, but when I added the export change to GDP ratio the result turned out to be insignificant.

Finally, as individuals do, governments (countries) have unlimited wants and needs but limited resources. Hence, managing and channeling resources in the most efficient way is also an important policy question. In my study, I had to allocate the total tax benefits to states by population. And I had only 3 years of annual data. Yet, my study could have had better and more reliable findings if I had had a larger and more detailed data set with quarterly data, because I would have been able to measure the lag effects and the long-term impacts of financial stimulus programs. A better and larger data set would also enable me to test neo-classic theories advocating the ineffectiveness or harmful effects of expansionary fiscal policies. For this reason, I think it is very important to conduct further research with more detailed and reliable U.S. based data to understand the short run and long run effects of fiscal policies.
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