Federal Construction Spending and the Economy

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Abstract

The goal of this paper is to analyze and explore the effectiveness of Federal Construction Sending as a fiscal stimulus tool. This paper finds that, while construction spending is statically ineffective at stimulating GDP Growth, which is similar to other forms of fiscal stimulus, it is relatively more effective than other stimulus at creating jobs and stimulating employment growth. For this reason, we are able to say that increased construction spending may achieve, in part, its policy goals.

Contents

1 Introduction

Government intervention in times of recession has long been supported and encouraged by economists. There has been a great deal of study done on the impact of monetary and fiscal policy, and it is commonly believed that, while the effects of monetary policy are delayed but substantial, the impact of fiscal policy is much more controversial. This paper will further explore the effects of fiscal policy, with a focus on comparing the effectiveness of government construction spending to other fiscal stimulus packages implemented by the United States government.

2 Background

2.1 Background on the Construction Industry

The construction industry is one that is highly sensitive to a country's economic climate. This sensitivity makes construction activity a very good proxy of economic health and growth. (Hillebrandt, 1985, p.20) Due to its vulnerability to the economic climate, the construction industry can see extreme cycles and is an industry hit particularly hard during times of recession. As the economy begins to slow, investors stop spending money on new construction and repairs, as they prepare for uncertain times. As this happens, many firms are left with too little work to operate profitably. Consequently, whatever net worth they may have established begins to deteriorate. Depending

on the length companies anticipate the recession to be, and the capital structure of the firm, companies can either downsize, continue to operate at a loss, or close their doors. With this the question becomes: Does causation work both ways? Can we stimulate the economy by stimulating the construction industry?

In many ways, funding construction in times of economic hardship seems to be a logical decision on the part of the government. First of all, as with many other things, construction becomes much cheaper in economic downturns due to the immense competition for work. All government projects that are available in the United States are awarded through sealed price auctions. In this form of auction, contractors deliver their bid and the contracting office awards the job to the lowest responsible bidder. During highly-strained times, it is not uncommon for some contractors to bid below the total cost of the project in an effort to cover their fixed costs. They hope that they will acquire more profitable work in the future and thus, be able to continue to run a profitable business. This makes recessions one of the most attractive times for government to invest in infrastructure.

With this in mind, it is important to remember that, while it is good that the government can purchase infrastructure for less than they would at another time, the main goal of fiscal stimulus is not to build up the nation's infrastructure but to build up the economy. It is this relationship that is less

obvious and requires further investigation.

It is also important to understand the real fragility of the construction industry as it is particularly risky. According to Dun and Bradstreet (2011), the construction industry has the second highest failure rate. Unsurprisingly, the industry as a whole also has one of the highest delinquency rates. (Dun and Bradstreet, 2011) This instability combined with the high sensitivity to business cycles, would generally make construction a particularly risky investment. However, the government is able to protect taxpayers' money and investments by shifting the risk to a third party. This is what is meant when they say lowest responsible bidder. The Miller Act requires that a surety bond guarantee all government-funded project. This bond guarantees the performance and subcontractor payment for a specified contract (U.S. General Services Administration Public Building Service, 2009) Ideally, this third party (the surety) prequalifies the contractor by evaluating the companies' capacity and capital, thus minimizing the number of construction bankruptcies on federal jobs. This by no means eliminates bankruptcies, it only shifts the burden. Once again, when considering the intent of federal stimulus packages it becomes evident that there may be some negative externalities that need to be examined when judging the benefits of using construction funding as a stimulus tool.

The construction industry is also unique in the fact that they bid jobs that

will start anywhere from the present time to years in advance. This means that, in normal times, many construction firms have their construction schedule planned a year or two in advance. Consequently, while the construction industry is sensitive to the economy it is also a lagging indicator. It also means that when the US economy enters recession the construction industry can remain relatively healthy for a short period so long as their backlog was established prior to the slow down. Therefore, the industry continues to suffer after the country begins to improve, as they must preform the contracts entered into the recession at the lower profit margin.

In the United States, the construction industry has low barriers to entry-and-exit which results in a high percentage of small businesses and the ability of these business to be very profitable. During periods of growth, these businesses usually prosper and expand based on management's discretion. however, in economic downturns they tend to have a harder time adjusting to changes in the economy. According to the United States Census Bureau statistics on US businesses, 62 percent of construction firms have between 1-4 employees with 90 percent having less that 20 employees. (U.S. Department of Commerce,2011) Some believe many of the issues with downsizing can be attributed to the fact that in small business there are far more personal connections to consider and owners are more hesitant to lay off employees. Often times these businesses are family operated, less sophisticated and more optimistic about the future. This can have a real impact on the financials of

a company. For instance, if a construction firm's owner has high fixed costs and expectations that the recession will be short, then it is sometimes in their best interest to operate at a loss as long as they can cover their variable costs. If they underestimate the length of the economic downturn, this could lead to operating at a loss for an extended period of time. This would make it likely that they eventually become insolvent. When the government makes announcements about future plans to increase construction spending owners expectations of the future are likely to be more optimistic than without the announcement. If the funds are insufficient to make a significant impact on the industry or don't make it to the area in which the firm operates, these firms may be worse off than if they had just shut down initially and waited for the economy to improve before reopening.

When the government provides construction funding during a recession the initial impact is that the company that obtains the contract receives the money for the project. This allows that company to continue to employ the needed workers and hopefully operate in a profitable manner. Usually, the company that receives the initial contract also hires subcontractors and buys materials with the money provided by the government. Obliviously, this money propagates though the construction industry and directly funds employment. The question remains, to what extent does this funding stimulate the economy beyond the direct impact, both short term and long term? Is the impact of job creation sustained?

2.2 Literature Review

For many years, economists have been in general agreement that fiscal multipliers are much smaller than Keynesian economics initially suggested. There are a few key reasons why this is the case. To understand current economic theory of fiscal stimulus we must look to the past and understand the basic model.

The Keynesian model suggests that expansionary fiscal policy can significantly increase output, employment levels and positively stimulate the economy. Under the Keynesian model, firms and employees negotiate nominal wage contracts that leave the real wage unchanged, in anticipation of the price adjustment. Anticipated fiscal policies then have no effect on real variables in the long run. With this, we can see that a temporary increase in output could be created while having no negative long run implications. (Romer and Romer, 1994)

While it is appealing to think that fiscal stimulus is an effective tool that the government has at its disposal, it is important to understand its criticisms and why fiscal stimulus has continued to lose popularity since the 1960's. First, and perhaps the most intuitive, reason why theory fails is the speed at which fiscal stimulus policies can be implemented. In most cases, it takes a significant amount of time for the United States government to collect

economic data and realize the economy is sliding into a recession. Once they do, it takes additional time for any stimulus package to be approved, put in place and the economy to see any positive effects. In many cases this is too late and the money actually reaches its intended targets as the economy starts to recover. With this said, its automatic stabilizers are less affected by the timing debate. Automatic stabilizers include taxes and unemployment insurance. It is easy to see that during a recession unemployment programs are utilized more and fewer taxes are paid, as the tax base decreases due to the rise in unemployment. It is evident that it eases the burden on U.S. citizens during times of economic strain. The more prevalent debate, however, relates to discretionary spending with the intent of boosting private spending and improving overall economic activity.

The next major criticism of discretionary fiscal spending effectiveness relates to the crowding out effect and the extent to which this reduces the fiscal multiplier. The crowding out effect refers to the displacement of private economic activity by public activity. Basic theory suggests that as government increases spending, creating a deficit, private savings increases in anticipation of increased future taxes. (Buiter, 1976) Empirical studies such as McDermott and Wescotts, " An Empirical Analysis of Fiscal Adjustments", demonstrates that strong governmental positions to reduce deficits can boost demand and growth.

The last major theory to consider when evaluating the effectiveness of fiscal spending relates to the interaction of fiscal spending and international trade. As government increases fiscal spending and the economy begins to improve, the country is strengthened relative to its trading partners. When this happens, imports increase, which once again leads to a fiscal multiplier that is lower than the Keynesian model would have suggested. (Mishkin, 1995)

Using Keynesian theory as a basis, many economist, have tried to empirically evaluate the magnitude of fiscal multipliers. In Romer and Romer's 1994 paper, "What Ends Recession", they used 3 empirical models to assess the impact of discretionary monetary and fiscal policy. First, they looked at an OLS regression of GDP growth on 8 lags of the federal funds rate and 8 lags of the budget deficit/surplus to GDP ratio. While they were able to prove that monetary policy is a strong and flexible tool in aiding economic recoveries in the United States, they concluded that, historically ,discretionary fiscal policy did not play an important role in those recoveries. (Romer and Romer, 1994)

That said, fiscal stimulus is still a common tool used in an attempt to stimulate the economy in times of recession/ depression.

As the US entered the most recent recession, it became very evident that

there is still much work to be done on understanding the optimal strategy for mitigating recessions and ensuring a fast recovery. With the main goals of saving/ creating jobs, spurring economic activity, and investing in long term growth, President Obama implemented the Recovery Act. The Recovery and Reinvestment Act was passed on February 13, 2009 and directed 787 billion dollars, which later increased to 840 billion dollars, towards tax cuts, funding of entitlement programs, and funding for federal contracts, grants, and loans. In this Act, an emphasis was placed on infrastructure development and enhancement. (Offices of Inspectors General, United States of America, 2009)

3 Data and Methodology

3.1 Data

This empirical section of this paper focuses on the impact of several key variables on GDP growth, in the United States, between 1964 and 2002. This analysis ends at 2002 as the way construction spending was accounted for in the US was changed in 2002 and the data sets that use these two different methods could not be combine. GDP growth is used as a proxy for economic prosperity. To measure U.S. GDP growth the GDP data series published by the department of commerce: Bureau of Economic Analysis was used. GDP is recorded in real 2005 chained dollars. While using GDP to

measure economic health has been criticized it is the most commonly used proxy. From the data it is evident that GDP has been steadily trending upward from 1969 to present. Looking at GDP growth gives us a better idea of if the economy is improving or deteriorating, in a given period.

The federal Funds rate is the interest rate at which depository intuitions can borrow from the Federal Reserve. This is the rate that lending institutions generally trade with each other overnight on an uncollateralized basis. Institutions lend and borrow with each other to meet reserve requirements at the end of each day. The federal funds rate is also the primary tool that is used by the government for implementing monetary policy. (Federal Reserve Bank of New York, 2012)

Construction employment figures are used to measure the impact on jobs. While this may not be the obvious choice I believe it gives a good indication of the direct impact of changes in construction funding on jobs. It is obvious that when the government funds construction projects workers are employed on those projects. It would however be nice to think that these jobs are more than temporary and that when the those jobs finish somehow workers remain employed and that growth in number of employees continues.

Federal tax receipts to GDP is used as a measure fiscal stimulus provided by tax incentives. By dividing by GDP we are given a good sense of

policy changes. In general taxes are a stable portion of the countries GDP which raises and declines based on government taxation decisions. While this maybe for a number of reasons, which may or may not be associated with actively trying to stimulate the economy the measured results provide insight into how rising and lowering taxes may impact GDP growth. It is intuitive to think that as taxes decrease, economic activity increase.

Next, Federal expenditure to GDP is used to evaluated increases and decreases in fiscal spending. By using the ratio and dividing by GDP it takes into account that the government spends more money in booming times as they are less worried about budgetary pressures compared to time of recession where tax receipts are lower.

In order to evaluate construction spending and other fiscal spending separately, one must transform this variable by subtracting federal construction spending from the federal expenditure numbers and then scaled non-construction federal spending by GDP as before. Non-construction spending includes a verity of different government spending, some of which very resistant to changes. This would include spending related to Medicate, Medicare, and defence. In contrast, it also includes spending that is highly correlated with GDP such as unemployment insurance.

To analyze federal construction spending I looked at federal construction

spending value put in place. The data is seasonally adjusted. While federal construction spending has declined significantly since the 1960s, it is still an important part of discretionary government expenditures. The value put in place is generated from a survey and describes the total dollar value of construction done in a given period on new structures and improvements. These numbers included the total cost of construction including the cost of architectural design, materials and general and administrative expense. It is also notable that this number would most likely be persistent. This is because not all contract take less than a quarter to complete. For example large buildings such as school and hospitals typically take longer than a year while short paving jobs and repairs are likely to be less than 3 months. Typically the contractor will bill the government/ contracting office monthly for the work the have completed. Usually, this is front loaded as architectural services and set up costs are billed at the begging. It is important to recognize that the impact of value put in place in the subsequent periods may simply be related to the initial contract. In order to deduce a significant impact I will look at the long rung impact. As with the other variables construction spending is scaled by GDP.

3.2 Methodology

To determine the effectiveness of fiscal stimulus as a tool to minimize the severity and length of recessions, this paper relies on two models fit to data describing key indicators of monetary policy, fiscal policy and GDP growth.

Both models are analyzed separately and then the results are compared.

3.2.1 Single Equation Estimation

The first model used is comparable to the OLS model used in the Romer and Romers paper, "What Ends Recessions."

$$Y_t = \sum_{i=1}^{8}(A_{t-i} + B_{t-i} + D_{t-i}) + \epsilon$$

Where:

Y - GDP growth

A - δ in the federal funds rate

B Federal Expenditure to GDP ratio

D - Federal Receipts to GDP ratio

with i lags

While we do not expect that the results of fiscal policy will be immediate, in order for its effects to be relevant it is fair to say that the impact should be visible with in two years following the policy action. As such this model looks at the first 8 lags. In order to look at the impact of Fiscal policy related to construction specifically, I separated Romer and Romer's deficit: GDP variable into Construction Spending: GDP, Non construction expenditure: GDP and Federal receipts: GDP, which can be thought of as a proxy for fiscal

stimulus related to tax policy. Breaking up this variable into it components provides and opportunity to evaluate the different types of fiscal policy and look at the relative effectiveness.

3.2.2 SVAR

To better understand the propagation effects of changes, and the direction of causality a Structural VAR model is used, which is better equipped to analyze the direction of causality and allows for constraints on contemporaneous effect.

A Structural Vector Autoregressive model (SVAR) fits a multivariate time series regression to multiple series of data and is used to capture the linear interdependencies of the data. In a VAR model the evolution of a set of endogenous variables is illustrated by a linear representation of only past values of those variables. A structural VAR allows for contemporaneous effects and constraints on the lagged effects of the variables in the VAR model.

With respect to government spending and GDP growth it is evident that in some cases as soon as the policy decision is announced there may be an impact. This could be due to the markets reacting to the news or for a more concrete reason such as construction spending being included in the calculation for GDP.

The VAR model I constructed is similar to the OLS model defined above but it also includes a measure of impact on jobs. This allows us to look at the other main policy goal of construction spending.

This VAR model describes the interdependencies of the described variables and is defined by the following system of equations:

$$Y_t = \sum_{i=1}^{8}(A_{t-i} + B_{t-i} + C_{t-i} + D_{t-i} + E_{t-i}) + \epsilon$$

$$A_t = \sum_{i=1}^{8}(B_{t-i} + C_{t-i} + D_{t-i}i + E_{t-i} + Y_{t-i}) + \epsilon$$

$$B_t = \sum_{i=1}^{8}(A_{t-i} + C_{t-i} + D_{t-i} + E_{t-i} + Y_{t-i}) + \epsilon$$

$$C_t = \sum_{i=1}^{8}(A_{t-i} + B_{t-i} + D_{t-i} + E_{t-i} + Y_{t-i}) + \epsilon$$

$$D_t = \sum_{i=1}^{8}(A_{t-i} + B_{t-i} + C_{t-i} + E_{t-i} + Y_{t-i}) + \epsilon$$

$$E_t = \sum_{i=1}^{8}(A_{t-i} + B_{t-i} + C_{t-i} + D_{t-i} + Y_{t-i}) + \epsilon$$

Where:

Y - GDP growth

A - δ in the federal funds rate

B Federal Construction Spending to GDP ratio

C - Non-Construction Federal Expenditure to GDP

D - Federal Receipts to GDP ratio

E - Construction Employment

ϵ represents a vector of error terms

with i lags

While it is reasonable to think that some of the drivers contemporaneously effect other variables in the above equations , it is clear that this is not always the case. For instance, this model assumes that the change in the federal funds rate, receipts to GDP, and construction spending to GDP are exogenous and controlled by the government. To account for this in the model a the contemporaneous effects constrained by the following matrix:

.	$GDPGrowth$	$EmplGrowth$	$Reciepts : GDP$	δFF	$Const.Spend : GDP$	$Non - Const.Spend : GDP$
$GDPGrowth$	1	.	.	.	.	.
$EmplGrowth$	0	1	.	.	.	.
$Reciepts : GDP$	0	0	1	.	.	.
δFF	0	0	0	1	.	.
$ConstSpend : GDP$	0	0	0	0	1	.
$Non - Const : GDP$	0	0	0	0	0	1

In the matrix above 0 indicates that the model doesnt allow for any contemporaneous effect between the variables indicated by the column and row labels. In all situations where the contemporaneous effect is equal to change a 1 is present. Lastly, everywhere a dot is found represents a relationship

where the model allows and tests for a contemporaneous effect. The matrix is constructed so that the order of the variables defines what variable effect each other. GDP growth is placed first to allow all other variables to effect GDP growth. Next in the matrix is employment growth which allows for it to be contemporaneously effected by Receipts to GDP, change in the federal funds rate, Construction spending and non-construction spending. This model on the other hand places construction, non-construction spending and receipts to GDP last so that they are constrained and are not contemporaneously affected by the other variables. This is in line with the assumptions described earlier.

Analyzing various selection criteria it was determined that a SVAR model with two lags was the best fit.

4 Results

4.1 Single Equation Estimation

Looking at the regression output from the first model seen below, we gain insight in to the impact of the identified drivers.

Source	SS	df	MS
Model	.005910896	27	.000218922
Residual	.007275196	152	.000047863
Total	.013186092	179	.000073665

Number of obs	180
F(27, 152)	4.57
Prob > F	0.0000
R-squared	0.4483
Adj R-squared	0.3503
Root MSE	.00692

GDPGrowth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ChangeinFF						
—.	.0011786	.0006205	1.90	0.059	-.0000473	.0024045
L1.	-.0000246	.00064	-0.04	0.969	-.001289	.0012399
L2.	-.0026672	.0006578	-4.05	0.000	-.0039668	-.0013675
L3.	-.0000964	.0006546	-0.15	0.883	-.0013898	.001197
L4.	-.0014127	.0006459	-2.19	0.030	-.0026889	-.0001365
L5.	-.0014207	.0006612	-2.15	0.033	-.0027271	-.0001143
L6.	-.0012131	.0006513	-1.86	0.064	-.0024999	.0000738
L7.	-.0002007	.0006565	-0.31	0.760	-.0014978	.0010964
L8.	-.0008918	.0006154	-1.45	0.149	-.0021077	.0003241
LnExpGdp						
—.	-.1340897	.0311464	-4.31	0.000	-.1956254	-.0725541
L1.	.1195024	.0421669	2.83	0.005	.0361935	.2028113
L2.	-.0194533	.0423302	-0.46	0.646	-.1030848	.0641782
L3.	.0926697	.0421191	2.20	0.029	.0094552	.1758842
L4.	-.0106715	.0422463	-0.25	0.801	-.0941373	.0727943
L5.	-.0694629	.0422007	-1.65	0.102	-.1528385	.0139127
L6.	-.0027658	.0423691	-0.07	0.948	-.0864742	.0809427
L7.	-.0302116	.0420378	-0.72	0.473	-.1132655	.0528423
L8.	.0541745	.030746	1.76	0.080	-.0065701	.1149192
LnReceiptsGdp						
—.	.0339086	.0217566	1.56	0.121	-.0090759	.076893
L1.	.0181408	.0259517	0.70	0.486	-.0331317	.0694134
L2.	.0040272	.0264693	0.15	0.879	-.048268	.0563223
L3.	-.0123861	.0266023	-0.47	0.642	-.0649441	.0401718
L4.	.0020138	.0265726	0.08	0.940	-.0504855	.0545131
L5.	-.0200085	.0265126	-0.75	0.452	-.0723893	.0323723
L6.	-.0241591	.0266736	-0.91	0.367	-.0768579	.0285398
L7.	.0076858	.0258261	0.30	0.766	-.0433387	.0587102
L8.	.0049029	.022125	0.22	0.825	-.0388095	.0486152
_cons	.0295021	.0115223	2.56	0.011	.0067375	.0522667

In the output we see that the coefficients on all of the lags of change in federal funds rate are negative. As such this indicates that an increase in the federal fund rate, leads to a decrease in GDP growth. This confirms what theory states about the governments use of the changes in the federal funds rate. In contrast, if the government wanted to stimulate economic activity a reduction in the federal funds rate would increase GDP growth, according to this statistical model. The results show that a 1percent decrease in the federal funds rate leads to an in crease in GDP growth for four periods following the change. Furthermore, the model shows that one period after a 1 percent increase federal expenditure to GDP ratio, GDP growth increases by 0.12 percent and continues to positively impact GDP growth overall until three quarters after the increase. At that time the impact becomes statistically insignificant.

The results for receipts to GDP is harder to interpret. Looking at Ln of receipts to GDP the results indicate that the coefficients switch are not statistically different from zero.

To investigate further, I ran a regression with construction spending separated from total expenditure. The results are shown below.

Source	SS	df	MS
Model	.005174011	36	.000143723
Residual	.00566221	110	.000051475
Total	.010836222	146	.000074221

Number of obs = 147
F(36, 110) = 2.79
Prob > F = 0.0000
R-squared = 0.4775
Adj R-squared = 0.3065
Root MSE = .00717

GDPGrowth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ChangeinFF						
--.	.0012135	.0006948	1.75	0.084	-.0001635	.0025905
L1.	.0004071	.0007064	0.58	0.566	-.0009929	.0018071
L2.	-.0030529	.0007401	-4.12	0.000	-.0045197	-.0015861
L3.	-.0005	.0007462	-0.67	0.504	-.0019788	.0009789
L4.	-.0016889	.0007247	-2.33	0.022	-.003125	-.0002528
L5.	-.0019612	.0007389	-2.65	0.009	-.0034255	-.0004969
L6.	-.0017465	.000741	-2.36	0.020	-.0032149	-.0002781
L7.	-.0000131	.0007399	-0.02	0.986	-.0014794	.0014533
L8.	-.0007371	.0006942	-1.06	0.291	-.0021128	.0006386
LnNonconstructionSpendgdp						
--.	-.0661827	.0339645	-1.95	0.054	-.1334924	.0011271
L1.	.0570534	.0455888	1.25	0.213	-.0332929	.1473997
L2.	-.0473682	.044797	-1.06	0.293	-.1361454	.0414089
L3.	.0941837	.0435346	2.16	0.033	.0079083	.180459
L4.	.0130204	.0421677	0.31	0.758	-.070546	.0965868
L5.	-.0980791	.0376058	-2.61	0.010	-.172605	-.0235532
L6.	.0036082	.034591	0.10	0.917	-.0649431	.0721595
L7.	-.0006449	.0349743	-0.02	0.985	-.0699558	.0686659
L8.	.0402539	.0249804	1.61	0.110	-.0092515	.0897593
LnConstructionSpendGdp						
--.	-.0066171	.0124718	-0.53	0.597	-.0313333	.0180991
L1.	.0053206	.0152121	0.35	0.727	-.0248263	.0354674
L2.	-.0079007	.0148573	-0.53	0.596	-.0373443	.021543
L3.	.0135066	.0146503	0.92	0.359	-.0155269	.0425401
L4.	-.0036078	.0147249	-0.25	0.807	-.0327891	.0255735
L5.	-.0129211	.0149779	-0.86	0.390	-.0426037	.0167615
L6.	-.0012261	.0155213	-0.08	0.937	-.0319857	.0295336
L7.	.006297	.0158666	0.40	0.692	-.0251468	.0377409
L8.	.0086648	.0129318	0.67	0.504	-.016963	.0342927
LnReceiptsGdp						
--.	.0514893	.029437	1.75	0.083	-.0068479	.1098265
L1.	.0088389	.0336735	0.26	0.793	-.057894	.0755718
L2.	-.0422233	.0332034	-1.27	0.206	-.1080247	.023578
L3.	-.0230016	.0343495	-0.67	0.504	-.0910743	.0450712
L4.	.0434237	.0336243	1.29	0.199	-.0232118	.1100593
L5.	-.0067885	.0342082	-0.20	0.843	-.0745811	.0610041
L6.	-.0263063	.0358097	-0.73	0.464	-.0972726	.0446601
L7.	-.0126501	.0343048	-0.37	0.713	-.0806341	.0553339
L8.	.002258	.0291673	0.08	0.938	-.0555447	.0600607
_cons	-.0007512	.0410904	-0.02	0.985	-.0821828	.0806804

In this regression, as in the previous one, we see that an increase in the federal funds rate leads to a decrease in GDP growth and that changes in receipts: GDP have little to no effect on GDP growth. However in this case

we see that construction spending to GDP also is not statistically different from zero while non-construction spending looks to have a slight impact. The results show that in the fourth quarter following a 1 percent increase in federal non-construction spending leads to net effect of 0.038 percent GDP growth. This suggests that, while fiscal spending overall my have an impact on GDP growth, using construction spending as a fiscal stimulus tool seems to have no impact on GDP growth.

By looking at the joint test we see that we fail to reject the null and we can not say that construction: GDP has an impact that is different from zero.

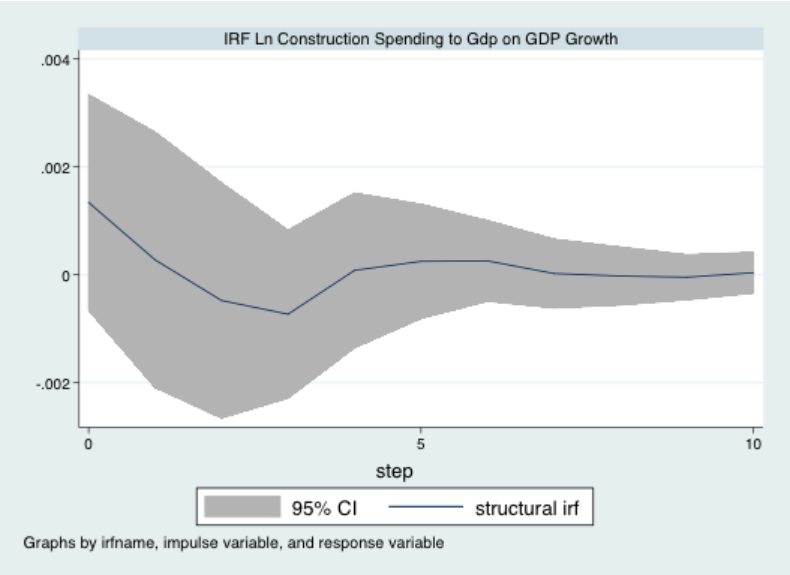
4.2 SVAR

To further understand these results and validate the findings we look at the results of the S-VAR model.

Looking at the granger causality results we see that Ln of receipts to GDP, and Ln of Construction spending to GDP don not granger cause GDP growth, where as the same can non be said about the change in federal funds rate. However, it appears that Ln of construction spending to GDP may granger cause employment growth. The question is then; what is the impact?

Finally, this analysis uses impulse response functions to understand the propagation effect and how the policy changes impacts GDP growth and employment. An impulse response function shows how a dynamic system is affected when a system is shocked with a 1unit increase in one of the variables. Because the variables are interrelated this helps to show the overall effect in a manor that is more easily interpreted. The Line shows the predicted path, while the grey area represents the 95 percent confidence interval of the predicted path at each lag, 1 to 10, following the shock.

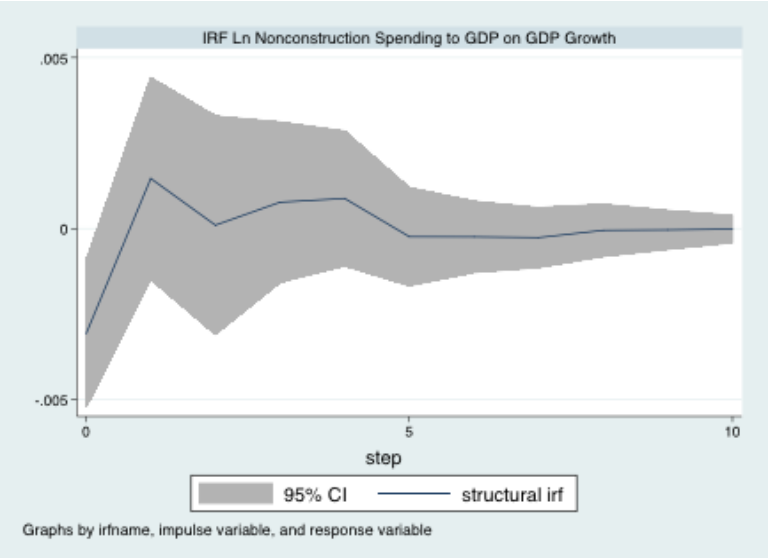
Graph 1: Impulse Response Function of a Shock to Ln Construction Spending on GDP Growth, structural



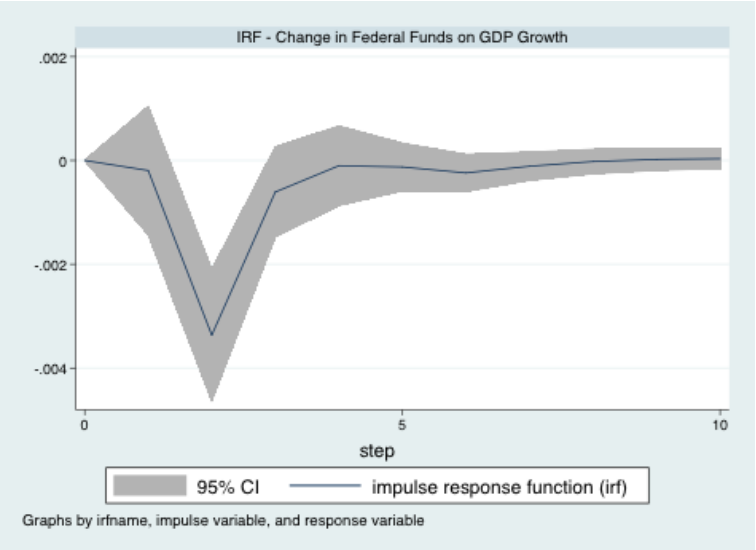
Looking at this impulse response function, we see that statistically there is no increase or decrease as a result of a 1percent increase in construction spending to GDP.

This also shows that while the impact is not certainly greater than zero, there appears to be an increase in GDP growth in the period following the shock and 3 periods after the shock. After the fifth period the effect returns to zero. As such it is possible that construction spending is not the most effective means of stimulating the economy. To further understand this we look to the impulse response function of ln non-construction spending: GDP and change in federal funds rate on GDP growth.

Graph 2: Impulse Response Function of a Shock to Non-Construction Spending on GDP Growth, structural



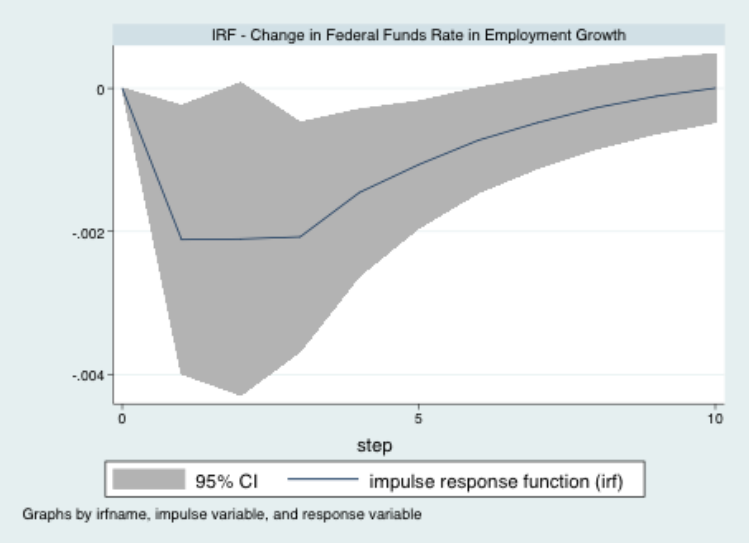
Graph 3: Impulse response function of change in federal funds rate on GDP Growth



From the impulse response function of change in federal funds rate on GDP growth, it is evident that a positive shock to change in the federal funds rate leads to a significant decrease in GDP growth. This confirms that using monetary policy to spur economic activity is justified by historical data. By decreasing the federal funds rate, it is possible it increase GDP growth. While this is a positive result, it only examines the short run impact. It is note worthy that, in the long run, if rates are held artificially low, it can have a negative impact on the economy. For example, low interest rates can cause pension funds and insurance companies to suffer as it becomes harder to maintain fully funded funds as they are heavily dependent on returns from safe long run investments. This may lead to instability in the future, further

out than our IRFs show.

Graph 4: Impulse response function of change in federal funds rate on Employment Growth



Looking at the impulse response function of a shock to the change in federal funds rate on employment growth, it is evident that there is also a positive impact on employment growth when there is a decrease in the federal funds rate. Overall, it seems that using the federal funds rate as a tool during recessions seem like an appropriate method.

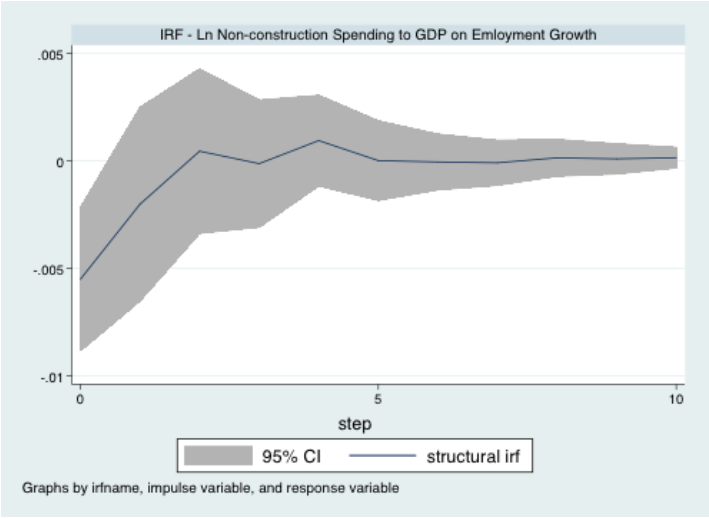
Looking at the IRF above it appears that changes in Ln of construction spending to GDP and Ln non-construction spending both had an impact that was not statistically different than zero at the 95 percent level. However, they

also both showed a predicted path that was positive. While it appears that fiscal stimulus fails to meet its policy goals with respect to GDP growth, it is also notable that there is no negative impact either. Thus, if it is effective at improving employment it would still be considered an overall success.

As such, this analysis then examines the relationship of Ln construction spending and non-construction spending to GDP with employment growth.

Graph 5: Impulse response function of Construction Spending on Employment Growth

Graph 6: Impulse response function of Non-Construction Spending on Employment Growth



From the impulse response function we see that, statistically at the 95percent level, there is no impact on employment growth with an increase in construction and non-construction spending. With this said the projected path for both are positive. It is predicted that a 1 percent increase in construction spending to GDP will result in a 0.003 percent increase in employment growth. Comparatively, the impact of a shock to non-construction spending

Overall this is a positive outcome and supports the argument for increased construction spending during recessions.

5 Conclusions

Based on the empirical results, while funding construction as a means of stimulating the economy is less effective than monetary policy action, it is relatively more effective than other types of fiscal spending. Increases in construction spending to GDP may have a positive impact on GDP growth that is prolonged for 3 periods. While this job growth is specific to the construction industry we see that not only were the jobs sustained but so was the growth. While the growth is minimal compared to the effect of changing the federal funds rate it becomes an effective option when you can no longer lower the federal funds rate. An example of this is the current recession where the interest rate was very low and could not be lowed as it is bound by zero. While it is not an optimal decision to use fiscal policy, it does not appear to have any significant negative effects on the economy in the short or long run.

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7 Apendix

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
ChangeinFF	LnReceiptsGdp	4.0612	2	0.131
ChangeinFF	LnNonconstructi~p	.90734	2	0.635
ChangeinFF	LnConstructionS~p	.21535	2	0.898
ChangeinFF	GDPGrowth	3.9082	2	0.142
ChangeinFF	EmpGrowth	6.2149	2	0.045
ChangeinFF	ALL	32.302	10	0.000
LnReceiptsGdp	ChangeinFF	5.3298	2	0.070
LnReceiptsGdp	LnNonconstructi~p	4.19	2	0.123
LnReceiptsGdp	LnConstructionS~p	12.768	2	0.002
LnReceiptsGdp	GDPGrowth	.2352	2	0.889
LnReceiptsGdp	EmpGrowth	5.6673	2	0.059
LnReceiptsGdp	ALL	34.908	10	0.000
LnNonconstructi~p	ChangeinFF	4.3153	2	0.116
LnNonconstructi~p	LnReceiptsGdp	.58947	2	0.745
LnNonconstructi~p	LnConstructionS~p	6.1657	2	0.046
LnNonconstructi~p	GDPGrowth	3.2003	2	0.202
LnNonconstructi~p	EmpGrowth	7.1389	2	0.028
LnNonconstructi~p	ALL	33.844	10	0.000
LnConstructionS~p	ChangeinFF	.84647	2	0.655
LnConstructionS~p	LnReceiptsGdp	.95709	2	0.620
LnConstructionS~p	LnNonconstructi~p	1.4746	2	0.478
LnConstructionS~p	GDPGrowth	2.5418	2	0.281
LnConstructionS~p	EmpGrowth	3.6159	2	0.164
LnConstructionS~p	ALL	14.337	10	0.158
GDPGrowth	ChangeinFF	21.289	2	0.000
GDPGrowth	LnReceiptsGdp	4.4179	2	0.110
GDPGrowth	LnNonconstructi~p	.60459	2	0.739
GDPGrowth	LnConstructionS~p	3.6303	2	0.163
GDPGrowth	EmpGrowth	14.56	2	0.001
GDPGrowth	ALL	51.417	10	0.000
EmpGrowth	ChangeinFF	6.515	2	0.038
EmpGrowth	LnReceiptsGdp	2.9406	2	0.230
EmpGrowth	LnNonconstructi~p	3.9604	2	0.138
EmpGrowth	LnConstructionS~p	5.232	2	0.073
EmpGrowth	GDPGrowth	5.5595	2	0.062
EmpGrowth	ALL	22.229	10	0.014