

Hello everyone. My name is Siddhartha Rao and I am going to talk to you about my research with Dr. Greenlaw on the American Recovery and Reinvestment Act.

So the main research question we were looking at is “how much government spending was needed to make the ARRA effective?” So how do we really know if the ARRA stimulus was effective or not. So, there is no real standardized definition and so the approach that we took is we would expect the economy to be very close to recovery or fully recovered by the ending of its funding. So in the case of the ARRA many of the programs were done in 2015 and a majority of the funding really spent up by 2012 and so these two graphs show the output gap on the top and then unemployment rate on the bottom. So if we are looking at that 2015 for a lot of the programs to be done we would really expect this to be much closer to zero than it really is and especially looking at 2012 there is still quite a ways to go in terms of economic recovery. How we would look at the unemployment rate is we would look at the pre-recession level which would be this 5% and 2016 is when we hit that point so in 2015 still above and in 2012 very above. And so for the possible reasons for this inefficiency with the stimulus package. One of the reasons is political and the reason for that is the year before the ARRA was implemented Bush put through TARP, Troubled Asset Relief Program, which also formed as a stimulus package to try and get the economy back on recovery and so at this time the republicans that were in congress really were against additional spending and so this was a major reason for the small amount of the stimulus. And so for this research question we used two approaches. The first is to use estimates from an ex-post forecast to simulate the possible effects of increasing the total ARRA stimulus. So really what this is we ran a regression, we used the estimates to then create an ex-post forecast to then model and then change the government spending to account for increases to the ARRA stimulus to see the effect that it would have on the economy. The second approach is pretty different and will be looking at specific programs and the different fiscal multiplier estimates that are going to be associated with those programs.

So what's the motivation for this? Well I am sure you all know that we are currently in a pandemic and a recession, currently one of the worst economic declines since the Great Depression. And so there is so much stimulus money flying around in terms of the CARES act and the American Rescue Plan it's really important to know what we should and shouldn't do in terms of the government stimulus because we could have another really slow recovery like from the Great Recession or we could have a very quick recovery if we do the stimulus correctly. And of course going off of that, the reason we looked at the ARRA as opposed to any other stimulus is that it's the most recent stimulus that was passed. So heres some previous literature. The majority of the previous literature that I looked at was from the Congressional Budget Office and this is really important because they have standardized methods of analysis they had methods put in place that they analyzed all past stimuli to measure the effect and economic impact of the stimulus. This first paper looked at 2009 and this came out in 2014 so this was five years after so they could really see the impact of this and this is where the multipliers came from for approach #2. So just giving much better general analysis of what the recession was and how the economy recovered at this time. The other three articles that I looked at either look at the pandemic specifically or how to compare the pandemic and past economic recessions. So looking at the effects of pandemic related legislature on output the main takeaway from this was social distancing is really hurting the economy and is forcing it to not bounce back as effectively compared to other different recessions, so the reason for the balance article is to provide different program costs for the ARRA really going into the detailed specific programs as opposed to big labels like medicaid or infrastructure costs showing what each one was really doing and the jeff stein piece is looking at the CARES act. So the fiscal multiplier is one of the most important things that we are looking at here and its really how you judge the economic impact or GDP generated from the stimulus the definition of the fiscal multiplier is how much GDP is generated from one fiscal dollar. So thats something that is going to come up.

So a little bit of economic theory, this is a macro economic problem so we used macroeconomic models. The first approach really used the aggregate expenditure model and the IS-LM model when looking at the regression that was used to create the forecast and so right here with this equation is the aggregate expenditure model and so what this is saying is that GDP is equal to consumption plus investment plus government spending which in this case we will be considering stimulus and then net exports which is exports minus imports. The next model is also important and its the consumption function and its basically saying consumption is equal to autonomous spending which is what people are going to spend no matter what so food shelter and so the marginal propensity to consumer or mpc and so this will account for increases in GDP causing people to consumer, more to buy more. This is just saying that GDP is equal to expenditure which is the equilibrium for the aggregate expenditure model. The IS-LM model is used to help look at the money supply side of the equation. Right here you can see some equation manipulation to the end point here which is going to say change in GDP over change in government spending is equal to this. And this is equal to multiplier broadly speaking, it is much more nuanced in terms of specific programs and I will get into that in approach #2 but this is really the theory behind the fiscal multiplier.

Going into approach #1, they used these two models and so what we are trying to do with the regression is to substitute variables in to these models to then account for the macro economy. So the main substitution are the output gap for Y because it is much better to look at the economy coming back to potential or fully recovering as opposed to just the GDP figure. The FFR helps to show investment but also the money supply because the FFR is the rate as which banks get money in terms of their interest rate from the federal reserve, and so it can account for investment in the expenditure equation and also the money supply in terms of the ISLN model. The highest income tax bracket is here to look at consumption and that was the best tax bracket that could be found to really gauge what was going on during this period. Corporate tax rate would have been included in the regression but it did not change during this time and so it was left out, because it wouldn't have any effect because it was a constant number. So this is just the equation of each variable that I said before. This is a time series, it's only looking at the united states quarterly data from 2000 to 2019. So these are the regression results, and main things to note are all three variables have significance at the 5% level, and then the highest tax bracket and federal funds rate have significance at the 5% level as well. So this is really good to show that it is truly capturing the changes and fluctuations in the output gap, and that can especially be shown through the .6 adjusted r squared, which is basically saying that 60% of variation is accounted for in this model. It should be noted that the government spending does have the correct sign to match the theory, the federal funds rate and the highest tax bracket do not. We would expect both of these to decrease, that would lead to an increase in economic activity. So this is the expost forecasting, really this is showing that the forecast, which is in red, does capture movements of the output gap over the years. So these are the simulation results, and to give some baseline here, the blue here is the real output gap that was shown in the last slide, and this brown line on the bottom is the expost forecast that was also shown on the last slide. Each other line is gonna be an increase to the stimulus, either the stimulus doubled tripled all the way up to six, which is this top lavender line. And so you can see here that only two of them either come close to 0 or reach 0, showing that they would have closed the gap in that efficient timeline. One thing to note, and kind of an assumption of this equation, is that there is no marginal diminishing returns here. Eachdollar is going to have the same multiplier that the last dollar did, and this may not be totally truthful because people aren't going to spend as much money if they get more money, dependent on what they have. Another is the reason for this convergence on the right is that the data was not altered in this section, and so it is going to match perfectly with the expost forecast model, which is exactly what happened here.

Going on to approach number two, this really looks at specific programs and their actual effectiveness in terms of multipliers. So as I stated before in the previous literature section, the multipliers were estimated by the CBO using their process. But the CBO did not have the cost breakdown for specific programs and their funding, and so that's why we used the program -- the balances the program costs. This graph on the right is showing the output gap in US dollars, which is going to be actual minus potential, and so the negative here, the lowest that it goes is 886 billion, and so that would be the gap that we're trying to fill, that we're trying to recover from. One thing to note about the data is that in this approach we are assuming that all of the funding is being spent at once, as opposed to over the years like the last approach, which is one of the downsides of this. So this is the main results from this. Just a breakdown of the table, we have the low and high estimate ranges for the multipliers. The original funding was then categorized by those different multipliers, and is shown as the total here. And then this is gonna be the multipliers times what the funding is set at, either it's the original funding amount, doubled, or tripled. So one thing that is interesting here is although we're looking at it as though all the funding is being spent at once, this is saying that a high estimate that the gap will have been closed by just the original funding and almost closed by the average. But of course, we can't always get the best result, which is what the highest is, and we don't necessarily get the low result, which is the worst case scenario. And so this really shows it is going to fall in between here, and obviously it did not for the original because the output gap was not closed by 818 billions dollars. In the paper, it's talked about if the funding was shifted from this lower multiplier to the higher one, it would have been able to completely close the output gap given the average amount. But it is still a probability and not necessarily that we are going to get this averaged amount.

So the conclusions here are that the stimulus could have been effective given the right funding, but it wasn't meant to be, clearly. Assumptions make each approach different, and what that really is saying is that the first approach helped to show the effect of increasing the stimulus over time, while the second approach shows the importance of putting it into the most effective programs. One thing to note, comparing the ARA to the COVID stimulus is the impact of social distancing. As I said before, very important because social distancing really does decrease the amount of economic activity that's going on, and the economic stimulus is bigger for COVID 19, which really does change a lot of the assumptions here because there will be diminishing marginal returns most likely. Also of course the cause is completely different for the pandemic as opposed to the 2008 recession. That being said, these are my references, and thank you for coming to my talk.