

U.S. Government Economic Stimulus Plan Outcomes

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I. Introduction

Since 2020, COVID19 has swept the world, affected the political, economic, and social fields. Facing negative impacts that have rarely seen in a century, the U.S. government issued many policies and economic stimulus plans to help recover financial losses and ensure social stability. Among these economic stimulus plans, the fiscal stimulus plans have played a significant role in alleviating the economic damage caused by the pandemic.

Firstly, the frequency that the government enacted new fiscal policies is high, and the scale of government spending was relatively large (Table 1). Furthermore, various fiscal policies focused on different aspects to improve national economic situations, and they have benefited many industrial fields. In March 2020, when COVID19 broke out and spread world widely, the first round of fiscal stimulus policies focused on emergency response and mainly supported the health sector in response to the epidemic. For example, CPRSAA stimulus supported vaccine development, epidemic treatment and diagnosis, disease detection, and disaster loans. The second round of fiscal stimulus aimed at helping families and making up for the economic losses of households caused by the epidemic, including paid holidays, tax cuts, and unemployment benefits. The FFCRA stimulus brought 192 billion dollars to support the U.S. economy. The third round of fiscal stimulus included personal and corporate assistance, which offered individuals and businesses cash and loans directly. The CARES Act, enacted on March 28, 2020, was the most extensive U.S. stimulus package since World War II. The fourth financial assistance package paid more attention on helping small businesses. On April 24, 2020, PPHEA was issued to helped small and medium size enterprises retain workers and provide aid loans for small businesses.

In 2021, when Joe Biden became the president, the administration enacted fiscal stimulus plans with the theme of "Build Back Better", benefiting the long-term growth of the American economy. The ARP, issued on March 11, 2021, focused on investing in public health while assisting families, communities, businesses, and education systems. The IIJA, passed on November 15, 2021, aimed to improve infrastructure investment, including bridges, roads, ports, and clean energy. Then the BBBA adopted

on November 19, 2021, mainly involved social expenditure and investment in climate change, including housing, environment, taxation, and immigration.

The economic stimulus has been a critical tool in the U.S. government's response to the recession and financial crisis. In 2008, the global financial crisis broke out. In order to recover the economy from severe damage caused by the financial crisis, the U.S. government enacted a lot of fiscal policies. President George W. Bush signed the Economic Stimulus Act of 2008 (ESA) in February 2008 and signed the Emergency Economic Stabilization Act of 2008 (EESA) on October 3, 2008. Then president Barack Obama signed the American Recovery and Reinvestment Act of 2009 (ARRA) in February 2009. The laws aimed at tax cuts, infrastructure investment, supporting the environment friendly energy and household income, etc. The fiscal stimulus issued in 2008 had the similar focus as the stimulus plans enacted during the COVID19 pandemic. Therefore, comparing the outcomes of two stimulus policies is of high research value.

Based on the COVID19 pandemic background, our main objective is to find the impacts of the U.S. economic stimulus plan on the whole U.S. economy. We are interested in finding the causal relations between the U.S. economic fiscal stimulus plans and U.S. GDP growth rate. For the first secondary objective, noticing that during 2008 financial crisis, U.S. government had also conducted several fiscal stimulus plans, and we are interested in comparing the impacts of 2008 financial crisis-led stimulus plans and COVID19-led stimulus plans on the U.S. economy development. For the second sub-objective, we want to study the impacts of fiscal stimulus plans on the U.S. inflation rate. For the last sub-objective, we would like to find the effects of fiscal stimulus plans on the unemployment rate during the COVID19 pandemic.

II. Literature Review

The effect of government stimulus policy is often summarized by a multiplier - the percentage increase in output that results when government spending is increased by 1 percent of GDP (Nakamura & Steinsson, 2014). Hall (2010) used the multiplier effect to measure the impact of U.S. fiscal policies on GDP in 2008 and concluded that fiscal stimulus contains two main methods. The first is that the government directly purchases

goods and services, mainly through infrastructure construction. The second is to increase public welfare, including the expansion of unemployment insurance, tax cuts, rebates, and other measures to increase cash in the hands of the public. Fiscal policy works mainly through multiplier effects, and infrastructure multipliers are generally larger than welfare multipliers. However, the Taylor rule implemented by the U.S. central bank will restrain the infrastructure multiplier, and the welfare multiplier will be limited by how much households can pay down debt and spend on future consumption. Thus, he concluded that the combination of increased federal purchases and benefits raised output and income by 2 percent. Parker et al. (2013) evaluated the policy of Economic Stimulus Payments (ESP) in U.S. fiscal policy in 2008. They measured the change in household spending directly caused by the receipt of the ESPs by using a natural experiment provided by the structure of the tax and found that on average households spent about 12 to 30 percent of their stimulus payments on non-durable consumption goods and services during the three-month period in which the payments were received.

The 2020 recession was caused largely by concern about the spread of COVID19 and government policies mainly aimed at limiting attacks on person-to-person contact (Gravelle et al., 2020). In response to the global economic downturn, governments around the world have adopted many stimulus plans, including fiscal and monetary measures targeting households, health care, manufacturing and servicing industries, and so on (Bayer et al., 2020; Cheng et al., 2020; Gourinchas, 2020). Siddik (2020) used Euclidean Distance (EI) to establish a standardized composite economic stimulus index (ICES). The index, which includes fiscal, monetary, and exchange rate measures, is used to analyze and compare the impact of governments' economic stimulus policies during the pandemic. At the height of the initial wave of the pandemic, interest rates were reduced close to the effective lower bound in several economies, so the scope for much further monetary impetus has been reduced. As a result of the fiscal policy responses, public sector debt has increased globally, particularly in advanced economies, which may raise government concerns (Naisbitt et al., 2021). However, in the short term, the fiscal stimulus package enacted by the U.S. government, has four notable characteristics, the scale exceeds expectations, the period is long, structural balance, bailout and recovery in parallel. According to the analysis of the New York

Fed Weekly Economic Index (WEI) data, the US economy is expected to achieve a better-than-expected recovery (Yang, 2021).

IV. Data Description

For the main objective of our research, we collected the related data on a monthly basis from January 2016 to January 2022 on FRED website. The Weekly Economic Index (WEI), Industrial Production (IP) and Consumer Price Index (CPI) are index data. Personal Consumption Expenditures (PC) and Disposable Personal Income (DPI) are both in units of billions of dollars. The monthly based Unemployment Level (UEL) data is in units of thousands of persons. Eventually we collected 73 observations for the main research question.

For the first secondary objective, we collected all related data on a quarterly basis from 2007 quarter 1 to 2021 quarter 4 on FRED website. There are 60 observations collected in total. The Gross Domestic Production (GDP), PC, Quarterly Net Exports of Goods and Services (NX), Gross Private Domestic Investment (GPDI) and Government Total Expenditures (GTE) are in billions of dollars. For the second sub-objective, we gathered the related monthly data from January 2019 to February 2022 on FRED website, and there are 38 observations collected. The 5-Year Breakeven Inflation Rate (IR) is in units of percent and WEI is in units of index. For the last sub-objective, we also collected monthly based data from January 2019 to February 2022 on FRED, and got 38 observations. Unemployment Rate (UER) is in units of thousands of people and Total Private Average Hourly Earnings of All Employees (WAGE) is in units of percent. WEI and IR are in units of index and percent respectively.

V. Empirical Strategy

1. Main research objective strategy

Our research mainly studies the impact of the U.S. government's fiscal economic stimulus plan on the overall economic development of the United States during the COVID19 pandemic. GDP could be a great measurement of economic development. However, for the main research question, the time period we selected is relatively short,

and we can only obtain the quarterly GDP data. This will lead to a lack of observation situation and a bad regression result. Regarding this, we decided to use the Weekly Economic Index (WEI) (Figure 1) as a proxy measurement for GDP. WEI is measured by ten indicators of real economic activity. It represents the common component of series covering consumer behavior, the labor market, and production data. Besides, WEI can reflect the trend of the real economy development in the United States at a higher frequency, and it is scaled to align with the four-quarter GDP growth rate (Lewis, Mertens, Stock & Trivedi, 2021). Therefore, it is much more helpful to use monthly WEI index data, instead of quarterly GDP data, to study our main research question. According to Lewis (2021), WEI is related to consumer behavior, labor market situation, taxation and production, etc. Based on that, when forming the regression model for the main research objective, we decided to use the PC, IP, UEL, DPI and CPI data as the explanatory variables to control for the interference of other factors.

We also need to include Fiscal Stimulus Plans Dummy variables that represent the related fiscal policies into our regression model. These dummy variables are set mainly based on their issue dates and potential effective periods. One thing to notice is the effectiveness lag of the fiscal stimulus plans. Tsuzuki (2016) claimed that a lag can have a stabilizing effect on the local determinacy when studying the effects of policy. Based on that, we decided to set a two months lag for the stimulus plans issued before January 2021, when Biden became the president, and for the rest of the stimulus plans we set a one-month lag. For stimulus issued before Biden became the president, we assumed a one-year effective period, and for the rest we assumed that they are still effective in 2022. After carefully reviewing the related stimulus and datasets, we created 2 dummy variables for the main research objective. Since the CFBCR, FFCRA, CARES and PPPHEA stimulus plans are issued when Trump was the president and they are all issued in the similar month, we combined them to create one single dummy variable to represent them all, and also set its issue date to be April 2020. Then the **CFCP** and **ARP** represent the combined stimulus plans dummy and ARP stimulus dummy respectively. We did not include the IIJA and BBBA stimulus as they all launched on November 2021, and the data we used is from January 2020 to January 2022, which may lead to an inapparent situation due to lack of related observations.

To run the regression, we applied the OLS method to estimate the causal relation between WEI and explanatory variables as well as dummy variables. For the regression results, we mainly focused on the significance and coefficients of the dummy variables in our model. Based on the research strategy, our main model formed is as following:

$$WEI_i = \beta_0 + \beta_1 * CFCP_i + \beta_2 * ARP_i + \beta_3 * PC_i + \beta_4 * IP_i + \beta_5 * UEL_i + \beta_6 * DPI_i + \beta_7 * CPI_i + \varepsilon_i$$

2. First sub-objective strategy

For the first secondary research objective, we want to compare the impacts of 2008 financial crisis-led and COVID19-led fiscal economic stimulus plans on the U.S. economy development. According to Fernando (2022), GDP can be determined via the expenditure approach, the output approach, and the income approach. We formed our regression model for this part mainly based on the expenditure method. For the expenditure method, GDP is determined by consumption, government spending, investment and net exports (Fernando, 2022). In order to compare the impacts of 2008 financial crisis-led fiscal stimulus and COVID19-led fiscal stimulus, we will run an OLS regression with quarterly data collected from 2007 Q1 to 2021 Q4. In this particular model, we set the U.S. quarterly GDP (Figure 2) as the dependent variable and use PC, NX, GPDI and GTE as the explanatory variables. For dummy variables, president George W. Bush signed the ESA stimulus in February 2008 and signed the EESA stimulus on October 3, 2008. Then president Barack Obama signed the ARRA stimulus in February 2009. Based on that, we set the **BUSH** and **OBAMA** as the 2008 financial crisis-led stimulus dummy variables, where BUSH contains the two main stimulus plans signed by president Bush and we assumed its issue date was 2008 quarter 1. The **CFCP** and **ARP** are the COVID19-led stimulus dummy variables and we assumed that the CFCP was issued in 2020 quarter 1. We set a one-quarter time lag for each crisis-led dummy and assumed the COVID19-led stimulus plans became effective in the same quarter as they issued and we assumed a 2-year effective period for each stimulus plan. We are interested in the coefficients of these two different dummy sets which may tell us how effective they are, respectively. The model formed for the first sub-objective is as following:

$$GDP_i = \lambda_0 + \lambda_1 * BUSH_i + \lambda_2 * OBAMA_i + \lambda_3 * CFCP_i + \lambda_4 * ARP_i + \lambda_5 * PC_i + \lambda_6 * NX_i + \lambda_7 * GPD_i + \lambda_8 * GTE_i + \varepsilon_i$$

3. Second and third sub-objective strategy

For the rest of the sub-objectives, we used the monthly data from Jan. 2019 to Feb. 2022, and we also applied the OLS method. For the second sub-objective, dummy variables settings are the same as they are in the main regression model. We set IR (Figure 3) as the dependent variable and WEI as the explanatory variable. To find the effect of the COVID19-led U.S. fiscal stimulus plans on the inflation rate, we formed the new regression model as following:

$$IR_i = \alpha_0 + \alpha_1 * CFCP_i + \alpha_2 * ARP_i + \alpha_3 * WEI_i + \varepsilon_i$$

For the last sub-objective, we set UER (Figure 4) as the dependent variable and WEI and IR as the explanatory variables. For this model, we set the effectiveness lag to be one month for CFCP and ARP, and set the effective period of CFCP to be one year. In order to find the impact of COVID19-led economic stimulus plans on the unemployment rate, we formed the model as following:

$$UER_i = \gamma_0 + \gamma_1 * CFCP_i + \gamma_2 * ARP_i + \gamma_3 * WEI_i + \gamma_4 * IR_i + \varepsilon_i$$

VI. Data Analysis

1. Main research objective analysis

Our main research objective is to find the impacts of the U.S. government fiscal stimulus plans on the development of the economy during the COVID19 pandemic, and we used WEI to reflect the economic situation. After running the OLS regression on the main model, we got the coefficients as following (Table 3):

$$WEI_i = 29.19 + 1.401 * CFCP_i + 10.41 * ARP_i - 0.000914 * PC_i + 0.243 * IP_i - 0.000688 * UEL_i + 0.00121 * DPI_i - 0.509 * CPI_i + \varepsilon_i$$

With R-squared equals 0.955, we can believe that the model we built fits the datasets pretty well. The CFCP and ARP dummies are of 99% significant level and so does the IP, UEL, DPI and CPI. This means that we can confidently use the coefficients of the CFCP and ARP dummy variables to explain the impacts of these stimulus plans on WEI.

With the coefficient of CFCP equals 1.401, we can say that on average, the implement of CFBCR, FFCRA, CARES and PPPHEA stimulus plans can improve the growth rate of the U.S. economy by 1.401 when holding all the other variables constant. The coefficient of the ARP dummy is 10.41 indicates that with the implementation of the ARP stimulus, the U.S. economy growth rate increased 10.41 when all the other factors unchanged. We also compared the coefficients of these two dummy variables. Although CFCP is about 1.6 times larger than ARP in terms of scale, ARP is around 7.4 times more effective in improving the economic level. One reason could be that the success of ARP is based on the CFCP, which contains many long-term economic incentives. Another reason could be that the Biden administration focused more on controlling the epidemic and ARP, which aimed more at solving public health problems, largely restored the public confidence.

2. First sub-objective analysis

For the first sub-objective, we want to learn the impacts of 2008 financial crisis-led stimulus plans and COVID19-led stimulus plans on U.S. GDP. The regression results (Table 3) are as following:

$$\begin{aligned} GDP_i = & 832.1 + 48.94 * BUSH_i + 66.93 * OBAMA_i + 122.8 * CFCP_i \\ & - 150.9 * ARP_i + 1.222 * PC_i + 0.739 * NX_i + 0.752 * GPDI_i \\ & + 0.0558 * GTE_i + \varepsilon_i \end{aligned}$$

The high R-squared value (0.9998) means that the variables in this model can reflect 99.98% of the variance of GDP. The coefficients of BUSH and OBAMA dummy variables are 48.94 and 66.93 respectively, which indicates that with 99% significant level, the issue of stimulus plans signed by Bush increased the U.S. GDP by 48.94 billion and the issue of stimulus signed by Obama increased the GDP by 66.93 billion. The coefficient of CFCP dummy (122.8) indicates that under the 99% significant level, the issue of CFBCR, FFCRA, CARES and PPPHEA stimulus helped recover the U.S. GDP by 122.8 billion. Compared the CFCP with BUSH and OBAMA, the COVID19-led stimulus plans launched before 2021 did around 2.5 times better than BUSH stimulus plans and almost 2 times better than the OBAMA stimulus. While for the ARP stimulus issued by Biden in March 2021, since the datasets we used is from 2007 quarter 1 to 2021 quarter 4 and we set one quarter lag for the effective date of the

stimulus plans, which led to a lack of observation problem, we got an unexpected regression result for the ARP dummy.

3. Second sub-objective analysis

The second sub-objective of our research is to find the effect of the COVID19-led economic stimulus plans on the U.S. inflation rate. The regression results (Table 3) are as following:

$$IR_i = 1.511 + 0.234 * CFCP_i + 0.584 * ARP_i + 0.0683 * WEI_i + \varepsilon_i$$

The R-squared (0.782) indicates that our model still fitted the data well. The regression results show that the implementation of stimulus plans during the COVID19 pandemic increased the inflation rate. To be specific, under the 95% significant level, the CFCP stimulus increased the U.S. inflation by 0.234 and under the 99% significant level, the ARP stimulus increased the inflation rate by 0.584. Compared the CFCP and ARP stimulus sets, we found that after the implementation of CFCP stimulus plans set, ARP did not help reduce the inflation while on the contrary, led to slightly higher inflation.

4. Third sub-objective analysis

The last research objective is to study the effects of the fiscal stimulus plans on U.S. unemployment rate. The regression results (Table 3) are as following:

$$UER_i = 7.174 + 2.293 * CFCP_i + 5.580 * ARP_i - 0.545 * WEI_i - 1.617 * IR_i + \varepsilon_i$$

The R-squared value equals 0.84 and it could be fairly high enough for us to use this model to explain the impacts of COVID19-led stimulus plans on the unemployment rate. However, the coefficients of CFCP and ARP are positive 2.293 and 5.58 respectively, which indicates that the implementation of fiscal stimulus plans did not help to reduce the unemployment rate and on the contrary, increased the unemployment. One explanation could relate to the effectiveness lag settings and lack of observations. Another explanation could be that the fiscal stimulus plans we discussed in this model did not try to directly or mean to reduce the unemployment rate, thus the coefficients of these stimulus dummies in this model actually reflect little about the real situation.

VII. Conclusion

For the main research objective, we found that these four fiscal stimulus plans enacted before 2021 and the ARP stimulus enacted by Biden all positively influenced the U.S. economy. Compared them we found that the ARP stimulus had a more effective impact in helping recover the U.S. economy. The implementation of CFBCR, FFCRA, CARES, and PPPHEA stimulus actually built a solid foundation for the success of the later fiscal policies. Therefore, any fiscal stimulus is essential for rescuing the U.S. economy from the shock caused by the COVID19 pandemic.

Focusing on the change in GDP, we compared the 2008 financial crisis-led stimulus plans with the COVID19-led stimulus plans. We found that both the stimulus packages signed by Bush and Obama in 2008 and the fiscal stimulus passed during the COVID19 pandemic had contributed significantly to the U.S. GDP. It is worth noting that the four stimulus packages enacted between March and April 2020 boosted GDP by more than twice as the 2008 stimulus. However, we still need more recent data to conclude the effectiveness of ARP as the available data is not enough for us to find the impact of ARP on U.S. GDP.

Finally, we studied the impacts of economic stimulus plans on the inflation rate and unemployment rate during COVID19 pandemic. The inflation rate has declined with the implementation of fiscal stimulus issued during the pandemic. Compared with the CFCP stimulus plans set, ARP has a more significant impact on reducing the inflation rate. Based on our study of the impacts of the stimulus packages on unemployment rate, we found that the unemployment rate still increased with the implementation of these policies. A possible explanation is that although the economic stimulus plan relieved the rapid increment of the unemployment rate, these policies did not directly reduce unemployment by creating jobs and they only offered welfare or rescue approaches. Therefore, reducing the unemployment rate still needs more efforts and time.

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Appendix

Figure 1. WEI

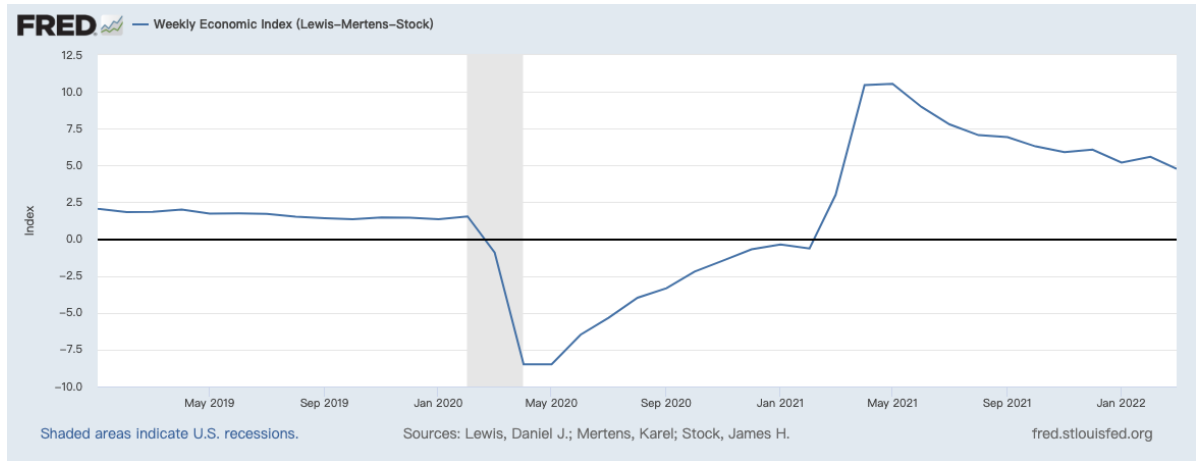


Figure 2. GDP

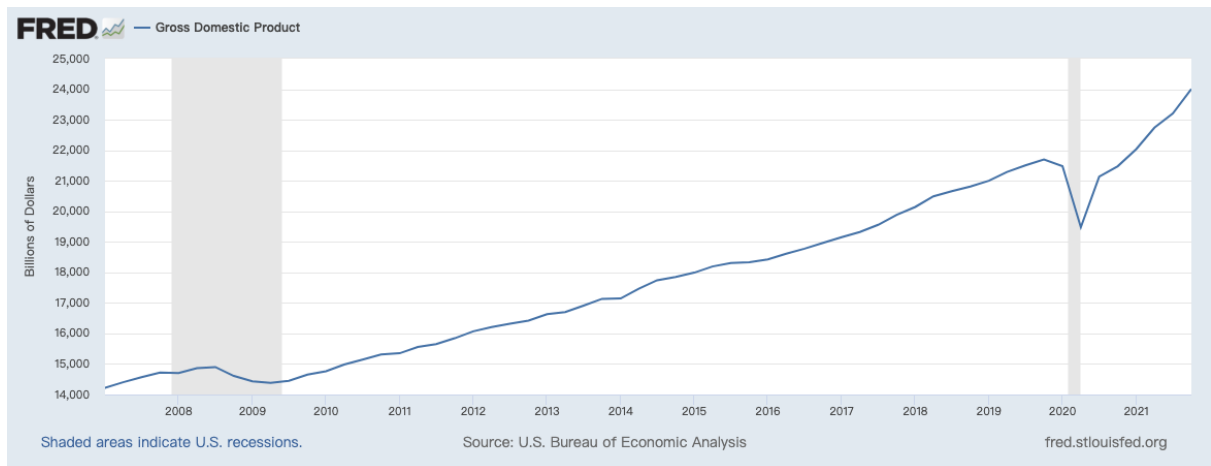


Figure 3. 5-Year Breakeven Inflation Rate

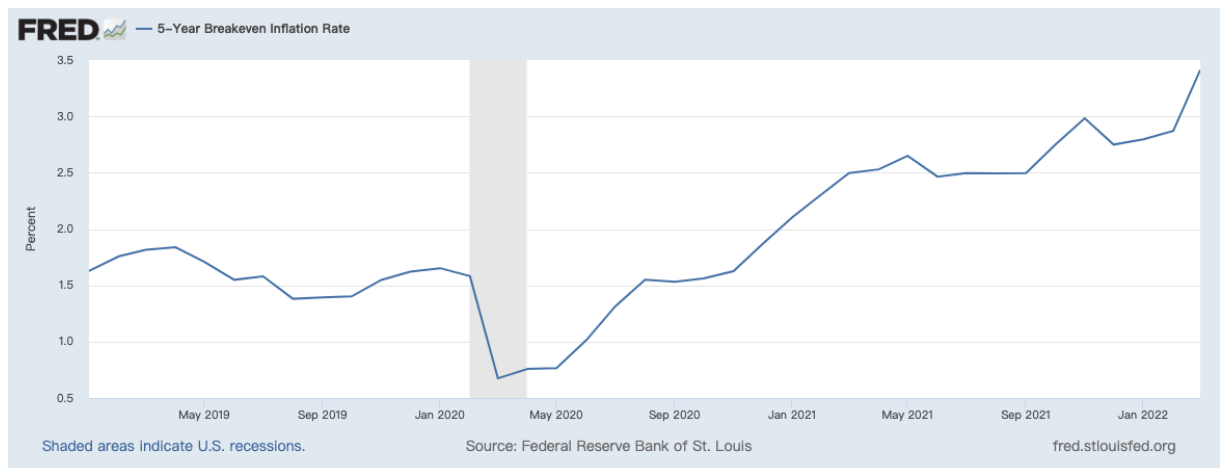


Figure 4. Unemployment Rate

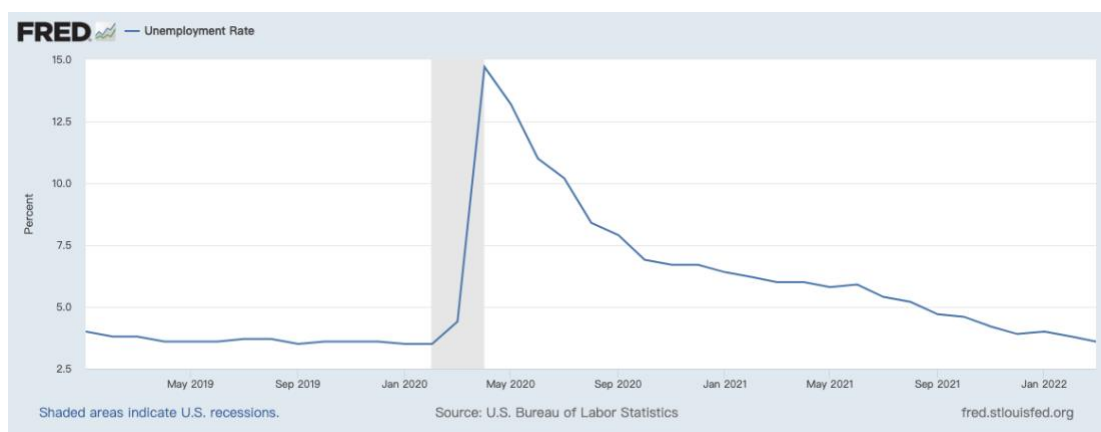


Table 1. U.S. Gov. COVID-19 Stimulus Plans

Stimulus Policies	Launched Time	Scale
Congressional funding bill for coronavirus response (CFBCR)	2020.3.6	8.3billion
Families First Coronavirus Response Act (FFCRA)	2020.3. 18	192billion
Coronavirus Aid, Relief, and Economic Security Act (CARES)	2020.3.28	2300billion
Paycheck Protection Program and HealthCare Enhancement Act (PPPHEA)	2020.4.24	483billion
American Rescue Plan (ARP)	2021.3. 11	1844billion
Infrastructure Investment and Jobs Act (IIJA)	2021. 11. 15	1200billion
Build Back Better Act (BBBA)	2021. 11. 19	1750billion

Table 2. Variable Description

Variable Name	Abbreviation	Source
Weekly Economic Index	WEI	https://fred.stlouisfed.org/series/WEI
Gross Domestic Production	GDP	https://fred.stlouisfed.org/series/GDP
5-Year Breakeven Inflation Rate	IR	https://fred.stlouisfed.org/series/T5YIE
Unemployment Rate	UER	https://fred.stlouisfed.org/series/UNRATE
Personal Consumption Expenditures	PC	https://fred.stlouisfed.org/series/PCE
Net Exports of Goods and Services	NX	https://fred.stlouisfed.org/series/NETEXP
Gross Private Domestic Investment	GPDI	https://fred.stlouisfed.org/series/GPDI
Government Total Expenditures	GTE	https://fred.stlouisfed.org/series/W068RCQ027SBEA
Industrial Production: Total Index	IP	https://fred.stlouisfed.org/series/INDPRO
Unemployment Level	UEL	https://fred.stlouisfed.org/series/UNEMPLOY
Disposable Personal Income	DPI	https://fred.stlouisfed.org/series/DSPI
Consumer Price Index: All Items	CPI	https://fred.stlouisfed.org/series/USACPIALLMINMEI

Table 3. Regression Results

	(1)	(2)	(3)	(4)
VARIABLES	WEI	GDP	IR	UER
BUSH	—	48.94*** (18.27)	—	—
OBAMA	—	66.93*** (22.25)	—	—
CFCP	1.401*** (0.370)	122.8*** (33.68)	0.234** (0.105)	2.293*** (0.466)
ARP	10.41*** (0.470)	-150.9*** (35.72)	0.584*** (0.173)	5.580*** (0.758)
PC	-0.000914 (0.000644)	1.222*** (0.0170)	—	—
NX	—	0.739*** (0.0720)	—	—
GPDI	—	0.752*** (0.0491)	—	—
GTE	—	0.0558*** (0.0108)	—	—
IP	0.243*** (0.0810)	—	—	—
UEL	-0.000688*** (0.000103)	—	—	—
DPI	0.00121*** (0.000188)	—	—	—
CPI	-0.509*** (0.138)	—	—	—
WEI	—	—	0.0683*** (0.0171)	-0.545*** (0.0852)
IR	—	—	—	-1.617** (0.662)
Constant	29.19** (11.34)	832.1*** (87.16)	1.511*** (0.0703)	7.174*** (1.027)
Observations	73	60	38	38
R-squared	0.955	1.000	0.782	0.840

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1