

DO STIMULUS CHECKS WORK?

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DEDICATION

To my family, for your unwavering support throughout my life.
Thank you for everything.

ABSTRACT
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The COVID-19 pandemic has greatly affected billions of lives around the world, and the CARES Act, the largest relief package in United States history was created to alleviate the effects of the pandemic. This policy introduced stimulus checks, direct payments to individuals and families that aimed to incentivize the consumption of goods and thus revive the economy. In this thesis I ask the question: do stimulus checks work? I try to answer this question using data from the Consumer Expenditure Survey, published by the Bureau of Labor Statistics, and utilizing household expenditures as a proxy for consumption in the economy. I format the data into aggregate monthly expenditures and calculate the monthly percentage change for 2019 and 2020 and find that returns in April-August 2020 seem abnormally larger than those seen in the same months in 2020. Using Python, I conduct three multiple linear regressions with varying sets of predictors to test whether the increase in expenditures for those months is indeed statistically significant. Among the findings uncovered by this analysis, I find that expenditures in April-July 2020 were, on average, \$206.63 USD higher than on other months. Additionally, expenses during those same months in 2020 were \$41.55 USD higher than other months in 2020 on average.

Keywords: stimulus checks, CARES Act, COVID-19, consumption, expenditures

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Introduction

The COVID-19 pandemic is an unprecedented global event that drastically altered the lives of almost everybody across the globe. Two years after the onset of the novel coronavirus, people have started to notice some positive shifts that have occurred as a product of the pandemic. However, the negative impacts loom larger. Countless lives have been lost, layoffs have left individuals with no financial security, and adjusting to a new way of life is a daunting task for many.^{1,2,3} Arguably the most poignant consequence of the pandemic has been the global economic recession. Millions of people have been left without job or financial security, left to figure out how support themselves and their families with whatever is left. Some countries, like the United States, have the ability to swiftly alleviate the effects of this economic downturn, but this is far from the reality for the rest of the world.

I was born and raised in Panama City, Panama. Although the Isthmus of Panama has stunning natural beauty and a stable economy when compared to the region, it lacks the financial prowess to deal with the recession rapidly and effectively. Newspapers and news programs would detail how the day to day lives of millions of Panamanians quickly dissolved into nothingness while I saw the government struggle to craft a response. Meanwhile, I saw the U.S. government passed the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) not even a month after COVID-19 was declared a pandemic by the World Health Organization (WHO). Although the CARES Act included many economic relief packages, I was mainly interested in what became a well-known policy: stimulus checks. I had never heard of these types of relief programs and was interested in how exactly they would affect the economy. All

through 2020 I heard people spending them in many different ways: buying clothes and gaming systems; paying bills, debt and spending it on anything that interested them. Once it was time to start thinking about my senior thesis, I remember asking myself these questions, and decided it would be an apt topic to research.

Furthermore, I would like to explain how researching the effect stimulus checks have on the economy is beneficial for the public, government officials, and foreign government officials. The implications of the stimulus checks, and the CARES Act at large, is crucial for tens of millions of American consumers and families who suffer from financial insecurity and unemployment because of the pandemic. Their futures almost completely hinge on how strong their financial and employment status is when the events of the pandemic subside; and the CARES Act aims to make those statuses as strong as possible. Thus, understanding the difference between the desired effects of the stimulus checks and the actual effects they had – in other words, understanding whether the stimulus checks achieved their desired effects and, if they fell short, how they failed to achieve their desired purpose.

Understanding the effect of stimulus checks on the economy is important because the public needs to become more aware about what are the desired effects of economic stimulus policies and if the policies fulfil their purpose. In the United States, the public is very divided, with the gap between the two parties seemingly becoming larger with each election cycle. This makes it increasingly difficult to find a candidate that accurately represents the views of the broader population. A more well-informed public will be able to bridge this gap, as they will identify candidates that represent their views more accurately.

Government officials and policy makers can also benefit from understanding the relationships between the desired and actual effects of stimulus checks. These individuals eventually draft, propose, and pass the policies that affect the broader American population. The relationships are especially useful for defining future policies that may be implemented in case another economic stimulus is needed. By analyzing the differences or similarities between the desired and actual effects of stimulus checks, policy makers can adjust policies implemented in the past in favor of policies that more accurately carry out their purpose. Additionally, they can align their policies within the limits of their political beliefs with what the public desires. This can include proposing policies that have an effect on a certain demographic, such as low-income households or individuals, or policies that look to increase the performance of economic variables, such as unemployment and consumption.

Finally, the use of stimulus checks in this pandemic can serve as a case study for foreign government officials. Alien policy makers can form takeaways from the economic effects of the stimulus checks and decide whether it is an appropriate policy to consider in case a similar situation is confronted in the future. Alternatively, they can use their takeaways to tweak existing policies aimed at relieving the current economic downturn. For example, Panamanian government officials can form takeaways from my analysis about stimulus checks and apply them to the current relief policies in place such as the *Vale Digital*. The *Vale Digital* is a recurring delivery of monetary resources to struggling individuals for them to fulfil their necessities such as buying food and medicine.

Setting aside my personal motivations for embarking in this thesis, I also must explain what this paper looks to achieve and the means I employ to do so. I have mentioned what I

hope to accomplish in this paper: do stimulus checks work? To do so, I need to find the effect the checks have on the consumption. For this thesis I decided to use the Consumer Expenditure Survey from the Department of Labor Statistics, which contains data on monthly household income and expenditures for a wide range of American consumers. I use aggregate monthly expenditures as a proxy for monthly consumption in the economy. To understand the effects of stimulus checks is to analyze and compare the aggregate monthly expenses for the months where the checks were distributed against the aggregate monthly expenses for the same month in the previous year. Through my analysis, I was able to pinpoint the effect, in USD, the stimulus check had on monthly expenses when compared to the previous year.

Regarding my analysis, I used both visual and statistical analyses to achieve my goal. First, I formatted the expenses into monthly aggregate expenditures and monthly percentage change of aggregate expenditures. This allowed me to visualize the data to recognize the months where the effects of the checks should be seen and provides a visual representation of the effects of the stimulus checks on monthly expenditures. To identify the tangible, quantitative effect of the stimulus checks on expenditures, I conducted three multiple linear regressions. I solely used different sets dummy variables for the three regressions. The coefficients of these sets of predictors allow me to estimate by how much the expenditures vary in 2020 when the checks were distributed to 2019 before the pandemic occurred and whether the increase or decrease in expenditures was statistically significant.

Background

Although most people are familiar with the background behind the pandemic, I wish to provide a brief background explaining the onset of the pandemic and the CARES Act, specifically the stimulus checks. However, I will only be providing background information for the time period relevant to this paper, which spans until the end of 2020. As the name suggests, the COVID-19 pandemic began in late 2019. On December 31, 2019, the WHO China Country office was informed of a novel, unknown virus that caused pneumonia-like symptoms in those infected.

Because of its highly infectious nature, the virus quickly spread across neighboring countries to China, the epicenter of the yet to be announced pandemic. By January 15, 2020, nearby countries such as Thailand and Japan had already reported confirmed, positive cases of the new coronavirus. On January 10th, the CDC published information about the virus on its website. Just 10 days later after publishing the information about the virus, the CDC reported the first confirmed case of COVID-19 in the United States in Washington state. After the White House Coronavirus Task Force is established on January 29, the task force declares the virus a national public health emergency. ⁴

On February 2nd, the United States imposed travel restrictions as air travel is limited across the globe. Nine days later, the WHO officially announces that the new virus will be known as COVID-19, short for coronavirus disease 2019. The spread of the virus quickly took over major cities around the world, with Italy becoming a hotspot for the virus in late February. As the spread reached near uncontrollable heights, the WHO officially classified the COVID-19 outbreak as a pandemic, the first since the A(H1N1) influenza pandemic of 2009. ^{5,6}

It was during the month of March that most countries started implementing containment strategies in attempts to curb the spread of the virus. It introduced lockdown measures on March 19th, just short of a week after President Donald Trump announced a national emergency due to the virus. The United States Senate approved the CARES Act on March 25th, and President Trump signed the bill into law on March 27th. On April 3rd, the United States imposed the now infamous mask mandate, recommending everyone to wear a mask while outside their home. A week later, the United States surpassed Italy as the global leader in reported COVID-19 deaths.⁷ During mid-April, the first stimulus checks started to be distributed, with most of them being delivered by mid-2020.⁸

Before continuing to the next section of this thesis, I want to provide some background on the CARES Act. The act was the economic relief bill passed by the United States to alleviate the economic downturn caused by the pandemic. Before diving into the details of the CARES Act, it is also important to highlight the timing during which this bill was passed. As I mentioned earlier in this section, the ratification of the CARES Act into law came just over a week after nationwide lockdown measures were imposed. During this time, most people believed lockdowns would last no more than a month, and our understanding of the virus was very shallow. The CARES Act arrived at a crucial time, it helped alleviate anxieties and uncertainties surrounding the novel pandemic and also helped American families to strengthen their financial status.

At a glance, it aimed to help American industries, families, workers, and small businesses through the pandemic. The bill was made up of \$2 trillion USD, making it the largest stimulus package in the history of the United States. It included grants and loans for small

businesses, unemployment benefits, direct payments to qualified individuals, financial aid for healthcare companies, loans to corporations, grants for airlines, financial aid for state and local governments, and blocks stock buybacks from large companies that receive aid from this package. Of the \$2 trillion USD, roughly 13% of it was allocated towards direct payments.⁹

These direct payments to individuals and families are delivered in the form of stimulus checks, the focus of this thesis. The U.S. government later approved the delivery of a second and third round of stimulus checks, but I will only be focusing on the first round in this thesis. To qualify for the first stimulus checks, there are four requirements one must fulfill to receive it. An individual must not surpass \$75,000 in adjusted gross income (AGI) or \$150,000 if filing as a married couple. Additionally, one cannot be a dependent of another person, have a valid Social Security Number, and qualify as a citizen or legal resident. For single individuals, they are eligible for up to \$1,200 or \$2,400 for a couple. If the person declares a dependent, \$500 extra dollars can be delivered for each dependent under the age of 17. The first stimulus check began distributing in mid-April 2020, while the second round of checks began delivery in December 2020 and the third in March 2021.¹⁰

Other policies in the CARES Act included the Paycheck Protection Plan (PPP), which provided loans for small businesses, allowing them to up to 2.5 times their average monthly payroll. Other programs include the Economic Injury Disaster Loans, which also provided loans for small businesses; the Pandemic Unemployment Insurance programs increased benefits and extended the eligibility of these benefits for those affected by the pandemic, and the Pandemic Emergency Unemployment program allowed those who drained their unemployment benefits to receive thirteen more weeks of benefits.¹¹

There were many more programs under the CARES Act umbrella, but to mention all of them would be unnecessary. The breakdown of the sources of for the CARES Act is as follows: 38% for loans, 13% for both direct payments and tax breaks, 11% for unemployment benefits, 10% for grants, and 14% for other spending. Households received most of the funding with 27% and closely followed by small businesses, who received 26% of the funding. Other recipients include large businesses receiving 23%, health providers and states & municipalities receiving 8% each, airlines received 3.3% while the Federal Emergency Management Agency (FEMA) received 2%; the rest of the funding (2.9%) was distributed among other recipients. Hopefully this provides a clearer idea of the CARES Act and the many areas it covered and aimed to alleviate economic insecurity.¹²

In the next sections of this thesis, I intend on explaining what exactly my analysis is and how it is different from what had been done. To understand the difference between my thesis and the previous work conducted in this field, I will first walk through some of the work I have researched in preparation for my analysis.

Literature Review

The CARES Act has been extensively studied because of the worldwide phenomenon that is the pandemic. However, a sizeable amount of the research done groups together the effects of the stimulus checks alongside those of the unemployment benefits also introduced in the act. Nonetheless, I also found a good portion of articles that dealt specifically with stimulus checks. Therefore, I decided to include papers researching both stimulus checks and the broader CARES Act in my literature review to provide a more holistic view on the work that has been

done in the field. I identified the articles falling into three categories, all of which I will detail in this section. These categories are: effects on economic variables, allocation of stimulus checks, and behavior of economic variables disregarding stimulus checks.

Using a complex, two-component model, Kaplan et al. (2020) provide a quantitative analysis between health outcomes and economic outcomes associated with the unemployment benefits and stimulus checks distributed by the CARES Act. They discovered that the stimulus check-unemployment benefit combination increased consumption by 2%. Carroll et al. (2020) also studied the effect of the CARES Act on consumption and found that consumption would not experience a strong recovery until preemptive requirements, such as social distancing, are abandoned. Deepening the analysis on economic variables, Bayer et al. (2020) found that the distribution of the stimulus checks caused the total economic output to decrease only 5%. Where the checks not distributed, the total economic output would have decreased by 20%. Additionally, Bayer et al. (2020) also found that the distribution of the stimulus checks resulted in a 0.5 multiplier for every dollar earned by the recipients. Kim and Lee (2020) turn to a voucher program in South Korea in an attempt to understand how stimulus checks may affect economic variables. Their findings detail that 30% of households across all income groups increased their spending and food consumption.

Other researchers turned their attention from the effects of stimulus checks to the allocation of the checks. Nygaard et al. (2020) concluded that by almost doubling the amount transferred in stimulus checks to low income and young consumers, the same effect of the stimulus checks could have been achieved at nearly half the cost of the current plan. Armantier et al. (2020) focus on how households can effectively allocate their stimulus checks. Their

research found that 35 percent of the checks were used to pay down debt, 36 percent was saved, and only 29 percent were used for consumption. Their analysis led them to conclude that, in the future, consumers should spend a larger portion of their stimulus checks to pay down debt and smaller portion on consumption.

There was also plenty of research dealing with the effects of other policies other than stimulus checks on economic variables. The effects of the pandemic on unemployment was the focus of Liu and Mai (2020), who found that occupations with a high need for physical contact experienced almost twice the amount of employment contraction than occupations with low suitability for remote work. However, occupations with low suitability for remote work also experienced a significant amount of employment contraction. A public database consisting of anonymized data from private companies was created by Chetty et al. (2020). In their paper, the group detailed that high-wage individuals cut their spending and experienced a V-shaped recession while low-wage individuals experienced large losses because of the decrease in spending of high-wage individuals. Indeed, most low-wage individuals worked in small businesses in wealthy areas that were forced to lay off employees because of the decreased spending by high-wage individuals. Janssen et al. (2021) evaluated the change in food consumption across three European countries during the first lockdown and found that 15 to 42 percent of individuals changed their food consumption during the pandemic. Baker et al. (2020) found that household spending increased over 40 percent in the first half of March but decreased by 25 to 30 percent by the end of the month.

The papers I have detailed in this section are incredibly useful to understand the effects stimulus checks and the broader CARES Act policies have on the economy. However, most, if

not all, of the papers attempt to project or predict the effect of the stimulus checks and the CARES Act policies. In my research, I am not trying to project any effects, but rather evaluate the performance of the stimulus checks compared to their desired effects.

Research Problem

As stated in the background section of this thesis, there were a total of three stimulus checks that were distributed. For this thesis, I decided to focus solely on the effects of the first stimulus checks, which were delivered starting on April 2020. At this point, the economy was on the decline and the United States government passed the CARES Act to alleviate the downturn; the stimulus checks were part of the CARES Act.

To understand the research problem of this thesis, it is important to understand the desired effects of the checks. Their purpose when they were distributed was to incentivize the public to spend the money distributed in these checks in the economy in any way possible. The result would be higher consumption, which would lift business and the people behind it from the recession. Thus, my research problem consists of evaluating the performance of the first stimulus checks in the months after they were distributed.

The performance of stimulus checks can be measured in variables such as unemployment rates and consumption. For the purposes of this thesis, the performance of the stimulus checks would be ideally measured as the increase or decrease in consumption attributable to the stimulus checks. An increase in consumption would reflect a positive performance of the stimulus checks, with a decrease in consumption reflecting a poor performance. Unfortunately, an issue arises when trying to calculate the fluctuations in

consumption as the data needed to calculate this volatility is difficult to obtain. Thus, I decided to use a proxy for consumption; I will detail more about the data and proxy I utilize in the later sections. Because I am using a proxy for my analysis, the measure of performance of the stimulus checks now shifts to measuring the increase or decrease the stimulus checks had on the proxy variable. It would be incorrect to assume a threshold that would dictate a performance as good or poor. Therefore, I interpret a statistically significant increase in the proxy variable as a good performance and a thoroughly statistically insignificant increase or decrease in the proxy variable as a poor performance. I will touch more on what I classify as statistically significant in the later sections that deal with the methods and results I utilized for this thesis.

Data and Methods

First, I will detail the data I used for this thesis followed by the methods. While researching possible datasets I could use, it proved difficult to find a publicly available dataset that contained consumption data in the format and granularity needed for this project. Thus, I decided that utilizing expenses as a proxy for consumption would be best.

I used the Consumer Expenditure Survey (CE) for the data in this thesis. It captures expenditure, income, and demographic data for American consumers. The survey records twelve-month estimates on expenditures and publishes a summary of them twice a year as well as providing annual microdata once a year; the intention behind collecting this data is understanding how American consumers spend their income. It is divided into two surveys: the Interview Survey for major and/or recurring items that the surveyed consumers are expected to

remember for three months or longer and the Diary Survey for minor, frequently purchased items. The Interview Survey include nine different files, all with varying periodicity that range from monthly to annual. The files contain a wide range of data from monthly income and expenditures to demographic characteristics of those surveyed in both detailed and summarized formats. I utilized the MTBI files, which details monthly expenditures in four files corresponding to the four quarters in the year. The Diary Survey is shorter than the Interview Survey, containing only five data files also with varying periodicity and contain much of the same information as the files in the Interview Survey.

The methodology for collecting this data varies. The Interview Survey utilized field representatives that interview – hence the name of the survey – consumer units (CUs) about their incurred expenses for the past three months. Thus, much of the data reported in this survey is organized into files corresponding to each quarter of the year. However, a caveat exists for the way the data is organized into the quarterly files. Interviews to CUs collect data for the last three months, so the Interview surveys often contain files corresponding to five quarters instead of four. The data reported in the fifth quarter files for the previous year represent data collected in interviews in January, February, and March of the current year. So the file for the fifth quarter in 2017 contains data collected in the first three months of 2018. This is done because the data for the end of 2017 has to be collected at the beginning of 2018 to be complete, and is also used to estimate data for the last month of 2017. It is included in a fifth quarter file because the data collected in 2018 references a data from 2017, so the data for the previous year was collected in the current year, deeming it out of scope. Thus, one needs to utilize data from the surveys of two calendar year surveys to estimate the full data for

a year. This is partially the reason why I used data from 2019 and 2020. This also means that the data for the last month of 2020 is incomplete. Unfortunately, it is impossible to complete the data from the 2020 survey since, at the time of writing, the 2021 survey is not yet released. I am only using the Interview Survey for this thesis, as it provided the most suitable data in terms of format and expenses.

Collecting data for the Diary survey is much more straightforward. The survey is called the Diary Survey because, unlike the Interview Survey, the data is not collected in interviews but rather is detailed in a diary by the CUs. The diaries are collected in two consecutive one-week intervals. Like the Interview Survey, this means that much of the data is reported in weekly formats.

Although the data is collected differently for the two surveys, the data for the quarterly and weekly files are both weighted using the same set of extensive and complicated formulas. This is done to correct the data in an attempt to portray a survey more representative of the broader population.

For my analysis I utilized multiple linear regressions to estimate the increase or decrease in the proxy variable. As I mentioned, I only utilized multiple linear regressions to estimate the effect of stimulus checks on monthly aggregate expenses. I conducted three regressions total, and they all follow the same formula. All of the predictors for all three regressions are dummy variables, but I use different, varying sets of the predictors for each regression. The formula for these regressions can be seen below.

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_n x_{in} + \varepsilon_i$$

In the equation above, y_i represents the dependent variable, which will always be the proxy variable for consumption in all three regressions. The term β_0 corresponds to the y-intercept while β_1 and β_2 represent the coefficients for x_{i1} and x_{i2} , which are the first and second predictor variables, respectively. β_n and x_{in} represent the coefficient and predictor variable for the n^{th} predictor variable, respectively. Finally, ε is the error term, otherwise known as the residuals.

In the next sections, I will further explain the process and variables used to complete the analysis as well as explain the results.

Results

In this thesis I conduct a visual analysis as well as a multiple regression analysis to evaluate the performance of the stimulus checks. To conduct the analyses, I used version 3.8.8 of Python through the Jupyter Lab interface version 3.0.14. In this version of Python, I utilized the pandas and statsmodels software libraries. Pandas provides the users with data manipulation and analysis tools, while statsmodels allows users to conduct complex statistical analyses on the data. I mainly used pandas to clean and further manipulate and format the data into a format that is suitable for visual and statistical analyses while I solely used statsmodels for multiple regression analyses.

For the visual analyses, I used the aggregate monthly expenses for all consumers in the CEX dataset and computed a monthly percentage change that I visualized in a line graph to identify possible increases in consumption. I then proceeded to carry out several multiple

regression analyses on the data to test whether the increase in monthly expenses was statistically significant or not.

The first step I took in my analysis was to calculate the monthly percentage change in monthly expenditures. However, before beginning my analysis I made sure to clean the data and check for any errors. The expenses were individually ledgered and, among other irrelevant information for my purposes, provided the year and month when it was incurred in different columns. I proceeded to create a date column that captured both the reference month and year. The final step before beginning my analysis was to aggregate and group the expenses by month. Finally, I calculated the percentage change in monthly expenditures. The table containing the change can be seen below. The “DATE” column refers to the month and year for which the expenses were incurred and aggregated. The “COST” column displays the aggregate cost of all the expenditures incurred in that month while the “CHANGE” column displays the percentage change in monthly expenditures.

DATE	COST	CHANGE
18-Jul	51,314,181	
18-Aug	101,410,079	97.63%
18-Sep	144,842,428	42.83%
18-Oct	143,653,442	-0.82%
18-Nov	142,553,146	-0.77%
18-Dec	141,414,507	-0.80%
19-Jan	140,311,620	-0.78%

19-Feb	139,962,663	-0.25%
19-Mar	144,768,934	3.43%
19-Apr	145,778,896	0.70%
19-May	139,814,387	-4.09%
19-Jun	143,280,778	2.48%
19-Jul	143,083,040	-0.14%
19-Aug	141,468,575	-1.13%
19-Sep	137,160,779	-3.05%
19-Oct	141,111,840	2.88%
19-Nov	138,810,526	-1.63%
19-Dec	151,685,291	9.28%
20-Jan	139,384,498	-8.11%
20-Feb	139,662,205	0.20%
20-Mar	141,913,878	1.61%
20-Apr	144,031,388	1.49%
20-May	141,111,012	-2.03%
20-Jun	153,048,731	8.46%
20-Jul	158,460,265	3.54%
20-Aug	164,796,616	4.00%

20-Sep	155,414,970	-5.69%
20-Oct	156,089,211	0.43%
20-Nov	150,924,645	-3.31%
20-Dec	163,452,288	8.30%
21-Jan	109,365,964	-33.09%
21-Feb	55,125,798	-49.60%

Table 1. Percentage Change of Monthly Expenditures

A quick glance at the table shows how expenses drastically increase and decrease in December and January. This, however, is due to cyclicalities as those months fall into the holiday season where gift-giving is common and widespread; thus, increasing expenses every year. Highlighted in yellow are the months of April to August in 2019 and 2020, as these months are of interest for this analysis. Because the majority of stimulus checks were not distributed until mid-2020 we can expect that the bulk of the effect of the checks to be seen between June and August. When comparing the monthly percentage change in monthly expenditures between June 2019 and June 2020, for example, we can see that the percentage change in monthly expenditures in June 2020 were just shy of 600 basis points (bps) higher than the percentage change in monthly expenditures in June 2019. We see the same effect in July and August where the difference in percentage change in monthly expenditures is 340 bps and 513 bps respectively.

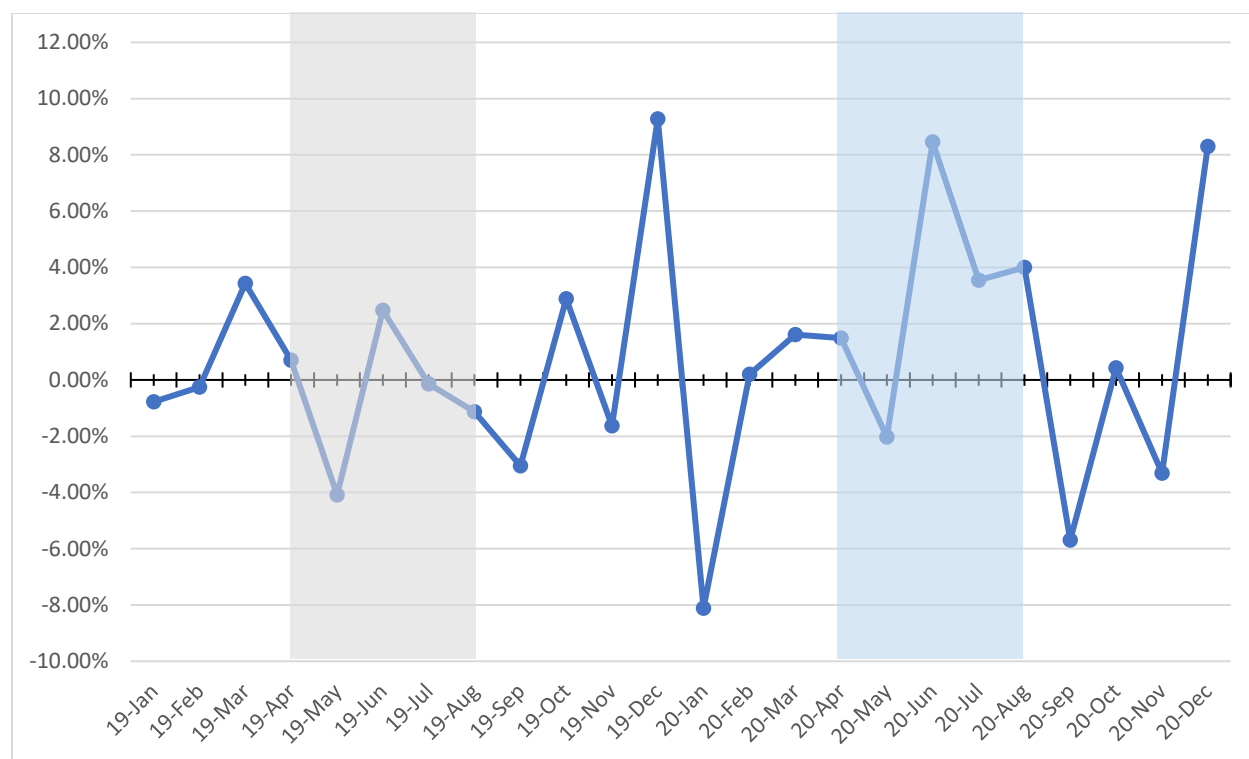


Figure 1. Visualization of Percentage Change in Monthly Expenditures

The graph above is a simple visualization of the percentage change in monthly expenditures, it helps us visualize how drastic the increase in percent change is when compared to the other monthly changes in expenditures. The grey shaded area is the April-August 2019 time period while the blue shaded area is the same time period for 2020. We can see how much more people were spending in the same time period for 2020 when compared to 2019.

Although the increase in the percentage change of monthly expenditures is probably due to the effects caused by the stimulus checks, more analyses are need to prove that stimulus checks are the cause of the increase. Therefore, I continued my analysis by running a series of multiple linear regressions to test whether the increase in expenditures was indeed

due to the stimulus checks. All of these regressions were comprised of only dummy variables. It is important to note that the data used for these regression analyses is the same as the one used in the first part of my analysis, but the regressions use individual-level expense data and not the monthly aggregated expense data I used for the first part of my analysis. It is important to note why I utilized individual expenditures and not aggregate expenditures in these regressions. Additionally, the coefficients of the dummy variables I utilize in this analysis represent the increase or decrease on individual expenditures rather than on monthly aggregate expenses. For example, if we find that the coefficient for the dummy variable representing expenses in April 2020 was 150, then that means that, on average, a single, individual expenditure incurred in April 2020 was \$150 USD higher than a single expenditure in any other month. This stays true for the results for all three regressions. I will explain in depth what every regression is testing for and their results later in this section, but I will take a minute to first explain what all of the variables in the regressions mean.

I carried out three multiple linear regressions, all containing solely dummy variable predictors. There is a series of dummy variables that appear in every regression. These are dummy variables indicating whether an expense took place in a specific month regardless of the year. They are named by the three-letter abbreviation of the month followed by “_dum”. For example, “jul_dum” will equal 1 if the expense was incurred in either July 2019 or July 2020 and 0 otherwise. There are a total of eleven of these dummy variables; I did not create one for January as its effects would be captured by the constant. The next series of dummy variables are similar to the first set of variables but check whether an expense was specifically incurred in a specified month in 2020. These are named similarly to the first set of variables, with the name

consisting of the three-word abbreviation of the month followed by “_check”. The variable “may_check” is equal to 1 if the expense was incurred in May 2020 and is 0 otherwise. There are only six variables of this kind, one for each month in the February-July 2020 time range. Lastly, there are two more dummy variables that need to be explained. The “post_check” dummy variable is equal to 1 if the expense was incurred any time between April-July 2020 while the “2020_check” variable is equal to 1 if the expense was incurred during any month in 2020. I have provided a table below that summarizes all of the variables I used in my regression analysis.

Variable Name	Description
feb_dum	Indicates whether an expense was incurred in February regardless of the year
mar_dum	Indicates whether an expense was incurred in March regardless of the year
abr_dum	Indicates whether an expense was incurred in April regardless of the year
may_dum	Indicates whether an expense was incurred in May regardless of the year
jun_dum	Indicates whether an expense was incurred in June regardless of the year
jul_dum	Indicates whether an expense was incurred in July regardless of the year
aug_dum	Indicates whether an expense was incurred in August regardless of the year
sep_dum	Indicates whether an expense was incurred in September regardless of the year
oct_dum	Indicates whether an expense was incurred in October regardless of the year
nov_dum	Indicates whether an expense was incurred in November regardless of the year
dec_dum	Indicates whether an expense was incurred in December regardless of the year

feb_check	Indicates whether an expense was incurred in February 2020
mar_check	Indicates whether an expense was incurred in March 2020
abr_check	Indicates whether an expense was incurred in April 2020
may_check	Indicates whether an expense was incurred in May 2020
jun_check	Indicates whether an expense was incurred in June 2020
jul_check	Indicates whether an expense was incurred in July 2020
post_check	Indicates whether an expense was incurred any time between April-July 2020
2020_check	Indicates whether an expense was incurred in 2020

Table 2. Summary of Variables Used in Regression Analyses

The first regression that I conducted included the first set of variables I described, which are also in every regression, and the “post_check” variable. The intention of this regression was to test whether if expenses incurred between April-July 2020 were, on average, higher and statistically significant than those incurred in every other month. The results of the regression are below.

Model:	OLS	Df Residuals:	3338489	
Dependent Variable:	COST	R-squared:	0.000	
No. Observations:	3338502	Adj. R-squared:	0.000	
Df Model:	12			
	Coef.	Std.Err.	t	P> t
const	985.4041	17.6975	55.6803	0.0000
feb_dum	14.8601	25.1239	0.5915	0.5542
mar_dum	57.6592	25.2320	2.2852	0.0223
apr_dum	3.9129	26.6242	0.1470	0.8832
may_dum	-38.6323	26.6250	-1.4510	0.1468

jun_dum	-13.2513	26.5669	-0.4988	0.6179
jul_dum	-27.9797	26.4633	-1.0573	0.2904
aug_dum	86.7090	24.9881	3.4700	0.0005
sep_dum	68.3495	25.1671	2.7158	0.0066
oct_dum	108.0347	25.3036	4.2695	0.0000
nov_dum	74.6117	25.2675	2.9529	0.0031
dec_dum	96.6839	24.8688	3.8878	0.0001
post_check	206.6312	18.0344	11.4576	0.0000

Table 3. First Regression Analysis Results

The results of this regression were very encouraging. With a coefficient of 206.63 and a p-value of 0.000, the “post_check” predictor was statistically significant. This means that, on average, the expenses incurred in April-July 2020 were \$206.63 USD higher than on other months. Although the results are encouraging, there are other potential regressions I thought of that could help provide more clarity on which months experienced the biggest increase due to the stimulus checks.

The second regression I ran contains the same predictors as the first one, but the “post_check” predictor was swapped out for the set of variables that check if the expenses were incurred in certain months in 2020. I was interested in seeing which months were significant and how much larger were the expenses in those months. The results are below.

Model:	OLS	Df Residuals:	3338484	
Dependent Variable:	COST	R-squared:	0.000	
No. Observations:	3338502	Adj. R-squared:	0.000	
Df Model:	17			
	Coef.	Std.Err.	t	P> t
const	985.404	17.6975	55.6805	0.0000
feb dum	-39.4612	30.2328	-1.3052	0.1918

mar_dum	-14.8102	30.1532	-0.4912	0.6233
apr_dum	-7.84236	30.1552	-0.2601	0.7948
may_dum	-40.31	30.2344	-1.3332	0.1825
jun_dum	-10.0746	30.3042	-0.3325	0.7395
jul_dum	-17.6002	30.2407	-0.5820	0.5606
aug_dum	86.709	24.9880	3.4700	0.0005
sep_dum	68.3495	25.1670	2.7158	0.0066
oct_dum	108.035	25.3035	4.2696	0.0000
nov_dum	74.6117	25.2674	2.9529	0.0031
dec_dum	96.6839	24.8687	3.8878	0.0001
feb_check	115.401	35.7267	3.2301	0.0012
mar_check	158.467	36.1010	4.3895	0.0000
apr_check	233.122	36.6522	6.3604	0.0000
may_check	210.341	36.4531	5.7702	0.0000
jun_check	199.871	35.8853	5.5697	0.0000
jul_check	185.087	35.3283	5.2391	0.0000

Table 4. Second Regression Analysis Results

All of the “_check” variables were statistically significant predictors, with all having p-values of 0.000 except for “feb_check” which had a p-value of 0.001. For this set of predictors, I decided to include February and March in the series because I was interested in seeing how the expenses after the stimulus checks were distributed compared to those before the checks were distributed. We can see that the predictors for April-July 2020 all had larger coefficients than the predictors for February and March. A pleasant surprise came when the “apr_check” predictor was the largest coefficient of the set, with May being the second largest with values of \$233.12 USD and \$210.34 USD respectively. This suggests that the effect of the stimulus checks could be seen more dramatically in the first couple of months since the checks were distributed. Alternatively, this increase in expenses could be a reflection of consumers spending more money on supplies as they prepared for the long quarantine ahead. Regardless, the effect

of the checks in increasing the monthly expenses is likely illustrated in the coefficients for the April-July “_check” variables.

Finally, the last regression was intended to provide more transparency on the difference in coefficients among the 2020 months. Thus, this regression includes the standard set of dummy variables and the “post_check” and “2020_check” variables. I am looking to see how much larger, on average, were expenses during the time range I am interested when compared to the rest of the months in 2020. The results for the final regression are below.

Model:	OLS	Df Residuals:	3338488	
Dependent Variable:	COST	R-squared:	0.000	
No. Observations:	3338502	Adj. R-squared:	0.000	
Df Model:	13			
	Coef.	Std.Err.	t	P> t
const	906.1346	18.70598	48.4409	0.0000
feb_dum	16.42207	25.12352	0.6537	0.5133
mar_dum	61.43368	25.23296	2.4347	0.0149
apr_dum	83.18245	27.30454	3.0465	0.0023
may_dum	40.63725	27.30533	1.4883	0.1367
jun_dum	66.01821	27.24868	2.4228	0.0154
jul_dum	51.28987	27.14766	1.8893	0.0589
aug_dum	84.89663	24.9878	3.3975	0.0007
sep_dum	67.48896	25.16659	2.6817	0.0073
oct_dum	108.4471	25.30299	4.2859	0.0000
nov_dum	76.02993	25.26707	3.0091	0.0026
dec_dum	96.62695	24.86812	3.8856	0.0001
2020_check	165.0827	12.62087	13.0801	0.0000
post_check	41.54854	22.01154	1.8876	0.0591

Table 5. Third Regression Analysis Results

In this regression we can see that expenses for the months of 2020 were, on average, \$165.08 higher than those for the months of 2019. This predictor was statistically significant with a p-value of 0.000. I have been utilizing a p-value tolerance of 0.05 for this analysis, meaning that any predictor with a p-value less than 0.05 is statistically significant. Following this tolerance, the p-value for the “post_check” variable is just slightly over the threshold with a p-value of 0.059. Although this is not the ideal result, it is still an interesting result that yields important insights. The coefficient was \$41.55 USD, which means that, on average, expenditures for the time period between April-July 2020 were that much higher than in other months in 2020.

Conclusion and Limitations

Overall, I believe it is appropriate to say that this thesis found that stimulus checks did indeed fulfill their purpose and increased expenditures. When compared to the months in 2019, expenses in April-July 2020 were \$206.63 USD higher on average. Further insights can be obtained when we evaluate the effect of stimulus checks on each month between April and July 2020 instead of evaluating the combined effect it had during that time period. When evaluating those individual effects, we find that April 2020 experienced the highest spike in expenditures out of all the months following the distribution of the stimulus checks. On average, expenditures were \$233.12 USD higher when compared to other months. Expenditures in May were, on average, the second highest when compared to other months as the regression analysis uncovered a \$210.34 increase in expenditures. This points out an interesting trend, which suggests that the effects of the stimulus checks may have been felt earlier than expected.

As I discussed when I reviewed my findings when visualizing the monthly percentage change in aggregate monthly expenditures, it seemed as if the increase in expenditures in June and July were the most abnormal. However, the regressions suggest that expenses in April and May 2020 were higher than those in June and July 2020; those were, on average, \$199.87 and \$185.09 USD higher than other months. Thus signifying that consumers were spending their stimulus checks earlier than expected, or that the increase in expenses may have been due to consumers spending more money in stocking up supplies for an elongated quarantine. Instead of only comparing the increase in expenses to those in 2019, I also found that expenses during April and July 2020 were just \$41.55 USD higher when compared to the months in 2020. Additionally, expenditures in 2020 were, on average, \$165.08 USD higher than in 2019. All of these findings suggest that, indeed, stimulus checks did increase household expenditures, which is a proxy for consumption in the larger economy.

As I mentioned in the introduction of this thesis, I pointed out that the general American public, public officials, and foreign officials can draw meaningful takeaways from this thesis and implement them in their future decisions. These three groups can all understand an estimate for how much the stimulus checks incentivized spending in the economy after reading this thesis, but the main takeaway from this thesis is that they work, and that they fulfilled their purpose. Thus, these three groups can utilize this takeaway to drive their decisions. The general American public can now adjust their voting preferences using the findings in this thesis. If a consumer believes that the increase expenditures caused by stimulus checks detailed in this thesis were not large enough, they can choose to vote for policymakers that use different policies. On the other hand, a consumer may be convinced that he increase in expenditures

detailed in this thesis were large enough and can vote for policymakers that want to include this policy in future relief packages.

Regarding government officials, they can also apply the findings from this thesis to their future policies. Like the American public, if a government official believes that the increase in expenditures was not enough, they can tweak their proposed policies to further incentivize larger consumption. Alternatively, they can decide that stimulus checks work perfectly well and continue to implement this policy in the future. A similar application goes to foreign government officials. Take the example of the *Vale Digital* in Panama. Panamanian government officials can see from this paper that larger, less frequent direct deposits to individuals and families yield statistically significant increases to household expenditures. The *Vale Digital* is a more frequent, but smaller direct deposit program that can be tweaked and improved. The Panamanian government officials can use their takeaways from this thesis and implement them into their existing *Vale Digital* program to increase its efficiency and effects.

I find it appropriate to also explain some of the limitations of this study. One major limitation comes from the data. Although the CEX is a fantastic dataset that allows researchers to draw a multitude of insights from it, it is not the best data for this study. A dataset with more expenditures and information about whether a CU received a stimulus check, how much was it, and when it was received can help provide more robust insights as well as eliminate any biases that may be present in this analysis. Additionally, a better dataset would have allowed me to conduct more analyses apart from regressions such as event studies.

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