The Effects of Quantitative Easing on the Economic Growth of the United States

Sheheryar Ahmed

Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master
of
Business Administration

Eastern Mediterranean University
September 2021
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Ali Hakan Ulusoy
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Business Administration.

Prof. Dr. Melek Şule Aker
Chair, Department of Business Administration

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Business Administration.

Prof. Dr. Melek Şule Aker
Supervisor

Examining Committee

1. Prof. Dr. Ahmet Aker

2. Prof. Dr. Melek Şule Aker

3. Prof. Dr. Mehmet Haluk Köksal

ABSTRACT

In the dark times of the economic crises of 2008, The United States implemented economic policies that were uncommon and unorthodox to many of the economists. An economic activity known as Quantitative Easing (QE) was performed in which the FED provided liquidity to the market by purchasing financial assets from the government and the private sector. Some economists agree with the decisions made by the FED, whereas others are not so optimistic about them. In this study I analyze how the economic growth of United States is affected by different variables including QE.

I conducted a multiple regression analysis over the period of Jan 2006 to July 2021-with GDP growth rate being the dependent variable and the independent variables being QE (M2 money supply rate), Inflation rate, Interest rate and Exchange rate (USD to EUR). The results showed that there is a strong negative relation between the GDP rate and M2 money supply rate which shows that QE might have rescued the US economy through the recession though not considering the consequences it could lead to.

Keywords: Macroeconomics analysis, Federal Reserve, Economic Policy

ÖZ

2008 ekonomik krizinin karanlık zamanlarında, Amerika Birleşik Devletler, pek çok ekonomist için alışılmadık ve alışılmışın dışında olan ekonomik faaliyetler gerçekleştirdi. Quantitative easing (QE) olarak bilinen ekonomik faaliyet FED'in hükümetten ve özel sektörden varlık satın alarak piyasadaki nakit parayı arttırmak politikası olarak tariff edilebilir. Bazı ekonomistler FED'in aldığı kararlara katılıyor, buna karşılık diğerleri bu konuda pek iyimser değil. Bu, tezde Amerika Birleşik Devletleri'nin büyümesinin QE dahil farklı değişkenlerden nasıl etkilendiğini analiz edilmektedir.

Analiz Ocak 2006 ile Temmuz 2021 arasında çoklu regresyon methoduyla yapılmıştır. GSYİH büyüme oranı bağımlı değişken ve QE (M2 para arzı oranı), Enflasyon oranı, Faiz oranı ve Döviz kuru (USD - EUR) bağımsız değişkenler olarak kabul edilmiştir. Sonuçlar, GSYİH oranı ile M2 para arzı oranı arasında güçlü bir negatif ilişki olduğunu gösterdi; bu, QE'nin yol açabileceği sonuçları dikkate almadan ABD ekonomisini durgunluk yoluyla kurtarmış olabileceğini gösteriyor.

Anahtar Kelimeler: Makroekonomi analizi, Federal reserve, ekonomik politika

ACKNOWLEDGMENT

I would like to record my gratitude to Prof. Dr. Sule Aker for supervising me through-out the writing of this thesis. At times when I felt lost or unsure, she guided me to what precisely I needed to do. As my thesis evolved, she saw the gaps that needed to be filled and directed me accordingly. I am more than grateful that I got her as my supervisor and it was surely an amazing experience for me.

Furthermore, I would like to give my love and gratitude to my mother and sister who supported and inspired me through-out the period of my thesis. They always had my back when I needed them the most. This encouragement is only effective when the close ones are supporting you. I give thanks to my close friends also who believed in me and I am amazed by how their optimism reflected on me.

PREFACE

The basis of this thesis originated from my passion in learning how money works. I believe every system can be understood if one understands the economic system of it. This is why everything in the world from sports to politics can be linked with money. Ever since U.S. dropped out of the Gold Standard in 1971, the world experienced a roller coaster of financial experiences. Essentially, all currencies in a "floating exchange" rate system abide by the laws of supply and demand. As for the United States (issuing the world reserve currency), it can be assumed that the country would get room to inflate their economy to keep up the growth.

It has been 50 years since Nixon pulled out of the Gold Standard. Although the U.S. has been an example and the hub of capitalism, some great minds in economics sense a collapse of the U.S. economic system. Robert Kiyosaki – The author of the book (Rich Dad Poor Dad), Mike Maloney – A famous economist and a precious metal investor, Michael Burry – A famous investor and a whistle blower of the 2008 housing bubble and many more believe that NO fiat currency backed by just confidence lives forever.

The United States adapted the unorthodox methods of "Quantitative Easing" during the economic crisis of 2008, which may reflect a significant weakness in the U.S. economic system. It became a motivation for me in understanding how the unconventional policy works and how it impacts the U.S. economy.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

It was in November 2008 when the first round of quantitative easing (QE) was launched in the US; an unconventional economic policy adapted due to the 2008 housing economic crises in the United States of America (US). Prior to the 2008 crises, the Federal Reserve (FED) used its federal funds rate to balance the inflation in the US economy. If the economy experiences overgrowth that can lead to hyperinflation, the FED would increase its federal funds rate to reduce borrowing, meaning that the cost of borrowing such as loans, credit, mortgages etc. would increase. On the other hand, if the economy stagnates and leads to recession the FED will decrease its federal funds rate to stimulate borrowing and spending of credits (Amadeo, The Balance, 2021).

Due to the collapse of housing bubble in 2008, the economic growth stagnated beyond expectations; hence, the FED lowered the federal funds rate to "zero-lower bound" to stimulate borrowing. Zero-lower bound is a term given to short-term interest rates which are near 0%. The purpose of it is to stimulate the economy by lending money with close to zero interest rate. This increases the demand for borrowing, which in turn stimulates the economy (Mitchell, 2021). The impact of the crisis however gave a glimpse of a recession on the horizon. The zero-lower bound of federal funds rate was deemed not effective enough as a tool to recover from the housing crises. That is when an unorthodox economic policy such as quantitative easing was adapted.

Quantitative easing is a program through which the FED provides liquidity to the economy by purchasing assets such as long-terms securities, mortgages, bonds etc. from U.S. government, commercial banks and in the open market. The intent of this program was to "jump start" the economy by providing monetary support in the form of liquidity. According to the FED's balance sheet, they had $870 billion in August 2007 in their reserves and by the early 2015, they had accumulated $4.5 trillion (FED, Board of Governors of the Federal Reserve System, 2021). It goes without saying that recent events of Covid-19 have the FED on its toes and "QE infinity" has been implemented. As of July 2021, the FED has expanded its balance sheet to $8.2 trillion (FED, Board of Governors of the Federal Reserve System, 2021).

This paper will be focusing on the relationship between all four QE rounds launched by the FED in contrast with economic growth in the United States. The dependent variable will be GDP growth and the independent variables are QE, inflation, interest rate, and exchange rate. The Hypothesis of this paper is as follows:

H1: QE should demonstrate a positive impact on the GDP growth of US (At least in the short term).

The general consensus would be comparing the QE rounds to Fisher's equation of money supply. When comparing QE program with the Fisher's equation of "quantity theory of money (MV=PT)", the comparison suggests that prices would increase if money supply increases. However, Fisher's equation is applicable in traditional monetary policy of interest rates but irrelevant in unconventional monetary policy of QE. This is perhaps down to the way QE is set up and the channels that are used to inject this liquidity into the financial sector. The liquidity provided comes in the form of Federal Reserve Deposits which are accessible to the commercial banks but not general public. Regardless, money is money in any form that has value and the

Federal Reserve Deposits provide that liquidity for banks to lend and exchange money more conveniently between themselves. It also helps in keeping the short-term interest rates low to stimulate borrowing. This form of money supply might be unusual but the hypothesis is that it does work and it should have some impact on the growth rate of the US. However; it goes without saying that QE is relatively a new phenomenon adopted by the US, the implication of QE on the long run can be very different. This thesis does not cover the long-term implications of QE on the GDP growth rate of the US.

H2: Inflation should have a positive impact on the GDP growth

Since we are looking at a timeframe in which the economy of the US suffered a recession, the inflation of the economy theoretically should assist the GDP growth to the benchmark of 2% during that timeframe. On the other hand, if the inflation rises without contributing to GDP growth, it would lead the US economy to stagflation. The US economy did experience a degree of stagflation in 2008 due to a fall in energy prices and the banks hoarding to cash in reserves; however, the overall consumer prices other than energy continued to rise (Estevez, 2021). To conclude H2, if the economy does not stagnate and inflation rate does not exceed 2%, the inflation rate should contribute positively to GDP growth.

H3: Interest rate should represent no correlation with GDP growth.

Interest rates set by the FED is the prime control of monetary policy when controlling the growth of economy. It is either expansionary monetary policy when under 2% inflation rate or contractionary monetary policy when above 2% inflation rate. Nevertheless; in the timeframe of our study, the interest rate was mostly at zero-lower bound. Meaning that the FED has reached the max capacity of lowering the

interest rates. Surely it still has an impact on the GDP growth but the hypothesis is that it is insignificant when compared to the impact of QE on GDP growth.

H4: Exchange rate between the US dollar to euro should have positive impact on GDP growth.

All is not bad for a depreciating US dollar in a recession as it opens ways to other opportunity costs. As the US dollar falls in relevance to euro, the price of products in the US falls compared to products abroad. This leads to a higher export from the US and a decline in imports, thus increasing the GDP growth rate.

1.2 QE timeline

The "multiple regression" method is used and our timeline of observation is on a span of 15 years starting from January 2006 and ending in June 2021. The rounds of quantitative easing are not single events but rather a bunch of large-scale asset purchases in a given period. The FED does not correlate their LSAP (Large Scale Asset Purchases - a formal method of saying Quantitative Easing) program announcements to a given QE round. Hence it is unclear for anyone to really point out when a particular QE round starts or ends. The timeline of QE implementation adapted are as follows:

"QE1) November 2008 - September 2010 (Yardeni, 2019)

QE2) September 2010 – October 2012 (Yardeni, 2019)

QE3) September 2012 – October 2014 (Yardeni, 2019)

QE4) March 2020 – June 2021" (Liesman, 2020)

The first three rounds of QE accumulated about $4.5 trillion in FED's balance sheet through a time span of 7 years. When the signs of recovery were imminent, The FED gradually reduced assets in their balance sheet in order to return back to the norm. The FED slowly but surely reduced their balance sheet down to $3.8 trillion by late 2019. Unfortunately, the world-wide pandemic took place soon after. Ever since the

pandemic took place, the FED has decided to unleash its full potential and print as much as they can to sustain the economic damage.

The graph below, Figure 1 shows the asset purchases by the FED in its balance sheet:

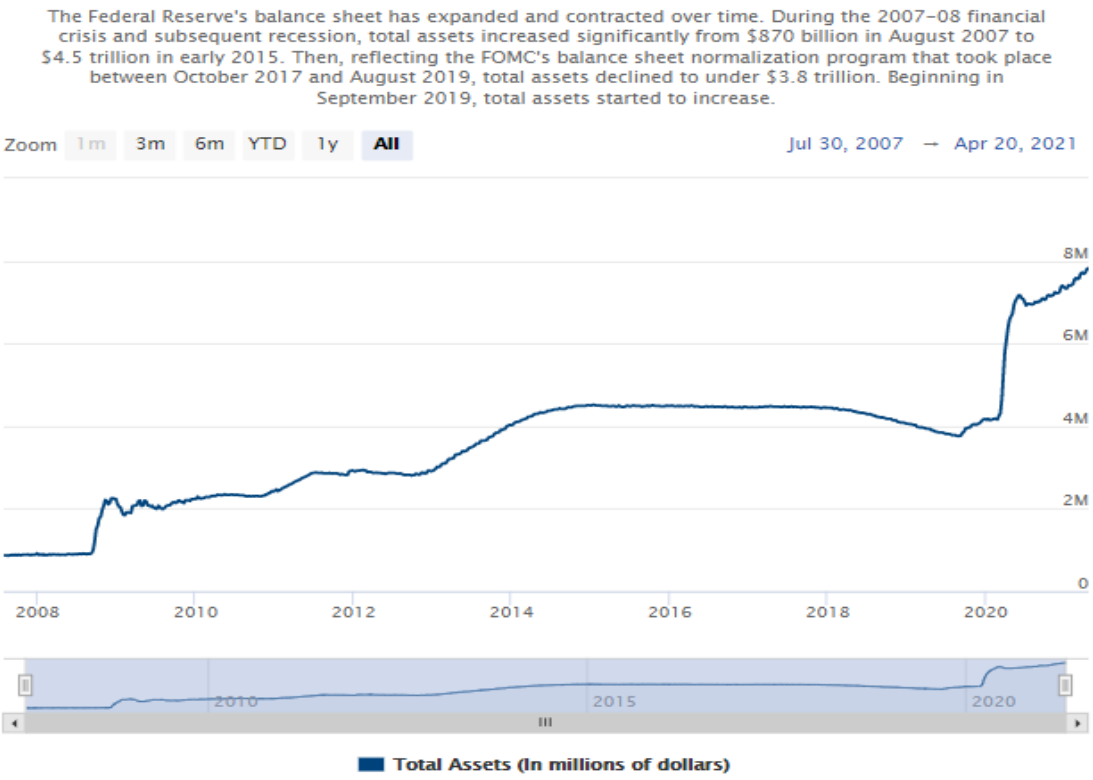

Figure 1: Total assets in FED's balance sheet
Source: (FED, Board of Governors of the Federal Reserve System, 2021)

Chapter 2

LITRATURE REVIEW

The Federal Reserve is the central bank of the United States. The FED's responsibilities fall under four main categories but not limited to:

a- Conducting monetary policy to achieve high employment and stable prices by manipulating the money and credit conditions.

b- Regulating the banking and financial system to protect the credit rights of consumers.

c- Maintain and contain systematic risk that may arise in the economy and in financial markets.

d- Providing financial services to the U.S. government, U.S. financial institutions and foreign official institutions.

(FED, What is the purpose of the Federal Reserve System, 2016)

How FED conducted its monetary policy prior to 2008 is more commonly known as "conventional" monetary policy. As mentioned in the introduction, the FED used the federal funds rate to influence the money and credit conditions. That way the FED can achieve stable prices and keep the inflation limited to two percent a year. However, the blue swan event of 2008 cornered the FED in taking extreme measures.

The housing bubble, which was filled with millions of sub-prime mortgages collapsed and the FED had to rescue the banking/housing sector (Denning, 2011). First, the federal funds rate dropped to zero-lower bound to stimulate borrowing. When the conventional monetary policy failed to recover the market, the FED launched its

first QE program on November 25th 2008 to purchase the "bad assets" (i.e. Mortgage Backed Securities). We will be looking at the four QE rounds individually in later paragraphs.

2.1 Gross Domestic Product

The growth of an economy is either measured by the country's total expenditures, total production or its total income. It is more common for countries to evaluate their GDP on expenditure methods rather than income methods. The GDP is calculated as follows as stated in Equation (1):

Gross Domestic Product = Consumption (C) + Investment (I) + Government spending (G) + Net exports (NX) (1)

Consumption, Investment and government spending are all pretty straight forward, however; there is a misconception about how the net exports impact the GDP of a country. The net exports = exports – imports, an increase in exports adds to the GDP but an increase in imports does not necessarily decrease the GDP. A perfect example is demonstrated in economic research by Scott A. Wolla where he explains that if a consumer imports a vehicle for $30,000 then this would add to "consumption (C)" whereas $30,000 would be subtracted in net exports simultaneously, leaving the GDP unchanged (Wolla, 2018).

The following graph is a representation of the GDP scaled from the year 2000 to 2021 by the Bureau of Economic Analysis.

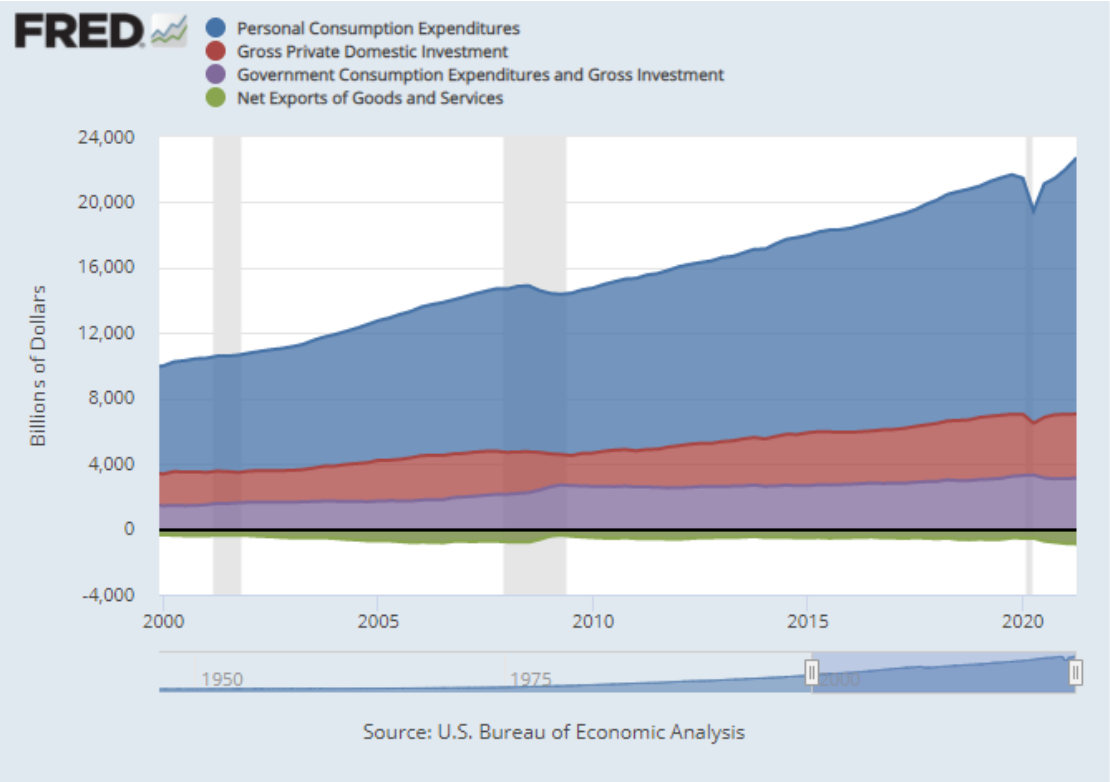

Figure 2: The GDP of the US (2000-2021)
Source: Bureau of Economic Analysis, 2021
Note: The scale of US dollars on the Y axis range from $0 to $24 trillion USD

All four variables that constitute the GDP (C + I + G + NX) are affect by Inflation, Interest rate, Exchange rate and expectedly Quantitative Easing in one way or the other. The aim of this paper is to estimate how the GDP if affected by Inflation, Interest rate, exchange rate and mainly how the fourth variable "QE" impacts the GDP.

2.2 Quantitative Easing 1 ($ 1.7 trillion)

QE1 was implemented by the FED in November 2008 with a plan that it would buy $600 billion worth of rotten assets (i.e., Mortgage-backed securities "MBS") and inject the market with money. The FED would conduct these Large-Scale Asset Purchases (LSAP) through open market operations and liquidate the investment banks with cash so that they can perhaps lend it out as loans to small businesses and general public, hoping to stabilize the economy. However, that did not seem to be the case.

The effect of QE1 did not seem to meet the expected outcome. Reasons of why the QE1 was not as effective is discussed in a later paragraph but the FED without wasting any time continued to expand the QE1 program. The FED furthermore decided to purchase $750 billion worth of MBS which led to the FED accumulating a total of $1.7 trillion in its balance sheet. (Amadeo, The Balance, 2021)

2.3 Quantitative Easing 2 ($ 600 billion)

The FED in August 2010, launched the QE2 program and decided to purchase $600 billion worth of U.S. treasuries and reinvestment of proceeds from previous Mortgage-Backed Security purchases. The second round of Quantitative Easing turned out to be more impactful than the previous. The lending procedures of the commercial and investment banks during QE2 stimulated the real economy with cash (Chen, Quantitative easing 2, 2021). However, all this has not increased the GDP of the US, as found in this research. Thus, increased liquidity, although increased bank lending, has not resulted in higher GDP growth.

One possible explanation to this phenomenon is expressed by Robert Pollin (2012) as the crises of 2008 dragged the United States into something known as a “liquidity trap”. Liquidity trap is a phenomenon in which interest rates are very low and the savings very high. This means that lending and borrowing is high due to low interest rates but the urge of spending and investing is rather low (Pollin, 2012). Unpredictable times such as the economic crises of 2008 changes consumer behavior which causes them to save money as cash in their savings account rather than spending or investing it in anything else. It generally occurs when citizens cannot see their future very clearly and they position themselves holding the most secure asset which is cash.

During QE1 the FED conducted LSAP programs through open market operations, liquidating the banks and market with cash. As the banks were borrowing

money from the FED with nearly zero interest rate, it led to them accumulating huge reserve of cash. The banks during the unpredictable times of QE1, held on to most of the reserves instead of lending it out to non-corporate and small businesses. (Pollin, 2012).

This means that the "money supply" was increasing but the cash velocity throughout the economy was extremely low. Hence, an increase in money supply without improvement in real economy meant that the economy could suffer from stagflation. The banks were not lending money as FED had expected them to do so. The banks were either clearing out the subprime mortgages from their books or simply hoarding up the cash for increasing their capital ratios. Some banks even complained that there were not enough borrowers who were credit worthy for lending the money to (Amadeo, The Balance, 2021).

Another reason to why the first QE1 program did not impact the economy as expected is because of "time lag". We are taking "time lag" as a general term given to the time duration it takes for an economic/fiscal policy to impact the economy after being implemented. For example, recognition lag is the time it takes for the government and central bank to realize and acknowledge that a particular economic event is taking place. It is then followed by a decision lag in which the leaders discuss and formulate a solution for the problem at hand. Finally, the response lag is the duration it takes for a fiscal policy chosen by the government and the central bank to show effects in the economy after being implemented. (Halton, 2021)

2.4 Quantitative Easing 3 ($ 2.025 trillion)

In September of 2012, the Federal Open Market Committee (FOMC – Twelve members of the FED) announced that they would further purchase additional Treasury securities and agency Mortgage-Backed Securities (MBS) through the open market

operations (FED, New york FED, 2012). The FED would purchase $40 billion worth of MBS every month until the markets have stabilized. The FED would also purchase long-term Treasury securities at the pace of $45 billion per month. This would mark the beginning of the third round of quantitative easing. The LSAP programs did improve the markets slowly but surely which is why in December 2013 the FED announced that they would reduce the pace of asset purchases. They would reduce the purchases on monthly basis of MBS from $40 billion to $35 billion and Treasury securities from $45 billion to $40 billion (FED, Board of governors of the Federal Reserve System, 2013). By the late October of 2014, FOMC announced that they would be terminating the QE programs since a significant improvement was seen in the markets and that the economic activity showed healthy signs.

2.5 Quantitative Easing 4 ($ 3.7 trillion) "As of writing this paper"

Ever since the terminating of QE program, the FED decided to apply the normalization principal policy. This meant that the FED would steadily decrease its asset holdings on its balance sheet which at the time capped to $4.5 trillion. Furthermore, the FED would gradually increase its Federal Fund Rate out of the zero-lower bound starting from November 2015. The FED kept on its track with the normalization policy and reduced the asset holdings on its balance sheet down to $3.8 trillion by late 2019.

Not long after, the world was hit by the deadly spread of Covid-19 resulting in a world-wide pandemic which would change the course of history. In the wake of pandemic, the chairman of FED Jerome Powell announced that the FED would deploy lending powers to an extraordinary measure and that they would continue to do so proactively and aggressively until they are confident that the road to recovery has been met (Cheng, 2021). This led to the initiation of fourth round of QE also known as "QE

infinity". On the 15th of March 2020, the FED announced that they would be purchasing $500 billion worth of treasury securities and $200 billion worth of MBS over coming months. However, the FED later announces on June 10 that they would instead purchase treasury securities and MBS indefinitely at the rate of $80 billion a month for treasury securities and $40 billion a month for residential and commercial mortgage-backed securities until further notice. (Cheng, 2021)

Additionally, on the 27th of March, former president Donald Trump signed the passing of a bill called the CARES Act. The Coronavirus Aid, Relief, and Economic Security Act is a whopping $2.3 trillion economic stimulus bill that aims to weather the storm created by the pandemic. The unemployment rate of the United States reached its highest peak of 14.8% by the April of 2020, the highest rate observed since 1948 (CRS, 2021). This meant that a great number of people were facing serious financial crisis, hence; the U.S. government decided to give out fiscal aid packages to the adults who earned less than $75,000 a year. The emergence of stimulus packages moved from Trump to Biden administration as the Biden administration passed the bill that included a US$2.3 trillion stimulus package also known as "American Rescue Plan" (Zarracina, 2021). Part of that fiscal plan provided US$1,400 to single adults and US$2400 to married couples, furthermore; families who had children would receive US$500 for each child under the age of 17 (Terrell, 2021). This rescue plan was one of the many other several relief packages as different parties in the government proposed their own plans of stimulus packages.

Figure 3 below is the balance sheet of the FED and there are placed indicators where the initiation of the 4 quantitative easing rounds took place.

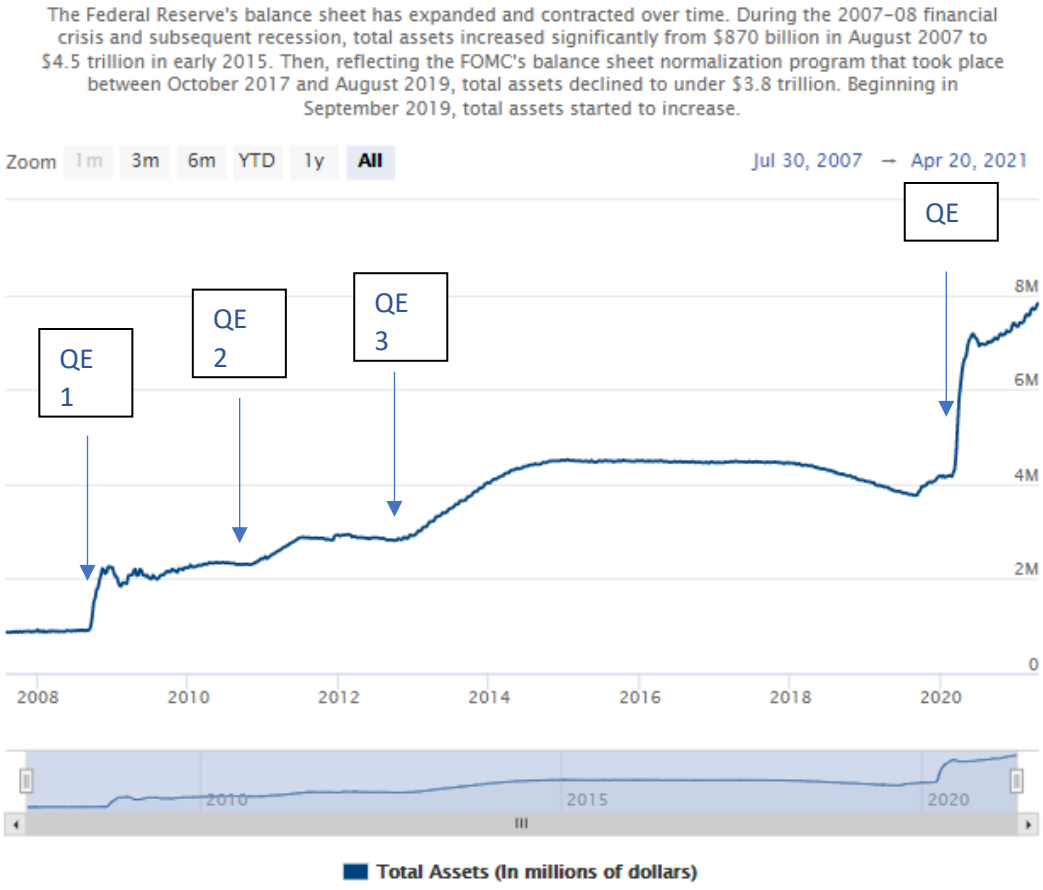

Figure 3: FED's balance sheet
Source: (FED, Board of Governors of the Federal Reserve System, 2021)

2.6 Money supply

There are many writings which examine the relationship among money supply, money demand and inflation. There is a famous equation known as the Fisher's equation which scientifically defines the "Quantity Theory of Money" as stated in Equation (2):

$$MV = PT \quad (2)$$

M is the total amount of money supply circulating in the economy

V is the velocity at which the money is circulating

P is the general level of pricing

T is the volume at which the transactions that are conducted

Fisher mentions in his book (The purchasing power of money), if we consider the velocity of circulation and the volume of transactions to be constant, according to Fisher's equation in Equation (2), if the money supply increases the prices would increase to compensate and vice versa. Hence, if the FED decides to conduct Large Scale Asset Purchase (LSAP) programs, the increase in money supply would probably lead to increase in prices.

Money supply in the United States is categorized in 3 categories known as M1, M2 and M3. The M1 money supply regards to the physical or hard cash that runs in an economy. It also includes demand deposits and other checkable deposits. The M2 money supply is composed of M1 and "near money" which is a term given to other parts of a money supply such as money market securities, mutual funds, saving deposits and other time deposits. The "near money" in M2 money supply are assets that are not as liquid as M1. The M3 money supply consist of M2 as well as longer time deposits, institutional money market funds, short term repurchase agreements and larger liquid assets. To keep a track of inflation, the values of M3 money supply traditionally were taken into consideration since economists used M3 to calculate the entire money supply within the economy (Westfall, 2021). Ever since 2006, the FED has stopped providing the data on M3 money supply. However, there are few other sources that still provide the M3 money supply data.

For the purposes of this paper, I will be using M2 money supply since there is an abundance of data available on M2 money supply, furthermore; the similarities between M2 and M3 money supply are noteworthy. The changes are minute between

M2 and M3 money supply considering the scale at which the volume of the money is supplied. This permits me to conduct a proper study with as little errors as possible.

The rate of M2 money supply in the United States had a significant increase soon after the execution of QE and the M2 money supply had an obvious deviation from its trend as seen in Figure 4. The grey area represents the recession of 2008 and economic impact of Covid-19.

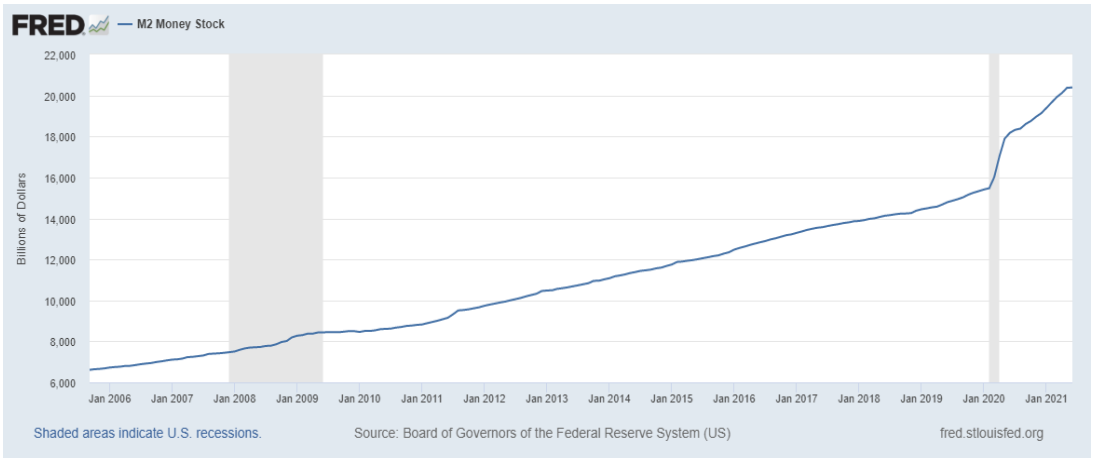

Figure 4: – M2 money supply
Source: (FRED, Fred economic data, 2021)

Due to the complex nature of LSAP's, a good alternative to figure out annual QE rounds injected in M2 is by observing the annual increase in M2 money supply. The table (1) below represents the increase in money supply obtained from outright M2 money supply chart (FRED, Fred economic data, 2021).

Table 1 : Annual M2 money supply (FRED, Fred economic data, 2021)

Year	M2 supply (Billions)
2006	$384.9
2007	$395.7
2008	$768.1
2009	$184.2
2010	$365
2011	$911.1
2012	$745.5
2013	$599.6
2014	$667.3
2015	$727.5
2016	$817.3
2017	$583.3
2018	$517.3
2019	$963.5
2020	$3,896
2021 (Q1+Q2)	$1141.4

2.7 Measuring inflation

Inflation in an economy is often referred as something negative and associated with the devaluation of a currency, however; there wouldn't be growth in an economy if not for inflation. It is widespread among policy makers that a healthy rate of inflation is around 2% annually. Inflation rate above 3% to 5% could lead to hyperinflation or anything below 1% could lead to a recession.

There are several methods used to measure the inflation in an economy however the most well-known method of measuring inflation is using Consumer Price Index (CPI). The CPI is the average price of a basket of goods such as food, beverages, transportation, clothes, electronics etc. The following formula, Equation (3) uses CPI to calculate inflation:

$$\text{Inflation} = \frac{CPI(t) - CPI\,(t-1)}{CPI\,(t-1)}\ x\ 100\% \qquad (3)$$

Equation (3) basically compares the CPI of the current year with the previous year and turns it into a percentage indicating an increase or decrease in the inflation rate. As mentioned earlier, it is important for the FED to keep a steady track of an increase of 2% in the CPI.

Inflation is usually categorized in two methods – cost push and demand-pull inflation. Cost push inflation occurs when the cost of making goods rise due to higher prices for raw material and/or labor. Therefore, the company increases the prices of the finished products. Let's say that the price of oil increases. This would mean that the companies' overall cost of supply, delivery, machinery, etc. would increase, leading to higher prices of finished products (Kenton, 2020).

Demand pull inflation on the other hand occurs due to the imbalance between aggregate supply and aggregate demand. If a demand for a product soar and there isn't

enough supply to back the demand, the prices for those products increase, leading to higher prices overall (Chen, Demand - pull inflation, 2021).

2.8 Relationship of variables with GDP rate

The relationship of inflation with GDP is rather complex since the growth in GDP leads to an increase in inflation, on the other hand; an increase in inflation does not necessarily lead to a higher growth. The prices of goods and services in an economy increase for several reasons and if it increases at 2% a year with increased production then that is considered healthy inflation but if the inflation outruns the production, then the prices for those products rapidly increase. Or in other words, too much money chasing too few goods, ultimately increasing the inflation rate of the economy.

The relationship of interest rate with GDP rate can be considered inversely related. As the central bank decreases interest rates, companies are more likely to borrow to invest, contributing to a higher GDP rate. Whereas, an increase in the interest rate lowers the motivation to borrow and to invest in businesses, leading to a lower production and a lower GDP rate (Nurina, 2015).

Exchange rates are a good means to measure the strength of a currency. Obviously, all currencies may experience inflation, therefore; with inflation a currency may lose its value compared to itself from previous years. Hence, having a benchmark with a corresponding currency is a good indicator to evaluate the strength of a particular currency (Nurina, 2015). When the dollar appreciates it gets cheaper for U.S. consumers to import foreign goods whereas the depreciation of the dollar would decrease foreign imports. Imports overall have little to no effect on the overall GDP (Nurina, 2015). The Gross Domestic Product specifically indicates the value of products made at home and not abroad. On the contrary, consumer spending or government spending on foreign goods contribute to the GDP. For a developed

country, the foreign exchange rate and GDP have a positive relationship. A weaker dollar enhances the volume at which net exports take place, consequently effecting the economic growth positively due to an increase in demand (Karahan, 2020).

Chapter 3

METHODOLOGY

3.1 Model

This paper is aimed towards understanding how the four variables "QE, Inflation, Interest rate and Exchange rate changes" affect the GDP growth rate and how much of that change is particularly influenced by QE. Hence; I will consider GDP rate as a dependent variable while QE, inflation, interest rate and exchange rate will be our independent variables. I believe that a model of multiple regression analysis may be the best model in order to corelate the changes in growth explained by the intervention of QE, inflation, interest rates and exchange rates.

$$Y = c_t + \alpha_t QE_t + \beta_t I_t + \delta_t R + \mu_t ER_t + e_t \quad (4)$$

Y = GDP growth rate (percentage increase or decrease in growth from previous year)

C = Constant of Equation (4) in time t (t1 = Q1 2006 + Q2 2006 + Q3 2006 +…. Q2 2021) "Quarterly"

QE =M2

α = Coefficient of QE

I = Inflation rate

B = Coefficient of I

R = Interest rate

δ = coefficient of R

ER = Exchange rate (US dollar to euro)

μ = Coefficient of ER

e = Error term of the equation

3.2 Data collection

I will observe inflation rate, interest rates, exchange rates and money supply rate (QE) on quarterly bases starting January 2006 and ending at July 2021. This results in a total of 62 quarters, hence; 62 observations. Each quarter consists of three months hence the mean average of the variables in those three months will represent one observation.

3.3 Statistical study

The following tables are the recordings of our dependent variables on quarterly bases:

Table 2: Represents inflation on quarterly bases (Q1 2006 – Q2 2021)

Table 3: Represents interest rates of the FED (Q1 2006 – Q2 2021)

Table 4: Represents exchange rate of US dollar with euro (Q1 2006 – Q2 2021)

Table 5: Represents M2 money supply rate (Q1 2006 – Q2 2021)

Table 2: Inflation rates (Multpl, 2021)

	1st Q	2nd Q	3rd Q	4th Q
2006	3.65%	4.01%	3.34%	1.94%
2007	2.43%	2.65%	2.36%	3.98%
2008	4.10%	4.38%	5.30%	1.61%
2009	-0.04%	-1.15%	-1.62%	1.46%
2010	2.36%	1.77%	1.18%	1.27%
2011	2.14%	3.43%	3.76%	3.29%
2012	2.82%	1.89%	1.70%	1.89%
2013	1.68%	1.39%	1.55%	1.23%
2014	1.41%	2.05%	1.78%	1.25%
2015	-0.06%	-0.04%	0.11%	0.47%
2016	1.08%	1.05%	1.17%	1.8%
2017	2.54%	1.9%	1.97%	2.12%
2018	2.21%	2.71%	2.64%	2.22%
2019	1.64%	1.81%	1.76%	2.03%
2020	2.12%	0.37%	1.22%	1.24%
2021	1.9%	4.85%	-	-

Table 3: Interest rates (FRED, Effective Federal Funs Fate, 2021)

	1st Q	2nd Q	3rd Q	4th Q
2006	4.45	4.9	5.24	5.24
2007	5.25	5.25	5.07	4.49
2008	3.17	2.08	1.94	0.5
2009	0.18	0.18	0.15	0.12
2010	0.13	0.58	0.19	0.19
2011	0.15	0.09	0.08	0.07
2012	0.1	0.15	0.14	0.16
2013	0.14	0.2	0.08	0.09
2014	0.07	0.09	0.09	0.1
2015	0.11	0.12	0.14	0.16
2016	0.36	0.37	0.4	0.45
2017	0.7	0.97	1.15	3.61
2018	1.45	1.74	1.92	2.22
2019	2.4	2.4	2.19	2.22
2020	1.26	0.06	0.09	0.09
2021	0.08	0.06	-	-

Table 4: Exchange rates “USD to Euro” (Macrotrends, 2021)

	1st Q	2nd Q	3rd Q	4th Q
2006	1.2	1.25	1.28	1.93
2007	1.3	1.34	1.37	1.44
2008	1.48	1.55	1.53	1.31
2009	1.31	1.35	1.42	1.48
2010	1.39	1.3	1.28	1.36
2011	1.37	1.45	1.43	1.35
2012	1.32	1.3	1.25	1.29
2013	1.33	1.3	1.32	1.35
2014	1.37	1.38	1.34	1.25
2015	1.15	1.1	1.11	1.09
2016	1.09	1.14	1.12	1.1
2017	1.06	1.09	1.17	1.17
2018	1.23	1.2	1.17	1.14
2019	1.14	1.12	1.11	1.11
2020	1.11	1.1	1.17	1.18
2021	1.21	1.2	-	-

Table 5: Table.5 M2 money supply rate (Longtermtrends, 2021)

	1st Q	2nd Q	3rd Q	4th Q
2006	4.85	5.23	5.25	5.59
2007	5.72	6.37	6.5	5.86
2008	6.35	6.36	6.01	8.29
2009	9.68	9.12	8.17	5.35
2010	2.09	1.94	2.58	3.35
2011	4.64	5.81	9.1	9.56
2012	10.19	9.56	7.13	7.63
2013	7.37	6.97	6.53	6.1
2014	6.12	6.46	6.32	5.78
2015	6.13	6.67	5.57	5.7
2016	6.02	6.7	7.11	7.29
2017	6.49	6.01	5.46	4.89
2018	4.18	3.94	3.83	3.47
2019	4.08	4.34	5.25	6.68
2020	7.87	20.60	23.37	24.27
2021	27.78	14.68	-	-

3.4 Correlation and Multiple Regression analysis

Table 6 : Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.726[a]	.527	.493	1.84698	.527	15.568	4	56	<.001

a. Predictors: (Constant), Inflation, M2_Supply_Rate, Exchange rate, FED interest rate

After performing the multiple regression with GDP rate being the dependent variable and M2 money supply rate, inflation rate, interest rate and exchange rate being the independent variables, we find that the adjusted R- square for GDP rate is 0.493. Meaning that M2 money supply rate, inflation rate, interest rate and exchange rate can designate 49.3 % of changes in GDP rate and the rest is explained by other variables related but not used in this study.

Table 6 below represents the correlations between our 5 variables (M2 money supply rate, FED interest rate, Exchange rates, inflation rate and GDP rate). [Note – all variables are “rates”. For example, GDP rate representing a percentage increase or decrease in growth from previous year and not the amount of goods or services sold in dollars]. This form of data collection had to be adapted because inflation and interest rate as variables can only be described as a percentage. Furthermore, adapting to this form of data collection improved the results when comparing “rates with rates” rather than comparing rates with the outright amount.

Table 7: Correlation matrix

		Nom_GDP_Rate	M2_Supply_Rate	FED interest rate	Exchange rate	Inflation
Nom_GDP_Rate	Pearson Correlation	1	-.586**	.391**	.029	.477**
	Sig. (2-tailed)		<.001	.002	.826	<.001
	N	61	61	61	61	61
M2_Supply_Rate	Pearson Correlation	-.586**	1	-.269*	-.135	-.104
	Sig. (2-tailed)	<.001		.034	.294	.421
	N	61	62	62	62	62
FED interest rate	Pearson Correlation	.391**	-.269*	1	.223	.448**
	Sig. (2-tailed)	.002	.034		.082	<.001
	N	61	62	62	62	62
Exchange rate	Pearson Correlation	.029	-.135	.223	1	.286*
	Sig. (2-tailed)	.826	.294	.082		.024
	N	61	62	62	62	62
Inflation	Pearson Correlation	.477**	-.104	.448**	.286*	1
	Sig. (2-tailed)	<.001	.421	<.001	.024	
	N	61	62	62	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The M2 money supply rate is statistically significant at <0.001 level and has a strong negative relation with GDP rate.

FED interest rate is also statistically significant at 0.002 level and show a positive relation with the GDP rate.

Exchange rate are not statistically significant since the correlation significance is <0.05 and exchange rates are at 0.826

Inflation rate is statistically significant at <0.001 level and has a strong positive relation with GDP rate.

Table 8: Multiple regression

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	7.452	2.101		3.547	<.001	3.243	11.660
	M2_Supply_Rate	-.276	.051	-.516	-5.406	<.001	-.378	-.174
	FED interest rate	.154	.166	.100	.927	.358	-.179	.486
	Exchange rate	-3.133	1.653	-.185	-1.895	.063	-6.445	.178
	Inflation	.822	.226	.398	3.641	<.001	.370	1.274

a. Dependent Variable: Nom_GDP_Rate

After performing the multiple regression analysis, the final Equation (5) is obtained:

$$Y = 7.452 – 0.516\ QE + 0.398\ I + 0.100\ R – 0.185\ ER + 1.\ 84698 \quad (5)$$

M2 money supply rate can describe 51.6 percent of change in GDP rate and is "negatively" correlated. This is the major finding of this research, because the result shows that a one percent increase in M2 will affect the GDP growth rate of the US by 51.6 percent. Thus, the major question of this research is answered and the answer to Hypothesis 1.

Inflation rate can describe 39.8 percent of change in GDP rate and is positively correlated, meaning that an increase in inflation will cause a rise in GDP rate. This also supports Hypothesis 2 as assumed earlier.

Fed's interest rates with the GDP rate show "no significance". The main reason for interest rates representing no significance on GDP rate can be explained due to interest rates hanging on the zero-lower bound where they have little to no effect on GDP. Out of 62 observations, 37 observations of the Federal Funds Rate have been on the zero lower bound (refer to Fig.5).

Exchange rate of USD to EUR shows no significance since the P value of exchange rate is not <0.05, and this could be attributed to dollar being an international reserve currency, and performing differently from other currencies.

The results of the multiple regression reflect three of our initial hypotheses to be true:

H1: QE does contribute to the GDP growth rate of United States

H2: The inflation rate does positively impact the GDP growth rate of United States

H3: The FED's interest rate showed little correlation with the GDP growth rate which can be considered insignificant.

H4: Our fourth hypothesis is not true since exchange rate (USD/EUR) show no significance after performing the multiple regression

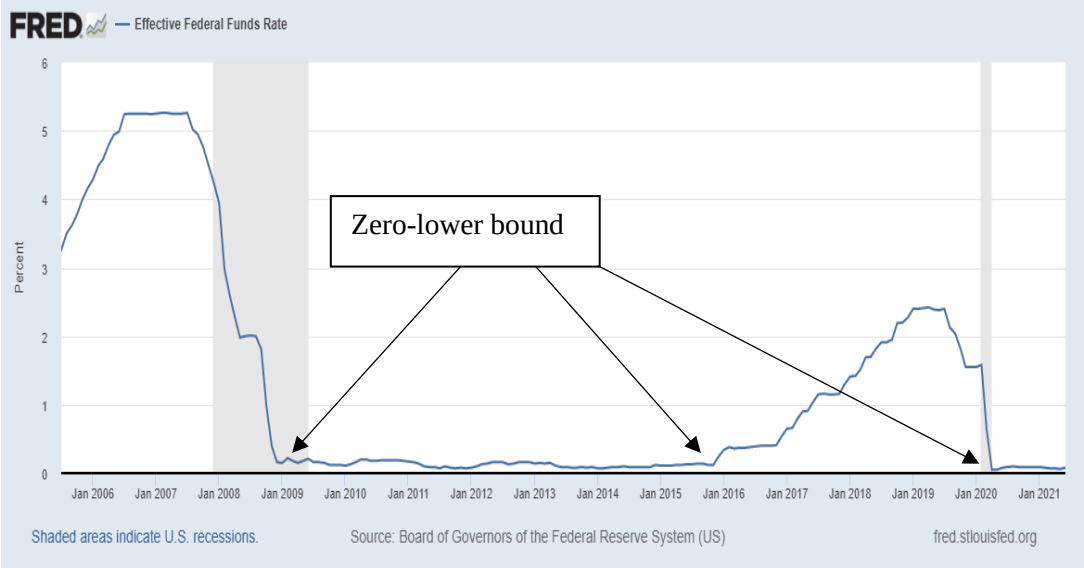

Figure 5: FED's interest from January 2006 to June 2021
(FRED, Effective Federal Fund Rate, 2021)

3.5 Results and explanation

According to the data of study, we found that not all of the four dependent variables effect GDP rate significantly. Exchange rates showed little to no correlation with GDP rate. Whereas M2 money supply rate, interest rate and inflation rate showed a strong correlation with GDP rate. M2 money supply has a strong negative correlation meanwhile the interest rate and the inflation rate show positive correlation.

The strongest relation of GDP rate was found with M2 money supply rate. M2 money supply rate could explain 51.6 percent change in GDP rate but with a "negative" correlation. There are several factors that can explain the cause of this negative relationship between these two variables.

One of the reasons that could explain the negative relationship are company stock buybacks or reinvestment in shares. A significant portion of the corporate world

has been increasingly investing in these open-market repurchases. It makes sense for the corporations to invest a portion of retained earnings in stock buybacks as it increases the dividends for the investors. However, taking on debt to invest in stock buybacks is bad management (Lazonick, 2020). The stock buybacks do not contribute to a company's productivity. Since no revenue generating investments are made, it results to a lower growth of the company and it gets harder for them to pay back the debt they took to invest in stock buybacks. As of writing this paper, the stocks have reached their all-time high's where-as unemployment is on the rise. So not only that the repurchases are inflating the stock markets with little to no actual productivity but also that it is swelling the income inequality (Lazonick, 2020).

Another reason that can explain the negative relation between M2 money supply and GDP growth are capital outflows from the US to developing and emerging market economies (EMEs). Capital outflows come in several forms but can be categorized into pull factors and push factors. Prior to the economic crises, pull factors were the prime drivers of capital inflow towards developing and EMEs and it primarily depended on the country's development and their growth potential. On the other hand, post economic crises period has surged the push factors of capital outflows where the capital flow is driven by the financial and macroeconomic conditions of advanced economies rather than the growth potential of EMEs (Achille Fofack, 2018). Capital outflows from the US might seem beneficial for the receiver (i.e., Developing and EMEs). However, the push factor of capital outflow can overheat the developing and EMEs as the prices of financial assets and real estate rise. Temporary capital outflow might have a limited impact on the US economy but a sustained large capital outflow could lead to hostile results (Pettinger, 2017).

Chapter 4

CONCLUSION

It has been 13 years since the Quantitative Easing policy was adapted by the FED of United States. Quantitative Easing is still a new policy when compared with the time calendar of macroeconomics. Little is known about the consequences of what this policy can lead to. It is evident that this strategy did overcome the recession of 2008. However, the long-term economic impact could reveal unwanted results which could massively depreciate the U.S. dollar and impact the growth of US.

There are a lot of challenges for the U.S. economy ahead that require attention. With the current capitalistic world economy and U.S dollar being the world reserve currency, a demolishing dollar will cause panic. FED being aware of that is trying its best to keep the wheels turning by keeping the engines running. As of writing this conclusion, the stocks have reached their all-time highs. Credits to QE through which companies were able to amp up their stock repurchase programs which in turn boosted the stock market and inflated the asset prices.

The experiment of “LSAP” by the FED through open market operations has showed supporting results in relevance to the health of US economy. Though, it cannot be stressed enough that this financial aid is a short-term solution that could cripple the U.S. economy in the long run.

REFERENCES

Achille Fofack, A. A. (2018). Assessing the post-quantitative easing surge in financial flows to developing and emerging market economies. *Applied Economics*.

Amadeo, K. (2020, December). *The balance*. Retrieved from https://www.thebalance.com/qe4-explanation-pros-and-cons3305532#:~:text=QE4%20was%20the%20fourth%20round,notes%20using%20credit%20it%20created.

Amadeo, K. (2021, March 18). *The Balance*. Retrieved from https://www.thebalance.com/fed-funds-rate-definition-impact-and-how-it-works-3306122

Barnes, R. (2021, June 29). *Investopedia* . Retrieved from https://www.investopedia.com/articles/06/gdpinflation.asp

Chen, J. (2021, June 4). *Demand - pull inflation*. Retrieved from Investopedia : https://www.investopedia.com/terms/d/demandpullinflation.asp

Chen, J. (2021, Feb 6). *Quantitative easing 2*. Retrieved from Investopedia: https://www.investopedia.com/terms/q/quantitative-easing-2-qe2.asp

Cheng, J. (2021, MArch). *Brookings*. Retrieved from https://www.brookings.edu/research/fed-response-to-covid19/

CRS. (2021). *Unemployment Rates During the COVID-19.* Congressional Research Service.

Denning, S. (2011, November). *Forbes*. Retrieved from https://www.forbes.com/sites/stevedenning/2011/11/22/5086/?sh=21965f71f92f

Estevez, E. (2021). *Stagflation*. Retrieved from Investopedia : https://www.investopedia.com/terms/s/stagflation.asp

FED. (2012, september 13). *New york FED*. Retrieved from https://www.newyorkfed.org/markets/opolicy/operating_policy_120913.html

FED. (2013, May). *Board of governors of the Federal Reserve System*. Retrieved from https://www.federalreserve.gov/newsevents/pressreleases/monetary20130501a.htm

FED. (2016, november). *What is the purpose of the Federal Reserve System*. Retrieved from https://www.federalreserve.gov/faqs/about_12594.htm#:~:text=Supervising%20and%20regulating%20banks%20and,may%20arise%20in%20financial%20markets.

FED. (2021, August 10). Retrieved from Board of Governors of the Federal Reserve System: https://www.federalreserve.gov/monetarypolicy/bst_recenttrends.htm

FED. (2021, March 21). *Board of Governors of the Federal Reserve System*. Retrieved from https://www.federalreserve.gov/monetarypolicy/bst_recenttrends.htm

Feldstein, M. (2011, Feb 24). *Project Syndicate*. Retrieved from https://www.project-syndicate.org/commentary/quantitative-easing-and-america-s-economic-rebound?barrier=accesspaylog

Fisher, I. (1992). *The purchasing power of money.* New York: Liberty Fund, Inc.

FRED. (2021). *Effective Federal Fund Rate*. Retrieved from FRED economic data: https://fred.stlouisfed.org/series/FEDFUNDS

FRED. (2021, July). *Effective Federal Funs Fate*. Retrieved from FRED economic data: https://fred.stlouisfed.org/series/FEDFUNDS

FRED. (2021). *Fred economic data*. Retrieved from https://fred.stlouisfed.org/series/M2SL

Gerald P. Dwyer, Jr. and R. W. Hafer. (1998). Is money irrelevant . pp. 3 - 17.

Halton, C. (2021, Jan). *Investopedia* . Retrieved from https://www.investopedia.com/terms/r/response_lag.asp

Karahan, Ö. (2020). *Influence of Exchange Rate on the Economic Growth.* Bandırma Onyedi Eylül University.

Kenton, W. (2020, September 30). *Cost push inflation*. Retrieved from Investopedia : https://www.investopedia.com/terms/c/costpushinflation.asp

Klyuev, Imus, and Srinivasan. (2009). *Unconventional Choices for Unconventional Times: Credit and Quantitative Easing in Advanced Economies.* IMF.

Lazonick, W. (2020, January 7). *Why Stock Buybacks Are Dangerous for the Economy*. Retrieved from Harvard Business Review: https://hbr.org/2020/01/why-stock-buybacks-are-dangerous-for-the-economy

Liesman, S. (2020, March 15). Retrieved from CNBC: https://www.cnbc.com/2020/03/15/federal-reserve-cuts-rates-to-zero-and-launches-massive-700-billion-quantitative-easing-program.html

Longtermtrends. (2021). *M2 money supply vs. Inflation*. Retrieved from Longtermtrends: https://www.longtermtrends.net/m2-money-supply-vs-inflation/

Macrotrends. (2021, July). *Euro Dollar Exchange Rate (EUR USD) - Historical Chart*. Retrieved from Macrotrends: https://www.macrotrends.net/2548/euro-dollar-exchange-rate-historical-chart

Mitchell, C. (2021, April 6). *Zero-bound*. Retrieved from Investopedia : https://www.investopedia.com/terms/z/zero-bound.asp

Multpl. (2021, July). *US inflation rate by year*. Retrieved from Multpl: https://www.multpl.com/inflation/table/by-year

Nurina, H. S. (2015). Analysis of the Effect of Inflation, Interest Rates, and Exchange Rates on Gross Domestic Product (GDP) in Indonesia. 13.

Pettinger, T. (2017, september 4). *Impact of money leaving the economy*. Retrieved from Economics help: https://www.economicshelp.org/blog/14264/economics/impact-of-money-leaving-the-economy/

Pollin, R. (2012, september). The great US liquidity trap of 2009–2011:. *are we stuck pushing on strings?*, pp. 55-76.

Probasco, J. (2021, March 31). *Investopedia* . Retrieved from https://www.investopedia.com/paycheck-protection-program-flexibility-act-of-2020-an-overview-4846944

Terrell, K. (2021, March 11). *AARP*. Retrieved from politics and society : https://www.aarp.org/politics-society/advocacy/info-2020/coronavirus-stimulus-checks.html#:~:text=The%20legislation%20will%20give%20single,for%20each%20child%20under%2017.

Westfall, P. (2021, March 11). *Money supply*. Retrieved from Investopedia: https://www.investopedia.com/terms/m/moneysupply.asp

Wolla, S. A. (2018, September). *How do imports affect GDP*. Retrieved from Economic research, federal reserve bank of ST.Louis: https://research.stlouisfed.org/publications/page1-econ/2018/09/04/how-do-imports-affect-gdp

Yardeni. (2019). *Yardeni Research*. Retrieved from https://www.yardeni.com/chronology-of-feds-quantitative-easing/

Zarracina, L. K. (2021, March 11). *USA today*. Retrieved from https://www.usatoday.com/in-depth/news/2021/03/11/covid-19-stimulus-how-much-do-coronavirus-relief-bills-cost/4602942001/