Impact of Monetary Aggregates on Consumer Behavior:
A Study on the Policy Response of the Federal Reserve against COVID-19

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Abstract

Consumers have tended to sharply decrease their spending during the COVID-19 pandemic due to pessimistic expectations related to the economic outlook, concerns about their jobs, and a decline in incomes. The Federal Reserve has taken several measures in response to the pandemic, resulting in increases in the money supply and asset sizes. This study aims to analyze the impact of monetary aggregates on consumer behavior before and after the pandemic by employing the bootstrap autoregressive distributed lag (ARDL) cointegration test with an exogenous structural break. The US money supply (M3) and total assets are used as dependent variables and consumer expenditure, consumer credit, and consumer sentiment are the independent variables. The data employed cover the period from January 2003 to August 2020. The results show cointegration relationships among consumer expenditure, the US money supply (M3), and total assets. The effect of the FED's policy response on consumer behavior has strengthened after the pandemic.

Keywords: consumer behavior, COVID-19, structural breaks

JEL Classification: C40, E21, E58

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1. Introduction

The COVID-19 pandemic has adverse global impacts and has affected many countries since the start of 2020, with an unforeseen duration and severity. The economic, moral, and social consequences of that great crisis are dramatic challenges faced by all parts of the economy. Countries worldwide are not only testing, monitoring, and treating people but also raising awareness of personal hygiene and social isolation against this pandemic. Almost all countries have adopted a partial lock-down approach, resulting in the shutdown of factories and companies, aircraft suspension, train interruption, and mobility restriction of goods and people (Reddy, 2020). Not only has the COVID-19 shock affected the economy, but the financial markets also have suffered from great turbulence. Caballero and Simsek (2020) indicate that such non-financial supply shocks as this one might endogenously cause financial shocks and severe contractions in the valuation and aggregate demand of assets, significantly amplifying the recession. We have seen that the financial terms for corporates have risen considerably because of the concerns about economic growth and declining liquidity in financial markets (ECB, 2020).

Following the beginning of the COVID-19 pandemic, the fiscal and monetary authorities have taken a variety of measures. The efforts of government officials to reduce the spread of the pandemic have caused decrease in spending of households and reduction in income of businesses, contributing to a recession. Central banks need to do their utmost to minimize the continuous economic harm so that the economy can expand again when the pandemic declines and provide products and services to satisfy demand. In case capital markets are blocked, companies attempt to use credit lines that may cause banks to offer treasury bonds and other securities or refuse certain loans. Most central banks have provided banks with unrestricted funding to satisfy credit outflows and ease financial pressure (Cheng et al., 2020). In order to alleviate stress on financial markets, the central banks carry out unconventional policies as well as traditional monetary policies. Initially, central banks worldwide have rapidly lowered their policy rates to allow for the needed stimulus. As the policy rates in developed economies were already very low, even negative, these central banks also tried to increase the magnitude of asset purchases and the liquidity in the economy thanks to quantitative easing programs (Demiralp, 2020).

According to the monetary economics, there is a relationship between money supply and consumer expenditure. Accordingly, the increase in the money supply results in an increase in consumer expenditure and shifts the aggregate demand (AD) curve to the right, while causing reduction in interest rates and more expenditure. In addition, Berg et al. (2019) emphasize that monetary policy instruments which do have impact on asset values, including interest rate cuts, that tend to increase the long-term asset values, affect consumption expenditures of households in U.S. From this perspective, the main objective of this study is to evaluate the monetary aggregates as money supply (M3) and total assets on consumer behavior by empirically analyzing consumer expenditures, consumer credits, and consumer sentiment in the period from 2003:01 through 2020:08. Our paper contributes to the academic literature in several ways. At first, there are a few studies focusing on the economic impact of the COVID-19 pandemic because it is a very recent issue, and there is very limited data available. Moreover, we employ the bootstrap autoregressive distributed lag (ARDL) cointegration test with an exogenous structural break that controls for the effect of COVID-19 to evaluate the FED's policy response on consumer behavior before and after the pandemic.

The study has the following structure: After providing brief information on the policy response of U.S Federal Reserve (FED) since the start of the COVID-19 in Section 2, Section 3 briefs literature and Section 4 presents the data, empirical methodology, and empirical results. Finally, the last section concludes by giving some policy implications.

2. Which Steps Has the FED Taken to Boost the U.S. Economy and Financial Markets?

The COVID-19 pandemic and public health security policies impacted the U.S economy with tremendous pace and scope in early 2020. Health authorities suggested general social isolation to reduce the transmission of the infection. This polled in the termination of all non-essential companies and operations as well as the use of shelter-at-home policies for all non-essential jobs. Consequently, almost whole sections of the economy were shut down by mid-March, which had two significant impacts. Firstly, economic growth was greatly affected, and industrial expansion in the U.S was interrupted. Millions of employees were laid off while several businesses closing and consumer spending declined. Cachanosky et al. (2021) indicate that there has been a rapid decline in economic activity starting in March 2020. The increasing concern of a pandemic accompanied

by stay-at-home orders and other controls on businesses and consumers led to a significant deterioration in economic activity. In April 2020, the unemployment rate soared to 14.7 percent. Annualized real gross domestic product (GDP) per capita amounting to 58,490 U.S dollars in the last quarter of 2019 dropped to 57,691 U.S dollars in the first quarter of 2020 and 52,387 U.S dollars in the second quarter of 2020. This means that in the first quarter of 2020, the real GDP, which measures the nation's overall economic production, drops by 5 percent annually, followed by an almost 30 percent decrease in the second quarter of 2020. The annualized growth rate from 2007:Q4 to 2009:Q2, the 2008-09 Global Financial Crisis period, was just -3.7 percent for comparison. While these figures give a measure of the total economic impact of the pandemic, they do not reflect the extreme challenges that many people face, including financial pressures that may follow job losses. Furthermore, U.S capital markets were seriously impacted by the economic collapse. The pandemic has extremely evident disturbances, which can also have significant detrimental impacts on households, firms, state governments as well as on local governments, hampering income and other cash flows. Many corporations and investors attempted to increase their cash resources and other highly liquid assets in response to the increasing realization by selling their holdings in other assets. At the beginning of March, this attempt to raise cash was a source of great pressure in many financial markets. The gap between the prices paid for selling and purchasing such securities has, for example, risen dramatically in U.S Treasury securities markets, making it hard to trade. Financial stress was more induced in the Treasury Market, which is typically one of the world's most liquid markets. Several corporations, state and local authorities, who frequently pay their short-term expenses by selling short-term cash securities, including payroll, leasing, and payment to the suppliers, have trouble collecting adequate funds to run. Ihrig et al. (2020) also stress that the subsequent liquidity crunch became highly severe in March, threatening to substantially exacerbate the harmful impacts of the pandemic on economies.
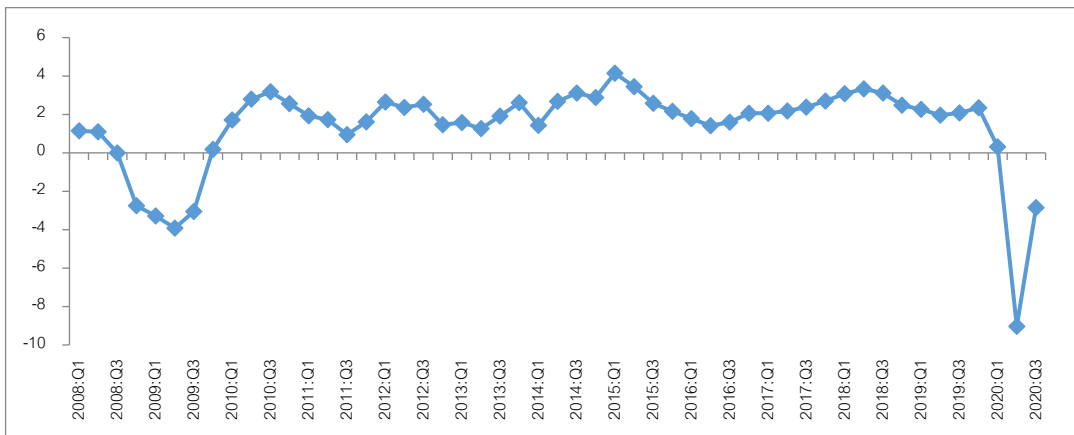
Figure 1: Real GDP, Quarterly Change; 2008-2020

Source: Federal Reserve Bank of St. Louis (2021a).

Figure 1 indicates the real GDP data in the period of 2008:Q1-2020:Q3. Accordingly, the U.S experienced its highest record drop in economic growth in the second quarter of 2020 after the sharp decline which was experienced in the 2008-2009 global financial crisis period. Since COVID-19 continues to expand throughout the world, resulting in economic turmoil, many economic indicators appear undesirable. The 9.5 percent drop in the second quarter is alarming because quarterly GDP had never surpassed even a 3 percent drop since record-keeping began in 1947. Some of the issues currently plaguing the economy include rising unemployment and declining consumer spending. First of all, more than 50 million employees are still out of jobs, as firms permanently shut down, and restrictions remain in many parts of the world. Consumer expenditure, which accounts for over two-thirds of the U.S. economy, fell 12.6 percent at its highest rate in April. While the CARES Act's weekly payments of 600 USD has helped raise household incomes, partly offsetting steep losses, the Provider Relief Fund has provided assistance to American families, employees, and healthcare providers with a total of 178 billion USD paid to hospitals and healthcare providers. In this stressful period, the money supply has grown tremendously, and the balance sheet of the central bank breaks records as trillions of dollars have been borrowed to cope with the crisis. Despite the cash infusion into the system, inflation plummeted to almost zero, well below the FED's targeted 2 percent rate-signaling deflationary pressure on the economy (Visual Capitalist, 2020; U.S Department of Health & Human Services, 2021).

FED adopted a broad variety of initiatives to alleviate the financial harm incurred by the pandemic, including loans to households, companies, capital markets as well as national and local governments up to 2.3 trillion USD in response to such crisis and a significant decline in the economy resulting from the COVID-19 pandemic, the associated business losses, the annulment of events and homeworking strategies. In this context, the Federal Reserve has introduced a series of ambitious policy measures in this period to encourage credit flow for households and businesses and to facilitate the smooth functioning of the financial markets. The Federal Reserve has cut its policy rate and the federal fund rate down to zero by a total of 1.5 percentage since the beginning of March, 2020 as part of the steps to ease the economic effect of the COVID-19 pandemic. The FED also updated its forward guidance on the overnight rate in September 2020 to reflect its new monetary policy framework. Furthermore, the FED has opened a series of lending facilities to facilitate the functioning of financial markets. It is critical since the federal fund rate is a benchmark for other short-term interest rates that therefore do have an effect on long-run interest rates and thereby lowers the cost of mortgages, automobile financing, and other loans. Moreover, the FED has also announced steps intended to ease cash flow tension for SMEs, as well as for municipalities (Martin, 2020; Cheng et al., 2021).

One of the several economic roles of the FED is to serve as the last resort lender. The FED carries out this role by providing a discount window that banks could use as a source of an emergency fund. The FED has declared that it would promote the use of the discount window by reducing the primary credit rate by 150 basis points to allow the window to be used actively. Cheng et al. (2021) state that the FED further lowered that rate by 2 percentage, from 2.25 percent to 0.25 percent until April, 2021. The FED has temporarily relaxed regulatory standards such as buffers for regulatory capital and liquidity and has eliminated the reserve requirements of the banks, thus creating flexibility for banks. The banking sector is exposed to a broad range of capital requirements based on international size and prominence, which are built as emergency reserves in periods of financial stress. The FED has stated that it would enable banks to lend to households and businesses afflicted by the COVID-19 pandemic by using these funds, which are usually not considered available, ensuring that the lending is carried out safely and soundly (Wade, 2020). In a move to lower interest rates broadly, the FED has also acquired large scale treasury securities and mortgage-backed securities to provide more stimulus, thus adding more liquidity to the financial system. Indeed, during the 2008-09 financial crisis, the FED used this instrument, which

was commonly regarded as "quantitative easing". With increasing its purchases and financing all of these activities above in this stressful period, the FED has expanded its balance sheet to over 7 trillion USD as of September 2020 (Labonte, 2020).

Dudley (2020), in his article published in Bloomberg, emphasizes that the balance sheet of the FED is growing, with expansion since mid-march of about 3 billion USD and now over 7 trillion USD in total. He expects that this might reach $10 billion by the end of 2020 as the central bank buys corporate bonds and municipal securities and lends medium-sized companies through monthly purchases of treasuries and mortgage-backed securities in large amounts. This will over double the level of the FED's balance sheet after the financial crisis of 2008-09. Figure 2 shows the expansion in the asset side of the Federal Reserve as of 2020:Q3. The size and composition of assets held by the FED have evolved noticeably throughout 2008-2020. Accordingly, total assets have reached 7.093.161 million USD while the securities held outright have reached 6.458.738 million USD.
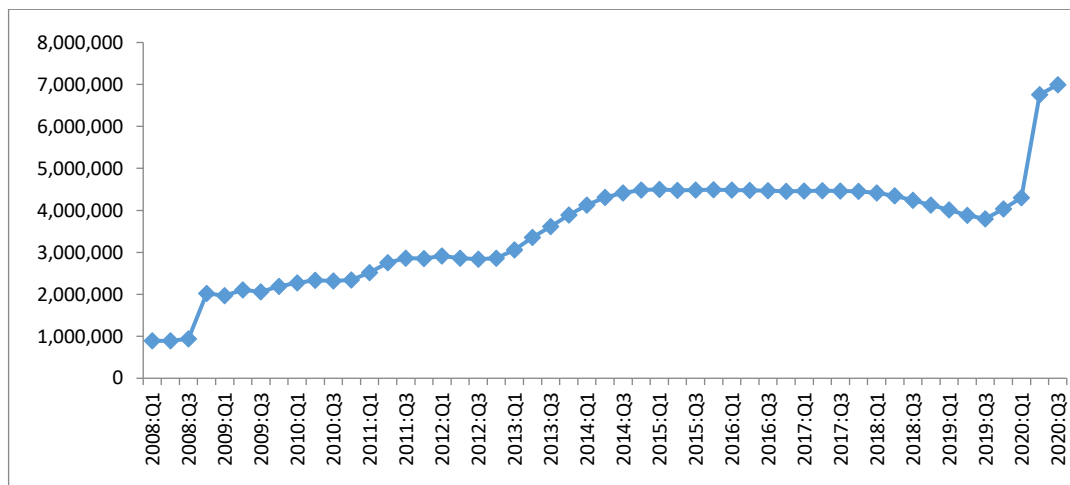

Figure 2: Total Assets of the Federal Reserve; 2008-2020

Source: Federal Reserve Bank of St. Louis (2021b).

2.1 Lending Facilities of the Federal Reserve Against COVID-19 Pandemic

Though the asset purchases have dramatically enlarged bank reserves, these liquid assets are in great demand and are unequally among banks, so short-term liquidity has remained insufficient, especially in credit markets. Consequently, like the other central banks that have announced several facilities to provide credit to certain financial markets, the FED offered different

lending facilities. For instance, the FED began to buy large volumes of securities, including treasuries, mortgage-backed, and commercial mortgage-backed securities, to restore the proper functioning of the financial system since these securities have become unsustainable as a result of the COVID-19 pandemic. The FED, which needs specific approval to take certain steps, also launched other liquidity and lending facilities to support several kinds of funding and credit markets and to restore confidence, including markets for financial instruments such as corporate bonds, commercial papers, municipal bonds, as well as asset-backed securities (Ihrig et al., 2020).

In response to COVID-19, the FED developed nine temporary emergency facilities. While the programs announced in March were an attempt to stabilize the general conditions of the credit market and were illiquid as a result of the fast spread of the COVID-19, the subsequent programs focused more on supporting businesses and municipalities affected by the pandemic economic disruption. The programs are established in various ways. In some of these, the FED buys loans or securities directly from the affected markets, and the FED makes lending directly to the concerned entities in other programs. The FED lends to financial institutions or investors to interfere in the affected markets; this lending is usually provided under attractive conditions to encourage business by often passing the credit risk to the FED on a non-recourse basis. On 23 March, the FED reactivated its Term Asset-Backed Securities Loan Facility (TALF) so that outstanding corporate bonds could become liquid. This facility helps the FED to offer financing to individuals, businesses, and small firms through lending to securities holders with the asset-backed securities collateralized by loans like newly-launched automobile loans, education loans, credit card receivables, equipment loans as well as small business loans.

In addition to resuming some facilities from the 2008-2009 recession like TALF, the FED launched new facilities to promote loans to municipalities, businesses, small and medium-sized enterprises. In this framework, the Primary Market Corporate Credit Facility (PMCCF), the Municipal Liquidity Facility (MLF), and the dual facilities of the Main Street Lending Program (MSLP) are relevant facilities of the FED. Additional facilities, such as the Money Market Mutual Fund Liquidity Facility (MMLF), the Commercial Paper Funding Facility (CPFF), the Secondary Market Corporate Credit Facility (SMCCF), and the Paycheck Protection Program Liquidity Facility (PPPLF) are also established to fund the parties which need liquidity. Of these, the PMCCF and SMCCF, which are designed to provide financing to large employers, are recent emergency lending facilities. FED improved the strength of two existing programs, the CPFF and PDCF (Haas & Neely, 2020).

A money market mutual fund is a type of mutual fund that only invests in very liquid instruments and hence provides high liquidity at low risk. The FED aimed to help money market funds in meeting households and other repayment needs of borrowers, improve overall market functions, and access to financing for the broader economy through the MMLF. The FED has greatly expanded the size of its repurchasing transactions to supply cash to capital markets and provides infinite amounts of liquidity. The MMLF offers non-recourse loans to financial institutions to buy securities that are exchanged to meet redemptions. This eliminates the risk of runs on money market funds as a result of a fund's inability to liquidate assets. In an effort to allow these participants to engage in both the money market mutual fund and the market in general, the FED recognizes a wide variety of eligible resources, including corporate paper. Commercial paper is an unsecured short-term financial instrument to corporate finance, which consists of short-term debt issued by financial companies, including banks, non-financial companies, municipalities, and corporations issuing asset-backed securities. The CPFF is a renewed crisis-era program in which the FED buys commercial paper and then lends to firms for up to 3 months, at 1 to 2 percentage points above overnight interest rates (Cheng et al., 2020). The CPFF acquires newly issued commercial papers from all sorts of U.S issuers who are not able to attract private sector investors. This facility might allow creditors to re-engage in commercial paper loans in a context that reduces a high risk of eligible issuers being unable to repay creditors by carrying out their maturing commercial paper obligations. A better commercial paper market will boost the willingness of businesses to retain workers and investments in the face of the COVID-19 pandemic.

In addition to its crisis-era initiatives, which rely largely on the financial markets functioning to safeguard its economies from its harmful consequences COVID-19, the FED has created new facilities that help highly rated U.S firms and announced that intensive liquidity measures would be taken. Loans to investment companies are another step in countering the harmful effects of COVID-19. In this respect, via the PDCF, the FED intends to offer a low interest rate scheme that was reactivated from the global financial crisis to lend to twenty-four major financial institutions for up to 90 days. These financial institutions can provide the FED with collateral involving municipal bonds and commercial papers. The goal then is to ensure that the credit markets survive at a time of distress in which financial institutions and individuals tend to escape volatile assets to retain cash, and dealers could face barriers to finance increasing inventories of securities that they can purchase in the market. Although primary dealers, like banks, rely heavily on short-term lending

markets as a result of their role as market makers. However, they are not able to use the discount window in contrast to the banks. The PDCF offers liquidity for primary dealers, a group of major government securities dealers that are market makers in the capital markets, and the FED's conventional counterparties in open market operations. In this sense, the PDCF, like the discount window, provides primary dealers with short-term, completely guaranteed loans. In an effort to enable such participants to engage more broadly in the corporate paper market, the FED would approve a wide variety of eligible assets, including corporate paper. International swap lines is another important instrument. The FED has extended existing U.S dollar liquidity swaps and developed a repo facility for international monetary authorities to promote dollar-denominated lending. Central banks can then easily access worldwide liquidity (Ihrig et al., 2020). In other words, the FED makes U.S dollars available to other central banks to lend to banks that need them through exchanging foreign currencies for charges on swaps. For the central banks of Canada, England, Euro-Area, Switzerland, and Japan, the FED reduced its charges for swaps and expanded these swaps' maturities while it has included the central banks of Australia, Sweden, Denmark, Norway, New Zealand, Brazil, Korea, Mexico, and Singapore to swap facilities. The FED is also supplying dollars via a new reserve facility to central banks that do not have an existing swap line by making overnight dollars loans to central banks under some circumstances (Cheng et al., 2020).

3. Literature Review

One of the key issues of monetary economics is the impact of monetary policy on the real economy and the sensitivity of economic variables to the policy instruments. The researches in the academic literature focusing on the impact of monetary aggregates on real economy go back to 1970s. For instance, Modigliani (1971) tries to answer the question to what extent, monetary policy affects economic activity through its direct impact on consumers' spending. In this context, Modigliani (1971) choose to concentrate on three major monetary policy variables as money supply, short-term interest rates and bank reserves. Dennis (1983) investigates the long-term relationship between monetary aggregates and nominal income across a selected group of countries including France, Italy, Germany, United Kingdom and United States and finds strong relationships between the variables. Following Meltzer (1999) which demonstrates that real monetary base growth is an important indicator of consumption growth in the U.S, Nelson (2002), attempts to illustrate that the same characteristic of base money holds for total output in both the

U.K and the U.S. In another study, Pallis and Katsouli (2003) investigate and measure the extent to which consumer prices are affected by changes in money supply (M1) and find a long-term relationship between consumer prices and M1.

With the outbreak of the COVID-19 pandemic, we see that the number of studies focusing on monetary policies of the central banks in that period. In this context, Coibion (2012) underlines that this sensitivity requires endogenous and exogenous adjustments in the monetary policy, and the monetary policy implemented by central banks is of critical importance, particularly in the financial crisis periods. In response to the economic and financial crisis resulting from the COVID-19 pandemic, most central banks have taken several measures. The adverse effects of the COVID-19 pandemic and the need to suggest policy implications have contributed to a noteworthy increase in recent pandemic-related reports and researches. The studies on academic literature and surveys of financial institutions indicate that economies experience a cycle of recession and a stressful period for the following period. Many of these studies on academic literature focus on the role of monetary policy in alleviating the detrimental consequences of the pandemic. The COVID-19 pandemic affects the monetary policy's role as the regulator of aggregate demand and assurer of macroeconomic stability. From this perspective, Pinshi (2020) attempts to assess the effects of the COVID-19 uncertainty shock on the economy and investigates the role of monetary policy in resolving the uncertainty resulting from the COVID-19 pandemic. The results of the study show that the COVID-19 instability effects are considerably greater and have an impact on aggregate demand, stocks, exchange rates, the degree of openness, confusing monetary policy implementations. His proposed models for assessing monetary policy responses reveal that monetary policy is inefficient and that for at least twenty-four months, it will have no impact. The findings also show that uncertainty weakens the central bank's ability to have an impact on the economy. Given that the uncertainty which the COVID-19 has created threats global demand and damaged monetary policies, he proposes designing unorthodox instruments for the gradual stabilization of the economy.

Zhang et al. (2020), noting that there are already thousands of people dead in the global spread of the COVID-19 pandemic, and this pandemic has brought huge challenges to the countries worldwide as well as drastic price changes in the capital markets, seek to examine the effect of the COVID-19 pandemic on the stock market risk by providing statistical analysis. Stock markets have been extremely volatile and unpredictable, owing to the significant uncertainty of the

pandemic and the resulting economic losses. It generated an extraordinary degree of risk, which has contributed to substantial losses for investors within a very short period. They attempt to identify the general trends of systemic risks and country-specific risks for the global financial markets. They also examine the likely implications of policy implementations, such as the FED's decision to conduct a zero percent interest rate and unrestricted quantitative easing and the degree to which these policies could put further risks to global financial markets. Their findings suggest that global financial market vulnerabilities in reaction to the pandemic have dramatically risen, and individual stock market exposure is directly related to each country's severity. The emerging market economies, like the developed countries, felt the risk aversion fully when global investors adjusted their portfolios as a result of the COVID-19 pandemic. As local currency bond yields rose as investors retreated, emerging market economies' currencies devalued significantly, revealing feedback loops between currency volatility and financial conditions in these economies. Many central banks in emerging market economies have implemented local currency bond-buying programs in reaction to the COVID-19 shock to cope with bond market dislocation, implying that they are prepared to take on the last resort role. The local currency bond yields declined substantially after the program announcements with little impact on exchange rates. These positive initial market reactions have shown the success of programs in restoring investor confidence and have not brought about higher expectations of inflation. Arslan et al. (2020) review the emerging market economies (EME) bond-buying schemes, describe the features of these EME bond-buying programs, evaluate their market implications and address the impacts for EME monetary policy frameworks while emphasizing that market reactions differ between countries dependent on initial circumstances in each jurisdiction as well as on the size, scope, and interaction of bond purchasing programs. Their analysis shows that the measures ultimately helped support the bond markets when they were introduced, but the implementation and coordination of these measures are quite critical.

Focusing on the U.S economy, Bekaert et al. (2020) try to forecast aggregate demand and aggregate supply components of the COVID-19 related recession, in real-time projections, by using a new identification scheme to derive aggregate U.S economy demand and supply shocks from real-time inflation and real GDP growth survey data. Their methodology utilizes non-Gaussian characteristics of macroeconomic forecast revisions and sets minimum theoretical assumptions. After having confirmed that their findings for U.S economic cycles after the World War II are largely

in compliance with the conventional opinion, they examine production and price changes in the period of the COVID-19 pandemic. Finding that changes in GDP are affected by adverse shocks to aggregate demand and supply, they suggest a sluggish rebound because of the lasting impact of the supply shock, while evidence indicates a somewhat quicker rebound with a recovery in aggregate supply heading the way. In this pandemic era, fiscal and monetary policies vary greatly. For instance, the U.S has the capability to implement more expanded policies, while emerging markets can respond more limitedly to crises. Benmelech and Tzur-Ilan (2020) study the determinants of fiscal and monetary policies implemented in the period of the COVID-19 pandemic and notice that the countries with high income declared larger fiscal policies than the countries with lower income and that the credit ratings of a country are often a key determinant of its fiscal expenditure in the period of the pandemic. High income economies plunged into recession at historically low interest rates, which has made the use of unconventional monetary policy mechanisms more possible. These results trigger concern that countries with weak credit history, lower credit scores, and particularly lower income, would not be able to employ fiscal policy instruments efficiently during economic crises. In their study, Cachanosky et al. (2021) provide a review of the Federal Reserve's policy reaction against the COVID-19 recession and assess the success of the FED's monetary and emergency lending policies. They suggest that while the FED's monetary policies have supported the economic recovery, as GDP growth and unemployment rebound to their long-run rates, the FED should have done more to enhance monetary stability.

4. Econometric Analysis

4.1 Methodology

We employ the following model to analyze the FED policy on consumer behavior:

$$LnY_t = \alpha_1 + \alpha_2 LnASSET_t + \alpha_2 LnM3_t + e_t \tag{1}$$

Where α_1, and e_t indicate the intercept, and an i.i.d. error term. Y_t shows the consumer behavior. We use consumer expenditure (*CEXP*), consumer credits (*CCRED*), and consumer sentiment (*CSENT*) for the proxy of this variable in different equations, ASSET and M3 show total assets[1] and the money supply, respectively.

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[1] It is the total value of assets held by the FED that includes government securities and the loans to regional banks such as treasuries, mortgage-backed securities and federal agency debt.

To test the cointegration relationship in Eq. 1, we employ the bounds test approach to the cointegration that is introduced by Pesaran et al. (2001). Pesaran et al. (2001) suggest using the F and t-tests to test the null hypothesis of no-cointegration in a dynamic error correction specification of an ARDL model. The ARDL bounds test has several attractive properties compared to other existing cointegration tests, e.g., the regressors could be either integrated at level or first differences, besides the test is reliable even in small sample sizes (Narayan & Narayan, 2005).

An ARDL model for the relationship in Equation 1 can be written as follows:

$$LnY_t = \alpha_1 + \sum_{i=1}^{p} \beta_i LnY_{t-i} + \sum_{j=0}^{q} \beta_j LnASSET_{t-j} + \sum_{k=0}^{r} \delta_k LnM3_{t-k} + u_t \tag{2}$$

Where i, and t show the lag index, the time period. To apply the test, we can re-parametrize Eq.2 into an error correction model as:

$$LnY_t = c + \phi LnY_{t-1} + \varphi LnASSET_{t-1} + \gamma LnM3_{t-1}$$
$$+ \sum_{i=1}^{p-1} \eta_i LnY_{t-i} + \sum_{j=0}^{q-1} \lambda_i LnASSET_{t-j} + \sum_{k=0}^{r-1} \theta_i LnM3_{t-k} + \omega_t \tag{3}$$

Pesaran et al. (2001) suggested a F test (F_1), and t test for testing the null hypothesis of $H_0 : \phi = \varphi = \gamma = 0$ and $H_0 : \phi = 0$, respectively. McNown et al. (2018) proposed an additional F test (F_2) to test the significance of the regressors $(H_0 : \varphi = \gamma = 0)$ in the ARDL model to complement the test statistics of Pesaran's test. In the case of rejection of all three null hypotheses, one can conclude that there is cointegration between the variables.

Pesaran et al. (2001) tabulated two sets of critical values for the first two hypotheses. The null hypothesis is rejected when the test statistic is higher than the upper critical value. The null cannot be rejected the null when the test statistic is lower than the lower critical value. However, there is an inconclusive inference when the test statistic falls between lower and upper critical values. McNown et al. (2018) suggest obtaining the critical values considering the specific stochastic properties of the variables in the test equation via bootstrap simulations, so one can eliminate the possibility of no-conclusion about the cointegration relationship. To determine the optimal lag lengths in the ARDL models, we use Akaike information criteria.

4.2 Data and Empirical Results

In our analysis, we use U.S money supply (M3) and total assets as our dependent variables and consumer expenditures, consumer credits, and consumer sentiment as our regressors. The data source is the Federal Reserve Bank of St. Louis (2021c), covering the period

from 2003:01 through 2020:08. In the analysis, we use logarithmic forms of the series for empirical purposes.

The only pre-requisite for the bootstrap ARDL cointegration test is that the dependent variable must be stationary at the first difference, while the regressors may be either stationary at the level or the first differences. So, to determine the integration levels of the variables, we employ unit root tests that suggested by Dickey and Fuller (1979) (ADF), Phillips and Perron (1988) (PP) unit root test, and Zivot and Andrews (1992) (ZA) unit root test that allows an endogenous structural break, and tabulate test results in Table 1.

Table 1: Results of Unit Root Tests

| Series | ADF Unit Root Test | | Phillips-Perron | | Zivot-Andrews Unit Root Test | |
	Level	First Differences	Level	First Differences	Level	First Differences
LnASSET	-0.592 (0.868)[5]	-4.889 (0)[4] *	-0.498 (0.888)	-7.509 (0) *	-6.285 [2]{2008M9}	
LnCCRED	-0.492 (0.889)[2]	-8.183 (0)[1] *	-0.531 (0.881)	-12.844 (0) *	-4.271 [2]{2008m11}	-9.749 [1]{2010M12}
LnCSENT	-1.817 (0.372)[8]	-5.048 (0)[7] *	-2.312 (0.169)	-14.901 (0) *	-4.305 [2]{2007M08}	-11.072 [2]{2008M07}
LnM3	1.462 (0.999)[2]	-7.539 (0)[1] *	1.706 (1)	-6.52 (0) *	-2.29 [2]{201106}	-9.09 [1]{2017M11}
LnCEXP	-2.041 (0.269)[4]	-9.79 (0)[3] *	-0.857 (0.8)	-12.126 (0) *	-3.877 [4]{2008M09}	-10.3 [3]{2009M08}

Note: Numbers in parentheses, brackets, and curly brackets show the p-values, optimal lag lengths, and breakpoint date, respectively.

* shows the statistically significance at the 1% level. 1% critical value for the Zivot-Andrews unit root test is -5.57.

The results of ADF and PP unit root tests demonstrate that all the considered series are stationary at the first differences. However, the ZA unit root test's results provide evidence of the first difference-stationary for all series, except LnASSET. Results of the ZA unit root test also reveal the effect of the 2008 Great Recession and the debt-ceiling crisis of 2011, since structural break dates are found in 2007, 2008, and 2011.

Since the dependent variables are integrated at the first difference, we can next test the long-run relationships between the variable using the bootstrap ARDL cointegration test. By following the studies of Cai et al. (2018), Goh et al. (2017), and Lin et al. (2018), we add a dummy variable to the ARDL model equations to consider the effect of the COVID-19 pandemic. We formulate the dummy variables such as:

$$DU_t = \begin{cases} 0, & \text{if } t \leq 2020{:}03 \\ 1, & \text{if } t > 2020{:}03 \end{cases}$$

Table 2 present the results [2].

Table 2: Results of the Bootstrap ARDL Test

Dependent Variable	Test Statistics		Bootstrap Critical Values		
		0.9	0.95	0.99	
LnCEXP	F_1	10.580*	4.390	5.236	8.288
(Selected Model:	t	-5.622*	-3.177	-3.510	-4.377
ARDL(3,3,0))	F_2	15.279*	5.791	6.840	10.754
LnCCRED	F_1	4.260	5.054	5.946	8.489
(Selected Model:	t	-3.524	-3.455	-3.780	-4.461
ARDL(3,0,0))	F_2	6.390	6.768	8.069	11.073
LnCSENT	F_1	2.301	4.815	5.592	7.325
(Selected Model:	t	-1.583	-3.350	-3.699	-4.240
ARDL(3,2,1))	F_2	1.456	6.377	7.480	9.905

Note: * shows the significance at the 1% level. Critical values are obtained using 5000 simulations.

The results in Table 2 supports evidence of a cointegration relationship between consumer expenditures, M3 money supply, and total assets since all three test statistics are statistically significant. There is no long-run relationship for the remaining. So, next, we estimate the long-run coefficients and present the results in Table 3:

Table 3: Long-run Coefficients (Dependent Variable: LnCEXP)

Variables	Coefficients	t-Statistics
Intercept	-13.228*	-16.619
LnASSET	-0.0823*	-6.116
LnM3	0.794*	24.239
DU	-89.066*	-2.878
DU*LASSET	-1.307*	-3.274
DU*LM3	3.587*	2.970

Note: 1% critical value for t-statistics is 2.58. * shows the significance at the 1% level.

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[2] For the LNCSENT equation, we also consider the effect of first stimulus check payment, however, the finding support no evidence of a cointegration relationship. The results are available upon request.

We observe from the results in Table 3 that LnAsset has a decreasing effect on LnCEXP, while LnM3 has an increasing impact. The coefficients can be interpreted as follows; before the COVID-19 pandemic, a 1 percent increase in total assets is associated with a 0.08 percent decrease in consumer expenditures, and a 1 percent increase in money supply creates 0.79 percent increase in CEXP. However, the effect of these variables seems to be stronger after the pandemic. A 1 percent increase in ASSET decreases CEXP by about 1.390 percent, and a 1 percent increase in M3 increases CEXP by about 4.38 percent. In economics, it is a well-known fact that as the money supply increases aggregate demand and consumer expenditures is a component of the aggregate demand, the increase in the money supply is expected to increase the consumer expenditures. Our finding is in line with this fact, implying a positive relationship between monetary policy implications (M3 growth) and aggregate demand. On the other hand, contrary, our finding signaling the negative relationship between assets and consumer expenditures is not in line with the researches including Berg et al. (2019). Next, we present the short-run coefficients in Table 4:

Table 4: Short-run Coefficients (Dependent Variable: LnCEXP)

Variables	Coefficients	t-Statistics
D(LnCEXP(-1))	-0.451*	-14.922
D(LnCEXP(-2))	-0.608*	-22.132
D(LnASSET)	-0.042*	-5.411
D(LnASSET(-1))	-0.008	-0.850
D(LnASSET(-2))	-0.040*	-5.024
Error Correction Term	-0.047*	-22.822

Note: 1% critical value for t-statistics is 2.58. * shows the significance at the 1% level.

The findings in Table 4 show that the error correction term is statistically significant and lies between zero and -1 that is evidence of a deviation from the long-run will be corrected in about 21 months. Besides, the results show that total assets also have a decreasing effect on consumer expenditures in the short-run.

In the case of the existence of a cointegration relationship between the variables, there must also exist a causality between the variables, at least unidirectionally. So, to support the findings bootstrap ARDL cointegration test and determine the predictive power of the variables, we

test the causality relationship between the variables using Hacker and Hatemi-J (2006) (HH) causality test. This causality test is based on a lag augmented vector autoregressive (VAR) model with the maximum integration levels of the variables, so one does not need to take the difference the data before the causality analysis. In this study, we employ the HH causality test and present the results in Table 5:

Table 5: Bootstrap Causality Test Results

Null Hypothesis	Test Statistics	VAR Lag	Bootstrap Critical Values		
			0.9	0.95	0.99
LnASSET ↛ LnCEXP	2.284	4	7.137	12.589	36.401
LnCEXP ↛ LnASSET	1.345	4	6.628	13.571	40.8
LnM3 ↛ LnCEXP	9.605***	5	8.646	12.435	24.175
LnCEXP ↛ LnM3	54.796*	5	8.258	11.931	23.294
LnASSET ↛ LnCCRED	2.705	4	6.854	11.75	29.63
LnCCRED ↛ LnASSET	1.718	4	6.338	11.296	29.516
LnM3 ↛ LnCCRED	4.721***	3	4.655	6.635	13.882
LnCCRED ↛ LnM3	2.697	3	4.54	6.781	14.677
LnASSET ↛ LnCSENT	12.683**	5	8.11	10.283	15.337
LnCSENT↛ LnASSET	5.37	5	8.083	10.409	14.877
LnM3 ↛ LnCSENT	10.424**	4	6.418	8.173	12.072
LnCSENT ↛ LnM3	1.199	4	6.478	8.073	11.868

Note: *, **, and *** show the statistically significance at the 1%, 5%, and 10% levels, respectively. Critical values are obtained running 5000 simulations.

The outcomes of the HH causality test imply that there is bidirectional causality between LnM3 and LnCEXP, and there is a unidirectional causality that runs from LnM3 to LnCCRED, from LnASSET to LnCSENT, and from LnM3 to LnCSENT. The bidirectional causality between LnM3 and LnCEXP confirms the results of the bootstrap ARDL cointegration test. Besides, we can also conclude that the M3 money supply has predictive power for consumer credits, and consumer sentiments and total assets have predictive power for consumer sentiments.

5. Conclusion

U.S has experienced the high effect of the COVID-19 pandemic on economic fundamentals, including GDP, unemployment rates, consumption, and investment expenditures. This prolonged pandemic is expected to lead to the largest third recession since the 1929 Great Depression and the 2008-09 Global Financial Crisis with a worldwide impact. FED adopted a broad variety of initiatives to alleviate the financial harm incurred by the pandemic, including loans to households, companies, capital markets as well as national and local governments in response to such crisis and a significant decline in the economy resulting from the COVID-19 pandemic. As a result of measures taken by the FED against the pandemic, its balance sheet has expanded dramatically. This paper attempts to analyze the monetary aggregates on consumer behavior before and after the pandemic by employing the bootstrap ARDL cointegration test with an exogenous structural break that controls for the effect of COVID-19. We use U.S money supply (M3) and total assets as our dependent variables and consumer expenditures, consumer credits, and consumer sentiment as our independent variables in our analysis covering the period from 2003:01 through 2020:08. Our results support evidence of a cointegration relationship between consumer expenditures, M3 money supply, and total assets. Furthermore, we find that M3 has a predictive for consumer credits, and consumer sentiment, while asset size has predictive power for consumer sentiments, meaning that FED's balance sheet expansion has an impact on consumer behavior. Our results are consistent with the studies of Pinshi (2020) and Arslan et al. (2020), suggesting that monetary policy implications play a key role in mitigating the adverse impacts of the COVID-19 pandemic.

Consumers have changed their behavior during the crisis. The pessimistic expectations about their countries' economic outlook, fear of getting the infection, concerns regarding jobs, decreases in incomes are the main reasons for consumers being mindful of their spending and purchasing less expensive products. Many people have expected the pandemic would prolong and tend to save more due to uncertainty in the economic environment. The increasing numbers made people cautious and scaled back on their expenditures. The U.S has announced stimulus packages of billions of dollars to support the growth. At the beginning of the third quarter, as people started to learn to live with the COVID-19 pandemic, countries started to reopen most of their economies. After the dramatic decline in the March-April period, consumers have settled into a new normal. Therefore, in the third quarter, we observe a rebound in consumer expenditures,

consumer credits, and consumer sentiment, following the sharp decline in these variables. The stimulus packages the U.S has implemented and also reopening the economy have probably positively contributed to this positive trend. The practices such as the 600 USD supplement for unemployment insurance also contributed to the rebound in consumer expectations in this period. Furthermore, as the spread of COVID-19 is likely to decline given that the treatment is expected to be available on a large scale soon, the pressure which the pandemic has created on consumers might decrease in the following period.

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