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Unconventional monetary policy: its impacts and effectiveness in economic and financial crises

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Abstract

This paper examines how the use of unconventional monetary policy instruments influences financial markets and the economy in times of crisis. Through an empirical event studies strategy, we assessed the impact of large-scale asset purchase program announcements during the COVID-19 pandemic crisis in 2020 with a focus on interest rates, exchange rates and equity markets. The results show that quantitative easing is effective in the sense of going beyond not only reducing short-term interest rates, but also causing significant reduction in long-term rates. The reduction in long-term rates occurs through the asset purchase channel in the secondary market, mainly of sovereign bonds, but also including other types of equity and private debt instruments. The results also showed a significant devaluation of the local currency of the country that undertakes quantitative easing compared to other countries. Unlike interest rates and currency markets, which react immediately to unconventional monetary policy announcements, the results showed that the stock market takes longer to reverse the downward trend observed during the crisis despite unprecedented monetary stimuli.

Keywords: unconventional monetary policy; large-scale asset purchase programs; *quantitative easing* ; COVID-19

1 INTRODUCTION

The triggering of global financial crises has led central banks of several countries to implement conventional and unconventional monetary policy measures with the aim of first stabilizing financial markets and, secondly, stimulating economic growth. Conventional instruments such as emergency lines of liquidity and, mainly, the reduction of the basic interest rate of the economy, were the main tools of the monetary authorities to face crises of great magnitude. What has been observed in recent years is a long trend of lower and lower interest rates in developed countries, with some reaching zero rates or even less than zero. This limit, where the monetary authority has little room for further interest rate reductions, is called in the literature as *Zero Lower Bound (ZLB)*. In a ZLB scenario and with the urgency, in times of crisis, to implement measures to stabilize financial markets and stimulate economic activity, some central banks have resorted to unconventional monetary policy instruments. Among these, four instruments stand out: the Negative Interest Rate Policy, the Extended Liquidity Financial Assistance, the *Forward Guidance* and the Large-Scale Asset Purchase Programs.

Despite some previous experiences, the first major laboratory for employing and evaluating the effectiveness of unconventional monetary policy mechanisms was the 2007-2008 Great Global Recession (GRG). Central banks in Europe, Japan and, mainly, the USA, made extensive use of these instruments, which generated a vast academic literature discussing their effects, advantages and disadvantages. Even with the overcoming of the GRG and the recovery of stability and economic growth, some monetary stimuli were maintained for years, raising the debate on the extent to which markets did not become dependent on a continuous stimulus and what would be the limit for this type of policy.. With the advent of the COVID-19 pandemic, which started in China at the end of 2019 and spread globally throughout 2020, a new financial and economic crisis took hold. Initially, without a vaccine, the only effective measures to contain the spread of the virus were social isolation. This caused supply and demand shocks in the economy and financial markets. The supply shock came from the stoppage of companies due to legal obligation or discretion with the aim of protecting the health of employees. Industries suspended production, logistics chains were interrupted and the main sector affected was services, the most dependent on social interaction for its functioning. The demand shock occurred as a result of the fall in consumer confidence in purchasing goods and services as a result of unemployment and lower incomes. The governments of states, provinces and municipalities, without the power to issue currency and with a sharp drop in revenue, also

had difficulty maintaining public services and goods. Once again, central governments were urged to promote a wide range of monetary and fiscal stimulus to reduce volatility and provide liquidity in markets, as well as support businesses, households and local governments.

This work seeks to analyze the unconventional monetary policies adopted by countries during the COVID-19 pandemic, in particular *quantitative easing* (QE) programs, their effects and effectiveness in combating the resulting financial crisis. Before the advent of the COVID-19 crisis in 2020, relevant academic literature was produced on the QE1 (2008), QE2 (2010) and QE3 (2012) programs. Our work, through an empirical approach of event studies, seeks to assess how QE4 (2020) differs from previous programs, whether the policy continues to produce the desired effects and at what cost. In this work we also analyze the recent phenomenon of the use of QE policy by central banks in emerging countries. After this introduction, in chapter 2 we provide a broad contextualization of the various instruments of unconventional monetary policy, their characteristics, modes of operation and objectives. Also in chapter 2, we analyze how these instruments were used by several developed and emerging countries throughout the IRM and the COVID-19 crisis. In chapter 3, we carried out a review of the academic literature showing the theoretical support for the implementation of unconventional PM and some empirical evidence. In Chapter 4 we present the modeling of our empirical event study strategy to assess the impacts of QE program announcements on interest, currency and *equity markets*. In Chapter 5 we explain the data sources on which we apply our econometric model. Chapter 6 presents the results of event studies and a discussion of them. Finally, in chapter 7, the conclusion of the work.

Our results show that QE announcement events produce a statistically significant impact of falling *yields* along the entire yield curve of sovereign bonds, including the longest vertices. In this sense, we corroborate the results found by Krishnamurthy and Vissing-Jorgensen (2011) and Gagnon et al. (2011), who studied the announcement events of the QE1 and QE2 programs on the occasion of the 2007-2008 GRG, as well as the results of Hartley and Rebucci (2020) on the occasion of the COVID-19 crisis in the year 2020. Additionally, in the In our work, we observed a devaluation of the US currency against other currencies on the days when the Fed announced its QE programs. The expected positive impact on stock exchanges was not seen in the short term after the events.

2 UNCONVENTIONAL MONETARY POLICY INSTRUMENTS AND THEIR RECENT IMPLEMENTATIONS

2.1 TYPES OF UNCONVENTIONAL MONETARY POLICY

Unlike conventional ones, unconventional monetary policy tools are not intended to attack short-term risk-free interest rates. They are designed for other purposes such as influencing long-term risk-free interest rates, providing liquidity in certain markets, affecting credit *spreads* and asset prices in the financial system. With the use of these unconventional instruments, central banks have become intermediaries in a diverse range of financial activities. Unconventional monetary policy evolved through stages as the financial conditions of each crisis changed in an experimental process. Throughout this process, its drivers sought to address problems in the monetary transmission mechanisms and provide additional monetary stimulus, given the impossibility of further reducing short-term interest rates. Many of the instruments were tested simultaneously, making it difficult to identify their effects individually. Among the unconventional monetary policy instruments addressed in the literature, the Negative Interest Rate Policy (PTJN), the Extended Liquidity Financial Assistance (AFLE), the Large-Scale Asset Purchase Programs (PCALE) and the Forward Guidance (FG).

Regarding PTJN, for a long time it was believed that the minimum threshold for the risk-free interest rate was zero (*Zero Lower Bound*). With the secular trend of interest reduction, it started to be considered that, in fact, there would be a minimum limit called *Effective Lower Bound* (ELB), not necessarily positive. According to Brunnermeier and Koby (2019), the ELB is determined by a combination of factors that may vary between different financial systems. The response of financial intermediaries to very low interest rates can block the transmission of interest reductions to the real economy. The profitability of these agents largely depends on the *spreads* between borrowing and borrowing interest rates, and their margins can deteriorate at very low interest rates. This is even more evident in a negative interest rate scenario, where an attempt by banks to establish a negative remuneration for retail deposits could motivate a rush of withdrawals as the cost of holding cash would become less than the to keep it on deposit. At the other end, interest rates on credit to firms and households would tend to be negative, generating an imbalance, limiting the supply and/or increasing the cost of credit. The ELB is the level where a marginal decrease in the basic interest rate starts

to have a reverse effect on monetary policy, making credit contractionary instead of expansionary.

Negative Interest Rate Policy came into use in developed economies with the advent of the 2007-2008 GRG ¹. As some central banks enter the negative interest frontier, it becomes clear that the ELB can be less than zero, with variations from one country to another due to idiosyncratic factors. PTJN are unconventional in the sense that they invert the orthodox logic that the holder of surplus resources should be remunerated for depositing this surplus. On the contrary, the surplus in the context of a PTJN incurs a cost for holding the surplus resources, which affects the formation of agents' expectations.

Regarding the second unconventional PM instrument, the AFLE, it differs from the AFL as an unconventional instrument in terms of the characteristics of its operations. Traditionally, the vast majority of monetary authorities have always provided Liquidity Financial Assistance (AFL) lines to financial institutions in difficulty. The role of central banks as lenders of last resort in itself cannot be considered unconventional monetary policy. With the financial turmoil at GRG, central banks created new lending facilities and expanded existing ones to provide ample liquidity to a wide range of financial institutions at the same time, which were under stress conditions. A good part of these extended operations accepted low quality collateral, were carried out for a longer term and at lower costs than the traditional one, given the growing systemic risk. By avoiding a general downturn in funding markets that would have exacerbated the crisis, AFLE helped financial intermediaries in greater need to make credit available to the real economy, which contributed to overcoming monetary transmission bottlenecks at the peak of the crisis. In later stages of the GRG, some AFLE operations evolved by making loans conditional on the beneficiary bank's commitment to lend to specific non-financial sectors of the economy. In this way, the economic policy maker managed to ensure that liquidity reached the end of the line for activities considered by him as a priority.

The *Forward Guidance* (FG), the third unconventional PM instrument analyzed, consists of publicly providing information about the future of monetary policy in order to influence agents' expectations. In a way, the FG is not a new instrument either. Many central banks have long had a policy of transparency with the market regarding the direction of their

¹With rare exceptions, such as Switzerland in the 1970s, which even charged 2% to non-resident depositors with Swiss franc accounts. The objective was to reduce the attraction of foreign capital flows. Exception also to Japan, with zero base interest rate in 1999.

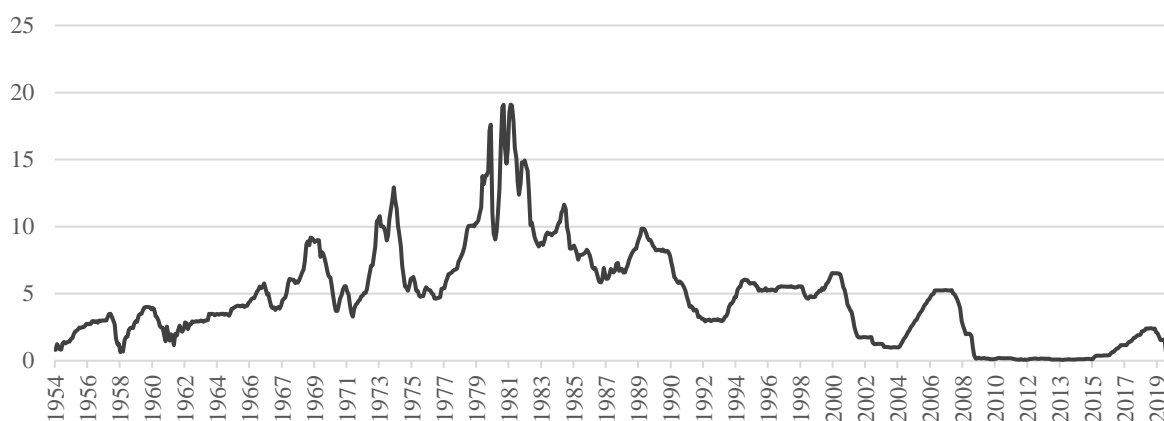
policy. Since the early 2000s, the Federal Reserve has employed the *guidance* of maintaining a policy of low interest rates for a “long term” (Meade et al 2015). The Bank of Japan introduced the FG in April 1999, two months before implementing its zero interest rate policy. Its president, Hayami (1999) evidenced the *guidance* by declaring that he would maintain the zero interest rate policy “until the concern about deflation is dissipated”. The FG is considered an unconventional monetary policy when it goes beyond and seeks to signal a strong commitment from the central bank in the pursuit of extraordinary actions and for a prolonged period of time. Typically, FG is combined with other unconventional tools like PTJN and AFLE and PCALE operations. The success of the FG instrument depends on the monetary authority's ability to communicate its intentions and its credibility. According to Campbell et al. (2012), there are two styles of *Forward Guidance* : the “ *Delphic* ” and the “ *Odysean* ”. The first is intended merely to predict the macroeconomic performance and possible actions resulting from monetary policy. The second goes further and publicly commits to certain actions.

Finally, the fourth and last instrument analyzed, the PCALEs, also known as *Quantitative Easing* (QE) programs, consist of actions to purchase assets outside the scope of short-term sovereign bonds. These large-scale unconventional operations include purchases of long-term sovereign bonds, private sector bonds, corporate shares and other types of *equities* such as Exchange Traded Funds (ETFs), real estate investment funds and others. QE is a controversial novelty post-GRG 2007-2008. Critics of this type of policy argue that the purchase of private sector assets goes beyond the monetary authority's mandate and exposes it to inappropriate financial risks. The rationale behind central banks' use of QE is the desired impact on asset prices. Public and private sector bond purchases tend to lower their interest rates and associated risk premiums and potentially overcome difficulties in monetary transmission links, lowering the cost of credit to the real economy. Purchases that remove low-risk assets from investors' portfolios are able, through a substitution effect, to stimulate demand for riskier assets, relaxing financial conditions with the expectation that this would boost aggregate demand.

2.2 IMPLEMENTATION OF UNCONVENTIONAL MONETARY POLICY IN THE GREAT GLOBAL RECESSION OF 2007-2008

With the exception of some localized crises, over the last few decades there has been a broad movement of interest rates reduction in developed economies. The US base interest rate (FED *Funds Rate* ²) reached an all-time high of 19.1% per year in 1981, during the Iran-Iraq war, as a result of a shock to global oil prices, high inflation and unemployment in the USA. After a long period of monetary easing, in 2004 the FED *Funds Rate* reached the level of 1% per year, in a period of low inflation and a significant increase in the Gross Domestic Product in that country. From 2004 to 2006, the Federal Reserve, in order to face rising inflation, raised the basic interest rate to the range of 5.25% and remained at a level of 4.25 until December 2007, when a strong turmoil began resulted in the 2007-2008 GRG (GRUSKY; WESTERN; WIMER, 2011).

Graph 2.1- Historical effective FED *Funds Rate* from 1954 to 2020



Source: FRED *Economic data* – Federal Reserve Bank of St. Louis (2020)

On the day the investment bank Lehman Brothers announced its bankruptcy, September 15, 2007, the basic interest rate in the US was 5.25% pa. What was observed from this milestone was an intense financial and economic crisis with reflexes not only in the United States, but in the entire global financial system. With room for conventional monetary stimulus, the Federal Reserve imposes successive cuts in the basic interest rate, reaching 0.09% pa on December 30, 2008 (graph 2.2).

² <https://fred.stlouisfed.org/series/FEDFUNDS>

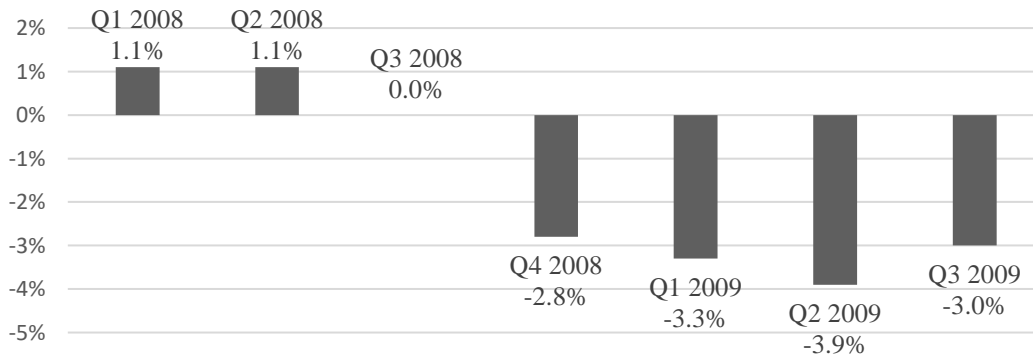
Graph 2.2– Historical Effective Funds Rate from 2007 to 2008



Source: FRED Economic data – Federal Reserve Bank of St. Louis (2020)

In December 2008, with the FED Funds Rate at 0.09% pa, the Federal Reserve approached a threshold called *Zero Lower Bound* (ZLB), in which the authority is no longer able to offer monetary stimulus via interest rate reduction of short term. Despite all the stimulus until then, the US economy was still in a deep recession, with the Gross Domestic Product (GDP) in the 4th quarter of 2008 at -2.8% compared to the same period in 2007 (graph 2.3). Without the possibility of making use of the conventional instrument (interest rate), the US central bank embarks on an unconventional monetary policy, including instruments such as *forward guidance* and large-scale asset purchase programs in the trillions of dollars, starting in November 2008. The use of unconventional monetary policy was not restricted to the US, but was also widely used by other central banks including the European Central Bank (ECB), Bank of England (BoE) and Bank of Japan (BoJ), countries that also had basic interest rates close to the *Zero Lower Bound*.

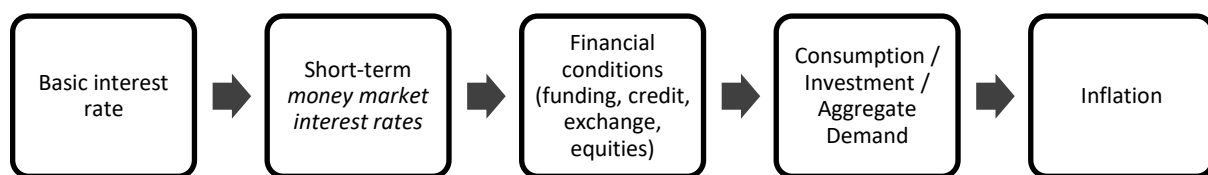
Graph 2.3– US GDP – Quarterly percentage change versus previous year



Source: FRED Economic data – Federal Reserve Bank of St. Louis (2020)

Monetary policy is conducted by central banks through their statutory objectives (POTTER 2019). In most countries that adopt a floating exchange rate regime, the main mandate of the monetary authority is to keep inflation close to a pre-established target. Some also aim to minimize the unemployment rate as a secondary mandate. The main conventional monetary policy tool of central banks is the control of the short-term interest rate in the open market for government bonds. Not only changes in the base rate, but also expectations of future changes affect agents' financial conditions via funding costs. Through transmission channels, financial conditions can affect variables such as activity, employment, exchange rates and inflation. Conventional monetary policy transmission channels include *links* related to short-term funding markets, through the bond maturity curve, bank funding and credit markets, exchange rates and capital markets. Figure 2.1 (POTTER 2019) briefly explains the transmission channels of monetary policy.

Figure 2.1– Simplified scheme of money transmission chain



Source: POTTER 2019

According to POTTER (2019), these transmission channels operate better when a certain set of conditions is satisfied. First, there must be room for the prime rate to move in the desired direction without the constraint of a lower bound. Second, the means of raising funds in the capital markets must work efficiently with the possibility of arbitrage between *overnight rates* and the rest of the term structure, so that the funding conditions of the different agents move in sync with the movements of the basic interest rate. Third, expectations for inflation must be well anchored by agents in general. When this occurs, inflationary surprises (in either direction) tend to be transitory and do not result in perennial inflationary effects. This set of three conditions was handily satisfied in most mature economies during the decades leading up to the 2007-2008 Great Global Recession.

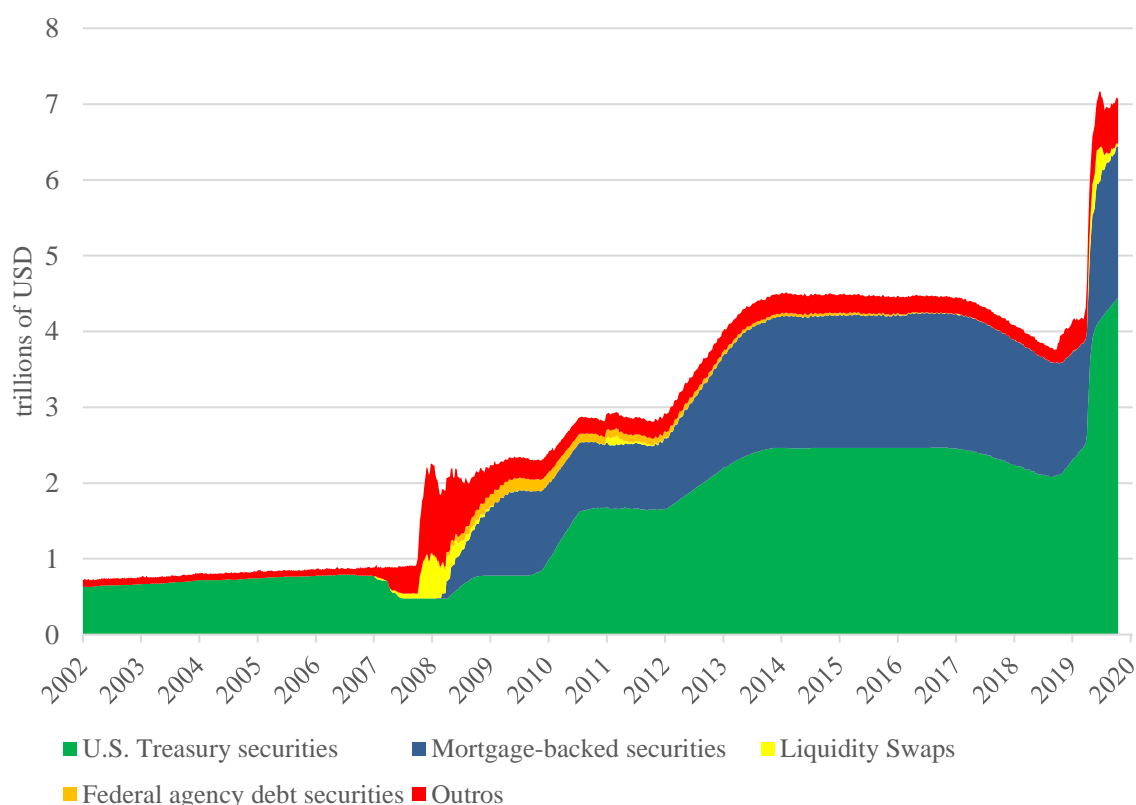
During the GRG, many central banks had to face a compromised financial sector and the effectiveness of traditional monetary tools proved ineffective. At first, financial conditions did not respond satisfactorily to reductions in basic interest rates. Subsequently, not even the reduction of basic rates became feasible due to the approximation of the ZLB. Hubrich and

Tetlow (2015) present empirical evidence of the weakness of conventional monetary policy in times of financial crises. Against this backdrop, central banks gradually began to adopt unconventional monetary policy instruments.

Until 2007, the Federal Reserve's balance sheet was reasonably stable. Graph 2.4 shows that, until the pre-IBC period of 2007-2008, the monetary authority's total assets amounted to just under USD 1 trillion and consisted mainly of US sovereign bonds, the *treasuries*. Most of these *treasuries* were short-term, within the monetary authority's conventional mandate to pursue the basic interest rate in the *money market*. interbank.

From November 2007 onwards, with the onset of the crisis, there was a rapid growth in the FED's balance of assets, reaching a total of USD 2.2 trillion in December 2008. In addition to more than doubling by about year, the composition of assets has also changed significantly.

Graph 2.4– Federal Reserve balance sheet (assets only)



Source: Federal Reserve – Board of Governors – File H.4.1 (2020)

The asset balance, which at the end of 2007 was basically composed of short-term sovereign bonds, at the end of 2008 starts to be composed of a considerable portion of liquidity

swaps (AFLE) and of private sector bonds (the “Others” component of the graph 2.4), evidencing a monetary expansion around USD 1 trillion in a short period of time. In a *press release* published on November 25, 2008 ³, the Federal Reserve announces the start of purchases of USD 600 billion in *mortgage-backed securities* (MBS), real estate mortgage-backed securities, in addition to *federal agency debt securities*, government bonds issued by agencies US quasi-governmental federal agencies. Added to the monthly purchases of tens of billions of dollars of *treasuries* with a maturity of 2 to 10 years, the Fed's assets reached USD 2.3 trillion on November 24, 2010. The PCALE that took place between November 2008 and November 2020 became known in the literature as QE1.

In November 2010, the Fed announced a second round of stimulus (CENSKY, 2010), covering purchases of USD 600 billion in *treasuries*. This phase, called QE2, runs until September 2012, when the Fed's assets reach a volume of USD 2.8 trillion.

On September 13, 2012 ⁴, the Federal Reserve begins QE3, announcing monthly purchases of USD 40 billion in MBS. In the same announcement, the US monetary authority communicates its intention to keep its benchmark interest rate close to zero until “at least mid-2015”. In a new announcement on December 12, 2012 ⁵, the Fed increases the monthly volume of purchases from USD 40 billion to USD 85 billion. On June 19, 2013, the president of the Fed announced the beginning of a policy of gradual reversal of monetary easing promoted by QE (PRIAL, 2013). This reversal became known as *tapering*. Specifically, he intended to reduce bond purchases from USD 85 billion to USD 65 billion per month and, while not announcing an interest rate increase, suggested that if inflation stayed within the target of 2% per year and If unemployment were to fall to 6.5%, the interest rate could rise. Financial markets' reaction to the *tapering announcement* was negative, with the Dow Jones index falling 659 points (-4.3%) between June 19 and 24, 2013. Large-scale asset purchases ceased on October 29, 2014, when total assets on the Fed's balance sheet stood at USD 4.5 trillion. With the maturity of some assets in the portfolio and the sale of others, the Fed's assets fall to USD 3.75 trillion at the end of August 2019.

³ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20081125b.htm>

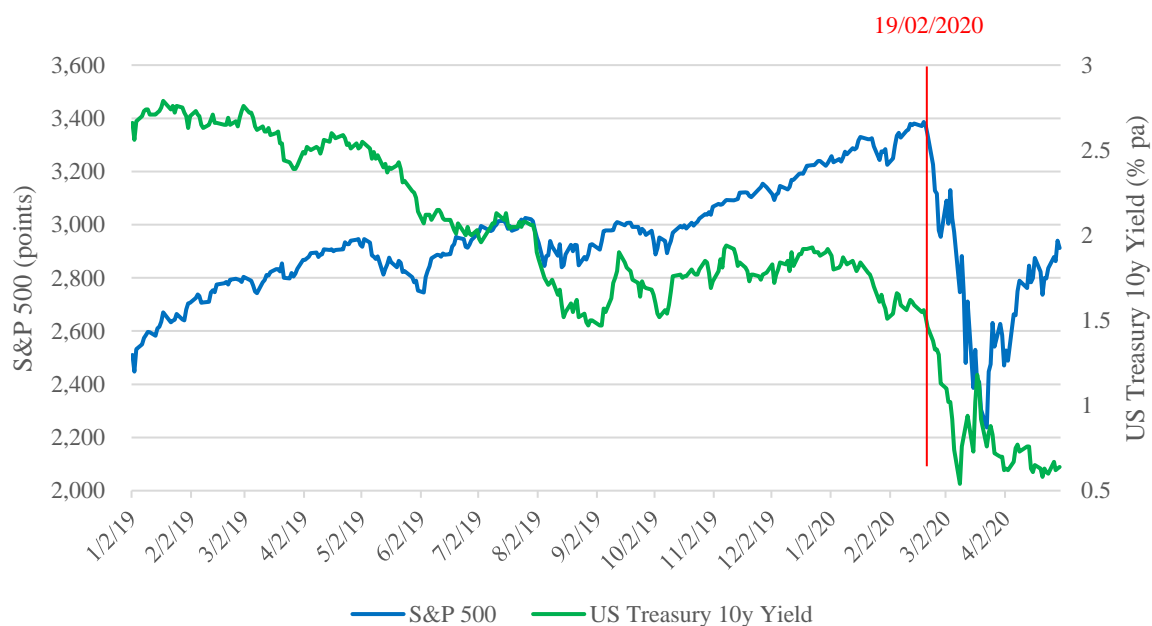
⁴ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20120913a.htm>

⁵ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20121212a.htm>

2.3 IMPLEMENTATION OF UNCONVENTIONAL MONETARY POLICY IN THE COVID-19 CRISIS

Between the end of 2019 and the beginning of 2020, the epidemic of the SARS-CoV-2 virus, which causes COVID-19, begins, with an epicenter in China. At the end of February 2020, with the virus spreading to other countries in Asia and Europe, it began to become clear that it was a pandemic, with the potential to cause large numbers of deaths around the globe. As economic agents mature the perception that, in order to combat the epidemic, there would be a high economic cost resulting from measures to restrict the movement and interaction between people, financial markets suffer a great shock (graph 2.5).

Graph 2.5– 10-Year S&P 500 and US Treasury Yield Index in COVID-19 Crisis



Source: Nasdaq (S&P 500) and FED – Board of Governors (US Treasury 10y Yield)

Between 02/19/2020 and 03/23/2020 (24 trading days) the SPX 500 index drops 1,149 points, equivalent to -33.9% (chart 2.5). The Fed acts strongly with several monetary stimuli that can be classified into four categories: interest rate cuts, Extended Liquidity Financial Assistance (AFLE), Large-Scale Asset Purchase Program (PCALE) and regulatory changes. In March 2020 alone, the US monetary authority cuts the basic interest rate (FED Funds Rate)

twice. The first reduction, of 0.5 pp on March 3, 2020⁶, and the second, of 1 pp on March 15, 2020⁷. Prior to that, the last time the Fed had cut the rate by a magnitude greater than 0.25 pp was during the 2007-2008 GRG. On March 15, 2020, the Fed also cuts the rediscount rate by⁸ 1.5 pp to 0.25% pa⁹. In another statement, on the same March 15, 2020¹⁰, the FOMC kicks off QE4, announcing purchases of USD 500 billion in sovereign bonds and USD 200 billion in MBS, totaling at least USD 700 billion in an asset purchase program in Large scale. A few days later, on March 23, 2020¹¹, the FOMC extends QE4, going beyond the initially forecasted USD 700 billion, and committing to purchases in “amount necessary to support the smooth functioning of markets and the effective transmission of monetary policy”. ”. This announcement of 03/23/2020 became known as the “QE *Infinity*” (SIMS; WU, 2020) because, in addition to being in virtually unlimited volume, it opened up the range of assets eligible for purchases, including, in addition to *treasuries* and MBS, private corporate bonds (*corporate bonds*). The chart highlights the implementation of QE4 by showing the Fed's assets, jumping from USD 4.3 trillion on March 11, 2020 to USD 7 trillion on May 20, 2020.

On the occasion of the COVID-19 crisis, the New York FED also extended the offer of liquidity via *repo operations*. This tool allows the central bank to buy government bonds from financial institutions (providing resources) with a commitment to resell them to the same institutions in the short term. Firstly, on March 12, 2020¹², it expanded the line available for *repos* by USD 1.5 trillion and then, on March 16, 2020¹³, an additional USD 500 billion for this type of operation.

The US monetary authority also relaunched programs that had not been used since the 2007-2008 GRG. One such program was the *Primary Dealer Credit Facility* (PDCF), which provides loans to primary *dealers* by *collateralizing a range of assets*.¹⁴The PDCF was announced on March 17, 2020¹⁵, with no limit on the amount of loans, but within a window that would remain open until December 31, 2020.

⁶ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200303a.htm>

⁷ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm>

⁸The rate charged by the central bank for very short-term liquidity lending to banks

⁹ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315b.htm>

¹⁰ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm>

¹¹ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm>

¹² https://www.newyorkfed.org/markets/operating_policy/operating_policy_200312a

¹³ https://www.newyorkfed.org/markets/operating_policy/operating_policy_200316

¹⁴Financial institutions accredited to act directly in central bank auctions

¹⁵ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200317b.htm>

With the unfolding of the COVID-19 crisis, the Fed diagnosed that, even after the dump of trillions of dollars in the financial system, most of the liquidity was ponded in the intermediaries and did not reach the real economy, which was facing a severe recession. Against this backdrop, another program relaunched in 2020 was the *Money Market Mutual Fund Liquidity Facility* (MMLF) ¹⁶. With the MMLF, the Boston FED made an effort to ensure that the injection of liquidity reaches the end of the line, in families and businesses. The rationale of this program was based on the loans of funds by the FED to financial institutions, which were collateralized by high quality assets purchased from *money market mutual funds*, funds widely used by families and firms for immediate redemption applications. In the MMLF, through a cascading effect, the liquidity provided by the FED would pass to financial institutions, then to *mutual funds*, finally reaching end investors. Like the PDCF, the MMLF had no established budget limit, but was limited to operating only until the last day of 2020. On March 18, 2020, the FED committed USD 10 billion to the MMLF ¹⁷.

The *Paycheck Protection Program Lending Facility* (PPPLF) ¹⁸ was yet another program designed to bypass intermediaries and reach the real economy. The PPPLF lent funds to banks so that they, in turn, could release credit operations for small businesses through the *Paycheck Protection Program* ¹⁹, which covered payroll and other company expenses for a period of 8 weeks at the height of the crisis. On June 5, 2020 ²⁰, the Federal Reserve Board established via a normative act that banks that adhere to the MMLF and the PPPLF would not have their *Liquidity Coverage Ratios* (LCR) ²¹ affected by the operations carried out within the scope of these programs.

Also within the framework of measures to aid the real economy, on March 17, 2020, the *Commercial Paper Funding Facility* (CPFF) was created ²², with a view to providing liquidity to the *commercial paper market*, short-term securities issued by private companies to raise funds for short-term expenses such as working capital, payroll, accounts payable and others. On March 23, 2020 ²³ the CPFF was extended to cover a wider range of *commercial*

¹⁶ <https://www.federalreserve.gov/monetarypolicy/mmlf.htm>

¹⁷ <https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200318a1.pdf>

¹⁸ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200409a.htm>

¹⁹ <https://www.sba.gov/funding-programs/loans/coronavirus-relief-options/paycheck-protection-program>

²⁰ <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20200505a.htm>

²¹ Short-term liquidity ratio that banks must comply with, within the framework of the Basel prudential regulation: $LCR = \frac{\text{High Quality Liquid Assets (HQLA)}}{\text{Fluxo de caixa total em 30 dias}}$

²² <https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200317a1.pdf>

²³ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm>

paper types. The amount committed by FED NY to the CPFF program was USD 10 billion ²⁴. The program was launched with an expected duration until March 17, 2021.

On March 23, 2020, the FED creates two programs to provide liquidity to large companies: the *Primary Market Corporate Credit Facility* (PMCCF) and the *Secondary Market Corporate Credit Facility* (SMCCF) ²⁵. The PMCCF was intended to grant credit to companies via the primary issuance of debt securities. To be eligible, the company must be *investment grade*. The maturity of the bonds should be up to 4 years, with a grace period of up to 6 months (extendable). The SMCCF, in turn, was created to buy corporate bonds and corporate bond ETFs ²⁶ on the secondary market. With a liquid secondary market for *corporate bonds* due to the SMCCF, the Fed expected an increase in banks' confidence in granting credit to large companies, as they would have the security of being able to sell the bonds on the secondary, incurring less risk. Adding the PMCCF and the SMCCF, the total limit of FED resources foreseen for the *corporate bond market* was USD 750 billion ²⁷, effective until December 31, 2020. The total effectively committed by the FED to the PMCCF and the SMCCF was USD 50 billion and USD 25 billion, respectively.

The *Term Asset-Backed Securities Loan Facility* (TALF) was an economic relief program created in the 2007-2008 crisis ²⁸relaunched on March 23, 2020 ²⁹. Its ultimate objective was to increase economic activity on the demand side. The operating mechanism of this tool consisted in the release of loans to banks by the FED New York. These credits were issued having as collateral the assets of the banks backed by automotive credit operations, personal credit, credit for the purchase of equipment, among others. The TALF, in addition to increasing the liquidity of banks, fostered credit to consumers and small businesses, which ultimately stimulated aggregate demand. In the COVID-19 crisis, the NY FED predicted a total amount of USD 100 billion allocated to the TALF. Loans under this line have a maturity of 3 years and, to be eligible, the beneficiary small business must: (i) be created or organized in the US under the laws of that country; (ii) have significant US operations and most of its staff are US-based; and (iii) maintain a relationship account with an intermediary agent (bank)

²⁴ <https://www.newyorkfed.org/markets/commercial-paper-funding-facility/commercial-paper-funding-facility-terms-and-conditions>

²⁵ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm>

²⁶ Exchange-Traded Funds: investment funds traded on the stock exchange

²⁷ <https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200728a1.pdf>

²⁸ <https://www.federalreserve.gov/monetarypolicy/20081125a.htm>

²⁹ <https://www.federalreserve.gov/monetarypolicy/talf.htm>

accredited in the program. The total effectively committed by the NY FED to the TALF was USD 10 billion ³⁰.

The *Main Street Lending Program* (MSLP) was created on April 9, 2020 ³¹ to support small and medium businesses and non-profits impacted by the coronavirus pandemic. The program made available up to USD 600 billion for the purchase of credit operations from banks to employers who were in good financial condition before the COVID-19 crisis. To encourage banks to lend to these companies, the Fed has committed to buying 95% of the credit, leaving 5% of the risk with the banks to deter irresponsible lending. In return for the loan, the beneficiary companies should make every effort to maintain the integrity of the employees' payroll, as well as avoid layoffs. To qualify, companies and nonprofits must have a maximum of 15,000 employees or up to USD 5 billion in revenue (base year 2019), among other requirements. The credits of the MSLP line should have a maturity of 5 years, with a grace period for payment of interest of 1 year and principal for 2 years. As of October 2020, the Fed had effectively committed USD 75 billion to the MSLP ³².

Due to the social isolation measures imposed by the authorities due to the coronavirus pandemic, the collection of public entities has fallen substantially, making it difficult to fund public services in the localities. With cities in *lockdown*, consumption tax collection has dropped as people decrease their level of consumption, especially discretionary. Income taxes, which in the US are partly state, have also fallen due to rising unemployment and falling incomes for employees. In the same announcement of April 9, 2020, the US monetary authority announced the *Municipal Liquidity Facility* (MLF) program, aimed at helping public entities. The MLF proposed to buy up to USD 500 billion of short-term bonds issued by US states, Washington DC, counties with at least 500,000 inhabitants, cities with at least 250,000 inhabitants, multi-state entities, among others. The program limited the purchase of government bonds to 20% of the revenue of each entity (states, counties and cities) earned in fiscal year 2017, with the possibility of exceptionalization. The summary of all programs undertaken by the Federal Reserve system to face the COVID-19 crisis in 2020 is presented in table 2.1.

Adding up all the monetary emergency stimulus programs (PCDF, CPFF, MMLF, PMCCF, SMCCF, TALF, PPPLF, MSLP and MLF), the total effectively spent by the Federal

³⁰ <https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200728a6.pdf>

³¹ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200409a.htm>

³² <https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200728a3.pdf>

Reserve system was USD 207 billion (on 09/30/2020). Despite the relevant figure, this total still represents only 7.6% of the total spent on *quantitative easing*, which totaled USD 2.7 trillion on 09/30/2020. This highlights the disproportionate weight of QE in relation to other monetary programs undertaken in the COVID-19 crisis (table 2.1).

Table 2.1- Fed emergency monetary policy programs in the COVID-19 crisis (USD billion) – duration and volumes

Program	announcement date	End of validity	Advertised volume *
QE	03/15/20	-	Unlimited
PDF	03/17/20	12/31/20	-
CPF	03/17/20	03/17/21	-
MMLF	03/18/20	12/31/20	-
PMCCF/SMCCF	03/23/20	12/31/20	750
TALF	03/23/20	12/31/20	100
PPPLF	09/04/20	12/31/20	-
MSLP	09/04/20	12/31/20	600
MLF	09/04/20	12/31/20	500

Source: Prepared by the author with data from the EDF (2020).
* until 09/30/2020

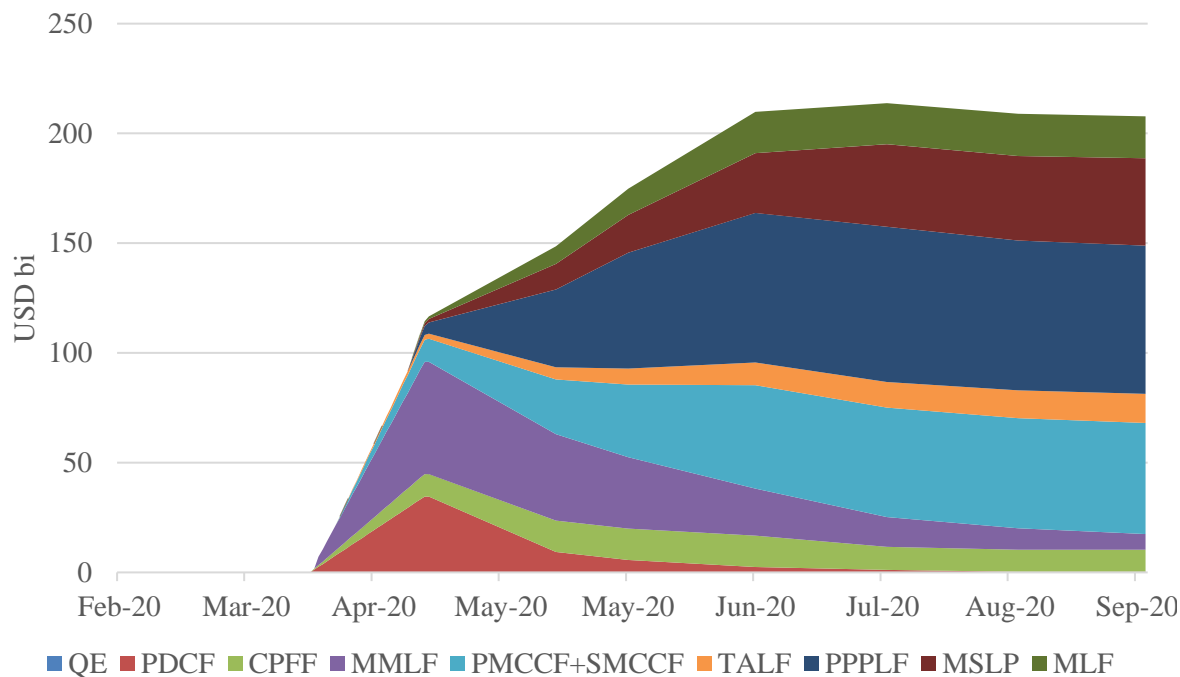
The emergency monetary stimulus programs announced in the US during the COVID-19 crisis were implemented as of the second quarter of 2020 and presented the evolution described in graph 2.6. Not everything that was committed was effectively executed. Execution depended on market reaction and agents' appetite and eligibility for program resources.

Frame 2.1– Summary of Fed emergency programs in the COVID-19 crisis

Initials	Name	Quite	The end
QE	<i>Quantitative Easing</i>	Purchase of public, private and <i>equity securities</i> .	Stimulation of aggregate demand and supply.
PDF	<i>Primary Dealer Credit Facility</i>	Short-term liquidity assistance to financial institutions.	Effective functioning of the financial system. Decreased systemic financial risk.
CPF	<i>Commercial Paper Funding Facility</i>	Purchase of <i>commercial papers</i> (securities issued by companies to pay short-term expenses).	Offer of credit to non-financial companies. Maintenance of jobs and activity.
MMLF	<i>Money Market Mutual Fund Liquidity Facility</i>	Credit to financial institutions with assets purchased from <i>money market mutual funds as collateral</i> .	Credit offer to families and companies. Increase in liquidity in financial markets.
PMCCF	<i>Primary Market Corporate Credit Facility</i>	Purchase of <i>corporate bonds</i> in the primary market.	Credit offer to large companies. Maintenance of jobs and activity.
SMCCF	<i>Secondary Market Corporate Credit Facility</i>	Purchase of <i>corporate bonds</i> on the secondary market.	Increase in liquidity in the <i>corporate bond market</i> . Credit offer to large companies. Maintenance of jobs and activity.
TALF	<i>Term Asset-Backed Securities Loan Facility</i>	Credit to banks with securitized consumer credit as collateral.	Incentive to aggregate demand (consumption).
PPPLF	<i>Paycheck Protection Program Lending Facility</i>	Credit to banks that lend money to small businesses.	Maintenance of jobs and activity in small businesses.
MSLP	<i>Main Street Lending Program</i>	Purchase of credit operations from banks to small and medium businesses and non-profit entities.	Maintenance of jobs and activity in small and medium-sized businesses and non-profit entities.
MLF	<i>Municipal Liquidity Facility</i>	Purchase of bonds issued by local governments (states, counties, municipalities, etc.)	Maintenance of public services.

Source: Prepared by the author with information from the EDF

Graph 2.6- Execution of the FED's emergency monetary policy programs in the COVID-19 crisis (ex-QE)



Source: Prepared by the author with data from the EDF (2020).

Other countries have also promoted QE programs to address the COVID-19 crisis, especially developed economies. On the occasion of the first wave of the pandemic in the first quarter of 2020, the United Kingdom was one of the most affected countries, both in terms of public health and economic-financial. The Bank of England (BoE) assessment was that the measures taken to contain the virus would result in an acute, intense and temporary economic shock³³. In the assessment of the BoE's Monetary Policy Committee (CPM), its role in this context was to help address the needs of UK businesses and households in dealing with the economic disruption associated with the pandemic. In the British financial market, as in other markets, conditions deteriorated as investors got rid of risky assets and shifted funds to risk-free short-term instruments. With global financial conditions increasingly restrictive, the BoE announces on March 19, 2020³³ a reduction in the short-term interest rate by 15 *basis points*, to 0.1% pa. In the same announcement, the British monetary authority committed to allocating a further £200 billion for purchases of medium to long-term sovereign government bonds, bringing the total amount of this type of asset on the BoE's balance sheet to £645 billion. In

³³ <https://www.bankofengland.co.uk/monetary-policy-summary-and-minutes/2020/monetary-policy-summary-for-the-special-monetary-policy-committee-meeting-on-19-march-2020>

March 2020, the UK GDP contracts by 7.2% compared to February 2020. In April 2020, a further contraction in GDP of 19.5% compared to March 2020³⁴. By June 2020, UK markets had already partially recovered from the lows seen in March of the same year. There were signs of heating up in household consumption and in service sector activity. However, a scenario of many risks and uncertainties remained, with the pandemic spreading in other countries. In this context, the BoE CPM announces on June 18, 2020 a³⁵ further £100 billion of QE aimed at sovereign bond purchases, bringing the monetary authority's stock of assets to £745 billion.

Japan, despite having one of the lowest rates of infection and deaths from COVID-19, has had its financial and economic conditions negatively affected by global conditions. In the assessment of the Bank of Japan (BoJ), capital market instabilities and uncertainties regarding the impacts of the pandemic on the global economy required monetary effort. On March 16, 2020³⁶, the Japanese monetary authority announced that it would maintain its “ *Quantitative and Qualitative Monetary Easing* ” (QQE) program targeting an inflation rate of 2% pa. Additionally, it would increase its sovereign bond purchase program., *Japan Government Bonds* (JGB), at JPY 80 trillion³⁷ per year, in order to keep the 10-year bond *yield around zero*. In the same announcement, the BoJ pledged to increase the pace of ETF purchases by JPY 12 trillion a year, JPY 180 billion annual purchases of real estate funds (J-REITs) and JPY 2 trillion purchases of *commercial papers* and bonds. corporate bonds of Japanese companies in the local market. Just over a month after that first announcement, the BoJ released a new statement on April 27, 2020³⁸ significantly extending monetary easing. In this statement, the diagnosis presented was that Japan's economy was in an increasingly severe situation due to the impact of the spread of the new coronavirus both locally and around the globe and that, despite some positive signs in response to the measures so far taken, the financial conditions of the companies continued to deteriorate and required more stimulus. The Japanese Monetary Policy Committee expands the QE indicating that, given the low liquidity in the bond market, it would increase “without definition upper limit” its program of active purchases of sovereign bonds (JGBs and T-Bills) in order to maintain *yields*. maturity 10 years around zero. To strengthen local businesses, it also announced an increase to JPY 20 trillion in the pace of purchases of corporate bonds and *commercial papers*.

³⁴ <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpmonthlyestimateuk/september2020>

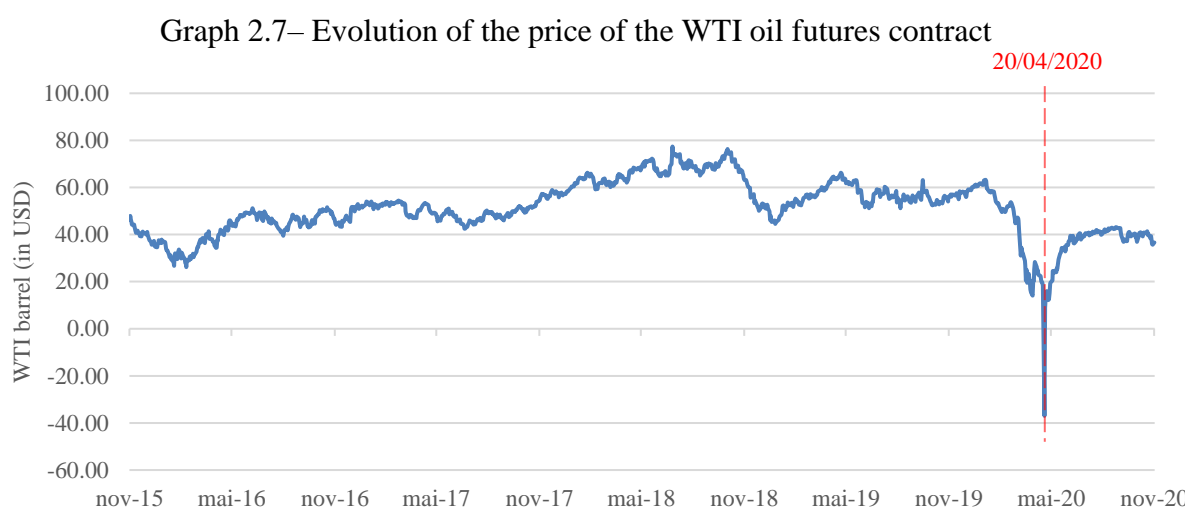
³⁵ <https://www.bankofengland.co.uk/monetary-policy-summary-and-minutes/2020/june-2020>

³⁶ https://www.boj.or.jp/en/announcements/release_2020/k200316b.pdf

³⁷ JPY is the symbol for the Japanese currency, the yen

³⁸ https://www.boj.or.jp/en/announcements/release_2020/k200427a.pdf

The Bank of Canada, in an announcement dated March 27, 2020 ³⁹, was also concerned about the pandemic, assessing that it would have serious consequences for Canadians and the economy in general, showing particular concern about the drop in oil prices. From the beginning of 2020 until the date of the announcement by the Bank of Canada (27/03/2020), the barrel of WTI oil had fallen by 74.7% with the collapse of global demand for the *commodity* due to mobility restrictions imposed by the pandemic and compounded by the price war between OPEC members led by Saudi Arabia and Russia ⁴⁰. On April 20, 2020, the WTI oil barrel futures contract would reach the unprecedented negative price of -36.98 USD/barrel ⁴¹(chart 2.7). For operational reasons, the WTI oil futures contract traded in the United States provides for the physical delivery of barrels on the expiration date. With inventories at full capacity, with no room to receive more oil, contract holders were willing to pay buyers to take them, creating the distortion.



Source: FRED Economic Data – Federal Reserve Bank of St Louis (2020).

The assessment of the Canadian monetary authority was that the main role in economic support to individuals and companies at that time belonged to fiscal policy and monetary policy had an important but complementary role. In the announcement on 03/27/2020, the Canadian central bank announced the reduction of the short-term basic interest rate by 50 bp to 0.25% pa. Additionally, it launched 2 new programs: one for the purchase of

³⁹ <https://www.bankofcanada.ca/2020/03/press-release-2020-03-27/>

⁴⁰ <https://edition.cnn.com/2020/03/08/investing/oil-prices-crash-opec-russia-saudi-arabia/index.html>

⁴¹ .

*commercial papers*⁴² and one for large-scale purchase of government bonds on the secondary market at a rate of 5 billion Canadian dollars a week. In the following weeks, it became clear to the government of Canada that, despite all the monetary stimulus in the financial market, there were frictions that made it difficult to transmit them to the end of the line: non-financial companies. To overcome this friction, on April 15, 2020,⁴³ the Bank of Canada introduced a new program of large-scale secondary market purchases aimed at *corporate bonds*. The total budget available for this program was 10 billion Canadian dollars, and the eligible securities were those of companies incorporated in the country with a remaining maturity of up to 5 years and with a minimum credit rating of *BBB or equivalent*. In the July 2020 Monetary Policy Report (RPM)⁴⁴, the Bank of Canada communicated its view of a scenario still extremely uncertain, despite the observation of a gradual reopening of economies. The RPM highlighted that, after the sharp drop in the first half of 2020, economic activity was already showing signs of recovery at the beginning of the second half, with the relaxation of measures to contain the epidemic combined with the extraordinary support of fiscal and monetary policies. The RPM also cited the rebound in *commodity* prices, including oil, as a sign of the start of an economic recovery. Despite everything, the RPM warned that Canadian inflation remained close to zero, which gave room for maintaining the current monetary stimulus policy. In an announcement released on July 15, 2020⁴⁵, the Bank of Canada announced that it would continue its QE program, maintaining its program of large-scale sovereign bond purchases at the level of at least CAD 5 billion per week.

The *Reserve Bank of Australia* (RBA), in a statement dated March 19, 2020⁴⁶, also expressed its concern about the pandemic and its repercussions on the economy and financial stability. In his text, he highlighted the high volatility of the markets, the sharp fall in the prices of risk assets and the fall in sovereign bond *yields* to historically low levels. In his view, the functioning of sovereign bond markets was impaired, causing dysfunctions in other markets given the importance of government *bonds* as a financial *benchmark*. The RBA was confident at the date (19/03/2020) that, at some point in the future, the virus would be contained and the Australian economy would recover and that, until that moment came, the role of the central bank was sustain jobs, income and businesses. In this way, when the health crisis was resolved,

⁴² *Commercial Paper Purchase Program* (CPPP)

⁴³ <https://www.bankofcanada.ca/2020/04/bank-canada-introduce-corporate-bond-purchase-program>

⁴⁴ <https://www.bankofcanada.ca/wp-content/uploads/2020/07/mpr-2020-07-15.pdf>

⁴⁵ <https://www.bankofcanada.ca/2020/07/fad-press-release-2020-07-15/>

⁴⁶ <https://www.rba.gov.au/media-releases/2020/mr-20-08.html>

the country would be in a position to recover strongly. The package of measures announced on 03/19/2020 included the reduction of the basic interest rate to 0.25% pa and a program of large-scale purchase of government bonds in the secondary market with no specified limit so that the sovereign bond *yield* year to reach the same level of 0.25% pa In a new announcement dated November 3, 2020 ⁴⁷, the Australian central bank updated its base case announcing a new stimulus package to support job creation and economic recovery contraction resulting from the pandemic. With Australia facing a period of high unemployment, the RBA was committed to using all the means at its disposal to encourage job creation. Despite the recovery in activity seen in the third quarter of 2020, the RBA expected a bumpy trajectory ahead with a full resumption dependent on successful containment of COVID-19. The package announced on 11/03/2020 included a further reduction in the short-term interest rate to 0.1% pa, maintenance of purchases of 3-year sovereign bonds chasing the same *yield* of 0.1% pa and another 100 billions of Australian dollars in purchases of government bonds with longer maturities, from 5 to 10 years.

The *Reserve Bank of New Zealand* (RBNZ), in a March 23, 2020 market release ⁴⁸, made its first PCALE announcement. To face the delicate moment of the New Zealand economy, it is committed to buy NZD 30 billion ⁴⁹in sovereign bonds of the country in the secondary market. As of April 7, 2020, ⁵⁰it has increased the program allocation to NZD 33 billion. On 14 May 2020 ⁵¹a further increase to NZD 60 billion and on 13 August 2020 ⁵²a further increase bringing the total resources of the government bond purchase program to NZD 100 billion.

Sweden was one of the countries that adopted one of the least restrictive policies in the fight against the pandemic. Despite this, the turmoil in global markets had a significant impact on the local financial market and economy. Sveriges Riksbank, the Swedish central

⁴⁷ <https://www.rba.gov.au/media-releases/2020/mr-20-28.html>

⁴⁸ <https://www.rbnz.govt.nz/markets-and-payments/domestic-markets/domestic-markets-media-releases/reserve-bank-to-begin-large-scale-asset-purchases-23-march-2020>

⁴⁹New Zealand Dollars

⁵⁰ <https://www.rbnz.govt.nz/markets-and-payments/domestic-markets/domestic-markets-media-releases/reserve-bank-to-extend-large-scale-asset-purchases>

⁵¹ <https://www.rbnz.govt.nz/markets-and-payments/domestic-markets/domestic-markets-media-releases/reserve-bank-market-operations-14-may>

⁵² <https://www.rbnz.govt.nz/markets-and-payments/domestic-markets/domestic-markets-media-releases/reserve-bank-market-operations-statement-13-august-2020>

bank, released a statement on March 16, 2020⁵³ in which it outlined its baseline scenario for events and implemented monetary policy measures. In his view, the spread of the virus would inevitably have negative impacts on economic activity. At the time, although it was still too early to measure the intensity of the impact and how long it would last, it was already clear in his opinion that companies in the tourism sector, such as hotels, travel agencies and restaurants, would be strongly affected. After contacting market agents, Riksbank also identified that there were still incipient signs of liquidity problems in financial markets. The statement signaled that continuing market turmoil meant that the supply of credit could quickly deteriorate. Sweden's central bank has been carrying out large-scale asset purchases since 2015. As of February 2020, just before the announcement, the total stock of Swedish sovereign bonds on the Riksbank's balance sheet amounted to SEK 340 billion. Given the exceptional situation of March 2020, with the strong crisis that was presented, the Riksbank chose to increase its government bond purchase program in order to maintain an expansionary monetary policy and provide support to the economy. The communiqué also mentioned that, in order to support the supply of credit in the economy, it was also necessary to purchase debt securities issued by Swedish municipalities. The total amount announced by the Riksbank on 3/16/2020 for its QE program was SEK 300 billion by year-end 2020. Added to the SEK⁵⁴340 billion already on its balance sheet, the new QE program would take the Riksbank's total assets to SEK 640 billion with the execution of QE 2020.

Developed economies, on average, have low basic interest rates and, therefore, less room for conventional monetary policy due to the *Zero Lower Bound limitation*. Due to this restriction, developed countries were the first to adopt unconventional instruments such as QE with the objective of monetary stimulus. Table 2.2 shows this phenomenon, showing the entire Euro Zone and a good part of the developed world with negative nominal interest rates in 2019 and 2020. However, more recently, a phenomenon of interest reduction has also been observed in some emerging countries. In emerging markets, there was a significant drop in the short-term real interest rate in the last years that preceded the COVID-19 pandemic. As a result, some central banks in these countries resorted to unconventional instruments to face the crisis in 2020.

⁵³ <https://www.riksbank.se/globalassets/media/nyheter--pressmeddelanden/pressmeddelanden/2020/bilagor/200316/appendix-b-bond-purchases-for-monetary-policy-purposes.pdf>

⁵⁴swedish krona

Table 2.2- Nominal short-term interest rate (% per annum) - 2011, 2019 and 2020

Country	2011	2019	2020
developed			
Australia	4.85	1.34	0.02
Canada	1.17	1.89	0.24
Denmark	1.38	-0.38	-0.23
United States	0.30	2.21	0.16
Japan	0.33	0.03	-0.06
New Zealand	2.80	1.52	0.27
Norway	2.87	1.55	0.36
UK	0.87	0.81	0.04
Sweden	1.66	-0.42	-0.12
Switzerland	0.12	-0.74	-0.78
euro zone	1.39	-0.36	-0.52
emerging			
South Africa	5.49	7.08	3.59
Brazil	10.91	4.50	2.00
Chile	4.94	2.68	0.50
Colombia	4.21	4.50	1.96
South Korea	3.44	1.70	0.66
Hungary	6.58	0.19	0.74
India	8.40	5.83	3.06
Indonesia	6.93	6.69	4.22
Mexico	4.86	8.27	4.49
Poland	4.58	1.72	0.22
Russia	5.49	7.69	4.64

Source: OECD and Central Bank of Brazil

On March 26, 2020 ⁵⁵, the Bank of Korea (BoK) released a monetary stimulus package, in line with what central banks of developed economies had been doing. In the statement, the BoK's Monetary Policy Committee explained its decision to offer an unlimited amount of liquidity to the market through weekly repo auctions (*repos*) for purchases of government and corporate bonds with a resale commitment. The purpose of the measure was to ensure financial market stability and support the timely implementation of the South Korean government's fiscal support package. In the same announcement, the BoK expanded the range of financial institutions eligible to participate in *repos auctions*. Securities eligible for acceptance as collateral for the repo has also been expanded beyond sovereigns to include corporate bonds of state-owned companies and debentures issued by banks.

The *South African Reserve Bank* (SARB) was also concerned about the unfolding of the COVID-19 health crisis on local financial markets. In a press release on March 25, 2020 ⁵⁶, SARB stated that, in response to the tensions observed in various markets, it had revised its liquidity management strategy. Among other measures in the package, the SARB announced that it would start a program to buy sovereign bonds on the secondary market. Purchases would be conducted along the term structure. In his opinion, in addition to providing liquidity and promoting the smooth behavior of domestic financial markets, the measure would allow the SARB to increase its Monetary Policy Portfolio (PPM). PPM is one of the main tools in the SARB arsenal for managing market liquidity and can be used to add or drain market liquidity.

The *board of the National Bank of Romania* (NBR), in an announcement released to the press on March 20, 2020 ⁵⁷, announced that, after holding an emergency meeting, it had agreed to adopt a package of measures aimed at mitigating the impact of the pandemic on families and Romanian companies. Within the context of the events of the first quarter of 2020, the monetary authority of Romania decided to reduce the short-term basic interest rate by 50 bp to 2% pa, provide liquidity to banks through repo operations ⁵⁸as well as promote a program to purchase large-scale secondary market sovereign bonds in an unspecified amount. Depending on the evolution of the situation in the following weeks, the NBR communicated a

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https://www.bok.or.kr/ucms/cmmn/file/fileDown.do?menuNo=400076&atchFileId=FILE_00000000016773&fileSn=1

56

<https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/9805/Further%20amendments%20to%20the%20money%20market%20liquidity%20management%20strategy%20of%20the%20SARB.pdf>

⁵⁷ <https://www.bnr.ro/page.aspx?prid=17617>

⁵⁸purchase of sovereign bonds with a resale commitment

forward guidance that it could reduce the banks' compulsory deposit requirements, if necessary. The NBR has committed to continue closely monitoring the unfolding of the spread of the coronavirus and its impacts on the country's economy and has not ruled out new media packages in the future.

On March 22, 2020, Bangko Sentral ng Pilipinas ⁵⁹(BSP) releases a *press release* ⁶⁰detailing a package of relief measures for the country's economy. The main measure: a PHP 300 billion government bond purchase program. ⁶¹According to Rosalia V. de Leon, the Philippine Secretary of the Treasury, this monetary stimulus was the most cost-effective of the available avenues to provide extra lifetime for government programs to combat the pandemic. The president of the country's monetary authority, Benjamin E. Diokno, said in the *press release* that he would continue to support government initiatives during the period of quarantine.

Banco de Mexico, in a statement published on April 21, 2020 ⁶², also announced a series of exceptional monetary measures, including a local QE program with purchases of 100 billion Mexican pesos in sovereign bonds. The bonds purchased would have a longer maturity than those commonly purchased on the open market to control the short-term interest rate. At that time of financial stress (April 2020), many banks faced liquidity problems and were forced to dispose of their government debt on unfavorable terms amid a cluster of high volatility. With the measure, the Mexican central bank hoped to facilitate an orderly intermediation of government bonds, benefiting financial institutions with liquidity needs.

The Central Bank of Brazil (BCB) found itself in the first quarter of 2020 in a comfortable situation for the use of conventional monetary policy. The interest rate was at a relatively high level compared to other countries. At the end of 2019, the economy's basic short-term interest rate (Selic) was 4.50% pa (table 2.2). Inflation had been well controlled since 2017. In 2017, there was an IPCA of 2.95% against the target of 4.5%. In 2018, IPCA of 3.75% against the target of 4.5%. And, in 2019, IPCA of 4.3% against a target of 4.25% (graph 2.8).

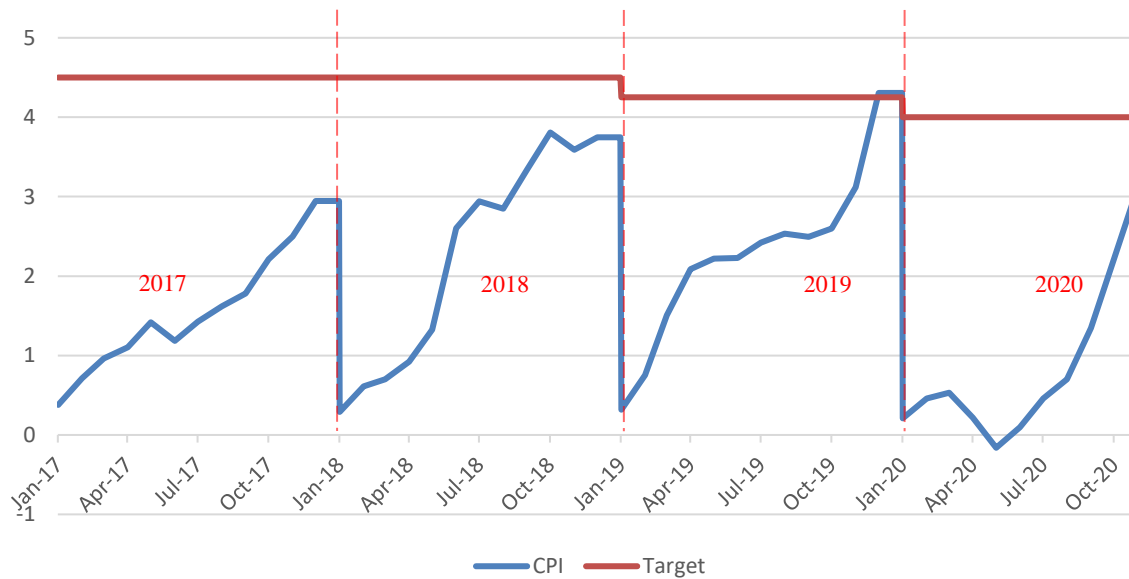
⁵⁹Central Bank of the Philippines

⁶⁰<https://www.bsp.gov.ph/SitePages/MediaAndResearch/MediaDisp.aspx?ItemId=5221>

⁶¹Philippine Peso

⁶²<https://www.banxico.org.mx/publicaciones-y-prensa/miscelaneos/%7B1E8E5322-7086-9563-570C-412659ECB292%7D.pdf>

Graph 2.8– Inflation and inflation targeting in Brazil – 2017 to 2020



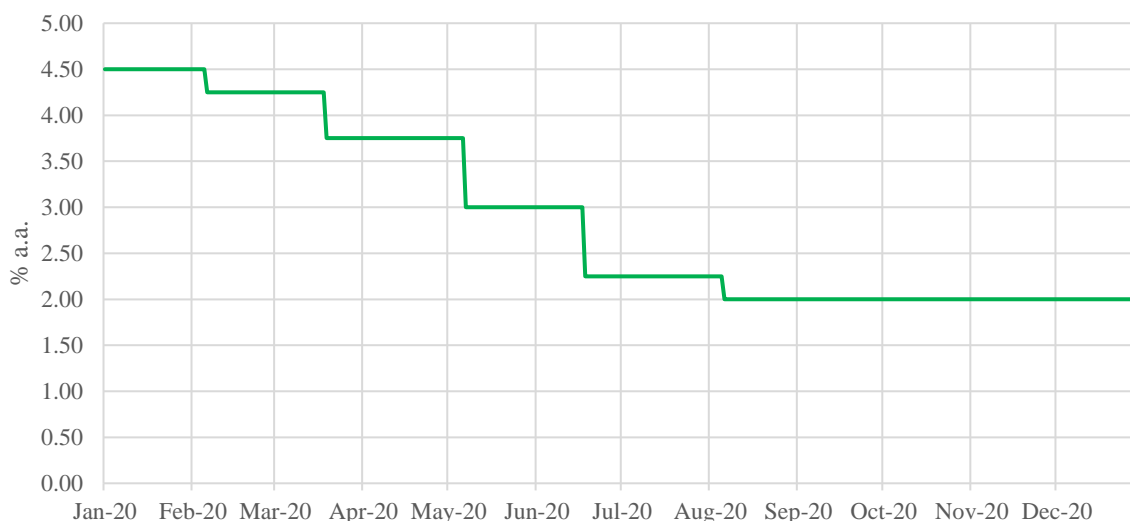
Source: Central Bank of Brazil

In addition, the demand shock resulting from the COVID-19 pandemic was considered deflationary (CHRISTENSEN; GAMBLE IV; ZHU, 2020). This scenario gave the Brazilian monetary authority a good margin to reduce interest rates. Throughout 2020, there were 5 Selic reductions (chart 2.9). On 02/06/2020 reduction of 25 bp from 4.50% to 4.25% pa On 03/19/2020 reduction of 50 bp to 3.75% pa On 05/07/2020 reduction of 75 bp to 3% aa On 06/18/2020 new cut from 75 bp to 2.25%. On 08/06/2020, the last cut of 2020, of 25 bp, taking the basic interest rate in Brazil to the lowest level in its history, 2% pa At the meeting in which the Economic Policy Committee (Copom) announced this latest reduction of the basic interest rate in 2020 to 2% pa, the official diagnosis of the collegiate was that the economic situation continued to prescribe extraordinarily high monetary stimulus, but recognized that, due to prudential and financial stability issues, the remaining space for the use of the monetary policy, if there were, should be small. Consequently, any future adjustments in the degree of stimulus would occur with additional gradualism and would depend on the perception of the fiscal trajectory, as well as on new information that would alter the Copom's assessment of prospective inflation ⁶³. After successive interest rate reductions, the Copom adopted an additional *forward guidance system* at the meeting held on September 16, 2020, in which it

⁶³ <https://www.bcb.gov.br/publicacoes/atascopom/05082020>

communicated its intention not to reduce the current level of monetary stimulus, subject to the maintenance of the fiscal regime and the anchoring of long-term inflation expectations ⁶⁴.

Graph 2.9- Selic rate - 2020



Source: Central Bank of Brazil

The BCB measures were not restricted to the Selic mechanism. On March 5, 2020, ^{65a} reduction in the reserve requirement ratio on time deposits was announced from 31% to 25%, releasing BRL 135 billion in liquidity to banks, effective as of March 16, 2020. On March 26, 2020 In 2020, the body announced a monetary stimulus package in the order of BRL 1.2 trillion ⁶⁶. It included a further reduction in the reserve requirement ratio on time deposits, from 25% to 17%, which would release more BRL 68 billion of liquidity into the financial system. Also in the same package, the creation of a funding instrument called New Term Deposit with Special Guarantee (NDPGE). The NDPGE would allow banks to raise funds from investors guaranteed by the Credit Guarantee Fund (FGC). With the funds raised, a positive effect of an increase in the supply of credit in the economy by banks was estimated in the order of BRL 200 billion ⁶⁷. The rules for issuing Letters of Credit for Agribusiness (LCA) were also relaxed to allow an estimated expansion of BRL 6.3 billion ⁶⁸ in the supply of rural credit. The BCB

⁶⁴ <https://www.bcb.gov.br/publicacoes/atascopom/16092020>

⁶⁵ <https://www.bcb.gov.br/en/pressdetail/2315/nota>

⁶⁶ <https://www.bcb.gov.br/en/pressdetail/2321/nota>

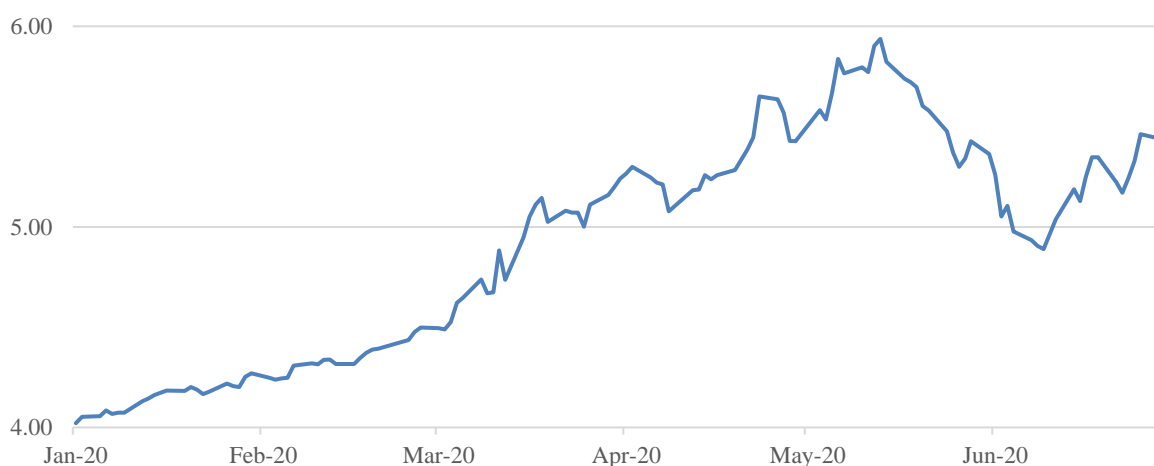
⁶⁷ <https://www.bcb.gov.br/estabilidadefinanceira/exibenormativo?tipo=Resolu%C3%A7%C3%A3o&numero=4785>

⁶⁸ <https://www.bcb.gov.br/estabilidadefinanceira/exibenormativo?tipo=Resolu%C3%A7%C3%A3o&numero=4787>

also started a special temporary liquidity line ⁶⁹in which it would grant loans to banks with debentures held by them as collateral, with an estimated impact of BRL 91 billion in increasing the credit supply by banks from the new funds received.

There was also concern about the devaluation of the real against the US dollar in the midst of the financial crisis. Despite the wide offer of currency *swaps* on the market, the US dollar moved from BRL 4.02 on 1/2/2020 to BRL 5.94 on 5/14/2020 (chart 2.10), the highest historical until then. With the fall in interest rates, fixed income lowered the return on capital allocated to this asset class, reducing the attractiveness of the allocation in Brazil. Part of the devaluation of the real can be attributed to the flight of capital from the country due to this lower remuneration of local interest. Another part can be attributed to the moment of turmoil in global financial markets, favoring the mobility of capital to central economies, in lower risk assets (BRIÈRE et al., 2012).

Graph 2.10– Dollar exchange rate against the Brazilian real - 2020



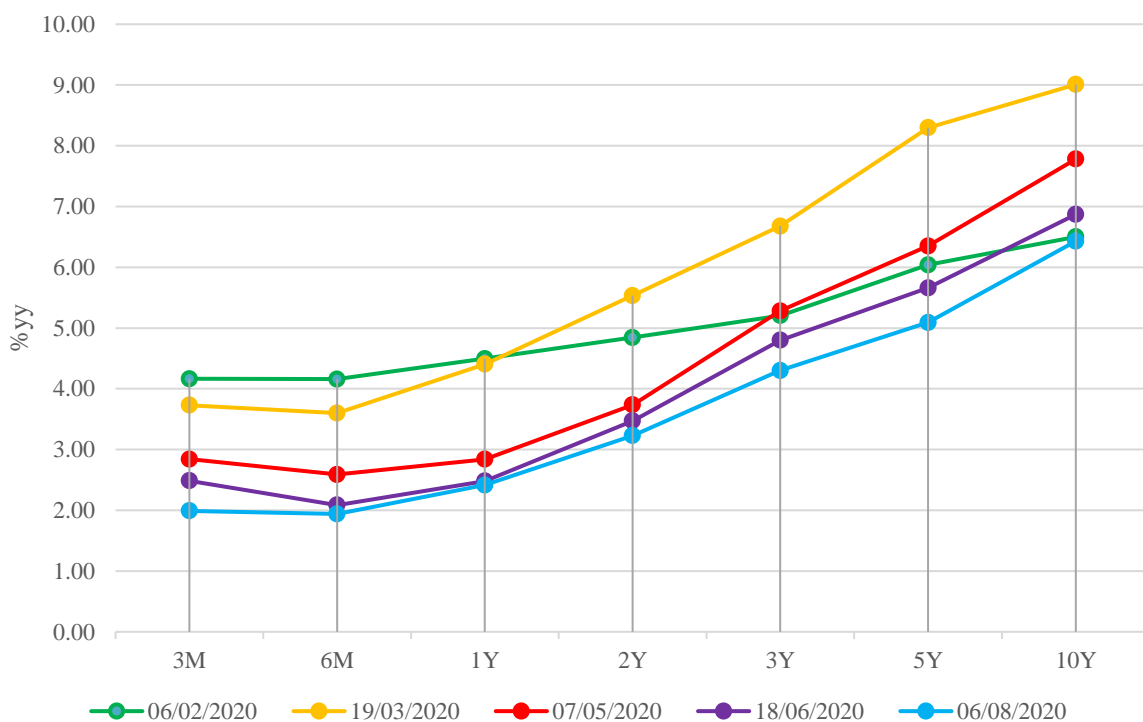
Source: Central Bank of Brazil

No type of large-scale asset purchase program was adopted by the BCB during the 2020 crisis. There was no regulatory framework in Brazil that allowed the monetary authority to use this type of policy at the time of the crisis. However, the term structure of interest rates in Brazil showed a notable behavior throughout 2020 (graph 2.11). Between the first Selic reduction on 02/06/2020 (green line) and the second on 03/19/2020 (yellow line), there was a drop in the short vertices and at the same time an increase in the long vertices, showing distrust on the part of investors that the short-term interest rate would not be sustainable in the long

⁶⁹ <https://www.bcb.gov.br/estabilidadefinanceira/exibenormativo?tipo=Resolu%C3%A7%C3%A3o&numero=4786>

term. In other words, market agents were pricing in that in the future the BCB would have to make a large increase in interest rates to compensate for the extraordinary monetary effort undertaken in the COVID-19 crisis. Over the months of April to August 2020, as seen in graph 2.11, the curve begins to fall at all vertices (short, medium and long), but there is still skepticism on the part of the market in the long part of the curve. It is noted that, even with 5 reductions in the short-term interest rate in the period, the 10-year vertex on 08/06/2020 remained practically at the same level as the same 10-year vertex on 02/06/2020.

Graph 2.11- Evolution of the interest rate term structure in Brazil in 2020



Source: Anbima

In short, the policy of strong monetary stimulus that helped to contain the instability in the financial system and the drop in economic activity at the time of the 2007-2008 GRG lasted longer than planned and was resumed with even greater intensity in the COVID-19 crisis. In this scenario, the academy has dedicated itself in recent years to understanding through which mechanisms monetary stimulus affects financial conditions and how these conditions influence the economy to verify whether monetary policy was achieving its objectives and at what cost.

3 THEORETICAL FOUNDATIONS OF UNCONVENTIONAL MONETARY POLICY AND EMPIRICAL EVIDENCE

In this chapter we will show that there is theoretical support for the use of unconventional monetary policy instruments. According to the literature, the effect of these instruments acts on frictions that occur in some monetary transmission channels with the advent of acute crises. We will also describe the results of empirical analyzes on the subject that indicate the effectiveness of unconventional instruments in overcoming these frictions.

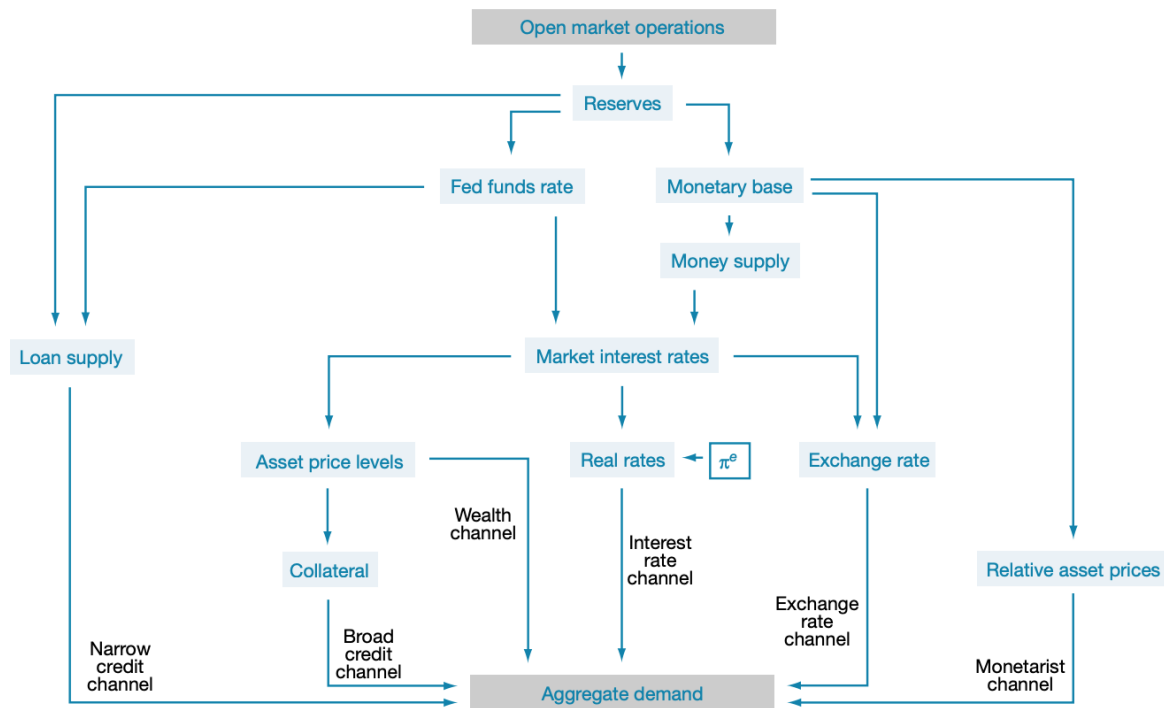
Under stable macroeconomic conditions, the central bank's monetary policy affects the term structure of nominal interest rates, as well as the prices of other assets and, ultimately, aggregate demand. The monetary transmission mechanism is the process by which asset prices and financial conditions in general are affected as a result of monetary policy decisions and end up influencing inflation. According to Kuttner and Mosser (2002), monetary policy is transmitted through five main channels: interest rates, exchange rates, credit, wealth and portfolio rebalancing (figure 3.1).

This monetary transmission framework may encounter frictions when the economy's benchmark interest rate approaches the *Zero Lower Bound* (ZLB). The first academic reference for studying the ZLB phenomenon was the Japanese financial crisis in the 1990s when, despite interest rates close to or equal to zero and various stimuli, there was little success on the part of the economic policy maker in increasing economic activity and inflation. (AHEARNE et al., 2002).

The Great Global Recession of 2007-2008 also hit the US ZLB ⁷⁰, which required unconventional efforts from the monetary authority to stimulate the economy. Bernanke et al. (2004) considered that it would be possible to obtain a positive reaction in economic activity in an economy in the ZLB through three complementary instruments: (i) using a communication policy to shape the expectations of agents regarding the evolution of interest rates ; (ii) increasing the size of the central bank's balance sheet, or *quantitative easing* ; and (iii) changing the composition of the central bank's balance sheet, for example, with targeted purchases of long-term bonds as a way of reducing long- term interest rates.

⁷⁰The ZLB was also hit in Europe in the same post-GRG period, with largely similar experiences

Figure 3.1- Monetary policy transmission channels

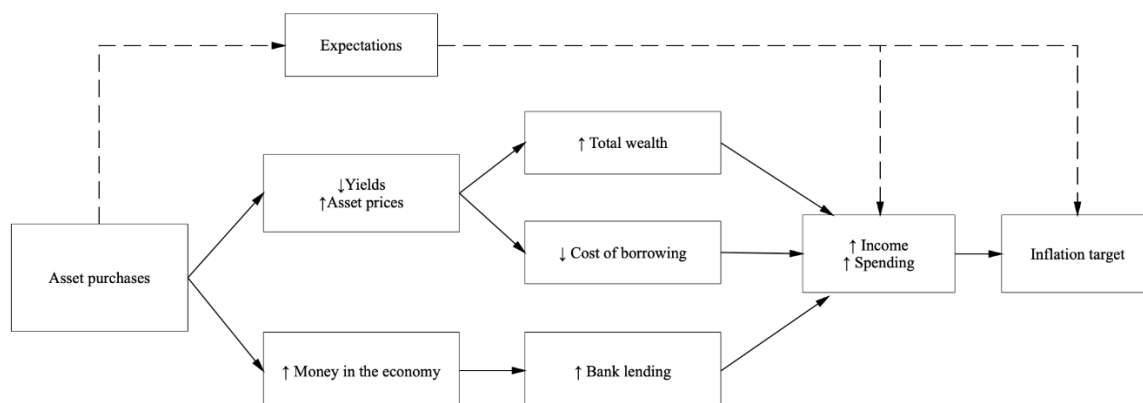


Source: Kuttner and Mosser (2002)

The Bank of England (2009) details the transmission channels of unconventional monetary stimulus as follows. The purchase of assets by the central bank via monetary expansion contributes to increased liquidity in the banking system. A consequence of this injection of liquidity is the increase in asset prices and the corresponding reduction in their *yields*. The large-scale purchase of assets by the monetary authority can increase prices and reduce asset *yields in different ways*. For example, when investors sell their assets to the central bank, their stock of free resources (money) may increase beyond the level desired by the investor, which may lead them to acquire other assets to rebalance their portfolio. Furthermore, as asset *yields* decrease, investors may have a tendency to seek out riskier assets to enhance their gains. This increased demand for risky assets in general could result in an increase in prices and a reduction in *yields* also in those risky assets that were not the focus of direct intervention by the central bank. Through a portfolio rebalancing channel, the primary effect of rising prices and lowering *yields* on sovereign bonds has a potential ripple effect on all other assets in the economy. In a globalized financial system with free movement of capital between economies, rising prices and falling *yields* on assets in a QE regime can lead to capital flight to other countries in search of higher *yields*. To do so, the investor must sell his local currency

and buy foreign currency. This contributes to the devaluation of the currency of the country whose central bank conducts the QE program, which favors the balance of its trade balance with the rest of the world. Additionally, large-scale purchases of corporate bonds and *commercial papers* contribute to lower yields on these private debt instruments. The consequence is a lower cost of credit in the capital market accessed by companies. With a greater supply of loans and a lower cost to borrow, businesses are able to make investments, maintain payroll and even generate new jobs. Another effect of the large-scale purchase of securities and *commercial papers* held by banks is the increase in the stock of liquid assets of these institutions which, in this context, may have greater appetite for expanding the supply of credit to businesses and families, stimulating investment and consumption, respectively. The increase in asset prices is also reflected in an increase in the wealth of asset holders. This can generate a propensity in those agents who feel richer towards a higher level of consumption, which also has a positive effect on aggregate demand. Finally, the anchoring of agents' expectations plays a fundamental role in the effectiveness of a monetary stimulus program. Without QE, firms and households would expect a long period of crisis with below-target inflation. But with the asset purchase program, that risk diminishes. And, for a given level of nominal interest rate, the increase in expected inflation causes the expectation for the real interest rate to decrease, which can provoke a stimulus to consumption and a permanent increase in the economy's price level. This entire rationale for transmitting monetary policy in the Bank of England's QE regime (2009) is illustrated in figure 3.2.

Figure 3.2- Transmission of monetary policy by *quantitative easing*



Source: Bank of England (2009)

The effectiveness of a QE policy depends on the decisions of financial institutions regarding the liquidity they receive from the central bank. If they retain the funds obtained from the purchase of assets by the monetary authority in the form of a liquidity *buffer*, QE does not achieve its objectives. It will only be effective if institutions use the liquidity to invest in other risky assets and/or increase the supply of credit. At the same time, when investors (families and non-banking companies) sell their assets, they turn into bank deposits. If these investors do not quickly rebalance their portfolio by redeeming deposits to buy risky assets, the liquidity provided by QE is ponded in bank deposits and does not have the monetary effect expected by the policymaker. The effectiveness of monetary stimulus also depends on the risk appetite of businesses and households. If these agents are not interested in taking out loans made available by financial institutions, liquidity remains ponded in commercial banks and the monetary transmission expected by the policy does not occur.

Bernanke (2012) argues that QE programs could better be termed “*credit easing*”, due to the fact that their effect on long-term interest rates does not come from an increase in the monetary base, but from a combination of effects on long-term interest rates. long-term *yields* through liquidity, signaling and portfolio rebalancing channels. By providing liquidity to the market, a central bank assumes the role of a consistent buyer of assets, which can encourage other market agents in the same direction and, with that, increase asset prices. The signaling channel can contribute to lower expectations for short-term interest rates and, thus, reduce the expectations component of long-term interest rates. Assuming that assets are (imperfectly) replaceable, the portfolio rebalancing effect predicts that a large-scale purchase of long-term bonds can reduce not only the long-term *yields* of these bonds, but also of other substitute assets for through its effect on term premiums. For example, a reduction in the long-term *yields* of a country's sovereign bonds may result in a reduction in the *yields* of the same country's private debt bonds, due to the partial substitutability between public and private bonds. Following the same principle, a reduction in the long-term *yields* of US sovereign bonds may result in a reduction in the sovereign *yields* of sovereign bonds of other countries due to the partial substitutability between *treasuries* and sovereign bonds of other countries. Although assets are not perfectly substitutable due to factors such as differential risk premiums, the term premium causes a partial substitution effect to be observed.

In the United States, the use of unconventional monetary policy instruments was introduced as a response to the Great Global Recession of 2007-2008 (GRG). But other countries also followed similar monetary measures. Fawley and Neely (2013) make a detailed

study of the QE programs of four major central banks: the Federal Reserve, Bank of England, European Central Bank, and Bank of Japan during the 2008 crisis and subsequent recovery. Initially, all these central banks resorted to large-scale asset purchases to alleviate the crisis in financial markets. However, in a second moment, the objectives were expanded to include the achievement of inflation targets, stimulus to the real economy and containment of European sovereign debt crises. The study by Fawley and Neely (2013) shows that the structures of the respective financial systems strongly influenced the design of unconventional intervention policies. They noted that the European Central Bank and the Bank of Japan focused their efforts on emergency lending operations directly to banks. On the other hand, US and UK central banks have opted for bond purchases, mainly on secondary markets, to expand the monetary base.

An efficient financial market embeds in the present price all future expectations regarding assets. When new information becomes available, prices soon adjust to reflect the market's perception of the information's impact on the future cash flow of assets. In the context of unconventional monetary policy, this forward-looking nature of markets means that researchers must analyze the immediate response of financial markets to policy change announcements and not wait for the announced transactions to take place. If the market reaction were not quick, there would be the possibility of intertemporal arbitrage in asset prices, which would generate implausible profit opportunities in the modern financial market. Thus, the efficient markets hypothesis indicates that the short-term impact of an advertisement is approximately the same as the expected long-term impact (FAMA, 1970). The only difference is the discount factor. The speed with which financial markets react to new information depends on the complexity of the information, whether the new information was expected or not, and the heterogeneity with which agents interpret it. For example, a simple announcement of a reduction in the prime rate usually results in a quick adjustment of the order of seconds or minutes in the prices of correlated assets. On the other hand, an unconventional monetary policy announcement can be more complex and require hours or days for its complete absorption by the market. Even so, it is a quick reaction on the horizon of the effective implementation of the announced measures. Due to the fact that asset prices react quickly to news about unconventional monetary policies and because this initial reaction is expected to be very close to the long-term impact, many researchers use the event study strategy to assess the effects of these policies. Event studies analyze asset prices in a narrow time window around

a potentially price-influencing incident in order to determine the effect of the incident on asset prices.

The use of event studies on the price of financial assets has significant results in the literature. QE1, the first monetary easing program undertaken in the US at the 2007-2008 GRG, was a novelty that allowed researchers to attribute to a small number of events related to the FOMC announcements all the important changes in the expectations of market agents.

and VissingJorgensen (2011) and Hancock and Passmore (2011) show that a surprise announcement of USD 1 trillion long-term bond purchases is related to 30 to 50 bp declines⁷¹ in *treasury yields* and to 66 bp declines in real estate mortgage-backed securities (MBS) *yields*. Similarly, an announcement of USD 1 trillion of long-term US sovereign bond purchases is linked to a 10-25 bp drop in *yields* on 10-year sovereign bonds from other countries (ex-US) as well as the a 1 to 1.5% appreciation in equity indices and a 3.5 to 6% fall in the USD against a basket of currencies (Neely (2015), Kiley (2014)).

The bulk of the effect of unconventional monetary policies is likely to be due to announcements that change market expectations rather than the execution of the policies themselves. For example, the great effect of a large-scale asset purchase program occurs at the time of its announcement, due to the change in agents' expectations, and not in the following months, when the purchases are effectively carried out (D'Amico and King (2013)). This also applies to conventional policies.

Hartley and Rebucci (2020) applied the event studies strategy to assess the impact of QE announcements in the COVID-19 crisis on sovereign bond *yields* in advanced and emerging economies. To measure statistical significance, they divided the change in 10-year *yields* in the 1, 2, and 3-day window after the events occurred by the series standard deviation. Unlike the strategy employed by Hartley and Rebucci (2020), our work uses the ordinary least squares (OLS) linear regression strategy to assess the statistical significance of changes in *yields* after the events (equation 2). Modeling via OLS makes it possible to calculate significance statistics with robust standard errors to deal with the heteroscedasticity observed in the series data. Unlike Hartley and Rebucci (2020), who focused on 10-year *yields*, we sought to analyze variations along the entire yield curve, which allowed us to verify at which maturity QE has a greater or lesser impact. We only evaluated 1-day windows to isolate the effect of the QE announcement from other events that could be unintentionally captured if we increased the

⁷¹Basis points

window to 2 or 3 days. Among these undesirable events we can mention economic relief announcements within the scope of fiscal policy and news about the evolution of the pandemic that could affect *yields* within the window, both outside the scope of our work, which is QE.

Another enhancement of our thesis in relation to the work of Hartley and Rebucci (2020) was to apply the same empirical strategy to analyze variations in stock exchange indices and in the Dollar Index, which allows us to go beyond interest rate markets and assess the impacts of events of QE in equity and currency markets as well. Additionally, as the article by Hartley and Rebucci (2020) is from June 2020, they were obviously only able to contemplate the events that have taken place to date. Our work, being later, had the opportunity to study several QE events that occurred throughout the second half of 2020 in advanced and emerging economies.

4 MODELING

To estimate the effects of QE programs on asset prices, our empirical strategy starts by building a series of returns as follows:

$$\Delta p_{t,t+1} = \frac{P_{t+1} - P_t}{P_t} * 100 \quad (1)$$

where $\Delta p_{t,t+1}$ is the percentage change in the asset price between time t and $t+1$ and P_t is the asset price at time t . Each time t represents the period of 1 business day of trading in the financial market.

To estimate the impact of a specific event, we use the specification

$$\Delta p_{t,t+1} = \beta_0 + \beta_1 D_t + \varepsilon \quad (\text{two})$$

Where D_t is a *dummy* variable that takes the value 1 on the event date and 0 otherwise and ε is the error term.

To estimate the joint impact of a group of events j , we sum all the individual impacts as specified in (3).

$$\Delta p_{t,t+1} = \beta_0 + \sum_{j=1}^N \beta_1^j D_t^j + \varepsilon \quad (3)$$

When we estimate the impact of FED measures in another country (ex-USA), this is calculated considering the relative exchange rate variation between the USD and the local currency of the other country according to (4).

$$\Delta p_{t,t+1}^* = \left[\left(1 + \frac{P_{t+1} - P_t}{P_t} \right) \left(1 + \frac{C_{t+1} - C_t}{C_t} \right) - 1 \right] \times 100 \quad (4)$$

where P_t denotes P_{t+1} the price of the asset in local currency at times t and $t+1$ and C_t C_{t+1} represents the exchange rate of the country's currency against the USD at times t and $t+1$. In other words, $\Delta p_{t,t+1}^*$ represents the change in the price of an asset abroad measured in USD.

This strategy is intended to capture the impact on the first trading day when the market held the information from the QE program announcements. We will conclude that unconventional monetary policy impacted the asset price if the β_1 estimated coefficient is statistically different from zero.

5 DATA

In this paper, we will analyze the effects of QE program announcements on the price of the following asset classes: (i) *yields* on sovereign bonds from the US and from several other developed and emerging countries; (ii) stock market indices of stock exchanges and (iii) *US dollar index*, index of the value of the US dollar in relation to a basket of currencies of other countries. For each asset, a series of daily percentage returns is constructed according to equation (1). The series starts on 02/01/2017 and goes until the date of the event.

The *yield data* on US and other sovereign bonds were obtained from the official websites of the respective monetary authorities, with the exception of China, South Korea and Malaysia, whose data were obtained from the Asian Bonds Online portal of Asian

Development Bank and India, whose data was obtained from the National Stock Exchange of India. The data source for each country's sovereign bond *yields is detailed in table 5.1.*

Frame 5.1– Data sources on sovereign bond *yields*

Country	Data source	Country	Data source
Germany	Deutsche Bundesbank	Netherlands	From Nederlandsche Bank
Australia	Reserve Bank of Australia	Hong Kong	Hong Kong Monetary Authority
Belgium	National Bank of Belgium	India	National Stock Exchange of India
Brazil	Brazilian central bank	Japan	Ministry of Finance Japan
Canada	Bank of Canada	Malaysia	Asian Development Bank
China	Asian Development Bank	Mexico	bank of mexico
South Korea	Asian Development Bank	Norway	Norges Bank
Spain	Bank of Spain	New Zealand	Reserve Bank of New Zealand
France	Bank of France	singapore	Monetary Authority of Singapore
Greece	Bank of Greece	thailand	Asian Development Bank

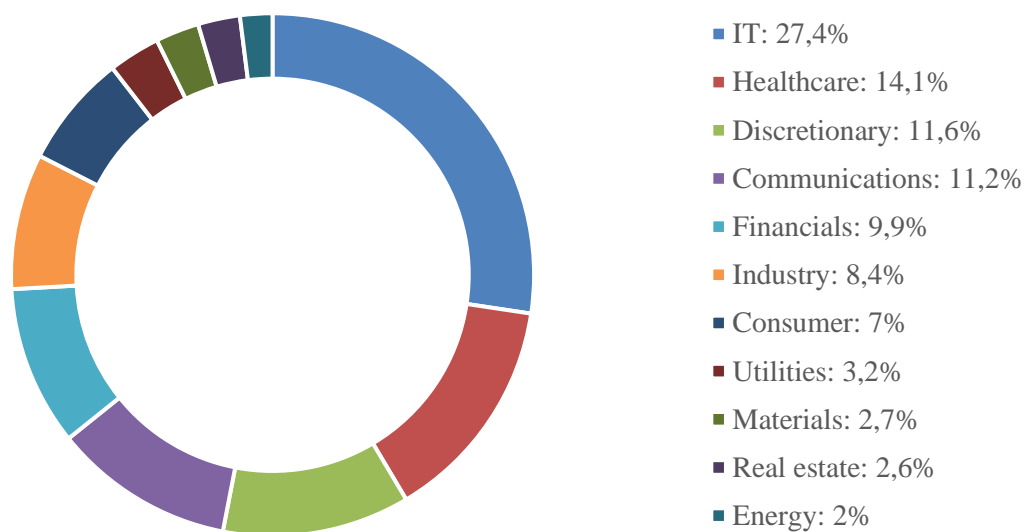
Source: Prepared by the author

The stock indices within the scope of this work are the S&P 500 and the Russell 2000. The S&P 500⁷² brings together the 500 largest companies listed on the stock exchange in the United States. This index, due to the significant number of constituent companies (500), the high complexity of the North American economy and the fact that most of the large companies in that country seek listing on the stock exchange, is diversified in companies from different fields of activity, with prevalence from the technology sector (27.4%). Because its methodology gives greater weight to companies with higher market value, the S&P 500 can be considered a picture of the dominant companies in their respective sectors, a reality far removed from the average North American business community. Being *large caps*, these companies are not free from suffering sharp drops in profits, as in the case of the COVID-19 crisis, but they

⁷² <https://www.spglobal.com/spdji/en/indices/equity/sp-500>

are less likely to go bankrupt, given their wide access to credit, investment capacity and market power to withstand long adverse periods. The weight of each sector in the S&P 500 is shown in Chart 5.1. The other stock index object of study in this work is the Russell 2000⁷³, composed of the 2,000 smallest companies within the Russell 3000, in turn composed of the 3,000 largest companies listed in the USA. Therefore, the Russell 2000 is essentially a *small cap* index, which better portrays the reality of the US private sector, with companies smaller, less dominant, more diversified and more connected to the real economy than the S&P 500.

Graph 5.1- Sectoral distribution in the S&P 500 index

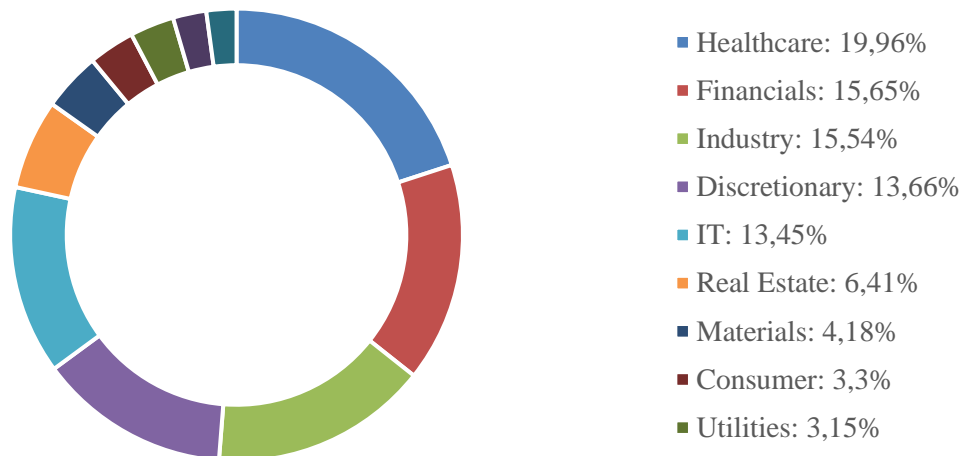


Source: S&P Global (base date 10/30/2020)

For comparison purposes, the 1,000 largest companies in the Russell 3000 represent about 90% of its market capitalization, leaving only 10% for the smallest 2,000 that make up the Russell 2000. Also as a reference, on 10/30/2020 the capitalization S&P 500 average was \$56.5 billion, and Russell 2000 was \$2.5 billion. The Russell 2000 distribution by sector is depicted in Graph 5.2.

⁷³ <https://www.ftserussell.com/products/indices/russell-us>

Graph 5.2– Sectoral distribution of the Russell 2000 index



Source: iShares (base date 11/23/2020)

The *US dollar index*⁷⁴ is a measure of the value of the US currency in relation to a basket of currencies from other countries with the composition described in table 5.1. It is an index maintained by the Intercontinental Exchange (ICE) traded on the stock exchange through the DXY contract. When the USD strengthens in the world, the DXY goes up, and when it weakens, the DXY goes down.

Table 5. - Composition of the 1 *US dollar index* currency basket

Coin	Weight
Euro (EUR)	57.6%
Japanese Yen (JPY)	13.6%
British pound (GBP)	11.9%
Canadian Dollar (CAD)	9.1%
Swedish krona (SEK)	4.2%
Swiss franc (CHF)	3.6%

Source: ICE – Intercontinental Exchange

⁷⁴ <https://www.theice.com/forex/usdx>

The events of monetary policy announcements studied in the scope of this work are those detailed in table 5.2 below.

Frame 5.2– Events studied

Country	Date	Description of the event
USA	03/03/20	- The fundamentals of the US economy remained strong - Reduction of the FED Funds Rate by 0.5 pp, for the range from 1 to 1.25%
USA	03/16/20 ^{to}	- The coronavirus outbreak has harmed communities and disrupted economic activity in many countries, including the US - Global financial conditions were also significantly affected. - Reduction of the FED Funds Rate by 1 pp, for the range from 0 to 0.25% - The Committee expects to maintain this target range until it is confident that the economy has weathered recent events and is on track to achieve its maximum employment and price stability targets. - QE with purchases of USD 500 billion in <i>treasuries</i> and USD 200 billion in MBS totaling USD 700 billion
USA	03/23/20	- The Fed will continue to buy Treasury bonds and MBS in amounts necessary to support the smooth functioning of the market and the effective transmission of monetary policy to broader financial conditions (“QE Infinity”)
UK	03/19/20 ^b	- Reduction of the basic interest rate by 15 bp to 0.1% a.a. and £200 billion GBP QE on sovereign and corporate bond purchases
UK	06/18/20 ^b	- £100 billion QE on sovereign bond purchases
Japan	03/16/20 ^b	- QE of 80 trillion JPY in sovereign bonds, 12 trillion JPY in ETFs, 180 billion JPY in REITs and 2 trillion JPY in <i>commercial paper</i> and corporate bonds
Japan	04/27/20 ^b	- QE on unlimited sovereign bond volume and 20 trillion JPY on <i>commercial paper</i> and corporate bonds
Canada	03/27/20	- Basic interest rate reduction by 50 bp to 0.25% pa and QE of 5 billion CAD per week in sovereign bonds plus unspecified amount of <i>commercial paper</i>
Canada	04/15/20	- CAD 10 billion QE on corporate bonds
Canada	07/15/20	- Maintenance of QE pace of sovereign bond purchases at the pace of CAD 5 billion per week
Australia	03/19/20 ^b	- Reduction of the base rate to 0.25% pa and unlimited purchases of sovereign bonds until the 3-year bond <i>yield</i> reaches 0.25% pa.
Australia	11/03/20	- Reduction of the base rate to 0.1% pa, unlimited purchases of sovereign bonds until the 3-year bond <i>yield</i> reaches 0.1% and AUD 100 billion in purchases of sovereign bonds with a maturity of 5 to 10 years.
NZ	03/23/20	- NZD 30 billion QE in sovereign bonds
Sweden	03/16/20 ^b	- QE of SEK 300 billion in sovereign bonds

(a) Announcement made on Sunday (15/03/20), with effective impact on the following Monday (16/03/20).

(b) Announcement made after the local market closes with an effective impact on the following business day.

Source: Prepared by the author

6 RESULTS AND DISCUSSION

In the context of the COVID-19 epidemic, which in the first quarter of 2020 began to spread out of China towards Europe and the United States, market players began to consider the hypothesis that the new coronavirus could turn into a crisis. of global health with strong impacts also on the economy. On March 3, 2020 ⁷⁵, the Fed declares that the fundamentals of the US economy remained strong, but that the coronavirus posed increasing risks to economic activity. In the same communiqué, the FOMC announced its decision to reduce the *FED Funds Rate* by 0.5 pp, to the range of 1 to 1.25% pa, and pledged to closely monitor the unfolding of the epidemic and its implications for the economy.

The impact of this announcement on the interest, stock and currency markets is shown in table 6.1. This 03/03/2020 event was a typical use of a conventional monetary policy instrument to reduce the short-term basic interest rate. What is observed as a result is a relevant reduction only in short-term rates (1 - month *treasury yield* dropping 21.57%), without major effects on long-term rates (30-year treasury yield dropping a *modest* 1.17 %).

Chart 6.1 makes it easier to visualize the effect of the 03/03/2020 event on the North American yield curve. Only the vertices related to the shorter maturities had a relevant *yield reduction*. In fact, what is clear from these results is that the impact of a conventional short-term interest rate reduction measure is strong on short-term bonds, but it declines consistently as the term increases until it becomes insignificant in the long term. deadline. In order to effectively stimulate aggregate demand, the most important are long-term rates, given their greater correlation with the supply of credit to productive activity and consumption.

The reaction from equity markets was also not positive, with the S&P 500 down 2.87% on the 1st trading day after the event. In the *valuation* models of publicly traded companies, the rate that matters most is also the long-term rate, through which the expected cash flow in the perpetuity of the companies is brought to present value. In other words, the positive impact on the *valuation* of companies resulting from the drop in interest rates did not offset the expected negative impact resulting from the drop in demand. As expected, the US currency depreciated 0.21% against the US Dollar Index currency basket due to a lower attractiveness for capital allocation in interest in the US.

⁷⁵ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200303a.htm>

Table 6.1– Impact of the announcement of the reduction of the FED *Funds Rate* by 0.5 pp on 03/03/2020

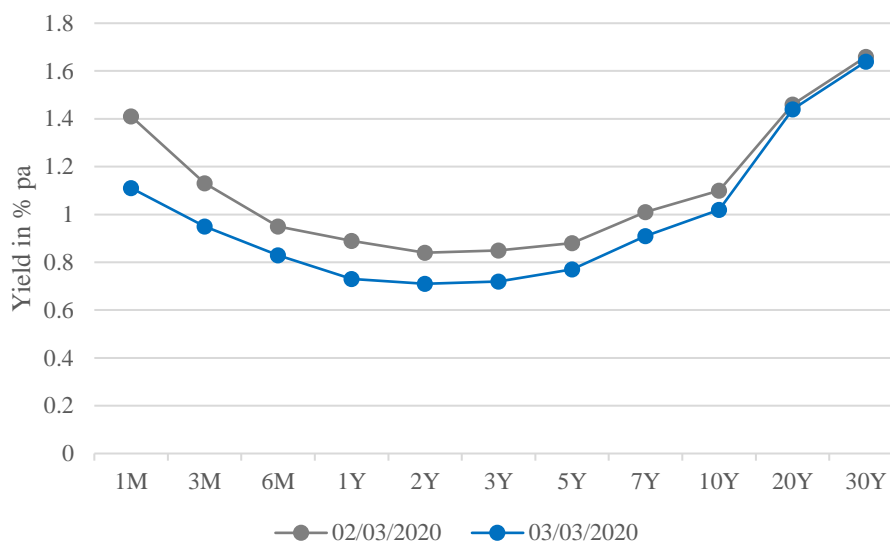
Active	Impact (1 day)	intercept
US <i>Treasury Yields</i> 1 month	-21.57*** (0.45)	0.29 (0.45)
US <i>Treasury Yields</i> 3 months	-16.08*** (0.41)	0.15 (0.41)
US <i>Treasury Yields</i> 6 months	-13.00*** (0.56)	0.37 (0.56)
US <i>Treasury Yields</i> 1 year	-17.91*** (0.15)	-0.07 (0.15)
US <i>Treasury Yields</i> 2 years	-15.37*** (0.16)	-0.11 (0.16)
US <i>Treasury Yields</i> 3 years	-15.21*** (0.17)	-0.08 (0.17)
US <i>Treasury Yields</i> 5 years	-12.43*** (0.15)	-0.07 (0.15)
US <i>Treasury Yields</i> 7 years	-9.83*** (0.12)	-0.07 (0.12)
US <i>Treasury Yields</i> 10 years	-7.23*** (0.12)	-0.05 (0.12)
US <i>Treasury Yields</i> 20 years	-1.34*** (0.10)	-0.03 (0.10)
US <i>Treasury Yields</i> 30 years	-1.17*** (0.08)	-0.04 (0.08)
S&P 500	-2.87*** (0.04)	0.06 (0.04)
Russell 2000	-2.17*** (0.05)	0.04 (0.05)
Dollar Index	-0.21*** (0.01)	-0.01 (0.01)

(1) US *Treasury Yields* x months/years represents the treasury *yield maturing* in x months/years. (2) The sample comprises the series of daily percentage returns of assets in the period from 01/02/2017 to 10/08/2020. (940 observations for each asset) (3) Robust standard errors. (4) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

There was no relevant monetary policy announcement on 03/03/2020 in the countries included in the Dollar Index currency basket (Euro Zone, Japan, United Kingdom, Canada, Sweden, Switzerland) that could generate any other extraordinary effect on the date. The first

country to react after the FED on 03/03/2020 was Canada, which announced a reduction in the basic interest rate by 0.5 pp on 03/04/2020.

Graph 6.1– Variation in the term structure of the interest rate of *treasuries* on 03/03/2020



Source: Federal Reserve – Board of Governors – H.15 File

After the 03/03/2020 event, stock exchanges, not only in the US, but around the world, would definitely enter *bear market territory*⁷⁶. The days of March 2020 that followed represented one of the biggest *crashes* in the history of the global financial market with a sequence of *circuit breakers* in the S&P 500 and in several other equity markets in other countries. On March 9, Black Monday I occurs, on March 12, Black Thursday, culminating on March 16, Black Monday II (table 6.2).

Table 6.2– S&P 500 *Crash* in March 2020

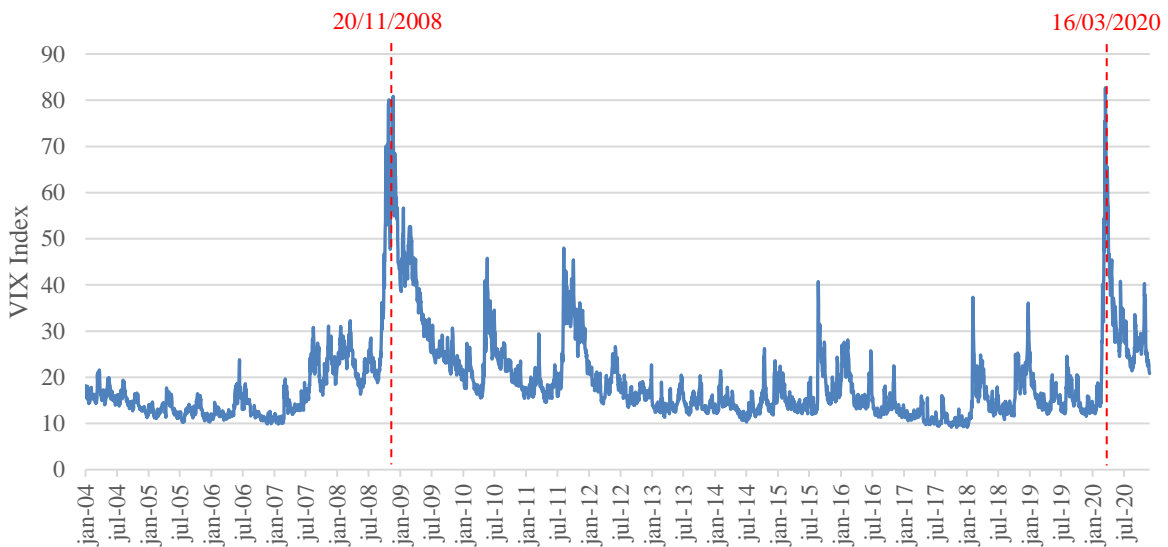
Event	Date	Variation % S&P 500	S&P 500 Closing
Black Monday I	09/03/2020	-7.60%	2,747
Black Thursday	03/12/2020	-9.51%	2,481
Black Monday II	03/16/2020	-11.98%	2,386

Source: Nasdaq

⁷⁶downward trend

A thermometer of the stress that settled in the market in March 2020 is the VIX index⁷⁷, a metric of stock market volatility obtained from the implied volatility of S&P 500 options. On Black Monday II (March 16, 2020) the VIX reached the highest value in the series (82.69), surpassing the hitherto high of 80.86 reached on November 20, 2008, the peak of the 2007-2008 GRG (chart 6.2).

Graph 6.2– Evolution of the VIX index



Source: CBoe

In this context, on 03/15/2020 the FED makes another 1 pp reduction in the FED *Funds Rate*, bringing the rate to the range of 0 to 0.25% pa In the same announcement, the monetary authority begins QE4 in the total amount of USD 700 billion, with USD 500 billion for long-term sovereign bonds and USD 200 billion for MBS. The result of the event of this announcement is shown in table 6.3.

⁷⁷ <https://cdn.cboe.com/resources/vix/vixwhite.pdf>

Table 6.3- Impact of the FED's 03/16/2020 announcement ^{to} reduce the FED Funds Rate by 1 pp and USD 700 billion for QE4

Active	Impact (1 day)	intercept
US <i>Treasury Yields</i> 1 month	-24.54*** (0.45)	0.30 (0.45)
US <i>Treasury Yields</i> 3 months	-14.43*** (0.41)	0.15 (0.41)
US <i>Treasury Yields</i> 6 months	-24.06*** (0.56)	0.38 (0.56)
US <i>Treasury Yields</i> 1 year	-23.62*** (0.15)	-0.06 (0.15)
US <i>Treasury Yields</i> 2 years	-26.44*** (0.15)	-0.09 (0.15)
US <i>Treasury Yields</i> 3 years	-25.79*** (0.16)	-0.07 (0.16)
US <i>Treasury Yields</i> 5 years	-29.95*** (0.15)	-0.05 (0.15)
US <i>Treasury Yields</i> 7 years	-24.66*** (0.12)	-0.05 (0.12)
US <i>Treasury Yields</i> 10 years	-22.31*** (0.12)	-0.03 (0.12)
US <i>Treasury Yields</i> 20 years	-16.01*** (0.09)	-0.02 (0.09)
US <i>Treasury Yields</i> 30 years	-14.08*** (0.08)	-0.02 (0.08)
S&P 500	-12.05*** (0.04)	0.07 (0.04)
Russell 2000	-14.32*** (0.05)	0.05 (0.05)
Dollar Index	-0.68*** (0.01)	-0.01 (0.01)

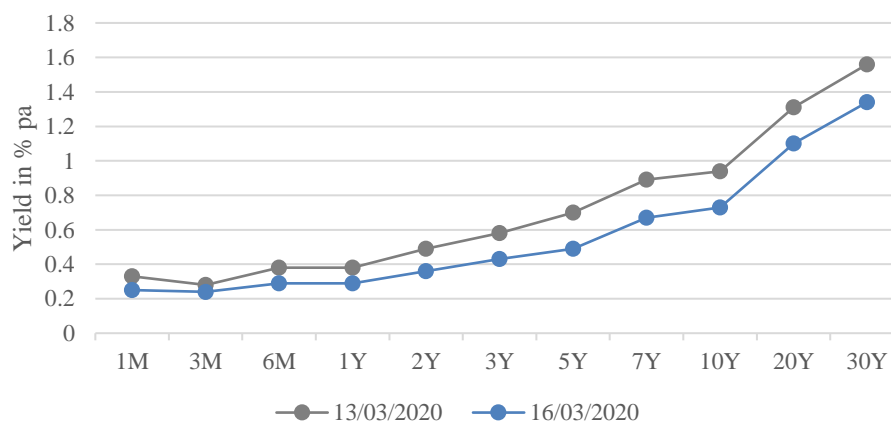
(1) US *Treasury Yields* x months/years represents the treasury *yield maturing* in x months/years. (2) The sample comprises the series of daily percentage returns of assets in the period from 01/02/2017 to 10/08/2020. (940 observations for each asset) (3) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

(a) the FED announcement was made on 03/15/2020 (Sunday) at 17:00. The impacts refer to 03/16/2020 (Monday) because it was the 1st trading day after the announcement.

This time, the announcement of 03/16/2020 combined a conventional monetary policy (reduction of the basic rate by 1 pp) with an unconventional policy of *quantitative easing* in the order of USD 700 billion. What can be observed in the study of events in table 6.3 is that, on this date, there was a significant effect not only on short-term, but also on long-term *yields*.

The 30-year treasury yield dropped 14.08% on 03/16/2020 versus a drop of just 1.17% on 03/03/2020. This effect is markedly different from the event of 03/03/2020, where there was only an important effect on short-term rates. Graph 6.3 visually presents the effect of the 03/16/2020 event in relation to the previous business day. It can be seen the short-term rate with little room for decline, close to the ZLB, and the long-term rates (10, 20 and 30 years) falling significantly as a result of the announcement, making it difficult, on a first reading, to distinguish the contribution of the FED Funds Rate reduction from the QE4 announcement, as the announcements took place simultaneously⁷⁸. Despite this difficulty, there are indications to support the thesis that the announcement of QE4 was what contributed decisively to the fall in the long part of the yield curve. This stems from the fact that the announcement took place at an extraordinary meeting of the FOMC held on 03/15/2020, a Sunday, at 17:00. Therefore, the market was probably already anticipating the reduction of the basic interest rate by 1 pp, but for a few days in the future, when the ordinary meeting took place. The surprise component of the announcement would not be the rate reduction itself, which would already be embedded in the curve, but the QE4.

Graph 6.3- Variation in the term structure of the interest rate of *treasuries* on 03/16/2020



Source: Federal Reserve – Board of Governors – H.15 File

The Dollar Index is down 0.68% on 3/16/2020 versus a 0.21% drop on 3/3/2020. On the other hand, the effect on equity markets was quite negative on 03/16/2020. The date was marked as Black Monday II, the day the S&P 500 dropped 12.05% and the Russell 2000 dropped 14.32, both among the biggest historic drops in their respective series. Unlike the interest and currency markets, where the effect of the announcement was immediately

⁷⁸ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm>

observed, the signaling of QE4 was not enough to have the expected positive effect on the stock market, which was still quite skeptical about the effect of QE on real economic activity.

The global relevance of the US economy and the strong capital flow in the world means that a measure of the magnitude of the QE4 announced on 03/16/2020 causes effects that go beyond the US and are observed in several other countries. In addition to the aforementioned reflection of the devaluation of the US Dollar in relation to other currencies, there is also an important impact on the *yields* of sovereign bonds from other countries (table 6.4). In emerging countries such as Brazil, Mexico and South Africa, there was a significant increase in *yields* and devaluation of local currencies in evidence that, even with a monetary relaxation in the central economy (USA), international capital migrates from emerging countries towards to the central economy in a “*flight to quality*” movement (BRIÈRE et al., 2012). In developed countries in Western Europe, there was also an increase in local *yields*. Despite the maturity of these economies, Europe in March 2020 was the epicenter of the pandemic ⁷⁹, which may have worsened investors' perception of the risk of these countries (POGHOSYAN, 2014). In most economies in Asia and Oceania, *yields were reduced* in a probable perception that these regions would have done well in the fight against the pandemic, added to the effect of lower remuneration of the capital allocated in North American *treasuries*, *making the migration of capital to countries with better risk-return*.

⁷⁹ <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-mission-briefing-on-covid-19---13-march-2020>

Table 6.4- Impact of the EDF announcement from 03/16/2020 ^{to} other countries

Country	Impact (1 day)	intercept	Country	Impact (1 day)	intercept
North America			Asia		
Canada	-4.95*** (0.10)	-0.04 (0.10)	China	-0.67*** (0.03)	-0.01 (0.03)
mexico ^b	3.95*** (0.05)	-0.01 (0.05)	Hong Kong	17.76*** (0.10)	-0.09 (0.10)
South America			India	-1.63*** (0.03)	0.02 (0.03)
Brazil	8.61*** (0.08)	0.04 (0.08)	Japan	241.19*** (3.76)	-3.17 (3.76)
Europe			South Korea	-5.16*** (0.07)	-0.03 (0.07)
Belgium	13807.89*** (1.77)	-0.24 (1.77)	Malaysia	-0.66*** (0.03)	-0.03 (0.03)
France	1579.74*** (16.66)	-13.88 (16.66)	singapore	-7.87*** (0.07)	-0.05 (0.07)
Germany	9.18*** (1.21)	-0.53 (1.21)	thailand	-12.49*** (0.08)	-0.06 (0.08)
Greece	7.96*** (0.20)	-0.21 (0.20)	Oceania		
Netherlands	37.67*** (0.80)	-0.35 (0.80)	Australia	-4.16*** (0.11)	-0.07 (0.11)
Norway	-6.99*** (0.09)	-0.02 (0.09)	New Zealand	-7.30*** (0.09)	-0.10 (0.09)
Spain	31.22*** (0.39)	0.34 (0.39)	Africa		
Sweden	89.31*** (4.76)	-4.42 (4.76)	South Africa	5.06*** (0.05)	0.04 (0.05)
UK	17.52*** (0.17)	0.01 (0.17)			

(1) Impact on the *yields* of 10-year sovereign bonds of each country, plus the exchange rate appreciation of the USD against the country's currency. (2) The sample comprises the series of daily percentage returns of 10-year *yields* and exchange rates in the period from 02/01/2017 to 16/03/2020. (817 observations for each country) (4) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

(a) the FED announcement was made on 03/15/2020 (Sunday) at 17:00. The impacts refer to 03/16/2020 (Monday) because it was the 1st trading day after the announcement.

(b) In Mexico it was a public holiday on 03/16/2020. The impact in this country refers to the 1st trading day after the local holiday, 03/17/2020.

Despite all efforts by governments to combat the crisis, financial markets remained under intense stress in the second half of March 2020. On 03/23/2020, the Federal Reserve makes its most dramatic intervention yet. In a statement, the FOMC discloses its decision to expand the program of large-scale purchases of *treasuries* and MBS by the amounts necessary to support the smooth functioning of the market and the effective transmission of monetary policy to broader financial conditions, what has become known as “QE Infinity”.

On the same date of 03/23/2020, the FED announced the expansion of the MMLF and CPFF programs, as well as creating the PMCCF, SMCCF and TALF programs. The reaction to this event in the interest, currency and equity markets is shown in table 6.5. There was a significant drop in the *yields* of short-term sovereign bonds (-75.35% in the 1-month *treasury yield*) and long-term (-14.17% in the 30-year *treasury yield*). Interestingly, the 6-month and 1-year bond *yields* appreciated, probably as a result of the failure of the Fed and/or the market to act on these specific maturities in favor of other maturities, but without compromising the general outlook of a significant drop in *yields* both in short, medium and long term. The US Dollar Index fell by 0.31% on 03/23/2020, in line with the drops on 03/03/2020 and 03/16/2020, confirming the theory's expectation (DEDOLA et al., 2020) that the Fed's unconventional monetary policy of monetary expansion is positively correlated with the depreciation of the US Dollar against other strong currencies. Once again, equity markets reacted negatively. The S&P 500 and Russell 2000 fell by 2.99% and 1.17% respectively, indicating a lack of clarity on the part of investors that any monetary stimulus would achieve the ultimate objective of increasing real economic activity. Despite the devaluation of stock indices on 03/23/2020, this was lower than that of the event on 03/16/2020, indicating a marginal cooling of tensions.

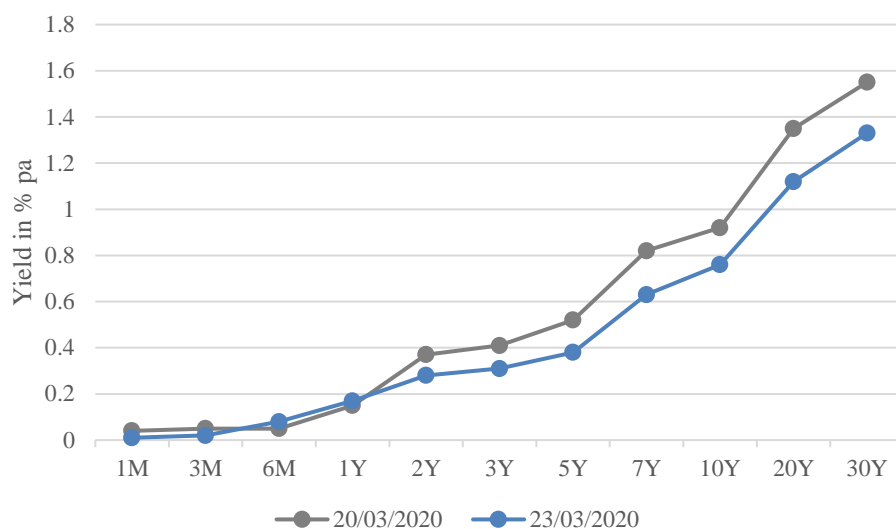
Table 6.5- Impact of the 3/23/2020 FED announcement (“QE Infinity”)

Active	Impact (1 day)	intercept
US <i>Treasury Yields</i> 1 month	-75.35*** (0.45)	0.35 (0.45)
US <i>Treasury Yields</i> 3 months	-60.19*** (0.41)	0.19 (0.41)
US <i>Treasury Yields</i> 6 months	59.71*** (0.56)	0.29 (0.56)
US <i>Treasury Yields</i> 1 year	13.44*** (0.15)	-0.10 (0.15)
US <i>Treasury Yields</i> 2 years	-24.23*** (0.15)	-0.10 (0.15)
US <i>Treasury Yields</i> 3 years	-24.32*** (0.16)	-0.07 (0.16)
US <i>Treasury Yields</i> 5 years	-26.87*** (0.15)	-0.05 (0.15)
US <i>Treasury Yields</i> 7 years	-23.11*** (0.12)	-0.06 (0.12)
US <i>Treasury Yields</i> 10 years	-17.36*** (0.12)	-0.04 (0.12)
US <i>Treasury Yields</i> 20 years	-17.02*** (0.09)	-0.02 (0.09)
US <i>Treasury Yields</i> 30 years	-14.17*** (0.08)	-0.02 (0.08)
S&P 500	-2.99*** (0.04)	0.06 (0.04)
Russell 2000	-1.17*** (0.05)	0.04 (0.05)
Dollar Index	-0.31*** (0.01)	-0.01 (0.01)

(1) US *Treasury Yields* x months/years represents the treasury *yield maturing* in x months/years. (2) The sample comprises the series of daily percentage returns of assets in the period from 01/02/2017 to 10/08/2020. (940 observations for each asset) (4) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

The impact of the “QE Infinity” announcement on 03/23/2020 can also be seen in Graph 6.4. Similar to the QE4 event on 03/16/2020, the “QE Infinity” on 03/23/20 had a major effect on the 5, 7, 10, 20, and 30 year long vertices. This shows the effectiveness of the program of large-scale *purchase* of long-term treasuries in the secondary market in order to reduce long-term interest rates.

Graph 6.4- Variation of the term structure of the interest rate of *treasuries* on 03/23/2020



Source: Federal Reserve – Board of Governors – H.15 File

Table 6.6 summarizes the 3 events of the Fed's monetary policy announcements and their impacts on the interest, equity and currency markets. The events of 3/16/20 and 3/23/20, which included QE announcements, related to sharp drops in long-term rates. All 3 events related to US Dollar depreciation. And the stock markets reacting negatively in the short term.

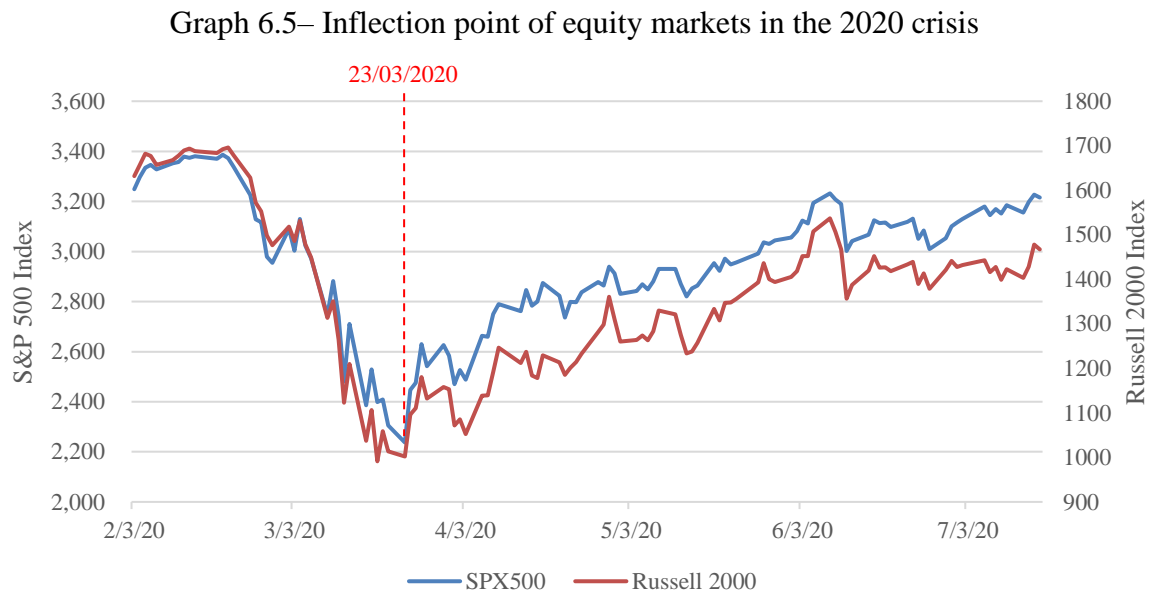
Table 6.6- Summary of March 2020 events

Active	Event		
	03/03/20 (conventional)	03/16/20 (conventional + Not conventional)	03/23/20 (Not conventional)
US Treasury Yields 1 month	-21.57***	-24.54***	-75.35***
US Treasury Yields 10 years	-7.23***	-22.31***	-17.36***
US Treasury Yields 30 years	-1.17***	-14.08***	-14.17***
S&P 500	-2.87***	-12.05***	-2.99***
Russell 2000	-2.17***	-14.32***	-1.17***
Dollar Index	-0.21***	-0.68***	-0.31***

Source: Federal Reserve – Board of Governors – H.15 File

Despite the falls in the stock exchanges observed on 03/23/2020, the date was marked as a turning point in the stock markets. On this day, the S&P 500 and several other stock indices

in the US and around the world marked the lowest of the year and from then on recovered strongly throughout 2020, as shown in chart 6.5.



Source: Nasdaq

The unprecedented “QE Infinity” in the US had effects in other countries as well. The results are shown in table 6.7.

Table 6.7- Impact of the 3/23/2020 FED announcement on 10-year sovereign yields priced in USD in other countries

Country	Impact (1 day)	intercept	Country	Impact (1 day)	intercept
North America			Asia		
Canada	-9.22*** (0.11)	-0.03 (0.11)	China ^{to}	-0.13*** (0.03)	-0.01 (0.03)
Mexico	9.31*** (0.05)	-0.01 (0.05)	Hong Kong ^{to}	2.44*** (0.11)	-0.06 (0.11)
South America			India ^{to}	-1.10*** (0.03)	0.03 (0.03)
Brazil	10.70*** (0.09)	0.07 (0.09)	Japan ^{to}	-34.63*** (3.76)	-2.50 (3.76)
Europe			South Korea ^{to}	-2.21*** (0.07)	-0.01 (0.07)
Belgium	-43.48* (18.17)	17.94 (18.17)	Malaysia ^{to}	0.41*** (0.03)	0.00 (0.03)
France	1.73 (16.68)	-11.79 (16.68)	Singapore ^{to}	-0.91*** (0.07)	-0.03 (0.07)
Germany	-39.30*** (1.20)	-0.43 (1.20)	Thailand ^{to}	-15.07*** (0.09)	-0.01 (0.09)
Greece	3.32*** (0.22)	-0.16 (0.22)	Oceania		
Netherlands	-47.29*** (3.90)	3.02 (3.90)	Australia ^{to}	-4.52*** (0.12)	-0.06 (0.12)
Norway	-3.33*** (0.09)	0.01 (0.09)	New Zealand ^{to}	-0.03 (0.11)	-0.09 (0.11)
Spain	-10.28*** (0.39)	0.43 (0.39)	Africa		
Sweden	-172.24*** (4.81)	-3.76 (4.81)	South Africa	6.06*** (0.06)	0.07 (0.06)
UK	-28.01*** (0.19)	0.06 (0.19)			

(1) Impact on the *yields* of 10-year sovereign bonds of each country, plus the exchange rate appreciation of the USD against the country's currency. (2) The sample comprises the series of daily percentage returns of 10-year yields and exchange rates in the period from 01/02/2017 to 03/23/2020. (822 observations for each country) (4) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

(a) The impacts of the countries of Asia and Oceania refer to 03/24/2020. The Fed's announcement on 03/23/2020 was at 8:00 am New York time. At this time, markets in Asia and Oceania were already closed. Therefore, the Fed announcement on 03/23/20 only had an impact on the Asian and Oceania markets on 03/24/20.

Unlike QE4 on 3/16/2020, the 3/23/2020 event is related to a drop in sovereign bond *yields* in Canada and almost all developed countries in Europe, Asia and Oceania. In emerging countries Brazil, Mexico and South Africa, *yields increased* and the local currency devaluation once again confirmed the “*flight to quality*” phenomenon.

Experiences with QE policies in Japan in the 1990s, the US and Europe in the 2007-2008 GRG provoked intense debate in academia and governments. In the wake of the COVID-19 crisis in 2020, several countries used QE to combat dysfunctions in financial markets, overcome frictions in monetary transmission and, ultimately, stimulate aggregate demand (Kuttner and Mosser (2002)). Notably, among developed economies, the United Kingdom, Japan, Canada, Australia, New Zealand and Sweden made use of the unconventional QE instrument throughout 2020. The effects of these events on the *yields* of the respective 10-year sovereign bonds country are shown in table 6.8. In all the events studied, there was an important and statistically significant impact on *yields*.

Among developing countries, few in 2020 were in a ZLB situation and had a regulatory framework that allowed a large-scale asset purchase program that characterized *quantitative easing*. In this work, we analyze a few QE events in developing countries, including South Korea, South Africa, Romania, Philippines and Mexico. The results of events on the *yields* of 10-year sovereign bonds for each country are presented in table 6.9. In both tables 6.8 and 6.9 the results were calculated in local currency and not in USD, since the effect to be measured is the announcement of the country's QE on the *yields* of the sovereign bonds themselves. As noted, the effect in developing countries is significant, but less intense than in developed countries.

Table 6.8- QE announcements in developed economies and their impact on the *yields* of the respective 10-year sovereign bonds

Country	Announcement date	Announcement	Impact (1 day)	intercept
UK	03/19/20 ^{to}	Reduction of the basic interest rate by 15 bp to 0.1% a.a. and £200bn GBP in sovereign and corporate bond purchases	-32.33*** (0.18)	0.07 (0.18)
UK	06/18/20 ^{to}	£100bn in sovereign bond purchases	-12.72*** (0.21)	0.03 (0.21)
Japan	03/16/20 ^{to}	Purchases of 80 tri JPY in sovereign bonds, 12 tri JPY in ETFs, 180 bi JPY in REITs and 2 tri JPY in <i>commercial paper</i> and corporate bonds	-14.02*** (3.71)	-2.65 (3.71)
Japan	04/27/20 ^{to}	Unlimited volume purchases of sovereign bonds and 20 tri JPY in <i>commercial paper</i> and corporate bonds	-30.41*** (3.76)	-1.95 (3.76)
Canada	03/27/20	Reduction of the basic interest rate by 50 bp to 0.25% pa and purchases of CAD 5 billion per week in sovereign bonds, in addition to an unspecified amount of <i>commercial paper</i>	-14.24*** (0.11)	-0.04 (0.11)
Canada	04/15/20	Purchases of CAD 10 billion in corporate bonds	-14.62*** (0.11)	-0.05 (0.11)
Canada	07/15/20	Maintenance of the pace of sovereign bond purchases at CAD 5 bi per week	-1.78*** (0.12)	-0.07 (0.12)
Australia	03/19/20 ^{to}	Reduction of the base rate to 0.25% pa and unlimited purchases of sovereign bonds until the 3-year bond <i>yield</i> reaches 0.25% pa.	-23.38*** (0.11)	-0.03 (0.11)
Australia	11/03/20	Reduction of the base rate to 0.1% pa, unlimited purchases of sovereign bonds until the 3-year bond <i>yield</i> reaches 0.1% and AUD 100 billion in purchases of sovereign bonds with a maturity of 5 to 10 years.	-6.03*** (0.11)	-0.06 (0.11)
New Zealand	03/23/20	Purchases of NZD 30 billion in sovereign bonds	-39.68*** (0.09)	-0.06 (0.09)
Sweden	03/16/20 ^{to}	Purchases of 300 billion SEK in sovereign bonds	- 246.02*** (4.57)	-3.98 (4.57)

(1) Impact on the *yields* of 10-year sovereign bonds in each country. (2) The sample comprises the series of daily percentage returns of 10-year *yields* in the period from 02/01/2017 to the date of each event. (4) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

(a) Announcement made after the local market closes with an effective impact on the next business day.

Table 6.9- QE announcements in emerging economies and their impact on the *yields* of the respective 10-year sovereign bonds

Country	Announcement	Announcement date	Impact (1 day)	intercept
South Korea	Unlimited volume of repo operations collateralized by sovereign bonds, corporate bonds of state-owned companies and bank debentures	03/26/20	- 7.08*** (0.07)	-0.01 (0.07)
South Africa	Unspecified volume of sovereign government bond purchases	03/25/20	- 8.67*** (0.03)	0.05 (0.03)
Romania	Reduction of the basic interest rate by 50 bp to 2% pa, unspecified volume of repo operations and purchases of sovereign government bonds	03/20/20	- 5.48*** (0.04)	0.07 (0.04)
Philippines	Purchases of 300 bi PHP in government bonds	03/22/20 ^{to}	-0.15 (0.13)	0.07 (0.13)
Mexico	Purchases of MXN 100 billion in sovereign bonds	04/21/20 ^{to}	- 3.19*** (0.03)	0.00 (0.03)

(1) Impact on the *yields* of 10-year sovereign bonds in each country. (2) The sample comprises the series of daily percentage returns of 10-year *yields* in the period from 02/01/2017 to the date of each event. (4) Robust standard errors. (5) (***), (**), (*) significant at the level of 1, 5, 10%, respectively.

(a) Announcement made after the local market closes with an effective impact on the next business day.

7 CONCLUSION

This work shows that there was a generalized fall in the basic interest rates in developed countries and in a good part of emerging ones compared to 2000. In this context of low cost of capital, central banks have found limitations in the use of conventional monetary policies in times of crisis, such as, for example, the instrument of reducing the short-term interest rate. Even when there is room for a reduction in the short-term rate, this reduction does not significantly affect long-term rates, which are more important for investment, consumption and economic activity in general than the short-term ones. Another conclusion is that conventional monetary policy tools encounter friction in monetary transmission mechanisms, which makes them ineffective in terms of their ultimate objective of stimulating aggregate demand, especially in times of stress in financial markets.

The empirical strategy of studying events used in this work showed that QE presents itself as an effective tool for reducing long-term interest rates through the secondary market channel of sovereign bond trading. With the intervention of QE programs in this channel, the

long-term interest rates of the economy as a whole are benignly reduced. This benign result was achieved due to the fact that QE did not change expectations of inflation or debt solvency. In the short term, QE and other unconventional monetary policies appear to have been able to mitigate the impact of financial market volatility and the recession. So far, there is no evidence to indicate that this type of policy has negatively affected long-term expectations regarding inflation and debt solvency. Another relevant result of our study of events is that the monetary expansion arising from the QE program contributes to the devaluation of the country's currency, in line with what was expected by theory.

The empirical study also showed that, unlike interest and currency markets, equity indices do not respond immediately to the monetary stimulus of QE. This can be measured as investor skepticism that the stimulus will actually achieve its ultimate goal of increased activity in the real economy. Another possibility is that a QE as bold as the one undertaken by the Fed may have caused investors to fear that the monetary authority, in possession of information not revealed to the market, would have an even more pessimistic view of the economy. Despite the initial skepticism, the set of monetary and fiscal measures proved successful in combating the harmful effects of the COVID-19 pandemic on the economy, with the world economy recovering strongly from the 3rd quarter of 2020. However, it is not trivial to distinguish the contribution of monetary policy from other forces such as fiscal policy, the relaxation of social isolation measures and the return of consumer and business confidence.

As future studies, we suggest the analysis of how the transmission of the first-order monetary stimulus takes place until it reaches the end of the line, in the real economy. Another suggestion is to study the scenario for the use of unconventional monetary policy in Brazil, a country that in its history has always lived with one of the highest interest rates in the world, both real and nominal, and which in the 2020 crisis reached the level of lowest interest in its history until then, with SELIC at 2% pa, below inflation.

The way for the use of QE programs in Brazil was opened with the passage of Constitutional Amendment 106, of May 7, 2020⁸⁰, in the midst of the COVID-19 crisis. EC 106 instituted the extraordinary fiscal, financial and contracting regime to face national public calamity resulting from the pandemic in 2020. In its text, the Amendment also authorized the Central Bank of Brazil to buy and sell, in addition to public bonds, also privately issued on the national secondary markets. Despite EC 106, there are difficulties for a QE policy to be

⁸⁰ http://www.planalto.gov.br/ccivil_03/constituicao/emendas/emc/emc106.htm

effectively implemented in Brazil. First, there is a question of lack of legal certainty arising from the non-regulation of the amendment so far. There are still other points to discuss in Brazil. How close are we to the ZLB? On 09/16/2020, with a nominal interest rate of 2% pa and an expectation of 1.95% inflation in 2020 according to the Focus bulletin ⁸¹, the Copom resumed the discussion on a potential minimum effective limit for the basic interest rate and its association with matters of a prudential nature and financial stability. For most Copom members, this limit would be significantly higher in emerging economies than in developed countries due to the presence of a risk premium. It was emphasized that this premium is dynamic and tends to be higher in Brazil, given its relative fiscal fragility and uncertainties regarding its prospective fiscal trajectory. In this context, in the view of the Brazilian monetary authority, we would already be close to the level at which additional interest rate reductions could be accompanied by instability in asset prices ⁸². Up to this moment (February 2021), the Copom's view proved to be correct, with an increase in inflation since then and little probability of maintaining the Selic at 2% pa in the medium term. The February 2021 Focus bulletin already indicates Selic at 3.5% pa at the end of 2021 ⁸³, which corroborates the view that, in fact, there was never any expectation by market agents that the Selic would remain at the level of 2% pa for a long time.

⁸¹ <https://www.bcb.gov.br/publicacoes/focus/11092020>

⁸² <https://www.bcb.gov.br/publicacoes/atascopom/16092020>

⁸³ <https://www.bcb.gov.br/publicacoes/focus/05022021>

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