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THE ROLE OF UNCONVENTIONAL MONETARY POLICY

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ABSTRACT

In recent years, central banks have used unconventional monetary policies to overcome the limitations imposed by the lower bound. In this work we review these measures, with special attention to QE and forward guidance. These measures are able to provide a greater stimulus than traditional monetary policies in the face of short-term interest rate constraints. This means that, despite the fact that they started out as exceptional and transitory, unconventional monetary policies have become part of central banks' standard tools to stimulate economic activity, achieve better financial conditions and improve economic welfare.

KEYWORDS

Unconventional monetary policy, QE, forward guidance, lower bound.

JEL classification

E31, E52, E58

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1. INTRODUCTION

During the Great Recession, most central banks have implemented a set of new monetary policy tools to influence financial and monetary conditions. These measures are a far cry from the traditional monetary policy approach of controlling the short-term interest rate.

The financial crisis, causing a large drop in economic activity, caused most central banks to aggressively reduce their interest rate to near zero. Falling interest rates are a major challenge to traditional monetary policies. The existence of an effective lower bound on interest rates coupled with low inflation targeting reduces the ability of these policies to stimulate the economy.

The lower bound causes a situation where the preference for liquidity is greater than the incentive to invest, the so-called trap liquidity. In this situation, an expansive monetary policy has no effect on prices, investment, or production. This causes the monetary policy to become unusable in the face of this situation. After the interest rate cut, the central banks, faced with the need to stimulate the economy, implemented so-called unconventional monetary policies. The tools used by the major central banks consist of the use of forward guidance to explain to market participants the economic outlook and their policy plans, and quantitative easing (QE), which is based on the purchase of long-term assets. These two, along with a set of other monetary policy measures, were used during the Great Recession.

The new tools have proved effective in providing more space for monetary policy in situations where the interest rate is limited by the lower bound. These tools have been able to alleviate financial conditions and provide additional stimulus against the lower bound without the possible costs or risks of these measures being relevant. Although their use began to be exceptional and temporary, these measures are becoming increasingly relevant and permanent in the monetary policy programs carried out by central banks. Hence the importance of analyzing their effects in order to find out how they work and how to achieve greater effectiveness in their use.

In the next section, we will present the unconventional monetary policies. In this section, we will analyze the experience gained from the use of these measures, the

transmission channels, and alternative non-traditional monetary policies. In section 3, the effects that the use of these measures had on different assets, their persistence over time, their role during the 2008 financial crisis, and the possible use of these measures in the future. In this section, we will provide a detailed description of how these policies are able to provide additional space for monetary policies. In section 4, we will explain the potential costs and risks inherent in the use of these policies. We will end with the conclusion reached about the use of the new tools.

2. UNCONVENTIONAL MONETARY POLICY

When monetary policymakers are faced with a situation where the short-term interest rate has reached an effective lower bound, traditional monetary policies are ineffective in providing stimulus to the economy. However, by operating with long-term interest rates and other asset prices and yields it is still possible to add stimulus when short-term interest rates reach the effective lower bound (Bernanke, 2020). According to Bernanke, the purchases of long-term financial assets by the central bank or quantitative easing (QE) together with the communication of the economic outlook and policy plans to be made by monetary policymakers (forward guidance) are the two main new types of tools. These, along with a set of alternative policies, are the so-called unconventional monetary policies.

2.1 Quantitative easing

The purchase of assets by the central bank or quantitative easing (QE) consists of the purchase of longer-maturity government bonds with newly issued reserves. As demand for these types of bonds increases, their price rises and the compensation for liquidity or risk than investors demand from them decreases (Brunnermeier and Reis, 2019).

The first central bank to adopt an asset purchase program in order to stimulate the economy against the lower bound was the Bank of Japan (BOJ) in 2001. The aim of the BOJ was to increase the monetary base by purchasing long-term assets.

The Federal Reserve (FED) in November 2008 announced its first large-scale asset purchase program in which it announced its intent to purchase government guaranteed mortgage-backed securities (MBS) and governments-sponsored enterprise debt (GSEs), Freddie Mac and Fannie Mae. There are four major programs adopted by the FED:

- *QE1*: In 2009, an increase in MBS purchases and the acquisition of U.S treasury securities were made.
- *QE2:* In 2010, a commitment by the FED to buy $600 billion in Treasury bonds.
- *The maturity extension program:* In 2011 and expanded in 2012, purchase of long-term public debt and sale of short-term treasury bonds to extend the average maturity of the portfolio.
- *QE3*: In 2012, commitment to purchase treasury bonds and MBS in order to improve the labor market outlook.

The purchase of long-term securities increased the average duration of the Federal Reserve portfolio by 5,3 years. The European Central Bank (ECB) did not carry out an asset purchase program until 2015 due to political and legal opposition (Bernanke, 2020).

Depending on the central bank, the types of assets acquired have varied considerably due to the legal restrictions they face. For example, the Federal Reserve was only able to buy Treasury securities and securities issued by the GSEs but other central banks not only bought government bonds but also corporate bonds, covered bonds issued by banks and stocks.

Lack of experience with QE has raised doubts about the effectiveness of asset purchases on financial conditions. The arguments regarding the positive aspects of QE revolve around two questions: i) if agents make their financial investment decisions based on the theory of "preferred habitats" a change in the net supply of different securities, must affect their relative prices. QE was seen by U.S. monetary policymakers as working to eliminate duration risk from the treasury market. This would lead to an increase in the value of long-term Treasury bonds or similar securities such as MBS by investors. The MBS purchases were also expected to result in a reduction in the difference between mortgages rates and treasury yields (Bernanke, 2020). ii) The second argument is based on the signaling effect of these large-scale asset purchase programs. The signaling effect acts as a commitment mechanism, the purchase of assets by the central bank may lead investors to believe in low short-term interest rates for a prolonged period. Policymakers announce QE programs with information about the likely duration of the asset purchase. These announcements cause investor confidence towards monetary policymakers as premature termination of the program may cause credibility costs to the central bank. Since short-term rates will be low there will be incentives for investors to also offer low long-term rates. According to Bernanke (2020), long-term rates conceptually can be the average of the expected short rates

over the life of the title and the term premium. The term premium is affected by portfolio effects, while investors' expectations of future short-term rates are influenced by the signaling effect. However, disentangling these two effects is not an easy question. It should be borne in mind that indirect effects such as portfolio effects than affects the term premium structure may also affect expectations.

When the central bank's purchase of assets, through changes in portfolio balancing or through signaling channels, succeeds in lowering long-term interest rates, the economy would react in a way similar to conventional monetary policy.

2.1.1 Transmission channels

Krishnamurthy and Vissing-Jorgensen (2011) wrote that through the analysis of the QE1 and QE2 programs, it can be established that the purchase of central bank assets is likely to operate through seven channels.

- *The signaling channel*, this channel is closely related to forward guidance, consists of communication by the central bank about lower future interest rates. To achieve a beneficial effect of non-traditional monetary policy on long-term bond yields, the central bank's commitment to maintaining low short-rate interest rates in the future must be credible. This credibility can be achieved through the acquisition of long-lived assets by the central bank, because if the central bank decides to raise interest rates it would face a loss on these assets. So, through the use of forward guidance, the purchase of long-term assets strengthens policy credibility by exposing the central bank's balance sheet to possible losses when short term interest rates rise. All bond market interest rates are affected by this channel.

- *The duration risk channel* consists of reducing the amount of long-term high-risk assets, such as Treasury bonds and MBS, that private investors are holding and increasing the amount of secure assets. In this way, the risk that investors have is reduced by making their portfolios more secure. This can be seen by using a theoretical single-factor model to systematize how the channel operates, where a risk premium on a bond of maturity t (formed by the product of the price of duration risk and the duration of the bond with maturity t). The QE can reduce duration risk by purchasing assets such as MBS or Treasury bonds,

which would cause a shift in the yield curve. Under this model, we can extract from the duration risk channel that the effects are greater for longer-lived assets and QE decreases the return on all nominal assets over the long term (Krishnamurthy and Vissing-Jorgensen, 2011).

- *The liquidity channel* with quantitative easing involves the purchase through the reserve balances of long-term securities. Because the latter are less liquid than reserve balance, QE increases liquidity and decreases the liquidity premium on the more liquid bonds. The predictions obtained through this channel are that QE increases the yield of the most liquid assets such as Treasury bonds.

- *The safety premium channel* is based on the large number of customers who have a higher preference for secure (low default risk) long-term assets such as Treasury bonds, these customers reduce the returns on the secure assets. When the supply of safe assets is lower, the security premium shifts upwards in response to high customer demand. The security channel indicates that a QE program of purchasing Treasury bonds decreases the yields on these bonds relative to less secure assets.

- *The prepayment risk premium channel.* The risk of prepayment appears when the early repayment of the principal of a mortgage is possible, and the holders of this type of assets usually demand a positive risk premium. This channel affected mainly the QE1 program, but it was not relevant in QE2, given that in the latter, purchases were massively directed to treasury bills (and did not include MBS). In the first case, the massive purchase of MBS succeeded in reducing the return of MBS, through the reduction in the prepayment risk held by investors.

- *The default risk channel* is based on the effectiveness attributed to QE policies to reduce the difference between the interest rate of an asset with a lower credit rating and the risk-free rate. The risk of default and its price can be affected by the QE, if the purchase of long-term assets succeeds in stimulating the economy. With the improvement of the economic outlook, the risk of default of companies will fall, and therefore this reduces the yield of the corporate bonds that the market demands. A recovering economy according to the standard

model of asset pricing will cause less risk aversion and thus lower the default risk premium. The credit default swap rates (CDS) are used to find out the risk of default in different maturities (Krishnamurthy and Vissing-Jorgensen, 2011).

- *The inflation channel* proposes that there be an effect on interest rates due to an increase in inflation expectations when an expansionary QE program is implemented. Furthermore, the QE may affect inflation uncertainty, and therefore affect the interest rate uncertainty and volatility. However, unlike changes in inflation expectations, interest rate uncertainty can increase or decrease under QE.

2.2 Forward Guidance

Forward guidance, one of the most widely used monetary policy tools by major central banks in recent years, consists of the communication of both economic and political development expectations by policymakers. As in the case of QE, the Bank of Japan was one of the first to use this tool with the promise not to raise the interest rate due to its zero interest rate policy until certain conditions are met.

The effects relevant to determining long-term returns through the use of forward guidance are broken down into announcements of the expected future path and unexpected changes in the fund rate. Within forward guidance we can distinguish two classes: Delphic forward guidance and Odyssean guidance. Delphic forward guidance consists of informing market participants an general public about the central bank's economic outlook and monetary policy plans. While Odyssean forward guidance is a commitment or promises to implement a specific of monetary policy, probably conditioned on both date and state-contingency, by policymakers. When policymakers are faced with a lower bound situation on interest rates, Delphic and Odyssean guidance can play a key role. Delphic guidance can help provide answers from monetary policymakers on proposed measures for inflation and employment. Odyssean guidance can be useful at the lower bound rates as the optimal monetary policy may be inconsistent over a period and the commitment of policymakers may be to follow the path of interest rates or to take measures that encourage deviation in the future. After the financial crisis, Bernanke(2020) explains how the Federal Reserve's guidance lacked sufficient commitment to be effective, meaning that the language used by the FED was Delphic when it should have been Odyssean. Once the FED committed itself

to lower the interest rate for a longer period, better macroeconomic results began to be produced.

In 2011, the Federal Open Market Committee (FOMC) conducted a more precise and aggressive forward guidance where, first, it indicated a date until which it would keep the federal funds rate near zero (Calendar guidance) and then linked its policy to conditions that had to be met to raise the rates (State-contingent guidance). State-contingent guidance is preferable because it allows for endogenous adjustment but calendar guidance also has the advantages of ease and adjustability (Bernanke, 2020). Due to the ability of forward guidance to modify expectations it can become a powerful tool in order to obtain a higher degree of accommodation at the lower limit of nominal interest rates.

Despite having analyzed QE and forward guidance tools separately, they are closely related. Quantitative easing works by pointing out the possible level of interest rates, and policymakers can also make announcements about future asset purchases. Both forward guidance and Quantitative easing have an effect on asset prices, making it difficult to separate the effect of the two instruments.

For example, Brunnermeier and Reis (2019) present a savings and investment model in which to maximize the stimulus provided, they focus on lowering the long-term interest rate by combining QE and forward guidance. This model is represented by the demand curve for lendable funds in which the investment has a negative slope, indicating that when interest rates fall, the investment increases, as the opportunity cost of the investment decreases. In contrast, the curve of supply of loanable funds (savings) has an upward slope, indicating that at higher interest rates, savers are willing to provide more funds to investors. The model, which assumes a time horizon of two periods, starts from period t where the horizontal axis represents the amount of long-term investment and the vertical axis is the long-term interest rate in two periods ($i^2 t$). The investment in two periods will be higher when $i^2 t$ is lower, this means that the opportunity cost of financing the investment will be lower. The saver can invest during two periods or renew the investment for two periods. The saver must form his expectation of the future interest rate (E[i $_{t+1}$]), as the future interest rate is not known. In efficient financial markets, the two-period lending curve would be a horizontal line, as the risk of refinancing this strategy can be diversified (represented by the horizontal dotted line in Figure 1). Conversely, with imperfect markets, the line representing saving will be upward sloping, as savers will only be willing to increase the supply of

loanable funds as interest rates rise. Savers demand an increasing risk premium (tp_t) to offset the risk they take on holding these bonds.

Starting from point A in Figure 1, a central bank that is at the lowest possible level of short-term interest rates, the lower bound, can follow two strategies in order to provide the greatest possible stimulus to investment. On the one hand, the forward guidance will reduce financial investors' expectations, this policy will make the saving curve vertical downwards. On the other hand, QE will increase the price level of long-term bonds due to increased demand. This price increase will offset the risk that investors take in holding the bonds and therefore reduce the tpt. QE will cause the saving curve to move horizontally to the right. The combination of both strategies will lead to a new equilibrium at point B with a lower long-term interest rate for two periods and higher investment. In this way, the combination of both policies is able to provide greater economic stimulus in situations where the central bank faces the lower bound.

Figure 1: Combination of QE and Forward Guidance
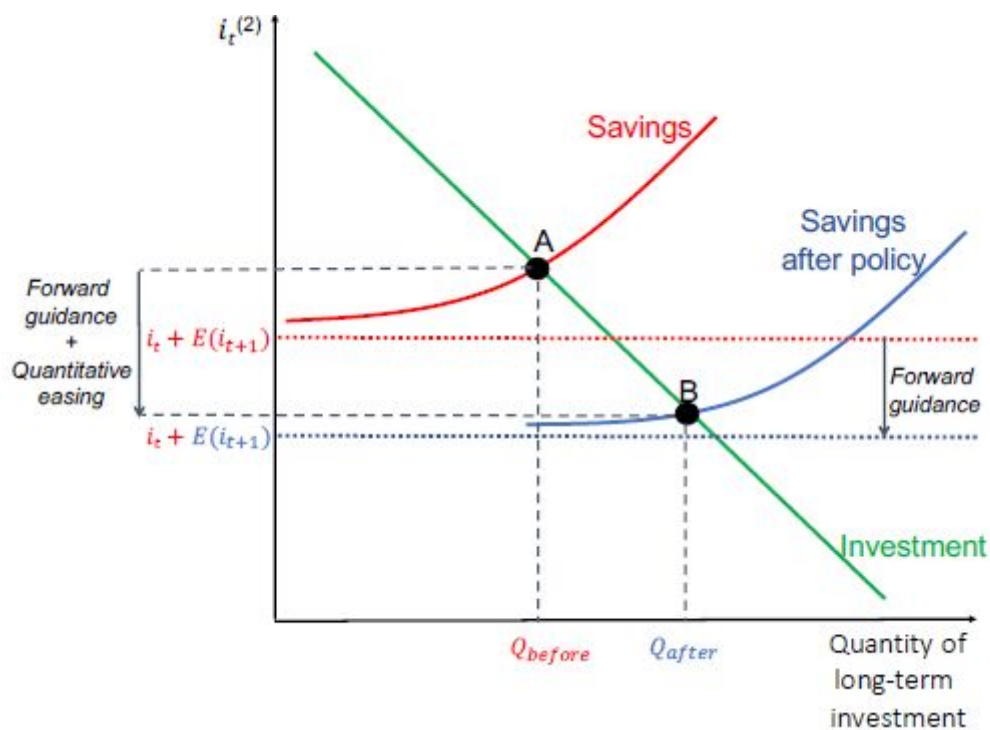
Source: Brunnermeier, and Reis. 2019, p.45.

The changes in yields and asset prices after FOMC announcements from 2009 to 2015 are due to the mix of the two policy tools. Forward guidance through changes in the expected path of interest rates and QE through changes in the level of long-term

interest rates. That both QE and forward guidance, due to the significant and persistent effect on yields and asset prices, acted in a similar way to traditional policies.

2.2.1 Transmission channel

According to Charbonneau and Lori (2015), forward guidance must operate through the term structure of the interest rate, the predictability of the monetary policy, and the anchoring of the long-term inflation expectations.

- *The term structure of the interest rate* relates to the yields that are offered on bonds at different terms or maturities. This structure reflects the expectations of market participants. The use of forward guidance increases central bank leverage and this may affect the expected future path of interest rates.

- *The predictability of the monetary policy* due to forward guidance statements should reduce interest rate uncertainty because of better forecasting by investors of short and long-term interest rates. Greater predictability of monetary policy by market participants helps to increase the effectiveness of monetary policies.

- *The anchoring of the long-term inflation expectations* reduces the sensitivity of long-term interest rates to general macroeconomic news, this means that it keeps market participants' average inflation forecasts stable and close to the central bank's inflation target. On the contrary, it increases sensitivity to forward guidance and in particular to state-contingent guidance.

2.3 Other unconventional monetary policy tools

In the post-crisis period, the main central banks have used several alternative tools apart from the already mentioned QE and forward guidance. The first of these alternative tools consist of the purchase by central banks of private assets such as corporate debt, and covered bonds, among others. The purchase of private assets gave central banks greater ability to affect private returns but can lead to the acceptance of credit risk and interest rate risk associated with quality assurance programs. In addition, the purchase of these assets may lead to a perception of greater

favoritism on the part of the central bank towards certain companies. Purchasing private sector assets linked to bank loans, the central bank aims to increase demand for these assets in order to raise their prices. This increase causes an incentive for banks to lend in order to create and sell more securities. Interest rates on bank loans due to the increased supply of loans will fall causing better financing conditions for both businesses and households.

The second tool was the purchase of bank loans financed in a cheap long-term way. This policy consist to provide long-term financing, with a mature of more than one year, to financial institutions. Subsidizing long-term loans or providing cheap long-term money, the central bank seeks to stimulate bank lending to the real economy. In this way, monetary policy can be strengthened and its transmission improved.

These programs were aimed at achieving broad economic stabilization to overcome loan bottlenecks and expanding access to credit for borrowers. This tool reduced banks' financing costs by making lending more plausible. One drawback of using these programs is that they depend on the health of the banking system. A well-capitalized bank has a limited need for cheap liquidity. Conversely, a bank with capitalization problems may find it is lending limited or have no incentive to make good loans.

Third, several central banks such as the BOJ and ECB adopted negative short-term interest rates. Negative interest rate policy (NIRP) consists of setting target nominal interest rates at a negative value. Using negative interest rates, instead of receiving money depositors must pay in order to keep their money in the bank. The use of these instruments is intended to stimulate the economy. In this way banks, companies, and families can be motivated to invest, lend, and spend money instead of paying a fee. A potential problem with this policy is financial stability issues, because banks' capital and lending capacity may not be easily transferable to depositors. There seems to be no evidence of this in the European experience. Altavila, et. al. (2019), have shown how "healthy" banks, in negative interest rate situations, have been able to pass on these negative rates to their corporate depositors. Under these conditions, banks offer more credit facilities, and companies rebalance their assets in order to reduce their current assets and increase their investment in tangible and intangible assets. Negative interest rates have shifted to banking, money market, and long term interest rates having positive but possibly small effects. It should be noted that negative short-term interest rates through QE or other means increase the central bank's ability to influence long-term rates in a lower bound situation.

Finally, the control of the yield curve is a tool that consists of lowering interest rates throughout the term structure. This control can be seen as a form of asset purchase (QE), that affects the price of bonds by making the number of bonds bought by the central bank determined endogenously. The control of the yield curve is based on the setting of a long-term interest rate target. Depending on the target set, the central bank buys or sells bonds until the desired level is reached. This policy in situations of lower bound, by maintaining long-term interest rates can be an effective alternative. It seems that the BOJ by monitoring the yield curve has been able to manage the financial situation more precisely, as well as looking like a more sustainable alternative.

3. MACROECONOMICS EFFECTS OF UNCONVENTIONAL MONETARY POLICY

So far we have seen that unconventional monetary policies can act in a very similar way to traditional policies by affecting financial conditions similar to they do when rates move away from the lower bound. We will now look at the macroeconomic effects expected by the FOMC of these policies in the 2008 crisis and offer some estimates of the macroeconomic effects of these policies. We will also see if the use of these policies can provide better economic results when the economy is close to the lower bound of the nominal interest rate.

3.1 Possible effects of unconventional monetary policies

Engen, Laubach, and Reifschneider (2015) wrote that FOMC programs, both QE and Forward guidance, were aimed at supporting economic activity and controlling undesirable disinflationary pressures. Through QE, the FOMC sought to lower the general level of long-term interest rates since this policy reduces the average duration of securities held by the public. This in turn would cause the term premium to fall, also causing the costs of long-term loans to fall.

On the one hand, for forward guidance to provide a significant stimulus to the economy it must significantly change the beliefs of financial market participants. The credibility of the policy conducted by the FOMC is key to participants' confidence that the FED will keep interest rates low for longer as the economy recovers. If participants' beliefs lead to expectations of the future path of short-term interest rates moving downwards and

expectations of future inflation increases, this will cause a decline in long-term real interest rates. This change in expectations, through arbitrage and indirect effects on other assets market, can increase the value of company shares, reduce the real value of the dollar in foreign currency, and improve financial conditions (Engen, Laubach, and Reifschneider, 2015).

On the other hand, quantitative easing programs undertaken by the FOMC showed the intention of providing additional accommodation. These programs can lead to changes in expectations and thus increase the confidence and effectiveness of policies. Quantitative easing can help to improve the effects of forward guidance since it can help give credibility to FOMC announcements, even in tolerating a slight temporary excess of inflation through the signaling channel. The relationship between these two policies makes it advisable to analyze the effects of both policies together. Moreover, both policies are usually announced at the same time, making it difficult to identify the effects separately.

3.2 The effects of forward guidance and QE

Using these new tools, stock prices should rise and long-term interest rates fall as market participants begin to anticipate central bank actions. It is necessary to achieve more affordable financial conditions in order to promote economic growth. For example, a decline in corporate bond rates will encourage investment, a rise in stock prices will increase confidence and improve consumer welfare, which in turn can lead to increased spending. Increased spending will support economic expansion in order to get out of the recession as quickly as possible. The following sections will analyze whether unconventional monetary policies were successful in influencing asset prices, leading to appropriate financial conditions.

3.2.1 Treasury yields

To estimate the effects on treasury yields Swanson (2017) adds both the period from 2009 to 2015 and the period prior to the zero lower bound (ZLB), thus comparing with the previous literature. In response to the FOMC's forward guidance announcements, changes in Treasury yields are systematic and statistically significant. The effect of forward guidance on treasury yields is very similar to the period before the ZLB but with the difference that the 6-month yield is significantly lower due to its proximity to zero

which causes less sensitivity to announcements, this is also the case with the 30-year yield. The effects of QE, which focused on the purchase of long-term bonds, had a greater influence on long-term interest rates and in particular on 10 and 30-year yields. With these results, Swanson concludes that both forward guidance and QE in the ZLB period were effective, reaching changes with a similar magnitude to the federal funds prior to this period.

Graphic 1. 10-Year Treasury Constant Maturity Rate.

Source: fred.stlouisfed.org, 2020.

As is shown in Graphic 1, 10-year Treasury bonds in the period of 2009 to 2015 followed a downward trend. As of 2011, with the implementation of an Odyssean Guidance and The Maturity Extension Program this decline becomes more significant. This is due to the appropriate use of forward guidance and the reduction of the supply of long-term Treasury bonds in the market, causing a reduction in the long-term interest rate.

3.2.2 Stock prices and exchange rates

As in the previous case, the results include the changes in the period prior to the ZLB. The effects on share prices and the exchange rate are based on the S&P 500 stock exchange index and the exchange rate of the dollar with the euro and the yen. The effects of forward guidance and QE in the period from 2009 to 2015 caused an increase in stock prices and a depreciation of the dollar (This result can be seen in Graphic 2, and 3). These exchange rate results are consistent with monetary policy shocks under the uncovered interest rate parity. Forward guidance was more effective

in influencing stock prices, but QE was more effective in the long-term interest rate. Both policies were effective and of a similar magnitude to the period before.

Graphic 2: S&P 500 daily index value at market close
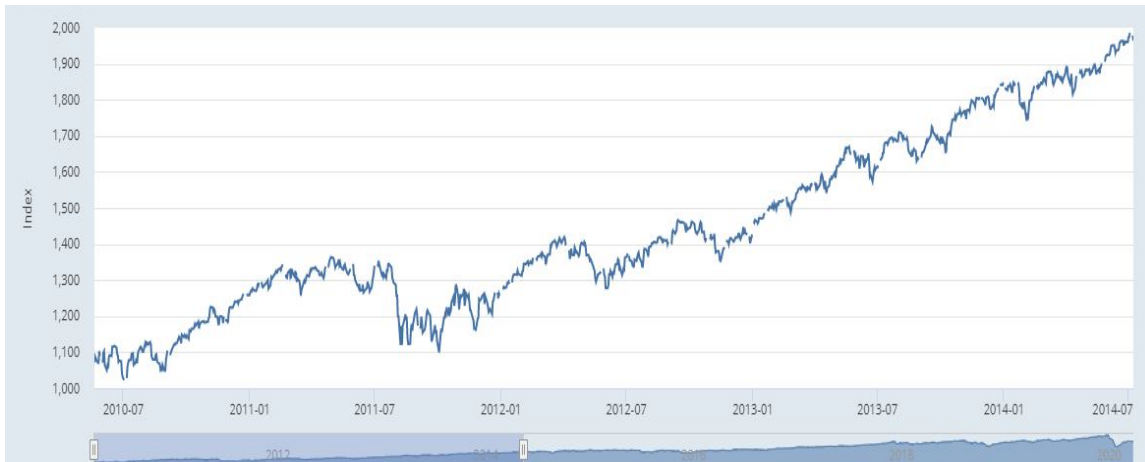
Source: fred.stlouisfed.org, 2020.

Graphic 3: U.S/Euro Foreign Exchange Rate

Source: fred.stlouisfed.org, 2020.

3.2.3 Corporate bond yields

Based on the yields and spreads on overnight corporate bonds, Swanson (2017) uses Moody's AAA and BAA indices to measure bond yields against FOMC announcements. During the period before the financial crisis the FOMC announcements produced a slight negative effect, in the ZLB period the effects produced by forward guidance seem not to have significant effects on corporate bond yields. Conversely, the purchase of long-term assets has a negative, and statistically significant effect on the corporate

bond yields. However, if the large-scale asset purchases include a considerable amount of mortgage-backed securities, the effect on the corporate bond yields would be greater, since these are best substitutes for MBSs than treasury bonds. These results are consistent with the result expected through the use of unconventional monetary policies.

Graphic 4: Moody's Seasoned AAA Corporate Bond Yield.

 Source: fred.stlouisfed.org, 2020.

Graphic 4 shows how corporate bond yields have been declining since the Great Recession. In the graph, the lower corporate bond yield coincides with the implementation of QE3, which contained the central bank's commitment to buy MBS.

3.3 The persistence of quantitative easing and forward guidance

The above results are based on the response of yields and prices within a 30 minute or one day period to the FOMC announcements. However, Swanson (2017) explains that if returns and asset prices are "martingale" the short-term responses obtained in the previous sections will be consistent with long-term periods. In contrast, recent studies show that unconventional monetary policy has had transitory effects. This is because arbitrage capital does not adjust instantly to asset prices or yields distortions, probably because the Fed's interventions are large, and the arbitrage process takes time. Swanson (2017) argues that soft local projections do not show significant effects of the dissipation of these policies over time.

3.4 The role of unconventional monetary policies in the 2008 crisis

The only experience of the use of unconventional monetary policies is in the process of recovery from the financial crisis of 2008 where most of the major central banks made use of these policies on several occasions. The limits of both traditional and unconventional monetary policies could be seen in this crisis where deep recessions and slow recoveries occurred, this is because monetary policies are not capable of reversing these situations but must mitigate their effects and accelerate recovery. There is no consensus in the literature about the effectiveness of unconventional monetary policies on the lower bound. For example, Engen, Laubach, and Reifschneider (2015) through its assessment with a model of the US economy (FRB/US) made a study to analyze the FED's policies and their macroeconomic effects. They claim that the measures used by the FOMC in early 2009 provided a only small additional stimulus to the real economy in the recession period and recovery process. The use of Delphic guidance in a period when the FOMC lacked sufficient credibility, together with the delayed effect of asset purchases, did not achieve much change in expectations causing a delay in policy effects. From 2011, with the implementation of more accurate and aggressive forward guidance, these measures had an increasing impact on the real economy, supporting the recovery process. It should be noted that this model did not capture all the effects that these measures could reflect as improvements in consumer and business confidence.

Another article that exposes how the zero lower bound restricted the effects of unconventional monetary policies was Gust et al. (2017), wherewith the use of Bayesian methods they estimated a non-linear DSGE model. In this model the authors were able to quantify the size and nature of the effects that caused the 2008 crisis and the impact of the ZLB on the recession. The DSGE model shows that the lower bound of the interest rate turned out to be an important limitation for monetary policy, making the recession deeper and making recovery more difficult. Gust et al. (2017) estimated that 30% of the sharp contraction in US GDP in 2009 was due to the zero lower bound.

On the contrary, there are views contrary to the articles cited above that suggest that the new monetary policy tools were able to overcome the limits imposed by the lower bound. An example can be Fernald et al. (2017) who, by decomposing the growth account to find out why the slow expansion of production in the United States, found that slow growth in total factor productivity and a fall in labor force participation was the cause of this slow expansion. These two effects, which were already in the period

before the recession, generated adverse effects that were magnified by the great recession. The indicators of resource utilization that are subject to monetary policies during the recovery from the crisis behaved in a normal way taking into account the impact of this crisis.

Wu and Xia (2014) used a non-linear term structure model to measure the effectiveness of non-conventional monetary policies in the recovery of the economy in the post-crisis period through short-term shadow interest rates. This model allows inference for the analysis of an economy with interest rates close to the lower bound. The shadow rate allows the study of the impact of monetary policies, making inferences in the yield curve, in a situation where the effective rate of federal funds (interest rate used by banks to lend and borrow from each other overnight.) is in the lower bound. When the interest rates fall to this situation, the shadow rate allows the usual economic models to continue to be used. These rates function as substitutes for the fed funds rate allowing the effects of monetary policy to be evaluated. In this way, it is possible to extract what would have been the short-term interest rate if it were not in a lower bound situation. In a period with a lower bound this shadow rate works as a negative rate. Conversely, the shadow rate in normal times is equal to the real political rate. Wu and Xia found in their model that unconventional measures had limited stimulus at the beginning of the post-crisis period but over time these measures provided greater accommodation. For example, the Federal Reserve's announcements to stimulate the economy led to a further reduction in the unemployment rate, by approximately 0.13% more than traditional policy could offer in a situation where it is not at the lower bound.

One article that shows indirect evidence that monetary policies in the post-crisis period were not much affected by the lower limit is Swanson (2018). Swanson, based on the various analyses, argues that the Federal Reserve will never be constrained by the lower bound because unconventional tools show similar effectiveness to traditional ones in normal times and the ability of the FED to affect medium and long term interest rates was not affected by the lower bound period. This makes the possibility of monetary policies being limited by the effective lower bound be "overstated".

Finally, Bernanke (2020) notes that the models do not address all the beneficial effects of these policies such as improving trust, risk-taking, and credit flows. Policies helped to restore these factors that were severely damaged by the Great Recession. The use of these policies eased financial conditions and produced better economic results than would have been the case with traditional policies. It should be noted that these instruments were not fully effective at the outset because of the uncertainty of

economic policymakers about the economic outlook as these instruments have costs and risks in their use. Through learning how to apply and communicate these instruments and through the understanding of market participants of these policies, they have become more effective over time and may have a greater influence in the future.

3.5 Potential of Unconventional Monetary Policies in the Future

Lower bound can influences interest rates more often in the future, traditional monetary policies could be ineffective and new tools could become more relevant. According to Bernanke (2020) the ability of the new monetary policies will depend on the level of the neutral interest rate which defines as "the interest rate associated with full employment and inflation in the long-run stable state". Using the DSGE model, several authors have analyzed the effect of the QE and forward guidance, without entering into the analysis of other types of non-conventional monetary policies that can provide additional stimuli such as NIRP. In the simulations, QE and forward guidance, for the period of the Great Recession and for seeing the long-term behavior of the U.S. economy, is effective in achieving monetary policy objectives, meaning that it is largely unaffected by the lower bound. It should be noted that the fixation on a particular mechanism in this model may cause other channels to be omitted. On the other side, the use of the FRB/US model, with advantages of flexibility and sectorial detail, can produce adequate results in different types of scenarios. The use of this model requires an adequate description of the financial sector and the relationship between financial conditions ant the real economy (Bernanke, 2020). When this model is used to forecast the macroeconomic consequences of the use of QE and forward guidance in a severe recession scenario, the recovery of the economy and the achievement of the inflation target could be reasonably effective. However, these policies do not contribute much to limiting the initial adverse effect of rising unemployment. This limitation in initial unemployment may be due to the delayed effects of monetary policy. This would justify the use of proactive and aggressive policies that help financial market participants to understand the measures used by the central bank in situations where the short-term interest rate reaches the lower bound.

Using the FRB/US model we can carry out a simulation of the effects of these policies on the economy in the long term. In this way, research can be carried out on the economic effects of these policies in the face of realistic adverse effects. In addition, it

allows the analysis of a possible adverse effect on an economy that is already in recession. Stochastic simulations, as this alternative is called, is also more useful than the simulation of a historical episode in the choice of instruments and regulatory frameworks with a long duration in time.

Bernanke (2020) using stochastic simulations of the FRB/US, makes a series of assumptions about nominal and real interest rates with the use of non-conventional monetary policies in order to identify cases where the lower bound is a constraint. In this way, it can be seen which alternative offers the best economic prospects. Bernanke assumes low neutral nominal and real interest rates together with the central bank's inflation target of 2%, where long term inflation expectations are anchored at this level. In his simulation he considers different policies in order to see the limitations that the lower limit would impose. The first simulation is based on Taylor's standard rule, where the "balanced approach" to this rule gives greater importance to unemployment and assumes the dependence of the policy rate on the delayed policy rate. An inflation target higher than the central bank's objective, which provides for increases in the neutral nominal rate, generates greater policy accommodation. To see the limitation imposed by the lower bound Bernanke makes a model without restrictions, that is, without any limitation of the lower bound that allows comparing this model with the standard model based on the Taylor Rule, with this comparison you can obtain the imposed costs by the lower bound. A second model used is based on variants of forward guidance in which the central bank promises to maintain the interest rate, when the economy is constrained by the lower bound, until a certain level of inflation is reached. The effects of forward guidance can sometimes provide irrational results on output and inflation expectations that produce the so-called forward guidance puzzle (Del Negro, Giannoni, and Patterson 2015). This puzzle overestimates the effects of forward guidance on macroeconomic responses due to its inconsistency over time. The effects can be eliminated by introducing a short time horizon as a reference point. To avoid this puzzle, this second model assumes that market participants are not confident that forward guidance will last more than 28 quarters, after which time the policy will return to Taylor's rule. The effects of forward guidance are not very significant in the simulations. In the third model, Bernanke (2020) analyzed four different quantitative easing policies depending on their aggressiveness. The purchase of central bank assets ends when there is a sufficient reduction in the output gap and a gradual reduction in the central bank's balance sheet begins in each of the different programs. This simulation counts on the recording of the size of the central bank's

balance sheet so that the acquisition of new assets is added to the previous ones. In this way, the distribution of the balance sheet in the long term can be observed. If the effect of the purchase of assets is less than desired, this purchase would increase until the economic result is achieved, and long-term interest rates are affected in a linear manner.

Finally, Bernanke (2020) conducted a simulation that combined QE and forward guidance together with the 2% inflation target. It is assumed that the participants in the model have rational expectations. This means that investors make their decisions using all available information and understand the economic policy, acting in the manner most beneficial to their interest. This model imposes a lower bound of zero on the short-term interest rate, and it is not limited to a negative long-rate interest rate, which would reflect the negative term premium. For each policy mentioned above, Bernanke calculates the average loss, which is the sum of the squared deviations of inflation from the 2% target and the unemployment gap. Higher average losses mean worse average performance, so we can rank unconventional policies and thus assess the marginal benefits of different policies. Comparing these average losses with Taylor's unrestricted rule one can see how these policies compensate for the effects of the lower bound.

Traditional policies without the support of the new tools work quite badly when neutral interest rates are low, and with inflation expectations falling this would cause the neutral nominal interest rate to fall and further damage the economy. Higher inflation targets would reduce the encounters with the lower bound. In this way, the performance of the base rules will improve. These targets may also have associated costs, as a permanently high inflation rate would reduce the potential for monetary policy. Both the QE and forward guidance lead to better results than the base rule, besides neutral nominal rates of 2 and 3% together with the combination of these two policies can compensate the effects of the lower bound with inflation rates close to the target and inflation expectations anchored. The most effective monetary policy is the one that combines a more aggressive QE together with forward guidance and 2% inflation. The combination of the new policies together with the 2% inflation target can have the same effect as the traditional policy with a 5% effective inflation target. Therefore, the new tools are able to provide 3 percentage points in relation to traditional policies without any limitations on short-term interest rates. Thus, the use of unconventional monetary policies should be preferable to an increase in inflation targeting.

The neutral nominal rate in a range equal to or above 2-3% together with the use of unconventional monetary policies is able to compensate for the lower bound. If the neutral nominal rate is below 2% it is seen that the use of the new monetary tools is still preferable but the average loss of these policies is higher than in the model without restrictions of the Taylor rule. This means that at levels below 2% the use of the new monetary tools does not compensate for the lower bound, in these cases in the simulation the economy remains for a long time at the lower bound and frequent negative long term interest rates. Having negative long-term interest rates can lead to problems such as market participants not holding long-term bonds with a yield below zero.

Bernanke (2020) notes that in developed economies the real neutral rate is between zero and a slight positive. This, together with the 2% inflation target and the absence of a 2% nominal neutral rate, points to the decline in inflation expectations. This means that the high drop in inflation expectations is limiting monetary policy in several regions such as Japan and Europe. Therefore, central banks in cooperation with fiscal authorities should try to bring inflation expectations closer to the target, so that monetary policy through the use of unconventional monetary policies could regain its effectiveness.

4. COSTS AND RISKS OF UNCONVENTIONAL MONETARY POLICY

As noted above, the use of these new monetary policies entails potential costs and risks that must be considered for the proper use of these policies, both the benefits they provide and their potential costs and risks should be analyzed when taking action. A long-term asset purchase is a policy that most concerns policymakers. It should be noted that most of these risks and costs have not been significant except for the risk of financial instability.

- **Loss of credibility**: Using forward guidance exposes the reputation and credibility of the central bank. The reputation of the central bank may be damaged by any adjustment or deviation from the declaration for previous intentions, which is understood as a breach of commitment due to not being fully understood by the public. When market participants consider that there is a weak or easily triggered exit clause, this produces a credibility problem by

making the public believe that the central bank has an incentive to break promises, thus affecting the effect of forward guidance on expectations. In addition, setting a certain threshold for policy completion that is reached more quickly than expected can also raise doubts about the credibility of any given threshold by viewing the central bank's initial impression as misleading.

- **Market functioning**: One of the cited potential costs of new tools of monetary policy is the adverse effects on market functioning. This potential problem would be especially attributable to asset purchases by the central bank, while it would not be relevant from the perspective of forward guidance. The conjecture is that QE negatively affects the number of traders, trade sizes, and the trading volume in the security markets. However, through the use of asset purchases, central banks have sought to ensure the proper functioning of the securities markets. The impairment of market functioning has hardly been seen in major economies, without an absence of two-way trade or loss of price discovery. During the financial crisis of 2008, QE has improved the functioning of the market by adding liquidity, producing confidence through lowering default risk premiums and improving the balance sheets of financial institutions.

- **Inflation**: Also, in this case, the potential problem is associated with QE. The purchase of assets by the central bank, as an incentive for banks to extend credit, can lead to an increase in the monetary base. An excessive increase in the money supply can cause high and uncontrolled inflation. Short-term interest rates close to zero cause a high elasticity of demand for bank reserves, resulting in a sharp decline in the speed of the money base, which can cause a liquidity trap situation. The use of new monetary tools by encouraging private investment through increased lending is an effective alternative to avoid the limitations of this trap. One concern of FOMC members was that inflation expectations could get out of control. Anchored inflation expectations could be affected by the use of the new monetary policies and fiscal deficits. The anchoring of inflation expectations due to the Great Recession deteriorated significantly, the purchase of long-term assets has helped to reverse long-term inflation expectations. As could be seen, both inflation and inflation expectations remained low despite unconventional monetary policies.

- **Managing exit**: The communication of the end of the asset purchase may be particularly sensitive due to the doubt that short-term interest rates can be raised in a timely manner and that the markets will not be disturbed by the contraction of the central bank's balance sheet. The FOMC developed ways to raise the official interest rate including paying interest on bank reserves at the appropriate time with great success. These measures led to a rise in interest rates from zero and the achievement of the new steady-state balance sheet.

- **Inequality**: Monetary policymakers do not consider distributive considerations such as the possible effects of low-interest rates on savers and an alleged increase in inequality due to these new monetary policy tools as a relevant cost. In general, the benefits provided by monetary policies to recover economic welfare are greater than the cost, and it is unwise to avoid this type of policy. These policies have helped in the decrease in unemployment, deflationary risk, an increase in salaries, investment, and benefits. Despite slow wage growth after the 2008 crisis, conventional measures would have further weakened this growth. Due to inequality is structural and slowly evolving, it must be addressed by fiscal policies and not by central banks, as the distributive effect of monetary policies is small.

- **Capital losses**: If interest rates rise unexpectedly, long-term securities acquired through the QE program can produce the risk of suffering capital losses which in turn could affect the central bank's profits. Socially, the cost of this loss is very slight because the benefits of a stronger economy are greater than the possible losses on the various assets acquired by the central bank. This risk was reduced by several factors such as the nonpayment of interest on central bank obligations. Not paying this interest gives the central bank credibility in paying out Treasury bonds. Furthermore, securities acquired prior to the purchase of long-term assets by the central bank provide additional cushioning as they provide additional earnings when yields fall. When the yield curve evolves with an upward slope, the central bank obtains a positive return net of the difference between its bonds and the bank reserve. Moreover, possible capital losses would not affect the taxpayer because a stronger economy produces high long-term returns, increasing tax revenues. QE in the period of

crisis has been very profitable but this does not mean that the loss of capital is not a concern for asset purchase programs.

- **Financial instability**: The recent financial crisis of 2008 raises concerns about whether past monetary policies may have generated risks of financial instability such as the creation of asset bubbles, excessive risk-taking by investors, promotion of leverage or destabilization of insurance and pension companies in their business model in the United States (Bernanke, 2020). How monetary policies affect financial stability is not yet known. Private agents may be motivated to take risks because of monetary easing. This risk does not have to be harmful when it is reasonably assumed, and could be a desirable objective for threatening the crisis and restoring economic growth. But effectively, investors and lenders may take excessive risks, and the central bank should be vigilant in avoiding these risks. If necessary, the central bank should intervene through the use of specific regulatory and macroprudential measures. Therefore, in the face of signs of financial instability, the central bank's first option should be to use regulatory and macroprudential measures. If these measures do not work or are insufficient, aggressive monetary policies can be reconsidered to improve financial stability, provided that the benefits outweigh the costs associated with not achieving short-term inflation and employment objectives. The use of unconventional monetary policies is more likely to be used in situations where the economy is depressed and risk-taking is required. QE has fewer risks than the use of a traditional expansionary policy. This is because the new monetary tools are able to compensate for the reduction in risk taken by investors and lenders increasing the supply of safe assets.

5. CONCLUSION

In this paper, we have reviewed the monetary policy of the major central banks since the Great Recession. In general, central banks have used unconventional monetary policies during this period because of the inability of traditional policies. Due to the restrictions imposed by the lower bound on short-term interest rates, the main central banks have used different non-conventional tools of monetary policy, fundamentally long term asset purchase (QE) and forward guidance.

THE ROLE OF UNCONVENTIONAL MONETARY POLICY

The experiences gained from the new monetary policy tools during the crisis indicate that these measures have had important effects on financial conditions that have been maintained over time. The combination of both measures has helped to cushion the adverse effects by showing that there is no need to increase the inflation target to avoid the lower bound constraint.

The increasingly frequent appearance of the lower bound may render traditional monetary policies ineffective, making QE and forward guidance together with the other monetary policy tools such as yield curve monitoring, NIRP, and others increasingly relevant in the future. Stochastic simulation of the FRB/US model, allows us to see that the capacity of these policies to overcome the restrictions imposed by the lower bound will depend on the level of the neutral nominal interest rate. A combination of QE and forward guidance coupled with a neutral nominal interest rate of 2-3% may offset the adverse effects of the lower bound. This makes the use of unconventional monetary policies preferable to the increase in inflation. Despite the possible cost and risks of these measures, experience shows that most of these risks have not influenced the economy. Due to low inflation expectations in most countries, monetary policy is being limited, making it necessary to cooperate with fiscal policies and central bank actions in order to bring inflation expectations are close to the target.

Unconventional monetary policies have started to become part of the standard measures of central banks and will become more relevant over the years because of the frequent encounters with the lower bound.

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