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Unconventional monetary policies of major central banks: an analysis of effects and effectiveness

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Introduction

The global financial crisis of 2008 had a profound impact on the global economy and brought significant challenges to central banks' conventional monetary policy tools. Conventional monetary policy includes controlling short-term interest rates through open market operations, reserve requirements as well as lending and deposits facilities. However, after the crisis, to stimulate economic growth, boost employment and prevent deflation, central banks resorted to Unconventional Monetary Policies (UMPs), namely Forward Guidance, Quantitative Easing (QE) and Negative Interest Rate Policy (NIRP).

In recent years, there has been significant interest in the effectiveness and impact of UMP, and researchers have conducted several studies on this topic, shedding light on different aspects of UMP and its implications. The implementation of unconventional monetary policy has been a subject of intense debate among economists and policymakers. Some argue that it has been an effective tool in supporting economic growth, while others believe that it has created significant risks to financial stability and may have long-term adverse effects on the economy. This paper aims to contribute to this debate by providing a comprehensive analysis of the literature on UMPs, analyzing the impact and effectiveness of forward guidance, QE and NIRP.

Methodology

The question at the core of this analysis is whether UMP tools are effective in achieving their intended objectives. Specifically, this analysis focuse on the impact of these policies on key macroeconomic variables such as inflation, economic growth, and employment, as well as the possible effects on financial stability and asset prices. The method used in this analysis is a comprehensive literature review of existing studies on unconventional monetary policy published in academic journals, working papers, and reports by central banks and other international organizations. The first section examines forward guidance, its goals, particularly in relation to the expectation theory, the different types that central banks may implement, and the effects of such policy on the economy. The second section focuses on the Market for Reserves, with a brief explanation of standing facilities and reserve requirements to illustrate the fluctuation of overnight interbank interest rates. The section then delves into Open Market Operations (OMOs), highlighting the various types of OMOs, and their advantages compared to the other conventional monetary policies. The third section discusses the Transmission Mechanism of Monetary Policy, as the effectiveness of monetary policy lies in its ability to indirectly influence macroeconomic variables through the decisions of economic agents. The effects of monetary policy on the economy, such as investment and employment, are not immediate but rather mediated, therefore, understanding the intricate mechanism and transmission channels of monetary policy, such as the interest rate channel, the asset-price channels, and the credit channels, is crucial before discussing policy measures like QE and negative interest rates. The fourth section explores

QE, examining its goals, transmission channels, and effects on the economy. Additionally, this section will explore Quantitative Tightening (QT), and the effects on central banks' balance sheets and the risks posed by this policy. The fifth section examines NIRP, outlining its goals and potential effects on the economy. Finally, the last section, evaluates the effectiveness of UMP as a whole.

Main Results

The results of the analysis focus on the impact and effectiveness of UMP tools. The use of forward guidance has been effective in pursuing and maintaining price stability, contributing to more stable money market conditions and anchored expectations. Overall, the results indicate that forward guidance can be a valuable tool for central banks that want to shape market expectations and achieve their policy objectives together with conveying to the public the perceived risks concerning the economic outlook. Indeed, findings indicate that central banks should invest in developing effective communication strategies to enhance the effectiveness of their policies. However, forward guidance's effectiveness depends on various factors that need to be carefully considered by policymakers, such as the length of the forward guidance horizon, the alignment of market interest rate expectations with the central bank's policy objectives over time, the interaction between the type of monetary policy regime and the expectations formation process and many others. The effectiveness of QE in promoting economic growth and stabilizing financial markets is still a matter of debate. Studies suggest that the success of QE is highly dependent on various factors, such as the timing of its deployment, the equilibrium real interest rate, and market conditions. QE may be ineffective if it is designed solely as QE in a narrow sense, only government bond purchases, and its impact on the real economy is found to be small and rather transitory compared to the impact of a reduction in short-term interest rates. Additionally, it is essential to consider the negative impact of QE policies on central bank balance sheets, credit risk exposure, and potential losses. Nonetheless, QE had positive impacts, including a reduction in risk spreads, a decline in yields, and an increase lending and in investment in capital expenditure and intangible assets. NIRP can impact the economy through two channels: the retail deposit channel and the portfolio rebalancing channel. While the retail deposit channel can have negative effects on bank profitability, the portfolio rebalancing channel can stimulate credit supply and the real economy. There are concerns about the potential side effects of NIRP, however it has been found successful in enhancing the effectiveness of easing strategies, such as forward guidance and QE, during economic recessions and deflationary times, leading to increased real activity, credit, financial prices, and inflation while reducing unemployment. Overall, this paper contribute to a better understanding of the impact and effectiveness of UMPs and the importance of coordinated policy efforts for effective monetary policymaking.

Chapter 1

Forward Guidance

1.1 - What is Forward Guidance?

Forward guidance is a policy in which the Central Bank provides (explicit) statements to the general public, describing the likely future path of monetary policy (policy decisions), thus of the policy interest rates, with the objective of managing the expectations about future interest rates. Forward guidance has been adopted by central banks worldwide in response to the economic downturn during the Great Recession, when the conduct and transmission of monetary policy have become significantly more complex as monetary authorities implemented a strategy of reducing the nominal interest rate to zero with the intention of spurring economic activity and employment. Prior to the crisis, central banks worldwide primarily relied on their short-term policy rates as their primary tool. However, when policy rates were reduced to zero without generating adequate economic stimulus, central banks abandoned this approach.[1]

As conventional monetary policy was limited by the zero lower bound (ZLB), and in light of persistent high unemployment and low output, monetary authorities attempted to provide further accommodation by announcing projections of future policy rates. Indeed, during the Great Recession, the use of forward guidance emerged as a potential strategy to mitigate substantial output losses, and, since then, it has become a key tool for monetary authorities to guide their policy.[2]

For example, the Federal Open Market Committee (FOMC) of the United States used forward guidance by issuing a statement to the public in December 2008 regarding the future course of interest rates when short-term interest rates reached the ZLB. Additionally, the Federal Reserve (Fed) implemented forward guidance by conveying information about its long-term inflation target in 2012. Forward guidance is likely to continue being employed by central banks when ZLB scenarios limit traditional monetary policy measures, as well as in non-ZLB periods, to enhance transparency and provide more precise information to the public.[3]

1.2 - Types of Forward Guidance

In practical application, central banks have implemented various types of forward guidance. Central banks do not unconditionally commit to a particular policy interest rate path, instead, they emphasize the interest rate path's evolution depending on the state of the economy. The inclusion of conditionality is a crucial element of forward guidance, as it reflects the central bank's uncertainty concerning the economic outlook

[1] Aßhoff S., Belke A., and Osowski T. (2021): *Unconventional monetary policy and inflation expectations in the Euro area.*

[2] Hagedorn M., Luo J., Manovskii I., and Mitman K. (2019): *Forward guidance.*

[3] Cole S. J. (2020): *The influence of learning and price-level targeting on central bank forward guidance.*

and enhances the central bank's credibility. Forward guidance statements have to be balanced, so as to convey a clear and straightforward message and at the same time effectively communicate the complexity of their underlying monetary policy assessment.[4] Forward guidance can be based on qualitative or quantitative factors, with targets that can be time-dependent, such as designating a specific date in the future as the point up to which interest rates will remain low.[5]

Four categories of forward guidance:

Pure qualitative Forward Guidance (ECB, 2014):
Does not have any specified end-date or numerical thresholds that would indicate the expected changes in policy interest rates in the future, and it also does not explicitly refer to any underlying conditions or objectives that would support such changes in policy. Instances of this practice can be observed in the form of forward guidance issued by the Federal Reserve System in 2003, which indicated that "policy accommodation can be maintained for a considerable period," and similar statements were made by the Fed at the onset of the crisis in 2008-2009.

Qualitative, conditional on narrative Forward Guidance (ECB, 2014):
Provides qualitative statements regarding the expected direction of policy interest rates while being supplemented by a description of a combination of macroeconomic conditions that are likely to affect monetary policy. The ECB's formulation adopted on July 4, 2013, which has been reiterated frequently since then, serves as an example of this type of forward guidance. This approach was also utilized before the crisis, in particular by the Bank of Japan (BoJ) in April 1999, when it committed to a near-zero interest rate policy "until concerns regarding deflation would be resolved".

Calendar-based Forward Guidance (ECB, 2014):
Refers to making a commitment that is conditional on a specific date or time frame after which the monetary policy stance is expected to change. The Bank of Canada, for instance, implemented calendar-based guidance in April 2009 by announcing that "based on the inflation outlook, it is expected that the target overnight rate will remain unchanged until the end of Q2 2010.". Similarly, the Fed adopted calendar-based guidance in 2011.

[4] ECB (2014): *The ECB's Forward Guidance.*
[5] Dell'Ariccia G., Rabanal P. and Sandri D. (2018): *Unconventional Monetary Policies in the Euro Area, Japan, and the United Kingdom.*

Outcome-based Forward Guidance (ECB, 2014):

Refers to a strategy that involves the use of explicit numerical conditions or thresholds that link central bank actions to a selected set of observed or projected economic variables. Following the application of qualitative and calendar-based guidance, the Fed adopted an outcome-based approach with numerical thresholds on unemployment and inflation at the end of 2012. Similarly, the Bank of England introduced outcome-based guidance in August 2013 based on an explicit numerical threshold on unemployment. The adoption of outcome-based guidance is motivated by the desire to clarify the relationship between future policy and changes in the economic outlook. In general, the shift towards this type of forward guidance is motivated by the desire to clarify the relationship between future policy and changes in the economic outlook, by linking forward guidance more directly to the Central Bank's economic objectives, with the aim of providing greater transparency regarding the impact of economic developments on future policy.

1.3 - Rationale Behind Forward Guidance

To gain a more comprehensive understanding of how central banks implement this policy, it is necessary to make reference to the "Expectations Theory."

1.3.1 - Expectations Theory

The expectations theory of the term structure of interest rate states the following:
"The interest rate on a long-term bond will equal the average of the short-term interest rates that people expect to occur over the life of the long-term bond." (Mishkin, 2019, p. 177)

Thus, the expectations theory asserts that discrepancies in interest rates across bonds with different maturities can be attributed to the fact that short-term interest rates are expected to have different values at future dates. A key assumption underlying this theory is that bond purchasers exhibit no preference for any specific maturity and will only hold a bond if its expected return exceeds that of another bond with a distinct maturity. Bonds that satisfy this criterion are considered to be perfect substitutes. Therefore, if bonds with differing maturities are perfect substitutes, then their expected returns must be equal.[6]

By rephrasing the above-mentioned definition of the expectations theory, it can be stated that that: "The n-period interest rate equals the average of the one-period interest rates expected to occur over the n-period life of the bond." (Mishkin, 2019, p. 179)

[6] Mishkin F.S. (2019): *The Economics of Money, Banking & Financial Markets*. 12th Edition.

Defining:

- i_t = today's (time t) interest rate on a one-period bond
- i_{t+1}^e = interest rate on a one-period bond expected for next period (time $t+1$)
- i_{nt} = today's (time t) interest rate on the n-period bond

then, tinterest rate i_{nt} on an n-period bond must be:

$$i_{nt} = \frac{i_t + i_{t+1}^e + i_{t+2}^e + \cdots + i_{t+(n-1)}^e}{n}$$

The expectations theory is a sophisticated framework that explicates the variations in the term structure of interest rates, represented by yield curves, across different time periods. In the case of an upward-sloping yield curve, the expectations theory proposes that the short-term interest rates are likely to increase in the future. This situation arises when the current long-term rate is higher than the current short-term rate, indicating that the projected average of future short-term rates will be higher than the current rate. Such an observation implies an anticipated rise in the short-term interest rates. In contrast, a negatively sloping or inverted yield curve suggests that the future average of short-term interest rates is lower than the current rate, indicating an expected decline in short-term interest rates. Finally, the expectations theory states that short-term interest rates are not anticipated to change in the future only when the yield curve is flat. The expectations theory further provides an explanation for the comovement of interest rates across bonds with varying maturities over time. As long-term rates are the average of expected future short-term rates, an upsurge in short-term rates would serve to raise the expected future short-term rates, consequently shaping the future outlook for these rates.[7]

The expectations theory is also a useful tool for explaining the typical shapes of yield curves. An upward sloping yield curve is observed when short-term interest rates are low, and an inverted curve appears when short-term rates are high. The underlying reason for these patterns is that when short-term rates are low, people expect them to increase in the future, and the average of future expected short-term rates is higher than the current short-term rate. As a result, long-term interest rates are significantly higher than current short-term rates, which leads to an upward slope in the yield curve. Conversely, when short-term rates are high, people generally anticipate a decrease in the future. In this scenario, long-term rates drop below short-term rates since the average of expected future short-term rates is lower than current short-term rates, resulting in an inverted and downward sloping yield curve.[8]

[7, 8] Mishkin F.S. (2019): *The Economics of Money, Banking & Financial Markets*. 12th Edition.

The expectations theory can be linked to the concept of forward guidance, as central banks have the ability to influence the long-term interest rate by committing to either decrease or increase the overnight rate and hold it for a prolonged period, which in turn changes the market's expectations of future short-term interest rates. In fact, the impact of monetary policy on the economy does not only depend on the short-term interest rates that the central bank can control with accuracy but also relies on the expectations that individuals and firms have on the future path of these rates. These expectations are crucial since they influence significant economic decisions such as investment and durable consumption, which indirectly affect employment, production, and price levels. Hence, by affecting the expectations of future short-term interest rates and subsequently altering the maturity spectrum of interest rates across intermediate to medium-term horizons, the central bank can ensure that its policy stance is effectively transmitted to the broader economy.[9]
One of the primary goals of central banks is to maintain well-established inflation expectations, which have a crucial effect on ultimate inflation rates. Understanding the expectation formation process is crucial to implement policies that can improve market stability during crises, as the central banks' ability to achieve price stability is dependent on maintaining stable inflation expectations.[10, 11]

1.3.2 - Rational and Adaptive Expectations

A simple and often plausible hypothesis is that people form their expectations based on the concept of adaptive expectations. Namely, individuals form their expectations regarding a particular variable on the basis of the values that have been recently observed. In other words, this approach is based on the straightforward assumption that past observations of a variable serve as the basis for the formation of future expectations. However, the rational expectations hypothesis has been the prevailing model for formulating hypotheses on expectation formation.[12]

The rational expectations approach presumes that individuals make optimal use of all available information to forecast the future. As monetary and fiscal policies have an impact on inflation, expected inflation also depends on the current monetary and fiscal policies. According to this theory, any change in monetary or fiscal policies will affect expectations, and an evaluation of policy changes must consider this effect. If expected inflation is reliant on recently observed inflation, then it is characterized by inertia, which implies that, for example, if inflation is high, a favorable supply shock or a an economic state characterized by high unemployment and low output is needed to reduce it. However, if individuals form expectations rationally, then an announcement regarding a change in policy that is credible could directly impact expectations.

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[9] Mishkin F.S. (2019): *The Economics of Money, Banking & Financial Markets*. 12th Edition.
[10] Aßhoff S., Belke A., and Osowski T. (2021): *Unconventional monetary policy and inflation expectations in the Euro area.*
[11, 12] Bao T., Hommes C., and Pei J. (2021): *Expectation formation in finance and macroeconomics: A review of new experimental evidence.*

Assuming that policymakers are credibly committed to reducing inflation, rational individuals will understand the commitment and will rapidly change their inflation expectations accordingly.[13] The central bank's credibility to anchor inflation expectations is important because a higher level of credibility necessitates smaller adjustments in interest rates to manage inflation, resulting in minimal fluctuations in employment and output. Consequently, a high degree of credibility is expected to be associated with reduced volatility in interest rates, facilitating the achievement of the inflation target and subsequently leading to less variability in both output and employment.[14]

Central banks generally provide sufficient information for the public to rationally form their expectations, enabling them to accurately anticipate near-term monetary policy decisions. However, to further enhance the effectiveness of monetary policy, central banks have increasingly employed forward guidance during crises. This involves more specific and systematic verbal communication the central bank's policy orientation. Most central banks are inflation targeters and the numerical target acts as an anchor for the public's longer-term inflation expectations, which are critical for economic decision-making. Communication and transparency are an important differentiator between inflation targeters and non-inflation targeters, as inflation targeting has proved to be successful above all as transparency and communication are concerned.[15] Research has shown that central banks that adopt inflation targeting tend to communicate more frequently and more openly with the public, providing regular updates on their assessments of the economy, inflation outlook, and policy stance, which helps to anchor expectations and build trust in the central bank's policy decisions. This level of transparency and communication in the decision-making process of a central bank has a significant impact on the effectiveness of inflation targeting, as it helps to minimize uncertainty and unpredictability in the market, thereby enabling a better alignment of expectations between the central bank and market participants. An effective steering of expectations about future monetary policy requires two key elements: clarity regarding the central bank's objective, and clarity about the monetary policy strategy it adopts to achieve that objective. Clear and effective communication from the central bank serves to make the central bank's reaction to changes in the economic outlook more transparent and explicit. This, in turn, helps to ensure that market participants and the public have a consistent and accurate understanding of the central bank's objectives and strategies, thereby reducing uncertainty and contributing to a more stable macroeconomic environment.[16]

[13] Mankiw N.G. (2019): *Macroeconomics.* 9th Edition.

[14] Montes G. C. (2013): *Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.*

[15, 16] ECB (2014): *The ECB's Forward Guidance*.

1.4 - Goals of Forward Guidance

During financial crisis, central banks began to view their communication regarding the path of the policy rate as an additional tool for managing the crisis due to the significant financial and economic disruptions it caused. In times of uncertainty, clear communication from the central bank can assist investors in making informed portfolio decisions, thereby facilitating the smooth transmission of monetary policy stimulus through financial prices.

Communication about the policy rate becomes especially important during severe financial crises, as the policy rate is likely to already be very low and there may be limited space for further policy action. In addition, economic actors may have difficulty predicting the future path of policy rates based on past trends, creating uncertainty that could negatively impact asset pricing, economic decision-making, and overall economic prospects. Without clear communication from the central bank, this uncertainty could persist and exacerbate the effects of the crisis. Hence, the first purpose of forward guidance is to introduce greater monetary policy accommodation when the policy rate reaches the lower bound and cannot be reduced further. This assurance by the central bank that the policy rate will remain at a low level for an extended period influences investors' expectations regarding future short-term rates and, in turn, puts downward pressure on longer-term interest rates. This can encourage portfolio shifts into longer maturity assets, leading to a compression of long-term yields. The second purpose of forward guidance is to prevent market volatility, particularly interest rate volatility, from influencing the monetary policy stance in undesired directions and hampering the transmission of the existing degree of accommodation. The provision of explicit information on the future path of policy interest rates, conditional on the state of the economy, reduces interest rate uncertainty and improves the planning of economic agents.[17]

1.5 - Effectiveness of Forward Guidance

To evaluate the effectiveness of forward guidance, an initial step is to examine whether the announcement resulted in an immediate market reaction that reflects a change in financial market expectations. If the forward guidance includes new and relevant information for the market, a reaction can be expected, provided that the announcement was not already anticipated. However, assessing the effectiveness of forward guidance requires consideration not only of the immediate market response but also of how well market interest rate expectations align with the central bank's policy objectives over time. To evaluate the effectiveness of forward guidance, it is not only important to consider the initial market response, but also to measure how closely market interest rate expectations align with the central bank's policy objectives over time. This assessment can be made by analyzing the impact of forward guidance on the uncertainty

[17] ECB (2014): *The ECB's Forward Guidance*.

surrounding future policy rates and the volatility of current forward money market rates. Ultimately, the effectiveness of forward guidance should be evaluated based on its macroeconomic effects resulting from the adjustments in expectations and market prices it may have induced.[18]

The study by Cole (2020) highlights that the interaction between the type of monetary policy regime and the expectations formation process is critical in evaluating the effectiveness of forward guidance. The study finds that rational expectations amplify the positive effects of a price-level targeting regime on forward guidance, relative to adaptive learning. This is because rational agents have a better understanding of the true model of the economy and can precisely estimate the effects of forward guidance statements on future variables such as output and inflation. In contrast, the reaction of expectations under adaptive learning agents is dampened due to the need to estimate the effects of forward guidance on the economy, which leads to a performance gap between the two expectations formation processes. These findings have important implications for policymakers seeking to improve the efficacy of forward guidance, suggesting that a price-level targeting regime with rational expectations can increase the effectiveness of forward guidance relative to an inflation targeting regime with adaptive learning. Furthermore, the length of the horizon also impacts the effectiveness of forward guidance, with rational expectations amplifying the positive effects of a price-level targeting regime for a longer time than adaptive learning.
Thus, to optimize the effectiveness of forward guidance, policymakers should firstly consider the length of the forward guidance horizon, and at the same time, if forward guidance and price-level targeting are implemented in an economy, how expectations are modeled, particularly with respect to the inflation target and the characteristics of the monetary policy regime.

According to ECB 2014, the use of forward guidance has proven effective in pursuing and achieving ECB's mandate of maintaining price stability in the euro area over the medium term. By providing greater clarity and transparency on the Governing Council's monetary policy orientation with respect to the future path of key ECB interest rates, forward guidance has contributed to more stable money market conditions and anchored policy rates expectations more firmly. The study shows that the ECB's forward guidance announcement in July 2013 triggered an immediate flattening of the money market curve, with forward rates declining by around five basis points at maturities over six months. The forward curve later steepened but has remained close to the level reached after the May 2013 decision for maturities of up to two years, indicating that forward guidance has remained effective in steering market expectations at the most relevant maturities for monetary policy. Furthermore, the study suggests that forward guidance has also reduced the market uncertainty about the path of future short-term interest rates and has reduced the sensitivity of money market forward rates to macroeconomic data releases. Overall, the evidence suggests that forward guidance

[18] ECB (2014): *The ECB's Forward Guidance*.

has been an effective tool for the ECB in providing greater clarity and transparency on its monetary policy orientation, contributing to more stable money market conditions and anchored expectations, which is crucial in maintaining price stability in the euro area over the medium term.

Coibion et al. (2022) observe that central bank communication strategies have been successful in minimizing financial volatility and shaping longer-term interest rates to achieve central banks' objectives.

Campbell et al. (2019) also state that communication considerably influences the propagation of monetary shocks, increasing the magnitude of the economy's responses to changes form the anticipated policy rates path, with private-sector expectations of future policy deviations significantly affecting these effects. However, the effectiveness of central bank announcements and communications in shaping individuals' expectations is unclear, as central banks have struggled to anchor inflation expectations among households and firms across most advanced economies. If their expectations are unresponsive to central bank announcements and communications, then central bank's policies cannot be effective.

This suggests that central banks should focus on developing effective communication and constantly explore innovative ways to communicate directly with the broader public to maximize the impact of their policies as forward guidance is a valuable tool for central banks that want to convey to the public the perceived risks concerning the economic outlook.[19, 20]

On the contrary, in their study, Hagedorn et al. (2019) conclude that forward guidance is not an effective monetary policy tool, particularly in a liquidity trap. The authors argue that the ineffectiveness of forward guidance is not due to the absence of redistribution channels, but rather the lack of redistribution induced by it. The study shows that forward guidance operates through two channels, the distributional and intertemporal substitution channels, neither of which are significantly triggered in their model. The authors explain that this lack of effectiveness is due to the minor impact on the tax and transfer system and the little effect on aggregate demand through distributional channels. Additionally, the study highlights that forward guidance only has a small effect on real interest rates, meaning that the intertemporal substitution channel through which it could have significant economic effects is also not triggered in their model. The authors suggests that forward guidance 's lack of effectiveness is a result of the absence of significant effects on real interest rates and limited redistribution induced by it, therefore, policymakers should not rely on forward guidance as a means of stimulating aggregate demand in a liquidity trap.

According to Dell'Ariccia et al. (2018), several factors may hamper the effectiveness of forward guidance and complicate the empirical assessment of its effects. Firstly, forward guidance may fail to influence expectations, especially when the guidance simply confirms what markets already anticipate or when markets do not consider the commitment to be credible. Secondly, the interpretation of forward guidance

[19] Coibion O., Gorodnichenko Y., and Weber M. (2022): *Monetary Policy Communications and Their Effects on Household Inflation Expectations.*

[20] Campbell J.R., Ferroni F., Fisher J.D.M., and Melosi L. (2019): The limits of forward guidance.

by markets can lead to unexpected outcomes. For instance, if a central bank announces that interest rates will remain low for a longer period than expected, it may signal that the central bank has greater concerns about the future economic outlook, thus reducing consumer and business confidence and leading to negative economic effects. On the other hand, if market participants believe that forward guidance will succeed in increasing inflation and real GDP growth, long-term rates may increase instead of decreasing. Referring to what was stated previously about the different types of forward guidance at the disposal of central banks, Moessner (2015) found mixed results based on the type of policy used by the Fed. The author observes that open-ended and time-contingent forward guidance announcements by the FOMC at the zero lower bound were effective in reducing long-term bond yields, while state-contingency forward guidance announcements led to an increase in long-term bond yields. These considerations underline that policymakers should carefully consider the type of forward guidance announcements they make and their timing in order to achieve their desired outcomes.

Chapter 2

Market for Reserves

2.1 - How do Central Banks target Interest Rates?

Central banks have adopted the practice of controlling or targeting the overnight interbank interest rate, i.e. the interest rate on reserve lending from one bank to another, as a means of signalling the direction of their monetary policy. This interest rate plays a crucial role in enabling central banks to influence the economy and achieve their objectives by affecting the interest rates that banks set on loans and deposits. At their meetings, central banks usually declare an official short-term interest rate, which has a significant impact on the interest rates in the entire economy and is closely monitored by market participants.
The overnight interbank interest rate, such as the Euro Short-Term Rate (€STR) in the Euro Area or the Fed Funds Rate (FFR) in the U.S., enables banks with a temporary overnight surplus or shortage of reserves to lend or borrow them from other banks.[21]

To understand the effects of monetary policy tools namely, reserve requirements, standing facilities (hence Negative Interest Rate Policy), and Open Market Operations (hence Quantitative Easing), on the overnight interbank rate, it is necessary to analyze the market for reserves, where this rate is determined, through a supply and demand analysis.

2.1.1 - Demand Curve

$$R^d = RR + ER$$

The demand curve for reserves (R^d) can be determined by examining the relationship between changes in the overnight rate and the quantity of reserves demanded by banks, while keeping all other factors constant. The quantity of reserves demanded by banks is made up of two components: required reserves (RR) , which are calculated as the required reserve ratio multiplied by the amount of deposits subject to reserve requirements, and excess reserves (ER), which are held by banks as a precautionary measure against deposit outflows. The cost of holding excess reserves is the opportunity cost, which is the difference between the interest rate that could be earned by lending these reserves out and the interest rate offered by the central bank in its deposit facility.Most major central banks, such as the ECB, Bank of England, and the Fed, provide deposit facilities that enable banks to deposit excess reserves and earn a fixed interest rate below the official rate.[22]

[21, 22] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

When the overnight rate is above the deposit rate, a decrease in the overnight rate results in a lower opportunity cost of holding excess reserves, thereby leading to an increase in the quantity of total reserves demanded, while keeping all other factors constant. As a result, when the overnight rate (i) exceeds the deposit rate (i_d), the demand curve for reserves (R^d) exhibits a downward slope. On the other hand, if the overnight rate falls below the deposit rate, banks will not be willing to lend reserves in the interbank market at a lower interest rate, leading them to indefinitely increase their deposit holdings. This results in a horizontal (infinitely elastic) demand curve for reserves at the deposit rate (i_d).[23]

2.1.2 - Supply Curve

$$R^s = NBR + BR$$

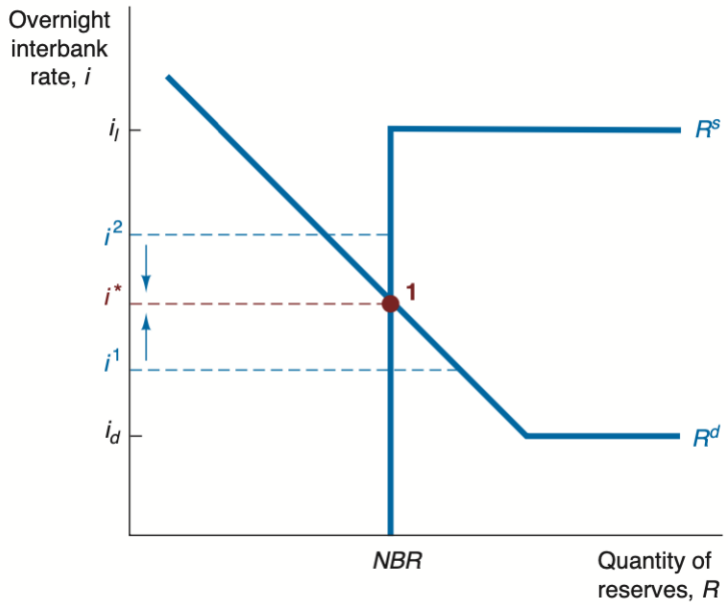
The supply of reserves, denoted as R^s, can be decomposed into two components, namely, non-borrowed reserves (NBR) and borrowed reserves (BR), which are supplied by the central bank's open market operations and lending facility, respectively. The main cost incurred in obtaining reserves from the central bank is the interest rate charged via its lending facility, known as the lending rate (i_l), which is typically set higher than the official rate and varies in response to changes in the latter.

Given that borrowing reserves from other banks can serve as a viable alternative to borrowing from the central bank, if the overnight rate (i) falls below the lending rate (i_l), banks will abstain from borrowing from the central bank. This is due to the availability of cheaper borrowing rates in the interbank market, which consequently results in the supply of borrowed reserves becoming zero.

As a result, if i remains lower than i_l, the supply of reserves will be restricted to non-borrowed reserves, NBR, and the supply curve will be vertical. Conversely, when the overnight rate exceeds the lending rate, banks borrow more from the central bank at i_l and lend out the proceeds in the interbank market at a higher rate, resulting in a flat (infinitely elastic) supply curve at i_l.[24]

[23, 24] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

2.1.3 - Market Equilibrium



Source: Mishkin et al., 2013, p. 328

The market reaches equilibrium when the quantity of reserves demanded is equal to the quantity supplied, i.e. $R^d = R^s$ as shown in point 1, which is the equilibrium point with an overnight rate of i^*

If the overnight rate is above the equilibrium rate, i^2, the quantity of reserves supplied is more than the quantity demanded, leading to an excess supply. This surplus in reserves causes the overnight rate to decrease to the equilibrium rate, i^*. Vice versa, if the overnight rate is below the equilibrium rate, i^1, the quantity of reserves demanded is more than the quantity supplied, resulting in an excess demand and causing the overnight rate to increase.[25]

2.2 - How do tools of Monetary Policy affect the Overnight Interest Rate?

Having covered the rationale behind movements in the overnight interbank rate, an analysis can be conducted to investigate the impact of changes in the tools of monetary policy on the market for reserves and the equilibrium overnight rate.

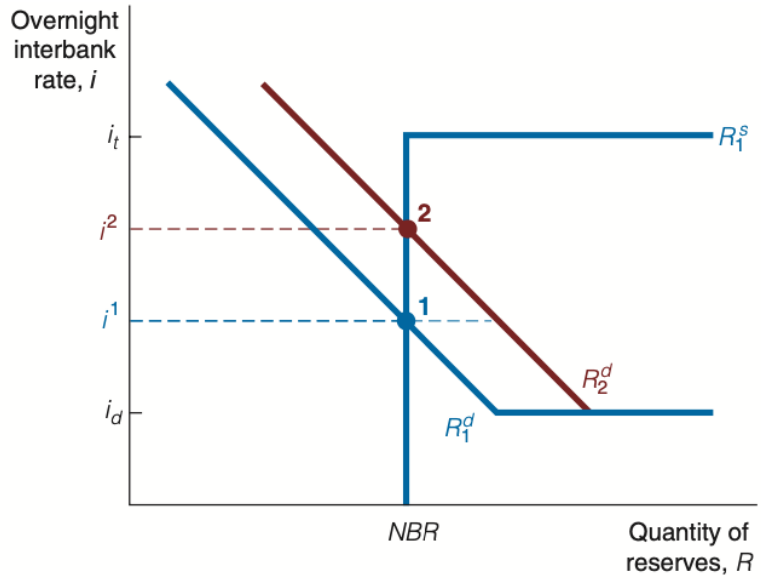
2.2.1 - Reserve Requirements

An increase in reserve requirements by the central bank leads to a rise in the overnight rate, as an increase in the required reserve ratio results in an increase in required reserves and consequently, an increase in the

[25] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

quantity of reserves demanded at any given interest rate. This leads to a shift in the demand curve to the right from R_1^d to R_2^d, which in turn leads to a shift in equilibrium from point 1 to point 2 and causes an increase in the overnight rate from i^1 to i^2.

On the contrary, a decrease in the required reserve ratio results in a decline in the quantity of demanded reserves, causing the demand curve to shift to the left and a subsequent fall in the overnight rate.[26]



Source: Mishkin et al., 2013, p. 333

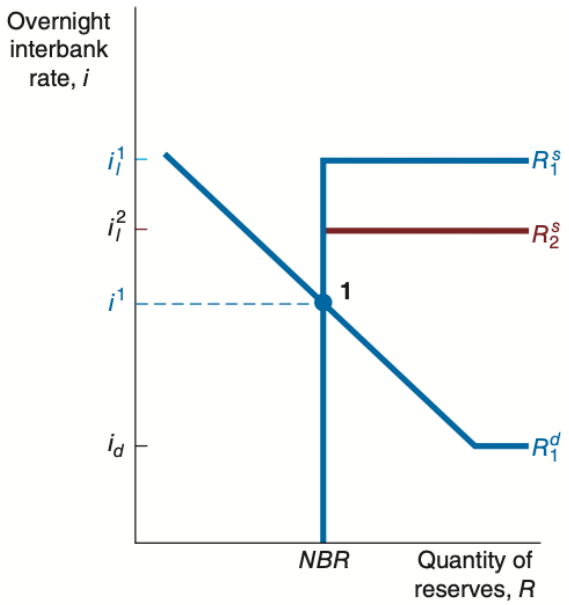
2.2.2 - Standing Facilities

Most major central banks provide lending and deposit facilities. Lending facilities are employed to offer overnight reserves to banks, against eligible collateral, at an interest rate that is usually higher than the official rate. Deposit facilities are made available to banks seeking to deposit their overnight reserves with the central bank at a deposit rate that is lower than the official rate.

Lending Rate

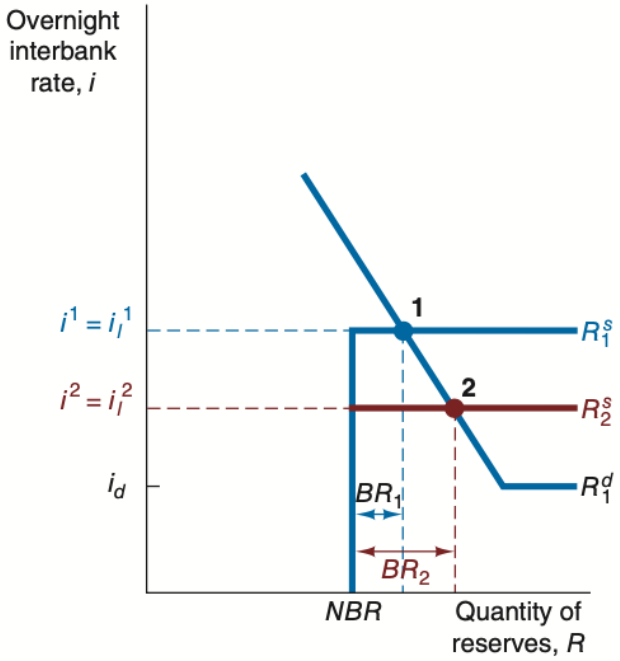
The impact of changes in the lending rate on the overnight rate depends on the intersection point of the supply and demand curves. A reduction in the lending rate by the central bank from i_l^1 to i_l^2 causes the horizontal section of the supply curve to shift downwards to R_2^s. However, if the intersection occurs at the vertical section of the supply curve, indicating zero borrowed reserves, the intersection remains at point 1, resulting in no change in the equilibrium overnight rate, which stays at i^1. Since this is the typical scenario, it can be inferred that most changes in lending rates have no effect on the overnight rate.[27]

[26, 27] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).



Source: Mishkin et al., 2013, p. 331

In situations where the demand curve intersects with the flat section of the supply curve, implying a certain level of lending (i.e., $BR > 0$), changes in the lending rate will have an impact on the overnight rate. At the outset, lending is positive, and the equilibrium overnight rate is equivalent to the lending rate, i.e., $i^1 = i_l^1$. The central bank reduces the lending rate from i_l^1 to i_l^2, the horizontal section of the supply curve shifts downward to R_2^s, changing the equilibrium from point 1 to point 2, causing the equilibrium overnight rate to decrease from i^1 to $i^2 = (i_l^2)$.[28]

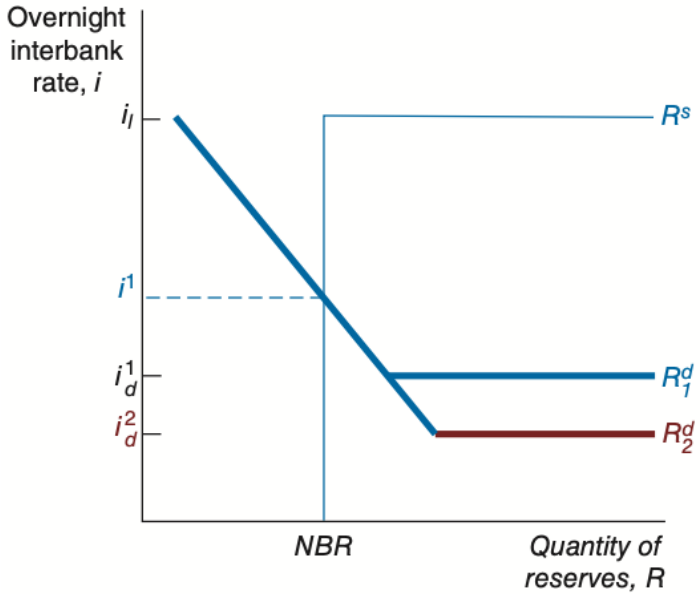


Source: Mishkin et al., 2013, p. 331

[28] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

Deposit Rate

As with what was analyzed previously regarding the lending rate, the impact of changes in the deposit rate on the overnight rate depends on the intersection point of the supply and demand curves. If the intersection is on the downward-sloping section, indicating the absence of bank deposits, a reduction in the deposit rate from i_d^1 to i_d^2 by the central bank causes the horizontal section of the demand curve to shift downward to R_2^d, but the intersection point of the supply and demand curves remains the same. Consequently, the equilibrium overnight rate remains unchanged and stays at i^1. This is a typical scenario since central banks frequently maintain the deposit rate below its target overnight rate, indicating that most changes in the deposit rate have no impact on the overnight rate.[29]

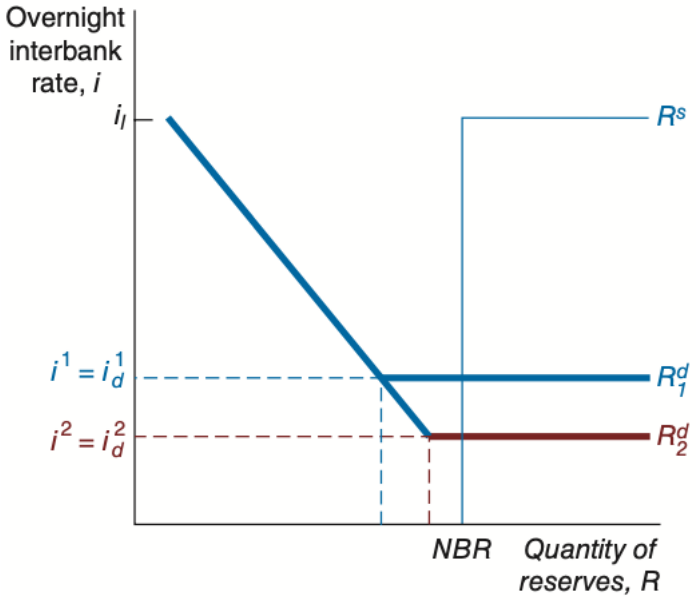


Source: Mishkin et al., 2013, p. 332

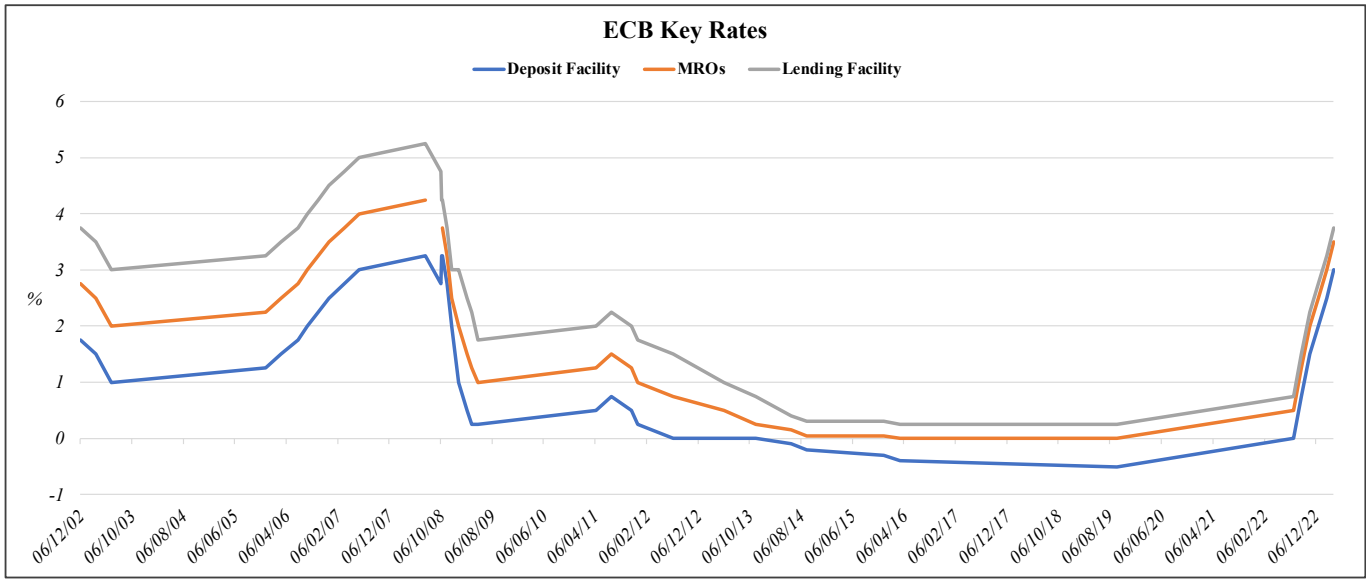
In the scenario where the supply curve intersects with the demand curve on its flat segment, indicating that there are some bank deposits at the central bank, changes in the deposit rate by will have an impact on the overnight rate. Initially, the equilibrium overnight rate is equal to the deposit rate, $i^1 = i_d^1$.

Subsequently, when the central bank reduces the deposit rate from i_d^1 to i_d^2, the horizontal section of the demand curveshift downward to R_2^d, causing the equilibrium to move. The outcome is a decrease in the equilibrium overnight rate from i^1 to i^2, which matches the new deposit rate, i_d^2.[30]

[29, 30] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).



Source: Mishkin et al., 2013, p. 332



Data:

https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

2.2.3 - Open Market Operations

Open market operations (OMOs) represent the primary tool for implementing monetary policy, as they present several advantages compared to other tools and have a crucial role in determining fluctuations in interest rates and the monetary base, thus in the money supply.

Advantages of open market operations:

1. "Open market operations occur at the initiative of the central bank, which has complete control over their volume." (Mishkin et al., 2013, p. 338)

This control mechanism is absent in lending facilities, where the central bank may employ interest rate adjustments to incentivize or discourage reserve borrowing by banks, but does have control over the quantity of borrowed reserves.

2. "Open market operations are flexible and precise; they can be used to any extent." (Mishkin et al., 2013, p. 338)

No matter how small a change in reserves or the monetary base is desired, open market operations can achieve it with a small purchase or sale of securities. Conversely, if the desired change in reserves or the base is very large, the open market operations tool is strong enough to do the job through a very large purchase or sale of securities.

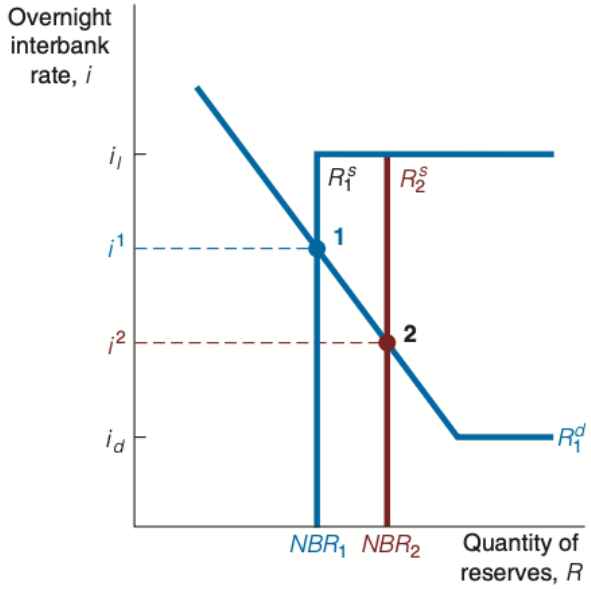
3. "Open market operations are easily reversed." (Mishkin et al., 2013, p. 338)

If a mistake is made in conducting an open market operation, the central bank can immediately reverse it. If the central bank decides that the overnight rate is too low because it has made too many open market purchases, it can immediately make a correction by conducting open market sales. (Mishkin et al., 2013)

4. "Open market operations can be implemented quickly; they involve no administrative delays." (Mishkin et al., 2013, p. 339)

OMOs are carried out through either open market purchases or sales, with the former expanding reserves and the monetary base, and the latter shrinking them. Therefore, open market purchases lead to an increase in the money supply and, in most cases, a decrease in short-term interest rates, while open market sales result in a decrease in the money supply and an increase in short-term interest rates.

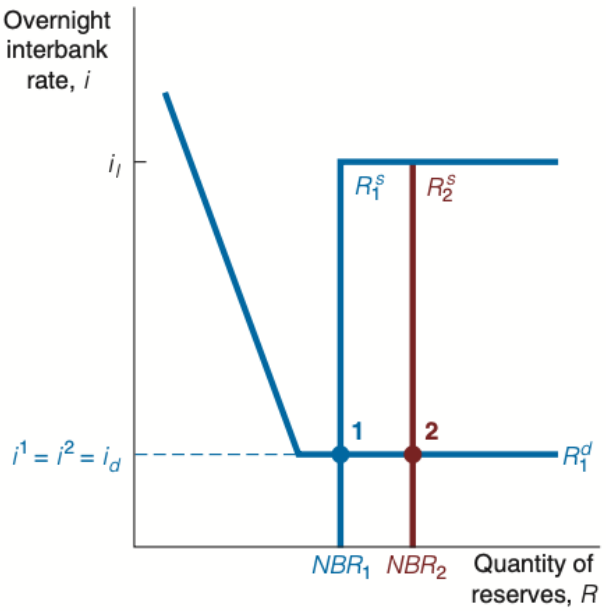
The impact of an open market operation is contingent on the initial intersection of the supply and demand curves. When the intersection occurs on the downward-sloped segment of the demand curve, an open market purchase increases the quantity of non-borrowed reserves, from NBR_1 to NBR_2. This increase in non-borrowed reserves leads to the rightward shift of the supply curve from R_1^s to R_2^s, and the equilibrium moves from point 1 to point 2, thereby lowering the overnight rate from i^1 to i^2. On the contrary, an open market sale decreases non-borrowed reserves and shifts the supply curve leftward, resulting in a rise in the overnight rate. As previously mentioned, since the central bank usually keeps the overnight rate target above the deposit rate, the conclusion is that, in most cases, an open market purchase causes the overnight rate to fall, whereas an open market sale causes the overnight rate to rise.[31]



Source: Mishkin et al., 2013, p. 330

In cases where the supply intersects the demand curve on its flat section open market purchases do not alter the overnight rate. In such a scenario, an increase in the quantity of reserves supplied through open market purchases, which shifts the demand curve to the right from R_1^s to R_2^2, would change the equilibrium point from 1 to 2. However, the overnight rate will remain constant at i_d since it acts as a lower bound for the overnight rate, but the supply of non-borrowed reserve will be higher.[32]

[31, 32] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).



Source: Mishkin et al., 2013, p. 330

Central banks have at their disposal two types of open market operations.

Temporary Open Market Operations:

Temporary OMOs are the preferred method of implementing an open market operation to be revoked later, as they are designed to have a short-term effect on reserves. Temporary OMOs can be conducted through repurchase agreements (repos) and reverse repurchase agreements (reverse repos). With repos, the central bank acquires securities and sells them back to the original seller at a predetermined date, usually within a year of the initial purchase. Reverse repos involve the central bank selling securities to a buyer with an agreement that the buyer will sell them back to the central bank at a later date.[33]

Outright Open Market Operations:

By using this type of OMOs, the central bank makes an outright purchase or sale of securities in the secondary market, which results in a permanent increase or decrease in reserve balances.[34]

[33, 34] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

Chapter 3

Transmission Mechanism of Monetary Policy

Monetary policy tools serve as important instruments, nonetheless, they occasionally yield unanticipated or undesired outcomes. Achieving success in the execution of monetary policy necessitates precise evaluation by monetary authorities regarding the timing and impact of their measures on the economy.[35] Monetary policy does not directly impact macroeconomic variables but influences them indirectly through the decisions of economic agents and various transmission channels. In the context of inflation targeting, the primary tool used by central banks to affect the economy is the interest rate. However, the effects of monetary policy on the economy, such as investment and employment, are not immediate but rather mediated through the influence on other economic variables. Consequently, understanding the intricate transmission mechanism and channels of monetary policy is essential before discussing QE and NIRP measures. The transmission mechanism explains how changes in central bank policies affect the broader economy, while channels serve as pathways through which these changes impact various sectors.[36]

3.1 - Interest Rate Channels

The conventional interest rate channel originates from the principles of traditional Keynesian theory.
Traditional Keynesian view of the Interest Rate (IR) channel:

$$MP \uparrow (expansionary\ monetary\ policy) \Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

A fall in real interest rates lowers the cost of capital, causing a rise in investment spending thereby leading to an increase in aggregate demand and a rise in output *Y*.
Early Keynesians thought that this channel was operating through firm's decisions on investments.
New Keynesians and Monetarists argue that the *IR* channel is stronger since they focus on the real rather than the nominal interest rate as the rate that affects consumer and business decisions. The Keynesian assumption of sticky prices, the fact that the aggregate price level adjusts slowly over time, means that expansionary monetary policy, which lowers the short- term nominal interest rate, also lowers the short-term real interest rate. Changes in real interest rates subsequently influence the decisions made by economic agents. Interest rates may affect not only investment by firms, but also housing and consumer durable expenditure. An important consideration to be made is that investment and consumption of durable goods depend on medium and long-term interest rates. Central banks have control over short-term interest rates,

[35] Mishkin F. S. (1995): *Symposium on the monetary transmission mechanism.*
[36] Montes G. C. (2013): *Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.*

but the strength of *IR* channel depends also on the response of medium- and long-term rates to short-term rates.[37, 38]

With nominal interest rates at the zero lower bound, a commitment to implement expansionary monetary policy in the future has the potential to increase the expected price level and hence expected inflation. This, in turn, leads to a reduction in the real interest rate, even in situations where the real interest rate is already at zero.[39]

$$MP \uparrow \Rightarrow \pi^e \uparrow \Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

3.2 - Other Asset-Price Channels

3.2.1 - Exchange Rate Channel

When domestic real interest rates fall, due to an expansionary monetary policy, domestic assets become less attractive. Thus, the relative value of domestic assets vis-à-vis assets denominated in other currencies declines, leading to a depreciation of the domestic currency (denoted by $E \downarrow$).
As a consequence, domestic goods become more competitively priced in comparison to foreign goods, thereby causing a rise in net exports ($NX \uparrow$) and overall output. In economies characterized by open trade and flexible exchange rates, the effectiveness of monetary policy through this channel is heightened due to the potential influence of exchange rate fluctuations.[40, 41]

$$MP \uparrow \Rightarrow i_r \downarrow \Rightarrow E \downarrow \Rightarrow NX \uparrow \Rightarrow Y \uparrow$$

3.2.2 - Tobin's q Theory

Tobin's q theory explains how monetary policy influences the economy by affecting equity valuation.

$$q = \frac{Market\ Value\ of\ Firm}{Replacement\ Cost\ of\ Capital}$$

If q is high, the market price of firms is high relative to the replacement cost of capital, thus acquiring new plant and equipment capital would be cheap relative to the market value of firms. Firms can issue stock at

[37, 40] Mishkin F. S. (1995): *Symposium on the monetary transmission mechanism.*
[38, 41] Montes G. C. (2013): *Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.*
[39] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

a premium price relative to the cost of the facilities and equipment they are buying, allowing for increased investment spending. Conversely, when q is low and the market value of firms is comparatively low relative to the cost of capital, firms are less inclined to purchase new investment goods, resulting in limited investment activity. Changes in monetary policy, such as alterations in the basic interest rate, can impact equity prices, making bonds more or less attractive relative to equities and causing the prices of equities to rise or fall accordingly. Consequently, lower or higher equity prices result in corresponding decreases or increases in q, consequently affecting investment spending. In expansionary monetary policy scenarios, the public tends to have surplus funds, and one place the public spends is in the stock market. This increased demand for stocks leads to higher stock prices and, consequently, a higher q value.[42, 43]

$$MP \uparrow \Rightarrow i_r \downarrow \Rightarrow P_S \uparrow \Rightarrow q \uparrow \Rightarrow Y \uparrow$$

3.2.3 - Wealth Effects

The wealth effect on consumption provides an alternative channel for the transmission of monetary policy through asset prices. This channel is rooted in the life cycle hypothesis of consumption developed by Franco Modigliani, which highlights the significance of household wealth in determining consumption expenditure. The connection between monetary policy and this channel is established through the relationship between interest rates and asset prices. For instance, when the central bank lowers interest rates, equity prices tend to increase. As a result, households who own shares experience a boost in their wealth. Consequently, when stock prices rise, financial wealth increases, leading to a rise in consumption and subsequently in output. Conversely, when equity prices fall and wealth decreases, households may reduce consumption.[44, 45]

$$MP \uparrow \Rightarrow i_r \downarrow \Rightarrow P_S \uparrow \Rightarrow W \uparrow \Rightarrow C \uparrow \Rightarrow Y \uparrow$$

3.3 - Credit Channels

Significant challenges related to asymmetric information exist within financial markets, and banks often assume a unique role in the transmission process. Within the credit channel, there are two distinct channels that can be identified: the bank lending channel and the balance sheet channel.

[42, 44] Mishkin F. S. (1995): *Symposium on the monetary transmission mechanism.*

[43,45] Montes G. C. (2013): *Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.*

3.3.1 - Bank Lending Channel

The bank lending channel is a significant aspect to consider. An expansionary monetary policy increases bank reserves and deposits, leading to an increase in the quantity of bank loans available. This increase in loan supply stimulates investment and spending.

$$MP \uparrow \Rightarrow R \uparrow \Rightarrow D \uparrow \Rightarrow loan\ supply \uparrow \Rightarrow I\ and\ C \uparrow \Rightarrow Y \uparrow$$

It is important to note that the impact of monetary policy on expenditure is likely to be greater for smaller firms, which heavily rely on bank loans, compared to larger firms that can directly access funds through stock and bond markets. While many economists still acknowledge the significant role of the bank lending channel in the monetary transmission mechanism, the structure of the financial system plays a crucial role in determining the relative importance of different transmission channels and the overall effectiveness of monetary policy across countries. Unfortunately policymakers, specifically central banks, face challenges due to the dynamic nature of financial systems, which evolves over time and leads to changes in the impact of monetary policy that are difficult to quantify.[46, 47]

3.3.2 - Balance - Sheet Channel

The balance-sheet channel operates through the net worth of business firms. A decrease in net worth has implications for lenders, as it reduces the collateral available for loans, thereby increasing potential losses resulting from adverse selection. Additionally, lower net worth of businesses exacerbates the moral hazard problem. This is because reduced net worth implies that owners have a smaller equity stake in their firms, which incentivizes them to engage in risky investments. Consequently, overall lending decreases, which hampers the financing of investment spending. An expansionary monetary policy, characterized by rising stock prices, increases the net worth of firms, thereby stimulating higher levels of investment spending and resulting in increased output.[48, 49]

$$MP \uparrow \Rightarrow P_S \uparrow \Rightarrow Net - worth\ of\ firms \uparrow \Rightarrow AS\ \&\ MH \downarrow \Rightarrow Lending\ to\ firms \uparrow \Rightarrow Y \uparrow$$

[46, 49] Mishkin F. S. (1995): *Symposium on the monetary transmission mechanism.*

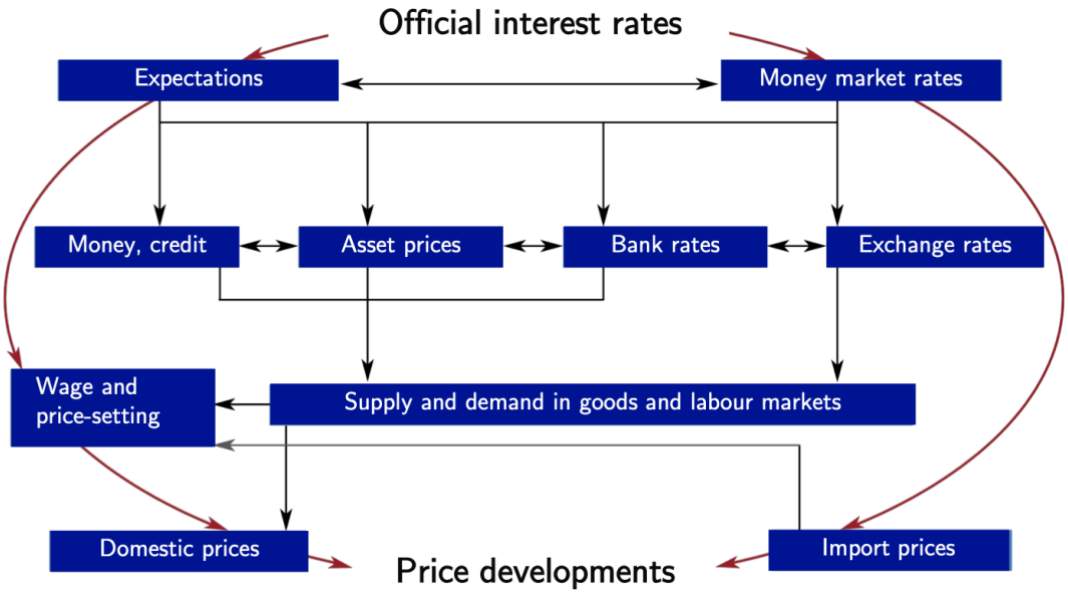
[47] Montes G. C. (2013): *Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.*

[48] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

3.3.3 - Cash Flow Channel

Expansionary monetary policy, characterized by a decrease in nominal interest rates, enhances firms' balance sheets as cash flow rises. The rise in cash flow improves the liquidity position of the firm, facilitating lenders in assessing the firm's ability to meet its financial obligations. Consequently, adverse selection and moral hazard problems become less severe.[50, 51]

$$MP \uparrow \Rightarrow i \downarrow \Rightarrow cash\ flow\ (liquidity) \uparrow \Rightarrow AS\ \&\ MH \downarrow \Rightarrow Lending\ to\ firms \uparrow \Rightarrow Y \uparrow$$



Source: https://www.ecb.europa.eu/pub/conferences/shared/pdf/20190701_CBS2019/ecb.CBS2019_Altavilla_Monetary_policy_transmission_mechanisms_presentation.en.pdf

[50] Mishkin F. S. (1995): *Symposium on the monetary transmission mechanism*

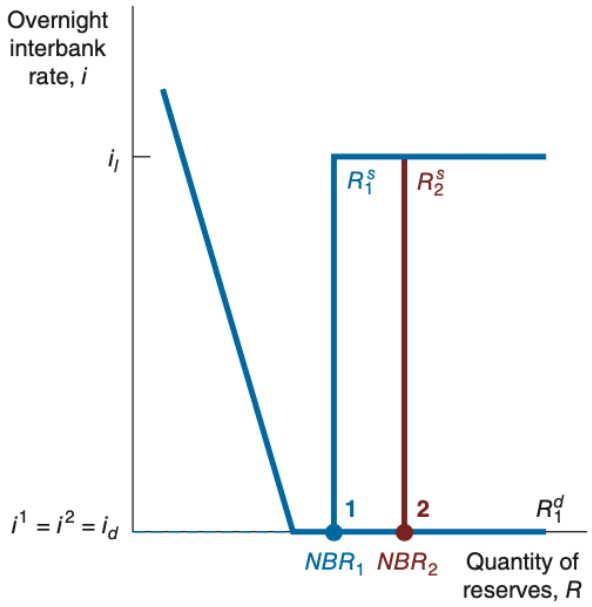
[51] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

Chapter 4

Quantitative Easing

4.1 - What is Quantitative Easing?

Quantitative Easing (QE) is an outright OMO, and differs from traditional open market operations mainly in terms of the types and volume of assets purchased. The term "quantitative easing" was initially coined to describe the monetary policy approach adopted by the Bank of Japan between 2001 and 2006.
Through quantitative easing, the central bank alters the supply of non-borrowed reserves, from R_1^s to R_2^s. QE causes the equilibrium point to shift from point 1 to point 2, while keeping the overnight rate unchanged at $i^1 = i^2 = i_d$, but increasing the reserve accounts that commercial banks hold at the central bank.[52]



Source: (Mishkin et al., 2013, p. 332)

QE is a monetary policy tool used by central banks to stimulate the economy and it typically involves the acquisition of long-term government bonds or other assets, such as privately issued securities, whereas traditional open market operations mainly involve short-term government securities.

In response to the credit crunch and loss of confidence in the global economy during and post the 2008-09 financial crisis and to counter and the 2020 recession triggered by the COVID-19 pandemic, central banks implemented varying actions depending on their jurisdiction and timing. For instance, in the US such efforts begun in late 2008. Both the Bank of England and the European Central Bank (ECB) undertook similar initiatives in the first half of 2009, while the Bank of Japan started much earlier, in the late 1990s.

[52] Mishkin F. S., Matthews K., and Giuliodori M. (2013): *The Economics of Money, Banking, and Financial Markets* (European Edition).

In both cases, the Fed purchased Treasury securities and Mortgage-Backed Securities (MBS). The Fed has indicated "that changing the target range for the federal funds rate is its primary means of adjusting the stance of monetary policy", while emphasizing that it "would be prepared to use its full range of tools, including altering the size and composition of its balance sheet, if future economic conditions were to warrant a more accommodative monetary policy than can be achieved solely by reducing the federal funds rate".[53]

In 2009 the BoE announced a large-scale asset purchase program utilizing central bank money to inject funds into the economy, boost nominal spending, and facilitate the achievement of the inflation target. The Bank of England's QE program focused on the purchase of UK government bonds, even though private assets were purchased as well. The QE increased the size of the BoE's balance sheet relative to GDP threefold compared to the pre-crisis era. Alongside earlier measures to support bank liquidity, these purchases helped improve market functioning.[54]

Following the bursting of Japan's bubble economy in the 1990s, the country experienced economic stagnation and deflation. Despite the BoJ's reduction of its policy rate to zero by 1999, the situation did not improve. In 2001, the BoJ launched the QE program. The BoJ initially made limited purchases of government bonds, but later purchased a wider range of securities and adopted a numerical inflation target, as well as a "yield curve control" approach in response to declining consumer prices, a weak banking system, and the prospect of a recession.[55]

The ECB focused on providing liquidity injections before introducing the Asset Purchase Programme to address concerns about missing its inflation target. While the ECB initially avoided buying large amounts of government bonds, it later had to in order to address the sovereign debt crisis in some countries.
The turning point came in July 2012 when the ECB's president, Mario Draghi, announced the Outright Monetary Transactions (OMT) program, which pledged to do "whatever it takes" to preserve the euro and was essential in restoring trust and confidence in the Eurozone. To help bring Euro area inflation back to the ECB's desired level of approximately 2%, the ECB's Governing Council announced a large-scale public sector purchase program (PSPP) in 2015, which comprised bonds issued by euro area central governments, government-related agencies, and European institutions. The PSPP, along with the purchase of private-sector assets, constituted the ECB's Expanded Asset Purchase Program (APP). Ultimately, both the BoJ

[53] Kiley M.T. (2018): *Quantitative Easing and the "New Normal" in Monetary Policy.*
[54] Joyce M., Tong M., and Woods R. (2011): *The United Kingdom's quantitative easing policy: design, operation and impact.*
[55] Bowman D., Cai F., Davies S., and Kamin S. (2015): *Quantitative easing and bank lending: Evidence from Japan.*

and the ECB purchased private securities, including corporate bonds, exchange-traded funds, and real-estate investment funds, in addition to government bonds.[56]

On March 10, 2016, the ECB included corporate bonds under the Corporate Sector Purchase Program (CSPP). In short, the CSPP aimed to enhance the transmission of monetary policy to the real economy by providing support to the corporate sector and reducing borrowing costs.[57]

4.2 - Quantitative Tightening

When the need for monetary stimulus decreases, central banks have the option to reduce the size of their balance sheet through a process called Quantitative Tightening (QT). During QT, the assets can either mature and drop off the central bank's balance sheet in a process known as balance sheet runoff, or the central bank can sell them. QT removes the monetary policy accommodation induced by previous QE, leading to an increase in long-term interest rates, which, in turn, decreases domestic investment and consumer spending on housing and durable goods. In addition, the budget reduction exerts upward pressure on the value of the dollar, which reduces U.S. exports. These effects reduce the support provided to economic activity and slow economic growth, thus reducing inflationary pressure and lessening the need for the Federal Reserve to raise short-term interest rates.[58]

4.3 - Central Banks' Balance Sheets Composition

Several factors influence the size and composition of central banks' balance sheet, including decisions made by central banks regarding monetary policies, domestic currency demand, and the actions of governments when it comes to borrowing and spending. The balance sheet's size increases whenever central banks purchase securities and issue corresponding liabilities, such as currency or reserves, meaning that the central bank's assets and liabilities grow simultaneously. Essentially, the central bank's balance sheet depicts its assets, which are the resources it owns, and its liabilities, which are the obligations it owes to other entities.[59]

[56] Urbschat F., and Watzka S. (2018): *Quantitative easing in the Euro Area – An event study approach*

[57] Abidi N., and Miquel-Flores I. (2018): *Who benefits from the corporate QE? A regression discontinuity design approach.*

[58, 59] Congressional Budget Office (2022): *How the Federal Reserve's Quantitative Easing Affects the Federal Budget.*

Federal Reserve

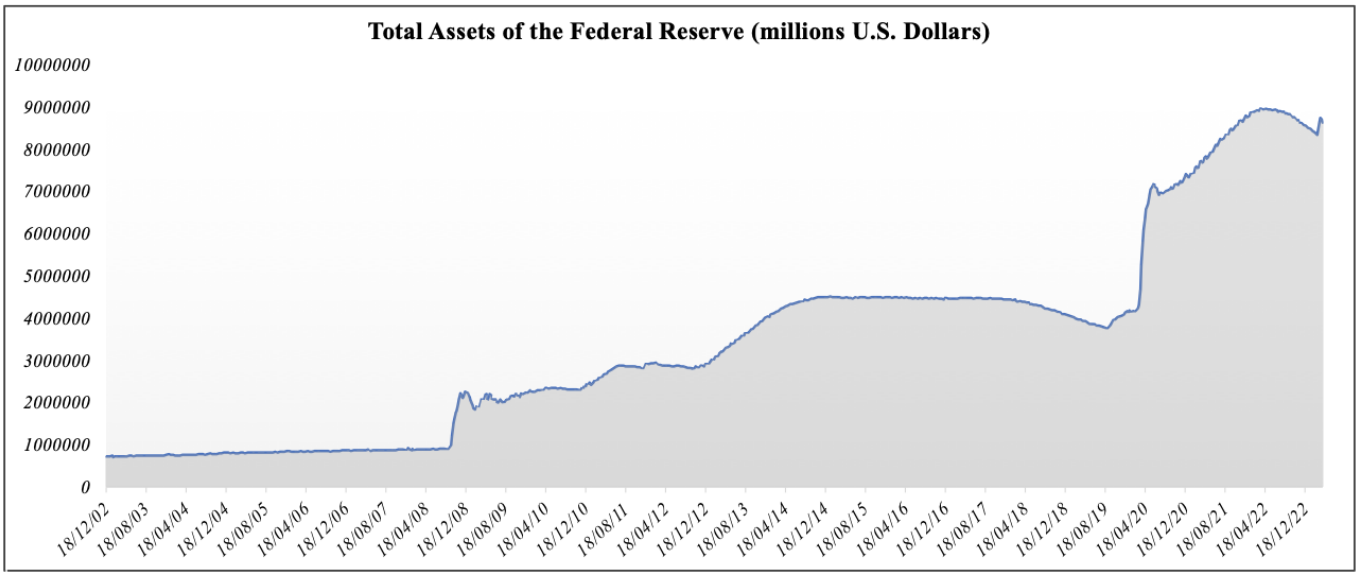
Assets

- U.S. Treasury securities
- Mortgage-Backed Securities
- Loans
- Central Bank Liquidity Swaps
- Net Portfolio Holdings of Special Purpose Vehicles (SPVs)
- Repurchase Agreements
- Gold
- Other assets denominated in foreign currencies

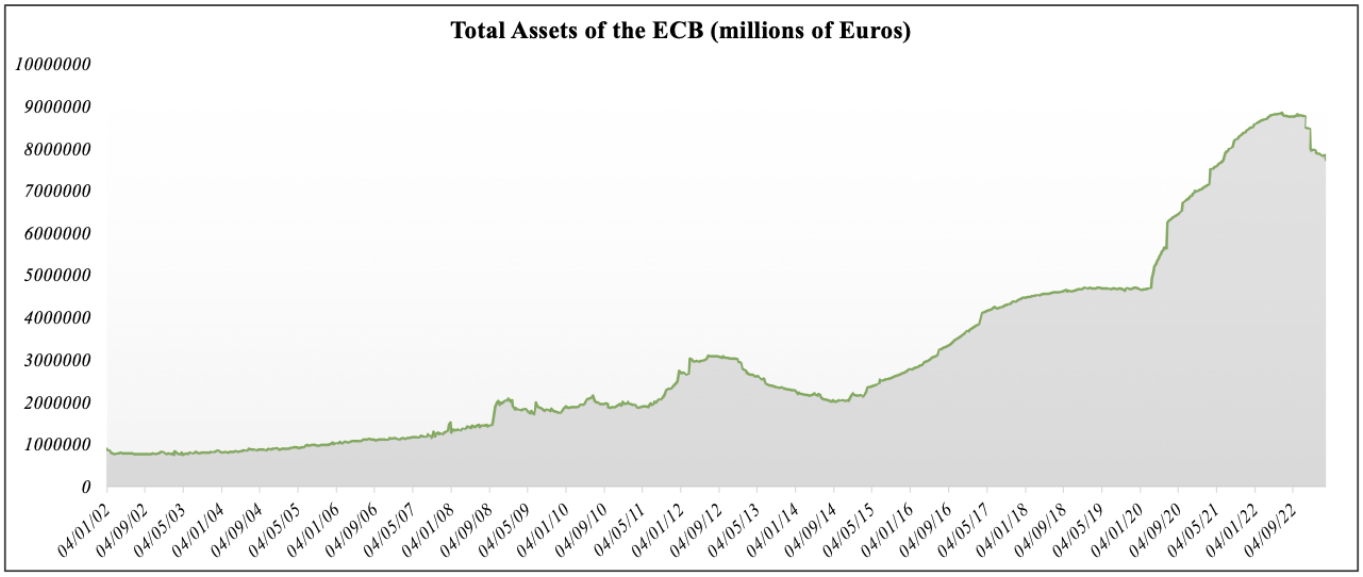
Liabilities

- Reserves
- Currency in circulation
- Treasury General Account (TGA)
- Reverse Repurchase Agreements
- Other

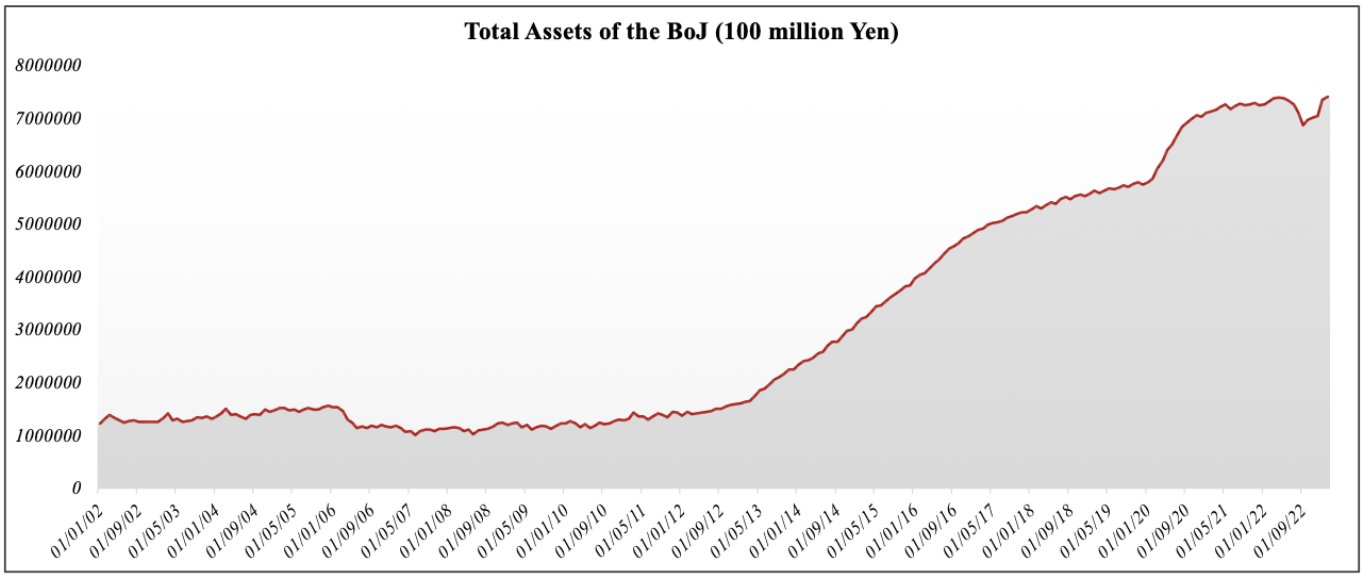
Overall, there has been a significant increase in the value of central banks' balance sheets since 2007. For example, the Fed's balance sheet was approximately 0.9 trillion U.S. dollars at that time. However, as of March 8, 2023, the Fed's balance sheet showed assets valued at 8.34 trillion U.S. dollars. The most notable increases occurred in 2008 and in the first half of 2020 due to the 2008 financial crisis and the COVID-19 pandemic.



Data: *https://fred.stlouisfed.org/series/WALCL*



Data: *https://fred.stlouisfed.org/series/ECBASSETSW*



Data: *https://fred.stlouisfed.org/series/JPNASSETS*

After the economic growth that followed the 2020 recession, the Fed ceased its QE program and stopped expanding its balance sheet in early 2022. Instead, the Fed began shrinking its balance sheet in the middle of 2022 through QT. According to the CBO's forecasts, QT is expected to persist until 2026, by which time the Federal Reserve is projected to purchase enough Treasury securities to sustain reserves as a proportion of GDP at a consistent value in line with pre-pandemic levels. Slightly less than $100 billion worth of assets will drop off of the Fed's balance sheet each month, as the Fed will reinvest only a fraction of the principal proceeds from Treasury securities and MBS that mature.[60]

[60] Congressional Budget Office (2022): *How the Federal Reserve's Quantitative Easing Affects the Federal Budget.*

4.4 - Risks

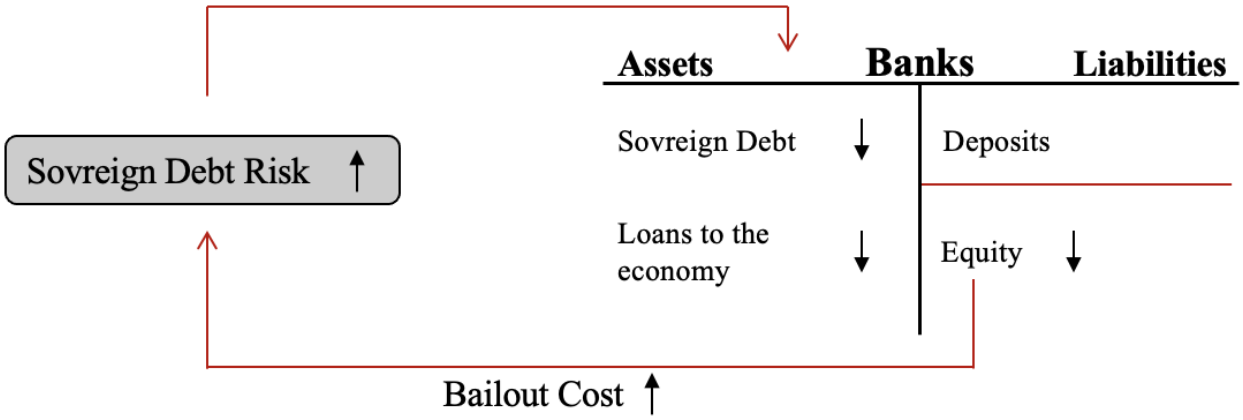
Using quantitative easing QE as a tool of monetary policy comes with a set of unique risks. This approach can make the government's interest costs more vulnerable to fluctuations in interest rates, increase the possibility of net losses for the central bank, and heighten the risk of instability in financial markets.

As previously mentioned, when a central bank engages in QE, it expands its balance sheet by creating bank reserves that are used to purchase securities. This, in turn, increases the percentage of total liabilities that are subject to a variable interest rate making the central bank more vulnerable to fluctuations in interest rates, raising the likelihood of the central bank experiencing periods of net losses. These losses could affect the central bank's ability to achieve its mandate and undermine perceptions of the central bank's independence and its ability to control inflation and promote economic growth.

Jäger and Grigoriadis (2017) suggest that while the implementation of QE by the ECB has been effective in lowering sovereign bond yield spreads, the purchase of GIIPS bonds through QE may have undermined the bailout promise effect, as a large amount of risky assets accumulated on the ECB's balance sheet. The bailout promise effect, which leads to a decrease in sovereign bond yield spreads, is the expectation that central banks will intervene to bailout banks and governments in a debt crisis.[61]

As a country experiences a debt crisis, the value of its bonds decreases. Since banks own these bonds, the value of assets in their balance sheet also decreases, leading to a decrease in their equity. This can lead to a situation where banks may face insolvency, and the government may need to intervene to avoid a bank crisis. However, as expectations increase for the government to bail out banks, credit risk ratings for the government decrease. Lower credit ratings increase government bond yields, which in turn widens spreads and slows down the economy as borrowing demand and investments decrease due to higher borrowing costs, leading to governments reducing taxes and borrowing more to meet government spending. When public debt rises, credit ratings fall further, lowering the value of government bonds, which in turn exacerbates banks' default problems and increases the bailout cost since, for the same amount of money needed, the government has to issue more debt. As public debt increases, credit ratings decrease further, which lowers the value of government bonds even more which worsens banks' insolvency problems. If bailout expectations decrease due to the accumulation of risky assets on the ECB's balance sheet, thus to the higher cost of bailout, then the credibility of the ECB bank is impaired, and the positive effects of UMPs may be offset by an increase in sovereign bond yield spreads in the Eurozone.

[61] Jäger J., and Grigoriadis T. (2017): *The effectiveness of the ECB's unconventional monetary policy: Comparative evidence from crisis and non-crisis Euro-area countries.*



The implementation of QT by the central bank reduces the supply of bank reserves, which is determined by the central bank's policy, while the demand for reserves is determined by financial markets, which can be difficult to observe and predict. The risks associated with QT are partially reduced by the central bank's introduction of a standing repo facility. One form of risk that comes with QT is that the induced increase in long-term rates could lead to a decline in economic output. This reduction in economic growth may also lead to a drop in the inflation and employment rates below the central bank's long-term target. However, the introduction of a standing repo facility by the central bank reduces these risks, by allowing primary dealers to convert government into reserves as required, helping to stabilize the minimum number of reserves necessary for stability in money markets.[62]

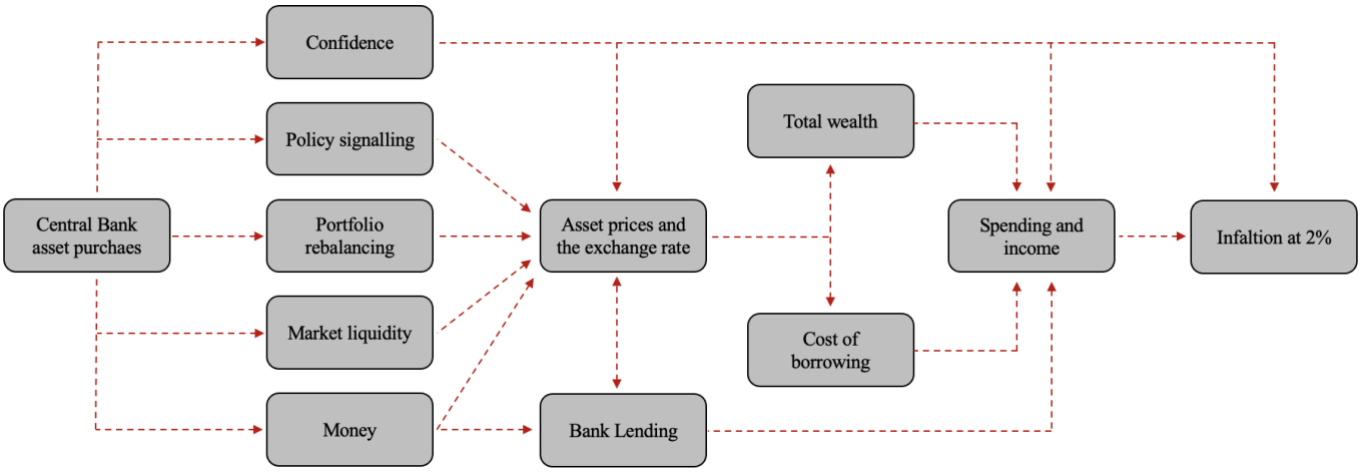
4.5 - Quantitative Easing Effects and Transmission Channels

Researchers have wondered whether unconventional policies should serve as a normal element of the conventional toolkit, to be used in case of deflation or recession. Many argue that together with forward guidance, QE can be an effective tool for monetary stimulus. There is a huge body of literature that has examined QE and its effects on the economy with mixed results and conclusions.

The primary goal of QE is to help achieve the central bank's monetary policy objectives of full employment and price stability by promoting nominal spending and stimulate domestic inflation aligning with the inflation target of 2% in the medium term, in fact Urbschat and Watzka (2018) argue that the success of the QE policy should be evaluated based on its effectiveness in returning inflation to the target rate. The main mechanism for QE to affect the real economy is through its impact on long-term interest rates. One of the most direct ways that QE affects interest rates is by modifying the supply of or demand for government bonds and other assets, which in turn could affect their price and yield. In a nutshell, by reducing long-term yields, the policy aims to encourage investors to sell government bonds and safe assets to purchase other securities, thus stimulating consumption and investment. Nonetheless, this is not the only way through

[62] Congressional Budget Office (2022): *How the Federal Reserve's Quantitative Easing Affects the Federal Budget.*

which QE operates and the mechanisms through which asset purchases may impact spending and inflation are multifaceted.



4.5.1 - Policy Signaling Channel

Dell'Ariccia et al. (2018), Joyce et al. (2011) and Andrade et al. (2016) highlight that asset purchases can have an impact on the economy through a signaling channel. Policy signaling effects refer to the impact of asset purchases on the expectations of economic agents about the future trajectory of monetary policy. This signaling channel is similar to forward guidance, where central banks communicate their intention to keep policy interest rates low for an extended period. Indeed, asset purchases may signal the central bank's commitment to meet its inflation target and lead market participants to expect lower policy rates for a prolonged period. The announcement of the timeline and amount of bond purchases is a common practice in implementing QE, as it serve as a signaling mechanism to improve the central bank's credibility, indeed, the marginal benefit of asset purchases over forward guidance lies precisely in enhancing the credibility of the central bank's announcement. This increased credibility is attributed to the fact that large-scale purchases of long-term assets expose the central bank to potential losses on its balance sheet if short-term rates are suddenly increased. Thus, the fear of these losses provides the central bank with an incentive to maintain low policy rates and increase them gradually as the economy recovers from the crisis, thereby altering agents' long-term inflation expectations. By anchoring inflation expectations to the central bank's target, and by conveying information about the underlying state of the economy that in turn shape the views of economic agents who may rely on central bank analysis, asset purchases can stimulate spending.

4.5.2 - Re-anchoring Channel

According to Andrade et al. (2016), QE is an effective tool for central banks to re-anchor inflation expectations in the private sector. Through the policy signaling channel, QE enables central banks to demonstrate their ability to maintain price stability by purchasing assets in the market, thereby reassuring

the private sector to control inflation expectations on levels consistent with price stability, as mentioned previously. An alternative mechanism that can account for a reanchoring channel operates through uncertainty. In periods of persistently low inflation, the private sector may have doubts about the credibility of the central bank's medium-term inflation objective. Central banks should ensure that their policy targets are perceived as credible, otherwise large-scale bond purchases can be damaging to their reputation. Credibility within the private sector is essential in order to achieve their inflation targets. If doubts about this objective persist, can lead to revisions in long-term inflation objective that reflects in revisions of long-term expectations. QE can help establish confidence in the central bank's ability to maintain price stability, which can, in turn, help to anchor long-term inflation expectations. Overall, this findings highlight the importance of transparency in central bank communication to prevent uncertainty and potential de-anchoring of inflation expectations, and provide important insights into the mechanisms by which quantitative easing can help re-anchor those expectations and promote price stability in the economy.

4.5.3 - Asset Valuation Channel

The study conducted by Andrade et al. (2016) emphasizes the significance of the asset valuation channel in the transmission of monetary policy. The study highlights two mechanisms that generate the asset valuation channel. The authors suggest that the first mechanism is active when banks face funding constraints due to their capital position as asset purchases can replace long-term or riskier assets with short-term and safe central bank reserves, reducing banks' portfolio riskiness, and allowing them to increase risky loans while reducing lending rates. Nevertheless, the effectiveness of asset purchases under this channel depends on the extent to which QE eases banks' funding constraints, with riskier asset purchases being more effective. The second mechanism that induces the asset valuation channel arises when investors face risk-bearing capacity constraints, such as value-at-risk constraints. The authors suggest that the central bank's asset purchases can eliminate some risk from the market, leading to a relaxation of the value-at-risk constraint, thereby reducing the market price of risk. It is important to note that the transfer of these risks on the central bank's balance sheet is not neutral as the central bank is not subject to value-at-risk or funding constraints and that has significant implications for financial stability.

4.5.4 - Portfolio Balance Channel

Joyce et al. (2011) and Takaoka and Takahashi (2022) discuss the impact of central bank asset purchases on asset prices through the portfolio balance channel. In their study, Takaoka and Takahashi (2022) provide evidence for the portfolio balance channel, noting that, in response to QE, the size of loan and bond issuances with a maturity longer than five years declines, as the reduced long-term yields put pressure on the returns of debt investors, prompting them to adjust their portfolios to achieve a certain level of yields. Joyce et al. (2011) argue that the overall impact of QE can be understood as a two-stage process. During

the initial 'impact' phase, asset purchases modify the composition of private sector portfolios by increasing the holdings of money while decreasing the holdings of medium and long-term bonds. The study shows that central banks can increase the money holdings of sellers when purchasing assets, however, as bonds and money are imperfect substitutes this leads to an initial imbalance, resulting in changes in asset prices. In the second phase, through to a series of portfolio rebalancing transactions that result in higher asset prices, equilibrium in money and capital markets is restored, with the signaling channel and other effects of asset purchases reinforcing this process. This channel has been found effective in reducingin reducing the spreads of long-term interest rates over expected policy rates (term premia) and the required return on risky assets relative to risk-free assets (risk premia). Higher asset prices, narrower spreads and lower yields generate increased wealth and reduced financing costs for firms and households, which in turn stimulates spending and raises the consumer price level, boosting economic growth.

4.5.5 - Liquidity Premia Channel

According to Joyce et al. (2011), central bank asset purchases can have a positive impact on financial markets by improving market functioning and increasing liquidity. This is achieved by actively encouraging trading, which reduces premia for illiquid assets. However, it is important to note that the effects of this channel are short-lived and only persist while the central bank is actively conducting asset purchases, thus may not be sustainable over the long-term. Therefore, policymakers should carefully consider the potential limitations and risks of targeting this channel as a mean to promote financial stability.

4.5.6 - Confidence Channel

Joyce et al. (2011) provides valuable insights into the complex interplay between policy interventions, financial markets, and consumer behavior, finding that asset purchases can have a significant impact on confidence levels, whose effects go beyond any effect generated by an increase in asset price. If QE can lead to an improved economic outlook, it directly boosts consumer confidence and, in turn, increase their willingness to spend. The authors note that some of this general improvement in confidence can also be reflected in higher asset prices, particularly through the reduction of risk and liquidity premia. The results suggest that the impact of asset purchases on the economy may extend beyond the immediate effects on asset prices.

4.5.7 - Bank Lending Channel

There are several papers that examine the impact of Asset Purchase Programs (APPs) on bank lending behavior, contributing to the debate on quantitative easing and banks' asset reallocation. While APPs

provide banks with liquidity in the form of central bank reserves, there is a growing debate on whether this impact can transmit to the real economy through the bank lending channel.

According to Joyce et al. (2011), QE can have positive impacts for what concerns the banking sector. When APPs are implemented the banking sector gains new reserves at the central bank. This increase in liquidity may prompt banks to provide more loans than they would have in the absence of the policy.

Luck and Zimmermann (2019) show that QE had positive effects on the banking system as it allowed banks to expand commercial and industrial lending. Moreover, the authors present empirical evidence that QE benefited banks with higher MBS holdings as they experienced higher stock returns following announcements to purchase MBS. Overall, the authors suggest that APPs can spur economic activity via a bank lending channel as the above mentioned effect increased household net worth, thus exerting an upward pressure on demand, which in turn positively affected employment. Bowman et al. (2015) found that Japan's QE had a positive and significant effect on bank lending, with weak banks benefiting more from QE than stronger banks, as it eased liquidity constraints for banks with weaker liquidity positions.

However, the effect of the BOJ's liquidity injections on bank lending was somewhat limited due to the substitution of central bank liquidity for interbank. As a result, the overall impact of QE was measured to be small, requiring large amounts of liquidity to achieve noticeable effects. Naqvi and Pungaliya (2022) explain that monetary policy impacts bank lending behavior by changing the costs of financing differently for small and large banks. Loose monetary policy reduces the cost of financing for banks, prompting them to undertake riskier investments due to the portfolio balancing effect. However, there is a lower bound for the cost of financing, and large banks face a "lower lower-bound" compared to small banks due to lower information asymmetries and implicit subsidies from being considered too-big-to-fail. This difference in financing costs between large and small banks alters the monetary transmission mechanism, with large banks playing a more significant role in the bank lending channel during loose monetary regimes. Kapoor and Peia (2020) found that not all types of loans contribute equally to liquidity creation, which increases when banks offer more illiquid loans, such as commercial lending. The authors highlight that US banks with a higher percentage of assets in MBS before the start of QE increased their real estate and commercial loans disproportionately more after QE. Additionally, results suggest that the impact of QE on liquidity creation was not uniform throughout the program and varied significantly across banks, raisesing concerns about QE's overall effectiveness in supporting the banking sector. Giansante et al. (2022), by examining the impact of APPs on bank lending behavior in the UK, argue that QE did not lead to any increase in bank lending. The authors' main finding is that if banks are not adequately capitalized, in the presence of risk-weighted capital requirements, expansionary monetary policies might coincide with adverse investment incentives. Indeed, the authors find that while QE did not lead to any increase in bank lending, there was a substantial increase in central bank reserves and government securities, indicating a reinvestment of QE proceeds in instruments with lower risk weights, like government securities, which limit the effectiveness of monetary policy expansion.

4.6 - Effectiveness of Quantitative Easing

Hanisch (2016) suggests that QE has been successful in stimulating real economic activity and create inflationary pressure in Japan. According to the author, the reduction in Japanese yields caused by QE indicates the presence of the signaling effect, and lead to a depreciation of the yen against multiple currencies, indicating the presence of the portfolio rebalancing effect. However, the author finds that QE effects on the real economy to be small and rather transitory compared to the impact of a reduction in short-term interest rates, which are found to have a strong impact on real economic activity.
According to Urbschat and Watzka (2018), the impact of asset purchase programs on financial markets is typically driven by two effects: the "stock" effect which occurs upon announcement of the program, and the "flow" effect which refers to the actual execution of the program. The authors suggest that asset purchase programs conducted during periods of market stress and high uncertainty tend to have a stronger impact on financial markets than those announced during more stable market conditions, mentioning that the ECB's QE rounds, implemented during a period of relative calm in financial markets, may have had weaker impacts as, while the first round of the ECB's APP had a strong effect, the marginal impact of each subsequent package decreased over time.

Kiley (2018) argues that the benefits of QE are limited to situations where the equilibrium real interest rate is low, (e.g., 1 percent or less). The effectiveness of QE is also influenced by the timing of its deployment, as it is most effective when implemented promptly after output falls below potential, indeed, strategies that delay the use of QE until output has significantly fallen below potential are less effective. Urbschat and Watzka (2018) find that that while countries with higher yields exhibited stronger reactions to the announcements of the APP, compared to those with yields near the zero lower bound. The authors supported the argument that large asset purchase programs at the zero-lower bound may be ineffective if they are designed solely as QE in a narrow sense, only government bond purchases, rather than credit easing, that lend directly to the distressed private sector, or other form of asset purchases. In this regard, De Santis and Zaghini (2021) found that the CSPP led to a significant increase in the issuance of euro-denominated bonds by eligible corporations, compared to other foreign currencies, highlighting the impact of the programme on real economic activity, with firms taking advantage of bond financing by increasing investment in marketable and equity securities, repurchasing their own stocks, holding cash, and carrying out investment in capital expenditure and intangible assets as well as short-term investment. Although the ECB's monetary policy tools, such as the CSPP, or other purchases of private securities can directly stimulate the economy, transfer risk from banks to central banks, reduce borrowing costs and risk of corporate defaults, they also expose the central bank to credit risk and potential losses.[63]

[63] Abidi N., and Miquel-Flores I. (2018): *Who benefits from the corporate QE? A regression discontinuity design approach*

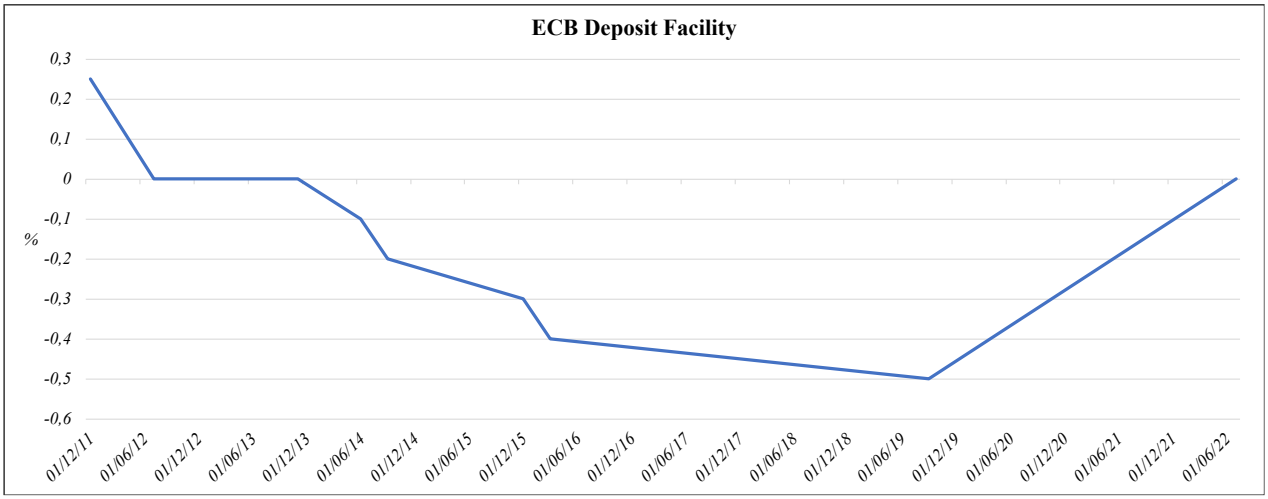
Specifically, Andrade et al. (2016) argue that in the event of an earlier than expected economic recovery central banks could be forced to increase policy interest rates, which could negatively impact their balance sheet, particularly if central banks hold a large amount of long-maturity, low-yield bonds.
Also, Abidi and Miquel-Flores (2018) indicate that the effects of the policy were not straightforward and may have had some negative effects initially. Nevertheless, the segment of high-yield corporate bonds saw compressed bid-ask spreads, indicating positive liquidity effects and an overall success of the policy in achieving its intended goals. These findings provide important insights into the effectiveness of UMP measures in promoting economic growth and stabilizing financial markets, playing an essential role in enhancing the monetary transmission mechanism, which ultimately benefited the Eurozone economy.

On the other hand, Weale and Wieladek (2022) state that QE has a statistically significant and negative impact on risk spreads, while there is no statistically significant difference between the effects of QE and conventional monetary policy for the stimulus necessary to achieve the same amount of inflation.
The study suggests that conventional monetary policy instruments may be more effective in stimulating credit and housing markets than QE. These findings have important implications for policymakers, particularly in light of concerns about the impact of monetary policy on wealth inequality and adverse financial stability spill-overs in emerging market countries. Mishkin and Eakins (2018) suggest other reasons for being skeptical about the effectiveness of quantitative easing policies. Firstly, when the federal funds rate had reached the zero-lower-bound, the expansion of the balance sheet and the monetary base could not lower short-term interest rates any further. The second reason is that the increase in reserves did not translate into an increase in lending as banks held their excess reserves instead of making loans. The same scenario seems to have played out during the BoJ's QE policy after the stock and real estate market bubbles burst. However, not only did the economy fail to recover, but inflation even became negative. These findings suggest that QE policies may not be as effective as policymakers had hoped and could have negative impacts on economic growth and stability. Despite the critics on the effectiveness of QE, the author suggests different ways in which the Fed's balance sheet can stimulate the economy. Firstly, by providing liquidity to a specific credit market that has seized up, the Fed can help it to allocate capital to productive uses, thereby stimulating the economy. Secondly, by purchasing particular securities, the Fed increases demand for these securities and can lower interest rates relative to other securities. This can be helpful in situations where short-term interest rates are already at zero, as asset purchases can still lower interest rates for borrowers in particular credit markets and stimulate spending. For example, purchases of MBS can lower interest rates on these securities, leading to a substantial decline in residential mortgage rates. Similarly, purchases of long-term government securities could lower their interest rates relative to short-term interest rates, which could boost investment spending as long-term interest rates are more relevant to investment decisions.

Chapter 5

Negative Interest Rate Policy

Negative interest rates have been adopted by several central banks worldwide, with Denmark being the first to introduce them in 2012, followed by the European Central Bank, Swiss National Bank, Swedish Central Bank, and Bank of Japan. For instance, the ECB moved its deposit rate into negative territory in June 2014 at minus 10 basis points and gradually decreasing it to minus 50 points in September 2019.



Data:

https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

This policy complements APPs and forward guidance and aims to stimulate the economy by encouraging commercial banks to increase their credit supply, reducing borrowing costs and increasing investment spending.

According to Draghi, NIRP had positive effects, however some central banks have been hesitant to adopt this policy due to the potential side effects on the banking system and credit supply.

On 24 October 2019, during his last press conference before the expiration of his mandate at the ECB, Mario Draghi said: “As a matter of fact, the overall assessment of negative rates is generally positive. For us, it's very positive; it's been a very positive experience. Negative rates have stimulated the economy and affected positively employment, and so all in all we're exactly in the direction we wanted them to be. But the IMF also raised concerns about potential side effects of very negative rates for a long time. The discussion really didn't go into too much detail, but we are also aware of that, and we are monitoring these risks. […] The overall assessment has been clearly positive. In other words, the improvements in the economy have more than offset negative side effects from low rates.”.[64]

[64] https://www.ecb.europa.eu/press/pressconf/2019/html/ecb.is191024~78a5550bc1.en.html

5.1 - NIRP Effects, Effectiveness and Transmission Channels

Many investigated the impact of negative interest rates on bank lending and found mixed evidence regarding its effect. Negative interest rates have been shown to have potential downsides for financial institutions and individuals' behavior, including distorting the concept of the time value of money and influencing borrowing practices and risk-taking. One of the potential consequences of NIRPs is an increase in cash usage, as individuals may choose to hold cash instead of interest-bearing deposits. This scenario could have negative consequences for the whole economy as migration from paper to electronic payments has been found to support economic growth and investments. Liñares-Zegarra and Willesson (2020) found that countries implementing NIRPs experienced an increase in cash usage, and this effect was weaker for countries with high levels of financial intermediation, as it helps lower information and transaction costs, thereby decreasing incentives of depositors to substitute card transactions for cash and allowing savers to achieve better diversification and liquidity of their funds compared to cash. There are also doubts about the ability of negative interest rates to increase inflation and spur growth. David-Pur et al. (2020) provide experimental evidence that a zero interest rate may be more efficient in promoting borrowing and risk-taking than a negative interest rate. Additionally, according to Nasir (2020), negative interest rates may be perceived as unfair and encourage banks and affected groups to retain savings or move wealth into risky assets, posing risks to financial stability. Boungou's (2019) study found that small and better-capitalized banks have taken less risk compared to larger and less capitalized banks in countries where negative rates have been implemented.

Bottero et al. (2020) claim that NIRP can impact the economy through two channels: the retail deposit channel and the portfolio rebalancing channel. Boungou and Hubert (2021) and Matthys et al. (2020) found that the effectiveness of negative interest rate policies and the strength of monetary policy transmission depend on both the pass-through to lending and deposit rates, and on bank heterogeneity which plays a crucial role in loan spreads. Loan spread reduction is most pronounced for small banks, banks with low capital buffers, banks with high existing loan quality, and banks with higher levels of diversification which rely more on non-interest income and that allows them to better shield from the negative effects of NIRP on net interest margins. Loan spread reduction causes a decrease in net interest income due to the downward rigidity of deposit rates, as banks they are reluctant to charge a negative interest rate on customer deposits. To preserve their profitability, banks employ several options, including increasing fees and commissions, reducing operating costs, personnel expenses and interest rates paid on non-customer deposit liabilities. For these reasons, banks' responses to NIRP are not immediate, but they adjust their strategy over time to mitigate the negative impact. Intuitively one can think that negative rates could boost credit supply, however, according to Borio and Gambacorta (2017), NIRP damage bank profitability by affecting net interest rate margins, thus the return on lending activities, and inducing banks to reduce credit supply.

Similarly, Bats et al. (2022) highlight that prolonged periods of negative interest rates have significant adverse effects on bank stock prices and bank performance, as in a negative interest rate environment the deposit margin shrinks and eventually turns negative. This reduces bank willingness to lend, thus hampering the transmission of monetary policy and increase financial stability risks.

On the other hand, the portfolio rebalancing channel has a counterbalancing effect. Yield curve at all maturities flattened with NIRP announcements causing a large decrease in the yield of liquid assets, some of which became even negative. As mentioned previously about the QE, the portfolio rebalancing incentivizes banks to reduce their holdings of low or negative yielding assets and shift their portfolios towards higher-yield assets which can stimulate credit supply and the real economy. It is not entirely clear which of the two channels has a prevailing effect, however Bottero et al., (2020) found that the announcement of NIRP led to an increase in the growth rate of total bank credit and had expansionary effects on credit supply and the real economy. Similarly, Lopez et al. (2020) suggest that concerns about the move into negative policy rates may be unfounded, as the income effects for banks in countries with negative rates have been small as banks can manage negative rates reasonably well and that the standard monetary transmission mechanism appears to work, since the move into negative policy rates encourages these banks to rebalance their asset portfolios and increase their lending activities. Boungou (2021) shows that negative interest rates have reduced the lending cost of banks located in countries affected by negative interest rates, leading to an increase in the lending supply, particularly loans with maturities ranging from 3 to 12 months and over 5 years, in the year following the introduction of the policy. These results depend on bank-specific characteristics with large and high-deposits banks reacting more strongly to negative interest rates by adjusting their lending behavior.

NIRP has been identified as a tool that can enhance the effectiveness of easing strategies like forward guidance and QE during economic recessions and deflationary times. According to Rostagno et al. (2021), NIRP can increase real activity, credit, financial prices, and inflation, while reducing unemployment. This suggests that the combined implementation of these three policies can significantly stimulate economic activity in the euro area. Boungou (2019) supports this idea by stating that NIRP can ease financial conditions, reduce term and credit risk premia, and improve borrowers' creditworthiness. Schelling and Towbin (2022) provide empirical evidence that negative rates can have positive effects on lending, even in deep negative territory, by enabling high-deposit banks to expand their lending and capture market shares by offering more generous lending terms, especially to firms from risky sectors. Overall, these findings suggest that NIRP can be a powerful tool to promote economic growth and support lending activity in challenging economic conditions.

Chapter 6

UMPs Effects

Hauzenberger et al. (2021) found that the transmission channels of monetary policy are impaired during times of uncertainty, and Barnea et al. (2014) state that financial stability policy tools such as capital ratios, required reserves, collateral requirements and leverage constraints imposed by regulators can hamper the monetary transmission mechanism have significant impacts on the effectiveness of monetary policy. These findings highlight the need for central banks to consider both UMPs and macro-prudential policies when making policy decisions. By doing so, central banks can ensure the stability of the financial system and maintain macroeconomic stability even during times of uncertainty.

Avalos and Mamatzakis (2022) examined the overall impact of UMP on bank soundness in the Euro area, highlighting the importance of considering differences in institutional settings and economic fundamentals when implementing a single monetary policy. Therefore, understanding the importance of coordinated policy efforts is essential for effective monetary policymaking. The study reveals that the impact of UMPs on bank resilience is complex and depends on various factors, nevertheless UMPs have an overall positive effect on bank soundness. Regarding the effectiveness of UMPs, Hauzenberger et al., (2021) claim that while conventional policy measures are negatively affected by uncertainty, unconventional measures tend to be more effective in affecting the real economy and expectations during periods of high uncertainty. The analysis suggests that, in period of uncertainty, the combination of forward guidance and QE with conventional policy measures may compensate for deficits in the transmission of conventional policy measures and might make conventional policy effects more persistent and robust.

To get a more detailed view of the effects of UMPs, Bats et al. (2022) note that changes in the central bank's policy rate affect interest rates with maturities up to 1 to 2 years, but if rates are cut below the expected lower bound, it may affect rates up to 5 years. Forward guidance affects interest rates between 2 and 5 years, while longer-term refinancing operations impact interest rates up to 4 years. QE long-term bonds purchases affect rates with maturities of more than 5 years, while yield curve control programs, like the one implemented by the BoJ, affect interest rates with maturities up to 10 years. Similarly, Neely's (2014) study examines the effects of UMP announcements on bond yields, exchange rates, and international markets. The results show that these policies significantly reduced expected long-term U.S. bond real and nominal yields, as well as long-term foreign dollar-denominated bond yields and the value of the dollar. Overall, the success of UMP in reducing long-term interest rates and the value of the dollar stimulated the U.S. economy through the export channel. Other studies emphasize the critical role played by the broad credit channel and the loan demand channel in transmitting UMP shocks to prices, and the stock market during crisis periods.

Matthys et al. (2020) found that US banks effectively transmit UMP to the real sector by offering lower spreads to corporate borrowers, indicating that these measures have successfully eased overall credit conditions. The study conducted by Ferrando et al. (2022) examined the impact of UMPs on firms' expectations of future credit availability and their subsequent effects on investment and employment growth. The study found that the announcement of the Outright Monetary Transactions Program, negative policy rates, and the CSPP improved credit expectations for firms. These results indicate that funding expectations play an essential role in the transmission of UMP through the bank lending channel as firms with higher expectations of future credit availability exhibit higher investment and employment growth, implying that changes in funding expectations can affect real decisions. Similarly, Evgenidis and Salachas (2019) suggest that UMP has a positive impact on the euro area macroeconomy through the credit channel, as UMP encourages loan demand, enables banks to ease their lending standards, and enhances borrowers' net worth.

The studies by Bjørnlanda and Jacobsen's (2010) and Koeniger et al. (2022) analyze that the effects of monetary policy on the housing market, showing that changes in interest rates have an immediate impact on house prices in most countries, and house prices can provide important information for monetary policy decisions. However, the response of interest rates to house price shocks varies across countries, implying that house prices play a different role in the monetary policy setting in different economies. Both studies provide evidence that housing is an important channel in the monetary transmission mechanism as the effects vary significantly across different countries and that the differences in institutional characteristics are key factors that affect the transmission of monetary policy to the housing market.

Ferreira and Serra's (2021) study investigates the impact of UMP announcements on European securities markets, finding that UMP have a positive and significant effect on European stock prices, particularly for bank stocks. Haitsma et al. (2016), discuss the impact of unexpected conventional and unconventional monetary policy decisions and demonstrate that both types of policy surprises affect the EURO STOXX 50 index, with the most significant effects observed for UMP, underlining that the ECB's actions have a positive and significant effect on the largest European stocks, particularly for highly leveraged firms.

During the sovereign debt crisis and the COVID 19 pandemic, to manage the risk stemming from the fragmentation due to the existence of 19 sovereign bond markets in the Euro Area which does not provide adequate transmission of monetary policies, the ECB leveraged UMPs to monitor sovereign spreads and stabilize economic activity. Fanelli and Marsi (2022) claim that in a deflationary environment, a single expansionary measure can address both the risk of deflation and rising sovereign spreads, as a reduction in sovereign euro area spreads increases stock market prices. Neely's (2022) research found that UMP announcements by the Fed have significantly affected asset prices and reduced US and foreign long-term

yields. Similarly, Ambler and Rumler's (2019) study focused on the impact of UMP announcements on nominal and real yields, highlighting that UMP announcements could be effective in reducing real interest rates, which in turn could boost aggregate demand and inflation. According to Dell'Ariccia et al. (2018), UMP has proven to be highly effective in providing additional monetary accommodation, stabilizing financial markets preventing additional financial distress. These findings demonstrate that central banks are not powerless when rates reach the zero bound and that these policies have been useful in mitigating the negative effects of financial crises, by positively affecting stock prices and promoting real GDP growth together with price stability.

Conclusion

UMPs have been a defining feature of the post-financial crisis and findings suggest that during times of uncertainty, as the transmission channels of conventional policies are impaired, UMPs seem more effective in affecting the real economy and expectations. However, the efficacy and potential long-term consequences of these policies are still subject to intense debate among economists and policymakers. As a deeper understanding of UMP's effects is necessary to inform policymakers and guide their decisions effectively, there are several possible reflection points for future research. Future studies should undertake a more comprehensive analysis of the transmission channels of monetary policy in the context of UMP measures. Exploring the intricate dynamics and interplay of the various transmission channels can provide insights into the complex transmission process and potential unintended consequences, that in turn can help policymakers to develop and use alternative and more effective policies that could complement or replace UMPs. Moreover, future research should examine the impact of UMP on financial stability, including the long-term implications of the expansion of central bank balance sheets on the broader economy. Additionally, is necessary to analyze the effects of UMPs on different economies and institutional characteristics, particularly on the housing market and securities markets. In conclusion, empirical studies have yielded mixed results regarding the effectiveness of UMP in stimulating economic growth, boosting inflation, and mitigating financial crises. While these policies have been successful in providing liquidity support and stabilizing asset prices in financial markets, their impact on real economic variables like investment, consumption, and employment remains uncertain, with persisting concerns regarding potential unintended consequences of these measures. Overall, the effectiveness of UMP measures depends on a complex interplay of various factors, such as the specific economic context, the implementation of the policy, and the interaction with other policy tools. Further research and analysis are needed to better understand the long-term effects and trade-offs associated with unconventional monetary policy, as well as to develop more effective and targeted approaches to achieving desired economic outcomes.

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