MONETARY POLICY, FINANCIAL INSTITUTIONS, AND FINANCIAL STABILITY IN THE EURO AREA

Dissertation

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Abstract

Despite the extensive expansionary monetary policy in the euro area over the last decade, nominal and real interest rates, GDP growth, and inflation have remained at low levels. Consequently, the European Central Bank failed to reach its primary objective to maintain price stability over the medium term. In light of the ongoing strategy review of the European Central Bank, this doctoral thesis adds to the understanding of the effectiveness of monetary policy transmission in the euro area. In the absence of clear empirical evidence on the effectiveness of so-far implemented measures, future options to exit the era of persistently weak inflation are explored, considering more direct instruments. This theoretical thesis among others suggests the new tool of Investment Helicopter Money and examines the effect of the introduction of a digital euro on monetary policy transmission. However, the Global Financial Crisis has impressively demonstrated that price stability is no guarantee for financial stability. To complement the picture, the interbank market as a first venue of changes in policy rates is studied in further detail. A dynamic credit flow process between lending and borrowing institutions shows that higher volatility of reserve flows can result in a threat to the resilience of the financial system. Thus, future options of monetary policy advancements are suggested to strengthen both price and financial stability.

Chapter 1

Introduction

On January 1st, 1999, a new currency, the euro, was launched and a new supranational institution, the Eurosystem,[1] took over responsibility for conducting monetary policy in the euro area. Since then, it pursues its primary objective to maintain price stability in the euro area over the medium term (Article 127 of the Treaty on the Functioning of the European Union (TFEU), 2012). This objective is accompanied by a secondary, but subordinated objective of supporting economic growth and full employment as well as an implicit financial stability objective to "*contribute to the smooth conduct of policies [. . .] relating to the prudential supervision of credit institutions and the stability of the financial system*" (Article 127.5 TFEU, 2012).

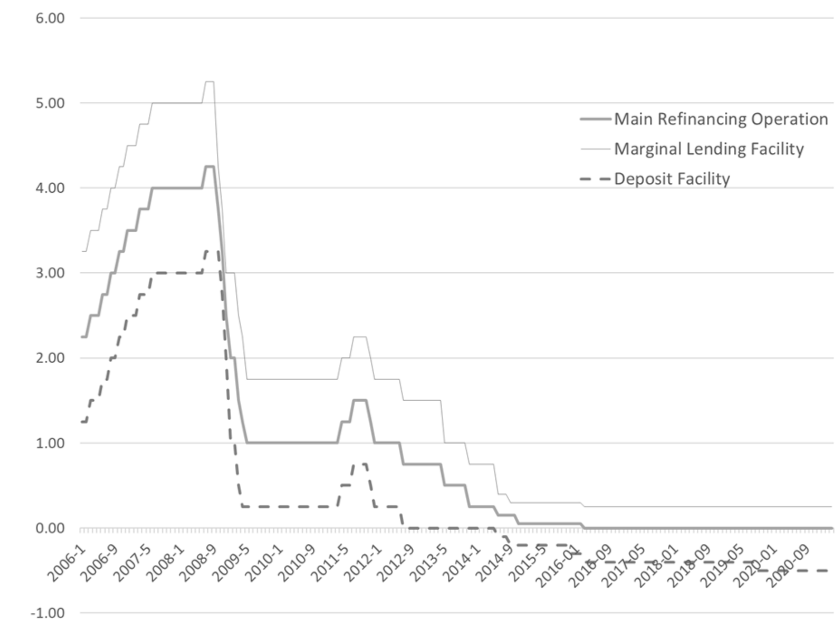
Since its strategy review in 2003, the ECB strives for an inflation rate of below, but close to 2 percent by steering money market, lending, and deposit rates. During the period of 1999 to 2007 inflation in the euro area has met its annual target, averaging 2 percent.[2] In late 2008, however, the effects of the Global Financial Crisis (GFC) unfolded, leading into the deepest recession in advanced economies since the 1930s. The crisis illustrated clearly that sustained price stability is no guarantee for financial stability and stressed the fundamental role of financial institutions in the monetary system.

To address the exceptionally severe and global economic downturn, monetary policy-makers initially responded by sequentially reducing policy interest rates to historical lows

[1] The Eurosystem comprises the European Central Bank (ECB) and the national central banks of all Member States of the euro area. On account of simplicity, the terms "Eurosystem" and "ECB" are used interchangeably throughout the thesis.

[2] Inflation is measured in terms of the quarterly overall Harmonised Index of Consumer Prices (HICP) over the period 1999 to 2007 with data retrieved from Eurostat (2021).

as shown in Figure 1·1. Soon interest rates reached the zero lower bound and conventional monetary policy tools were exhausted.



Source: Own representation with data retrieved from ECB (2021a)

Figure 1·1: Key Policy Rates of the ECB (2006 - 2020)

In an endeavor to provide further economic stimulus and to support the effectiveness of monetary policy, the ECB extended its monetary policy toolkit by innovative instruments, including negative interest rates, forward guidance, and balance sheet policies. In January 2015, the Eurosystem launched its large-scale asset purchase program to address the risks of too low inflation, which is commonly known as Quantitative Easing (QE).

Despite the usage of a broader scope of monetary policy instruments in the post-crisis era, inflation remained below target, averaging 1.3 percent over the period 2008 to 2020 (Eurostat, 2021). In October 2020, core inflation reached a new historical low of 0.2 percent (Eurostat, 2020). In the euro area, nominal GDP growth remains far slower than in pre-crisis times, having slipped from 3 percent in 1999 to 1.29 percent in 2019 (World Bank, 2021). Based on these developments, Lawrence H. Summers, former president of Harvard

University, and Anna Stansbury stated in 2019:

> *"Europe and Japan are currently caught in [...] a monetary black hole – a liquidity trap in which there is minimal scope for expansionary monetary policy."*

This environment poses fundamental challenges to central banks and questions the effectiveness of the current monetary policy framework. Since 2020, the ECB is in the process of reviewing its monetary policy strategy. It considers, amongst others, a revision of its inflation objective, monetary policy instruments, and the communication regarding the public good of its common currency. Overall, the developments described above point out that the operation and transmission of monetary policy in the euro area and its impact on economic activity need to be further understood. This thesis reassesses and discusses current challenges of monetary policy in the euro area. Looking to the future, it sheds light on remaining monetary policy options and new instruments to re-establish sound macroeconomic conditions. To complement the picture, it discusses the role of financial institutions with a particular focus on the interbank market to strengthen the resilience of the Eurosystem.

1.1 State of Research

We depart from a brief overview of the literature on the effectiveness of monetary policy. Following a review of the literature on the transmission of monetary policy from the central bank to the real economy, we focus on the role of financial institutions therein and finally survey perspectives on remaining policy tools to end the era of persistently weak inflation and slow GDP growth. Note that this is a broad overview of existing literature, while each of the following three studies discusses the associated and particularly relevant literature in a more comprehensive way.

1.1.1 Monetary Policy Transmission

As indicated above, the central bank cannot directly control inflation or output. Every monetary policy impulse has to be passed through the economy, ultimately affecting the price level. The effectiveness of this transmission process is subject to a long-standing and controversial debate. Several empirical studies find contradicting results of an exogenous monetary contraction, which can, on the one hand, cause an effective reduction in economic activity (e.g., Boivin et al., 2009; Weber et al., 2011) or, on the other, result in a small and even insignificant effect (e.g., Kim, 1999; Sims and Zha, 2006; Uhlig, 2005).

The complete transmission mechanism of monetary policy is generally regarded to be split into two stages. First, the change in policy rates is transmitted to financial markets, affecting asset prices, overall liquidity and credit conditions (ECB, 2000). Second, it is assumed to change spending behavior and affect real economic activity, though depending on wage and price reactions (De Haan et al., 2016).

Conventional Monetary Policy

Traditionally, the ECB uses conventional monetary policy (CMP) tools (i.e., main refinancing operations, standing facilities, and minimum reserve requirements), to directly affect money market interest rates in the interbank market (IBM), which are subsequently passed through to the banking sector, changing lending and deposit rates. The complete transmission process is regarded to take one to two years (ECB, 2010), including varying and unpredictable lag effects between policy impulse and price responses (Goodhart, 2001; ECB, 2019; De Haan et al., 2016), which result in transmission inertia and dilute the empirical identification of causal effects.

The operational target of monetary policy is the money market rate in the IBM. In the pre-crisis period, the IBM was regarded to operate perfectly, resulting in little research on its role in the monetary policy transmission process (Bucher et al., 2017; Jakab and Kumhof, 2015) and the steering of money market rates. Theoretical literature, thus, focused on the identification of a large variety of transmission channels of CMP, exploring the black box between changes in the policy rate and price responses - apart from IBM imperfections. According to Boivin et al. (2011), the identified channels can be categorized into two groups: neoclassical channels operating through the cost of capital and the credit view.

The most traditional channel is the "interest rate channel", according to which changes in the policy rate directly affect the user cost of capital and credit demand, which impacts investment and aggregate demand (Ireland, 2005; Mishkin, 1996). Regarding the pass-through to lending and deposit rates set by the banking sector, the literature has identified two main channels, both characterized by financial market imperfections. First, the "credit channel" as introduced by Bernanke and Gertler (1989) results from asymmetric information and operates through bank lending. Second, the "risk-taking channel" claims that the low interest rate environment can incentivize financial institutions to take higher risks in a search for yield (Borio and Zhu, 2012) or to affect financial institutions' measurement of risk regarding valuations, income, and cash flows (Gambacorta, 2009). As illustrated by the risk-taking channel, the literature has reached little consensus on the definition of the most important channels of monetary policy transmission, although offering a multitude of suggestions of CMP transmission channels.

Correspondingly, empirical evidence on the relative importance of these transmission channels remains inconclusive. For instance, Clements et al. (2001) identify the interest rate channel as the major transmission channel in the euro area in pre-crisis years. Their results show approximately 80 percent of all changes in the policy rate to be passed through this channel, while the credit channel appears to be of minor importance. In contrast to these findings, Egea and Hierro (2019) identify the credit channel to be dominating. Hence, it remains a challenging task to disentangle and quantify the effects of single transmission channels.

Furthermore, the speed of transmission remains unclear. For instance, the empirical study of Ehrmann (2000) finds a lag effect of two to eight quarters with the slowest transmission in Italy. In contrast, Havranek and Rusnak (2013) find the transmission to be the fastest in Italy. Their results indicate, on average, a longer overall lag of 12 quarters in the euro area. This ambiguity of empirical evidence on the transmission process in the euro area may be further complicated by the heterogeneity of countries, subject to a single monetary policy authority (cf. Barigozzi et al., 2014).

Consequently, analyses of the transmission mechanism of CMP remain inconclusive and incomplete. Although the theoretical literature argues in favor of a complete pass-through to real economic activity, the effect of monetary variables on real variables is still not completely understood (Freixas and Rochet, 2008). Empirical studies can only provide partial analyses of transmission channels, mainly regarding interest rate responses within the first stage of the transmission process. While the pass-through to money market rates, deposit and lending rates can be observed, the analysis of the transmission to real economic activity remains a key challenge. Some of the variables are not even observable (cf. Ciccarelli et al., 2015), therefore omitting the pass-through to investment and consumer spending and leaving the real effectiveness of CMP open to debate.

Unconventional Monetary Policy

Since all CMP transmission channels build on changes in interest rates, conventional interest rate policy was pre-crisis assumed to be restricted by the Zero Lower Bound (ZLB, McCallum, 2000). Previously to the GFC, the 2 percent inflation target was believed to be sufficient to minimize the probability of reaching the ZLB (Krugman, 2014). Post-crisis, however, the ECB, shifted gradually from interest rate to unconventional monetary policy (UMP), including the introduction of negative interest rates, large-scale asset purchases (i.e., QE), and increasing communication about future monetary policy (i.e., forward guidance) (more detailed chronologies of UMP in the euro area can be found in, e.g., Gambetti and Musso, 2017; Hammermann et al., 2019).

In a first phase, the ECB introduced UMP to prevent reaching the ZLB. Aiming to support monetary policy transmission, the ECB launched the Securities Markets Programme (SMP) and the Outright Monetary Transactions (OMT) in 2012. These programs focused on financial institutions and intended to incentivize banks to increase credit supply to the real-economy non-financial businesses. This was accompanied by a shift in the academic literature, paying increasingly attention to the role of the banking sector and its liquidity provision. Regarding the transmission channels, the credit channel (Ciccarelli et al., 2013; Darracq-Paries and De Santis, 2015) and the risk-taking channel (Altunbas et al., 2014; Jiménez et al., 2012) of monetary policy were more intensely researched. Concerning the former, e.g., Lenza et al. (2010) and Peersman (2011) find empirical evidence for an increased credit supply in the Eurozone, suggesting a stabilization of the financial sector. The transmission from the financial to the real sphere, however, could not be fully realized (Draghi, 2014).

Moreover, the seizing up of the IBM during the GFC has led to increased interest in imperfections of the IBM, including counterparty risk (e.g., Afonso et al., 2011; Freixas and Jorge, 2008; Heider et al., 2015), search costs for trading partners (e.g., Afonso and Lagos, 2015; Bech and Monnet, 2016; Vollmer and Wiese, 2016), or the impact of regulatory requirements (e.g., Bech and Keister, 2017; Bindseil, 2016; Jackson and Noss, 2015). Bech and Keister (2017), for instance, find that following the implementation of liquidity regulations, the central bank can have significant difficulties to control money market rates, and thus, to implement monetary policy.

Furthermore, the UMP measures undertaken by the ECB had a significant effect on day-to-day operations designed to set policy rates. Central banks switched from setting policy rates to satisfy reserve requirements to the rate paid on excess reserves (Borio and Zabai, 2016). To fight constraining market expectations and encourage bank lending, the ECB launched a stimulus package, including a negative interest-rate policy (NIRP). In June 2014, the ECB cut its deposit facility rate into negative territory and since then lowered it five times, reaching a historical low of -0.50 percent since September 2019. The transmission of NIRP is characterized by two main frictions. Firstly, financial institutions appear reluctant to pass through negative policy rates to deposit rates, fearing deposit withdrawals. Secondly, the transmission can be hindered when financial institutions hold increasingly cash instead of central bank reserves, which is referred to as the Effective Lower Bound (ELB). Hence, NIRP has shown that the lower bound is not, as previously assumed, zero, but negative because of cash storage costs.

Over time, negative policy rates have become a standard tool of the ECB, although they remain controversially discussed. The debate centers particularly on the trade-off between reinforced monetary policy transmission (e.g., Ryan and Whelan, 2019; Schnabel, 2020) and reduced bank profitability, which can result in a reduction of bank lending and higher risk-taking by financial institutions (see, e.g., Brunnermeier and Koby, 2018; Eggertsson et al., 2019; Heider at al., 2019). Overall, the effectiveness of NIRP remains open to debate. It is, however, noted, that research increasingly paid attention to the role of the banking sector within the transmission of monetary policy. Nevertheless, it has remained a long-standing and ongoing challenge to separate the effects between credit supply and credit demand, i.e., a shortage of willing and qualified borrowers, as explanatory causes for the dysfunctional transmission mechanism (e.g., Acharya et al., 2019; Giannone et al., 2011).

In the second phase, the ECB specifically aimed to bring inflation back to target. By actively using its balance sheet (Borio and Disyatat, 2010), new measures in the form of QE were implemented. The main transmission channels of those are referred to as the portfolio rebalancing channel (Gagnon et al., 2011; Gertler and Karadi 2011, 2013; Vayanos and Vila, 2009), which claims investors to rebalance their portfolio towards riskier assets, and the signaling channel (Bauer and Rudebusch, 2014; Christensen and Rudebusch, 2012; Van den End and Pattipeilohy, 2015) via which inflation expectations should be guided.

Yet, there is no clear evidence on the effectiveness of UMP in the euro area (Hachula et al., 2020). Some studies find significant impacts (Darracq-Paries and De Santis, 2015; Gibson et al., 2016) over heterogenous effects (Burriel and Galesi, 2018; Deutsche Bundesbank, 2016) to moderate impacts (Belke and Gros, 2019; Pattipeilohy et al., 2013). A particular difficulty in the empirical analysis of the effectiveness of UMP instruments remains the disentangling of effects caused by QE and those caused by other sources. On the other hand, the literature identifies negative side effects of UMP, such as a destabilization of the financial sector, the threat of asset bubbles (Ball et al., 2016), and a "doom loop" between banks and sovereign debt (e.g., Carpellini and Crosignani, 2018), raising concerns on financial stability.

In a speech held in March 2021 Fabio Panetta, Member of the Executive Board of the ECB, admitted: "*We [. . .] still face two prominent gaps that we need to close: the output gap and the inflation gap. And if we fail to do so with sufficient force [. . .] we could inadvertently hold back economic growth and depress inflation for years to come.*"

1.1.2 The Role of Financial Institutions

Before turning to those strands of the literature, which suggest new approaches to close the output and inflation gap, we will briefly review the economic thought of the role and function of banks in the monetary system, which has fundamentally changed over time. Traditionally regarded as mere intermediaries, channelling funds from savers to borrowers, banks were not adequately referred to in macroeconomic models (Werner, 2016). Following the GFC, however, financial institutions received increasingly attention and are rather regarded as money creators than as passive intermediaries, creating approximately 90 percent of the fiat money circulating in the current economy (cf. McLeay et al., 2014). The following section shortly reviews the debate on the role of banks in the economy and sheds light on the relationship between credit creation, monetary policy, and financial stability.

Traditionally, banks were assumed to be financial intermediaries, optimally allocating funds in the economy by accumulating real savings from non-bank depositors and lending them to non-bank borrowers. Major contributors to the financial intermediation theory of banking are, e.g., Keynes (1936), Tobin (1969), Diamond and Dybvig (1983), Bernanke and Gertler (1995). According to this widespread view, banks decrease transaction costs in the economy, fulfilling several transformation functions (see, for instance, Blanchard and Illing (2014) or Matthews and Thompson (2014) for textbook representations). According to this theory, ultimately, banks' loan provision is restricted by the quantity of previously collected loanable funds, mainly stemming from taking in retail deposits (or taking central bank credits).

Textbook models also refer to the fractional reserve theory of banking, which, however, has not entered the academic literature (Jakab and Kumhof, 2015). According to this theory, the banking system in aggregate can create a multiple of bank deposits from high-powered money injected by the central bank. The central bank has the monopoly power to create reserves, which can be held by the banking sector, and banknotes, which are available to the public. In this view, the central bank, thus, controls the quantity of reserves supplied and the required reserve ratio. The metric to measure broad money supply from the monetary base injected by the central bank is the standard money multiplier. While this metric remained stable in normal times, it has been criticized after the GFC (Carpenter and Demiralp, 2012; Disyatat, 2011; Goodhart, 2010) with banks increasingly holding excess reserves. The wide gap between theory and reality has called for a reassessment of the role of banks in money creation (ECB, 2011; Goodhart, 2010; Keister and McAndrews, 2009) and questioned whether the transmission mechanism was impaired by bank loan supply or credit demand.

Moreover, this theory assumes central banks to exercise control via the quantity of reserves supplied and the reserve ratio. In reality, however, various central banks have abandoned the reserve requirement (e.g., Sweden, New Zealand), supply reserves in unlimited quantity (though against adequate collateral) to safeguard financial stability and control short-term interest rates (Jakab and Kumhof, 2015). The quantity of reserves, thus, endogenously adjusts according to demand.

Following the GFC, the credit creation theory of banking has received increasingly attention. According to this theory, every bank loan provision simultaneously creates a corresponding deposit in the borrower's bank account. In this view, banks rather create deposits by lending than lending out existing deposits or reserves. Although the idea traces back to the early 20th century (Phillips, 1920), it was overruled by mainstream economic theory. In recent years, it has been supported by an empirical analysis (Werner, 2014) and applied to the current monetary system by several studies (see, e.g., Jakab and Kumhof, 2015; King, 2016; Ryan-Collins et al., 2012). According to this theory, the majority of money is fiat money, created by banks via credit provision (McLeay et al. 2014; Deutsche Bundesbank, 2017).

The literature has investigated in how far the credit creation of banks can have contributed to creating financial instabilities. For instance, the excessive stock and rapid expansion of credit can destroy macroeconomic stability (Bernanke, 2010; Gourinchas and Obstfeld, 2012; Mian and Sufi, 2011) or lead into crises (Jordá et al., 2013; Schularick and Taylor, 2012). Regarding the inflationary effects of credit creation, Werner (2016) distinguishes between the purpose of use. While productive uses are claimed to be inflation generating, credits financing financial activities leave inflation unaffected, resulting in financial bubbles (Werner, 2016).

In a nutshell, depending on which banking theory is dominant, different approaches to bank regulations and implications for monetary policy will result. The assessment of money supply in the economy and its implications for price stability have to be enhanced by the analysis of the credit creation process of the banking system and resulting implications for financial stability (Jakab and Kumhof, 2015; McLeay et al., 2014).

1.1.3 Currently Proposed Solutions

In the absence of clear evidence on the effectiveness of CMP and UMP tools and an increased concern on the smooth transmission via the banking sector, a new discussion has emerged, dealing with remaining policy tools of central banks and a more direct implementation of monetary policy.

On the one hand, suggestions refer to an extension of already implemented measures. Amongst others, it is suggested to further reduce NIRP below the current level (see, e.g., Ball et al., 2016), although limited by a "reversal rate" at which bank capital and lending capacity will be reduced (Brunnermeier and Koby, 2018). Moreover, interest rates would have to be reduced substantially in order to provide economic stimulus (Eggertsson and

Krugman, 2012). According to Ball et al. (2016), it is further suggested to extend the scope of asset purchases under QE, e.g., by purchasing private bonds, equities or shares in real estate investment trusts as already used by the Bank of Japan, or to use forward guidance more intensely in order to steer inflation expectations by referring to forecasts and commitments (termed "Delphic" and "Odyssean" by Campbell et al. (2012)).

The literature, on the other hand, also discusses the introduction of new policy tools. A first debate centers on the introduction of helicopter money as suggested by various organizations and some scholars (see, e.g., Bützer, 2017). Based on an early thought experiment of Friedman (1969), a helicopter dropping money from the sky, the idea was reintroduced in the policy debate by Bernanke (2002). Having persisted over decades in the academic debate it has received increasingly attention as alternative monetary policy tool to deliver monetary stimulus in the lower bound environment (see, e.g., Muellbauer, 2014; Turner, 2013, 2015), although its implementation is scarcely modelled in academic research (see, for instance, Buiter, 2014; Galí, 2019; Punzo and Rossi, 2016). The instrument seeks to channel purchasing power directly from the central bank to the non-bank private sector, thereby circumventing the dependence on commercial bank lending to raise aggregate demand.

A second debate considers the introduction of a new, electronic central bank liability, which is directly issued to the public. The desirability of issuing Central Bank Digital Currencies (CBDCs) has gained increasingly interest in recent years, leading to a rapidly growing literature, yet predominantly conducted by central banks. Since 2020, the ECB launched its digital euro project, which considers the introduction of a CBDC over the next five years (Lagarde, 2021). This may allow a more direct implementation of monetary policy (see, e.g., BIS, 2018; Davoodalhoessini et al., 2020). Further, interest-bearing CBDCs can serve as a new monetary policy tool, which tends to enhance transparency (Bordo and Levin, 2017).

In addition, interest-bearing CBDCs can potentially solve the problem of cash hoarding to avoid negative interest rates, and thus, lower the ELB (Bordo and Levin, 2017; Meaning et al., 2018). Rogoff (2014) argues generally in favor of a cashless economy, in which market participants cannot avoid negative interest rates and the ELB issue were solved. If cash is not abolished completely, the literature discusses to tax cash holdings, e.g, with devices to pay negative interest rates on cash holdings (Buiter, 2009) or a central bank lottery, which makes the "winner" serial numbers of banknotes worthless (Mankiw, 2009).

Finally, a debate reconsiders to raise the optimal inflation rate. Early proponents are Krugman (1998), Bernanke (2000) and Blanchard et al. (2010), while, e.g., Caraballo and Efthimiadis (2012) refer specifically to the euro area. The literature argues mainly for a modest increase to three or four percent (Ball et al., 2016; Blanchard et al., 2010). While main benefits refer to a raise in expected inflation and further distance to the ZLB (Ball et al., 2016), associated costs are overinvestment, distortions with the tax system and frequent price adjustments (see, e.g., Rodríguez Palenzuela et al., 2003). More generally, inflation targeting is suggested to have failed (Leijonhufvud, 2008) or even "*increase the likelihood of a financial crisis*" (Giavazzi and Giovannini, 2010). These considerations, however, rather refer to the exclusion of asset prices in the measurement of inflation, thus, calling for a reassessment of inflation measurement.

1.2 Research Gap

The current state of research has demonstrated various approaches aiming to clarify the path of central bank impulses transmitted through the economy, resulting in explanatory approaches of the inflation puzzle and suggestions on the improvement of monetary policy effectiveness. This section identifies the associated research gaps regarding monetary policy transmission and the role of financial institutions in the current slow growth- low inflation environment. Bridging these gaps improves policy decisions by providing a deeper understanding of the transmission of monetary policy and the role of financial institutions therein. The following subsections, however, provide only a broad overview, while the specific shortcomings and restrictions in the literature will motivate each chapter of this thesis in further detail.

1.2.1 Monetary Policy Transmission

As outlined in the previous section, the mutual interdependence of transmission channels of monetary policy has led to a long-standing and ongoing controversial debate about the identification and relative importance of operating channels (Egea and Hierro, 2019). Empirical studies mainly focus on interest rate and asset price responses to central bank tools, while the impact on economic activity is scarcely researched (Borio and Zabai, 2016; Wright, 2012). Some variables, such as credit demand or supply, are not even observable, which impedes the clear identification of a complete pass-through (cf. Ciccarelli et al., 2015). Consequently, especially the second stage of the transmission process from financial markets to real economic activity remains incompletely understood (Freixas and Rochet, 2008), leaving the operation of the entire transmission mechanism as a black box.

The effectiveness of implemented UMP tools is controversially discussed as it is difficult to disentangle QE-induced effects from other causes (Gern et al., 2015). While overall evidence suggests a heterogenous, but mainly successful effect on financial conditions (e.g., bond yields, asset prices and exchange rates), UMP raises concerns on undesirable side-effects (see, e.g., Ball et al. (2016) for an overview), long-term effectiveness as well as exit issues (Borio and Zabai, 2016). Further scepticism is raised, e.g., by Martin and Milas (2012) or Fabo et al. (2020), according to whom QE-supporting literature is dominated by central bank research, which may result in a conflict of interest when self-evaluating their own policies.

To the best of our knowledge, it remains unclear whether monetary policy interventions need more time, more strength, or a new approach to deliver on its objective. Existing research focuses on the financial sphere, while the transmission to the real sphere remains of crucial importance. In search of an effective economic stimulus, it may be the time to explore new avenues beyond the current UMP tools.

The literature of the proposal of helicopter money suffers from several drawbacks. A major shortcoming of the general concept is the dependence of its effectiveness on consumers' willingness to spend (Lavoie and Fiebiger, 2018; Van Rooi and De Haan, 2019).

Moreover, helicopter money is controversially discussed, mainly since it is regarded as a combination of monetary and fiscal policy (e.g., Galí, 2019; Rogoff, 2017), which raises concerns on central bank independence (Issing, 2015) and political as well as legal feasibility (Mayer, 2016). In addition, its implementation appears particularly difficult in the political setting of the Eurosystem without breaching the TFEU. Existing approaches, such as the Modern Monetary Theory (cf. Mitchell et al., 2019) do not take the specific institutional arrangements in the euro area framework into consideration and, e.g., do not separate between the monetary and fiscal authority. This calls for a more specific and Eurosystem-tailored proposal. Although having remained in the discussion over decades, the concept of helicopter money was never in-depth formalized in economic modeling. The literature remains mainly descriptive as its implementation is scarcely modelled in academic research (see, for instance, Buiter, 2014; Galí, 2019; Punzo and Rossi, 2016).

The second debate on the introduction of CBDCs is younger than the helicopter money approach, although more likely to be implemented since central banks are currently intensely researching the topic. According to Bofinger and Haas (2021), however, rather a digital alternative for an international payment system is needed than a digital substitute for cash. The majority of the CBDC literature is purely descriptive (Bech and Garratt, 2017; Bordo and Levin, 2017; Bjerg, 2017). A minority includes formal theoretical models of CBDCs (see, e.g., Andolfatto, 2018; Barrdear and Kumhof, 2016; Williamson, 2019), which mainly finds CBDCs to be welfare-improving. By contrast, the impact of the introduction of CBDCs on the banking sector remains inconclusive (e.g., Chiu et al., 2019; Keister and Sanches, 2019) and needs further investigation. Furthermore, the majority of the literature raises concerns regarding a destabilization of the financial system (Andolfatto, 2018; Brunnermeier and Niepelt, 2019; Carapella and Flemming, 2020; Fernández-Villaverde et al., 2020), while it remains unclear whether this risk can be mitigated. Empirical evidence is not yet given with scarce data availability, since the world's first CBDC was launched in 2020 (CBB, 2019), although several pilot studies are expected to deliver further insights. This early-stage research on CBDCs, thus, bears not only legal and organizational challenges, but needs further exploration on both, a theoretical as well as empirical level.

1.2.2 The Role of Financial Institutions

Despite the confirmation of the credit creation theory by McLeay et al. (2014) and Deutsche Bundesbank (2017), prevailing analyses are still dominated by the financial intermediation theory of banking. This results in conflicting views on monetary policy, bank regulation and financial stability. Moreover, the effects of the banking sector's credit creation on financial markets, but also on investment, inflation and growth needs to be further investigated

Although research gained increasingly interest in the operation of the IBM in the aftermath of the GFC, its operation is still not well understood and unclear how it exactly works (Allen et al., 2018). Empirical research on the IBM in the euro area is limited due to scarce data availability. Overnight data is only offered by the EONIA (European Overnight Index Average), while intraday trading can only be studied for the Italian IBM (e-MID) (Angelini, 2000; Baglioni and Monticini, 2008, 2010, 2013; Fricke and Lux, 2015). However, it is questionable whether the Italian IBM can be representative for the heterogenous set of countries in the euro area, hampering a generalization of results for monetary policy implications.

In addition, previous work on the euro area is dominated by studies on the effectiveness of expansionary monetary policy in the form of credit easing on the IBM (Lenza et al., 2010; Giannone et al., 2011, 2012), while the effect of contractionary monetary policy has been less investigated. Much of existing theoretical analyses of the operation of the IBM focuses on portfolio balance effects, referring to banks' balance sheet compositions and resulting stock equilibria (e.g., Bech and Keister, 2017; Hauck and Neyer, 2014). By contrast, the operation of the IBM between those equilibria, i.e., the flow adjustment process, is rarely considered (see, e.g., Reale (2019) for a stock-flow consistent model).

1.3 Structure of This Thesis and Outlook

To improve the transmission of monetary policy, and to enhance the understanding of the role of financial institutions in the financial system, three theoretical studies are presented in the following chapters: Which reasons could have diluted the transmission of the monetary impulse of the central bank to the real sector? How do interbank markets work? And how can a resilient financial system be safeguarded in a world of increasing uncertainty? These are key questions, which the following three chapters will deal with.

Chapter 2, *Boosting European Demand by Means of Investment Helicopter Money*, is joint work with Thomas Gries. It is a slightly revised version of a paper accepted for publication in Credit and Capital Markets in 2021. This contribution explains in further detail why a new monetary approach is currently needed in the euro area and further suggests the new concept of Investment Helicopter Money (IHM), applied to increase monetary policy effectiveness.

First, a comprehensive review of monetary policy transmission in the current framework presents theoretical and empirical evidence on an apparently impaired transmission mechanism. While interest rates and asset prices often respond to impulses of the central bank, the effects on the real economy, specifically on investments, are rarely observable. Hence, the paper explores potential future extensions of monetary policy instruments. Based on different concepts of helicopter money currently discussed in academic literature, the new approach of IHM is introduced. IHM aims to offer a direct real effect without crowding-out investment or rising debt levels. To further clarify the concept, the effects of IHM are compared with different monetary policy tools currently used. Most importantly, necessary institutional arrangements are discussed, and the suggested tool is contrasted with a simple monetary or fiscal impulse. We conclude with a discussion on whether its implementation would be within the ECB's mandate.

Having considered helicopter money (i.e., approaches under which money is distributed by the central bank directly to the non-bank private sector) in Chapter 2, Chapter 3 investigates the effects of a related recent project of the ECB on monetary policy transmission. The digital euro initiative researches the creation of a new, digital form of central bank money, which can be directly available to the non-bank private sector.

Chapter 3 results from the paper *Central Bank Digital Currencies and Monetary Policy Effectiveness* (single-authored), which was published in the Working Paper Dissertations Series No. 74/2021-06. It studies the potential impact on the transmission of monetary policy following the introduction of a universally accessible central bank liability. We first survey and interpret key properties of money and money-like assets in the current monetary framework, which motivates a discussion of the proposed forms of CBDCs and the digital euro. Against this background, the arbitrage model of Meaning et al. (2018) is extended and closed. This allows for investigating the effect of the implementation of CBDCs on the effectiveness of monetary policy transmission, liquidity regulations, and financial stability. In accordance with Meaning et al. (2018), our results imply monetary policy to be effective following the introduction of interest-bearing CBDCs, potentially reinforcing the transmission mechanism. Further, the ECB's (2020) suggestion is confirmed, referring to a mitigation of the risk of banking sector disintermediation by an increase in non-pecuniary benefits of holding bank deposits in relation to CBDCs.

Having analyzed financial instabilities resulting from a universally accessible central bank liability, the following chapter turns to financial instabilities in the current financial system, where access to reserves is restricted to the banking sector. It examines determinants of IBM stability, the interest rate of which serves as operational target of monetary policy implementation (Gabrieli and Georg, 2014).

Chapter 4, *Systemic Instability of the Interbank Credit Market*, again, is joint work with Thomas Gries. An almost identical version of this paper was published in the Working Paper Dissertations Series No. 75/2021-07. Furthermore, it is a slightly revised version of a publication in the Conference Paper Series 2019 of the Verein für Socialpolitik as "Beiträge zur Jahrestagung des Vereins für Socialpolitik 2019: 30 Jahre Mauerfall - Demokratie und Marktwirtschaft - Session: Empirical Finance, No. G05-V3". An earlier version of this paper was presented at several conferences, including the Money- Macro Finance Conference of the Research Centre for Economic Analysis (Warsaw, 2019), the Annual Conference of the European Financial Management Association (Ponta Delgada, 2019), the 36th Symposium on Money, Banking and Finance (Besançon, 2019) and the University of Queensland (Brisbane, 2020).

This contribution models dynamics in the interbank credit market. Pre-crisis regarded as smoothly operating, the IBM has increasingly gained attention following the market disruptions during the GFC. However, still very little is known about its exact operation (Allen et al., 2018). While traditional analyses refer to stock analyses, this study sheds light on a dynamic flow mechanism of reserves between lending and borrowing institutions.

In our theoretical model, credit supply is restricted by the availability of stochastic liquidity inflows to lending institutions. Following a shock in the form of an increase in volatility of these liquidity inflows, a sequential flow adjustment process sets in. In "normal times" the flow dynamics remain smooth within a stable adjustment regime. However, a higher volatility of reserve flows can change the lending process, resulting in a bifurcation of the equilibrium. Defining interbank "market resilience" as the probability of remaining in the stable regime, we identify determinants of falling in a regime of unstable dynamics and relate it to monetary policy tightening. To prevent falling in the unstable regime, implications regarding preventive ex ante as well as mitigating ex post policies are discussed.

Finally, Chapter 5, *Conclusion*, presents the main findings and insights of this thesis as well as resulting policy implications. In addition, it provides a brief outlook for future research.

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