THE DISTRIBUTIONAL EFFECTS OF MONETARY POLICY: A COMPARISON BETWEEN THE UNITED STATES AND THE EURO AREA

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Biographic note

Ester Almeida was born in Minas Gerais, Brazil on May 6\textsuperscript{th}, 1995. At the age of nine, she moved to Porto, Portugal, where she grew up.

In 2016, she graduated with a bachelor’s degree in Business Administration from the School of Economics and Management of the University of Porto. In the same year and school, she decided to further her education by enrolling in the Master of Economics programme.

While studying, Ester had two professional experiences in start-ups at Business Ignition Programme (BIP) where she created and developed a business model. In 2017, she accepted the challenge of moving to Copenhagen, Denmark, to work as Finance and Control Intern for Nestlé Nordics, where she currently holds the position of NBE Project Supporter.
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Abstract

This dissertation aims to study the distributional impact of monetary policy, focusing on the unconventional policies applied by the Federal Reserve Bank of America (Fed) and the European Central Bank (ECB) in response to the financial and economic conditions originated by the Global Financial Crisis.

Recently, the impact of monetary policy on inequality has received a renewed interest in the literature, which discusses the different channels through which the former affects the latter for several specific economies. Nonetheless, the detailed comparative analyses of the effects of monetary policies on inequality on different economies are still very scarce (Dobbs, Lund, Koller, & Shwayder, 2013). The main motivation for this dissertation is this gap in the literature.

First, the description of the evolution of monetary policy allows to conclude that the Fed and the ECB undertook unconventional instruments with distinct timings and scope. Second, the OECD data on income inequality demonstrates that, from 2007 to 2016, inequality has increased more in the United States than in the Euro Area, suggesting that wealth inequality could have had a similar evolution. Third, the literature review and the empirical evidence indicate that the distributional effects of non-traditional monetary policies are mainly driven by the portfolio composition channel.

Building on these findings, a comparative analysis of the contribution of the portfolio composition channel on wealth inequality is presented. The results suggest that, in the United States, the house factor has contributed to a decrease in wealth inequality since 2012, whereas the stock and bond factors have led to an increase in wealth inequality. In the Euro Area, the bond factor appeared to be the only factor contributing to an increase in wealth inequality.

JEL codes: D31, E31, E52, E58, E65, G12
Keywords: Monetary Policy, Inequality, Euro Area, United States, Income, Wealth.
Resumo

Esta dissertação tem como objetivo estudar os efeitos redistributivos da política monetária, focando-se nas políticas não convencionais aplicadas pelo Sistema de Reserva Federal dos Estados Unidos (Fed) e pelo Banco Central Europeu (BCE) em resposta às condições financeiras e econômicas originadas pela Crise Financeira Global.

Recentemente, a literatura sobre o impacto da política monetária na desigualdade tem recebido um novo interesse, discutindo os diferentes canais através dos quais a primeira variável afeta a segunda para diversas e específicas economias. Contudo, as análises comparativas entre os efeitos das políticas monetárias na desigualdade para diferentes economias são ainda escassas. A principal motivação desta dissertação é essa lacuna da literatura.

Primeiro, a descrição da evolução da política monetária permite concluir que o Fed e o BCE executaram instrumentos não convencionais em períodos e com âmbitos distintos. Segundo, os dados sobre a desigualdade de rendimentos da OCDE demonstram que, entre 2007 e 2016, a desigualdade tem aumentado mais nos Estados Unidos do que na Área do Euro, sugerindo que a desigualdade na riqueza pode ter tido uma evolução similar. Terceiro, a revisão da literatura e a evidência empírica indicam que os efeitos das políticas monetárias não tradicionais são principalmente transmitidos pelo canal portfolio composition. Com base nestas conclusões, apresenta-se uma análise comparativa da contribuição do canal portfolio composition para a desigualdade na riqueza. Os resultados sugerem que, nos Estados Unidos, o fator imobiliário tem contribuído para a redução da desigualdade na riqueza desde 2012, enquanto que os fatores ação e obrigação resultaram no aumento da desigualdade na riqueza. Na Área do Euro, o fator obrigação parece ter sido o único fator a contribuir para o aumento da desigualdade na riqueza.

Códigos JEL: D31, E31, E52, E58, E65, G12

Palavras-chave: Política Monetária, Desigualdade, Área do Euro, Estados Unidos, Rendimento, Riqueza.
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1. Introduction

The most noteworthy financial event of the beginning of this century was the Global Financial Crisis (GFC). This extraordinary event started in the United States (U.S.) in the summer of 2007 and then expanded to economies around the world, causing the Great Recession (Fontan, Claveau, & Dietsch, 2016). As the standard policy transmission channels were constrained due to the zero lower bound on short-term interest rates and the freeze of interbank and credit markets, central banks engaged into liquidity provision through unprecedented tools and mechanisms known as unconventional monetary policies (Lenza, Pill, & Reichlin, 2010).

The novelty of those non-standard policies and their apparent temporal coincidence with the rising level of inequality in advanced and emerging economies led researchers to question whether such monetary policies could have a substantial redistributive impact in the economy (Domanski, Scatigna, & Zabai, 2016). Such question is, moreover, motivated by the plausible redistributive effects of at least some of the transmission channels of non-standard policies.

The apparent association between monetary policy and inequality is important not only for social, but also for economic reasons. Socially, inequality may be considered by the public as an unfair consequence of this macroeconomic policy; therefore, limiting such negative outcome has an intrinsic value (Fontan et al., 2016). Economically, excessive levels of inequality may hinder the transmission of monetary policy to an important number of households, thus affecting the expected results of monetary policy (Banco de Portugal, 2017). Moreover, if the distributional effects of monetary policy turn from temporary to persistent, such policy-induced inequality can have an impact on long-term economic growth (Babu, Bhaskaran, & Venkatesh, 2016; Barro, 2000; Turnovsky, 2015). Hence, although the main goal of central banks is to maintain price stability, monetary policymakers have interest in understanding the relation between monetary policy and inequality for social, political and economic reasons (Deutsche Bundesbank, 2016), and such knowledge may influence the design of monetary policy (Coibion, Gorodnichenko, Kueng, & Silvia, 2017).

The redistributive effects of monetary policy (conventional and unconventional) has recently received a renewed interest as a research and policy topic, with many economists contributing to the literature. The literature includes several analyses of specific economies, such as the U.S. (Coibion et al., 2017; Davtyan, 2017; Doepke, Schneider, & Selezneva, 2015), the United Kingdom (Mumtaz & Theophilopoulou, 2017), Japan (Inui, Sudo, & Yamada, 2017).
and the aggregate Euro Area (E.A.) (Guerello, 2018; Lenza & Slacalek, 2018; Samarina & Nguyen, 2019). However, the detailed comparison between the impact of monetary policies on inequality on different economies is still very scarce (Dobbs et al., 2013). This is a key motivation for this dissertation.

This dissertation builds on the differences between the conduct and timing of conventional and unconventional monetary policies following the Great Recession in the U.S. vs the E.A., and on the differences between changes in inequality in those areas in the relevant periods. Its aim is to uncover the likely effects of recent monetary policies on inequality, comparing policies and outcomes in the U.S. and the E.A.

Regarding monetary policy, the main facts are that unconventional policies were launched immediately in 2008-09 in the U.S., but only more recently and with different instruments in the E.A.

Regarding inequality, the main facts are that, from 2007 to 2016, income inequality, measured by the Gini coefficient of market income, has increased 2% in the E.A. and 5% in the U.S.; moreover, in the U.S., the Gini coefficient increased by 2% only from 2009 to 2010.

Based on these facts, this dissertation aims at contributing to answering the following question: Could the different outcomes regarding inequality be associated with the differences in unconventional tools and timings of unconventional policies in the U.S. vs the E.A.?

With such purpose, this dissertation will: i) Present and compare the evolution of the monetary policy of the Fed and of the ECB since 2007; ii) Describe the channels through which monetary policy affects inequality; iii) Review and summarize the conclusions of the literature and iv) Provide an analysis of the redistributive impact of unconventional policies.

The dissertation is divided into five chapters. The current one, Introduction, indicates the motivation and objectives of this study. Chapter 2 describes monetary policy in the U.S. and in the E.A., starting with the conventional pre-financial crisis framework, and then, after briefly explaining the new economic background brought about by the crisis, explaining and comparing how unconventional monetary policies were implemented in the U.S. and the E.A. Chapter 3 presents the concept of inequality and some of its most used measures, and discusses the main trends in inequality in the U.S. and the E.A., essentially by graphical means. Chapter 4 relates the two topics, monetary policy and inequality: First, explaining the channels through which monetary policy impacts inequality according to the literature; Secondly, reviewing the results in the literature for each channel; Lastly, presenting our own analysis and discussion of the literature. The dissertation ends with a brief conclusion in chapter 5.
2. Monetary Policy

Monetary policy comprises the interventions by central banks with the tools at their disposal (instruments) to achieve their statutory goals (objectives). To do so, central banks rely on several channels of the transmission mechanism of monetary conditions to aggregate demand and aim at the final objectives of nominal and real stability (Tuckwell & Mendonça, 2016).

The policy goals of the Federal Reserve Bank of America (Fed) and the Eurosystem (ECB)\(^1\) have been distinct from their outset. In the Federal Reserve Act, Section 2A, it is stated that the Fed aims at promoting price stability, employment maximization and long-term interest rates moderation (Board of Governors of the Federal Reserve System, 1913). For the Fed, price stability is “inflation at the rate of 2 percent, as measure by annual change in the price index for personal consumption expenditures” (Board of Governors of the Federal Reserve System, 2019b). The ECB, according to the Treaty on the Functioning of the European Union (2008), Article 127, aims unambiguously at maintaining price stability, which consists in a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) below but close to 2% over the medium term (European Central Bank, 2011).

Up until the GFC, the standard instruments at the disposal of both central banks were deemed adequate to accomplish their goals. Additionally, the mechanisms were not very dissimilar between the Fed and the ECB, as will be detailed below. Nonetheless, due to the GFC, the zero-lower bound on nominal interest rates (ZNLB\(^2\)) became binding and the interbank and credit markets became frozen, which turned the standard tools inoperative and led to the need of both central banks engaging into liquidity provision through unconventional mechanisms. These, differently from the conventional, may be considered more distinct between the Fed and ECB.

The novelty of those unconventional policies and their temporal coincidence with the rising level of inequality in the U.S. and the E.A. (actually throughout advanced and emerging economies) led researchers to question whether such monetary policies could have a substantial redistributive impact in the economy (Domanski et al., 2016); hence, the motivation for this dissertation.

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1 In this dissertation, the actions decided upon and applied by the Governing Council of the Eurosystem are presented as ‘ECB’ measures. Indeed, throughout the dissertation, ‘ECB’ should be considered as ‘Eurosystem’, which is the actual monetary policymaker in the E.A.

2 In this dissertation, in line with the literature (Cœuré, 2015), ZNLB refers to a situation in which short-term interest rates achieved zero or became very close to that bound.
Against this background, to compare the effects of monetary policy on inequality in the U.S. and the E.A., it is mandatory that we start by describing the functioning and evolution along time of monetary policy in the U.S. and the E.A. In this chapter, we briefly describe and compare the conventional and unconventional monetary policy of the U.S. and the E.A., including their timings, tools, quantitative dimension and transmission mechanisms. To achieve our aim, we divide the presentation into a subchapter relative to the conventional policies – dominant before the GFC – and other relative to the unconventional policies – that became dominant following the GFC.

A summary of the main monetary policies measures of the Fed and ECB applied after the GFC is presented in Table A 1 and Table A 2, respectively.

2.1. Conventional Monetary Policy

The primary objective of both the Fed and the ECB is to maintain price stability, which is considered a pre-condition to achieve high levels of economic growth and employment as well as stability of the financial system (subsidiary objectives more explicitly stated in the case of the Fed). Both institutions aim at sustaining the inflation rate close to 2% over the medium term (Board of Governors of the Federal Reserve System, 2012; European Central Bank, 2018), therefore avoiding persistent price fluctuations.

To attain the inflation target, conventional monetary policy acts by setting short-term money market interest rates, therefore influencing overall interest rates and, indirectly, asset prices, wealth and currency exchange rates, which, in turn, will impact investment, production, employment and inflation (Board of Governors of the Federal Reserve System, 2016).

The transmission of the monetary policy to the real sector comprehends a number of mechanisms and distinct economic agents (European Central Bank, 2011). This complex process initiates with central banks’ definition of the interest rates at which commercial banks should lend to each other overnight. In the U.S., the key official interest rate is named the federal funds rate (FFR) (Board of Governors of the Federal Reserve System, 2016); in the E.A., the overnight money market rate, the EONIA, is influenced more indirectly by the ECB, as will be seen next in this subchapter. To influence the price of the operations among commercial banks, the central banks detain a set of conventional tools.

The Fed’s traditional monetary policy tools for targeting the main funding rate, the FFR, are (Board of Governors of the Federal Reserve System, 2016):
- **Open market operations (OMOs):** purchases or sales, in the open market, of U.S. government and agency securities. Each transaction with the counterparties affects the volume of reserves in the banking system and, thus, the FFR level. These transactions may be temporary (including a repurchase agreement on a given collateral) or permanent.

- **Discount window lending:** facility through which all depository institutions can have access to overnight liquidity by borrowing from the Fed. These loans are available at a discount rate that is higher than the targeted FFR, acting, therefore, as a ceiling on the price of liquidity available to banks. There are three types of discount window lending: primary credit, secondary credit, and seasonal credit. The primary credit is available only to depository institutions with credible financial conditions. Other institutions can, nevertheless, borrow from the secondary credit, if eligible for the discount window, at a higher interest rate.

- **Reserve requirements:** mechanism through which the central bank controls the percentage of deposits that depository institutions must hold as reserves, thus influencing their demand for reserves.

The ECB’s traditional monetary policy tools for achieving EONIA are (European Central Bank, 2006, 2011):

- **Open market operations:** operations of liquidity provision, against collateral, or absorption conducted by the ECB with the E.A.’s money market counterparties. These operations include main refinancing operations (MROs), longer-term refinancing operations (LTROs), fine-tuning operations (FTOs) and structural operations (SOs). The MROs are the most important instrument and consist in one-week liquidity provision to counterparties against a collateral. Its interest rate is the main refinance rate. The LTROs were initially set as 3-month operations, but with some flexibility on the maturity. The FTOs and SOs were not standardized from the outset. Similar to the Fed, each transaction with the credit institutions influences the liquidity in the banking system and, thus, the EIONA and the money market rates for other maturities.

- **Standing facilities:** overnight credit and deposit facilities available to all counterparties at their own initiative with no quantitative limits. Counterparties can
use the marginal lending facility to acquire overnight liquidity against eligible assets and the deposit facility to make overnight deposits. The marginal lending facility interest rate sets a ceiling to the short interest rates, whereas the deposit facility provides a floor for the short interest rates. Contrary to the open market operations, the standing facilities are operated by the national central banks.

- **Minimum reverses:** minimum deposit system, based on a percentage of the shorter-term deposits, that the credit institutions must hold on the national banks. This tool aims at creating a structural need of funds by banks as well as stabilising money market interest rates (given their monthly computation).

In spite of some differences, such as on the number of counterparties\(^3\), the type of open market operations\(^4\) and the set of overnight facilities\(^5\), the core characteristics of conventional monetary policy tools of the Fed and the ECB were rather similar (Rehbock, 2013). Both intended to act on the liquidity of commercial banks and therefore set the interest rates at which these commercial institutions lend to each other at the shortest maturities. Consequently, this affects the whole spectrum of interest rates at which banks and other lenders offer fund to one another, to companies and to households (Board of Governors of the Federal Reserve System, 2018). As for the longer-term interest rates, they are essentially determined by expectations on the evolution of future (short-term) monetary policy interest rates as well by the degree of risk aversion and *premia* – both comprised in the yield curve. By influencing longer rates, policy subsequently affects lending and spending by rational consumers and businesses and the prices of goods and services in the economy.

In 2008, the financial and economic conditions resulting from the most noteworthy financial event of the beginning of this century, the GFC, would require the use of non-conventional monetary tools and mechanisms by the Fed and ECB, as will be explained next.

### 2.2. The Global Financial Crisis

The GFC alludes to the time span of severe tensions in the worldwide financial markets and banking systems between the summer of 2007 and early 2009. The cause of this extreme event can be pointed out as the combination of four factors: low interest rates, excessive

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\(^3\) The Fed operates directly only with 20 primary dealers, whereas the ECB deals with approximately 2000 credit institutions (Lenza et al., 2010).

\(^4\) The Fed buys or sells securities, while the ECB lends to banks (Rehbock, 2013).

\(^5\) The Fed provides one facility, whereas the ECB provides two (Rehbock, 2013).
risk-taking by banks, insufficient regulation for financial instruments and globalization (Ellis, 2009; The Reserve Bank of Australia, 2018).

In the U.S., the period preceding the GFC was marked by economic stability and strong development. Against this background, and due to legislation changes on mortgage loans during the 1990s, subprime lending started to grow and, consequently, house prices (Gorton, 2008). Expectations that house prices would continue to increase created an incentive for demand and supply in the mortgage-credit market. From the demand side, the low interest rates encouraged subprime borrowers to indebt themselves to acquire and build houses. From the supply side, banks and other lenders were convinced that the favourable economic conditions would continue, not assessing accurately the risk of their clients’ credit default. The loans provided by the banks were grouped in packages, overall denominated mortgage-backed securities (MBS), which included mortgage loans with distinct real risks, and sold to investors as representing low risk assets. These investors encompassed banks from the U.S. and from Europe (The Reserve Bank of Australia, 2018).

The attractiveness of this market would, however, fade with the increase of credit cost. Between 2004 and 2006, the Fed rose its interest rates from 1.00% to 5.25% and house prices started to decline, preventing borrowers from repaying their debts (Matthews & Driver, 2015; The Reserve Bank of Australia, 2018).

Stresses in the financial system first appeared in mid-2007, culminating in the crash of the MBS market in 2008, when speculators attempted to recover some of their investments by selling MBS securities, but few investors were purchasing (Matthews & Driver, 2015). In September of the same year, Lehman Brothers, one of the largest investment banks in the U.S., filed for bankruptcy, generating a panic in the financial markets (The Reserve Bank of Australia, 2018). Thus, the tensions in the housing market contaminated the money markets, wherein banks and other financial institutions lacked trust in each other and in other agents, and had therefore decided to minimize the credit.

The first reaction of central banks to the tensions in the interbank market that preceded the GFC was to inject overnight liquidity to banks, pushing down the short-term interest rates to unprecedented levels (Figure 1). Conventional monetary policy tools were, thus, the initial response of the Fed and the ECB. The ECB reacted by providing unlimited overnight

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6 Since 1992, the standard requirements were gradually relaxed by the Federal National Mortgage Association and by the Federal Home Loan Mortgage Corporation (Matthews & Driver, 2015).

7 Subprime borrowers refer to agents with high default risks (Matthews & Driver, 2015).
liquidity to banks in a total of €95 billion, on 9 August of 2007, and by executing additional refinancing operations with extended maturities of up to 6 months, later on (European Central Bank, 2011). The Fed also facilitated access to liquidity by easing the terms on primary credit and by conducting auctions of fixed quantities of discount window credit (Board of Governors of the Federal Reserve System, 2016).

On 15 September 2008, when the Lehman Brothers’ collapse alarmed the financial markets, the Fed and the ECB needed to resort to innovative measures (Lenza et al., 2010). Regarding the conventional interest rate policy, the main refinancing rate was reduced by 50 basis points (bp) on 8 October 2008 and by 325 bp during the next 7 months, achieving a historic level of 1.00% in May 2009, while the federal funds rate target was initially cut by 5.25% and then reduced to a range of 0 to 0.25% at the end of 2008 (Board of Governors of the Federal Reserve System, 2016).

**Figure 1. Main Policy Rates**

![Image of Figure 1](image_url)

Source: Fed, ECB

Soon after the GFC, the standard monetary policy tools became inoperative as the ZNLB was reached at the beginning of 2009 in the U.S. and the interbank and credit markets froze both in the U.S. and in the E.A. (the ZNLB would only become binding during 2014, in the case of the E.A.). This raised the need for a gradual adoption of non-standard policy measures by the Fed and ECB. Even though their policy responses differed in many details, they have common features, such as expanding their balance sheets (Lenza et al., 2010), as will be discussed in the next division.
2.3. **Unconventional Monetary Policy**

Unconventional monetary policy refers to the measures employed by central banks that are not part of their standard policy toolbox (Smaghi, 2009). Unconventional policy comprises both the creation of new instruments (e.g., preannouncement of policy measures or large-scale purchase of assets) and the new use of traditional instruments (e.g., negative official interest rates and refinancing operations conditional on the transmission of the liquidity to the non-financial sector). Non-standard measures can be divided in four categories (Dobbs et al., 2013):

- **Liquidity facilities**: provision of liquidity to the banking sector in the money market;
- **Credit facilities**: liquidity provision by credit conditional on lending from the banking sector to the economy;
- **Large-scale asset purchases**: outright acquisition of financial assets by central banks, until maturity, to inject liquidity directly into the economy; it includes quantitative easing (QE), which corresponds to an expansion of the central bank balance sheet (Lenza et al., 2010);
- **Forward guidance**: public communications about the future of the monetary policy.

Another distinction often present in the literature is between unconventional policies of qualitative easing – changes in the composition of the central bank’s balance sheet – and quantitative easing – change in the size of the central bank’s balance sheet. While in an initial phase of the GFC the former were dominant, since the explosion of the GFC with the Lehman Brothers’ collapse on 15 September of 2008, monetary policies evolved to a combination of the former with the latter (Lenza et al., 2010), including also some signalling about the future of the balance sheet of the central bank and overall monetary policy.

In view of the specificities of the unconventional monetary policies conducted by the Fed and ECB, in terms of timing, instruments and dimension, we now turn to a detailed description of the responses of each central bank and comparison between both policies.

2.3.1. **Federal Reserve System**

The Fed’s initial response to the GFC – reduction of the FFR – diminished some of the strains in the financial markets, but the GFC and the recession of 2007 soon proved to be
too severe, calling for the implementation of non-traditional policies.

One of the first less conventional policy measures was the reduction of the interest rate and the increase of the maturity – up to 90 days – of the primary credit discount window facility.

Moreover, to tackle the pressure on short-term markets, a temporary Term Auction Facility (TAF) was created. This consisted in providing liquidity to eligible depository institutions through an auction system with a more extensive range of collaterals than the one accepted before in the open market operations (Board of Governors of the Federal Reserve System, 2008). The initial TAF auctions aimed at supplying $20 thousand millions over a 28 days maturity, but during 2008 the amount auctioned increased to $150 thousand millions and the maturity could be of 28 or of 84 days (Board of Governors of the Federal Reserve System, 2009).

Additionally, exchange temporary swap arrangements were established with other central banks, notably with the ECB, to reduce the pressure in the foreign short-term dollar markets (Board of Governors of the Federal Reserve System, 2008).

From 2008 onwards, the Fed adopted a comprehensive unconventional approach, as described below. With the aim of injecting liquidity in the economy and of pressing downwards longer-term interest rates, the Fed announced the following programmes (Board of Governors of the Federal Reserve System, 2009):

- **The Term Securities Lending Facility (TSLF).** The Fed would lend up to $200 thousand millions of U.S. treasury (UST) securities to primary dealers over a maturity of 28 days, rather than overnight, and against an extended list of collaterals (Burton, Nesiba, & Brown, 2010)

- **The Primary Dealer Credit Facility (PDCF).** Mechanism similar to the discount window, through which primary dealers could borrow overnight liquidity directly from the Fed. This was the first time that nonbank institutions were included in Fed lending.

- **Support of Critical Institutions.** To diminish the negative implications of the bankruptcy of financial institutions, the Fed intervened to support Bear Stearns, the American International Group, the Citigroup and the Bank of America.

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8 In this dissertation, we use the long numeric scale.
▪ **The Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF).** The Fed allowed U.S. depository institutions and bank holding companies to use money market mutual funds to purchase high-quality asset-backed commercial paper (ABCP).

▪ **The Commercial Paper Funding Facility (CPFF).** Credit provided to eligible commercial paper issuers.

▪ **The Money Market Investor Funding Facility (MMIFF).** The purchase of local currency certificates of deposit and commercial paper from eligible investors of the U.S. money market mutual funds and from other similar entities.

▪ **The Term Asset-Backed Securities Loan Facility (TALF).** The Fed facilitated credit to households and small businesses in exchange of asset-backed securities (ABS) collateralized by minor loans, such as students’ and credit cards’, and loans guaranteed by the Small Business Administration.

▪ **Direct Purchase of Assets.** The first Large-Scale Asset Purchase (LSAP1) programme, announced in 25 November 2008, consisted in purchasing up to $600 thousand million of assets, both housing related debt obligations ($100 thousand million) and agency MBS backed by Fannie Mae, Freddie Mac and Ginnie Mae ($500 thousand million). In March 2009, the LSAP1 was expanded to include the purchase of agency securities by a total of $850 thousand million and of longer-term UST securities by a total of $300 thousand million.

In addition, the conventional monetary policy was combined with guidance on the future of the monetary policy: the Fed reduced the FFR to a range of 0 to 0.25% and communicated that these “exceptionally low” levels of the FFR would likely be maintained “for some time” (Labonte, 2019).

On 24 September 2009, as the financial market conditions improved, the Fed decided to decrease gradually the liquidity provided through the TAF and to reduce the maturity of credit provision from 90 days to 28 days. Furthermore, between October 2009 and February 2010, several liquidity and credit facilities expired (TSLF, PDCE, AMLF, CPFF and MMIFF) (Board of Governors of the Federal Reserve System, 2010).

The financial conditions indicated a sustained recovery along the first quarter of 2010, but the negative spillovers of the fiscal strains in Europe affected the expected results in the
domestic market. Of highlight is the consequent rise in the credit spreads on some U.S. corporate, the re-emergence of tensions in the short-term funding markets and the decline in broad equity price indexes. In response, in November 2010, the Fed introduced the LSAP2, which involved further acquisitions of $600 thousand millions of longer-term UST securities until June 2011 at a pace of about $75 thousand million per month (Board of Governors of the Federal Reserve System, 2011). This programme aimed at reducing the pressure on longer-term interest rates and the foreign exchange value of the dollar, and at improving asset prices.

In its August 2011 policy statement, the FOMC also announced it would keep the FFR at zero until 2015 (Board of Governors of the Federal Reserve System, 2015c). One month later, the Fed revealed a new asset purchase programme – the Maturity Extension Program (MEP). Like the LSAP2, its objective was to put downward pressure on longer-term interest rates, but the procedure to fund the purchase of longer-term securities was different. On the LSAP2, the Fed had issued bank reverses, changing its balance sheet. On the MEP, on the other hand, the Fed would fund the purchase of longer-term UST securities (6 to 30 years) by selling $667 thousand million of short-term UST (3 years or less), leaving the balance sheet little altered (Board of Governors of the Federal Reserve System, 2013b; Femia, Huther, & Tambalotti, 2011).

In September 2012, given a sluggish recovery of the economy, the FOMC announced its third LSAP programme. Unlike the first two asset purchase programmes and the MEP, the LSAP3 was open-ended, meaning that the total size of the whole programme was not indicated when announced and activated. The LSAP3 initially consisted in purchases of agency MBS at a pace of $40 thousand million per month (Board of Governors of the Federal Reserve System, 2013a), but as of January 2013, these purchases were supplemented by $45 thousand million per month of longer-term UST (Board of Governors of the Federal Reserve System, 2014).

In December 2013, given signs of economic recovery, the FOMC started to slow the rate of its asset purchases, achieving a rate of $10 thousand million per month in early 2014 (Board of Governors of the Federal Reserve System, 2014). Later, in October 2014, the LSAP3 was concluded (Board of Governors of the Federal Reserve System, 2015a).

In 2015, the FOMC decided to change the interest rates for the first time in seven years by increasing the target range for the FFR to above zero. Yet, it communicated that “the timing and size of future adjustments to the target range for the FFR” would depend on
“the realized and expected economic conditions relative to its objectives of maximum em-
ployment and 2 percent inflation” (Board of Governors of the Federal Reserve System,
2015b).

Since then, the monetary policy of the Fed has mainly consisted on conjugating conve-
nventional tools with forward guidance.

2.3.2. European Central Bank

The impact of the GFC on the E.A. was especially strong, for several idiosyncratic rea-
sons. One is the fragmentation of the European banking system, which made it even more
difficult for monetary policy to be transmitted throughout the E.A. Another, is the relative
hesitation of the ECB to launch strong unconventional measures, given their youth and still
recent credibility. And yet another is the lack of a mechanism for sharing risk across coun-
tries, which leaves the responsibility to support national banking sectors to the respective
sovereigns (Praet, 2017).

Against this background, the crisis was more prolonged and comprised several stages that
can be grouped in three phases (Cour-Thimann & Winkler, 2012; Lane, 2012; Praet, 2017):

i. The Global Financial Crisis (2008-2009);

ii. The Euro Area sovereign debt crisis (2010-2012);


Following the initial phase, the financial and economic crisis escalated into a sovereign
crisis in 2010 (Fratzscher, Duca, & Straub, 2016). Then, despite the unconventional re-
sponses of the ECB to deal with the GFC and the sovereign debt crisis, the E.A. economy
remained subdued and there was an increasing expectation of deflation – which eventually
led to stronger unconventional measures.

2.3.2.1. The Global Financial Crisis and the ECBs response

The Lehman Brothers’ collapse on 15 September of 2008 alarmed the European financial
markets to the point that the solvency of many European financial institutions became un-
certain (Jägera & Grigoriadis, 2017). Given the dominant role of banks as providers of credit
to firms and households in the E.A., the ECB had to improve bank liquidity (Lenza et al.,
2010). The ECB started by reducing its key interest rates but had to resort to some unconven-
tional policies from October 2008 onwards. The first non-standard measures were the
following (Cour-Thimann & Winkler, 2012):

- **Fixed-rate full allotment (FRFA).** The ECB started providing unlimited liquidity to monetary and financial institutions at a fixed interest rate. This was applied to all refinancing operations (European Central Bank, 2017a).

- **Extension of the maturity of liquidity provision.** The maximum maturity of the LRTOs was extended from three months to twelve months (European Central Bank, 2011). This, in combination with the first component, preserved the money market interest rates at low levels and contributed to the ECB’s intermediation task.

- **Extension of collateral eligibility.** The spectrum of collaterals accepted in refinancing operations was extended to riskier and less liquid assets.

- **Currency swap agreements.** Increase in provision of liquidity in foreign currencies, in particular U.S. dollars, at different maturities, and against euro-denominated collateral.

- **Covered bond purchase programme (CBPP).** The ECB announced the gradual purchase of covered bonds in a total of €60 billion between June 2009 and June 2010. Covered bonds are securities backed by mortgages and held on the consolidated balance sheet of the issuer.

These unconventional mechanisms have deterred the collapse of the financial system. However, the fragmentation of the banking system, the fragility of public finances in the more vulnerable countries and the lack of risk-sharing mechanisms in the E.A. prompted a sovereign crisis in 2010 (Fratzscher et al., 2016). The main underlying reason for the vicious circle “financial crisis – sovereign crisis – financial crisis” was the lack of cross-country risk-sharing mechanisms, with the responsibility to support national banks resorting to the respective sovereigns (Praet, 2017).

### 2.3.2.2. The Euro Area sovereign debt crisis and the ECBs response

The GFC had different effects across the E.A. For the periphery economies, the international financial flows dry-up of the late 2008 had a larger negative impact due to the dependency of these economies banking system on international short-term debt markets. Consequently, the sovereigns of the respective national banks were responsible for supporting their financial institutions, resulting in an increase of their deficit. In late 2009, there was apparent
evidence of larger-than-expected deficit-to-GDP ratios in several countries. This would represent the first link of the vicious cycle “financial crisis – sovereign crisis – financial crisis”. The most concerning economy was Greece, with a revised 2009 budget deficit forecast equal to more than the double of the one presented by the previous government (Lane, 2012).

In early 2010, the market tensions reappeared in some segments, mainly due to the market expectations about a possible sovereign default in Greece, with a risk of negative spillovers on Italy, Ireland, Portugal and Spain. Subsequently, government bonds yields reached unseen levels, affecting the private-sector lending rates, the bank balance sheets and liquidity provisions. This would represent the second link on the vicious cycle and would require again an unconventional approach to sustain the efficiency of the transmission of the monetary policy to the real economy. In May 2010, the ECB launched the Securities Markets Programme (SMP), which consisted in the purchase of (public and private) debt securities in the secondary market (Eser, Amaro, Iacobelli, & Rubens, 2012). In this first round, the SMP was dedicated to the acquisition of bonds issued by Portugal, Greece and Ireland. In the summer of 2011, when the Spanish and Italian debts caused severe strain in the government bond markets, the SMP was reactivated and bonds issued by Italy and Spain were also included in the programme. This was not, however, enough to restore market confidence.

In the autumn of the same year, the interconnection between the sovereigns and the national banking systems affected negatively, and once again, the financial system: the soundness of bank’s balance sheets started to be questioned, due to the decrease in the market value of the large amount of sovereign bonds in their balance sheets. As a result, there was a severe credit crunch.

In this phase, the ECB policy included the following main new components, which were announced on 8 December 2011 (Cour-Thimann & Winkler, 2012; Eser et al., 2012):

- Two LTROs with a maturity of 3 years each;
- Reduction in the reserve ratio, from 2% to 1%;
- Expansion of the spectrum of accepted collaterals;
- Launch of the CBPP2 in November 2011, reaching a total amount of purchases of €16.4 billion by its end in October 2012 (European Central Bank, 2019).

Despite these policy actions, the economic and financial situation kept on aggravating. In 2012, there were signs of growing fragmentation in the E.A., with difficult funding conditions for households and firms in the more vulnerable countries. Moreover, tensions in the
markets of sovereign debt of these periphery countries increased, which led to ever increasing costs for banks’ funding, further hindering their ability to supply credit. The government bond yields of some countries started to include substantial redenomination risk premia, suggesting that markets were seeing as more likely that these countries could leave the E.A. Overall, the transmission of monetary policy was essentially blocked throughout the E.A. (Cour-Thimann & Winkler, 2012). At this stage, in July 2012, the ECB’s president Mario Draghi stated in a public speech that “(…) the ECB is ready to do whatever it takes to preserve the euro” (Draghi, 2012). This would be followed by the announcement of Outright Monetary Transactions (OMT) – replacing the SMP – whose objective was to act as an insurance tool against redenomination risk. In practice, provided that the bond-issuing countries accepted to participate in an appropriate European Financial Stability Facility/European Stability Mechanism (EFSF/ESM) programme, the ECB would purchase government-issued bonds in the secondary market (Cour-Thimann & Winkler, 2012). The mere announcement of OMTs – which were never implemented – proved enough to restore the confidence in the sovereign bond market, contributing to the reduction and convergence of government bond yields and of covered bond spreads in lower-rated economies.

2.3.2.3. Deflationary trends and the ECB’s response

Even after defeating the sovereign crisis, the E.A. kept on recording a poor economic performance, in a context of general deleveraging and decreasing bank lending. In the last months of 2013, loans to the private sector were contracting at a rate of 2%, which indicated a risk of a credit crunch. In particular, inflation rates exhibited a persistent downward trend, and deflation was becoming an increasingly likely scenario. Against this background, the ECB reduced the MRO rates twice, achieving 0.25% in November, and communicated that it expected that the key interest rates would “remain at present or lower level for an extended period of time”. Additionally, the Governing Council informed that banks would continue to have access to liquidity through fixed rate tender procedures with full allotment in all refinancing operations for as long as it was necessary (Alvarez et al., 2017)

By mid-2014, the drastic fall in oil prices would add more disinflationary pressures to the economy. In response, a package of new measures was adopted (Alvarez et al., 2017):

- **Targeted Longer-Term Refinancing Operations (TLTROs).** These operations aimed at allowing banks to borrow from the ECB at fixed interest rates for up to four years in a sequence of eight operations led at quarterly intervals from
September 2014. These LTROs were targeted in the sense that the amount borrowed by banks would be linked to their lending volume to non-financial corporations and households.

- **Negative Deposit Facility Interest Rate.** The interest rate for the overnight deposit facility – applied to reserves in excess of the minimum reserve requirements – became negative for the first time since June 2014. The rate then decreased from -0.10% in June 2014 to -0.40% in March 2016.

- **Large-Scale Purchases Programme.** Two new private sector purchase programmes were created: the Covered Bond Purchase Programme 3 (CBPP3) and the Asset-Backed Securities Purchase Programme (ABSPP). Both programmes are still active.

- **Public Sector Purchase Programme (PSPP).** In January 2015, the PSPP was announced and combined with the CBPP3 and the ABSPP, thus forming the Asset Purchase Programme (APP). The PSPP includes purchases of bonds, with a maturity from 2 to 30 years, issued by central governments, agencies and international or supranational institutions from the E.A. Initially, it was announced that the APP purchases would amount to €60 billion per month until September 2016 or until inflation achieved a tendency congruent with the ECB’s goal on price stability – a commitment that was clearly a measure of forward guidance.

In December 2015, the APP was extended until March 2017 and, in March 2016, the monthly purchase increased to €80 billion per month. Around the same time, the Corporate Sector Purchase Programme (CSPP) was announced and included in the APP (Alvarez et al., 2017; European Central Bank, 2016). This programme would broaden the APP scope to include investment-grade euro-denominated bonds issued by non-bank corporations.

Moreover, a second round of four Targeted Long-Term Refinancing Operations, TLTRO-II, was announced and implemented from June 2016 to March 2017 (European Central Bank, 2016).

### 2.4. Unconventional response in times of crisis

When the financial crisis became global, the focus of the Fed and of the ECB was to provide liquidity to financial institutions (Lenza et al., 2010). The distinct starting points of the U.S. and of the E.A. called, however, for different reactions. The ECB was, already before
the crisis, in the frontline of addressing the money market tensions through large MROs of around €300 billion, while the Fed’s regular refinancing operations were much smaller and of about $30 billion. Additionally, the number of ECB’s counterparties and the scope of collaterals that it accepted were both wider than those of the Fed. Consequently, most of the initial instruments used by the ECB before the GFC, even though part of its previously operational framework, were deemed enough to address the chaos in the money market. In contrast, the Fed immediately started an unconventional approach in December 2007 by, for instance, providing liquidity to an extended set of counterparties and collaterals through the TAF (Lenza et al., 2010). As a matter of fact, the new facilities employed by the Fed can be considered as an attempt to imitate the ECB’s standard operations (see references supporting this argument in Lenza et al. (2010)).

Owing to these different starting points, the operations used after the failure of Lehman Brothers varied across central banks. For instance, the Fed’s balance sheet has more than doubled since September 2008, while the ECB’s balance sheet increased only 60% from its initial level, and mostly to accommodate the normal demand for liquidity. Figure 2 shows how the overall size of the balance sheets of the Fed and the ECB relative to GDP were distinct before the Lehman’s demise (Lenza et al., 2010).

**Figure 2.** Size of central bank’s balance sheets (% of GDP)

![Figure 2](source: Fed, ECB, World Bank)

The figure shows that the size of the balance sheets increased to similar proportions of GDP after the GFC and until 2011. However, the nature of the operations and of counterparties behind such similar paths were different. Given the dominant role of banks as providers of credit to firms and households in the E.A., the ECB had to focus on improving
bank liquidity, and did so through the covered bond market. Therefore, the ECB proceeded operating through its usual counterparties. By contrast, the less important role of banks as credit suppliers in the U.S. implied that the Fed had to include non-bank institutions as counterparties, especially for asset-backed securities purchases. By acting through non-bank counterparties, the Fed expected to impact directly on portfolio choices, thus on asset prices and finally spending – otherwise, there would be the risk that the liquidity injected would be trapped in the banking system (Lenza et al., 2010).

Figure 3. The balance sheet of the Fed

The assets piled up in the balance sheet of the Fed and the ECB were also distinct along the unconventional period. The Fed initiated QE right in January 2009 and its purchases consisted mainly in agency MBS, agency debt and longer-term UST. The ECB, on the other hand, started QE only in 2015 and focused its programme on covered bonds, asset-backed securities, public sector securities and, finally, corporate sector bonds. Figure 3 and Figure 4 clearly show this different patterns of QE.

Another key difference between policies in the U.S. and the E.A. relates to the decision on how low should the central banks decrease the target level for official interest rates. The
Fed kept the FFR at the lower bound, while the ECB went further and introduced in 2014 negative interest rates for reserves in excess of the minimum reserve requirements and for other deposits detained by the ECB (European Central Bank, 2014).

**Figure 4.** The balance sheet of the ECB

One new challenge for the analysis of monetary policy resulting from the use of unconventional policies relates to the indicator of the policy stance. Under conventional policies the short money market interest rate targeted by central banks is the variable that characterizes the stance of the monetary policy. However, with the ZNLB becoming binding and with policy including unconventional policy tools, the informational value of these interest rates is very limited. This led researchers to suggest new models – typically called shadow rate models – that bring into a notional short-term interest rate the effect of both conventional and unconventional monetary policies. The interpretation of shadow rates is similar to that of the standard short interest rates – a lower shadow rate represents an expansionary monetary policy – but its path may be negative and is supposed to compactly summarise the stance resulting from all monetary policy actions. Figure 5 and Figure 6 show the estimates of shadow rates for the U.S. and the E.A. from widely used models – the Wu
and Xia (2016) and the Krippner (2012) models of the shadow rate.

Figure 5. Shadow interest rate of Wu and Xia

According to the two models, from 2009 to 2014, the monetary policy of the Fed has been more expansionary than the ECB’s, while the opposite happened since then. This timeline coincides with the conclusion of the Fed’s assets purchase programme and with the launch of the ECB’s QE. The model of Wu and Xia clearly marks the three quantitative easing events of the Fed, showed through the expansion of the securities held outright in Figure 3, with a decrease of the shadow interest rate from the end of 2008 to mid-2013. Interestingly, the models of both the Wu and Xia, and Krippner show that from mid-2013, the monetary policy actions of the Fed gradually became less expansionary and, eventually, contractionary since 2015-16.

Regarding the main monetary policy events of the ECB, the implementation of QE policies, showed through the expansion of the securities held outright in Figure 4, can be seen in the model of Krippner, in which is represented by a decrease of around 5 pp on the shadow interest rate from mid-2015 to end of 2016.
Figure 6. Shadow interest rate of Krippner

Source: Krippner (2012)
3. Inequality

3.1. Main concepts

Inequality will be defined, in this dissertation, as a disproportional distribution of an economic variable directly associated with the standard of living, either the flow of income or the stock of wealth, across groups of households (Carter & Reardon, 2014).

Income denotes, in a broad sense, regular flows such as wages and salaries, self-employment revenue, interests and dividends from invested funds, pensions or other benefits from social insurances, rents and other transfers, as well as other irregular profits (OECD, 2003b). Based on this definition, three measures of income may be presented (OECD, 2016):

- **Market income:** income before transfers\(^9\) and taxes;
- **Gross income:** income after transfers and before taxes;
- **Disposable income:** income after transfers and taxes.

Wealth, in turn, is a stock variable that corresponds to the net value of the non-financial and financial assets owned by a household (OECD, 2003a).

The measure of these economic variables, income and wealth, may differ from their actual values for several reasons. For instance, the surveys on wealth suffer deviations due to non-response and underreporting at the top of the distribution (Vermeulen, 2016). Moreover, as high-frequency longitudinal household surveys are still scarce and of poor quality, researchers often need to apply techniques to infer about micro features, which can lead to errors (Samarina & Nguyen, 2019). Finally, it should be emphasized that wealth inequality may vary along time without any change in the actual quantity and composition of the net assets held by households, but simply because of valuation effects arising from changes in the prices of assets or because of changes in saving and borrowing transactions (Domanski et al., 2016).

3.2. Inequality measures

The Lorenz curve is a simple graph representation of inequality. It is displayed in Figure 7, in which the horizontal axis indicates the cumulative percentage of households, from the poorest to the richest, and the vertical axis presents the cumulative percentage of the distributitional variable (e.g., income). The 45-degree line represents perfect equality, where each x percentile of the population receives x percentile of the variable. The Lorenz curve, usually

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\(^9\)Namely, unemployment insurance, social security and worker's compensation.
shown in relation to the 45-degree line, represents the percentage of the distributional variable that each cumulative x percent of the households receives during a period. Hence, the farther the Lorenz is from the perfect distribution line, the more unequal is the distribution of the variable across the population (Afonso et al., 2015).

**Figure 7. Lorenz Curve**

![Lorenz Curve Diagram](source: Own elaboration based on Afonso, LaFleur, and Alarcón (2015); Haughton and Khandker (2009))

The Gini coefficient, which is based on the Lorenz curve, is the measure of inequality most commonly used in the literature. This index measures the extent to which the distribution in an economy deviates from a perfectly equal distribution. In other words, it is the ratio of the area between the Lorenz curve and the 45-degree line; in terms of Figure 7, it is equal to \( A/(A+B) \) (Afonso et al., 2015; Haughton & Khandker, 2009). By construction, the Gini coefficient ranges from 0, meaning perfect equality (\( A=0 \)), to 100, meaning complete inequality (\( B=0 \)) (Afonso, LaFleur, & Alarcón, 2015; Carey, Haughton, & Ravallion, 2005).

Ratios between layers of households according to their share in global income or wealth are also widely used measures of inequality. The inter-decile ratio measures the ratio of the average income of the richest x percent of the population to the average income of the bottom x percent (Afonso et al., 2015). There are three most commonly used ratios: the 90-10 ratio, the 90-50 ratio and the 50-10 ratio. The first allows for comparing inequality between the top 10% of the distribution (the 90th percentile) and the bottom 10% of the distribution (the 10th percentile). The other two are useful to study changes in inequality within more
specific levels of standard of living: the 90-50 ratio measures inequality in the top half of the distribution, whereas the 50-10 ratio measures disparities in the bottom half of the distribution (Martinez & Slivinski, 2008). Although simple, these measures have the disadvantage of being vulnerable to extreme values and outliers (Afonso et al., 2015).

A more complex measure is the Theil index, which is part of the Generalized Entropy measures. This measure indicates the entropic distance of the population from the perfect egalitarian distribution (United States Census Bureau, 2016). The Theil index\(^{10}\) values vary between 0 and ∞, with zero indicating an equal distribution and a higher number referring to a higher level of inequality (Haughton & Khandker, 2009).

### 3.3. Inequality trends

The World Inequality Report (WIR) 2018 (Alvaredo, Chancel, Piketty, Saez, & Zucman, 2018) shows that income inequality has increased in most countries between 2007 and 2016, even though at distinct speeds – see Figure 8. Furthermore, the WIR 2018 shows that, for the same period, wealth inequality has been rising faster in the U.S. than it has been in Europe.

The growing level of inequality in advanced and emerging economies (the latter not shown in Figure 8) has been increasingly attracting the attention of policymakers – among others, Bernanke (2015), Draghi (2015, 2016) and Constâncio (2017) – the public, the press and academia (Furceri, Loungani, & Zdzenicka, 2018; OECD, 2015).

Traditionally, the literature has associated inequality with structural long-term causes, such as technological progress, demographic changes, globalization and the structure of markets with an emphasis on the labour market (Furceri et al., 2018). More recently, given the apparent coincidence between the GFC and the ensuing unconventional monetary policy actions and a substantial increase in inequality, some literature has turned its attention to the possible links between monetary policy and inequality. In the next chapter of this dissertation such connection is explored, first by reviewing the theoretical channels and the results in the literature, and then focusing on one particularly relevant specific channel – the portfolio composition channel.

---

\(^{10}\) A detailed presentation of the Theil index computation is beyond the scope of this dissertation. The interested reader is referred to Haughton and Khandker (2009).
Figure 8. Evolution of income inequality (2007 – 2016)

1. Increase
2. Little change (variation of less than 1.0 percentage points)
3. Decrease

Source: Own elaboration based on OECD and SWIID.
4. Monetary policy and inequality

Before the implementation of non-standard monetary policies, there is, to the best of our knowledge, no literature on direct effects of (conventional) monetary policy on inequality; in fact, the focus of research was on the connection between inflation and inequality – see, among others, Albanesi (2007); Bulir (2001); Doepke and Schneider (2006); Easterly and Fischer (2001); Erosa and Ventura (2002); Li and Zou (2002); Romer and Romer (1998).

With the advent of unconventional monetary policies, the state-of-the-art changed: many economists and policymakers started to inquire their economic consequences, including possible effects on inequality. In particular, given the apparent temporal association between the GFC, the Great Recession and the rising level of inequality in advanced economies and emerging countries, it has been argued that unconventional and also conventional monetary policies could have an impact on inequality (Domanski et al., 2016; OECD, 2015; UNU-WIDER, 2017).

The overall distributive effect of monetary policy depends on the functioning and relative importance of several channels through which monetary policy can impact inequality. Coibion et al. (2017) presents five channels, which are the ones considered by many authors in the literature (Davtyan, 2017). A schematic description and explanation is provided below for each channel (Lambrecht, 2015):

- **Income composition channel.** The primary sources of income are heterogeneous across households, with each type of income, such as labor, business, financial and transfer, being differently affected by changes in policy rates. Low income households tend to depend on transfers, while those near the median on labor earnings and the upper tail households more on business and capital income (Amaral, 2017). Assuming that an expansionary monetary policy \((M \uparrow)\), by decreasing interest rates \((i \downarrow)\), increases asset prices \((P_a \uparrow)\) and, thus, raises capital income more than labor income, income inequality would increase after such shock (Inui et al., 2017). Schematically,\(^{11}\)

\[\begin{align*}
\text{In the schematic diagrams, } M \text{ stands for the stock of money, } i \text{ for interest rates, } P_a \text{ denotes the price of assets (with } P_{ebh}, \text{ being the price of equity, bonds and houses), } V_{cash} \text{ is the value of liquid assets, } \pi \text{ is inflation, and } Y \text{ is aggregate output.}\end{align*}\]

\(^{11}\)
\[ \Rightarrow \text{low income households} \Rightarrow Y \rightarrow M \uparrow \Rightarrow i \downarrow \Rightarrow P_a \uparrow \]

\[ \Rightarrow \text{high income households} \Rightarrow Y \uparrow \]

- **Financial segmentation channel.** Some agents are more connected to the financial market, having access to further specialized information about how the market functions, and to further financial instruments. Given that connected agents are typically wealthier than unconnected households and that the transmission of monetary policy shocks via financial markets is especially important, an expansionary monetary policy would increase inequality through this channel (Williamson, 2009).

\[ \Rightarrow \text{unconnected agents} \Rightarrow Y \rightarrow M \uparrow \Rightarrow i \downarrow \Rightarrow P_a \uparrow \]

\[ \Rightarrow \text{connected agents} \Rightarrow Y \uparrow \]

- **Portfolio channel.** Portfolios differ on size and composition across households, with each type of asset being differently affected by monetary policy and by inflation. Empirical evidence indicates that the proportion of household wealth held in liquid assets decreases with household’s levels of income and wealth, as the poorer households usually hold relatively more cash and less financial assets than richer households (Albanesi, 2007; Erosa & Ventura, 2002). As liquidity is less protected from inflation, higher inflation (\( \pi \uparrow \)) rates are expected to harm more households at the bottom of the distribution.

Regarding financial assets, Bernanke and Kuttner (2005) show that an expansionary monetary policy can affect stock prices through three possible channels: increase in expected future dividends, reduction of the discount rate, and changes in risk premium associated to stocks. While an expansionary policy should benefit richer households, who own more stocks, some authors argue that the net effect on inequality can be lessened by housing prices increases as the middle and bottom households own, on average, a higher proportion of their wealth in housing (Albert & Gómez-Fernández, 2018).

The effects of non-traditional monetary policies, namely assets purchase pro-
grammes, operate mainly through this channel. It is expected that an expansionary monetary policy, by increasing the price of equity, bonds and housing \((P_{e,b,h} \uparrow)\), and decreasing the value of cash \((V_{cash} \downarrow)\), would result in an increase in inequality:

\[
\Rightarrow P_{e,b,h} \uparrow \Rightarrow holders \Rightarrow Y \uparrow \\
M \uparrow \Rightarrow i \downarrow \Rightarrow \pi \uparrow \\
\Rightarrow V_{cash} \downarrow \Rightarrow holders \Rightarrow Y \downarrow
\]

- **Savings redistribution channel.** Decreases in interest rates and subsequent increases in inflation, *ceteris paribus*, benefit borrowers and hurt savers, as the real value of nominal debts drops. The impact on inequality depends on the distribution of financial assets net of liabilities as well as their maturities across households and their degree of protection from inflation (Amaral, 2017). Empirical research, such as Doepke and Schneider (2006), found that middle-aged and middle-class individuals would benefit more in terms of wealth with increases in inflation.

\[
\Rightarrow borrowers \Rightarrow Y \uparrow \\
M \uparrow \Rightarrow i \downarrow \Rightarrow \pi \uparrow \\
\Rightarrow savers \Rightarrow Y \downarrow
\]

- **Earnings heterogeneity channel.** Changes in monetary policy may affect labour earnings differently across households. E.g., since low-income households are usually composed of low-skill individuals, they are more sensitive to changes in unemployment, as they are typically the first to lose the most when unemployment increases. Hence, expansionary monetary policies, to the extent that they increase employment and decrease the unemployment rate \((U \downarrow)\), tend to benefit the poorer households and thus to reduce inequality.

\[
\Rightarrow low \text{ income households} \Rightarrow Y \downarrow \\
M \uparrow \Rightarrow U \downarrow \\
\Rightarrow high \text{ income households} \Rightarrow Y \rightarrow
\]
In a more compact taxonomy, Nakajima (2015) classifies these five channels as inflation or income channels. His inflation channel includes the financial segmentation, the portfolio and the savings redistribution channels; his income channel includes the income composition and the earnings heterogeneity channels.

Table 1. Contribution of transmission channels to inequality

<table>
<thead>
<tr>
<th>Channel</th>
<th>Expected impact of an expansionary policy¹</th>
<th>Variable directly Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income composition</td>
<td>Negative</td>
<td>Income</td>
</tr>
<tr>
<td>Financial segmentation</td>
<td>Negative</td>
<td>Inflation</td>
</tr>
<tr>
<td>Portfolio composition</td>
<td>Negative</td>
<td>Inflation</td>
</tr>
<tr>
<td>Savings redistribution</td>
<td>Positive</td>
<td>Inflation</td>
</tr>
<tr>
<td>Earnings heterogeneity</td>
<td>Positive</td>
<td>Income</td>
</tr>
</tbody>
</table>

¹ Negative – increases inequality
Positive – decreases inequality

Source: Own elaboration

4.1. Literature review

The link between monetary policy and inequality is currently a heated debate among economists, policymakers and the public, following the GFC, the Great recession and unconventional monetary policies. Before 2008, in contrast, the focus of research was the study of the connection between inflation and inequality. Since 2008, the focus of the literature has changed, turning to analyses of conventional and unconventional monetary policy on income and wealth inequality.

In this subsection we will present a review of the literature on the relation between monetary policy and inequality. The review is structured around three perspectives, respectively: the type of inequality, income and wealth; the monetary policy transmission channel involved; and the type of monetary policy. A summary of the results is presented in Table A 3 and Table A 4 of the annexes.

4.1.1. Income inequality

The distributional effects of a monetary policy shock on income inequality are, in general, linked to the income composition and earning heterogeneity channels (Colciago et al., 2018;
The former channel points out the heterogeneity in the primary sources of income across households, whereas the latter refers to the dissimilar impact of monetary policy shocks on labour earnings of low- and high-income households (Coibion et al., 2017). As the effects of monetary policy shocks on income inequality are opposite for these two channels, the overall impact needs to be empirically evaluated.

A major recent contribution to the literature has been put forth by Coibion et al. (2017). They analyse the effects of conventional monetary policy on inequality in the U.S. over 1980Q3-2008Q4 using the linear local projections method suggested by Jordà (2005) and, as data, monetary policy shocks identified with the narrative approach of Romer and Romer (1998) and the household income data from the Consumer Expenditure Survey (CEX). Overall, they conclude that contractionary shocks increase income inequality – namely, an increase of 100 bp in the policy rate is associated with a rise in the Gini coefficient of market income of up to 1.00%.

Commenting on research such as Coibion et al. (2017), Saiki and Frost (2014) point out that the CEX lacks information relative to the top one percent of the income distribution, which could influence the results. Davtyan (2017) aims at overcoming this caveat by considering the whole share of the U.S. income distribution, including the top one percent. By estimating a vector autoregressive (VAR) model that includes the Gini index for disposable income based on the OECD for 1983-2012, she concludes that a contractionary conventional monetary policy, measured by an increase of one-standard-deviation in the policy rate, is associated with a 0.10 percentage point (pp) decrease in income inequality.

In contrast, and consistent with Coibion et al. (2017), Furceri et al. (2016) find that a restrictive monetary policy has a significant impact on inequality, increasing it. As regards method, they use the linear local projections of Jordà (2005) whereas, regarding data, they study a panel of 32 countries – including, of relevance for this dissertation, France, Germany, Italy, the Netherlands, the Slovak Republic, Spain and the U.S. – from 1990 to 2013, using the income inequality measures from the Standardized World Income Inequality Database (SWIID). Overall, they find that an unexpected positive variation of 100 bp in the policy rate rises the gross Gini (market measure) by 1.20% one year after the shock and 1.75% four years later. Notably, they find that the monetary policy impact is asymmetric: an unanticipated increase in the policy rate rises income inequality more than a decrease reduces it.

Hafemann et al. (2018) look at the impact on income inequality – measured by the Gini
coefficient of market and disposable income obtained from the SWIID – of both conventional and unconventional monetary policy shocks in Canada, Hungary, South Korea, Sweden, the Czech Republic and the U.S. from 1995 to 2015. Using a VAR model and the shadow interest rate of Wu and Xia (2016) as monetary policy indicator, they find that an expansionary monetary policy shock increases the Gini coefficient for both market and net income in the U.S.

Samarina and Nguyen (2019) conduct an analysis similar to Hafemann et al. (2018) for the E.A. With data for Austria, Belgium, France, Finland, Germany, Greece, Italy, the Netherlands, Portugal and Spain for 1999Q1-2014Q4 and measuring conventional and unconventional monetary policy shocks with the shadow interest rate and income inequality with data from the SWIID, they estimate a Proxy-SVAR (structural vector autoregressive model). Their estimates indicate that an expansionary monetary policy has a significant impact in income inequality: a shadow interest rate shock of -100 bp reduces the Gini coefficient of market income by about -1.01.

Similar results for the E.A. have been found in analyses considering only an unconventional monetary policy shock. Lenza and Slacalek (2018) study the distributional effects of QE on income (and wealth) for the four largest E.A. economies – France, Germany, Spain and Italy. They estimate a Bayesian VAR with monetary policy shocks measured by an exogenous assets purchase, using income data from the second wave of the Household Finance and Consumption Survey (HFCS) – reference year: 2014. They conclude that the Gini coefficient for gross household income declines from 43.07 to 42.86 one year after an expansionary monetary policy shock measured by a 30 bp drop in the term spread.

4.1.1.1. Income composition channel

According to theory, an expansionary monetary policy shock should, by reducing interest rates, increase income inequality through this channel. However, the actual empirical effects of this channel are not clear.

Coibion et al. (2017) results suggest that a conventional contractionary shock – namely an increase of 100 bp in the policy rate – is associated with an increase in income inequality in the U.S., as the difference between the 90-50 and the 50-10 deciles increases by up to 5.00%. The rise in inequality is due both to the increase in the income of households at the 90th percentile and the severe decrease of the income of households at the 10th percentile. The income composition channel explains such effects as follows. After a contractionary
monetary policy, transfers fall in comparison to wages and, because households in the bottom quintile are more dependent on transfers than the other groups, there is an increase in income inequality.

Coibion et al. (2017) also hint that financial income increases but, given the lack of data for the top one percent of the income distribution in their database, they present no quantified conclusions. Such lack of data is pointed out by Saiki and Frost (2014) as one of the limitations of the CEX due to the supposedly considerable role of the upper end of the income distribution in inequality dynamics on the U.S. since 1980 (Davtyan, 2017).

O’Farrell, Rawdanowicz, and Inaba (2016) assess the distributional effects of an expansionary monetary policy in eight OECD countries – Belgium, Canada, France, Germany, Italy, Netherlands, United Kingdom and U.S. – using a microsimulation approach. The data used for the U.S. are from the 2007 and 2010 Survey of Consumer Finances (SCF) and for the E.A. are from the 2010 European Commission Business and Consumer Survey (BCS). By assessing the impact of a shock cut in interest rates on assets returns and on debt servicing costs\(^{12}\), they found that a 1.00 pp cut in the interest rate results in an increase in income inequality in Belgium, France, Germany and Italy, but it reduces inequality in the Netherlands. However, when simulating a larger policy shock – a 4.00 pp decrease in the interest rate – they find that income inequality increases for all countries. As for the U.S., these effects are small and not significant – a 1.00-pp cut in the interest rate results in a reduction of only 0.15 pp on the Gini index for gross income.

Hafemann et al. (2018) analyse the impact of both conventional and unconventional shocks on income inequality, focusing on the income composition channel through the behaviour of the Capital-Wage (CW) ratio after a shock. For the U.S., they find that an expansionary monetary policy increases capital income more than labour income – the CW ratio rises by 0.80 pp. Moreover, they find that the income composition channel dominates over the earnings heterogeneity channel.

For the whole E.A., the unavailability of high-frequency micro-data of income is a constraint for the study of the impact of monetary policy through this channel – see e.g. Guerello (2018). Following an exercise of uncovering the Theil index from the BCS, for 2005-2014, she uses country-level VAR models to assess the overall impact of expansionary conventional and unconventional monetary policy shocks. Overall, Guerello (2018) finds that

\(^{12}\) This refers to disposable income, which also encompasses fiscal policy decisions.
a 100 bp reduction in the short-term rate decreases income inequality for the E.A. One year after the impulse, the Theil index falls by 2.00. The analysis for each country suggests that for the majority, income dispersion does not react. Nonetheless, for a few economies the income dispersion increases in the short-run but decreases at longer horizons. Moreover, she also concludes that income inequality rises in countries in which wealth has a larger weight of financial assets and less so of deposits.

However, Samarina and Nguyen (2019) argue against the uncovering of income measures from the qualitative answers of the BCS, as these may not be representative of actual households’ income, but rather of their perception about their income. Yet, the results obtained by Samarina and Nguyen (2019) for the E.A. are similar to Guerello (2018). As already mentioned in 4.1.1., the baseline model wherein the income composition and the earnings heterogeneity channel are considered produces a considerable reduction in the Gini coefficient. To disentangle the contribution of the income composition channel, they consider a counterfactual scenario in which the earnings heterogeneity channel would not be taken in account in the expansionary monetary policy shock. The contribution of the income composition channel to inequality suggests that higher stock prices weakens the response of the Gini coefficient to a negative conventional and unconventional monetary policy shock when compared to the contribution of the baseline model. This indicates the disequalizing impact of the income composition channel.

In contrast, Lenza and Slacalek (2018)’s study of the E.A. indicate that one year after a QE shock – measured by a 30 bp drop in the term spread – there is an increase of around 0.28% in the income of the top quintile and an increase of only around 0.08 in the bottom’s quintile. Thus, their findings suggest that, through the income composition channel, an expansionary unconventional monetary policy leads to an increase in income inequality.

4.1.1.2. Earnings heterogeneity channel

This channel focuses specifically on labour earnings, differently from the income composition channel, which considers all types of income. According to this channel, an expansionary monetary policy, by decreasing the unemployment rate, should reduce inequality.

The major recent contribution with this regard is Coibion et al. (2017), already mentioned above in the discussion of the income composition channel. Their main finding is that the impact of a conventional contractionary monetary policy impulse through this mechanism is minor in the U.S. An increase of 100 bp on the policy rate leads to a small reaction of the
earnings gap between the 90th and the 50th percentiles – by around 1-2.00% –, although the hypothesis that the responses of these quintiles are equal can be rejected. In turn, the hypothesis of equal reactions cannot be rejected for the 10th and the 50th percentiles. Therefore, a contractionary monetary policy shock has a small effect, if not null, on income inequality.

Davtyan (2017), on the other hand, finds that a contractionary conventional monetary policy shock, measured by an increase of one-standard-deviation in the policy rate, decreases the Gini index of wage inequality (based on the Current Population Survey (CPS)) in the U.S. by around 0.04 pp.

In contrast, Furceri et al. (2018) conclude that a contractionary conventional policy shock appears to increase income inequality. They focus on the earnings heterogeneity channel and deliver a stylized analysis for the U.S. First, they show that an unexpected 100 bp positive variation in interest rates results in a significant reduction in the share of wage income in GDP – approximately 0.50 pp in the short term and 1.50 pp in the medium term. Additionally, they demonstrate that, after an unanticipated increase of 100 bp in the policy rates, inequality rises more in countries with higher labour shares than in countries with relatively lower shares. This suggests that a contractionary monetary policy increases income inequality.

Hafemann et al. (2018) also analyse the existence of the earnings heterogeneity channel by considering the impact of a conventional and unconventional shock on employment. For the U.S., they find that an expansionary monetary policy increases employment and, thus, may reduce income inequality.

Consistently, Samarina and Nguyen (2019) find that, in the E.A., a conventional and unconventional expansionary monetary policy, measured by a surprise cut of the policy rate by 100 bp, decreases the Gini coefficient (i.e. decreases inequality) by 0.37%, in an analysis in which only wages are considered.

Montecino and Epstein (2015) study the impact of QE (unconventional policy shocks) on income and wealth inequality in the U.S. by comparing the “pre-QE period” (2008-2010) with the “QE period” (2011-2013). As data they use the SCF household survey and as method they combine re-centered influence functions (RIF) regressions with the Oaxaca-Blinder decomposition method. Their results suggest that the earnings heterogeneity channel contribution seems relevant between the pre- and QE period, as expansionary policies led to an increase in employment that decreased income inequality for all the assessed measures:
0.70 pp in the 90-10 ratio and -0.001 in the Gini coefficient\textsuperscript{13}.

Davtyan (2018) also studies the impact of unconventional monetary policy on income inequality in the U.S. with similar results, although using policy measures distinct from those of Montecino and Epstein (2015). As policy measures, she uses the Fed’s total assets, the total monetary base and the shadow FFR proposed by Wu and Xia (2016). As measures of income inequality, she uses the Gini index for disposable income from the OECD database, the Gini index for wages from the CEPR (Centre for Economic Policy Research) dataset and the percentile ratio based on DeNavas-Walt and Proctor (2015). Her structural VAR model for 2009-2015 suggests that, regarding the Gini index for wages, relevant for this channel, an expansionary unconventional monetary policy shock — measured by one-standard-deviation increase in the impulse — decreases wage inequality by up to 0.06 pp.

Similar findings have been obtained for unconventional policy shocks in the E.A. Notably, Lenza and Slacalek (2018) find that income inequality decreases with a QE expansionary impulse. According to their interpretation, this is explained by the fact that the unemployment rate reduction is more concentrated in the bottom income quintile, where the number of unemployed households is higher. E.g., regarding the impulse responses of unemployment rate by income quintile in Italy, they find that the unemployment rate of the bottom 20% decreases by up to 2.50 pp whereas, for the top 20%, falls only by up to 0.30 pp.

\subsection*{4.1.2. Wealth inequality}

The distributional effects of a monetary policy shock on wealth inequality operate, in theory, through three channels: the savings redistribution, the financial segmentation and the portfolio composition channels.

The savings redistribution channel refers to the impact of an unexpected inflation on nominal contracts. The financial segmentation channel describes the distribution of wealth across households due to their (un)connection to financial markets. The portfolio composition is related to the allocation of wealth by households across assets.

As happens for income inequality, the net effect of monetary policy on wealth should be empirically assessed, given the possible opposite effects across channels. However, the literature has mainly focused on the portfolio channel and, therefore, it is not possible to review

\textsuperscript{13} The type of income is not mentioned and, for that reason, this measure of inequality should be carefully compared with other studies’ results.
an overall impact.

4.1.2.1. Savings redistribution channel

According to this channel, an expansionary monetary policy that results in an unexpected increase in inflation will increase wealth inequality.

Doepke and Schneider (2006) is the seminal work on the redistributive effects of inflation through surprise changes in the value of nominal assets. They study the savings redistribution channel in the U.S. based on the data of the 1989 and 2001 editions of the SCF, simulating two inflation scenarios. The first, denominated full surprise scenario, considers wealth redistribution through reduction in the real value of nominal payments caused by an unexpected one-off increase in the price level, under no change in nominal interest rates. The second consists in a surprising one-off announcement that prices will be five pp higher than expected for the following 10 years. In this scenario, wealth redistribution is caused by the higher discount rates of future nominal payments and is thus dependent of the maturity of assets and liabilities. Overall, inflation benefits the young and hurts the old households, for both scenarios. This occurs because the young middle class typically has a considerable fixed-rate mortgage position, therefore benefiting the most from higher inflation. Regarding the comparison of the benefits and losses of each class, the results indicate that the young poor’s gains are significant for the full surprise scenario, but minor for the other, because the duration of the debt of this class is shorter than that of the middle class. The elderly middle and bottom classes households’ losses are larger in the full surprise scenario, whereas the rich are more hurt from anticipated inflation. An interesting finding is that the middle-class pensioners (i.e., households above 65 years old) are more affected in the full surprise scenario through their savings deposits.

4.1.2.2. Financial segmentation channel

This channel predicts that an expansionary monetary policy, by increasing the price of financial assets and, thus, the wealth of households connected to financial markets, increases inequality.

The definition of agents (un)connected to financial markets may be found in, e.g., Williamson (2009): banks and other financial intermediaries, and the companies and households that frequently trade with these financial intermediaries are connected agents; agents that trade irregularly in financial institutions and markets are considered unconnected and
are only affected indirectly by the central bank’s policy. The effects of monetary policy are eventually spread throughout the economy, when connected agents exchange goods and services with the unconnected ones. However, as Ledoit (2011) argues, households trade accordingly to their distance and closeness, and so connected agents may trade more frequently with other connected than with unconnected agents. As a result, the effects of, say, an expansionary monetary policy may not be uniformly transmitted over the cross–section of wealth distribution, benefiting most the connected agents.

4.1.2.3. Portfolio composition channel

An expansionary monetary policy that results in an unexpected increase in inflation will decrease the wealth of households that hold a portfolio relatively richer in assets not protected against inflation and will increase the wealth of the remaining households. This is the wealth-related channel most explored in the literature.

Domanski et al. (2016) present a stylized analysis of the impact of variations in interest rates and assets prices (conventional and unconventional shocks, respectively) on wealth inequality. They study France, Germany, Italy, Spain, the United Kingdom and the U.S., with the microdata for the E.A. countries based on the 2013 HFCS and that for the U.S. based on the 2012 SCF. Their results suggest that wealth inequality, measured as the ratio of the net wealth of richer to poorer households, increases after an expansionary policy shock, with equity and housing prices being the main drivers of these changes. One particularly interesting result is that, in the U.S., the key contributor to higher wealth inequality are stock prices from 2009 onwards, but their impact diminished from 2011 onwards given the increased relevance of housing prices. Another clear result is that in Italy, from 2012 onwards, the key driver has been the price of bonds.

O'Farrell et al. (2016) also assess the impact of unconventional expansionary monetary policy shocks on wealth inequality through the effects of asset price changes for the U.S. and for the E.A. In a first general stylized analysis, they considered three assets, with real state assumed to be more equally distributed among households, in contrast with bonds and equities. An increase of 10% in housing prices leads to a reduction in wealth inequality, whereas an identic change in the other assets’ prices raises inequality. Nonetheless, they find that net wealth inequality decreases when the price of all three assets rises.

In a more realistic scenario, they consider different price changes across assets and different households’ portfolios across countries. Specifically, they simulate a price increase of 8%
in equity, 6% in bond prices, 2% in real estates and 0% in the remaining assets, after a monetary policy easing shock in two countries: country A, which is meant to mimic the characteristics of the U.S. (2007 and 2010 SCF), and country B, which is meant to mimic those of the E.A. (2010 HFCS). In country A, financial assets whose prices react to monetary policy shocks weight the most, while in country B assets whose prices either do not react or react weakly to policy shocks are dominant. Moreover, the distribution of all assets across households are more skewed in A than in B. Under these assumptions, policy shocks and the resulting asset price changes reduce net wealth inequality in country A and increase it in country B. In country A, households located in the middle of the wealth distribution are positively impacted by asset prices changes, which does not happen in country B. These results are consistent with the logic that the effects on inequality of asset prices changes induced by monetary policy are dependent on the size and relative distribution of assets and liabilities. Ultimately, the effects of asset prices’ changes on net wealth is an empirical question.

Francisco, Fernández, and Claramunt (2017) focus on the effects of stock price changes over wealth inequality. They study the U.S. with data from December 2008 to December 2013 of the SCF, and the E.A. with data from July 2009 to September 2016 of the HFCS. Their VAR model results indicate that a one-standard-deviation shock to the monetary base (the policy indicator) increases stock prices by up to 0.01 pp in the U.S., while the variation on stock price is not significantly in the E.A. This suggests that unconventional measures may have increased wealth inequality in the U.S.

These results for the E.A. are consistent with those of Adam and Tzamourani (2016). They assess the distributional impact of an unconventional monetary policy through an increase of 10% in the prices of equity, bonds and housing, using data retrieved from the 2010 HFCS. They conclude that capital gains resulting from bonds and equity price valuations tend to be concentrated in a small share of households, whereas the benefits of housing prices are more evenly spread. Regarding bond variations, even though only few households benefit from it, they are widespread across the distribution; in the case of equity, advantages are concentrated on the 5% richest households. The results concerning the impact of variations in housing prices may be summarised as follows: first, fluctuations in housing prices impact a higher number of households than bond and equity changes; second, housing price increases generally occur among the middle- and upper middle-class of the net wealth distribution, with the median household benefiting the most from housing price increases; third, the impact of variations in the prices of this asset is heterogeneous among E.A. countries.
These results are consistent with those obtained with the Gini coefficient: net wealth inequality is not affected by bond price boosts, while it increases significantly with equity price rises and it decreases with housing price increases, especially for countries where poor households hold more often a house.

Lenza and Slacalek (2018) analyse the distributional effects of QE on income and wealth for the four largest economies in the E.A. – France, Germany, Spain and Italy. They estimate a Bayesian VAR with monetary policy measures as an exogenous assets purchase shock, with income data based on the 2014 HFCS. They conclude that the Gini coefficient of net wealth did not vary significantly with the unconventional policy shocks, mainly due to the impact of housing prices increases.

A summary of the literature is presented in a more concise and systematic way in Table A3 and Table A4 of the annexes.

4.2. Analysis of the portfolio composition channel

The empirical evidence on the distributional effects of monetary policy is, in general and for each channel, in accordance with theory. It could be argued that the portfolio composition channel is to some extent an exception as its impact highly depends on the relative size and distribution of assets and liabilities among households (Adam & Tzamourani, 2016; Guerello, 2018; O'Farrell et al., 2016). Consequently, a comparative analysis of the contribution of this channel to wealth inequality in the U.S. vs E.A. is arguably an interesting contribution to the literature.

As mentioned in the beginning of this chapter, the portfolio channel is the main channel through which unconventional monetary policy affects inequality (Francisco et al., 2017) and the transmission occurs via asset prices. Empirical studies show that non-standard monetary policies, especially large-scale asset purchase programmes, have increased house, stock and medium-term bond prices (for the U.S., Swanson (2015) and for the E.A., Lenza and Slacalek (2018)). Generally, our review of the literature indicates that increases in housing prices diminish wealth inequality (housing factor), whereas increases in equity and bonds prices increase wealth inequality (equity factor and bond factor, respectively).

To assess the effects of the portfolio composition channel on wealth inequality in the U.S. and in the E.A., we now conduct a simple empirical analysis. The exercise consists of presenting and comparing: i) The households’ portfolio structure of both economies; ii) The evolution of prices of each asset existing in households’ portfolios during the periods of
conventional and unconventional monetary policies; and iii) The expected impact of unconventional monetary policy shocks on wealth inequality, by jointly considering (i) and (ii).

**Figure 9.** Composition of households’ wealth for the U.S., 2016 (% of total assets)

Figure 9 and Figure 10 graphically display the composition of the portfolios of households wealth in the U.S. and in the E.A., respectively. They aim at providing relevant information for step (i) of our exercise. Unfortunately, the available data are not completely comparable; in particular, there is no wealth information for the bottom 20% of U.S. households.

Nevertheless, it is possible to see that the households’ main residence is the most relevant asset for the bottom 60% of the distribution both for the U.S. and the E.A., with similar weights in the two economies. It is also possible to see that the top 20% of households in terms of wealth own more stocks and bonds in the U.S. than the top 20% of households in the E.A.
We now proceed to step (ii) of our exercise. Focusing first on the real estate factor, Figure 11 presents the evolution of housing prices in the U.S and in the E.A. In the U.S., the price of this asset proceeded to fall until the second quarter of 2012, even though the first two large-scale asset purchase programmes occurred in 2008 and 2009. However, from 2012 onwards, housing prices started to increase. The U.S. index (base 100 in 2007) surpassed the equivalent index of the E.A. since 2017. In the E.A., on the contrary, house prices remained relatively constant and, in comparison to the 2007 level, almost unchanged until the second quarter of 2015. The boom in E.A. housing prices seen after 2015 seems associated with the large-scale asset purchase programme of the ECB, implemented in March of 2015.

Given the similar weight of main residence in the household’s wealth distribution of the two economies, shown in (i), the data presented in (ii) allows for some conclusions in step (iii), to which we now proceed. The data suggest that the housing factor may have contributed to an increase in wealth inequality in the U.S. from 2007 to 2012 but may have had the opposite impact in inequality from then on; overall, house prices inequality seems to be associated more with the GFC than with the unconventional monetary policy – which, on the contrary, may have mitigated it. In the E.A., the data suggest that the house price factor may have not, on average, affected wealth inequality from 2007 to 2015, but may have contributed to some decrease in wealth inequality since then – given the increase in house prices seemingly associated with unconventional policies.
We now perform step (ii) regarding stocks. Figure 12 displays the S&P500 and the stoxx600 indexes, representative of the U.S. and E.A. stock prices, respectively. In the U.S., stock prices have increased steadily since 2009, achieving the double of the 2007 overall price level in 2018. In turn, the E.A. index, stoxx600, recovered slightly from the GFC in 2010 and 2011, but then came to a standstill in 2012 (surely a side-effect of the sovereign debt crisis), and recorded very limited increases in 2013-14 and in 2017-18. Even though household wealth data are not directly comparable, as already mentioned, it is known that stocks impact more the wealth of the top 20% of the household distribution of the U.S. than of the E.A. Therefore, it may be tentatively argued that the data suggests that stocks may have increased wealth inequality more in the U.S. than in the E.A., following the unconventional monetary policies that started in 2008-09 in the U.S. – step (iii).

Lastly, we conclude step (ii) of our exercise focusing on the bond factor. Figure 13 shows that the prices of ten-year bonds have in general increased since 2007 for both economies. However, the index with base 100 in 2007 was higher in the U.S. until 2014 – surely because of the stagnation of bond prices in the E.A. in 2010-12 due to the sovereign debt crisis, and to the effects of the very early measures of QE in the U.S. in 2008-09. From 2014 onwards, bond prices increased less in the U.S. than in the E.A., differently from the previous period. These data, together with that discussed in step (i), may indicate, for step (iii), that between 2007 and 2014 the bond factor may have had a higher contribution to an increase in wealth inequality in the U.S. than in the E.A. From 2014 onwards, the conclusions are not so straight-
forward as the share of bonds in the E.A. household’s wealth is lower than in the U.S. households\textsuperscript{14}.

**Figure 12.** Stock price index (100 = 2007)

![Stock price index chart](source: Bloomberg)

**Figure 13.** Bond price index (100 = 2007)

![Bond price index chart](source: Bloomberg)

\textsuperscript{14} Moreover, it is well known that the sovereign debt crisis led to the need of rescuing several monetary and financial institutions in some E.A. countries, with additional taxes. These surely have had redistributive effects. Although this issue is related to the facts and data that we present and discuss, it is beyond the purpose of this dissertation, as it relates not to the effects of conventional/unconventional monetary policies, but to the effects of fiscal policy – even if determined by monetary and financial disruptions.
We now end this section presenting a summary of our findings in Table 2:

**Table 2. Summary of the impact of the portfolio factors on wealth inequality**

<table>
<thead>
<tr>
<th>Variable</th>
<th>U.S.</th>
<th>E.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bond factor</strong></td>
<td>2007 – : increase</td>
<td>2007 – : increase</td>
</tr>
</tbody>
</table>

Source: Own elaboration
5. Final considerations

The novelty of unconventional monetary policies and their apparent temporal coincidence with rising levels of inequality in advanced and emerging economies led researchers to question the possible redistributive impact of such policies (Domanski et al., 2016).

While a large literature has recently been developed on this topic, most analyses focus on a single country or economic area and comparisons of the impact of monetary policies on inequality in different economies are still scarce.

This dissertation has looked at the specific cases of the U.S. and the E.A. Building on the different timing and tools of conventional and unconventional monetary policies following the Great Recession in the U.S. and the E.A., and on the different changes in inequality in those areas in the relevant periods, this dissertation aim has been to uncover the likely effects of recent monetary policies on inequality, comparing policies and outcomes in these two economic areas.

The dissertation proceeded in three main steps, which have set the stage for the final analysis, conducted in section 4.2.

First, it has been shown in chapter 2 that the unconventional policies of the two central banks have differed, mainly on the timing and scope of their QE measures. The Fed initiated QE right in January 2009 and its purchases consisted mostly in agency MBS, agency debt and longer-term UST. The ECB, on the other hand, did not adopt a proper QE programme before 2015, and it did so by acquiring public sector securities, corporate sector bonds and asset-backed securities, which added to the acquisition of covered bonds that had started before.

Second, it has been shown in chapter 3 that, from 2007 to 2016, inequality has increased more in the U.S. than in the E.A., when measured by the Gini coefficient of market income. There seems to have been a similar evolution of wealth inequality – for which there are no comparable data.

Third, our review of the literature on the relation between monetary policy and inequality in the first section of chapter 4, led us to conclude that the theory predicts that non-traditional monetary policies, namely assets purchase programmes, impacts inequality mainly through the portfolio composition channel. Additionally, the reviewed empirical evidence supports the hypothesis that the impact of monetary policy on wealth inequality depends crucially on the composition of households’ assets portfolios.

Overall, we put forth the hypothesis that the post-GFC unconventional monetary policies
– especially QE – may have had different redistributive impacts on the U.S. and E.A. because of their different timings and tools, consistent with the transmission of policy through the portfolio composition channel.

Against this background, in section 4.2, we conducted a tentative comparison of the contribution of the portfolio composition channel as a transmission mechanism from unconventional monetary policies to wealth inequality in the two economies. The results suggest that, in the U.S., the house factor has contributed to a decrease in wealth inequality since 2012, whereas the stock and bond factors have led to an increase in wealth inequality. In the E.A., the bond factor appeared to be the only factor contributing to an increase in wealth inequality. However, given the minor share of bonds in the E.A. households wealth portfolios, compared to their share in U.S. households’ portfolios, it could be argued that the redistributive effects of unconventional policies through bond prices are smaller in the E.A. than in the U.S.

Our results should be taken with caution, at least for two reasons. First, unconventional policies were much more recent in the E.A., and therefore their full effects on inequality may still unfold in the near future. Second, our approach, while data-based, remains qualitative: the unavailability of micro-level high-frequency income and wealth data for the E.A. precluded a full-fledged econometric analysis of the redistributive impact of unconventional monetary policies.

To sum up, this dissertation provides contributions, at least at two levels. First, our literature review clarifies and substantially improves the ability of readers to understand the problem of the relation between monetary policy and inequality, in particular when policy takes the unconventional forms adopted after the GFC. Second, building on the literature and on the differences between unconventional policies in the U.S. and in the E.A., our comparison between these two economic areas yields some indication about the effects of such policies on inequality, particularly through the channel of the composition of households’ portfolios.
6. Bibliography


Federal Reserve Act, § 2A (1913).


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the zero lower bound on interest rates Conference, London.


Febelfin Connect event, Brussels/Londerzeel.


7. Annexes

Table A 1. Summary of monetary policies of the Fed after the GFC

<table>
<thead>
<tr>
<th>Time</th>
<th>Policy name</th>
<th>Summary of the policy</th>
<th>Policy type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 07</td>
<td>Term Auction Facility (TAF)</td>
<td>Term funding for depository institutions</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Dec. 07</td>
<td>Swap Arrangements</td>
<td>Exchange temporary swap arrangements were established with the ECB and the Swiss National Bank (SNB)</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Mar. 08</td>
<td>Term Securities Lending Facility (TSLF)</td>
<td>Auctions for Treasury bills in exchange for illiquid securities</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Mar. 08</td>
<td>Primary Dealer Credit Facility (PDCF)</td>
<td>Discount window facility for primary dealers</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Sep. 08</td>
<td>Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)</td>
<td>U.S. depository institutions and bank holding companies could use money market mutual funds to purchase high-quality asset-backed commercial paper (ABCP)</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Oct. 08</td>
<td>Commercial Paper Funding Facility (CPFF)</td>
<td>Purchased 90-day commercial paper</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Oct. 08</td>
<td>Money Market Investor Funding Facility (MMIFF)</td>
<td>Term funding to increase liquidity for Money Market Funds</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Nov. 08</td>
<td>Term Asset-Backed Securities Loan Facility (TALF)</td>
<td>Supported issuance of asset-backed securities</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Nov. 08</td>
<td>Large-Scale Asset Purchase (1)</td>
<td>Purchased $300 thousand million USTs, $1,450 thousand million MBS and agency debt</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Dec. 08</td>
<td>FOMC communications</td>
<td>Since December 16, 2008, the Fed has been conjugating an-</td>
<td>Forward guidance</td>
</tr>
</tbody>
</table>

15 Announcement period.
Announcements on the future of the monetary policy with conventional tools (such as FFR changes) and with unconventional actions (e.g., LSAP)

<table>
<thead>
<tr>
<th>Date</th>
<th>Action Description</th>
<th>Asset purchases</th>
<th>Conventional tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 10</td>
<td>Large-Scale Asset Purchase (2)</td>
<td>Purchased $600 thousand million in Treasuries</td>
<td></td>
</tr>
<tr>
<td>Sep. 11</td>
<td>Maturity Extension Program (MEP)</td>
<td>Purchase longer-term UST securities (6 to 30 years) by selling $667 thousand million of short-term UST (3 years or less), leaving the balance sheet little altered</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Sep. 12</td>
<td>Large-Scale Asset Purchase (3)</td>
<td>Purchased $85 thousand million (USTs and MBS) per month</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Dec. 15</td>
<td>FFR</td>
<td>Since December 2015, the Fed has been increasing the FFR, having achieved a level of 2.25-2.50% in December 2018</td>
<td>Conventional tools</td>
</tr>
</tbody>
</table>

Source: Own elaboration, based on Board of Governors of the Federal Reserve System (2009, 2019a); Hesse, Hofmann, and Weber (2018); Santor and Suchanek (2013)
Table A 2. Summary of monetary policies of the ECB after the GFC

<table>
<thead>
<tr>
<th>Time</th>
<th>Policy name</th>
<th>Summary of the policy</th>
<th>Policy type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 07</td>
<td>3-months LTRO</td>
<td>First supplementary three-month LTRO</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Dec. 07</td>
<td>Swap Arrangements</td>
<td>Exchange temporary swap arrangements were established with the Fed</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>Mar. 08</td>
<td>6-months LTRO</td>
<td>First supplementary six-month LTRO</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Oct. 08</td>
<td>Expansion of Refinancing Operations</td>
<td>Increased funding through fixed-rate full-allotment operations</td>
<td>Liquidity facility</td>
</tr>
<tr>
<td>May 09</td>
<td>Covered bond purchase programme (1)</td>
<td>Purchased €60 billion of covered bonds</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>May 09</td>
<td>12-months LTRO</td>
<td>First supplementary twelve-month LTRO. 3 operations: June, September and December 2009</td>
<td>Credit facility</td>
</tr>
<tr>
<td>May 10</td>
<td>Securities Markets Programme</td>
<td>Purchased €200 billion in periphery sovereign debt</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Oct. 11</td>
<td>Covered bond purchase programme (2)</td>
<td>Purchased €16.4 billion of covered bonds</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Oct. 11</td>
<td>12-months LTRO</td>
<td>2 operations: October and December 2011</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Dec. 11</td>
<td>3-year LTROs</td>
<td>2 operations: December 2011 and February 2012</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Jul. 12</td>
<td>“Whatever it takes”</td>
<td>Communication by Mario Draghi that the “(…) the ECB is ready to do whatever it takes to preserve the euro”</td>
<td>Forward guidance</td>
</tr>
<tr>
<td>Aug. 12</td>
<td>Outright Monetary Transactions (OMT)</td>
<td>Announcement of OMT; so far, this tool has not been activated</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Jul. 13</td>
<td>Communication</td>
<td>Communication that the key interest rates would “remain at present or lower level for an extended period of time”</td>
<td>Forward guidance</td>
</tr>
<tr>
<td>Jun. 14</td>
<td>TLTRO-I</td>
<td>8 quarterly operations from September 14 to June 16</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Date</td>
<td>Program Description</td>
<td>Description</td>
<td>Category</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Jun. 14</td>
<td>Negative Deposit Facility Interest Rate</td>
<td>The deposit facility rate decreased gradually from 0 to -0.4%</td>
<td></td>
</tr>
<tr>
<td>Sept. 14</td>
<td>Covered bond purchase programme (3)</td>
<td>Purchase of covered bonds. Still on going</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Sept. 14</td>
<td>Asset-backed securities purchase programme (ABSPP)</td>
<td>Purchase of asset-backed securities. Still on going</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Jan. 15</td>
<td>Public Sector Purchase Programme</td>
<td>Purchase of public sector securities. Still on going</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Jan. 15</td>
<td>Asset Purchase Programme (APP)</td>
<td>The APP includes all purchase programmes under which both private and public sector securities are purchased. Thus, APP = CBPP3 + ABSPP + PSPP</td>
<td>Asset purchases</td>
</tr>
<tr>
<td>Mar. 16</td>
<td>TLTRO-II</td>
<td>Four operations starting in June 2016</td>
<td>Credit facility</td>
</tr>
<tr>
<td>Apr. 16</td>
<td>Corporate Sector Purchase Programme (CSPP)</td>
<td>Purchase of investment-grade euro-denominated bonds issued by non-bank corporations. Thus, the new APP = CBPP3 + ABSPP + PSPP + CSPP</td>
<td>Asset purchases</td>
</tr>
</tbody>
</table>

Source: Own elaboration, based on Alvarez et al. (2017); Banco de Portugal (2015)
### Table A3. Summary of empirical studies: income inequality

<table>
<thead>
<tr>
<th>Authors</th>
<th>Countries</th>
<th>Period</th>
<th>Monetary Policy</th>
<th>Inequality Measure</th>
<th>Data</th>
<th>Channel</th>
<th>Impact on Inequality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Earnings heterogeneity</td>
<td>Negligible</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>expansionary</td>
<td></td>
<td></td>
<td>Earnings heterogeneity</td>
<td>Decrease</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>expansionary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>expansionary</td>
<td></td>
<td></td>
<td>Earnings heterogeneity</td>
<td>Decrease</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Earnings heterogeneity</td>
<td>Decrease</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on Colciago, Samarina, and de Haan (2018)
Table A 4. Summary of empirical studies: wealth inequality

<table>
<thead>
<tr>
<th>Authors</th>
<th>Countries</th>
<th>Period</th>
<th>Monetary Policy</th>
<th>Inequality measure</th>
<th>Data</th>
<th>Channel</th>
<th>Impact on inequality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williamson (2009)</td>
<td>-</td>
<td>-</td>
<td>Expansionary</td>
<td>-</td>
<td>-</td>
<td>Financial segmentation</td>
<td>Increase</td>
</tr>
<tr>
<td>Ledoit (2011)</td>
<td>-</td>
<td>-</td>
<td>Expansionary</td>
<td>-</td>
<td>-</td>
<td>Financial segmentation</td>
<td>Increase</td>
</tr>
<tr>
<td>Adam and Tzamourani (2016)</td>
<td>E.A.</td>
<td>2010</td>
<td>Unconventional expansionary</td>
<td>Gini net wealth</td>
<td>HFCS</td>
<td>Portfolio composition</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Own elaboration based on Colciago et al. (2018)