Università degli Studi di Padova

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HOW FAR FROM THE TARGET?

EFFECTIVENESS OF THE EU MONETARY POLICY IN TIMES OF CRISIS

Supervisor Professor Donata Favaro

Candidate Nicola Cavallini
ID Number 1180285

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A mia sorella

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INTRODUCTION & SUMMARY

Over the past 10 years, Europe has witnessed two enormous financial crises: the Great Recession and the Sovereign Debt crisis. During this time, most European countries faced ever-worsening financial states, and it is only thanks to European Central Bank's (ECB) intervention that some countries were saved from total financial collapse. The adoption of Quantitative Easing policy has produced some small but positive effects within the euro area. However, it is unclear whether these policies are still necessary, and if they are not, why the ECB has continued to renew such a large purchasing programme? If they are necessary, why have target levels of inflation not yet been met across Europe?

These are the questions that triggered our desire to explore the ways in which the ECB conducts its monetary policy, as well as the instruments used by the United States Federal Reserve Bank and the rest of the world's central banks during the same period. We also hope to determine whether it would have been possible for the ECB to have performed better during these financial crises.

CHAPTER 1 will detail the standard monetary policies of the ECB, then identify the main target of the ECB. We will conclude this first section with a description of the sets of tools available to the ECB and its American counterpart.

In CHAPTER 2, we will describe the Sovereign Debt crisis and the ECB's reaction to it, illustrating in detail the different phases of the European Quantitative Easing programme and its main transmission channels.

Following this, CHAPTER 3 tries to examine the effectiveness of the Unconventional Monetary Policy from both a macroeconomic and microeconomic perspective. We will illustrate the results of the shock caused by the Unconventional Monetary Policy and how the heterogeneity among European countries resulted in different effects in terms of price and output. Finally, we will try to analyse the main causes of the still-low inflation levels by examining the money multipliers of the various European countries and the factors at the base of their reduction.

In conclusion, we will suggest some policies that could be implemented in response to the heterogeneity of the euro zone countries. These policies would aim to minimise the difference between the real and potential values of some variables, such as gross domestic product and unemployment levels. Moreover, we will also propose some reforms that would increase the soundness of the banking system across member states.

To draw on the now-famous 2012 speech by the former ECB governor Mario Draghi that "the euro is irreversible", now it is time to forge an effective and strong European Union.

1. CHAPTER

THE ORDINARY MONETARY POLICY

This chapter will focus on the ordinary monetary policy that the European Central Bank (ECB) usually conducts under the conventional monetary regime. Once the main target of the ECB (1.1) is defined, the principal instruments through which the ECB conducts its monetary policy will be explained in the second section (1.2). The first section presents a comparison of the ECB and the Federal Reserve's objectives; in fact, frequently, its counterpart, the central bank of the United States (US) (the Federal Reserve System [FED]) is taken as a benchmark or guide for the implementation of the European monetary policy. Thus, a description of the FED's monetary policy instruments will also be provided (1.3).
Moreover, the chapter presents the ordinary monetary policy conducted by every central bank under a conventional monetary regime, the variables that a central bank considers when implementing the policy, and, from an analytical and graphical point of view, the equilibrium condition between the demand for central bank money and the supply of that money (1.4). Finally, the last section (1.5) presents a discussion of the Taylor Rule that can be viewed as an operational procedure that represents the fluctuations of the FED's interest rate and the ECB's interest rate over the last 15–20 years.

1.1 Targets of ECB and FED

In Europe, the European Central Bank (ECB) is the main institution responsible for defining and implementing monetary policy. ECB, together with the banks that actually adopt the euro as currency, the so-called National Central Banks (NCBs), constitute the European System of Central Banks (ESCB). ECB's role is important because it coordinates the operations that each NCB can execute; thus, for example, the ECB coordinates the transaction regarding the

supply of funds to banks, or it holds and manages the foreign exchange reserve of the different European member states (Micossi, 2015).

There is an important difference between the implementation of a monetary policy and the implementation of a fiscal policy; in fact, if the fiscal policy is established at the country level, the monetary policy is much more centralised. Consequently, every European member state is responsible for the definition and implementation of its fiscal policy. For example, a country can adopt a contractionary fiscal policy, such as the reduction in the amount of the Value Added Tax (VAT), in order to stimulate consumption and investments, but it cannot implement any kind of monetary policies. This is the result of the unification process started in 1992 with the drafting of the Maastricht Treaty that ended with the introduction of the euro in 2001. From that moment on, the monetary policy was no longer under the control of each single state.

The ECB's guidelines and decisions are conducted on the basis of specific targets. In particular, the ECB establishes the main benchmarks that it would like to reach, and, in accordance with these, it defines the correct policies that have to be transmitted to the NCBs.

The main target of ECB is defined in chapter 2 of the TFEU, article 127(1), ex article 105(1):

Article 127

(Ex Article 105 TEC)

1. The primary objective of the European System of Central Banks (hereinafter referred to as 'the ESCB') shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union. The ESCB shall act in accordance with the principle of an open market economy with free competition, favouring an efficient allocation of resources, and in compliance with the principles set out in Article 119.

As explained by the article, maintaining price stability is the main target of the ECB. Only when this benchmark is reached does the ECB support the European policies that incentivise balanced and sustainable growth. Accordingly, the target level of prices established by the ECB is below, but close, to 2%.

As previously mentioned, the central bank of the US, the FED, is often taken as a benchmark when the European monetary policy is defined and implemented, so its policy is relevant. To better understand the FED's monetary policy, it is important to consider how its targets differ from those of its European counterpart.

The section 225a in Title 12: "*Banks and Banking*", in Chapter 3: "*Federal Reserve System*" of the *United States Code* (U.S.C), edition 2006, states that:

> *TITLE 12—BANKS AND BANKING*
>
> *225a. Maintenance of long run growth of monetary and credit aggregates. The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.*

While maintaining price stability is the main target of the ECB, the FED presents a "Dual Mandate" and pursues two main objectives: price stability, like its European counterpart, and, equally important, full employment. While the latter target does not mean a level of unemployment rate equal to 0%, it does imply a level of unemployment rate as close as possible to the level of the Non-Accelerating Inflation Rate of Unemployment (NAIRU). In conjunction with these two objectives, the FED pursues other two economic outcomes: the increase in production and moderation of long-term interest rates.

As previously explained, in some ways, the European monetary policy is influenced by the decisions of its US counterpart, and when comparing the monetary policy of the ECB and the FED, is it important to consider that different targets determine different policies. The different targets between the central banks is one of the reasons for the unequal effects of the so-called extraordinary monetary policies that will be explained in the subsequent sections of this chapter.

1.2 Conventional Instruments of the European monetary policy

This section explains the monetary policy instruments used by the ECB during conventional periods. A distinction must be made between the so-called conventional and unconventional periods. The first is a period characterised by stable economic conditions, while the second refers to periods affected by some financial distress, such as a global crisis, economic recessions or any kind of event that prevents the use of the traditional instruments in the implementation of the monetary policy.

Implementation of the European monetary policy rests on two pillars (Micossi, 2015). The first pillar is the monetary policy strategy; it defines the appropriate interest rate needed to

achieve price stability. The second pillar is the operational framework; it consists of the set of tools and procedures that are used to achieve the desired interest rate.
Thus, when establishing and implementing its conventional monetary policy, the ECB uses the following instruments (European Central Bank, 2006):

- Open Market Operations (OMOs);
- Standing Facilities;
- Minimum reserve requirements for credit institutions.

The OMOs consists of :

- **Main Refinancing Operations (MROs)**: these reverse transactions regularly provide liquidity to the different NCBs. They are usually conducted in a decentralized way, way, every week, on the basis of standard tenders, according to a European calendar;
- **Longer-term Refinancing Operations (LTROs):** these are always reverse transactions that provide liquidity to the NCBs; however, with respect to MROs, they have a longer maturity, usually equal to three months. Like MROs, they are conducted on the basis of standard tenders;
- **Fine Tuning Operations:** these are ad hoc measures that provide liquidity to the central banks in a situation of shortage; in particular, they want to smooth the movement of the interest rate caused by unexpected liquidity fluctuations. Normally, they are conducted by the ECB on the basis of quick tenders or through bilateral procedures;
- **Structural Operations:** these are usually conducted through the issue of debt certificates, by reverse or outright transactions. They are conducted every time the ECB wants to regulate its structural position given the European financial situation.

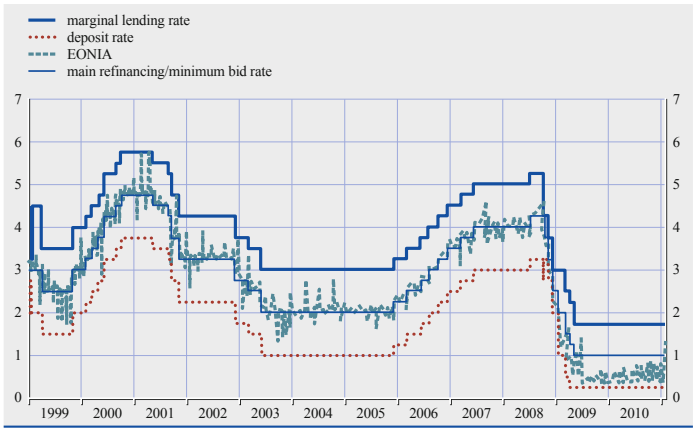
The second tool available to the ECB is the Standing Facilities. Different from the MROs, these are procedures that provide and absorb liquidity overnight, so they are managed by the NCBs, and they are conducted on a daily basis. The Standing Facilities consist of the **marginal lending facility** and the **deposit facility**. Different commercial banks can use the marginal lending facility to obtain liquidity overnight from the NCB to satisfy any possible daily shortages. With the deposit facility, the different commercial banks can deposit the excess overnight liquidity into the NCB.

Usually, the interest rates applied to these two instruments are used to determine the corridor through which the overnight market interest rate moves. For example, the interest rate on the marginal lending facilities is used as the ceiling of the corridor; since 18 September 2019, it is equal to 0.25%. The deposit facility rate is used as the floor; since18 September 2019, it is equal to -0.50% (ECB website). The overnight market interest rate moves through these two values, and it represents the average interest rate at which banks lend funds in the euro's interbank money market.

In most cases, the overnight market interest rate is generally defined as the "*interest rate*", and it is the main instrument taken into consideration at when defining and implementing a monetary policy. Accordingly, each central bank uses a different term for this interest rate:

- The ECB uses Euro OverNight Index Average (EONIA);
- The FED uses Federal Funds Rate (US Federal Reserve overnight rate);
- The Bank of England (BOE) uses Sterling OverNight Index Average (SONIA);
- The Bank of Japan (BOJ) uses Japanese Uncollateralised Overnight Call Rate (MUTAN).

Figure 1: Key ECB interest rates and the EONIA since 1999 (Percentages per annum; daily data).



Source: European Central Bank (2011).

Figure 1 depicts the marginal lending facility rate (the ceiling) and the deposit facility rate (the floor) that constitute the corridor. As seen, the EONIA interest rate and the interest rate of MROs, which is as important as the EONIA, move through this corridor. The graph represents the interest rate fluctuations from 1999 to 2010. As seen, beginning in 2008 there was a strong decrease in the interest rate due to the US financial crisis.

Regarding the interest rate, is important to introduce the assumption that, in reality, the ECB controls and handles the real, and thus, the inflation-adjusted, short-term interest rate, not the nominal one. This is because the real interest rate considers variations in the inflation expectations. Moreover, the real short-term interest rate changes the level of the asset prices and influences the decisions made by consumers, investors and banks, which also effects the overall level of economic output.

The **minimum reserve requirement for credit institutions** is the last instrument that the ECB can use to conduct its monetary policy under the conventional regime. This refers to the percentage of deposits and debt securities, with a maturity up to two years, that each credit institution must hold in its current account. In the euro system, this has changed over time. Until 2012, this percentage was equal to 2%; since then, it has been reduced to 1% (ECB website). This reserve requirement is used to maintain the stability of the money market interest rate and create or increase a structural liquidity shortage; this deficit is covered by implementing the MROs and the LTROs.

1.3 Conventional Instruments of the FED monetary policy

This section presents a description of the conventional monetary policy's instruments used by the FED in order to reach its main targets. It can be noted that the set of tools available for the ECB and the FED are almost identical, even though they have different policy targets. The main instruments used by the FED are (Federal Reserve, 2018):

- Open Market Operations OMOs;
- Discount Rate;
- Reserve Requirements;
- Term Deposit Facility (TDF).

The most important tool available to the FED is the OMO. OMOs are the purchases and sales of securities in the open market conducted by the US central bank; thus, any OMO changes the volume of the FED's balance sheet. There are two types of OMOs: permanent OMOs and temporary OMOs.
In permanent OMOs, the central bank outright purchases or sells the securities for the Federal Reserve's portfolio, defined as the System Open Market Account (SOMA). These operations

are usually used to fulfil the long-run factors that drive the expansion of the FED's balance sheet.

Permanent OMOs must be distinguished from temporary OMOs. The latter are all the operations conducted by the FED in order to satisfy any reserve needs that are considered to be transitory. A repo (repurchase) agreement and a reverse repo agreement are two examples of temporary OMOs. Under a repo agreement, the FED buys a security with the agreement of reselling it in the future. In the case of a reverse repo agreement, the FED sells a security with the agreement of repurchasing the same one in the future.

The second instrument used by the FED is the **Discount Rate**. This is the rate charged on loans that commercial banks and other depository institutions receive from their regional Federal Reserve Bank's lending facility. The FED offers three discount rate windows: primary credit, secondary credit and seasonal credit.

For the primary credit option, loans are extended for a very short period of time, usually overnight, to depository institutions that have good and stable financial conditions. The depository institutions excluded from the primary credit option can ask for the secondary credit option in order to satisfy any kind of liquidity shortages and eventual financial distress. In general, the interest rate is higher under the secondary credit option than the primary credit option, and the latter is higher, in turn, than the short-term market interest rate. The third option is seasonal credit, which is directed at the small depository institutions that have frequent fluctuations in seasonal funds, such as the depository institutions of agricultural communities, in which liquidity fluctuates in accordance with the natural cycle of the agricultural industry.

Another instrument used by FED to conduct its monetary policy is the **Reserve Requirements**. This is the amount of funds that a depository institution must hold in reserve against specified deposit liabilities. Different depository institutions must hold reserves in the form of cash or deposits at the FED. Different percentages of the reserve are required, depending on the amount of liabilities the bank has. It is possible to distinguish three main ratios: 0%, 3% and 10%. Table 1 presents the actual different thresholds assigned to each of these ratios (FED website):

Table 1: Minimum Federal Reserve Requirements.

Net transactions accounts	*% of liabilities required*
$0 to $16.3 million	0%
More than $16.3 million to $124.2 million	3%
More than $124.2 million	10%

Source: FED website.

The fourth main instrument that facilitates the implementation of the FED's monetary policy is the **Term Deposit Facility (TDF)**. The FED uses this instrument to manage the amount of reserve balances held by depository institutions. Every depository institution that participates in this system will benefit because the funds placed in the term deposit will be removed from its reserve account for the entire period of the term deposit. In this situation, reserve banks provide a TDF; thus, each participating depositary institution will receive earnings on the deposits placed at the reserve bank's TDF.

1.4 The equilibrium in the money market

This section explains the general monetary policy conducted by every central bank once it has identified its main targets. First, the equilibrium condition in the financial markets is defined, under the assumption that the money supply is directly control by the central bank. Then, the real economic assumption of commercial banks as suppliers of money is discussed. This development will be added to the previous model; moreover, its difference, with respect to the previous easier case, will be analytically explained.

To better understand how the central banks effectively work, it is first necessary to explain the fundamental equilibrium condition in the financial market; this is the same for every single central bank, and it is pursued by the ECB, the FED, the BOE and the BOJ. This fundamental condition states that the money demand must be equal to the money supply (Blanchard *et al*., 2012).

The **money demand** is the relation that explains the amount of money that people would like to hold, taking into consideration the trade-off between the currency and deposit account. This

trade-off is based on two factors: the transactions' frequency and the interest yield. It is obvious that, if the frequency of the transaction is very high, an individual will prefer to maintain a larger amount of currency with respect to his/her deposit accounts; however, this will prevent him/her from receiving a larger amount of interest from the deposit account. Therefore, every individual presents a particular mix of currency and deposits, and this combination depends on the interest rate and the frequency of the transactions. In turn, the latter factor depends on the individual's nominal wage; in fact, a higher nominal income is usually associated with a higher frequency and a larger number of transactions.

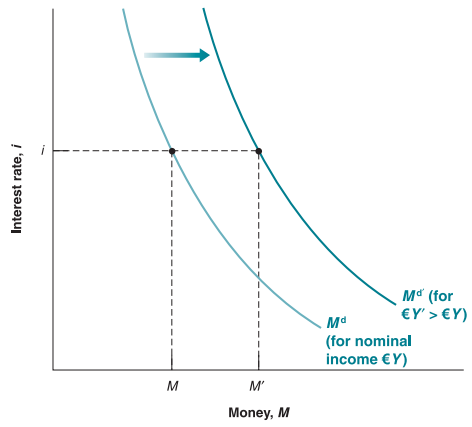
Money demand can be explained by the following equation:

$$M^d = €YL(i)$$

where Md is the money demand, $€Y$ is the nominal wage and $L(i)$ is a function of the interest rate. The interest rate has a negative effect on the money demand. In fact, the higher the interest rate, the higher the individual's preference for a deposit account; this results in a lower demand for money. Instead, in the case of a nominal wage increase, the money demand increases because the individual will request a higher amount of currency since it is assumed that the frequency of the transaction will increase with a larger amount of income.

As seen in Figure 2, the money demand curve has a negative slope because of the trade-off in the individual preferences. A higher interest rate will determine a lower amount of money. Moreover, it is possible to see the shift in the curve. Increasing the nominal wage to the level $€Y'$ will cause movement to the right of the curve. Thus, at the same level of interest rate, the increase in the nominal income will determine the increase in the money demand.

Figure 2: Money demand curve.



Source: Blanchard et al. (2010).

For **money supply**, the relation is different. If the money demand depends on the level of the interest rate, the money supply does not. Under the strong assumption that only the central bank supplies money, the equation is:

$$M^s = M$$

where M^s is the money supply and M is the total amount of money issued by the central bank. From the money demand and money supply equations, it is possible to identify the equilibrium condition:

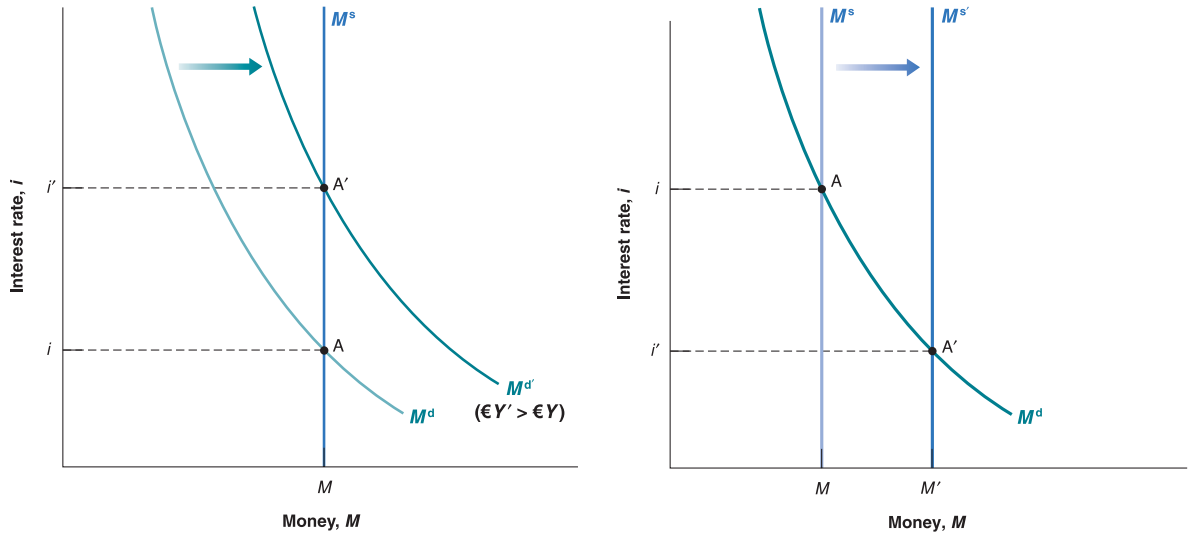
$$Money\ supply\ =\ Money\ demand$$

$$M^s = M^d$$

$$M = €YL(i)$$

Graphically, this equilibrium condition is represented by the intersection of the two curves (point A in both graphs). As seen in the Figure 3, the money supply is fixed because it is established by the central bank; for this reason, it is vertical. The previous shift in the money demand curve as a result of the increase in nominal income $€Y'$ will determine the increase in the interest rate; this is because, at the initial level of the interest rate i, the new money demand exceeds the previous money supply ($M^{d\prime} > M^s$), and, in order to preserve the equilibrium condition, and thus discourage the money request, the interest rate must increase to the level i'. In contrast, the right side of the Figure 3 shows an increase in the money supply. In this case, at the initial level of interest rate i, the new money supply exceeds the previous money demand ($M^{s\prime} > M^d$), so the individual is much more willing to leave money in his/her deposit account. To preserve the equilibrium condition and encourage the demand of currency, the interest rate must decrease to the level i'. The initial stable situations are graphically represented by point A in both graphs, while the new equilibrium situations are represented graphically by point A'.

Figure 3: Variations of the money demand and the money supply curve.



Source: Blanchard et al. (2010).

The last case that discusses increasing the money supply to the new level $M^{s\prime}$, perfectly represents the theoretical behaviour of each central bank. In fact, the ECB as well as the FED, the BOE and the BOJ, must first set the objective interest rate and then reduce or increase the money supply depending on the target. The reduction (or increase) of the money supply (M^s) will increase (or reduce) the level of the interest rate through the price mechanism. For example, an increase in the money supply means an increase in the purchase of bonds, which will reduce the interest rate. The higher the bond price, the lower the interest rate. However, this case represents a simple situation in which the money supply is exclusively determined by the central bank; in reality, this is not true.

In the real world, the central bank must also consider the money supplied in the form of reserves issued by other financial institutions, such as commercial banks. Consequently, determining the interest rate, in this case, is much more complex. In particular, the interest rate is determined by the intersection of two curves: the supply of the central bank money with the demand for the central bank money. The **supply of the central bank money** is directly provided and managed by the central bank, while the d**emand for central bank money** is more complex than the money demand previously discussed. In fact, the new demand is an extension of the previous one, and it consists of the total demand for currency and the demand for reserves by banks.

- As before, total demand for currency depends on the individual's decision to hold deposits or money. It is already known that the demand for money depends, in turn, on the interest rate and the frequency of the transactions; it is expressed by the equation:

$$M^d = €YL(i)$$

Given the total amount of money demanded by the individual, he/she must decide on the amount of money he/she would like to hold as currency and the amount of money he/she would like to hold as deposits. Consequently, there will be an equation for the demand for currency: CU^d and an equation for the demand for deposits: D^d. Assuming that every individual holds a fixed amount of currency (c), the equations for these two demands would be:

$$CU^d = cM^d$$

$$D^d = (1-c)M^d$$

The first equation represents the first component of the demand for central bank money; in fact, it shows the public demand for the currency.

- The demand for reserves by banks depends on the demand for deposits. Because banks must hold a certain amount of reserves in relation to the amount of deposits that they have, the demand for deposits generates the demand for reserves by banks. The higher the amount of the deposits that the banks hold, the higher the amount of reserves they also must hold. Banks hold reserves for safety reasons; in fact, it is possible that the daily inflows of cash are lower than the daily outflows of cash, so a bank holds a reserve in order to satisfy the possible shortage of cash. They also hold reserved due to legal obligations.

Defining θ as the reserves ratio, R as the total amount of the reserve and D as the total amount of deposits, it is possible to establish the following relation:

$$R = \theta D$$

If individuals would like to hold the amount of deposits defined by D^d, then the banks must hold θD^d reserves. Thus, the demand for reserves by banks is:

$$R^d = \theta(1-c)M^d$$

Given the equations for the public demand for currency and the demand for reserves by banks, it is possible to determine the **demand for central bank money** (H^d):

$$H^d = CU^d + R^d$$

$$H^d = cM^d + \theta(1-c)M^d$$

$$H^d = [c + \theta(1 - c)]M^d$$

Substituting the M^d with the equation found in the previous paragraph, the equation becomes:

$$H^d = [c + \theta(1 - c)]€YL(i)$$

This equation represents the demand for central bank money.

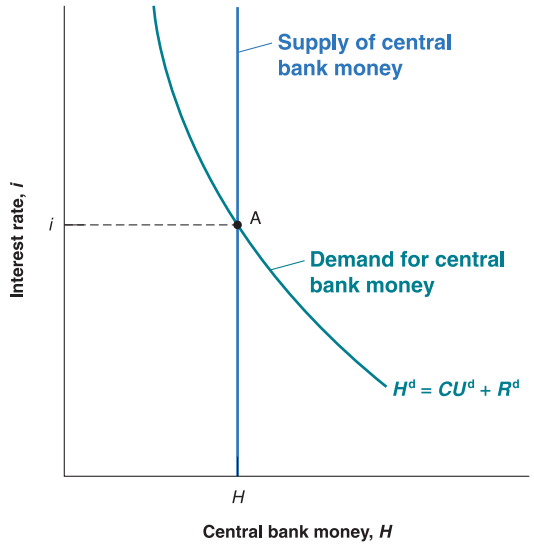
Since the **supply of the central bank money** (H) is fixed and established by the central bank, the interest rate is determined by the equivalence of the two curves.

$$H = H^d$$

$$H = [c + \theta(1 - c)]€YL(i)$$

Graphically, the equilibrium interest rate is identified by the intersection of the two curves, as seen in Figure 4.

Figure 4: Equilibrium in the market for central bank money and determination of the interest rate.



Source: Blanchard et al. (2010).

The amount of money supplied by the central bank is, by definition, equal to the reserves plus the currency. From an analytical point of view, the supply of the central bank money (H) is equal to the demand for currency plus the reserve demand:

$$H = CU^d + R^d$$

By moving the terms of the equation, it is possible to find that the reserve supply $(H - CU^d)$ is equal to the reserve demand (R^d):

$$H - CU^d = R^d$$

$$R^s = R^d$$

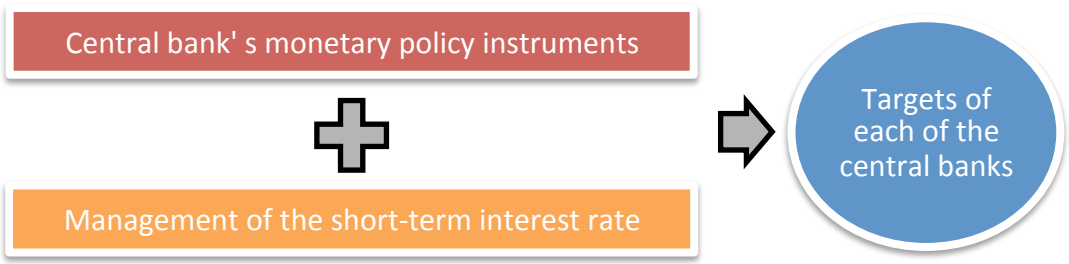
This means that it is possible to establish the correct interest rate, not only by using the demand for central bank money and the supply of the central bank money, but also by using the demand and supply of the reserve. Therefore, each central bank can act in order to influence the reserve market and, in this way, achieve the desired interest rate. The behaviour of the ECB and the FED at the moment the interest rate of the reserve market is defined is somewhat different; the ECB defines the corridor over which the reserve interest rate (EONIA) has to move, while the FED conducts OMOs in order to achieve and maintain the reserve interest rate, as much as possible, near to the Federal Funds Target.

1.5 Empirical evidence on inflation: the Taylor Rule

This section discusses the Taylor Rule as a possible procedure that can help the central bank at the moment the interest rate is defined. According to the empirical estimations, this rule represents the trend and the fluctuations of the interest rate in Europe and the US. However, this does not mean that the ECB and the FED strictly implement the Taylor Rule; in fact, at the moment the interest rate is determined, these central banks also use other models and other variables to adopt the best interest rate.

As previously mentioned, price stability is the main target pursued by the ECB, and, under the conventional monetary regime, it conducts OMOs in order to manage the interest rate and achieve the desired level of inflation. It is obvious that the inflation rate is not under the control of the central banks. Thus, the Taylor Rule can help them determine the interest rate given the inflation rate target.

The graph below summarises the decision-making process of each central bank:



Is difficult to establish which kind of rule the ECB should use to implement its monetary policy; it is certain that the interest rate should be managed by the main instrument available to a central bank in order to achieve its price stability target, but economists have proposed different rules that each central bank could follow to conduct its monetary policy and achieve its monetary target. This will be illustrated using three different possible rules, each one sustained by a different economic group (Mankiw & Taylor, 2011).

The first rule, which is sustained by monetarists, supposes that the central bank should maintain a stable growth rate for the money supply. They think that fluctuation in the money supply is the main reason for variations in the economy, and they assert that a stable and slow increase in the growth rate of the money supply should facilitate stability in the production and unemployment levels, resulting in steady prices. The main criticism of this rule has been that the stable growth rate of the money supply only stabilises the economy if the liquidity in circulation is always stable and does not fluctuate; as is already known, this is impossible since, in general, the economy is always affected by some shock, an example that was illustrated is the possible increase in the money demand.

A second rule that is strongly sustained by the economists is that one should consider the nominal gross domestic product (GDP); this rule illustrates that the central bank should determine a target for the nominal GDP, and it should follow the preannounced objective by increasing or reducing the monetary growth. If the nominal GDP is lower than the nominal GDP's target, then the central bank has to increase the monetary growth in order to increase the aggregate demand. With respect to the previous idea promoted by the monetarists, this rule has more support from other economists since the definition and the pursuit of the nominal GDP's target permits a higher stabilisation of the liquidity in circulation of the aggregate production, resulting in a higher price stability for the whole economy.

The third and last rule, which is most often implemented by the central bank, and in particular by the ECB, is the pursuit of an inflation target. The central bank changes the money supply in accordance with the actual level of inflation and its target level. For this option, the Taylor Rule can be considered a possible integration for the monetary policy; this means that it is not used as *dogma* by the ECB, but it can help the central bank in the conduction of the policy and, thus, its pursuit of price stability. The Taylor Rule can constitute a possible short-term operational procedure that the ECB can use to reach its long-term target (price stability).

Thus, two important variables are included in the formulation of this rule. The first variable is the inflation target in accordance with the objective of the ECB. The second variable is the output gap, which illustrates the actual economic situation of the country and the actual, possible pressure due to inflation.

The original formulation of the Taylor Rule illustrates a theoretical definition of the interest rate by a central bank. In particular, it considers the output gap, the target level of inflation and its actual level; the rule is explained as follows (Alcidi *et al*., 2016):

$$i_t^i = r^* + \pi_t + 0.5(\pi_t - \pi_t^*) + 0.5\bar{y}_t^i$$

where:

i_t^i : The level of the nominal interest rate;

r^* : The level of the long-term real equilibrium interest rate;

π_t : The current level of the inflation rate;

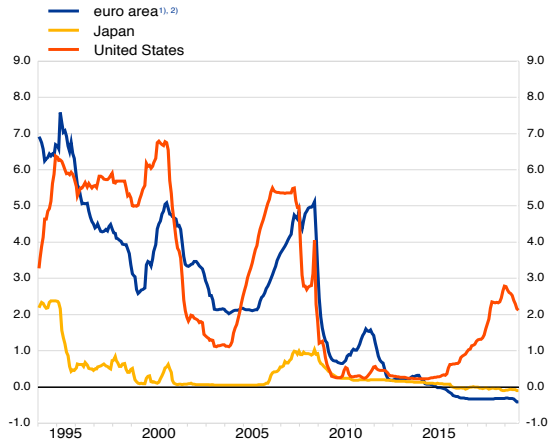
π^* : The target level of the inflation rate;

$\bar{y}_t^i$: The level of the output gap.

In its original formulation, a key feature of the Taylor Rule is that it attributes an equal weight to the level of inflation and to the level of the output gap. In fact, the coefficients in the equation are both equal to 0.5; however, Taylor's idea is that the central bank should react to actual inflation with a factor of 1.5, since the main mandate of the central bank is to stabilise prices. Numerous economists have tested the application of the Taylor Rule, and they discovered that such a relationship describes the fluctuation of the interest rate for the US as well as other countries, such as those in Europe, over the last 15–20 years.

However, it is clear that, in reality, no central banks rigidly follow the Taylor Rule; in fact, at the moment the monetary policy is implemented, they also consider other variables and other models that can help them identify the best monetary solution. The Taylor Rule did not provide a convincing answer during the financial crisis of 2008; moreover, the common monetary policy of reduction of the interest rate by the ECB and by the FED did not produce any kind of results. In fact, as seen in Figure 5, all the main central banks, the ECB, the FED and the BOJ, have a very low interest rate, almost equal to 0. A further decrease in the interest rate under the so-called zero lower bound (ZLB) level would not have produced any results in any of the countries.

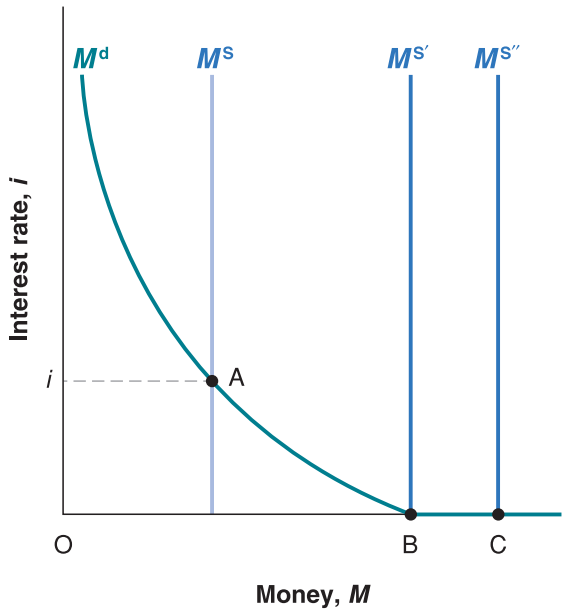
Figure 5: Month money market rates (monthly averages; percentages per annum).



Source: ECB bulletin (2019).

From the information presented in Figure 5, it is clear that all of the major countries have slipped into a liquidity trap, so the interest rate is too low to implement any kind of monetary policy. The situation can be illustrated, as seen in Figure 6.

Figure 6: Money demand, money supply and the liquidity trap.



Source: Blanchard et al. (2010).

Point B perfectly describes the liquidity trap; in particular, since the interest rate is equal to 0%, individuals are indifferent to the holding of currency or bonds because they do not yield any kind of interest. Thus, any attempt to increase the monetary supply $M^{s\prime\prime}$ is useless. This is represented by point C in Figure 6.

Economists have supported different and controversial theories to address this problem. In particular, Keynes (1936), and many other economists, supported the theory that during a phase characterized by ZLB any central bank is helpless. Monetarists, such as Mishkin (1996), used evidence to support the idea that the situation can be solved using by a significant amount of liquidity into the system.

To solve the depressed situation and to escape from the liquidity trap, the major central banks have implemented a series of unconventional monetary policies (UMP) to inject liquidity into the system; since these policies have resulted in an increase in the amounts listed on the balance sheets of the central banks, they are commonly referred to as Quantitative Easing.

2. CHAPTER

EUROPEAN QUANTITATIVE EASING

This chapter will describe the European reaction to the Great Recession as well as the main policies implemented by the ECB to solve the depressed European financial situation. Initially, the chapter will explain the so-called European sovereign debt crisis (Section 2.1), and it will then continue with a description of the European turning point, the 'whatever it takes' (WIT) speech given by Mario Draghi in 2012. This speech ideally divided the initial, weak European unconventional monetary policy (Section 2.2) from the effective, strong reaction of quantitative easing (QE) by the ECB (Section 2.3). The chapter will also include a detailed description of the asset amounts purchased by the ECB, and it will explain the reasoning behind this acquisition. Finally, the chapter will conclude with a description of the main transmission channels of QE (Section 2.4) and an illustration of QE policy in the rest of the world (Section 2.5). To evaluate the effectiveness of European QE policy, and because the monetary policy of the Federal Reserve (FED) is usually adopted by the ECB as a terms of comparison, this last section will mainly focus on the American monetary reaction. However, it will conclude with a brief description of the QE implemented by the Bank of England (BOE) and Bank of Japan (BOJ) and with a graphical representation of the balance sheets of each central bank.

2.1 The real European crisis

This section will explain the European situation after the crisis of 2008; particularly, it will analyse the economic condition of some European countries in terms of general government gross debt and GDP growth rate. The section will explain the evolution of the sovereign debt crisis after the burst of the subprime bubble in the US, and it will then discuss the Securities

Market Programme (SMP), the intervention of the ECB. Finally, this section will conclude with a presentation of the financial condition of the PIIGS countries (Portugal, Ireland, Italy, Greece and Spain) in 2012 compared to Germany.

The previous chapter ended with a discussion of how the most advanced economic countries slipped into a liquidity trap. The leading country was the US; in fact, with the burst of the subprime bubble and the subsequent crash of the American housing market, the global financial situation was seriously affected. A general reduction of the interest rate occurred in every advanced country, including the European Union.

After the subprime crisis, most European commercial banks were in a bad financial situation. Therefore, the main solution adopted by most of the European Union member states was the implementation of nationalization policies. The first bank that was nationalized was the Northern Rock Bank; it was the fifth largest bank in the UK in 2007, and it was nationalized in February 2008. This was one of numerous cases of public intervention directed at helping the failing banking system. Other similar cases occurred in many other European Union member states, including Portugal, France, Germany, Greece and many others. The government of each of these states supported its banking system by issuing loans and warranties and implementing recapitalizations and credit lines.

In general, the European Union allocated €3.166 billion to support the weak banking system, thus encouraging economic recovery and preventing the possible crash of the European financial system. However, the large amount of money issued and injected into the system determined an increase in public debt. As shown in Figure 7, the amount of government debt in some major European countries rose in 2008, mainly because of these public interventions. Even important and financially stable countries, like Germany, showed a debt increase; between 2007 and 2010, the German general government debt increased from 63.7% to 81.8% of the GDP (Consob, 2011). This negative debt situation was common in Europe and was still was higher than the European target in 2018.

This target was identified in article 126(2b) of the Treaty of Functioning of the European Union (TFEU), which stated the limit of the ratio between the levels of the country's debt and its GDP, in particular it states:

Article 126

2. The Commission shall monitor the development of the budgetary situation and of the stock of government debt in the Member States with a view to identifying gross errors. In particular it shall examine compliance with budgetary discipline on the basis of the following two criteria:

(a) Whether the ratio of the planned or actual government deficit to gross domestic product exceeds a reference value, unless: - either the ratio has declined substantially and continuously and reached a level that comes close to the reference value, - or, alternatively, the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value;

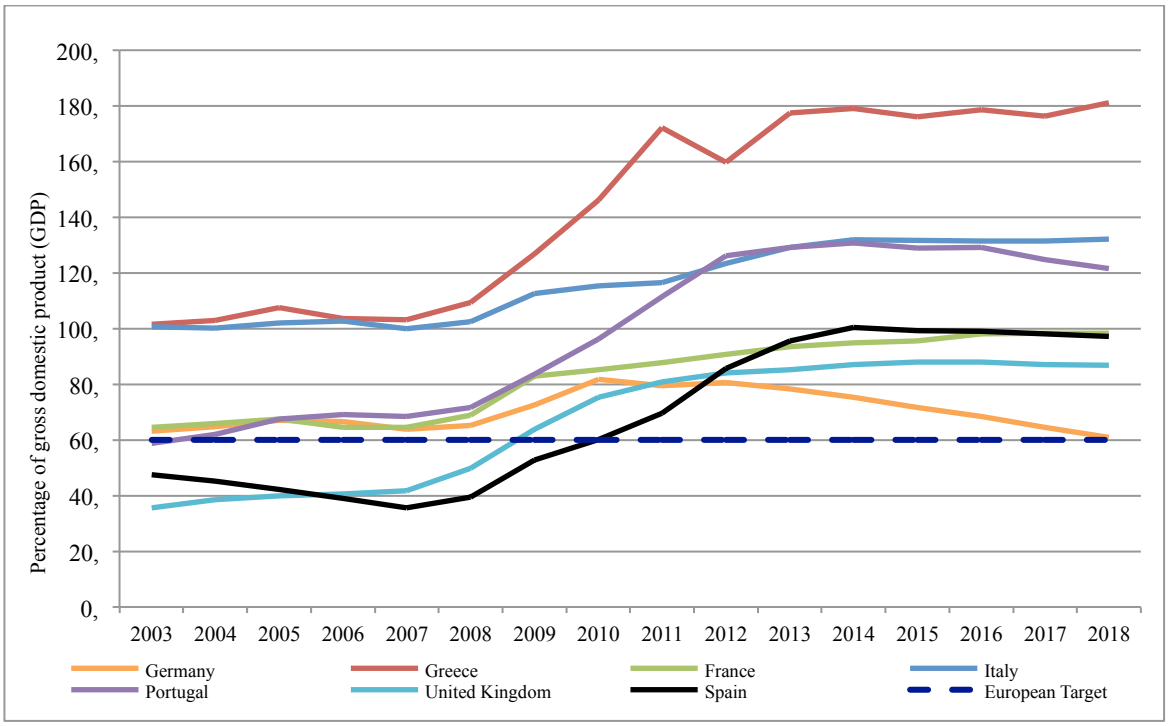
(b) Whether the ratio of government debt to gross domestic product exceeds a reference value, unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace.

The reference values mentioned in the article are explained and quantified in protocol 12(1). They are as follows:

- 3% for the ratio of planned or actual government deficit to GDP at market prices
- 60% for the ratio of government debt to GDP at market prices

Even as the crisis of 2008 ended, these limits were not observed by the European countries to which they apply. As mentioned above, the large amount of support provided by the central governments created a huge increase in their level of debt, laying the foundation for the sovereign debt crisis of 2012.

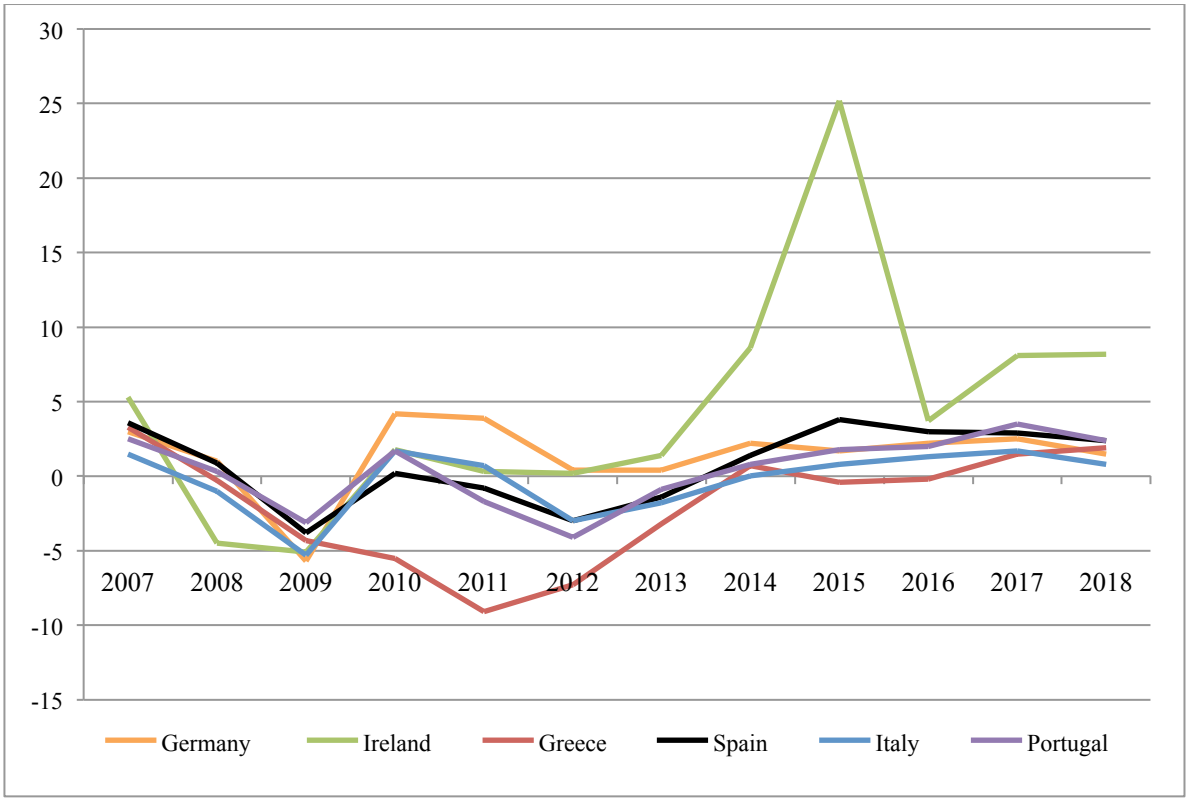
Figure 7: General government gross debt as a percentage of GDP for the main European countries.



Source: Our elaborations on Eurostat data.

At the beginning of the crisis, the European situation was heterogeneous; for example, the European countries presented significant differences in growth rate and public financial conditions. In this way, two sides of the European Union could be distinguished: the 'core' European countries and the PIIGS countries. The core countries, like Germany, presented a stable economic activity and a low level of public debt compared to other European countries. In contrast, the PIIGS countries presented a weak economic situation due to the unstable dynamic of public debt, which was exacerbated by the payment of accumulated interests and by recently implemented nationalization policies (Talamo and Di Stefano, 2016).

Figure 8: GDP growth rate (annual %) of Germany and PIIGS.



Source: Our elaborations on Eurostat data.

In addition, the PIIGS countries showed a high level of deficit and a low GDP growth rate. In fact, as seen in Figure 8, each of these countries presented a negative GDP growth rate in 2009. Interestingly, Germany also recorded a negative growth rate in 2009. The country's growth rate for that year was -5.7%, the lowest level among the European states considered herein. In 2010, Europe recorded a general economic recovery, during which time European GDP growth rates increased again (Figure 9). Among the considered countries, the highest increase in GDP growth rate during this time was that of Germany, with a value of +4.2%.

Figure 9: GDP growth rate (annual %) for the Euro area.

Source: Our elaboration on World Bank data.

Despite the 2010 recovery of the European economy as a whole and because of the huge differences between countries, the financial situation drastically changed for some European Union member states when Greece's bills became public in 2009. In October 2009, Greece's government updated the public financial projections, changing the deficit/GDP ratio from the theoretical value of 3.7% to the effective value of 12.7%. Immediately, the Fitch Ratings Agency downgraded the rating level of the country from A to A-, and by the end of 2009, the country held the rating level of BBB+. This event stands as the beginning of the real European crisis; while the crisis of 2008 weakly affected the European Union member states, the sovereign debt crisis caused a general downgrade in creditworthiness for numerous countries. The main states that showed this downgrading and, therefore, recorded a significant increase in payment of accumulated interests were Portugal and Ireland (in the period immediately after Greece's case) as well as Spain and Italy (in the subsequent period).

To solve the dramatic and dangerous situation caused by the Greek economic concealment, the European Union and the International Monetary Fund (IMF) instituted the SMP in May 2010. The SMP focused on the purchase of an unspecified amount of government bonds in secondary markets to monitor the spread's dynamic. During that year, the European Union and IMF granted a loan of €110 billion to save Greece from default. This was merely the first intervention; in November of the same year, the European Union and IMF granted two other loans. The first one was directed to the Irish Central Bank for an amount of €85 billion (equal to almost 55% of Ireland's GDP), and the second loan for €78 billion was granted to the Portuguese Central Bank. The Fitch Rating Agency downgraded Ireland's government bonds

from the rating level of A+ to BBB+, and it downgraded Portugal's rating level from A+ to AA-.

Due to this change in rating, the crisis intensified for these countries. In general, the downgrading of a government's ratings causes a reduction in the creditworthiness of the country, and this creates, in turn, a series of negative effects. One possible negative effect is the reduction of foreign investments in the country's bonds; a low rating is associated with a higher level of risk, so investors are discouraged from investing in that specific country. Another negative effect is GDP contraction; the higher probability of default creates a higher interest rate, and in turn, this reduces domestic investments. Diminishing domestic investments causes a contraction of production, thus worsening the financial condition of the country.

This perfectly describes what happened in Italy, which was affected by the crisis in 2011 when the return on treasury bills reached 7%, showing a progressive accumulation of debt. Therefore, the Fitch Rating Agency downgraded the Italian government bonds from AA- to A+. During this period, the value of the spread between BTP and BUND (German treasury bills) moved from 200 basis points (bp) to the highest peak of 570 bp in November 2011. This caused many investors, who were nervous about the unstable financial situation in Italy, to deposit their money in countries like Germany, which were evaluated as 'safe' by the agency's rating. This phenomenon, or 'flight to quality', damaged and aggravated the Italian economic condition, decreasing the state's likelihood of recovery (Consob, 2011).

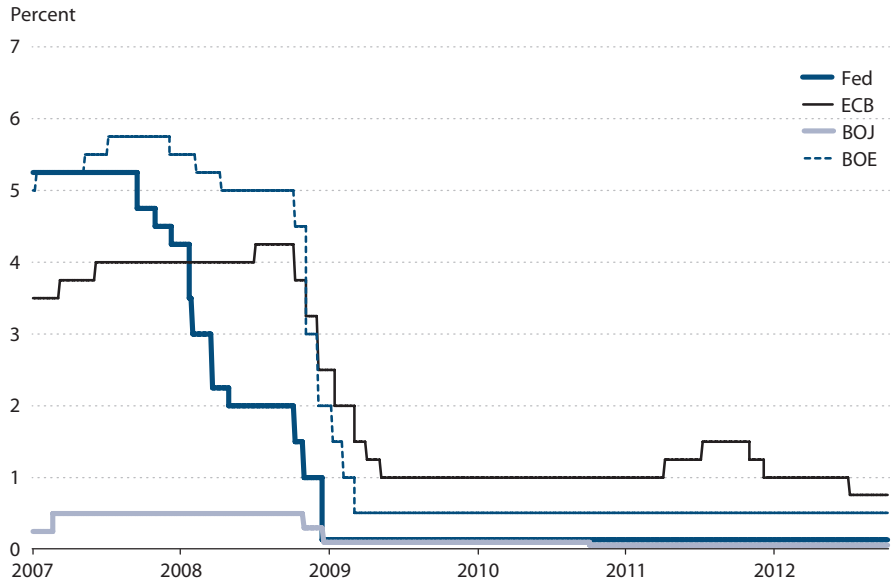
2.2 The European Union initial reaction to the crisis

The ECB reacted differently during the years of crisis, and two difference phases can be distinguished during which time the ECB implemented several monetary policy countermeasures. The first period included the ECB's immediate reaction after the American crisis of 2008, while the second phase was started by the WIT speech of 2012. This section will focus on the initial phase of reaction.

During the first phase, the ECB's reaction to the crisis of 2008 did not diverge from the initial reaction of the FED; immediately after the burst of the subprime crisis, both central banks reduced the interest rate to incentivise economic recovery. However, despite the common policies implemented by different global central banks, a comparison of the early interventions of

the ECB, FED, BOE and BOJ reveals some differences, particularly in terms of time. As seen in Figure 10, the ECB's reduction of the interest rate in 2008 occurred with some delay compared to that of the other countries; the FED had reduced the interest rate already in 2007 (Reisenbichler, 2019).

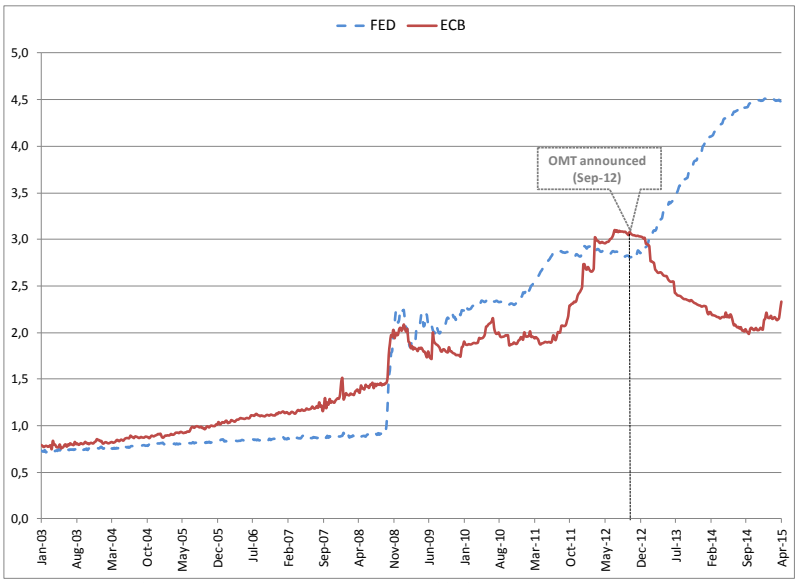
Figure 10: The European Central Bank (ECB), Bank of Japan (BOJ) and Bank of England (BOE) main policy rates



Source: Fawley and Neely (2013).

Between October 2008 and May 2009, the ECB tried to implement some *credit enhancement* measures to support the interbank market and compensate for the contraction of global sales. During this time, it reduced the main refinancing rate by 325 bp, causing the rate to reach a value of 1%. The ECB also extended the maturity of long-term refinancing operations (LTROs); in October 2008, it raised their regular maturity from 3 months to 6 months and subsequently increased their maturity to 12 months. Moreover, the ECB also launched its first covered bond purchase programme (CBPP1) with the intention of reviving a relevant market that had always represented an important source of financing for European banks. Through this programme, the ECB purchased €60 billion in securities and, in combination with the implementation of these measures, it extended the list of eligible assets. As seen in Figure 11, the first set of countermeasures in 2008 increased the size of the ECB's balance sheet to a level higher than €2 trillion (Micossi, 2015).

Figure 11: The balance sheet of the Federal Reserve (FED) and the ECB (2003 to 2015; trillions of dollars or Euros).

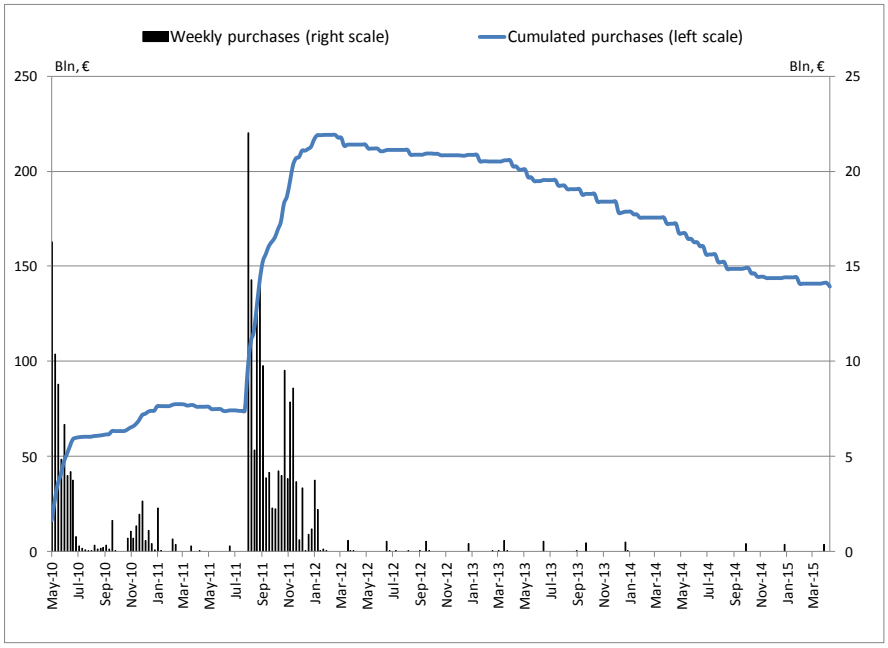


Source: Micossi (2015).

The second phase of ECB reactions started with Greece's public announcement of a huge increase in the debt/GDP ratio and the start of the European sovereign debt crisis, as explained previously. Although the initial solution implemented by the ECB in 2010 was the introduction of the SMP, the purchase of public and private sector debt securities in the secondary market was sterilized by weekly fixed-term deposit transactions. The main purpose of the programme was preventing the injection of too much liquidity into the banking system, but the main problem associated with the SMP was that the ECB did not reveal the amount of money designated for the purchases. Moreover, the ECB did not disclose the set of securities to be targeted. In this way, the programme produced lower than expected results, and therefore, its market impact was strongly reduced.

As seen in Figure 12, the SMP mainly concentrated on purchases of securities during its implementation (May 2010) and in August 2011. In March 2011, the programme was temporarily suspended apparently because of the European Council's rejection of the European stability mechanism (ESM), which should have had the power of operating in the secondary bond market. The SMP was reactivated in August 2011 when the ECB purchased a large amount of Italian and Spanish sovereign bonds, but once Berlusconi's government showed no intention to implement the promised reforms, the programme was indefinitely suspended. In September 2011, the Outright Monetary Transaction (OMT) replaced the SMP.

Figure 12: The ECB Securities Market Programme.



Source: Micossi (2015).

Because of the turbulence in the Italian and Spanish financial markets, the ECB decided to purchase an additional €40 billion covered bonds (CBPP2) in October 2011 destined to them. Italy and Spain represented some potential problems for the European Union. In fact, at the end of 2011, the idea that Greece would leave the European Union was well established in Europe, and Italy and Spain represented two potential similar cases due to their poor financial situations.

In fact, despite the launch of two very long-term refinancing operations (VLTROs) with a maturity of 3 years, and despite the reduction of the minimum reserve requirement from the value of 2% to 1%, the actual situation of these countries remained problematic. During the first VLTRO in December 2011, more than 500 European commercial banks benefitted from the implementation of such a policy; they received funds equal to €490 billion. In addition, the ECB designated an estimated €530 billion for more than 800 European commercial banks during the second VLTRO in February 2012. However, the Italian and Spanish banking systems were still weak.

The situation radically changed on 26 July 2012, when the ECB's president Mario Draghi gave his famous speech in London: 'Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough' (Mario Draghi, 26 July 2012).

His speech represented the real turning point for financially stressed countries like Italy, Spain and Greece.
With this speech, the ECB implemented the OMT. The announcement of this programme was vital for Italy, Spain and Greece; under the OMT, the ECB and the NCBs were ready to operate in the countries' secondary sovereign-bond markets by purchasing unlimited amounts of bonds with maturity below 3 years with no pre-specified time limit. However, the ECB imposed a condition on the states involved in the OMT programme. It forced the states to sign an economic plan in accordance with the European Financial Stability Facility (EFSF) authority. The OMT never needed to be implemented, though; the simple announcement that the ECB was ready to save every European Union member state was enough to calm the market. As a result of the announcement, the Italian and Portuguese spreads reduced by 100 bp and 180 bp, respectively, from July 2012 to September 2012 (Talamo and Di Stefano, 2016).

In this way, the ECB ideally accepted the role of lender of last resort, although it has never explicitly accepted this function, mainly due to possible moral hazards. In fact, the ECB still believes that, because the states know that it is always at their disposal to purchase an unlimited amount of sovereign bonds, they are incentivised to issue an excessive amount of debt. The implementation of such measures produced a positive effect in Italy, Spain and Greece; in fact, the OMT announcement increased the financial stability of these countries and reduced the flight to quality phenomenon.

2.3 ECB Quantitative Easing

To evaluate the effectiveness of the European unconventional monetary policy, its composition must first be analysed. This section will explain in detail the unconventional monetary policies adopted by the ECB since the WIT speech in 2012, and it will illustrate the reasoning behind such unconventional measures. Since the main result of these policies was an increase in the ECB's balance sheet, they are commonly referred to as QE. The section will conclude with the last programme announced by the ECB, which ended in December 2018. However, this programme was extended by the ECB in October 2019 to increase and facilitate banking credit inside Europe.

With the European sovereign debt crisis, the ECB discovered that previously used conventional monetary policies were completely useless. Because it aimed to incentivise a faster

economic recovery of the continent, the ECB tried to implement other provisions—the so-called European unconventional measures. Some examples of these unconventional measures include the already implemented SMP and VLTROs. These provisions were executed before the interest rate reached the ZLB value, and they can be seen as a sort of extension of the ECB's role of lender of last resort. The implementation of such measures produced discrete results.

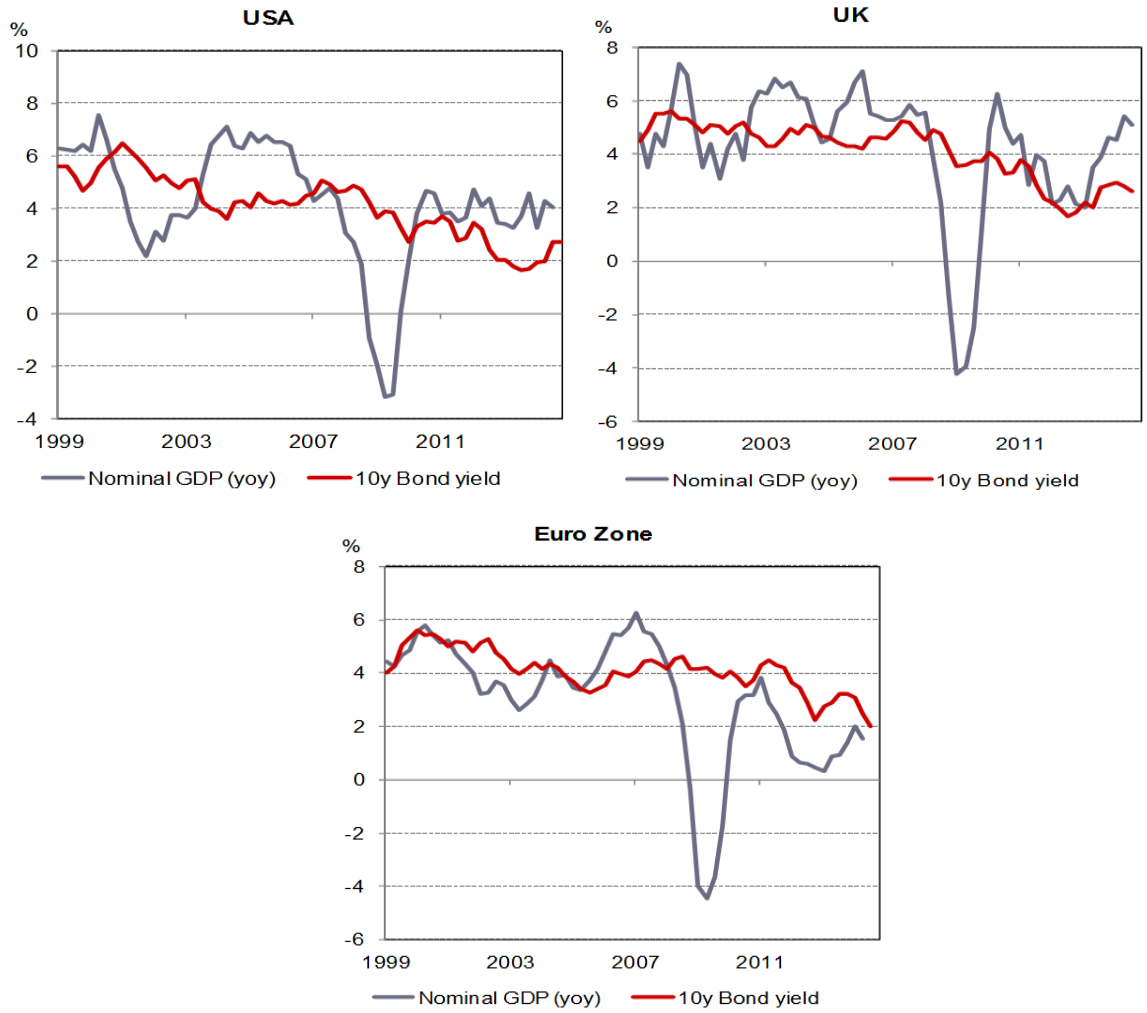
However, once the interest rate reached the ZLB and the focus of the ECB moved from the stabilization of the European banking system to the stimulation of European real growth and reduction of deflation, the Eurotower researched other solutions. The ECB then decided to implement some countermeasures to reduce the long-term interest rate; after all, the short-term interest rate had reached ZLB, and therefore, it was impossible for the ECB to further reduce it. In contrast, the long-term interest rate remained positive, even when the short-term rate reached 0%.

The ECB used two different techniques to reduce the long-term interest rate. The first instrument was *forward guidance*. Through this tool, the ECB tried to influence the interest rate expectations, announcing in advance that the low-rate policy would remain in force for a long period of time, not just temporarily. The second method implemented by the ECB was the purchase of a large number of long-term assets. Through this purchase, the ECB increased the price of these assets and set in motion the so-called *portfolio balance effect*. The intention of the ECB was an assets substitution in the private portfolio. These two techniques were not mutually exclusive; implementation of the first method did not preclude adoption of the second. As mentioned above, these unconventional measures are referred to as QE because they caused a huge increase in the overall size of the central bank's balance sheet.

Despite the ECB's implementation of previous measures, the value of the long-term interest rates did not decrease enough. Comparison of the 10-year government bond yield of the ECB with that of other central banks like the FED and the BOE shows that the reduction of long-term interest rates was higher for the FED and BOE. Both the FED and BOE reduced the 10-year government bond yield to a value lower than the GDP growth rate, thus reducing the interest burden for these countries. Such was not the case for the ECB. In fact, as shown in Figure 13, the ECB was not able to reduce the 10-year government bond yield so that its value was lower than the nominal GDP growth rate of Europe. This can be considered one of the

many reasons for the lower impact of QE in Europe than in other countries (Bini Smaghi, 2014).

Figure 13: Nominal GDP growth rate and 10-years government bond yield.



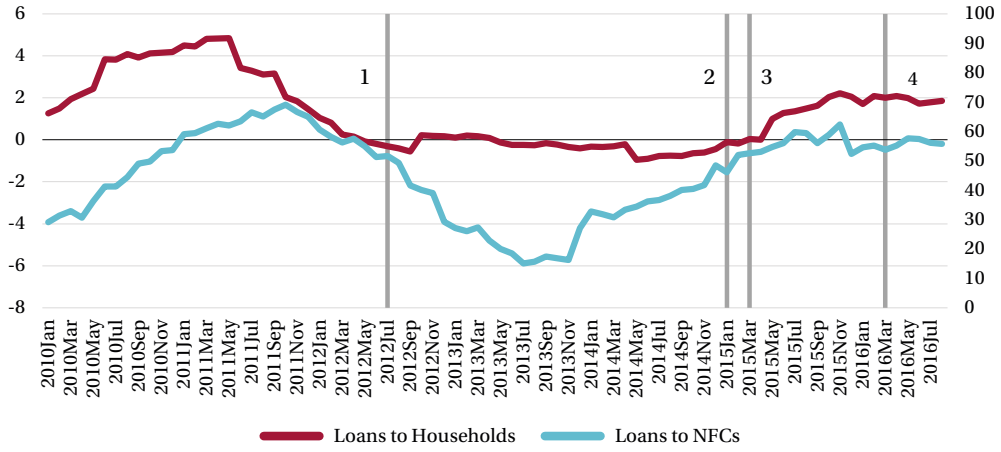
Source: Bini Smaghi (2014).

After the WIT speech and the launch of the VLTROs, the ECB decided to implement further measures to support the private sector and encourage, as much as possible, private credit and the banks' supply of loans. Therefore, it launched two different programmes at the end of 2014. The first was a new covered bond purchase programme (CBPP3) begun in October 2014, and the second one was the asset-backed securities purchase programme (ABSPP) started in November of the same year.

In addition, the ECB announced a series of targeted long-term refinancing operations (TLTROs) in June 2014. Moreover, it decided to reduce the deposit facility rate to a negative

value (-0.10%) for the first time. In this way, the ECB tried to stimulate the aggregate demand and incentivise banks to issue loans to households and non-financial corporations (NFCs). As seen in Figure 8, the amount of loans issued by banks to households and NFCs had reduced drastically from May 2011, particularly in the case of loans to NFCs. Through the ECB's actions, the amount of loans increased; however, this increase was still far from the ECB's target (Demertzis and Wolff, 2016).

Figure 14: Loans to households and non-financial corporations (NFCs; year-on-year growth, %).



Source: Eurostat and European Central Bank. Note: 1) 'Whatever it takes' (see footnote 5); 2) PSPP Announcement; 3) Start of PSPP; 4) CSPP and expansion of PSPP.

Source: Demertzis and Wolff (2016).

Despite the introduction of these numerous programmes, the economic situation of the countries was still very weak. Moreover, the lower-than-expected increase in the level of Harmonized Index of Consumer Prices (HICP), a measurement that represents the consumer inflation level, forced the ECB Governing Council to launch an expanded asset purchase programme (APP), under which the ECB purchased monthly assets for an amount approximately equal to €60 billion from March 2015 to the end of September 2016.

The APP launched by Mario Draghi in January 2015 included the following:

- ABSPP
- CBPP3
- The public sector purchase programme (PSPP)

Under the PSPP, the ECB planned to purchase €50 billion of securities in the secondary market every month for the entire period until September 2016. The idea was for the ECB to con-

tinue purchasing assets until the level of the inflation returned to the European target level. The PSPP announced by the ECB planned the acquisition of bonds issued by the European Union member states and by some national agencies for an amount equal to €836 billion and securities issued by certain European institutions for an amount of €114 billion. The monthly purchase of the ECB for the period from March 2015 to September 2016 included 19 months, so the entire amount of the programme was established around €950 billion (19 months x €50 billion).

To the PSPP's monthly cost of €50 billion must be added the monthly €10 billion of the ABSPP and CBPP3. Therefore, to the initial value of €950 billion must be added €190 billion (19 months x €10 billion). Thus, the programme was equal to €1.4 trillion; in this way, the balance sheet of the ECB was reduced to the pre-crisis level.

The 8% of sovereign and the 12% of securities of the monthly €50 billion were held by the ECB on its account. Therefore, the risk associated with these purchases was shared among the European Union member states. The remaining part of the monthly €50 billion was designated for the purchase of national public securities, and it was allocated to each NCB in accordance with the capital-key criteria. Table 2 explains the allocation of the monthly asset purchase under the APP from March 2015 to September 2016 (Micossi, 2015).

Table 2: The allocation of monthly asset purchases by the Eurosystem.

Bonds	Bondholder	Monthly purchase	Total Purchase
ABS and Covered Bonds	ECB	€10 billion	€190 billion
European institutions	ECB	€6 billion (12% of €50 billion)	€114 billion
European Central governments And agencies	ECB	€4 billion (8% of €50 billion)	€76 billion
European Central governments And agencies	NCBs	€40 billion (80% of €50 billion)	€760 billion
TOTAL		**€60 billion**	**€1.14 trillion**

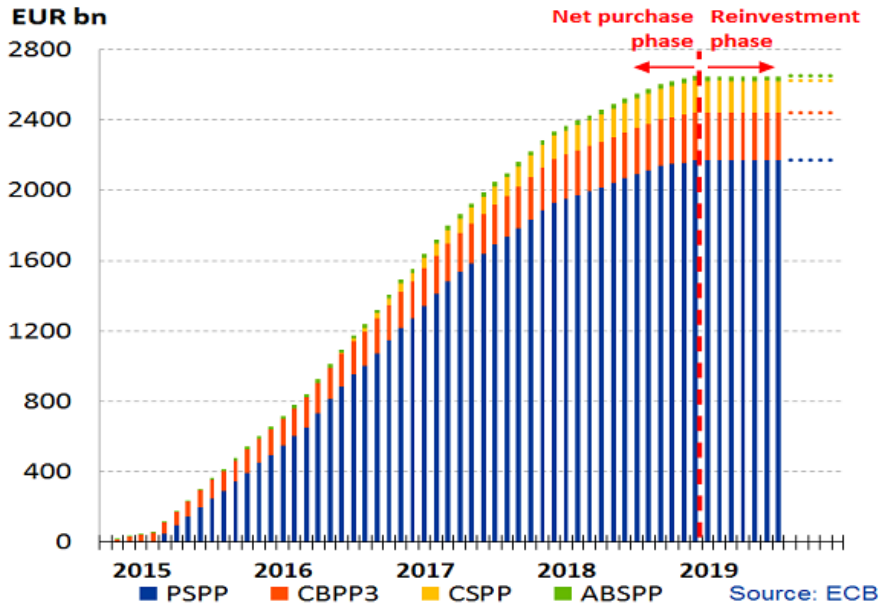
Source: Micossi (2015).

The ECB's governing council decided to expand the APP in March 2016. It introduced a CSPP mainly directed at increasing and facilitating the bank's credit to NFCs. In addition, the

ECB launched a new series of TLTROs (TLTRO II) with a maturity of 4 years. Therefore, the ECB continued the programme that would have ended in September 2016.

The last phase of the APP ended on December 2018. As seen in Figure 15, the number of securities purchased from 2015 to 2018 drastically increased during that time, due to the ECB's intensification of the PSPP and CBPP3.

Figure 15: Asset purchase programme (APP) cumulative net purchases, by programme.

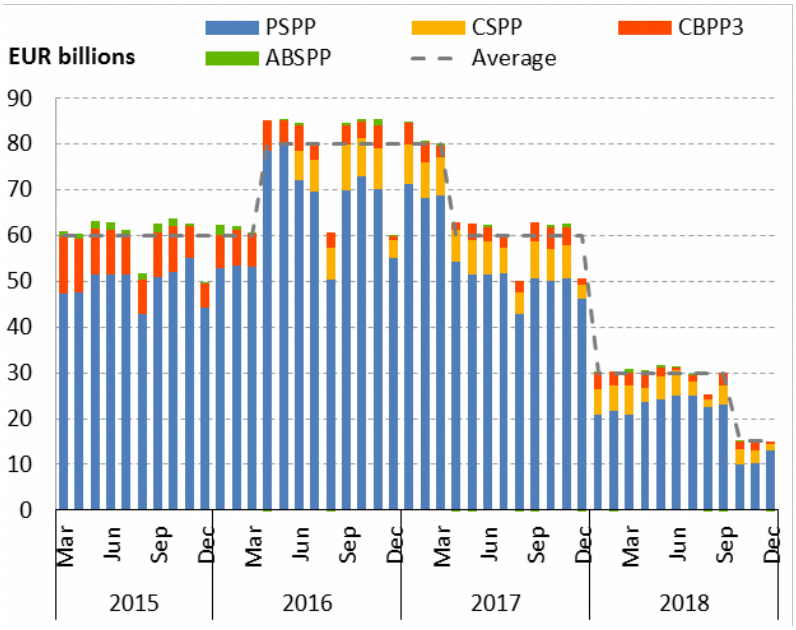


Source: ECB.

The average pace of monthly purchases conducted by the ECB under the APP since the early implementation in March 2015 can be summarized as follows (Figure 16; European Central Bank, 2019):

- €60 billion from March 2015 to March 2016
- €80 billion from April 2016 to March 2017
- €60 billion from April 2017 to December 2017
- €30 billion from January 2018 to September 2018
- €15 billion from October 2018 to December 2018

Figure 16: History of APP net asset purchase



Source: ECB.

The ECB has been criticized by some economists because it waited too long to implement such unconventional measures. Even members of the ECB's governing council, such as Orphanides in 2017 and Honohan in 2018, criticized the ECB's reaction. In their opinion, the ECB should have acted earlier and with more determination. According to them, the main reason for the delay was that the ECB's self-imposed constraints were more imagined than real, due to an over-interpretation of the ECB Statute (Neri and Siviero, 2019).

2.4 The main transmission channels of Quantitative Easing

The ECB's adoption of unconventional monetary measures affected the real economy through different channels (Neri and Siviero, 2019). This section will explain the main transmission channels through which the European QE policy produced such results.

- **The signalling channel and the scarcity channel**

  The signalling channel and the scarcity channel are strongly linked. When the ECB bought some financial assets, this purchase generated two different effects. The first was an increase in the price of the asset due to the reduction of its risk-free component. Since the asset was purchased by the ECB, the risk associated with the asset was reduced; thus, its price increased. This describes the signalling channel. The second effect was the de-

cline of the premium component due to the scarcity channel. Investors preferred to buy the assets purchased by the ECB, but the amount of these assets was lower; therefore, the investors were forced to accept a lower yield for them.

- **The excess liquidity channel**

  The ECB's purchase of a large amount of assets caused an increase of the liquidity inside the interbank market. Since the amount of money inside the system was higher than before, the interest rate in the interbank market decreased. This incentivised banks to offer loans to the real economy and even to each other.

- **The confidence channel**

  The implementation of the QE by the ECB produced effects in terms of reputation. The programme showed the strong intent of the ECB to reach its inflation target, thus increasing the credibility of the central bank. This, in turn, produced positive effects on the inflation expectations of the consumers and the investors, who were then incentivised to spend money.

- **The portfolio-rebalancing channel**

  The purchase of one type of asset by the ECB caused an increase in the price and a reduction of the yield of that specific asset. As a result, investors tried to find another category of asset that produced a higher yield. This, in turn, caused an increase in the price and a reduction of the yields of the second category of assets. The mechanism continued this cycle, thus producing a general increase in the level of prices of each category of assets.

- **The exchange rate channel**

  The reduction of the yield of the domestic assets was associated with an increase in the yields of foreign assets. In other words, investors preferred to buy foreign assets due to their higher gain. As a result, the demand of foreign currency increased, causing a depreciation of the domestic currency. In turn, the domestic depreciation of the exchange rate caused an increase of exports and, thus, an overall gain for the European area.

- **The government budget constraint channel**
  The decline of the yields produced a positive effect for the governments' debts. The State then could save money by lowering the cost of debt and using these saved funds to incentivise the real economy, thus reducing financial constraints and encouraging private consumption and investments.

2.5 Quantitative easing in the US and the rest of the world

This section will explain the QE policy in the rest of the world, particularly in the US, UK and Japan. Since the main focus of this thesis is the evaluation of European QE, a useful means of comparison is the monetary countermeasures implemented by the FED during the distressing period. For this reason, the American case will be more deeply analysed than the QE policies of other countries. In addition, because the American countermeasures were executed immediately after the crisis of 2008, the Wall Street meltdown will be briefly analysed to better understand the reasoning behind the FED purchases at the early stage.

On 15 November 2008, Lehman Brothers, one of the major banks in the US, failed, causing the so-called Great Recession to strike the world. Beginning in the US, this was the largest crisis since 1929, and it rapidly affected all other advanced countries. The main cause behind the crisis was the burst of the housing bubble. Before the crisis, the housing market was strongly incentivised by the American government due to the following reasons:

- Politicians' desire to provide one house to every American, including ethnic minorities
- Politicians' hope of giving back some stimulus to the American economy, which had been strongly affected by the dot.com bubble in 2000 and later by the terrorist attack in 2001
- Politicians' desire to reduce the enormous commercial imbalance that the American economy presented with respect to the other countries, particularly China.

A large stimulus to the expansion of the housing market was given through the introduction of some new and complex financial instruments. The first was the securitization process, which mainly involved American mortgages. Securitization includes an originator of the mortgage (the bank), which gives the credit to a vehicle company created *ad hoc* to receive such loans.

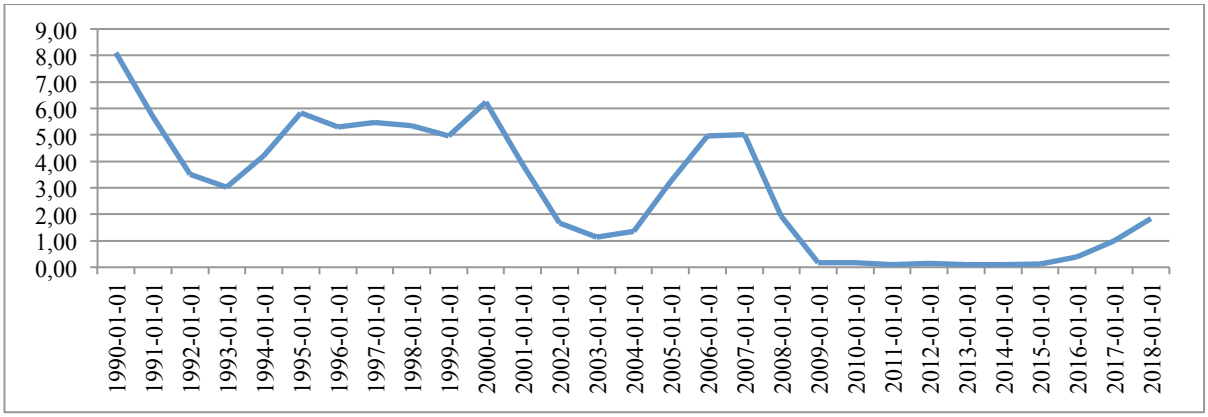
This company is called the special purpose vehicle (SPV). In exchange for the credit, the bank receives an equal amount of liquidity, allowing the bank with the received funds to offer additional mortgages to other individuals. In turn, the SPV uses these credits as a guarantee to issue some bonds, which are named differently in relation to their underlying. In general, the bonds are called asset-backed securities (ABS), but when the underlying is a mortgage, they are called mortgage-backed securities (MBS). When private or public debt is the underlying, they are called collateralized debt obligation (CDO), and in the case of very short-term credits they are called asset-backed commercial paper (ABCP). Any type of asset can be securitized, but normally it is an asset with periodical cash flows. For this reason, the most common form of securitization is one with home equity mortgages.

Generally, securitization converts an asset or group of assets into a marketable security and creates liquidity in the marketplace for an amount equal to the value of the assets being securitized. Usually, the securitized assets are divided into different layers or tranches, which are tailored to the investment risk tolerance of different types of investors. For instance, the lower risk layer may be purchased by pension funds seeking a secure, steady return, while the higher risk layer might be purchased by hedge funds willing to take a risk on mortgages that may or may not be paid off.

Once the MBS is created by the SPV, it is sold in the secondary market to the participants, and the coupon's payments are no longer guaranteed by the bank, but depend on the SPV. In turn, the SPV's payments depend on the payments of the mortgages by the individuals. Therefore, when the individuals become insolvent, the whole process collapses. This is exactly what happened in the case of the US crisis of 2008. With the burst of the housing financial bubble, the American economy collapsed, and its problems propagated in the European economy.

The American reaction to the crisis was immediate; as seen in Figure 17, the FED had already started to decrease the effective interest rate since 2006, and when this rate reached the ZLB in 2008, the FED immediately implemented QE (Coughlin, 2018).

Figure 17: Effective Federal Funds Rate



Source: Our elaboration on Federal Reserve Economic data.

The QE adopted by the FED can be summarized in three main phases: QE1, QE2 and QE3. The first phase of the American QE (QE1) was implemented in 2008 in concomitance with the default of the Lehman Brothers. The FED decided to designate a large amount of liquidity to the housing market for two main reasons: (1) this sector had been severely affected by the crisis, and (2) the sector represented a possible transmission channel for a faster and easier recovery for the US economy. For this reason, an APP of $500 billion was backed by the two government-sponsored housing enterprises, Fannie Mae and Freddie Mac, and these funds were mainly directed to the purchase of MBS and the reduction of mortgage rates. QE1 ended in 2009, and the FED purchased about $1.725 trillion of assets. The second phase of QE (QE2) started in 2010. It was different from the previous one; this new APP included $600 billion purchases of treasury bonds. In fact, the FED was no longer interested only in the reduction of the mortgage rate but was also focused on the reduction of overall long-term interest rates. The third and final round of American QE (QE3) started in 2012 and consisted of monthly purchases of $40 billion in MBS and $45 billion in treasuries. To summarize, the American QE implemented by the FED beginning in 2008 produced a large increase of the FED's balance sheet; from 2008 to 2018, the FED's balance sheet increased more than 450%, from the initial value of $900 billion to the final value of $4.5 trillion in 2018. This final value in 2018 included $1.8 trillion in MBS and $2.5 trillion in treasury bonds.

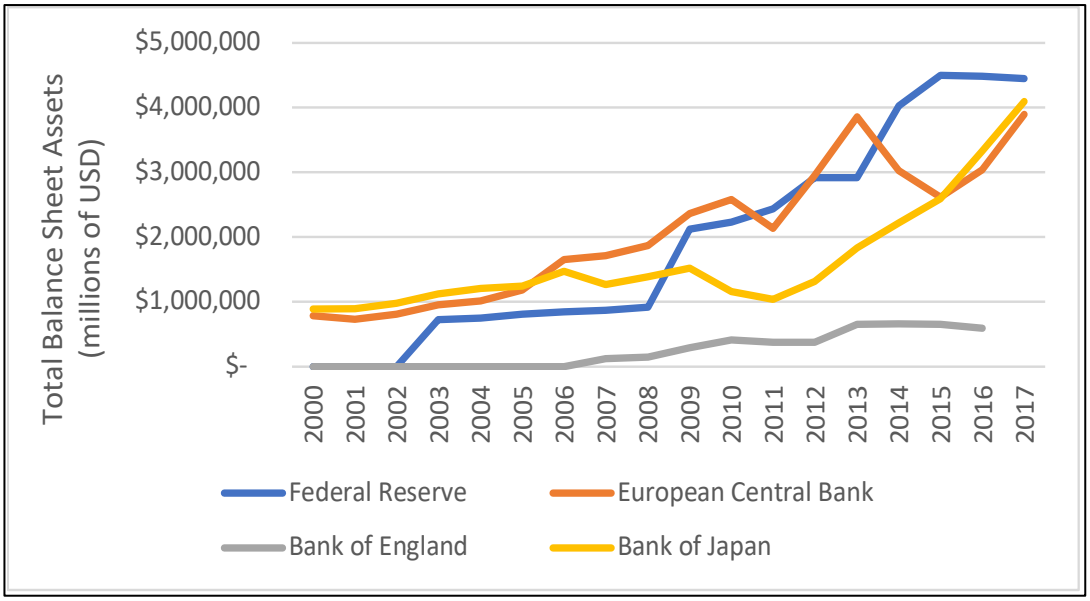
This was the behaviour of the FED, but some other countries like the UK and Japan also experienced the Great Recession, and the American crisis quickly became a worldwide phenomenon. To mitigate the financial crisis of 2008, the BOE and BOJ implemented a monetary policy similar to that of the ECB and FED.

The BOE's APP can be divided into two different phases. During the first phase, the ECB announced the intention of purchasing high-quality private assets with a limit of £50 billion. However, the total amount of private assets that the BOE bought through this policy was just £3 billion. In addition, the policy implemented by the BOE was financed by selling short-term gilts (the UK's government bonds); therefore, the BOE's balance sheet was not affected by the adoption of the APP. During the second phase, started in March 2009, the BOE adopted an official QE policy. The initial limit imposed on the acquisition of assets was £75 billion; it was later increased to £200 billion in November 2009. The main consequence of the English QE was the increase of the monetary base. As a result, the balance sheet of the BOE increased drastically. The programme was temporarily suspended between February 2009 and October 2011 and subsequently reactivated; however, from 2008 until 2017, the BOE's balance sheet increased from £94 billion to almost £400 billion.

The situation in Japan was completely different. The BOJ had already started a QE programme during the 1990s, one that purchased Japanese government bonds to uplift the Japanese economy. The programme did not produce the expected results because of a weak banking system; however, in the following year, Japan implemented some structural reforms, like the introduction of minimum reserve requirements, to improve the transmission mechanism inside the most important system of its economy. The results of such reforms were affected by the dot.com bubble and subsequently by the crisis in 2008. The monthly pace purchases by the BOJ reached ¥1.2 trillion in 2002 and did not stop in the subsequent years. When the 2008 crisis hit the Japanese economy, the BOJ announced an unlimited lending of money to the commercial banks at a rate almost equal to 0% in order to stimulate and facilitate the recovery of its bank-centric economic system. From 2008 to 2012, the dismissal date of the programme, the balance sheet of the BOJ increased by an amount almost equal to ¥106.8 trillion.

Figure 18 illustrates how the balance sheets of the main advanced countries increased between 2000 and 2018 (Coughlin, 2018).

Figure 18: Total central bank assets in millions of USD, 2008-2017



Source: Coughlin (2018).

3. CHAPTER

THE EFFECTIVENESS OF THE EUROPEAN QUANTITATIVE EASING

Our work evaluates the effectiveness of European QE, and since the main target of the ECB is price stability, we will judge the resultant level of prices after the QE policy. This evaluation can be difficult because the European QE is most often compared against those implemented by American counterpart. However, this comparison is not precise; in fact, the two continents present radical political and economic differences. Another reason is how the numerous studies conducted during recent years sometimes show discordance with regard to the European results, so it is difficult to establish which model better represents the real and effective case; moreover, there is also difficulty defining the variables analysed by the models. In particular, some models perfectly fit the reality from a theoretical point of view, but empirically do not fit at all. As a consequence, the effectiveness of the QE is not imputable just to one reason but depends on a large number of possible causes.

With regard to this, since the principal target of the ECB is price stability, our work focuses on the evaluation of price variations among European countries.

In particular, the first paragraph (3.1) will analyse the inflation rate in Europe and how it changed during the years since the introduction of the European Union in 1999; moreover, it will try to explain these fluctuations analysing the role of the interest rate's differences between the core and peripheral European countries.

Subsequently, the chapter will analyse the variation of the inflation levels among European states following the implementation of the Unconventional Monetary Policies (UMP) by the ECB. In particular, it will estimate these variations at the macroeconomic level according to the study conducted by Burriel and Galesi (2017) which explains how the prices and outputs changed after the UMP shock (3.2). The chapter then addresses the microeconomic level, and, in particular, the section will illustrate the New Keynesian Models studied by Galì and Gertler (2001). These models use the price stickiness and the degree of backwardness to illustrate in-

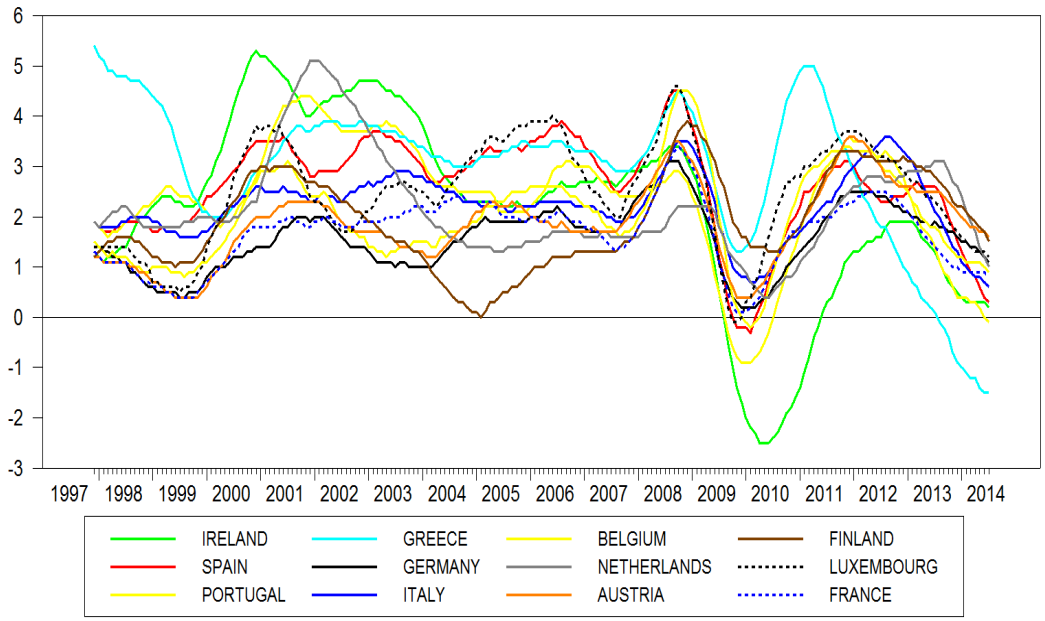
flation levels; research from Schäfer (2018) will be used to illustrate the inflations variation during three distinct periods, in particular, the pre-crisis period from 1999 through mid-2007, the crisis period until August 2012 and, finally, the "Whatever It Takes" (WIT) period, which started with Mario Draghi's statement in London in 2012 through end-2015.

3.1 Country Inflation differentials

The initial intention of the unconventional countermeasures adopted by the ECB was the saving of the countries negatively affected by the sovereign debt crisis, but once the economic conditions of these countries became sustainable again, the European Central Bank did not stop the QE policy. The continuation of the QE and its actual renewal is due to a level of inflation still far from the target.

Thus, we will initially illustrate the changes in the European level of inflation. In particular, since the introduction of the European Union in 1999, the European countries experimented with systematic variations in inflation which mainly occurred between the peripheral and core countries.

Figure 19: Year-Over-Year HICP Inflation Rates for Euro Area Members

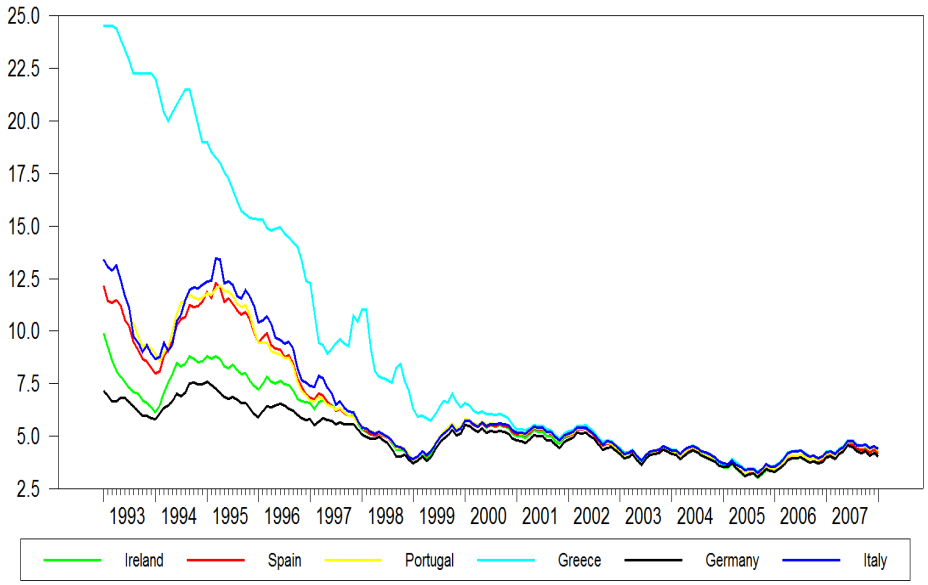


Source: European Parliament (2014).

As shown in Figure 19, inflation rates among the European member states sampled showed clear variations, but there were also some common trends among them. In particular, from

2002 to 2007, inflation was stable within these countries; then, in 2008, most experienced a jump in inflation, mainly due to increased oil prices. Inflation continued to increase, so, in 2009, inflation started decreasing as a consequence of the global recession. Inflation rates rose again until early 2012; henceforth, inflation began falling; this context allows the so-called PIIGS in 2008 to be observed. When paired with the global crisis, these countries presented levels of inflation higher than Germany; inflation levels decreased in some countries, specifically in Greece and Ireland, but mainly because of the sovereign debt crisis. In the following years, countries would experience the same distressing situation as Greece, and, in 2014, still presented levels of inflation much higher than Germany. To better understand the differences between inflation rates among the European countries, it is useful to analyse the wide variation in interest rates across the states to understand the vast disparities in the interest rates at which governments, households and firms could borrow. Figure 21 illustrates that such inequality has been present since 1993, so from a period significantly before the introduction of the European Union.

Figure 20: Long-Term Sovereign Bond Yields for Selected Countries



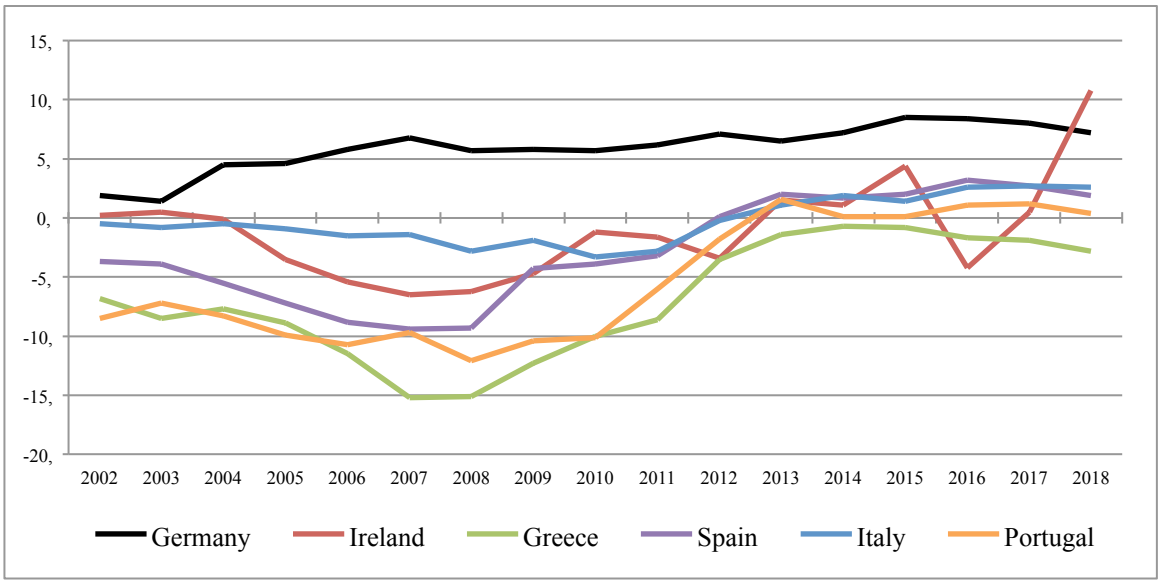
Source: European Parliament (2014).

As seen in Figure 20, interest rates between the PIIGS and Germany had significant disparities which resulted from differing degrees of reputation among the countries. In particular, states with bad reputations presented higher interest rates, and, as a consequence, increased the cost of borrowing for those states. For example, Greece presented a negative reputation in Europe mainly because of the numerous devaluations of its currency. These actions discour-

aged the other states from lending money to the Greek government, and this immediately raised the country's interest rates. These differences in interest rates among the countries apparently disappeared with the introduction of the European Union in 1999. Greece reached the European interest rate some years later, but, in 2009, at the beginning of the Great Recession, this differential re-emerged and negatively affected the financial stability of the weaker and more indebted countries (Whelan, 2014).

From the point of view of a single country, it is possible to see that, for some states, interest rates remained fixed or changed very little with the introduction of the European Union. The best example of this is Germany, as inflation levels have remained unchanged since 1999; the situation radically changed for other countries, where the introduction of the Euro caused a huge decrease in the cost of borrowing; the best examples are the cases of Greece and Italy. The apparently positive aspects of the reduction of the cost of borrowing, in reality, served as the foundation for the future sovereign debt crisis and the actual high level of debt for some countries; in particular, for the peripheral countries, the substantial reduction to the cost of borrowing facilitated credit debt, and, as a consequence, in these states, the amount of both private and public debt increased drastically. Figure 21 better illustrates how the debt positions of PIIGS deteriorated over the years with respect to Germany.

Figure 21: Current Account Balance as a Percentage of GDP for Selected Countries



Source: Our elaboration on Eurostat data.

This huge imbalance has been detrimental for some states; in particular, the main consequence for some European peripheral countries, such as Spain and Ireland, has been the loss

of competitiveness because of increased levels of inflation. Since Spanish and Irish goods were more expensive than products from other European states, exportations decreased, and, instead, importation rates for Spain and Ireland rose. As a consequence, this negatively affected the countries' balance of payments.

The countries with significant debts needed to move into a path of account surpluses, which, in turn, would help them to reduce their international debtor positions; this increase in current accounts can occur through stimulating exports. As such, the situations of PIIGS improves with respect to the lowest peak in 2008. However, excluding the case of Ireland, their actual situation is not so different from that recorded during the sovereign debt crisis in 2013.

In theory, the PIIGS could obtain significant gains in terms of competitiveness by recording negative inflation rates, but two main problems are related to this possible solution: first, the workers and the trade unions of these financially stressed countries strongly opposed a possible reduction of wages, and, second, a possible deflation in these countries would not result in cut wages, but, instead, would destroy the labour markets because of numerous layoffs. As a consequence, the solution which could be implemented at the European level was to increase the levels of inflation in those countries which were reputed to be financially stable and which could afford higher inflation rates (the core countries, which included Germany); according to the study, this is the best way to potentially rebalance the Euro Area (Whelan, 2014).

In sum, inflation rates have not been constant nor identical over the years and among the countries. The ECB tried to solve problems related to levels of inflation mainly by adopting Quantitative Easing; however, actual levels are still far from ideal. Next, we estimate, in detail, the effect of the UMP on levels of inflation and output; since its effects were not homogeneous within Europe we will explain the reasons behind such differentials.

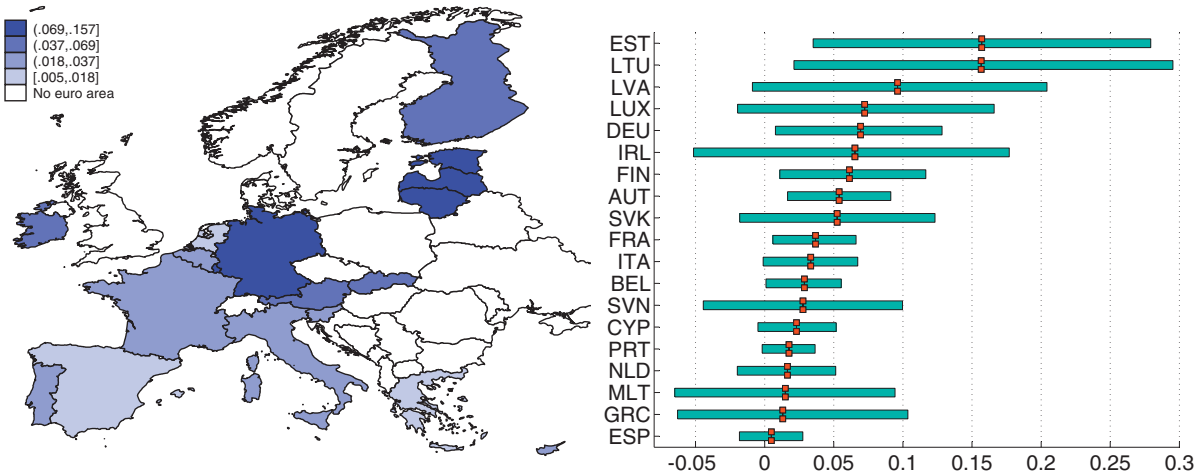
3.2 QE effects on countries' outputs and prices level over the years

A study conducted by Burriel and Galesi (2017) which evaluated the effects of the UMP on the prices and levels of output at the national level. This study is based on the analysis of macroeconomic variables, which means that prices and outputs are studied in relation to some macro variables as the country's level of real GDP per capita, or for example, the country's level of unemployment.

We assess the effectiveness of the UMP shocks in Europe and introduce the interesting aspects of cross-country interactions, in particular, the spillover effect inside Europe, which helps to explain the differing effects recorded at the national levels. Since prices and outputs

were uniquely affected for all European countries, we analyse the other reasons at the base of such divergence; moreover, we explain countries' features which might have dampened the effectiveness of the UMP shocks.

Figure 22: Cross-country variation of output responses to a UMP shock

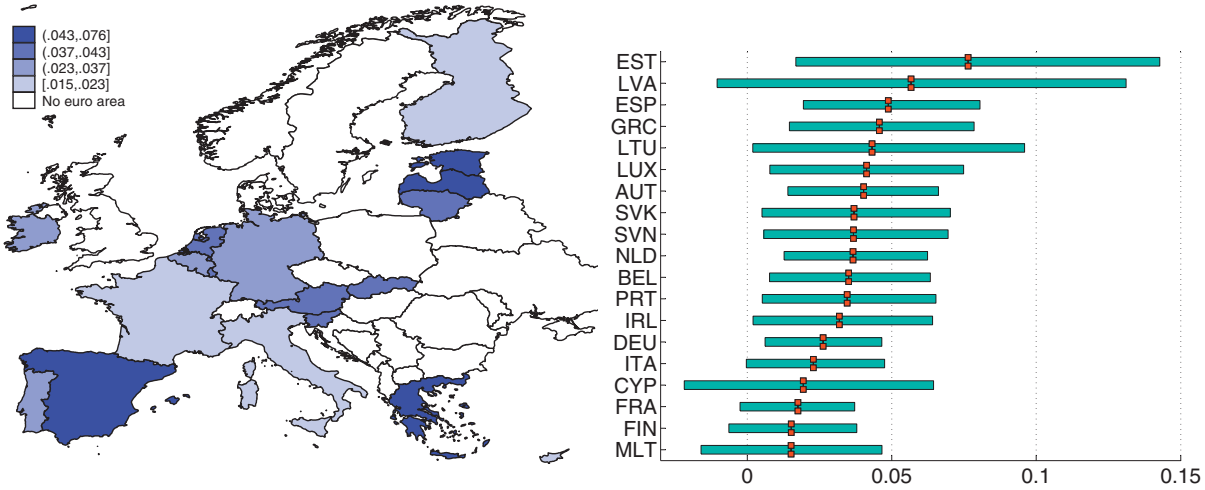


(a) Output

Source: Burriel and Galesi (2017).

Figure 22 shows the effects on output and price variations across Europe. In particular, it is possible to distinguish some countries with more relevant variations and other countries with effects which are not statistically significant. The effects on output and prices are positive for almost every country, but, according to this, there is a certain degree of heterogeneity.

Figure 23: Cross-country variation of prices responses to a UMP shock



(b) Prices

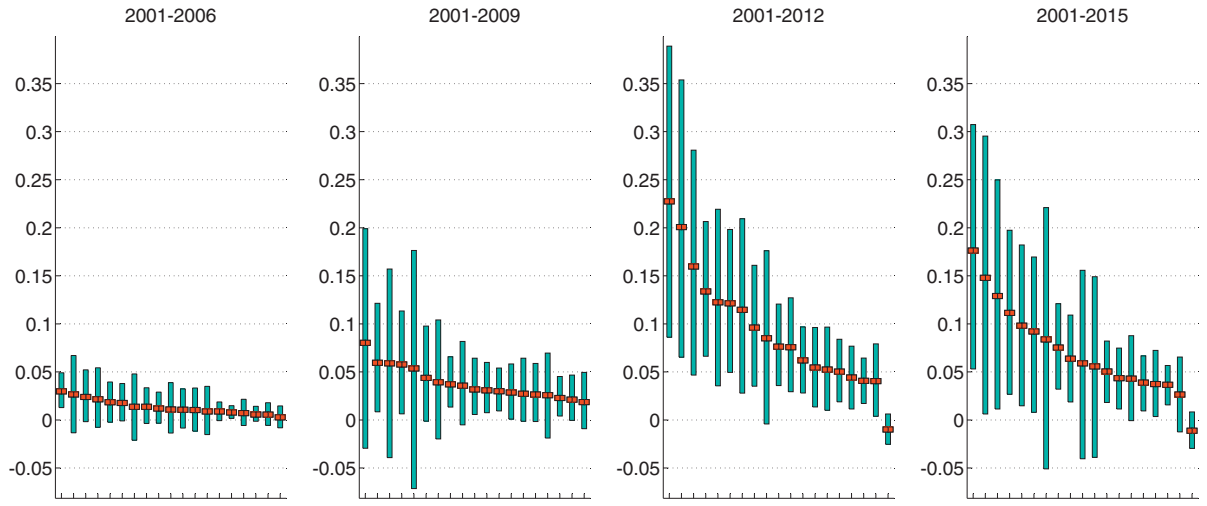
Source: Burriel and Galesi (2017).

In particular, Baltic countries reported the highest variations in terms of prices and output; more specifically, Estonia demonstrated the greatest increase in prices and output. This is illustrated on the right side of both figures, which present the ascending median peak responses for each country. For example, concerning price levels, Estonia recorded the highest increase (about 8 basis points), followed by Latvia, Spain and Greece (Figure 23); the effect, instead, is smaller in Germany (almost 3 basis points), and other countries such as France and Italy were scarcely significant. The effects on output are small or not statistically significant in the countries recently affected by the sovereign debt crisis, so, in the cases of Portugal, Greece and Spain.

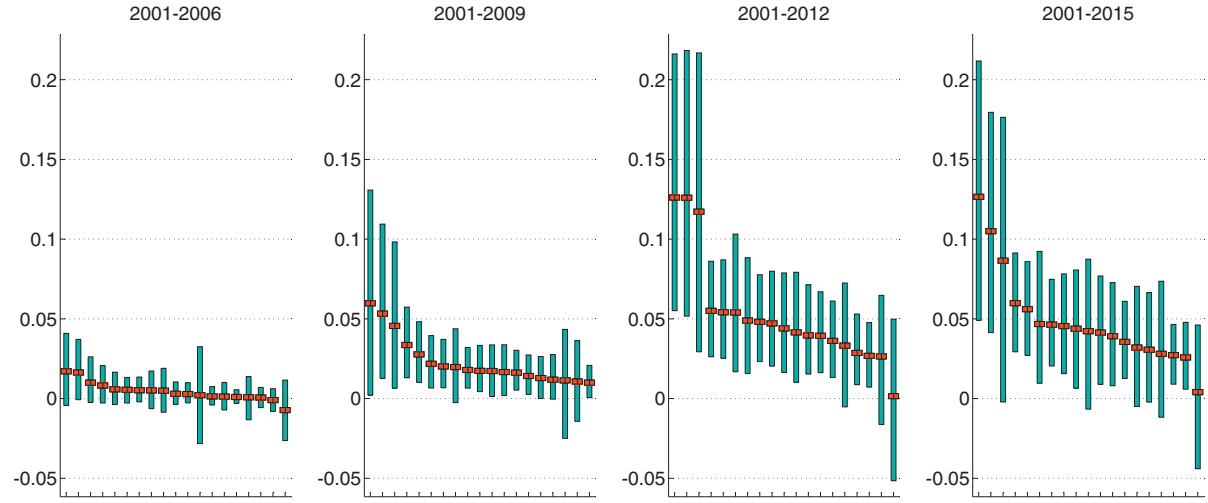
Both previous figures illustrate the heterogeneity among European countries. The study by Burriel et al. (2017) not only explains this difference but also estimates the evolution of this heterogeneity. To assess changes from over the years, they estimated the model for four distinct periods, each one larger than the previous by 3 years. As such, the first period spans January 2001 to December 2006; the second period contains the first but also includes the beginning of the Great Recession, so it spans January 2001 to December 2009; the third period includes the implementation of the UMP by the ECB at the early stage of the sovereign debt crisis, so it spans January 2001 to December 2012;, the final periods envelops Europe's response to the crisis, so it covers January 2001 to September 2015.

Figure 24 shows the distinction between the four periods to demonstrate the effects of the UMP, in particular, the increased amount of the balance sheet which produced stronger results at the outset of the sovereign debt crisis from the moment of its effective implementation; in addition, the effects on prices and outputs present similar trends. In fact, pricing and output levels both increased during the sovereign debt crisis in 2012, and both decreased in the final phase of the 2001–2015 period.

Figure 24: Cross-country effects of UMP shock over time



(a) Output



(b) Prices

Source: Burriel and Galesi (2017).

These effects are minor and not statistically significant during the first period, but they significantly increase and become statistically significant mainly in the third period; in the final period, which includes the full sample, the effect slightly diminishes but remains statistically significant compared to the first and second periods.

A further element which allows the identification of the heterogeneity among the countries is the different standard deviations recorded during the periods. Standard deviations for the first and second periods were similar, so the average effects for these countries were almost equal in terms of prices and output. In particular, it was 0.008% for output and 0.006% for prices. The divergence occurs during the sovereign debt crisis; during this period, heterogeneity reached its peak, with a standard deviation of 0.058% for output and 0.033% for prices. Thus,

in Europe, following the implementation of the UMP by the ECB, different countries recorded different effects in terms of prices and outputs, and, in particular, the differences among countries were greater in terms of output in relation to price. Table 3 reports the data just analysed.

Table 3: Descriptive statistics of the cross-country effects of UMP shocks over time

	Output				Prices			
	Mean	*Min*	*Max*	*Std. dev.*	*Mean*	*Min*	*Max*	*Std. dev.*
Benchmark	0.054	0.005	0.158	0.044	0.037	0.016	0.079	0.016
2001–2006	0.014	0.003	0.029	0.008	0.005	−0.008	0.018	0.006
2001–2009	0.037	0.018	0.077	0.016	0.023	0.010	0.058	0.014
2001–2012	0.091	−0.010	0.225	0.058	0.052	0.003	0.126	0.033
2001–2015	0.069	−0.011	0.170	0.044	0.048	0.004	0.126	0.029

Source: Burriel and Galesi (2017).

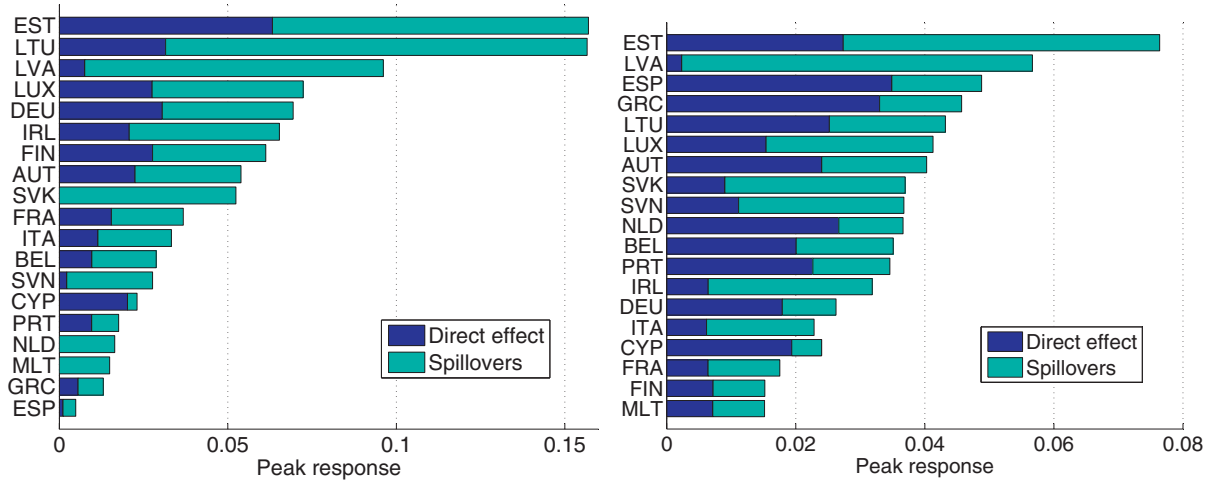
In addition to the previous analysis, the study also compares the effects on prices and outputs distinguishing those countries financially distressed, which were the PIIGS plus Cyprus. It was determined that the average output increased by 8 basis points in the stressed countries and 16 basis points in non-stressed countries; pricing levels increased, on average, by 9 basis points for stressed countries and 7 basis points for non-stressed countries.

This study shows that the UMP has produced a larger gain in countries which have not been affected by the sovereign debt crisis. In fact, the stressed countries experienced less significant increases in output with respect to the financially stable European countries. This has not encouraged the economic recovery of the PIIGS.

3.3 The role of cross-country spillovers

Burriel et al. (2017) evaluated why the UMP produced these shocks in very heterogeneous ways among the European countries. The first element analysed in the study are the cross-country interactions which caused asymmetric transmission via spillover effects. As such, the following figure compares the direct effects on the prices and outputs for every country with those originated by the cross-country interactions.

Figure 25: Direct and spillover effects of UMP shocks on output and prices



(a) Output (b) Prices

Source: Burriel and Galesi (2017).

Figure 25 shows two main results which emerged in such a comparison. The first is that spillover drastically amplifies the effects of UMP shocks; the second is that a substantial part of the heterogeneity in the effects can be attributed to the spillover within European countries. In accordance with the first previous result, the average peak output without spillover approximates 2 basis points; when considering spillover, effects are more than double, as they equal 5 basis points. A similar situation occurs with prices; the average peak responses are 2 basis points and 4 basis points, without and with spillover, respectively.

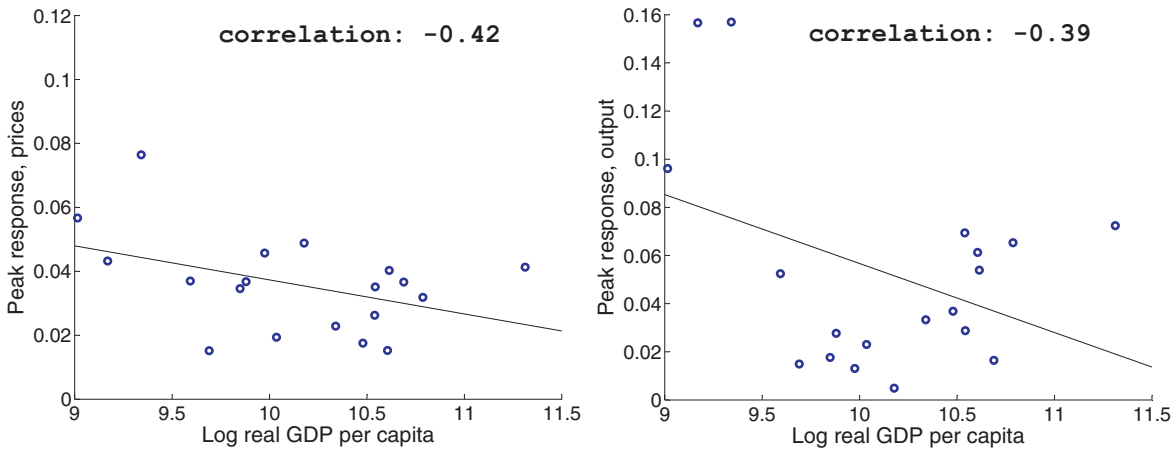
Concerning the second outcome, the figure shows that the substantial heterogeneity among the European countries in terms of output levels and in terms of pricing levels following the implementation of UMP is due in large measure to the presence of spillover. In particular, in the absence of cross-country interactions, the effects on output varies from 0 basis points to 6 basis points, while the effects on prices lies between 0 basis points and 3 basis points; spillover between countries should be considered. Instead, the effects largely increase, in particular from 2 basis points to 8 basis points and from 0 basis points to 16 basis points, respectively, for the range of responses of prices and output.

The results show an important consideration which is further supported by another study, which was conducted by Beneckà, Fadejeva and Feldkircher (2018), where, in particular, both studies show the importance of accounting for cross-country interdependencies when assessing the transmission of monetary policies both conventional and unconventional across the EU. Overlooking spillover in the EU would substantially underestimate the effects of UMP shocks (Burriel et al. 2017).

3.4 The causes of QE heterogeneous effectiveness across EU countries

The study then illustrates which structural features of the country's economy accurately estimate the heterogeneity of the effects on prices and outputs; the first feature analysed is the real GDP per capita, considered a possible proxy of the economic development of a country. In fact, it is reasonable to assume that the effects of a UMP shock could vary due to differences between the GDPs of the countries in question with respect to its potential value. In particular, if a country presents a GDPs level almost equal to its potential value, the effect of the UMP will be higher because the shock will entirely transfer into an increase in the level of prices. If a country presents a GDP which is lower with respect to its potential value, then the UMP can increase both the prices and the GDP dampening the increase of inflation levels.
Figure 26 illustrates the correlation between the real GDP per capita and the effects of UMP shocks on both prices and outputs.

Figure 26: Peak responses of prices or output and the country's real GDP per capita

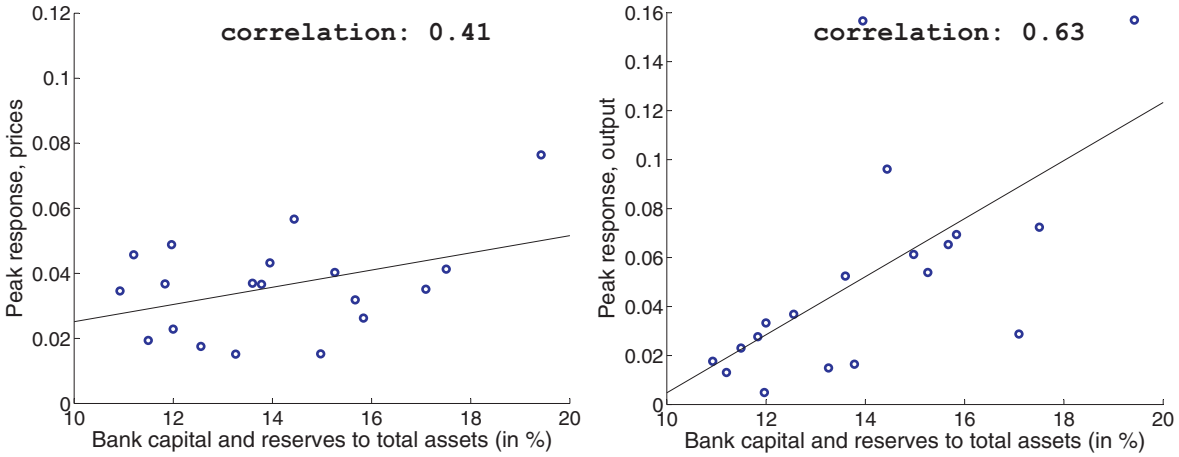


Source: Burriel and Galesi (2017).

Figure 26 presents two negative correlations, which means that the effect on prices is higher in those countries that present a greater differential between the potential and the effective GDP. The same relationship is found for output, which reported more significant effects.
The study also accounted for the soundness of the banking sector, which was determined using an index measuring the total assets constituting the capital which were held by banks. According to this, it could be relevant to consider the differences among the capitals held by the banks in the countries of the sample because, in general, the monetary stimulus implemented by the ECB has a positive effect on the balance sheets of the banks. For this reason, in theory,

the increases on the balance sheets should translate into increased lending activity; however, if banks presented some financial problems, the huge injection of liquidity resulting from the UMP could incentivise them to resolve their financial problems and re-establish the solidity of their balance sheets, and so the lending activity (Burriel et al., 2017).

Figure 27: Peak responses of prices or output and the country's Bank capital and reserve to total assets

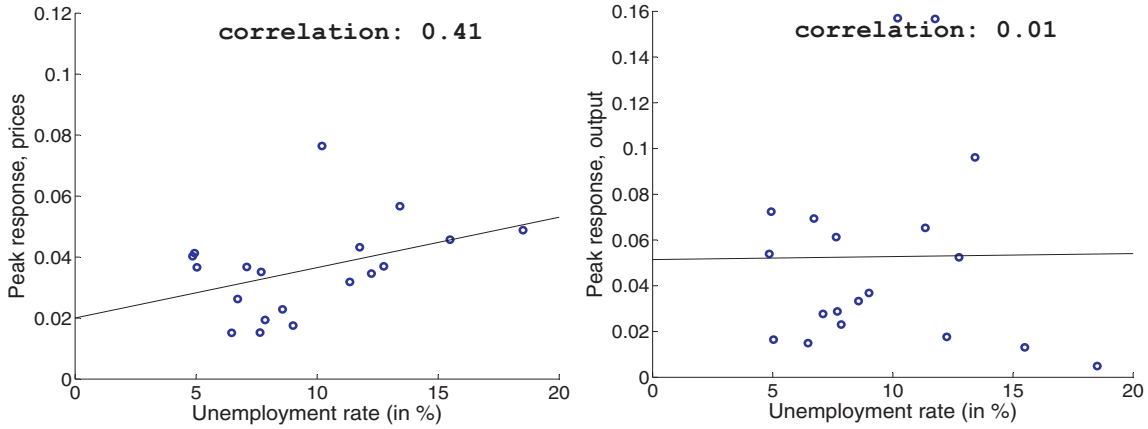


Source: Burriel and Galesi (2017).

Figure 27 shows positive correlations between the soundness of the banking sector and the effects on prices and outputs; this means that those countries which present sounder banking systems were more affected by the UMP shocks with respect to those countries with more fragile banking sectors. As such the effect is more noticeable when analysing the reaction in relation to output with respect to pricing levels.

The third element taken in consideration by the study is the level of unemployment; this variable is taken into account as an approximation of the level of the aggregate demand conditions and as an estimation of the labour market frictions for each country in the sample. In particular, constrained household borrowing limited demand according to the level of income, so possible increases to consumption, employment, and economic activity levels for the country were marginally affected by the expansionary UMP shocks. The same situation occurred when the labour market presented some frictions as strict employment protection regulation; in this case, the effectiveness of the unconventional monetary policies adopted by the ECB was mitigated because of these hard restrictions which limited the creation of jobs (Burriel et al., 2017).

Figure 28: Peak responses of prices or output and the country's unemployment rate (in %)

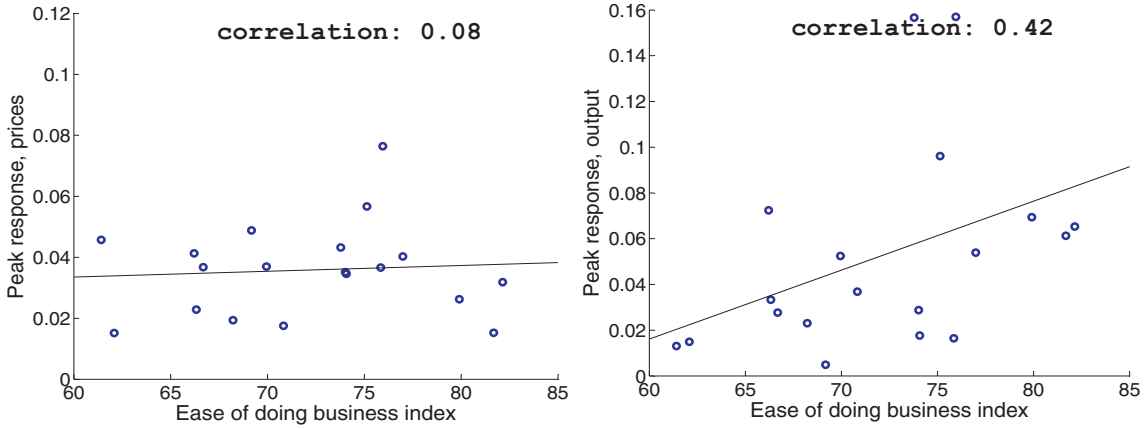


Source: Burriel and Galesi (2017).

Figure 28 shows the correlation between unemployment rates and the median peak responses of prices and outputs after a UMP shock; the effects are more evident with prices. The countries with higher levels of unemployment were subject to stronger effects in terms of price increases with respect to those countries with higher levels of employment. Concerning the level of output, it seems that the countries with very high levels of unemployment presented very small effects on the output after the UMP shock; the correlation is low likely due to a significant difference between the countries in the sample. In fact, the scatter plot shows a large number of outliers which could distort and smooth the correlation.

The final variable analysed was an index developed by World Bank which illustrates the ease of doing business in the countries considered; in particular, its value goes from 0 to 100, where the maximum value (100) describes a regulatory environment ideal to starting and conducting a new firm.

Figure 29: Peak responses of prices or output and the country's ease of doing business index



Source: Burriel and Galesi (2017).

Figure 29 shows the relationship between the median peak responses of prices and outputs after an UMP shock; in particular, the effects on prices were not clear. In fact, the high dispersion of countries smoothes the relationship between the index and the adoption of the extraordinary monetary measures. Output evidently displayed positive and relatively high correlations; this means that the countries which were easier to do business with recorded higher effects in terms of output after the implementation of the UMP by the ECB (Burriel et al., 2017).

Table 4 presents the structural characteristics of the economy, which have been previously explained, which are analysed by distinguishing direct from spillover effects.

Table 4: Effects of UMP shocks and country characteristics

	Output			Prices		
	Direct effect	*Spillover effect*	*Total effect*	*Direct effect*	*Spillover effect*	*Total effect*
Real GDP per capita	−0.01	−0.04**	−0.04**	0.00	−0.01*	−0.01*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.00)
Banks' capital ratio	0.44**	0.76**	1.20***	0.05	0.43***	0.48***
	(0.20)	(0.30)	(0.31)	(0.11)	(0.10)	(0.13)
Unemployment rate	−0.02	−0.00	−0.02	0.10	0.10	0.20**
	(0.07)	(0.10)	(0.14)	(0.08)	(0.07)	(0.08)
Ease of doing business	0.04	0.10	0.14	−0.02	−0.02	−0.04
	(0.04)	(0.10)	(0.12)	(0.04)	(0.04)	(0.05)
Constant	−0.02	0.23*	0.21	−0.01	0.07	0.06
	(0.06)	(0.12)	(0.16)	(0.06)	(0.06)	(0.07)
Observations	19	19	19	19	19	19
R^2	0.51	0.68	0.71	0.10	0.61	0.62

Source: Burriel and Galesi (2017).

The table shows that less-developed countries benefitted more in terms of output from the UMP shocks; it is interesting that this relationship arises from spillover effects. The same situation happens when analysing prices and banks' capital ratios; according to this, countries with more fragile banking systems benefit relatively less than other countries, which mainly results from spillover.

The table shows that the country's international dimension is relevant and matters at the moment of the identification of the potential determinants of the heterogeneous transmission of UMP shocks.

3.5 The New Keynesian interpretation of QE effectiveness

The Phillips Curve forms the basis of numerous models, most of which are called New Keynesian Models, which start from this relationship and introduce some microeconomic variables, as the price stickiness and the degree of backwardness, to try to explain variations in inflation.

As such, we will now illustrate the model proposed by Galì and Gertler (1999) and Galì et al. (2001); the model used by Galì et al. (1999) presents three distinctive features with respect to the traditional Phillips Curve. The first regards the analysed variable; in particular, the model uses the real marginal cost in place of the output gap (or the unemployment level) since, according to the New Keynesians, it directly accounts for the effects of the productivity gains on inflation; second, a subset of firms are allowed to set their prices according to a backward looking rule, so, in this way, they try to estimate the inflation persistence by comparing with a pure forward-looking model. The final feature regards the structural parameters of the model. In particular, they analysed the degree of price 'stickiness' so the average duration that a price remains fixed, and the degree of 'backwardness', so the fraction of firms that use as rule of thumb the backward-looking rule.

They assumed an environment constituted by a set of monopolistically competitive firms which face some type of constraints on price adjustments. The most common form of such a constraint is the time; in other words, the price adjustment rule, for the set of firms, is time-dependent. This means that for every period, it is possible to distinguish a fraction of firms $\left(\frac{1}{X}\right)$ which set their prices for X periods. Taylor already introduced the latter scenario in 1980, but the key difference is that, in the model proposed by Galì et al. (1999), the pricing decision evolves explicitly from a monopolistic competitor's profit maximization problem, subject to the constraint of time-dependent price adjustments. However, in order to simplify the model and resolve the aggregation problem, Galì et al. (1999) decided to employ the Calvo assumption (1983).

As such, the model proposed by Galì et al. (1999) assumes that each firm is able to adjust its prices in any given period with a fixed probability $(1-\theta)$ which is independent of the time that the price has been fixed. The study departs from Calvo's assumption by introducing the coexistence of two types of firms, in particular, a fraction $(1-\omega)$ of firms called "forward looking" which set optimal prices using all available information in order to forecast the future marginal costs; the remaining firms (ω) are called "backward looking" and instead use

the recent history of the aggregate price behaviour as a rule of thumb when defining their prices. The following equation describes this environment:

$$p_t = \theta p_{t-1} + (1-\theta)p_t^*$$

In particular, by defining as p_t^f the price set by the forward looking firms at time t and p_t^b as the price set by the backward looking firms at time t, it is possible to explain the optimal price with the subsequent equation

$$p_t^* = (1-\omega)p_t^f + \omega p_t^b$$

in which the forward looking firms behave in an optimal way because they take into consideration all the available information in order to forecast the future value of the marginal cost. In fact, by denoting (mc_t^n) as the firm's nominal marginal cost at t and β as a subjective discount factor, then a firm which chooses the price at t will maximise the expected discounted profits subject to the time-dependent pricing rule. The optimal reset price for the forward looking firms may be formulated as follows:

$$p_t^f = (1-\beta\theta)\sum_{k=0}^{\infty}(\beta\theta)^k E_t\{mc_{t+k}^n\}$$

The model illustrated by Galì et al. (1999) explains the main variables that have been investigated by Schäfer (2018) in a comparison of the European countries. In particular, he used this New Keynesian model as the basis for his estimations (Schäfer, 2018):

$$\pi_t = \lambda mc_t + \gamma_f E_t\{\pi_{t+1}\} + \gamma_b \pi_{t-1}$$

According to this, he analysed the price stickiness (θ) and the degree of backwardness (ω) of six European countries, Austria, Germany, Spain, France, Italy and the Netherlands, during three distinct periods, in particular, during the pre-crisis period from January 1999 to July 2007, in the crisis period from August 2007 to August 2012 and during the "Whatever It Takes" period (WIT) from September 2012 to June 2016.
The Table 5 illustrates and describes the variable analysed in the study:

Table 5: Variables analysed in the study

Variable	Description
$(1-\theta)$	Probability that firms change their prices
$(1-\omega)$	Amount of firms that change their price optimally

Source: Schäfer (2018).

The study uses the GDP Deflator annualised rate as a measure to illustrate the variation in term of prices, according to this, the Table 6 summarizes the results recorded in each European state of the sample.

- **Austria**

Table 6 allows us to see that in this country the price stickiness θ increased during the period of the crisis and decreased in the period following the crisis, which means that during the stressed period, the probability that the Austrian firms changed their prices was very low. In other words, they were less able to change their prices compared with the situation post-crisis. Regarding the degree of backwardness ω, it declined during the crisis; this means that, unexpectedly, in the stressed period there was a larger number of firms which changed their prices optimally and a lower number of firms which easily changed their prices using as rule of thumb the price from the period before. This is unexpected because, in theory, during a period of crisis, the firms should be more inclined to adopt the price of the period before, as the future is more uncertain, so, in theory, ω should increase. Since ω increased again after 2012, a possible interpretation would be that the crisis somehow decreased marginal cost uncertainty in Austria, while the ECB's reaction after 2012 increased this uncertainty again. During the crisis period, in fact, the firms were more confident of the future development of the marginal cost and so were better able to implement the optimal price with respect to the period characterised by the ECB monetary policy (Schäfer, 2018).

Table 6: Summary of the results recorded in the each country

Dependent Var.	GDP Deflator (annualised rate of change)		
	Pre-crisis	**Crisis**	**WIT**
$\theta_{Austria}$	0.4724***	0.5301***	0.4498***
	(0.0007)	(0.0008)	(0.0026)
$\omega_{Austria}$	0.6089***	0.4303***	0.5664***
	(0.0007)	(0.0008)	(0.0012)
$\theta_{Germany}$	0.6109***	0.4545***	0.1267***
	(0.0007)	(0.0017)	(0.0116)
$\omega_{Germany}$	0.3957***	0.5935***	0.8748***
	(0.0007)	(0.0031)	(0.0103)
θ_{Spain}	0.5354***	0.9385***	0.5997***
	(0.0005)	(0.0024)	(0.0053)
ω_{Spain}	0.468***	0.2547***	0.2071***
	(0.0005)	(0.0026)	(0.0023)
θ_{France}	0.6238***	0.3191***	0.4962***
	(0.0008)	(0.0023)	(0.0043)
ω_{France}	0.3739***	0.6458***	0.5168***
	(0.0008)	(0.0019)	(0.0025)
θ_{Italy}	0.5351***	0.4773***	0.7031***
	(0.0004)	(0.0008)	(0.0037)
ω_{Italy}	0.4601***	0.5459***	0.364***
	(0.0005)	(0.0008)	(0.0022)
$\theta_{Netherlands}$	0.4586***	0.3725***	0.8416***
	(0.0004)	(0.003)	(0.0042)
$\omega_{Netherlands}$	0.5461***	0.4037***	0.3622***
	(0.0005)	(0.0015)	(0.0025)

Source: Schäfer (2018).

- **Germany**

The Table 6 illustrates price stickiness and the degree of backwardness in the case of Germany. In particular, it is possible to see that the value of θ decreased more during the three distinct periods. This means that the probability that German firms could change their prices always increased. Instead, concerning ω, it increased during the three distinct periods. This implies that a lower number of firms during the years always set their price optimally, so they used as a rule of thumb the level of the prices of the period before (Schäfer, 2018).

- **Spain**

In the case of Spain, it is possible to see that the price stickiness θ increased during the crisis period (Table 6) in fact, it reached almost one. This means that during the financially stressed period, Spanish firms were less able to change their prices. In other words, the probability that they could change their prices was almost 0%; however, this probability increased again during the WIT period. However, the degree of backwardness, ω, decreased during the crisis period and further dropped following the WIT speech. This means that Spanish firms greatly anticipated the disinflation trend of the crisis and successfully stabilised their prices following the financial troubles. In fact, a decreasing value of ω implied a larger number of firms which set their prices optimally and a lower number of firms which easily fixed their prices according to the period before (Schäfer, 2018).

- **France**

Looking at the values for price stickiness and the degree of backwardness for France, it is possible to see that the trends oppose those recorded in Austria and in Spain. In particular, Table 6 shows that price stickiness decreased during the crisis period and increased in the following period. This means that the probability θ that French firms could change their prices was very high during the financial crisis and decreased after 2012. Instead, the degree of backwardness, ω, increased during the crisis period and diminished during the following one. This perfectly aligns with the common theory; in fact, during the crisis period, the number of firms which set their prices optimally should have decreased due to the greater uncertainty surrounding the future, so prices should equal those from the period before; instead, after the crisis, the number of firms which set their prices optimally should increase because the crisis situation has passed: it would be resolved and there would be less uncertainty surrounding the future (Schäfer, 2018).

- **Italy**

The effects in Italy regarding price stickiness and the degree of backwardness are similar to those recorded in France. In particular, as the Table 6 shows, the probability $(1-\theta)$ that a firm could change its prices increased during the crisis period, likely due to the disinflation pressures, and decreased after 2012, probably due to the stabilisation of inflation expectations. The degree of backwardness, ω, increased during the crisis period and decreased in the following one. This, again, aligns with the common theory that during the financially distressed

period, the number of firms which set their prices optimally should decrease, and, instead, should increase during economically stable phases (Schäfer, 2018).

- **Netherlands**

As is possible to see from the Table 6 the price stickiness in the case of the Netherlands decreased during the crisis period and increased after 2012. This means that the probability that Dutch firms could change their prices strongly decreased between the crisis period and the following WIT period. Instead, the degree of backwardness, ω, always decreased more during the three distinct periods of time. This implies that a larger number of Dutch firms were always forward-looking when setting their prices and that they optimally anticipated the marginal cost variation throughout the years (Schäfer, 2018).

This study has demonstrated that some results perfectly align with the common theory, as is the case for the French and the Italian changes in the degree of backwardness over the years, while others do not align, as with Austria's degree of backwardness during the crisis period. However, the results highlighted that the Great Recession and the UMP had, and probably still have, a profound impact on the dynamic of the European inflation. In fact, most results recorded in the third period are largely different from those recorded in the first one. This means that the crisis and the subsequent ECB reactions have permanently changed the countries' inflation dynamics. Moreover, the study shows that the crisis of 2009 and the following countermeasures adopted by the ECB have affected in very different ways the European member states in terms of both price stickiness and degree of backwardness, demonstrating again the huge heterogeneity among EU countries. This implies the need for cautious monetary policy and, furthermore, an actual low level of economic convergence among the European member states.

3.6 The role of the money multiplier on the inflation level

As explained in the previous paragraphs, different levels of inflation exist among European countries. Moreover, some possible factors have already been illustrated that determine such different values between the European member states. Accordingly, despite the implementation of a common monetary policy by the ECB, this policy does not translate into an equal increase in real money throughout all European countries. Consequently, we will try to explain

why there has not been an equal monetary increase among the European countries despite the implementation of the QE. To do so, we have analysed the M1 and M3 growth rates for each European country and the role of the money multiplier on the inflation level.

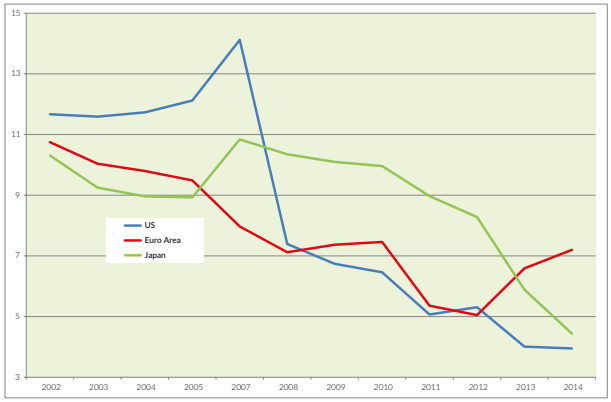
The underlying idea of the monetary policy's transmission process is that by changing the monetary base, the central banks can affect the quantity of money present in the system. However, they are not able to perfectly control the whole quantity of money. In fact, an increase in the monetary base can lead to an increase in the money stock, but the effect depends on the willingness of the commercial banks to utilise the excess reserve to extend the credit, and, in addition, it depends on the individuals' preferences to hold cash rather than deposits.

The money multiplier is an important variable in the analysis of the inflation level; in particular, studies show that a decrease in the money multiplier coincides with a decrease in the level of inflation. The money multiplier is equal to the ratio between the broad money and the monetary base, and it strongly influences the bank activity. In particular, the higher the value of the money multiplier, the higher will be the amount of liquidity that the banks can create. This ratio is influenced by two main variables: the reserve ratio and the currency ratio. The reserve ratio (rr) is equal to the amount of reserves over deposits, while the currency ratio (cr) is the quantity of currency over the deposits. The money multiplier and the monetary base influence the money supply according to the following equation:

$$M^s = \left(\frac{cr + 1}{cr + rr}\right) * MB$$

Figure 30 shows that the money multiplier decreased dramatically since the beginning of the global financial crisis in the third quarter of 2008 in all three major currency areas.

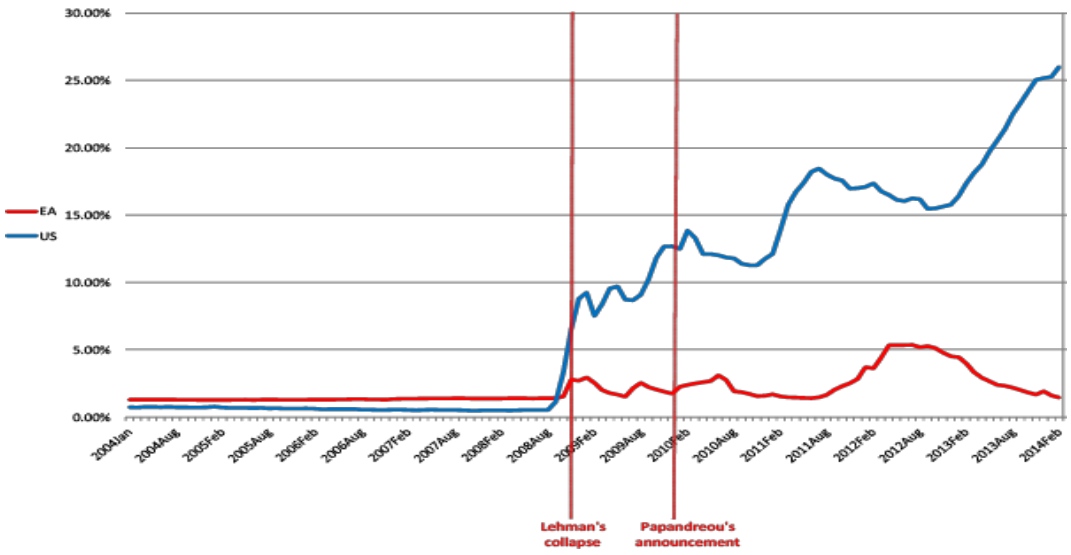
Figure 30: Money multiplier in the US, Euro Area and Japan, 2002-2014



Source: Dabrowski (2016).

There are numerous factors that contributed to this decline. For example, in periods of crisis, the values of the currency ratio and the reserve ratio both tend to increase, resulting in a decrease in the money multiplier. In fact, the common behaviour of individuals during a period of crisis is reduced trust in the banking system, so, as a consequence, they prefer to hold currency instead of bank deposits, reducing the money available in the banking system. Accordingly, the value of the currency ratio (cr) tends to increase in economically stressed periods. On the other side, from the bank's point of view, in a situation of crisis the bankers usually increase the amount of reserves, adopting a more 'conservative' business model. In fact, bankers are often scared about a possible bank run by individuals, and so they increase the excess reserve in order to have enough liquidity to satisfy the possible requests. As a consequence, the value of the reserve ratio (rr) increases. Figure 31 perfectly illustrates the variation of the reserve ratio in the case of the Euro Area (EA) and the US. For both regions, the value of the reserve ratio (rr) strongly increased after the Lehman Brothers' collapse (the first vertical red line), even if the effect is larger in the US than in Europe. Regarding Europe, the amount of the (rr) increased even after the bill's announcement of the Greek Prime Minister Papandreou (the second vertical red line) in 2010.

Figure 31: Total Reserves as a Share of Total Banking Credit in the EA and in the US

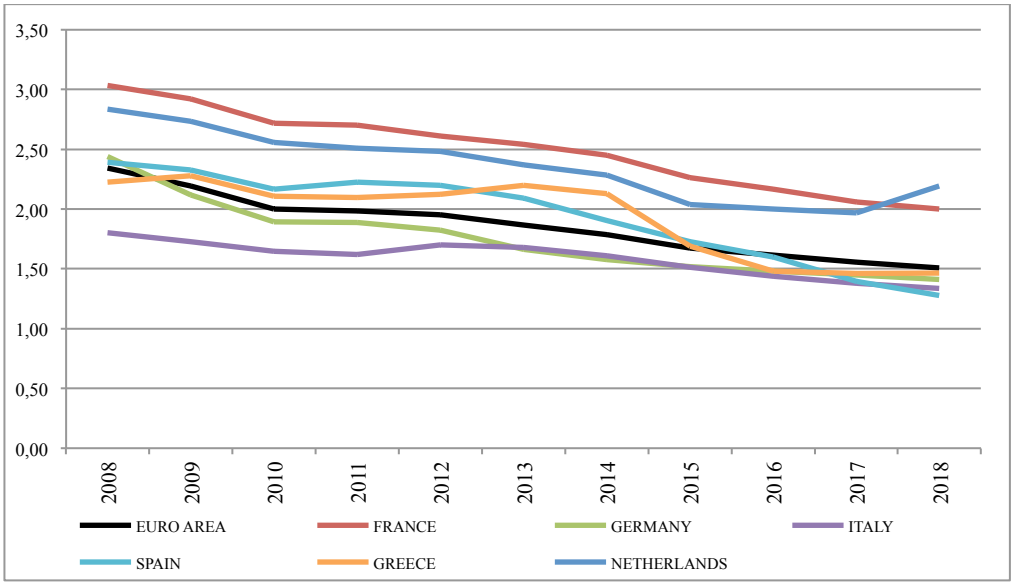


Source: Cukierman (2014).

A comparison between the money multipliers of the main European countries evinces a common trend among the states. In particular, Figure 32 illustrates the reduction of the money multiplier over the years and the differences in terms of values. In 2018, the highest value is

reached by the Netherlands, while Spain and Italy present the lowest values. Taking a European-wide perspective, it is possible to see that in the EA in general, there is a decreasing trend in the money multiplier over the last 10 years, and the Sovereign Debt crisis in 2012 created a further crease in it.

Figure 32: The money multiplier for selected countries, 2008-2018

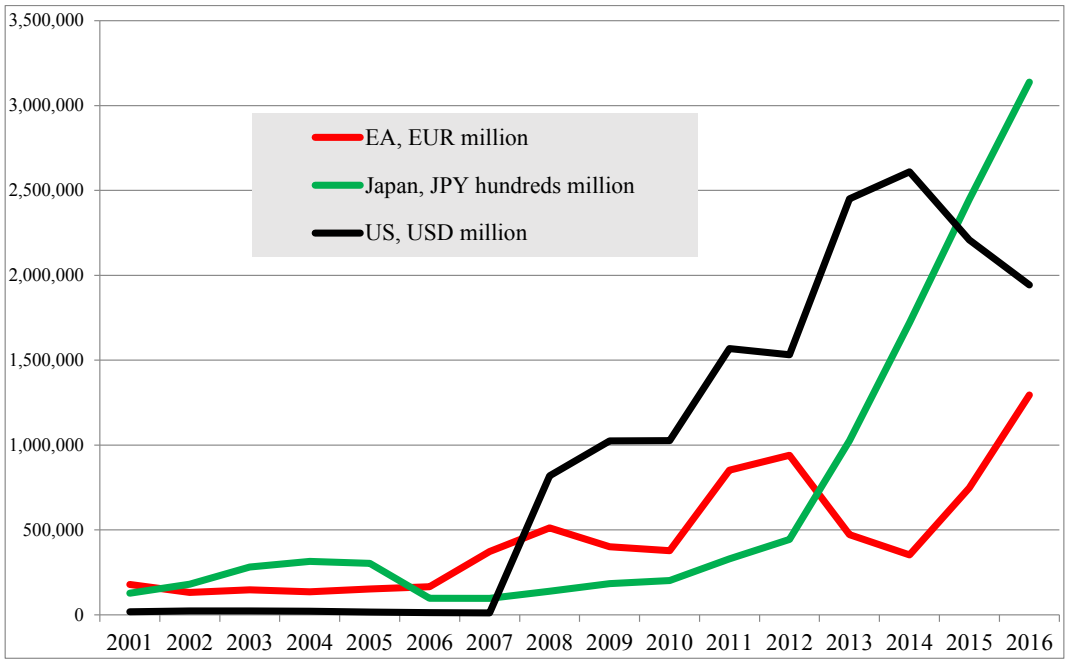


Source: Our elaboration on Trading Economics data.

The regulatory environment has an effect on the final value of the money multiplier. In particular, tighter regulations, like an increase in the values of the capital adequacy ratio (CAR) or in the liquidity coverage ratio (LCR), will inevitably disincentive the banks to borrow money. Also, the monetary instrument of the mandatory reserve requirements (MMR), already explained in the first chapter, determines a reduction in the money multiplier. Hence, some central banks of economically advanced countries, like the Bank of England (BOE), have de facto abandoned this instrument for the last two decades.

Surprisingly, another possible element that has determined a decrease in the money multiplier is the unconventional monetary policy. This factor finds more empirical than theoretical evidence. In fact, most of the time, periods of decline in the money multiplier and of increases in commercial banks deposits in central banks coincide with the phases of the QE. In support of this, the interval in the US (second half of 2013) characterized by a reduction in asset purchases and the time in Europe between 2012-2013 when the ECB temporarily stopped the unconventional monetary measures (Figure 33) coincide with periods when, respectively, the American and the European money multiplier recorded a small increase (Dabrowski, 2018).

Figure 33: Central bank liabilities to other depository corporations in the US, EA and Japan, 2002-2016

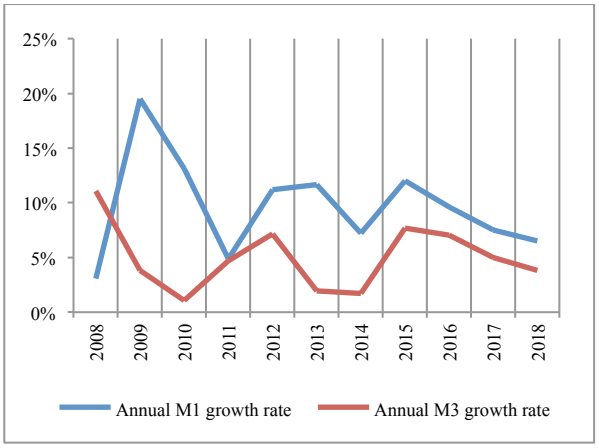


Source: Dabrowski (2018).

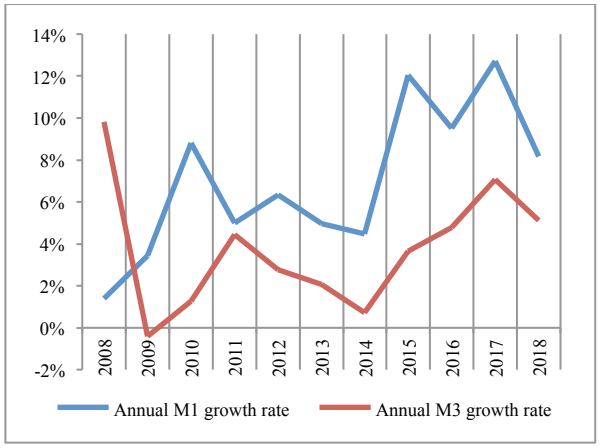
The hypothesis supposed by this study is that: 'Probably, QE has absorbed so many low-risk liquid securities from the financial market that commercial banks have had to increase their voluntary deposits in central banks to manage their liquidity' (Dabrowski, 2018). This means that if the hypothesis is correct, the main instrument used by the ECB to increase the money supply has, in reality, produced the opposite effect.

The fluctuation of the money multiplier can be explained to some extent by the trend of two monetary aggregates, M3 and M1, which in turn affect the level of inflation. Hence, it may be interesting to analyse the growth rates of the monetary aggregates of the main European countries over the last 10 years (Figure 34).

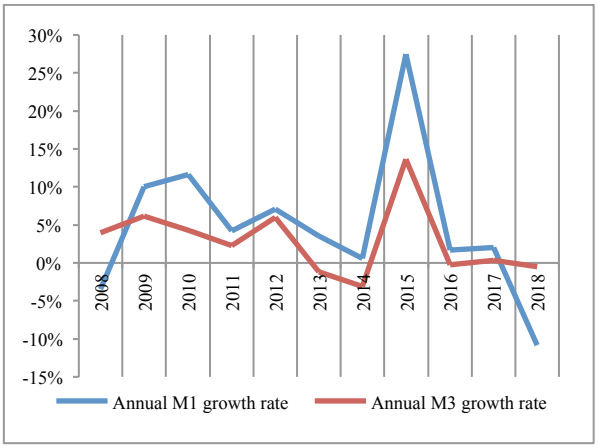
Figure 34: Annual M1 & M3 growth rate for selected countries, 2008-2018



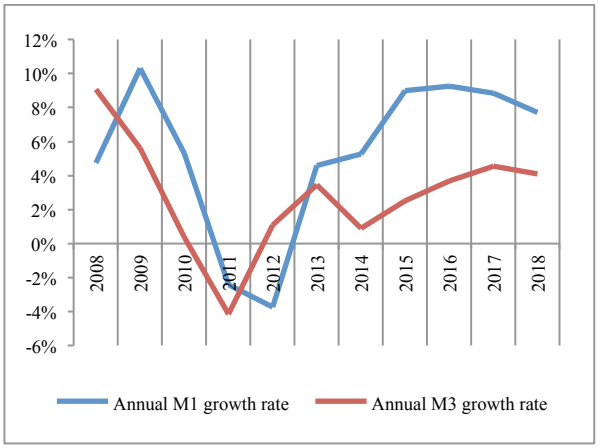
Germany



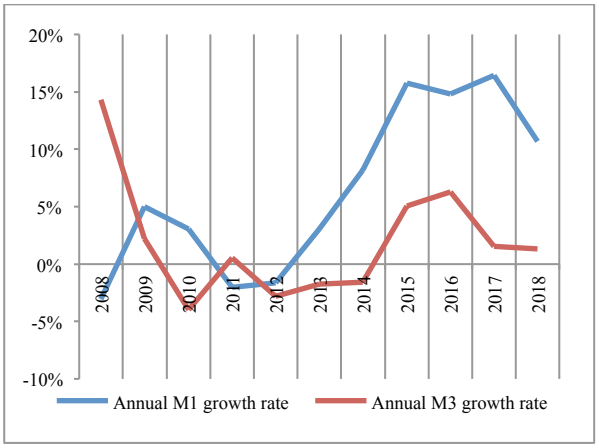
France



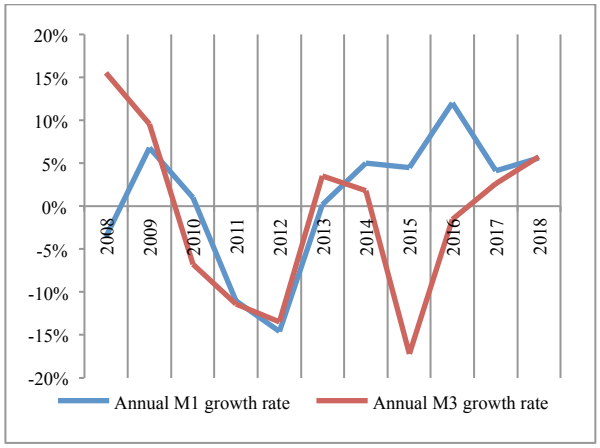
Netherlands



Italy



Spain



Greece

Source: Our elaboration on Trading Economics data.

A comparison between the main European countries shows that the growth rate of M3 is almost always lower than the growth rate of M1. This means that over the years, the increase in

the M1 has not been associated with an increase in M3, or that the latter increased but at lower level than expected.

In practical terms, this implies that even if the ECB increased the liquidity in the system (as an increase in the value of M1 is recorded), this injection does not determine an expansion of M3. This indicates that the level of inflation does not rise even if the ECB supplies a large amount of liquidity; in fact, in normal times, the growth of the monetary aggregate M3 reflects an increase in the level of inflation. However, it is possible to observe a clear difference between the situation of some important countries like Germany and France and other countries, particularly those affected by the Sovereign Debt crisis. In fact, both Germany and France never recorded a negative M3 growth rate value, which inevitably affected the value of inflation in these countries positively. However, the situation is the opposite in economically stressed countries, particularly in Greece.

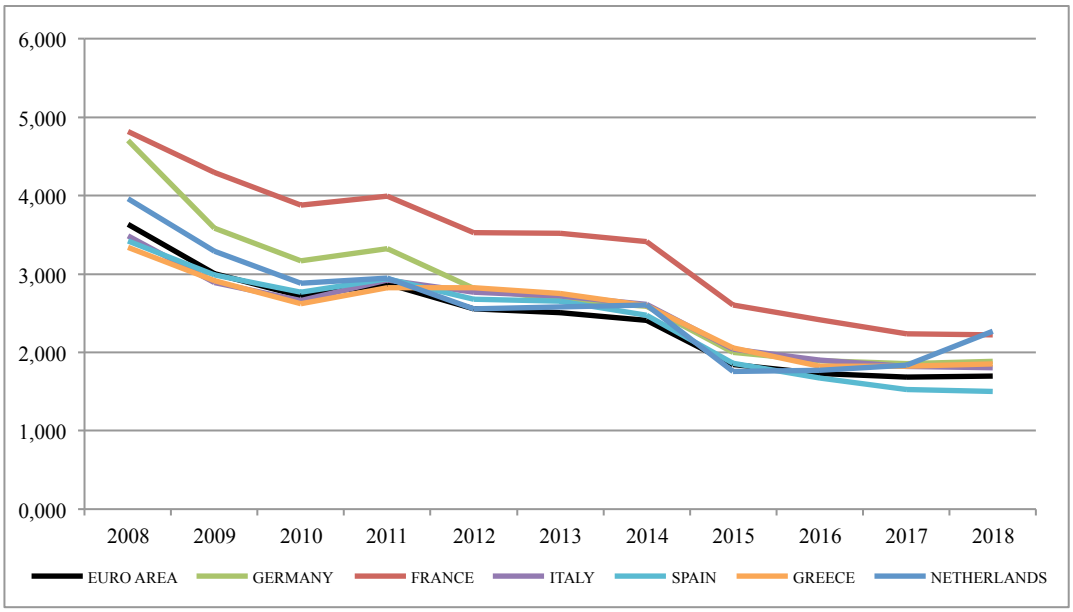
Concerning the variables at the base of the money multiplier (the currency ratio and the reserve ratio), a significant role is played by the banking system. In particular, the debate regarding the banks' regulation is controversial. On the one hand, numerous specialists are in favour of tighter regulation; in fact, in this way, the individuals' confidence in the banking system could increase, which should decrease country's currency ratio. Moreover, tighter regulation should increase the stability of the system and prevent an eventual possible bank crisis. On the other hand, other experts maintain that tighter regulation, and so the numerous instruments introduced by the ECB, such as the CAR and LCR, previously explained, in some measure limit a possible increase in the money multiplier and, for this reason, should be better conformed to the bank's needs.

Regarding these policies, there is also debate concerning the central bank's involvement in bank regulation and supervision. On the one hand, there are numerous arguments in favour of the central banks' engagement in both actions. It is possible that having banking regulation and supervision under the same central bank's jurisdiction would produce better mutual coordination, since the actions are strongly correlated. Moreover, from a practical point of view, some arguments in favour of this possibility regard the similarity in the professional skills and data sources used at the moment of regulation and in supervision reports. On the other hand, the main argument in favour of a distinction between supervision and regulation relates to the government's independence. In fact, this distinction could be an advantage because the monetary policy is not conducted according to the political cycle and so is independent from the politician's power. On the other hand, this could be a limitation; if the action conducted by the central bank involves even a fiscal countermeasure as a support, this becomes impossible. In

particular, it is possible that the government party is not disposed to accept the implementation of a fiscal policy as a support to the monetary one, which inevitably decreases the effectiveness of the monetary measure.

A decrease in the money multiplier is not the only possible explanation of the actual low level of inflation recorded inside the EA. Some other factors that cause a decline in the level of inflation include the decrease of money velocity and supply-side shocks. Money velocity is defined as the ratio between the nominal GDP and broad money, and, in the case of the US, for example, it measures the number of times that one dollar is used to purchase final goods and services included in GDP. If the currency of a country suffers from limited credibility, then the demand for that specific currency will collapse because of the flight to foreign currencies and, as a consequence, the money velocity will decrease. Figure 35 shows the decrease in money velocity of the main European states. An interesting aspect is that all the states considered in the sample (which represent the main EA states) present a value of money velocity higher than the EA's one. This means that some other countries, not represented in the graph, alter the final value of the EU's money velocity and negatively affect the resultant level of inflation in the EA.

Figure 35: The money velocity for selected countries, 2008-2018

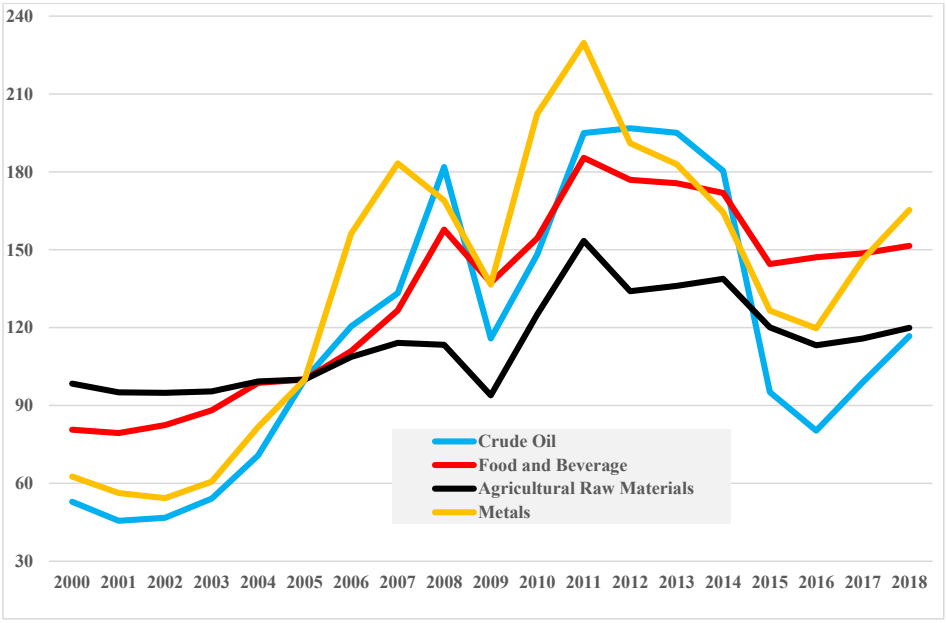


Source: Our elaboration on Trading Economics data.

The last factor that can affect the level of inflation is supply shocks. The commodities market occupies a significant role in the explanation of price fluctuations; in particular, domestic in-

flation is affected by the prices of imported energy, by imported food and by other commodities like metals, minerals and agricultural raw materials. In general, supply shocks, which refer to the increase in the price level of these products, should determine an increase in the level of the country's prices. The main reason why the supply-shocks do not produce an increase in prices is because the aggregate demand presents a very low level. However, looking at the trends of some commodity prices indexes (Figure 36), it is evident that these prices are actually growing; hence, in the future, the price levels will likely increase.

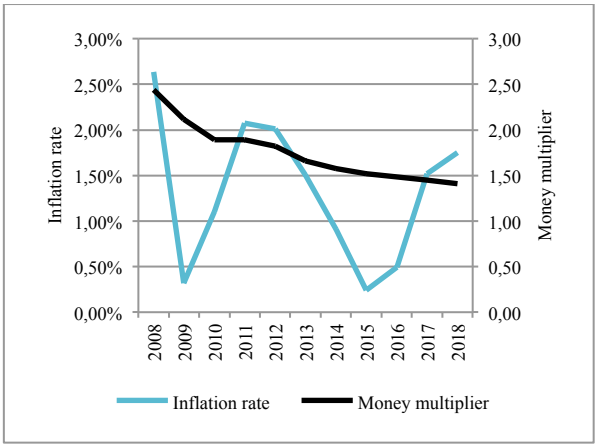
Figure 36: Indexes of commodity prices, 2000-2018 (2005=100)



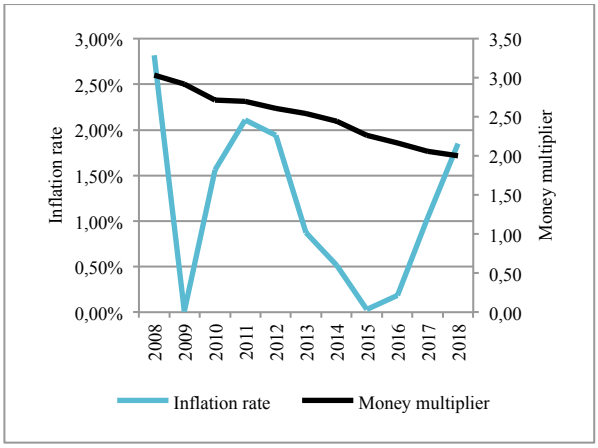
Source: Dabrowski (2018).

In the end, the QE policy has been more effective in some countries like Germany, France and Netherlands, while in the others, like Spain, Greece and Italy, it seems that it has not produced the expected results. A possible explanation can be found in looking at the values of the inflation rate and of the money multiplier at the country level. Figure 37 illustrates the inflation rate and the money multiplier for the main European countries:

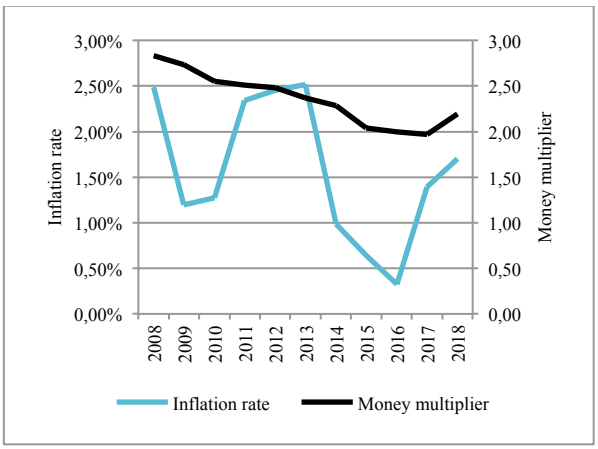
Figure 37: Inflation rate and money multiplier for selected countries, 2008-2018



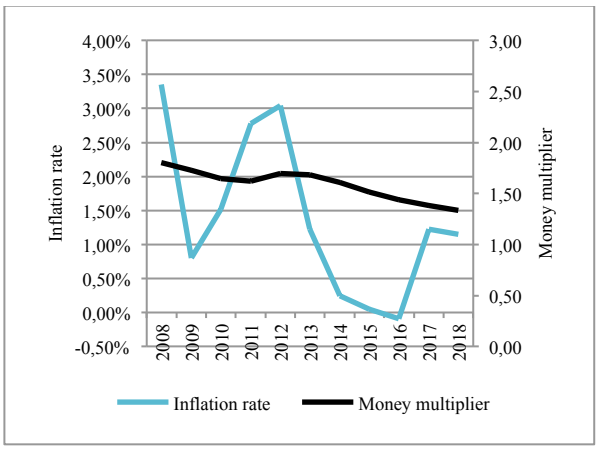
Germany



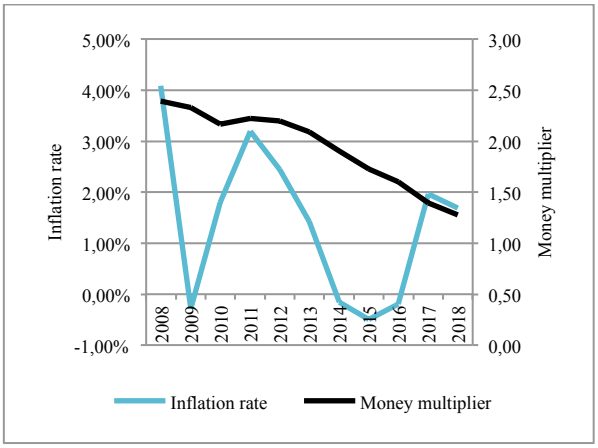
France



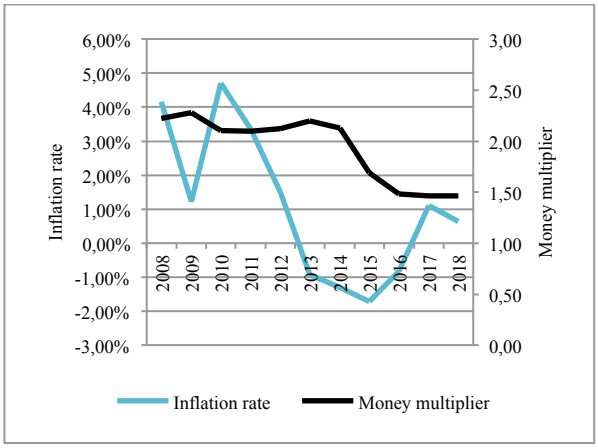
Netherlands



Italy



Spain



Greece

Source: Our elaboration on Trading Economics data.

From the comparison, it is evident that those countries with a value of the money multiplier higher than the European 'threshold' also present a higher level of inflation. The European average money multiplier is 1.5, and, from the study, it is possible to see that countries with an equal or higher value are also those with a higher value of inflation. These countries are Germany, France and Netherlands, for which the QE policy has produced a very positive effect.

In other countries, the situation is more complex. For peripheral countries like Greece, Spain and Italy, the QE policy seems not to have produced a higher effect. In reality, this is true if only the final value of inflation is analysed. In fact, all these countries presented a very low level of inflation; in mid-2017, none exceeded the value of 1.5%, and the situation was much more serious in Italy where the value of inflation in 2018 was equal to 1.15%. In these countries, the QE policy has not produced the expected results; the inflation level was still far from the target. However, from another point of view, the QE policy implemented by the ECB has not been completely useless; while the inflation was, and currently is, still low, the economic situations of these countries were not comparable to those of the core member states.

Hence, it is important to consider that the Sovereign Debt crisis has drastically affected the economies of Italy, Spain and Greece. To better understand the seriousness of the crisis, it is useful to analyse the inflation levels of these countries in 2015 at the moment of the QE policy's implementation inside the EA. Greece presented the worst level of inflation at (-1.73%). The Spanish situation was not much better at (-0.50%), and, finally, the Italian one was positive but almost null at 0.04%. These data show that the economic conditions were dramatic, and, even if the core countries presented very low inflation levels, they never recorded a negative value. Moreover, the situation in 2016 was exacerbated; the core countries recorded a supplemental increase in inflation levels, while the peripherals registered further decreases.

Therefore, expecting that the QE policy could completely resolve this condition was excessively optimistic. However, the QE policy has produced some positive effects even in the peripheral countries. For example, in Spain, the inflation level reached the value of 1.97%. Although the Spanish money multiplier was lower than the European average, the inflation radically increased. The analysis of the M1 and M3 growth rates can help us to understand better the reasons at the base. Our study shows that the growth rate of M1 radically has increased since 2013 and has remained at a very higher level over the years when compared with the pre-crisis situation. The huge increase in M1 has also been associated with an increase in M3; this means that Spain was able to transform the huge injection of liquidity supplied by the ECB into money and, as a result, its level of inflation increased. The reason at the base of this

success can likely be found in the implementation of the so-called TROIKA programme, which has reformed the banking systems of countries recently affected by the Sovereign Debt crisis and thus has produced positive effects in term of financial stability.

CONCLUSIONS

Our work has tried to explain the effects of the ECB's unconventional monetary policy on the level of prices and the reasons why the QE policy has not actually produced an increase in the level of inflation. As Whelan's study (2014) finds, there is a historical difference in inflation values among the European member states, and this differential has been significantly exacerbated by the Sovereign Debt crisis of 2012. The ECB's adoption of the QE has produced a positive effect on the level of prices, but a lower one than the expected. Burriel et al.'s study (2017) shows that this increase occurs after the UMP shocks and, in particular, distinguishes between the direct and indirect effects due to so-called cross-country interactions.

This study evinces that core European countries like Germany and France benefited to a greater extent from the QE policy than peripheral countries like Greece and Spain. The benefits that the core countries received from the QE have been an increase in the level of the output, as in the case of Germany and, to a smaller degree, the Netherlands, or an increase in price level, as in the case of France. However, the QE policy has not produced the expected results in peripheral countries like Italy, Spain and Greece, where the Sovereign Debt crisis has drastically affected the economy.

The possible reasons why the QE policy has not produced the expected results are numerous. First of all, a possible cause is the difference between the real GDP and the potential GDP of the countries. It is reasonable to assume that a country with a GDP level almost equal to its potential value will record a higher increase in the level of prices than a country with a GDP level lower than its potential one. Another possible cause is the soundness of the banking sector, as countries with a more fragile banking system will record a lower increase in the level of prices. A reason why countries like Spain and Greece recorded an unexpected increase in the level of prices, even if they presented a lower level of banking soundness, may lie in the fact that they subscribed to the so-called TROIKA programme. Participation in this programme implies a compulsory and substantial reform of the banking sector following the

ECB's indications and with the supervision of the IMF. Finally, the level of unemployment may also have contributed to the low effectiveness of the QE policy. In particular, those countries with a low level of unemployment will record a higher increase in the level of prices after a UMP shock. The lack of market frictions will determine an increase in the aggregate demand and, subsequently, an increase in the level of prices.

In addition to macroeconomic analysis, our work tried to analyse variations that the UMP shock has produced at the microeconomic level. A study conducted by Schäfer (2018) analyses the effect of the European countermeasures on price stickiness and the degree of backwardness for some main European countries. Moreover, it shows that the UMP has produced a heterogeneous effect on the level of prices among the sample's countries; this proves that a real and effective economic convergence is still far away among the European member states.

Despite the implementation of a common monetary policy by the ECB, this policy does not translate into an equal increase in real money throughout all European countries. For this reason, the last point analysed by our work is the relationship between the inflation rate and the money multiplier. In particular, it is evident that the money multiplier is different across the European member states and, hence, it is possible that the effectiveness of the QE policy has been influenced by this variable. An important aspect regards the M1 and M3 growth rates; if we compare the core and peripheral countries, we observe that Germany and France never record an negative M3 growth rate value, which inevitably positively affects their values of inflation. However, the situation is the opposite if we consider the peripheral countries, particularly Greece which has started to record a positive M3 growth rate only since 2016. According to our work, we can say that the QE policy has produced a larger positive effect in the core countries than the peripherals, but it has not been completely useless in the peripheral countries. A good example is the 'Spanish miracle' and the increase of Spanish inflation despite the Sovereign Debt crisis.

In conclusion, the money multiplier is an important factor in inflation analysis and in the evaluation of the monetary policy implemented by a central bank, but it is not the only one. It different values among the European countries reflects the large heterogeneity among them. For this reason, when we try to evaluate the effectiveness of the UMP and the reasons why the QE policy has not produced the expected results, we cannot overlook the historical and ongoing differences among the countries, which inevitably dampen the policy's effects. We cannot expect an equal effect among the European countries as long as homogeneity among them does not occur. Such homogeneity implies similar money multipliers among the states, but also a lower difference between the real GDP and its potential level in each country, a level of

unemployment close to its frictional value in every state, and, finally, a more stable and structured banking system in every European member state. In other words, it implies Europe truly being a real and effective Union.

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