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CONVENTIONAL AND UNCONVENTIONAL MONETARY POLICIES BY THE ECB AND THEIR IMPACT ON THE EUROPEAN BANKING SECTOR

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Contents

ABSTRACT

The thesis details the various monetary policy transmission mechanisms and investigates how they relate with unconventional monetary policies adopted by the European Central Bank following the financial crisis of 2007.

The object of the thesis is the European banking environment. The ultimate goal is to understand how European banks react to European Central Bank's policies. In particular, the focus is on how financial institutions were hit by the extraordinary macroeconomic scenario, and by the subsequent monetary policies promulgated by the European Central Bank throughout the last ten years.

The thesis is composed by three main chapters.

In the first one, monetary policy transmission channels are detailed and analyzed in their main components.

In the second chapter, an historical overview of all the most important conventional and unconventional decisions made by the European Central Bank is proposed.

In the last chapter, the impact of these monetary policies on the European banking sector is investigated.

EXECUTIVE SUMMARY

The financial crisis that started in 2007 constitutes a watershed within the central bank operating framework.

During the first years of its existence, the traditional framework of the new-born central bank has proved sufficient to control inflation. However, after the financial crisis and in particular, after the start of the European debt crisis of 2012, unconventional monetary policies have been a necessary addition to drive the economy and inflation on pre-established routes (i.e. according to the statute of the European Central Bank: "to maintain inflation rates below, but close to, 2% over the medium term").

Until 2007, the central bank has carried on few important interventions. It mainly took initiatives to smooth the process towards monetary union and managed key interest rates, attempting to influence inflation through the so-called monetary transmission mechanisms[1].

In particular, two main channels may be identified: the interest channel and the credit channel. The first focuses on the overall effects of interest rates on investments. In particular, the higher the interest rates and thus the costs of the sources of funds, the higher the weighted average cost of capital for firms, and the lower the level of real investments undertaken by corporations.

However, other "financial factors" are at play and magnify the effects of monetary policy decisions on output. The credit channel[2], in fact, operates consistently with the interest rate channel.

[1] Modifications in the key interest rates, in fact, affect the overall economy moving market rates consistently, financial asset prices (inversely related to the discount factor used), influencing the level of net worth of economic agents and their expectations, and exchange rates (interest rates together with the level of the economic activity within a country, are the most important determinants of currencies' exchange rates).
All of these factors have delayed impacts on the level of domestic and external demand, that in turn, influence the domestic inflationary pressure and ultimately the level of inflation within a country.

[2] The credit channel may be furtherly subdivided into a balance sheet channel and a bank lending channel.
The former analyses the credit market from the economic agents' perspective, taking a demand side approach. In particular, it focuses on how monetary policy decisions influence the financial solidity of borrowers, their net worth level, and ultimately the level of credit extended by banks to economic agents influenced by asymmetric information problems (the credit level extended is positively related to aggregate demand and eventually the level of inflation).
The latter analyses the credit market from the financial institutions' perspective, focusing on how monetary policies influence the supply of credit through the level of reserves within the banking system, and how the level of banking capital is instrumental in determining the ultimate effects of monetary stances to banks.

On the other hand, after the financial crisis, the European Central Bank had to put in place numerous unconventional monetary policies to complement standard decisions (i.e. progressive cuts in key interest rates and expansionary open market operations). In fact, first, the turbulence created by the sub-prime crisis and the subsequent Lehman default, and second, the European debt crisis, notably depressed the underlying European economic activity. Therefore, rigorous and decisive monetary policy stances were required to avoid deflationary threats.

As a consequence, the ECB widened its traditional operational framework, extending the length of LTROs, widening the set of counterparties accepted and the collateral eligible. For the first time, it set negative interest rates (interest rate on deposit facility, on 11TH June 2014). Moreover, it amended a series of purchasing programs, from the first version of the SMP until the well-known quantitative easing, together with an uninterrupted usage of the forward guidance.

These unconventional stances have contributed to create exceptional macroeconomic conditions, depressing and flattening yield curves. The thesis details how the banking sector was hit by unconventional monetary policies. It underlines common consequences that unconventional stances have on banking balance sheets, on actual profitability of banks and on their market capitalization. In particular, it demonstrates that unconventional monetary policies per se, accounting also for the positive impacts they have on the overall economic environment, are positively related to banking current profitability, despite the common perception about low-for-long interest rate environment.

The monetary transmission mechanisms

1.1 The Monetary Transmission Mechanisms

Central banks play a vital role in the economic environment of most of the countries in the world. Generally, they are involved in plenty of tasks such as the issuance of the country's currency (as the monopoly supplier), the banker to the government and the bankers' bank, the lender of last resort, the regulator and the supervisor of payments system. Therefore, to have a general understanding of the economic situation, knowing how a central bank operates and how it is able to influence the real economy, is literally essential.

Among the different tasks that central banks have, the main goal defined in plenty of central banks' statutes is to maintain price stability. Normally, this is identified as a range of targeted inflation[3], as the figure below shows.

Country/Region	
Australia	Australian Federal Reserve's target is inflation between 2.0% and 3.0%.
Canada	Bank of Canada's target is CPI inflation within 1.0% and 3.0%.
Euro-area	ECB's target is CPI inflation below a ceiling of 2%.
South Korea	Bank of Korea's target for 2010–2012 is CPI inflation within ±1.0 percentage of 3.0%.
New Zealand	Reserve Bank of New Zealand's target is inflation between 1.0% and 3.0%.
Sweden	Riksbank's target is CPI inflation within ±1.0 percentage point of 2.0%.
United Kingdom	Bank of England's target is CPI inflation within ±1.0 percentage point of 2.0%.

FIGURE 1.1: INFLATION TARGETING[4]

To do so, the central bank targets nominal interest rates in the economy, mainly overnight or with a very short-term nature. This maneuver will be effective if it manages to affect real activity and eventually the rate of increase in prices. This process, which is stylized in the picture 1.2 below, is called monetary transmission mechanism. According to the ECB definition, monetary transmission mechanism consists of "various channels through which monetary policy actions affect the economy and the price level in particular".

[3] The main exception to the inflation-targeting rule is the exchange rate target. However, what concretely happens, is that, to keep exchange rates within the predefined band, the central bank involves in a series of transactions concerning the foreign reserves and the own-currency. This affects the monetary base, the quantity of money in the system, the level of short-term interest rates and ultimately the level of inflation of the country.

[4] Source: CFA institute: economic volume.

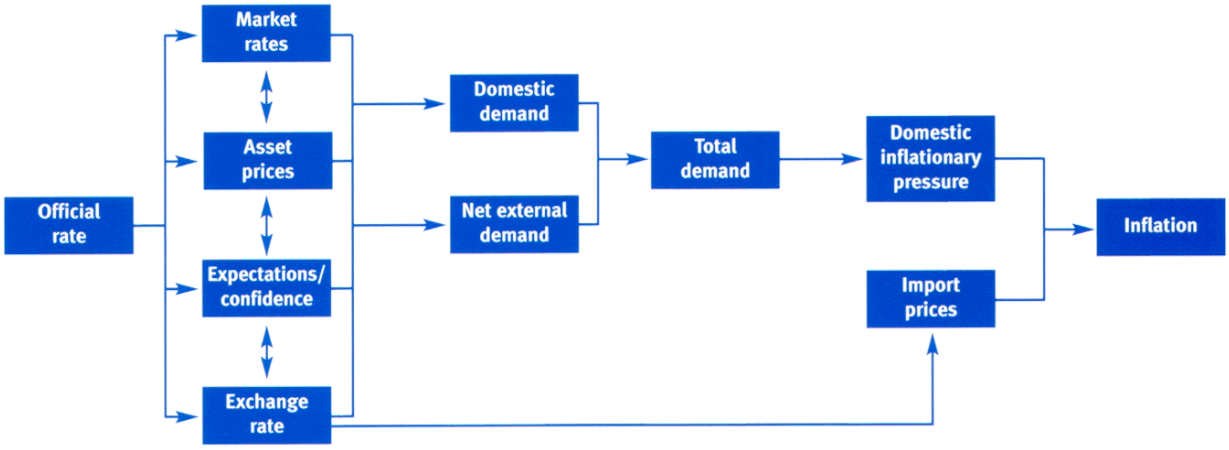

FIGURE 1.2: REPRESENTATION OF THE MONETARY TRANSMISSION MECHANISM[5]

Monetary transmission mechanism typically works in two main steps: first, modifications in the policy rates fixed by the central bank or in the monetary base affect market rates, asset prices, exchange rates and credit conditions within the system, which in turn affect the credit demand. Second, these changes influence consumptions of goods, services and investments that, in turn, affect the total aggregate demand and eventually the rate of increase in price.

In particular, as the figure 1.2 reports (an open economy is considered), official rates decided by the central bank, move base rates for commercial banks and interbank rates, consequently leading to adjustments in the overall market interest rate environment and in the cost of borrowing fixed by banks both for individual and firms.

Moreover, the prices of financial assets (inversely related to the discount factor used) adjust to changes in the overall level of interest rates in the economy.

Private agents' expectations play a major role in the mechanism too. In fact, if movements in the rates fixed by the central bank are largely expected, economic agents will respond accordingly. For instance, if an interest rate increase is expected (therefore, a monetary policy tightening); consumption, borrowing and asset prices may all decline due to the process of expectation revisions. In fact, higher interests rate negatively affect the net worth of economic agents and

[5] *Source*: Bank of England and CFA institute: economic volume.

increase the cost of borrowing[6], resulting in lower demand for loans and, over a longer-run, lower consumption.

Imports and exports will be affected as well, since changes in interest rates are one of the main determinants of the exchange rate movements.

These four effects are transmitted to the total demand for goods and services in a country, via the internal market (domestic demand) and the demand from "international" economic agents (net external demand), that in turn will determine the inflationary pressure over the system.

It is worth noting that changes in the exchange rate will also have a direct impact on inflation through import prices. For instance, a depreciation of the domestic currency causes the import prices to raise, putting additional pressure over inflation.

The general framework depicted in figure 1.2, may help to summary all the different monetary transmission channels in just one framework.

The next paragraphs will describe in detail the various monetary transmission channels, that, despite having different starting points will always converge to consequences and effects described in figure 1.2, to eventually end up, if successful, affecting total demand and inflation.

1.2 The Money View

To ultimately affect inflation, central banks can start from increasing/decreasing the size of the monetary base. This is referred as *money view* or *interest rate channel*. This theory states that changes in the money offer (M_s) affect the value and the structure of the interest rates in the economy. Therefore, instead of setting different levels of official rates (or together with; the two decisions are not mutually exclusive), central banks may adjust money supply to reach the desired level of interest rates in the economy.

It is worth highlighting that under the interest rate channel all the financial instruments are considered as perfectly substitute. In other words, this monetary transmission mechanism does not differentiate bank loans from bonds or equity financing or any other source of funds (i.e. the focus

[6] The lending rate fixed by banks may be decomposed into a base rate (highly related to central banks monetary policies) plus a spread.

is on the effect over the overall weighted average cost of capital that influences net present value calculations and so investment decisions).

Therefore, the demand for *all* the sources of funds may decrease in total so that money view operates.

The interest rate channel can be well described through the IS-LM model.

1.2.1 The IS-LM model

Picture 1.3 showed below, describes an equilibrium in the money market in the IS-LM model. The equilibrium is found at the intercept between the money offer (M_S) controlled by the central bank, and the money demand (L_d) of the economic agents. Note that the money demand is positively influenced by the level of output. In fact, it is reasonable to assume that the higher the income the higher the needs of liquid money to execute transactions.

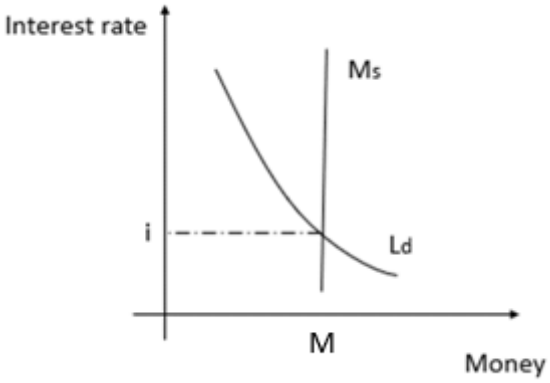

FIGURE 1.3: EQUILIBRIUM IN MONEY MARKET

In the IS-LM model, the central bank executes monetary policies only modifying the monetary base[7], and so the money offer (M_S) that, in turn, affects the level of interests in the economy.

[7] The monetary base is related to the money offer from the following formula:

$$M_S = mm * MB$$

Where, *mm* is the money multiplier defined as:

$$mm = \frac{1 + \frac{Currency}{Deposits}}{\frac{Currency}{Deposits} + \frac{Reserves}{Deposits}}$$

For instance, if the central bank desires to decrease the interest rates in the economy, it will increase the money supply (M_s), reaching so the new equilibrium in the money market, as shown in picture 1.4.

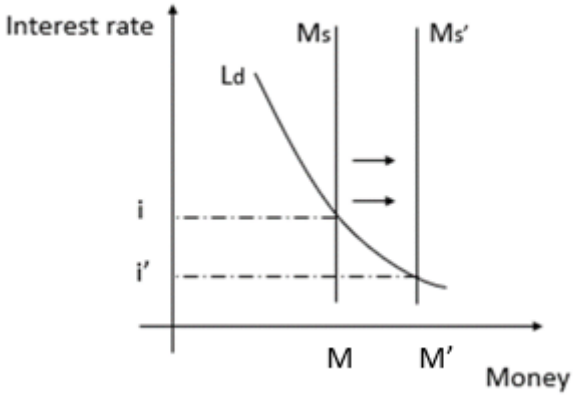

FIGURE 1.4: INCREASE IN MONEY SUPPLY (MS)

This will shift the LM curve, that, in fact, is simply derived by the equilibrium in the money market. In the case just described, the increase in M_s leads to a decrease in interest rates, that in the model causes an increase in the total amount of real investments[8], due to the decrease of the cost-of-capital as emphasized in the neoclassical literature.

This increases the aggregate demand and eventually raises the final total output, consistently with what showed in the flow chart of figure 1.2. Moreover, output and inflation are positively correlated. Thus, theoretically speaking, an increase in the output should lead to an increase in inflation.

It is worth highlighting that the last step of the process is not captured by the IS-LM model, that assumes price rigidity.

However, according to modern economic literature "it is difficult to explain the magnitude, timing, and composition of the economy's response to monetary policy shocks solely in terms of conventional interest-rate effects" as stated by Bernanke and Gentler (1995). "Financial Factors", such as credit market imperfections, asymmetric information in general and frictions, may help in amplifying effects of monetary policy decisions on output.

[8] In the IS-LM model investments are defined as inversely related to interest rates plus a constant value of fixed investments.

As a consequence, other relevant transmission channel may act consistently.

1.3 The Credit View

According to Bernanke and Gentler, credit channel should be seen as "an enhancement mechanism (of conventional interest rate effects), not a truly independent or parallel channel". Thus, as "a set of factors that amplify and propagate conventional interest rate effects".
Credit channel could be furtherly split into: *balance sheet channel* and *bank lending channel.*

1.3.1 The Balance Sheet Channel

Balance sheet channel is linked to the concept of external finance premium (i.e. the difference between the cost of funds raised externally and the opportunity cost of internal funds, that stems from imperfections in financial markets such as asymmetric information and the principal-agent problem). In particular, monetary policies directly influence the size of the external finance premium required to the borrowers. In fact, changes in the official interest rates affect the net worth of borrowers (interest rates are negatively related to the price of financial assets owned by the economic agents). As a consequence, changes in the level of interest rates affect the borrower's financial position, potentially[9] worsening asymmetric information problems[10]. In particular, the lower the borrower's financial solidity (that worsens asymmetric information problems), the higher the amount of the external finance premium required and eventually the worse the overall credit conditions.

For instance, a monetary policy tightening weakens borrowers' balance sheet in at least three different ways.
First of all, financial asset values are negatively related to interest rates. Therefore, a tight monetary policy leads to a shrink of the overall collateral value that may be put up by the borrower.

[9] The problem of asymmetric information between borrowers and lenders worsens in case of a decrease in the value of the net worth pledged by borrowers.
[10] Asymmetric information stems from imperfections in the real economy functioning. In general, it is referred as a situation in which one party of a transaction has more information than the other party.

Moreover, rising interest rates increases the financial expenditures on floating-rate debt, furtherly weakening debtor financial position (if already indebted). It is worth noting that many firms manage working capital leveraging on short-term floating-rate debts.
A third indirect and deferred effect can be registered too. In fact, a restrictive monetary policy may lower spending by customers, thereby reducing revenues for the firm.
In general, corporate cash flows and profits tend to decrease after a tightening monetary policy, because of the increase in interest expenses and the quicker decline of revenues with respect to the fixed & semi-fixed firm cost structure.

As said, a lower net worth put up by borrowers worsens asymmetric information problems.
The key role played by the net worth amount available and by asymmetric information within the balance sheet channel is detailed by Simon Gilchrist and Egon Zakrajsek (1995).
The model (summarized by the related picture 1.5 showed below) starts from the firm funds demand function (D) and the marginal fund cost curve (S). In particular, the D curve is downward sloping since marginal returns from investment decrease, while the S curve is initially horizontal tilting upward only after the end of the net worth (internal funds; W) put up by the borrower. It is worth highlighting that the S curve shape reflects the structure of agency costs[11]. In fact, agency costs increase as the amount of funds borrowed increases (thus, only after W). Note also that agency costs limit the funds borrowed by the firm to I_0 (i.e. $I_0 - W$) instead of the optimal I^* (i.e. $I^* - W$). Moreover, these funds are available at a higher cost due to the presence of the External Finance Premium (EFP) caused by the just mentioned asymmetric information problem.

Suppose now that the central bank decides to apply a tightening monetary policy.
This decision leads to an overall increase in the cost of the different sources of funds as expressed by the interest rate channel. However, according to the balance sheet channel other effects act consistently. Especially, net worth reduces from W_0 to W_1 (for the reasons explained before), leading to worsening in asymmetric information problems. This last passage steepens the S_0 curve to S_1, so increasing the external finance premium required to the borrower (from P_0 to P_1). This causes a further reduction in investments from I_2 to I_1, known as the "financial accelerator" effect.

[11] Agency costs arise since an "external" agent acts on behalf of a principal. They are caused by asymmetric information problem.

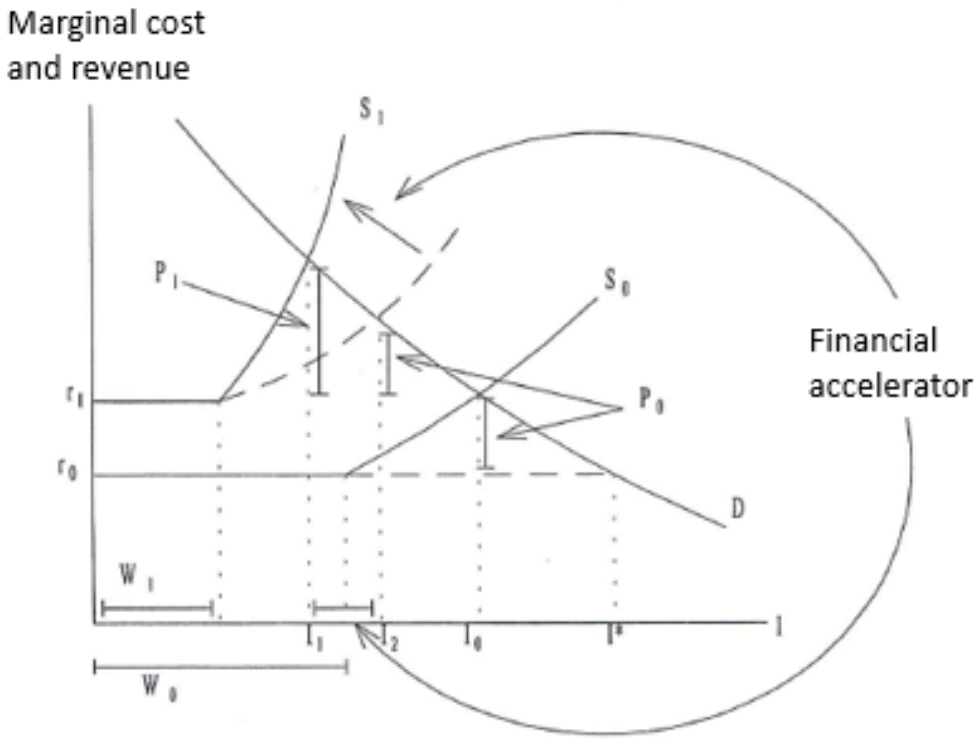

FIGURE 1.5: GRAPHIC REPRESENTATION OF SIMON GILCHRIST AND EGON ZAKRAJSEK'S MODEL

It is worth noting that asymmetric information problems affect firms unevenly in accordance to their financial solidity. For instance, during financial recession credit was extended mainly to best investors (referred as "flight to quality"), with inefficient firms rapidly drawing down the access to bank credit. Indeed, as emphasized by Greenwald and Stiglitz (1993), the same shock in firms' net worth caused by monetary policy stances may affect firms' business differently.

Their model stresses the role between financial and real decisions and the key role that net worth plays. Under four main assumptions[12] they concluded that the relation between the net worth owned by a firm and the output produced is represented by a concave curve (please, see the related picture 1.6 below).

[12] The four main assumptions are:

A) Credit rationing in stock market. Thus, firms must use bank credit to obtain funds.
B) Firms operate in a competitive market. They produce consumption goods, employing just labor as input with decreasing return to scale.
C) Firms must pay labor before receiving revenues from sales of their products.
D) They do not have enough internal funds.

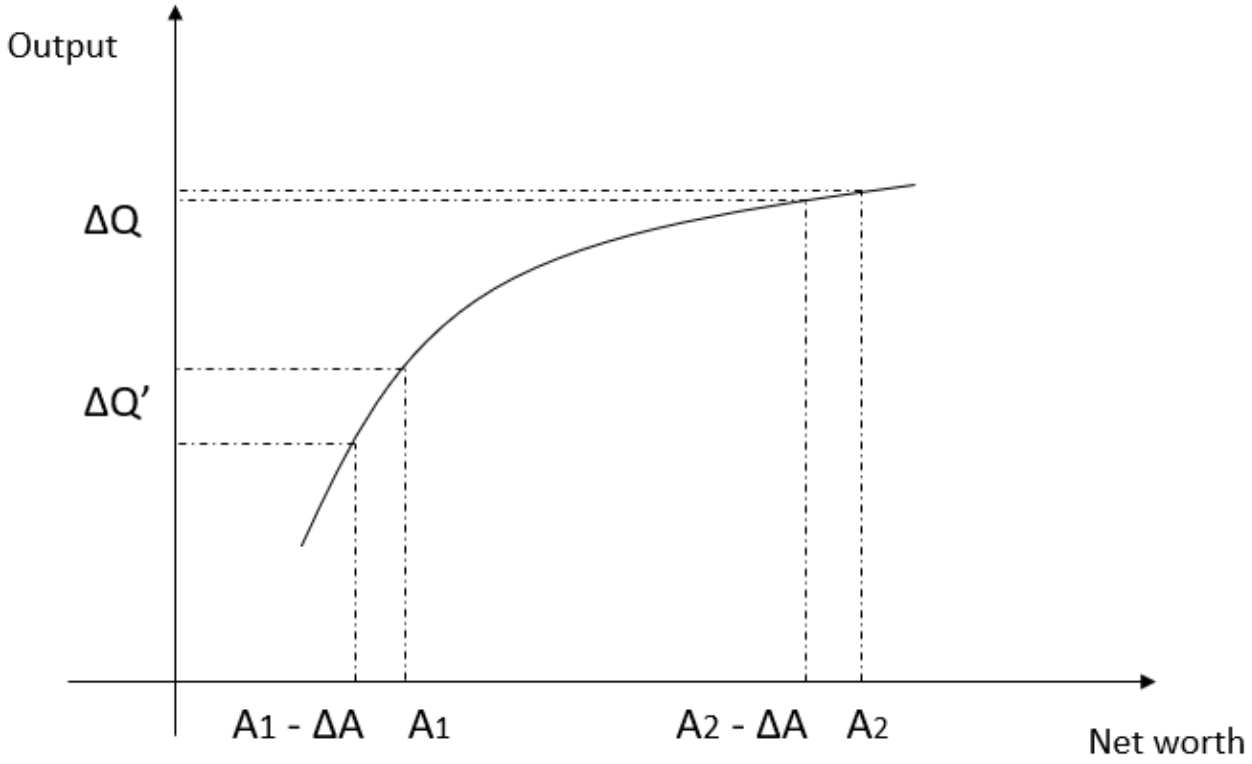

FIGURE 1.6: GRAPHIC RELATIONSHIP BETWEEN OUTPUT (Q) AND NET WORTH (A)

Where, A = Net Worth and Q = output produced by the firm.

Thus, the same shock (ΔA) for two different firms leads to widely different results in the output produced (ΔQ) according to the initial level of their net worth. In particular, the shock widely damages the firm with less initial net worth (lower collateral) harshly affecting its business decisions.

In short, balance sheet channel synthetizes another way in which monetary policy decisions by the central bank affect real economy. In particular, it is fair to suppose that the better the financial situation of borrowers, the lower the negative effects of asymmetric information within the economy and thus, the higher the overall amount of credit extended. Thus, as already emphasized in picture 1.2, this positively affects investments, thus aggregate demand and eventually inflation.

1.3.2 The Bank Lending Channel

Monetary policies do not only affect borrowers' balance sheet, but even impact the supply of credit. This is called the bank lending channel.

According to Bernanke and Blinder's model (1988), open market operations affect the supply of bank loans impacting bank funds available for lending activities. For instance, an open market sale by the central bank, decreases reserves and hence deposits from the banking system, impairing banks capability to lend money.
However, a key assumption of the model is that deposits represent the main resource to fund loans. Furthermore, banks cannot attract other sources of funds to replace lost retail deposits.

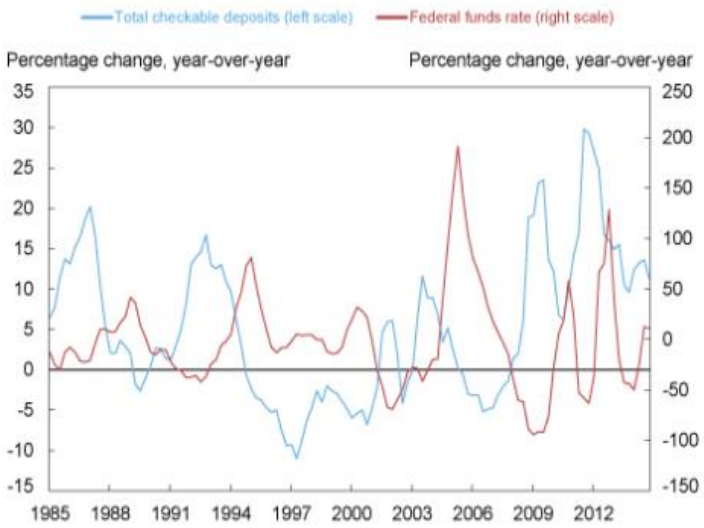

FIGURE 1.7: RETAIL DEPOSIT GROWTH AND THE FED FUNDS RATE

Here, an important remark must be done. As the Federal Reserve Bank of New York shows in its article in 2016, retail deposits are negatively correlated to the fed funds rate (see figure 1.7 on the left). This can be explained either by a decrease in money demand following a tightening monetary policy, or by a decline in central bank reserves that reduce the creation of reservable deposits, or by both.

The lifelikeness of the Bernanke and Blinder's model assumptions about the irreplaceability of retail deposits in bank lending activities has been challenged throughout time. In particular, recent economic literature[14] has focused its attention on the role of securitization, market funding, financial innovation as a whole, as well as supervisory regulations establishing capital requirements

[13] *Source:* Federal Reserve Bank of New York, "Would Monetary Tightening Increase Bank Wholesale Funding?".
[14] *Source:* Articles from European Central Bank, "Monetary policy transmission in the euro area, a decade after the introduction of the Euro".

for the banking system. All these factors, particularly the possibility of securitizing bank loans and the growing usage of non-depository sources of funds (bonds, covered bonds etc.) reduce the role of deposits as main funding source for loans activities.

As far as regulations is concerned, derivatives can be used to transfer risks to third party, moving them outside the balance sheet. This permits banks to free capital, thereby alleviating constraints on the expansion of the bank asset side.

As a result, under normal conditions, financial innovations lower the effectiveness of bank lending channel.

Overall, three key conditions for the proper functioning of the bank lending channel may be identified.

1) Monetary policies should be able to affect bank reserves and credit activities; in other words, it should be difficult for banks to find funds different from overnight deposits (no liabilities management).
2) Imperfect substitutivity between loans and bonds in the bank portfolio (no asset management); in other words, after a decrease in the liability side, the asset side decreases as well through reduction in loans.
3) Imperfect substitutivity of bank loans with other sources of funds for potential borrowers; in other words, there must be borrowers that depends on bank loans to finance their investments. This is typically true for small firms due to asymmetric information problems within the credit market.

1.3.2.1 The CC-LM MODEL

Bernanke and Blinder (1988) extended the IS-LM model considering the credit market too. Therefore, in order to analyze the effects that the credit extended has on the economy, they relaxed the underlying hypothesis done in the IS-LM model of perfect substitutivity among all the financial instruments. Indeed, bonds and bank loans are considered as two distinct categories. Under this new assumption investment function changes:

$$I = g - b[\alpha i_b - (1 - \alpha) i_l)]$$

Where g > 0, α > 0, i_b = nominal interest rate on bonds, i_l = nominal interest rate on loans and $\alpha i_b - (1 - \alpha) i_l$ the average cost of the funds necessary to finance the firm's investments (the hypothesis underlying the model is that firms do not have any internal fund available to finance investments). Note that the investment function has a further negative component (the one related to bank loans) with respect to the IS-LM simple investment function. This is due to the imperfect substitutivity of the two sources of financing[15].

As far as credit market equilibrium is concerned, its equilibrium is derived from:

$$L_s = L_d \qquad [1]$$

In particular, according to the following definitions:

$L = Loans,$

$\sigma = Required\ reserve - deposit\ ratio,$

$D = Demand\ deposits\ from\ non - banking\ public,$

$$L_d = L_d(i_b, i_l)$$

$$L_s = \gamma(i_b, i_l) D(1 - \sigma)$$

Thus, the equilibrium is detailed in the picture 1.8 showed below.

[15] The CC-LM model is built on the **pecking order theory**. This theory states that the different sources of funds are imperfect substitutes and that their cost is proportional to the asymmetric information faced. In particular, the higher the asymmetric information the higher the cost of the sources of fund used. This implies that self-financing is the cheapest resource available to firms while equity financing the most expensive.
Obviously, since investment decisions depends on the source of funds chosen, **Modigliani – Miller theorem** does not hold (again, due to the presence of asymmetric information).

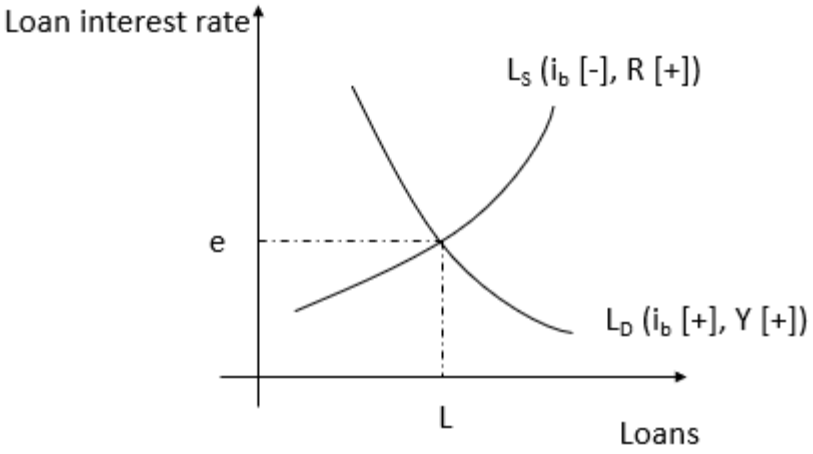

FIGURE 1.8: EQUILIBRIUM IN THE LOAN MARKET

Note that,

$$i_l = \delta(i_b, y, R)$$

Where R stands for the total reserve held by the banking sector. In particular, as it is even possible to note from the picture 1.8:

$$\frac{\partial i_l}{\partial i_b} > 0, \frac{\partial i_l}{\partial y} > 0, \frac{\partial i_l}{\partial R} < 0.$$

Substituting the relation [1] within the "modified" IS curve[16], it is possible to obtain the CC curve of the model, as displayed by the picture below. The CC of the curve stands for "Credit and Commodities", that models the equilibrium in the credit and goods markets. It is conceptually similar to the IS curve of the IS-LM model, but it differentiates bonds and bank loans, that are no more considered as perfectly substitutes.

[16] This is meant as an IS curve function of i_l too.

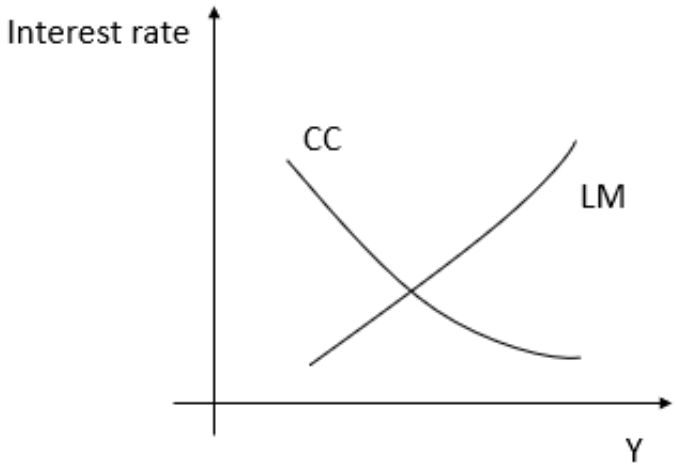

FIGURE 1.9: CC CURVE WITHIN THE CC-LM MODEL

Now, having detailed the theoretical framework of the model, it is possible to note how monetary policies adopted by the central bank affects the economy also through bank loans availability. Suppose that the central bank put in place an expansionary monetary policy increasing the monetary base. The first effect is detailed in the picture 1.10.

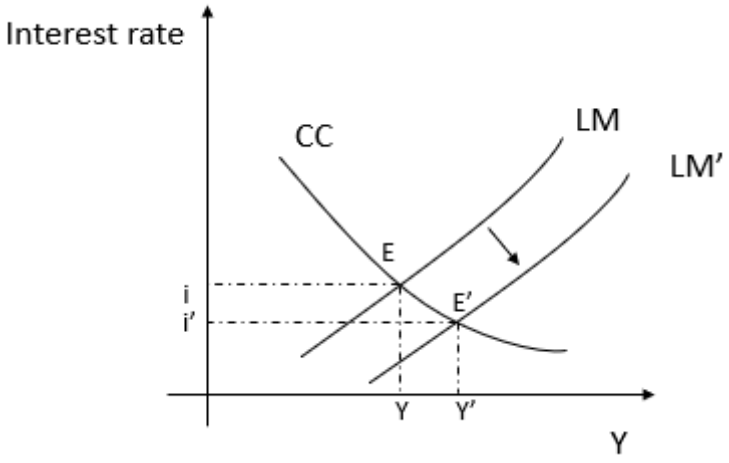

FIGURE 1.10: LIQUIDITY EFFECT

An increase in the monetary base leads to a decrease in the average interest rate within the bond market stimulating investments in the economy, consistently with the traditional interest rate channel. This effect is referred as *liquidity effect* and explains the transition from E to E'.

However, a second effect applies too.

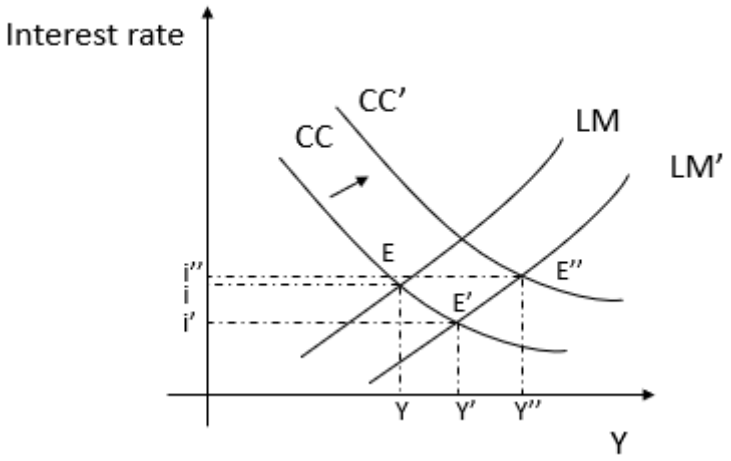

FIGURE 1.11: CREDIT AVAILABILITY EFFECT

In fact, an increase in the overall amount of reserves raises the overall supply of loans. This shifts CC curve upwards. This effect is referred as *credit availability effect* and explains the transition from E' to E''.

Overall, money and lending channel operate consistently, amplifying the result on the total output of the model. Therefore, the final effect on output is magnified by the increasing availability of bank loans that furtherly raises the output.

1.3.3 The Bank Capital Channel & The Risk-Taking Channel

Another relevant aspect that can affect the supply of bank loans and therefore the effectiveness of the bank lending channel, is the role of bank's own capital. In fact, highly capitalized banks can more easily access funding sources, thus, being able to extend more credit to firms even during monetary tightening periods. Instead, low capitalized banks would be more deeply affected by monetary policies.

For instance, a tight monetary policy would more strongly increase external finance cost for less capitalized banks than for highly capitalized ones. This mechanism, known as bank capital channel, reinforces bank lending channel.

It is necessary to emphasized that bank capital channel is particularly relevant in recession periods when capital is scarce.

Moreover, monetary policies may also have an impact on the willingness of banks to bear risks while lending to costumers. This channel is referred as risk-taking channel, and it takes place through two main ways: first, lower interest rates increase financial securities value and specifically the value of the collateral put upfront by borrowers.

Second, a lower interest rate environment makes riskier assets (with higher yields) more appealing. These circumstances lead to an increase in bank lending activities due to a reduction in credit standards required.

On one hand in the last decades, this channel has been furtherly reinforced by the possibility of transferring risk to third parties (both through securitization and derivatives) that may cause insufficient monitoring activity by banks and weakening of lending standards.

On the other hand, increase in the regulatory requirements through Basel III and improvements in national regulatory frameworks, have ultimately put a cap to this dangerous trend.

To remark the role of credit channels, and thus of balance sheet and bank lending channel, in the overall framework depicted in figure 1.2, it is worth highlighting that the number and the amount of the loans extended are positively correlated to investments and consumptions. Thus, in case of an expansionary monetary policy, it is fair to expect an increase in the aggregate demand driven also by an increase in loans available both to individuals and firms.

1.4 The Exchange Rate Channel

Exchange rates are another determinant that eventually may affect inflation. As already described in the first section, exchange rates influence inflation both in a direct and indirect way through the import prices of final and intermediate goods respectively.

For instance, a euro depreciation pushes up the overall HICP (Harmonized Index of Consumer Prices) both due to an increase in the prices to consumer for final goods, and to an increase in the production costs for intermediate goods, that may be transferred to final prices to keep constant the mark-up applied.

However, there are two important aspects that is important to highlight.

First, the relation between final prices (and thus inflation) and intermediate import prices strongly depend on sector and product characteristics. For instance, a microeconomic relevant factor is related to the concentration of the industry.

In fact, in a highly competitive market and especially if the good has different substitute products, even in case of a currency depreciation, firms need to keep their prices as constant as possible to maintain market share, thereby reducing their margins.

Second, the net results on HICP inflation is a combination of lagged effects from past exchange rate movements. In particular, final goods have an immediate impact on HICP while intermediate goods typically take longer to influence the inflation level.

Moreover, exchange rates influence export and import volume too. In fact, a depreciation of the currency is typically related to an increase in net exports (reduction in import while increase in export volumes due to a higher real attractiveness of internal goods).

The whole channel functioning is described in the figure 1.12 showed below, in the case of a currency depreciation.

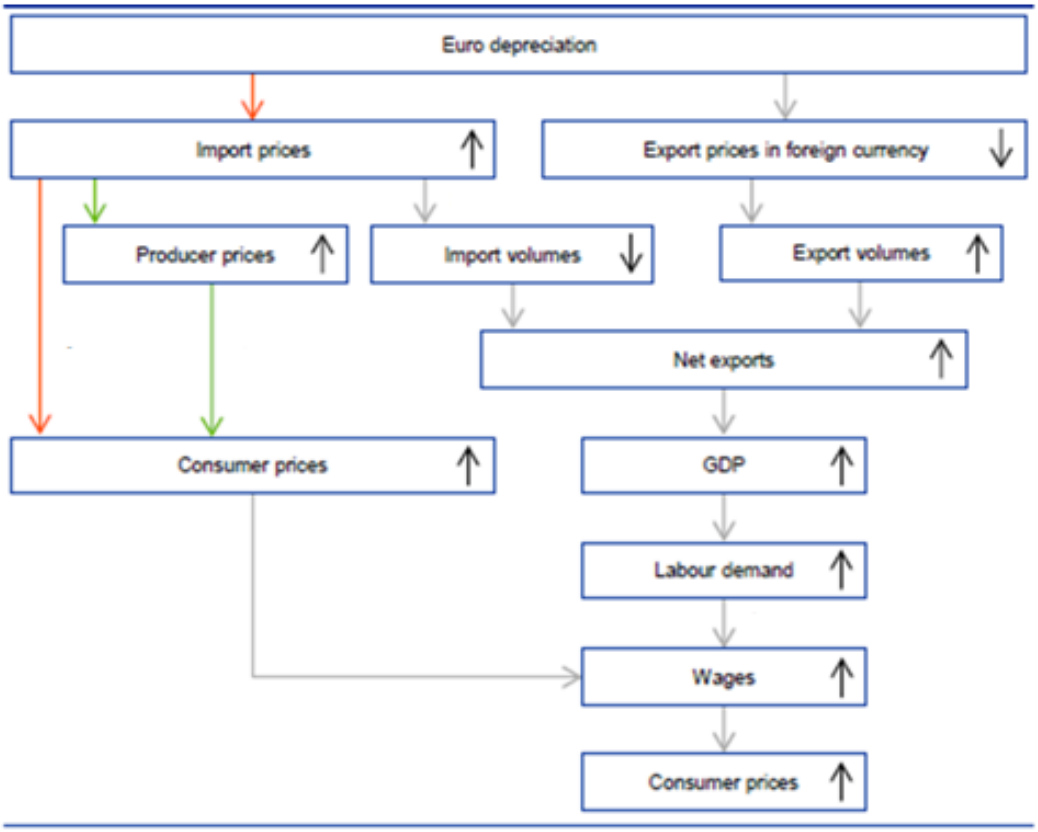

FIGURE 1.12: EXCHANGE RATE CHANNEL[17]

Once having described the most important channels that link monetary policies with the real economy, it is necessary to focus on the role of expectations, one of the main protagonists in each transmission mechanism.

1.5 The crucial role of expectations

Indeed, expectations are one of the key determinants for the efficacy of monetary policies. Mervin King (2005) said "the real influence of monetary policy is less the effect of any individual monthly decision on interest rates and more the ability of the framework of policy to condition inflation expectations".

In fact, as initially stated, expectations play a key role in each channel of policy transmission.

[17] *Source:* Articles from European Central Bank, "Exchange rate pass-through euro area inflation".

It is sufficient to note that the central bank has power to directly move very-short term nominal interest rates; however, consumption and investment decisions are largely related to real longer-term interest rates, which in turn depend on expectations about inflation.
Obviously, expectations influence the transmission of monetary stimuli to real economy even through other determinants such as expected future profits and wealth.

Thus, to fully appreciate the importance of expectations in shaping economic results, may be necessary to explain, with a higher degree of detail, how consumptions and investment decisions are correlated with expectations. This can be accomplished through two different approaches.
First, a more intuitive model is proposed in which consumption and investment functions are analyzed in their key components. Second, resolving a Dynamic Stochastic General Equilibrium (DSGE) model in order to show that output at t_0 is related also to interest rates expected at t_1.

1.5.1 Consumption and Investment functions

As far as consumption is concerned, it is possible to explicit its function in the following way:

$$C_t = (Total\ Wealth_t, Y_{Lt} - T_t)$$

Consumption today positively depend on both the total wealth of the individual and on his labor income net of taxes (T_t). It is worth noting that total wealth is composed by financial and housing wealth and the present value of all the future after-tax labor income.
Thus, expectations affect consumption in at least two ways: first, through expectations about the future net job incomes; second, through the value of financial assets owned by the individual, that in turn is formed starting from expectations on future cash flows guaranteed by financial instruments.
Investments are strongly related to expectations too. In fact, to decide whether to invest or not in a new project, it is necessary to calculate the present value of its future expected cash flows and compare them with the initial costs sustained.

In formula:

$$Net\ Present\ Value = \sum_{i=0}^{T} \frac{CF_i}{(1 + Discount\ Rate)^i}$$

1.5.2 DSGE Model

The approach built by Richard Clarida, Jordi Galí, and Mark Gertler (1999) starts from the hypothesis of nominal prices (and wages) stickiness in the short run. In fact, as the authors stated, "temporary nominal price rigidities provide the key friction that gives rise to nonneutral effects of monetary policy." Considering the following variables:

$Y_t = stochastic\ component\ of\ the\ output,$
$Z_t = natural\ level\ of\ the\ output,$
$X_t = output\ gap, defined\ as\ Y_t - Z_t,$
$л_t = inflation\ rate\ at\ t,$
$i_t = nominal\ interest\ rate.$

The two baseline equations of the model (1 & 2) may be respectively compared to an "IS" curve, since it inversely relates output gap and real interest rate (i.e. $[i_t - E_t\pi_{t+1}]$), and to a "Philips curve", since it positively relates inflation and output gap.

$$x_t = -\phi[i_t - E_t\pi_{t+1}] + E_t x_{t+1} + g_t \quad [1]$$

$$\pi_t = \lambda x_t + \beta E_t\pi_{t+1} + u_t \quad [2]$$

Where, g_t and u_t are disturbance terms.

Equations 1 is obtained from the household's optimal saving decision, imposing the equilibrium condition that consumption equals output less government expenditures.

It is worth highlighting how the resulting expression differs from the traditional IS. In fact, [1] is related even to the expected future output as well as interest rate. Therefore, higher consumption

forecasted in t_{t+1} increases the current output too. In other words, expectations of higher output for the next period lead economic agents to consume more today raising so the current output demand. It is explicative to iterate the equation [1] forward:

$$x_t = E_t \sum_{i=0}^{\infty} \{-\phi[i_{t+i} - \pi_{t+1+i}] + g_{t+i}\}$$

The equation obtained clarifies how expectations about the future affect current results within the framework proposed. In fact, the output gap at time t does not depend only on the current interest rate, but also on its expected future path. Thus, this result demonstrates how current policy actions as well as expectations about future measures affect aggregate demand.

The "Philips curve" [2] is derived as well from an explicit optimization problem considering an environment composed by monopolistically competitive firms. The equation [2], similarly to what a traditional expectation-augmented Philips curve does, relates the inflation rate to the output gap and expected inflation level. However, differences emerge through the iteration of the relation [2] forward:

$$\pi_t = E_t \sum_{i=0}^{\infty} \beta^i [\lambda x_{t+i} + u_{t+i}]$$

Differently from the Philips curve with backward looking expectations, here there is no lagged dependence in inflation. Instead, inflation depends completely on current and expected future economic situation. Roughly speaking, firms set their prices considering expected future marginal costs.

The central bank objective function translates the behavior of the target variables within the framework into a welfare measure to guide its monetary policy stances. The objective function takes the following structure:

$$\max -\frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i [\propto x_{t+i}^2 + \pi^2{}_{t+1}] \right\}$$

Where, the parameter $\propto$ is the relative weight on output deviations.

Therefore, the policy problem is to choose a time path for the instrument i_t considering the target variables x_t and π_t in order to maximize the objective function reported above, subject to the constraints [1] and [2].

Established the theoretical framework, it is fundamental to remark how the target variables depend not only on the current policy but also on expectations about future policies. In fact, it has been just demonstrated that the output gap depends on the future path of the interest rate while, inflation depends on the current and expected future behavior of the output gap.
Therefore, to be effective a monetary policy does not only have to affect current interest rates but also their future level.

1.5.2.1 Credibility

A direct implication of what just stated is that in this kind of environment credibility[18] about future monetary policy intentions becomes a key issue. In fact, as José Manuel González-Páramo (2007) reports "the final impact of a policy move depends to a very large extent on its impact on expectations, which increases the significance of credibility issues for monetary policy."
For instance, a central bank that is able to credibly signal its intention to keep inflation low in the next future may be able to diminish the current inflation level within the economy system with less cost in terms of output reduction than might otherwise be required.

Thus, stated the importance of credibility, the key factor becomes how the Central Bank may establish and reinforce its credibility during mandates. Three main ingredients may be identified:

- Independence from the county government. Thus, it is fundamental to disentangle politics from monetary policy actions. In fact, politicians may exercise influences over the central bank to opt for expansionary monetary stances with the final aim of reducing unemployment rates in the short run for political advantages, even though this decision does not represent the optimum one in terms of medium to long-run inflation rate.

[18] Credibility is defined as the degree to which people and markets believe that a policy announcement will actually be implemented and followed through.
Source: Macroeconomics a European perspective.

- Long mandates for the central bank governors to assure trustiness and continuity in their decisions. Moreover, long mandates guarantee that the governing Board takes decisions always having in mind a long-term horizon; thus, reducing opportunistically behaviors in the short-run.
- Preferences towards conservative Governs in line with the objective of low inflation.

Measure of expectations may be interpreted as a proxy of the level of the central bank credibility. In fact, anchoring inflation expectations requires that the central bank is considered credible and capable of reacting to various shocks with the final aim of maintaining price stability.
Finally, it is worth highlighting that this credible commitment per se, helps in anchoring inflation to the target desired.

Thus, until now it has been made explicit how all the macro economic framework is deeply affected by expectations in its key components (i.e. consumption decisions, investment choices and reaction to monetary policies stances).
Ultimately, a case that may be useful to explore is the liquidity trap. In fact, even in this case, expectations play a major role to determine the result of the monetary policy applied.

1.5.3 Liquidity Trap

Liquidity trap describes a situation in which interest rates are so low to be very close, or even at, the zero-lower bound.
In this case, once people dispose of enough money for their transactions, they are almost indifferent between owning the rest of their wealth as bonds or as currency, since both guarantee the same return equal to zero.
This situation can be described through the *IS-LM* model. Figure 1.13 represents the equilibrium in the money market. Please note that, a further increase in the money offering (from M_s to M_s') by the central bank, does not affect interest rates.

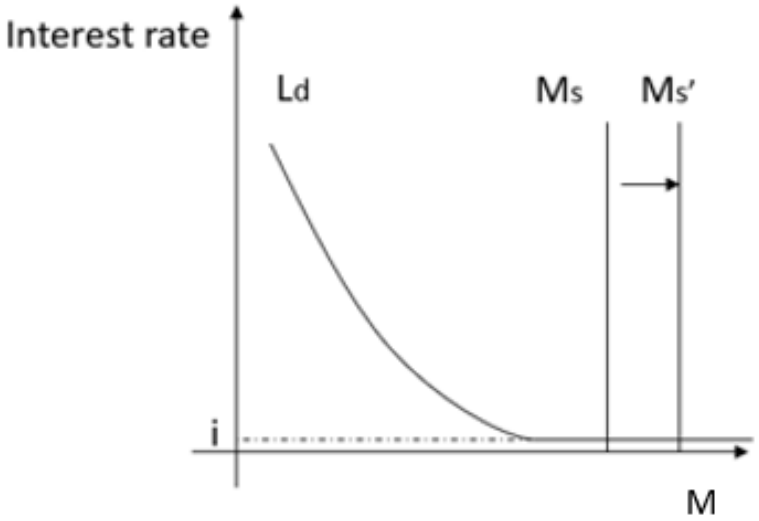

FIGURE 1.13: MONEY DEMAND, MONEY SUPPLY AND THE LIQUIDITY TRAP

Given the money market as represented in the figure 1.13, different *LM* curves according to the money offering can be represented as below.

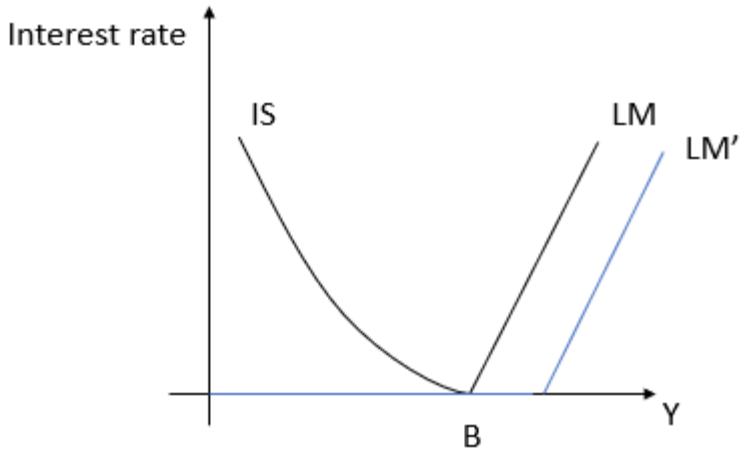

FIGURE 1.14: THE IS-LM MODEL AND THE LIQUIDITY TRAP

Note, that the intersection for both the LM curves represented remains at point B.

In short: once interest rates are equal to zero, expansionary monetary policies become useless.

However, expectations should be considered as well to have a complete understanding of the scenario. In fact, since every agent in the economy expects interest rates to raise soon, no one wants to hold bonds. This is because growing interest rates means decreasing prices. Therefore, if no one wants to invest money in bonds, firms do not have funds to finance their projects.
Thus, the intended effect of the monetary policy to stimulate investments, fails.

1.6 Limitations of the framework

The first limitation, intrinsic to the central bank model, arises from the nature itself of the monetary policies. In fact, they simply need time to be effective. Therefore, central banks must deal with future data and it must take decisions in a forward-looking way, predicting what the future inflation will be. Central banks adopt plenty of macroeconomic projections and indicators (for instance, monetary aggregates such as M3 in Europe) to predict future developments of inflation.
Furthermore, limitations of monetary policies include problems in the transmission mechanism and the relative ineffectiveness of interest rate adjustments as a policy tool in deflationary environments.
First, all the decisions made by central banks have just a delayed effect on the ultimate target and are transmitted through the real economy through several channels where different actors play an important part. However, there may be occasions in which monetary stimuli are not transmitted seamlessly through the economy.
For instance, the economy is largely moved by long-term (real) interest rates while, central banks may have an almost perfect control just on short-term (nominal) interest rates. This means that, are the market expectations about short-term rates over time to form the overall interest rate term structure, under the so-called expectations theory. Undoubtedly, the level of credibility of the central bank and the eventual usage of unconventional instruments such as the forward guidance, help the central bank to be effective in transmitting the intended message through the economy. Still, market expectations play a pivotal part.
Furthermore, central banks have important limitations in affecting the actual quantity of money (measured as different broad money indicators depending on which country), that in turn is influenced also by private citizen choices (the amount of liquid currency out of deposits) and by banking choices (the amount of reserves kept). This almost obliges central banks to give up the

possibility to use money quantity variations to influence inflation in the short run (in this case, generally, the preferred method is to move key interest rates).

However, trends in money growth are fundamental in determining the level of inflation in the long-run.

Severe limitations arise in extreme occasions such as the liquidity trap, when interest rates are close to zero or at the zero-lower bound. In these situations, as already underlined, monetary policies may become completely ineffective obliging the central bank to intervene in unconventional ways. In these cases, fiscal policies are fundamental to stimulate the economy; however, it is up to governments to adopt the necessary reforms to increase competitiveness as well as address structural factors in the economy.

Conventional and unconventional monetary policy tools to escape the Great Recession

2.1 The European Central Bank

From now on, the focus will be just on the European environment and therefore, on the European Central Bank (ECB). All the monetary transmission mechanisms just detailed, applied to the European economic environment as well.

The European Central Bank has an essential role in the European economic life, playing several crucial tasks.
It has a monopoly on the issuance of the fiat money used within Euro countries, the euro. Therefore, it plays a key role in maintaining confidence in its currency and in safeguarding its value. As its website reports: “our main aim is to maintain price stability, i.e. to safeguard the value of the euro.” Moreover, it has a crucial role in conducting foreign exchange operations, managing and handling foreign currency reserves and regulating operations in the payment systems.
However, the most precious role it has consists in defining and implementing monetary policies. Its final aim is to reach price stability, which, as the Governing Council clarified in 2003 means “maintain inflation rates below, but close to, 2% over the medium term.”
To do so, ECB has traditionally implemented a set of instruments that can be classified among three main classes: open market operations, minimum reserves requirement and standing facilities services.

Open market operations (OMOs) consist in acquisition or sales of financial instruments (mainly government bonds) on the open market with the final purpose of affecting the monetary base and consequently the level of short-term interest rates. ECB starts the open market operations, deciding the terms and conditions and the instruments accepted. The typical settlement is based on a repurchase agreement where ECB sells\buys securities from a commercial bank with the agreement of reverting the transaction at some time in the future. The securities exchanged represent the collateral for the loan the central bank makes to the commercial bank involved in the transaction. According to the duration of this loan, OMO can be divided into either main refinancing operations (MROs) with maturity normally of one week, or longer-term refinancing operations (LTROs) with standard maturity of three months.

Refinancing operations are organized through auctions, either in a fixed rate tender or in a variable rate tender. In the former, the ECB specifies the interest rate on the loan in advance and the counterparties bid only the amount of money, while in the latter the counterparties bid the interest rate too.
Minimum reserve requirements are controlled and decided by ECB within the Euro area. Doing so, ECB attempts to modify the amount of money in circulation in the economic system, thus affecting money market interest rates.
In fact, monetary aggregate measures are also influenced (via money multiplier) by the amount of liquid money banks keep in their balance sheets, both due to required reserves imposed by ECB and excess reserves voluntarily kept by commercial banks.

Standing facilities are a source of overnight liquidity for banks on their own initiative (contrary to OMO). Two different standing facilities are available: marginal lending facility and deposit facility. The former is used to obtain overnight liquidity against eligible assets, while the latter is used to make overnight deposits. The interest rates on the two standing facilities are fixed by the ECB.
It is worth noting that these two interest rates create the so-called “ECB corridor”: a range within the overnight rate can fluctuate in. In fact, the interest rate on marginal lending facility provide a ceiling to the overnight rate in the money market, while the rate on deposit provide a floor.

After having detailed the different monetary transmission mechanisms working in the real economy, the next paragraph focuses on how monetary policies have been traditionally implemented by European Central Banks until the financial crisis of 2007-2008.

2.2 The traditional implementation of monetary policies

Between the transition from monetary union and the financial crisis, European Central Bank has guaranteed price stability moving the three official interest rates (i.e. interest rate on MRO, rate on the deposit facility and on the marginal lending facility).

Among the normal fluctuations dictated by the need of stimulating or slowing down the economy, few key changes are worth noting:

1) On 22 December 1998 the ECB announced an upcoming exceptional measure to facilitate the transition to the new regime by market participants, consisting of a decrease in key interest rates.
2) On 8 June 2000 the ECB announced that from 28 June on, the main refinancing operations of the Euro-system would be conducted as variable rate tenders. This decision has been taken by ECB as "a response to the severe overbidding which has developed in the context of the current fixed rate tender procedure. For the purpose of signaling the monetary policy stance, the minimum bid rate is designed to play the role performed, until now, by the rate in fixed rate tenders."[19]
3) Between May 2001 and June 2003, ECB progressively diminished key interest rates to stimulate the economy in a troubled period. In fact, geopolitical uncertainty (due to the terrorist attack of 11 September) and the dot.com crash in the US financial markets, contribute to furtherly brake European economy in an already slow-growth phase.
4) From March 2006, the Governing Council of ECB decided to progressively increase the key interest rates to counter the inflationary pressure in the Eurozone.

The table below summarizes the interest rates decided by the Governing Council of the ECB in the period considered. All the interest rates levels are expressed in percentages per annum.

[19] *Source:* ECB press release, 16 June 2000.

TABLE 2.1: KEY INTEREST RATES IN THE PERIOD 1999-2007

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
1999	1 Jan.	2,00%	3,00%	-	4,50%
	4 Jan.	2,75%	3,00%	-	3,25%
	22 Jan.	2,00%	3,00%	-	4,50%
	9 Apr.	1,50%	2,50%	-	3,50%
	5 Nov.	2,00%	3,00%	-	4,00%
2000	4 Febr.	2,25%	3,25%	-	4,25%
	17 Mar.	2,50%	3,50%	-	4,50%
	28 Apr.	2,75%	3,75%	-	4,75%
	9 Jun.	3,25%	4,25%	-	5,25%
	28 Jun.	3,25%	-	4,25%	5,25%
	1 Sep.	3,50%	-	4,50%	5,50%
	6 Oct.	3,75%	-	4,75%	5,75%
2001	11 May	3,50%	-	4,50%	5,50%
	31 Aug.	3,25%	-	4,25%	5,25%
	18 Sep.	2,75%	-	3,75%	4,75%
	9 Nov.	2,25%	-	3,25%	4,25%
2002	6 Dec.	1,75%	-	2,75%	3,75%
2003	7 Mar.	1,50%	-	2,50%	3,50%
	6 Jun.	1,00%	-	2,00%	3,00%
2005	6 Dec.	1,25%	-	2,25%	3,25%
2006	8 Mar.	1,50%	-	2,50%	3,50%
	15 Jun.	1,75%	-	2,75%	3,75%
	9 Aug.	2,00%	-	3,00%	4,00%
	11 Oct.	2,25%	-	3,25%	4,25%
	13 Dec.	2,50%	-	3,50%	4,50%
2007	14 Mar.	2,75%	-	3,75%	4,75%
	13 Jun.	3,00%	-	4,00%	5,00%

2.3 The financial Crisis

In the summer of 2007, persistent rumors about the significant exposure of Euro banks to US subprime market[20] perturbated trading activities and money market interest rates. However, ECB was able to manage the circumstance by only slightly changing its standard framework, while contemporary injecting liquidity in the market (almost 100 billion €).

Theses slight changes decided by the ECB during these months have to be reconducted to three main categories: first, ECB provides higher flexibility to its open market operations by adopting fine-tuning operations[21] and modifying the time-framework of liquidity provision. Second, it extended the maturity of open market operations (i.e. LTROs), passing from the standard three months to six months. Third, ECB together with other central banks provide US Dollar funding.

[20] This market segment serves borrowers with low credit ratings. The high default rate on Subprime Mortgage is seen as one of the main factor that started financial crisis in 2007.

[21] Non-standard operations executed with the aim of smoothing interest rates fluctuations caused by liquidity shortages. The instruments and procedures applied can be modified each time according to the specific objective pursued by the European Central Bank.

However, the uncertainty that surrounded financial markets drastically increased in September 2008. In fact, the collapse of Lehman Brothers wreaked havoc in credit institutions and financial markets all over the world. In particular, interbank market, the most important source of short-term liquidity for banks, almost ceased to work due to growing uncertainty on financial health of participants. As in the summer of 2007, this uncertainty was driven by the exposure of euro banks to US sub-prime housing market.

If left unresolved, this situation would have led to the impossibility of refinancing many bank assets, if not through a massive deleveraging, and to consequent severe limitations in real economy financing.

In fact, a disorderly and massive deleveraging process undertaken by most of the banks, would have had serious implications. Indeed, a significant adverse shock to bank balance sheets may trigger sharp reactions from banks, that can reply tightening credit standards and drastically reducing loan supply, generating tremendous effects in the real economy.

FIGURE 2.1: FUNDING OF NON-FINANCIAL CORPORATIONS IN THE EURO AREA AND IN THE USA

This scenario would have perfectly applied to Europe, due to the higher dependency of European borrowers to the banking system (please, see the related picture 2.1 on the left[22] [23]).

In this case, the transmission mechanisms of standard monetary policy might have been compromised requiring stronger interventions from the European Central Bank (i.e. non-standard monetary policies).

Thus, to avoid this scenario, the first priority for the ECB was to provide the liquidity that banks needed. To facilitate liquidity provisions, it steadily decreased the key interest rates from October 2008 to May 2009 (see, table 2.2 below).

[22] *Sources:* Eurostat, ECB and Federal Reserve System.
[23] It displays the shares in accumulated debt transactions between 2002 and 2012Q1.

TABLE 2.2: KEY INTEREST RATES IN THE PERIOD 2008-2009

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
2008	9 Jul.	3,25%	-	4,25%	5,25%
	8 Oct.	2,75%	-	-	4,75%
	9 Oct.	3,25%	-	-	4,25%
	15 Oct.	3,25%	3,75%	-	4,25%
	12 Nov.	2,75%	3,25%	-	3,75%
	10 Dec.	2,00%	2,50%	-	3,00%
2009	21 Jan.	1,00%	2,00%	-	3,00%
	11 Mar.	0,50%	1,50%	-	2,50%
	8 Apr.	0,25%	1,25%	-	2,25%
	13 May	0,25%	1,00%	-	1,75%

2.4 Unconventional Monetary Policies

Moreover, ECB temporarily put in place numerous unconventional monetary policies[24] to support bank liquidity and credit flows beyond what could be simply achieved just cutting official interest rates.

Nonstandard monetary policies adopted by ECB can be classified into five main dimensions:

1. *Fixed-rate full allotment.* Thanks to this decision all the suitable financial institutions in the Euro area have an unlimited access to liquidity supplied by central bank, provided that they are able to put up adequate collateral. This considerably changes the traditional framework of all refinancing operations during the financial crisis.
2. *Extension of collateral eligibility.* ECB widened the list of financial instruments accepted as collateral in refinancing operations. Thus, the possibility of banks to refinance also less liquid assets reliefs the liquidity shortage caused by the relevant drop in interbank lending after Lehman default.
3. *Extension of the maturity of liquidity provision.* The maximum maturity of LTROs was once again extended to 12 months, from June 2009 on. This aimed at maintaining money market interest rates at low level and reducing refinancing worries for the banking sector in Europe. Thus, through the reduction of liquidity costs and providing more guarantees on liquidity planning even in medium terms, European banks were expected to increase loan supply to the real economy.

[24] Unconventional monetary policies are employed by Central Banks when interest rates are close or at the zero lower bound and there are concerns about deflation or deflation is even occurring.

4. *Currency swap agreements.* To avoid a shortfall of US dollar funding[25] , the Euro system provisionally extended liquidity denominated in other currencies too (especially in US dollars, thanks to an agreement with the US Federal Reserve).
5. *Covered bond purchase program (CBPP).* The Euro system engaged in buying covered bonds[26] for a total amount of 60 billion Euro gradually from June 2009 to June 2010 (2,5% of the total outstanding value of covered bonds). The program had the objective of revival the market for covered bonds, given its strategic importance as one of the most important sources of funding for Euro banks.

As Philippine Cour-Thimann and Bernhard Winkler (2013) stated: "the evidence available suggests that the non-standard measures taken from October 2008 have been instrumental in stabilizing the financial system and the economy, as well as in ensuring price stability". On the same page is Peter Praet, member of the Executive Board of the ECB, that in its speech in Milan declared: "measures undertaken by the Euro-system (…) in the period from 2008 to 2010 have helped to prevent self-enforcing spirals and a credit crunch."[27]

2.5 Euro area sovereign debt crisis

Another relevant shock hit the euro area. In fact, in the first months of 2010 Europe was threatened by the possibility of a Greek sovereign default, that would have had consequences even on Ireland, Portugal, Italy and Spain. Because of these concerns, in May 2010 some market segments for government bonds stopped functioning properly. Given the importance of government bonds in banks' balance sheet, as well their relevance in liquidity operations and as benchmark for lending rates in private sector, this situation would have led to an impairment in various transmission channels.

Thus, another strong intervention from ECB was necessary. ECB promptly responded establishing the Securities Markets Program (SMP) with the aim of providing liquidity in the impaired market segments to assure the proper transmission of non-standard monetary policies.

[25] Most of Euro banks have significant liabilities denominated in Dollars.

[26] Covered bonds are securities backed by mortgages, that the bank still held in its balance sheets, unlike with ABS. Thus, the holder has a claim even on the underlying asset in case of the borrower default. The program was related to covered bonds denominated in euro and issued in the euro area.

[27] *Source:* Speech by Peter Praet, Member of the Executive Board of the ECB, at the Conference: "The Effect of Tighter Regulatory Requirements on Bank Profitability and Risk-Taking Incentives", Milan, 26 October 2012.

Three main channels of potential disruption have been recognized.

First, the *price channel* which is related to the link between government bonds yields and market rates and with the cost of borrowing in the economy.
Indeed, it is worth remembering the high correlation between sovereign rating and banks rating within a country. Therefore, higher yields in government bonds (not sustainable for any sovereign), may consequently lead to increasing financing costs even for banks and ultimately affect lending rates that banks apply to final customers.

Second, the *liquidity channel* which is related to the leading role that government bonds have in repo transactions in the Euro area. Thus, failures in government bond sectors may lead to greater difficulties in getting the liquidity that banks need.
Moreover, a rating downgrade of government bonds may lead to margin calls (given their relevant presence in banks' balance sheet) as well as changes in their suitability as collateral, with a consequent further strengthening of liquidity problems for banks.

Third, the *balance sheet channel* which is related to the loss in value of government bonds due to the increase in the yield required in the market. The decrease in the asset side value of the bank, likely higher than the decrease in the liability side[28], is compensated by a further decline in the bank own capital, with a consequent increase in banking leverage. Thus, the need to reduce leverage together with regulatory constraints on minimum capital required, may lead to further impairments of bank capability to extend loans.

SMP plan promulgated by ECB was effective in mitigating disruptions in the just mentioned channels and in supporting financial markets (yields of sovereign bonds relevantly declined). Therefore, as stated by Philippine Cour-Thimann and Bernhard Winkler (2013) "SMP helped to avoid for some time an uncontrolled increase in sovereign bond yields and thereby in general financing costs for the economy with adverse implication for price stability". Moreover, ECB put in place also other non-standard monetary policies together with SMP plan. For example, it furtherly enlarged the list of financial instruments accepted as collateral and extended maturity for its liquidity provisions.

[28] Caused by a higher-yield environment that in turn affect even bank liabilities reducing their market value.

2.6 The intensification of the sovereign debt crisis

However, the difficult situation in Europe caused by the general braking of the economy together with numerous downgrades of sovereign bonds (this time, even in France, Belgium and Austria governments bonds showed falling prices) and uncertainty related to the financial situation of South-European countries, impaired once again the interbank market[29].
Notably, during this year, bank credit default swaps spreads[30] exceeded the peak registered after Lehman default.

To worsen even more the situation, European Banking Authority temporarily increased capital requirements. Overall core Tier1 capital ratio was raised to 9% of Risk Weighted Assets (RWA). This decision created an urgency in the banking sector to raise additional equity capital for a total amount of nearly 100 billion euro. At this point, the serious and tangible problem was once again to avoid a massive deleveraging (aimed at decreasing assets and so RWAs) to improve capital ratios.
ECB decided that the Securities Market Program established in 2010 was no more enough to cope with this difficult situation. To provide financial institutions with short-term liquidity and enough guarantees to permit banks not to shut down lines of credit to the real economy, ECB together with the steady reduction of key interest rates applied in 2011 (see, the related table 2.3 below), responded in four main ways:

TABLE 2.3: KEY INTEREST RATES IN 2011

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
2011	13 Apr.	0,50%	1,25%	-	2,00%
	13 Jul.	0,75%	1,50%	-	2,25%
	9 Nov.	0,50%	1,25%	-	2,00%
	14 Dec.	0,25%	1,00%	-	1,75%

1. Two LTROs of three years maturity, to give financial institutions guarantees of having sufficient liquidity over the medium term. The most relevant changes with respect to the normal framework were once again the extended maturity allowed but, in particular, an

[29] It is worth remembering the strict correlation between the country and its national banking system.
[30] A Credit Default Swap (CDS) is a credit derivative that transfer the credit exposure to a third party. An increase in the premium requested by the seller of the derivative to insure the credit underlying, has to be seen as a decrease in the credit worthiness of the original debtor.

option given to the counterparty to settle the transaction at any moment after the completion of the first year.

2. Reduction in the minimum reserve ratio with the purpose of freeing additional capital for bank liquidity.
3. A further increase in the collateral availability, extended in particular to Asset Backed Securities (ABS), to certain foreign-currency paper issued and the removal of the rating waiver for Greek government securities.
4. A second covered bond purchase program (CBPP2) for a total nominal amount of 16.4 billion euro.

2.7 The third stage of the crisis

The frightening period in Europe continued even in 2012. In particular, separatist movements in Greece together with the downgrade rating of nine European government bonds[31] and of sixteen Spanish banks credit rating by Standard & Poor's, casted additional shadows over financial markets. For these reasons, government bonds' yield peaked once again and started to include redenomination risk premia[32].

This circumstance prompted the ECB to intervene another time. Mario Draghi at the end of July announced "within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough". In September the European Central Bank announced to be ready to massively intervene in the secondary sovereign bond market, under a new program called Outright Monetary Transactions (OMT) which substituted the ending SMP. The measure targeted several and severe distortions in government bond markets, originated from unfounded fears about the reversibility of the euro, with the final aim of ensuring the proper transmission of monetary stimuli to the real economy.

Notably, the OMT program was ex-ante unlimited in time and scope. The main targets are short-term government bonds issued by European countries in financial distress. Moreover, the program is characterized by a high degree of transparency with periodic publication of transactions per countries concerned.

[31] Austria, Cyprus, France, Italy, Malta, Portugal, Slovakia, Slovenia and Spain.

[32] Investors asked an additional premium due to the risk that some Euro countries would have exited the Economic and Monetary Union (EMU).

According to Mario Draghi's declaration the program put in place by the ECB, was fundamental to contain market volatility in the euro area and, together with fiscal policies implemented by South Euro countries, to relevantly reduce sovereign bond yields. This "led to a dramatic improvement in monetary transmission policy".

However, at the beginning of 2013, the decreasing inflation (it dropped well below the 2% target generally all over Europe) along with the slow growth-phase, pushed ECB to put in place another precautionary non-standard measure, the **forward guidance**. Benoît Cœuré, a member of the executive board of the ECB, defined[33] forward guidance as an "explicit statement(s) by a central bank about the likely path of future policy rates. These statements are typically conditioned – more or less explicitly - on the evolution of certain key macroeconomic aggregates". In particular, the first time that ECB implemented forward guidance policy was through Mario Draghi's words in July 2013: "looking ahead, our monetary policy stance will remain accommodative for as long as necessary. The Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time".

The declaration aimed at stabilizing money market conditions as well as anchoring more firmly market expectations about the future ECB decisions[34]. Moreover, conditioning private expectations related to short-term interest rates and thus, in turn, influencing expectations about long-term interest rates too, may strengthen the transmission of monetary policies to the real economy.

The high level of transparency showed by the ECB has been undoubtfully beneficial in a so turbulent period characterized by exceptional uncertainty, such as the beginning of 2013.[35]

In fact, in such circumstances most of the economists agrees on the necessity to manage expectations on the future path of interest rates as ECB did. However, other economists criticized ECB recommending even stronger measures. For instance, Fisher and Justiniano (2013) suggested that the central bank has to explicitly commit in keeping at low levels key interest rates even if the recovery has taken momentum, thus even potentially overlooking its inflation objective for a period of time.

[33] *Source:* ECB speech, Benoît Cœuré, New York (2013).
[34] As emphasized in section 1, expectations play a pivotal role in monetary transmission channels.
[35] *Source:* Speech by Benoît Cœuré, "The usefulness of forward guidance".

To complete the scenario, ECB decided to apply the following interest rates as shown in the table 2.4 below.

TABLE 2.4: KEY INTEREST RATES IN 2011

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
2012	11 Jul.	0,00%	0,75%	-	1,50%
2013	8 May	0,00%	0,50%	-	1,00%
	13 Nov.	0,00%	0,25%	-	0,75%

2.8 Ultra-low inflation and Quantitative Easing

FIGURE 2.2: HICP VALUES THROUGHOUT 1996 TO 2014

Low inflation persisted, reflecting severe shortfall in the aggregate demand and raising additional concern about the credit supply conditions, that still remained tight in Europe especially for small and medium enterprises and in the countries under stress. In fact, inflation continued to diminish even at the end of 2013, dropping below 1% and reaching an historical trough, second only to the period immediately after Lehman default (see figure 2.2 above).

To face this decreasing inflation trend ECB announced in June 2014 a comprehensive package of expansionary monetary policies, including an additional cut in key interest rates (please, see the

related table 2.5 below). It is worth highlighting that deposit facility rates dropped below zero for the first time in the ECB history.

TABLE 2.5: KEY INTEREST RATES IN 2014

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
2014	11 Jun.	-0,10%	0,15%	-	0,40%
	10 Sep.	-0,20%	0,05%	-	0,30%

As Peter Praet, member of the Executive Board of the ECB, noted in its speech[36] at the Febelfin Connect event, the decision to decrease even below zero the interest rate on deposit facility has been revolutionary but in the meanwhile fundamental. In fact, "the negative interest rate on our deposit facility, which – in a context of excess reserves – has brought overnight rates down to negative levels, (…) have provided additional effective stimulus. The fact that policy rates can indeed turn negative has also contributed to flattening the short to medium end of the yield curve, thereby easing broader financing conditions by removing the upward bias to yields that comes from the perception that rates can only go up, not down."

ECB, together with the cut just mentioned in key interest rates, adopted other relevant non-standard monetary policies. Most importantly, it announced the Targeted Longer-Term Refinancing Operations, or TLTROs[37], in order to offer over a sizeable period of time additional funding for financial institutions in exchange of new credit to non-financial corporations (the amount that banks can borrow in these operations is proportional to their loans to non-financial corporations and households).

A relevant difference between TLTROs and LTROs is that the formers have fixed rather than flexible rates (ten basis point over the MRO rate at the time in which the operation is stipulated). Thus, the clear advantage is to have at a fixed and at a very low cost (please, see the related table 2.5 above) funds for a prolonged period of time, independently from the MRO rate decided in the following years[38].

[36] *Source:* ECB Speech by Peter Praet at Febelfin Connect event, 16 March 2017.

[37] Targeted Longer-Term Refinancing Operations (TLTROs) are Euro system long term operations to provide funds to financial institutions up to four years. The target is to ease private sector credit conditions offering long term source of funds at attractive rates for credit institutions.

[38] LTROs rates are variable and thus linked to the MRO rate over the period of the program.

According to Vítor Constâncio, Vice-President of the ECB, in its speech in Frankfurt [39] "the announcement of the program (i.e. TLTROs) has produced a beneficial effect by flattening interest rates along the term structure", reducing in this way (other things being equal) even long-term real interest rates and thus reinforcing the transmission of monetary policies stances.
However, about a month after the announcement of TLTROs the situation worsened further: GDP measures indicated a stagnation of the economic activity while the inflation dropped down to 0,4%, as well as expectations over inflation for the following five years. This situation obliged ECB to strengthen the monetary policy package implemented in June with other exceptional decisions together with an additional cut of ten basis point in key interest rates (see, the related table 2.5 above).

ECB decided to implement two additional asset purchase programs: a third version of the covered bond purchase program (CBPP3) and the asset backed securities purchase program (ABSPP).
It is worth highlighting the importance of the asset-backed securities for the banking system. In fact, ABSs help banks in extending credit to the real economy providing the necessary funds for new lending through securitization of loans and their consequent sale.
The eligible assets suitable for the two purchase programs have to respect minimum required fixed by the ECB, that for instance reduced the total amount of acceptable covered bonds from the total size of 1.2 trillion euro[40] to about 600 billion euro. Moreover, Greek and Cypriot securities are not excluded a priori from the eligible list, provided that these countries remain under European programs.
The two programs were expected to impact different monetary transmission channels.
First, expectations "which we reckon will respond to our determined policy of using our balance sheet in a more direct way" (Vítor Constâncio, 2014).
Second, through the value of financial assets. In fact, liquidity injected within the market thanks to the just mentioned programs, may have spillover effects on all type of assets, from corporate bonds to exchange rates.

Interestingly enough, the market positively responded to ECB meetings both in June and in September. In fact, as the figure 2.3 below shows, forward yield curve in all the euro area related to

[39] *Source:* ECB Speech by Vítor Constâncio, 6 October 2014.
[40] The segment size measure is referred to June 2014.

sovereign bonds declined. Once again, it is worth remembering the tight connection between government cost of external funds (and rating) and the cost of external funds for the banking system. Substantial downwards effects have to be noted even for long-term corporate bonds yield. These circumstances may overall positively stimulate the aggregate demand (thanks to the general decrease in the interest rate environment, consistently with the interest rate channel and the balance sheet channel) thus pushing inflation closer to the ECB's target.

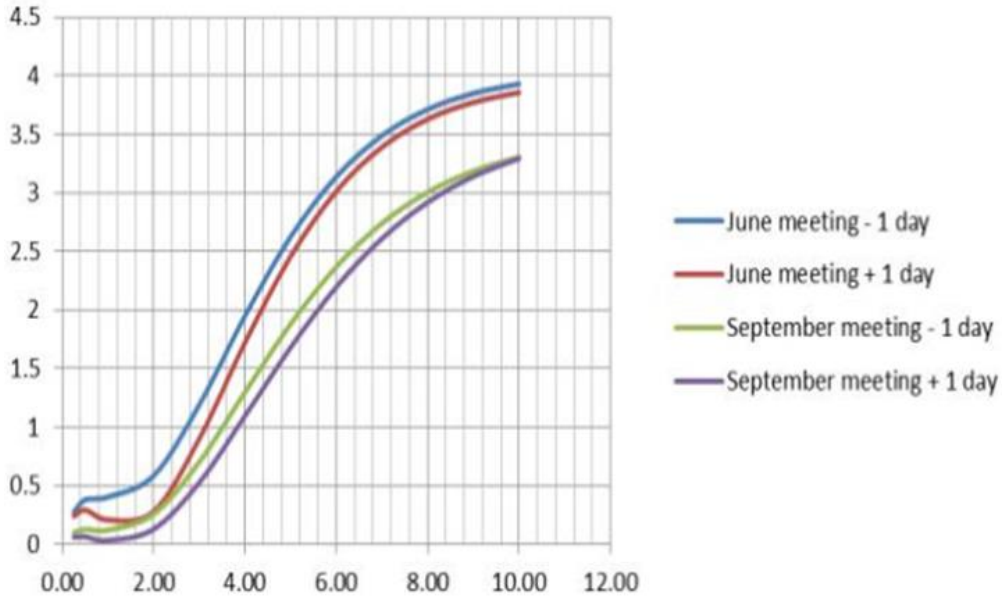

FIGURE 2.3: FORWARD YIELD CURVE OF ALL EURO AREA SOVEREIGN BONDS (3 MONTH – 10 YEARS)[41]

It is worth noting that the impact is stronger over the four-year time horizon of the TLTROs program. This implies that the market discounts a strong predicted effect of these new monetary policy stances (especially true for yields of the countries under financial distress).

[41] *Source:* Speech by Vítor Constâncio, Frankfurt am Main, 6 October 2014, ECB section.

2.8.1 Quantitative Easing

FIGURE 2.4: HICP VALUES THROUGHOUT 1996 TO 2016

The deflation trend alarm started at the beginning of 2013, even worsened in the 2014-2016 period (please, see the related figure 2.4 above).

To face deflationary pressures, in January 2015 the ECB strengthened once again the monetary policy package first implemented in June 2014.

Thus, the ECB decided to extend the CBPP3 and ABSPP programs, purchasing also euro-denominated securities (under the program referred as PSPP)[42] that meet pre-established criteria; ECB launched the so-called extended Asset Purchase Program (APP) known also as Quantitative Easing (QE). Moreover, it declared to be willing to invest a total combined[43] amount of 60 billion euro each month from March 2015 until at least September 2016, and in any case until the Governing Council would judge the adjustment in the path of inflation as sustainable and consistent with the ECB target. The purchase of assets has to be conducted according to the equity stake of each country in the ECB's own capital, as referred in the figure 2.5 shown below.

[42] The securities eligible in the PSPP program includes, nominal and inflation-linked central government bonds and bonds issued by recognized agencies, regional or local governments, international organizations and multilateral development banks located in the Euro-area.

[43] Under all the programs undertaken.

	Equity shares	Bond purchase (billion €)
Nationale Bank van België	3,5	35
Deutsche Bundesbank	27,1	271
Central Bank of Ireland	1,6	16
Bank of Greece	2,8	28
Banco de España	11,9	119
Banque de France	20,3	203
Banca d'Italia	17,9	179
De Nederlandsche Bank	5,7	57
Oesterreichische Nationalbank	2,8	28
Banco de Portugal	2,5	25
Suomen Pannki - Finlands Bank	1,8	18
Others	2,3	23
Total	100	1000

FIGURE 2.5: NATIONAL CENTRAL BANKS' PARTICIPATIONS WITHIN ECB'S EQUITY STAKE

Furthermore, the continued use by the ECB side of its forward guidance policy contributed to anchor expectations even in an unprecedent economic and financial environment (i.e. "the program will be conducted (…) until we see a sustained adjustment in the path of inflation").

The announcement, together with the details of the purchase program implemented, immediately and deeply affect the economy sending the euro to a 11-year low level against the US Dollar[44], pushing shares prices up and bond yields down, particularly those of the countries under financial stress (including Italy, Spain and Portugal).

However, disappointing results coming from inflation path obliged ECB to progressively modify APP in the duration and the amount invested. On the 3rd of December 2015, ECB lengthened the expected duration of the program, extending it, at least, to March 2017.

On the 10th of March 2016, the Governing Council decided to increase the amount invested to 80 billion euro each month and to implement a new corporate securities purchase program (CSPP), starting from April 2016. On the 8th of December 2016, the Governing Council decided to extend the program duration by other nine months until December 2017 at least, but reducing the total amount invested each month to 60 billion euro.

[44] In the afternoon of 22 January 2015 euro was down at 1.1367$.

The graph below details the monthly net purchases undertaken by the ECB from the beginning of the APP until recent days, summarizing all the changes just mentioned and providing an interesting cross section per program too.

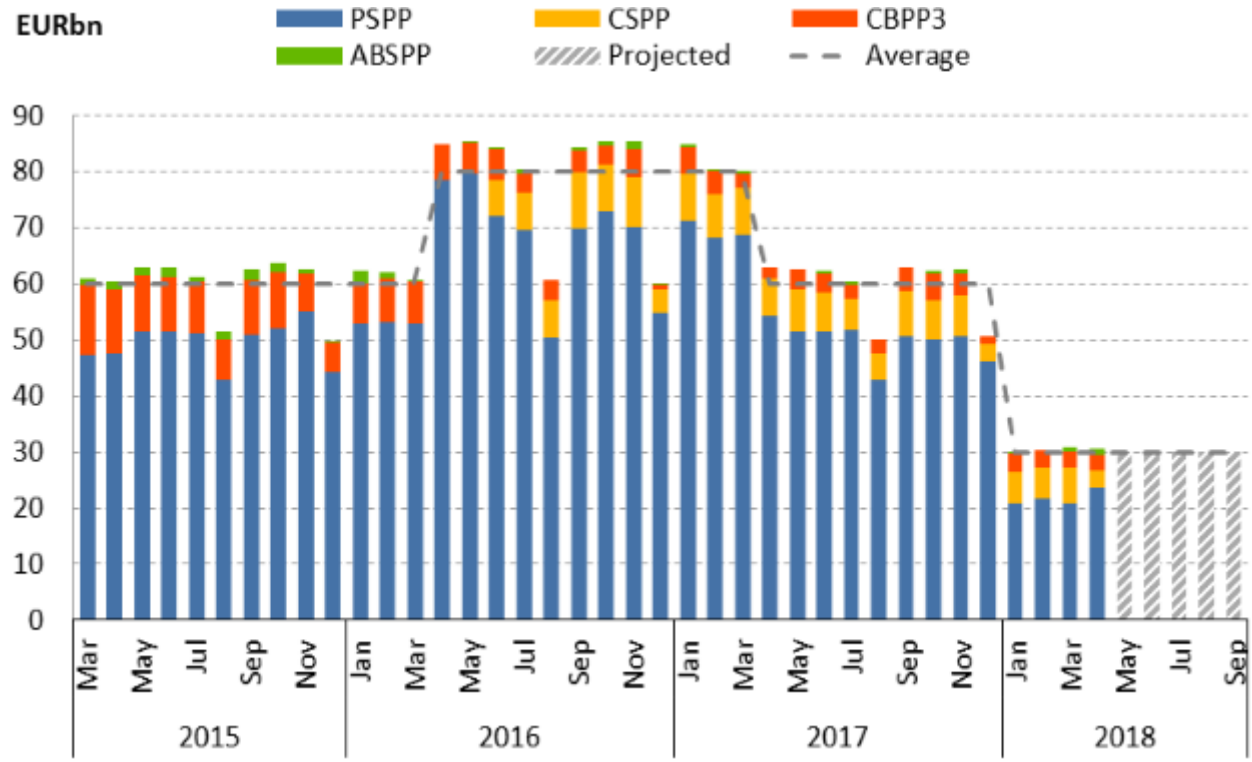

FIGURE 2.6: APP MONTHLY NET PURCHASES, BY PROGRAM[45]

In parallel with decisions related to the APP program, ECB implemented other relevant expansionary policies. First, ECB kept cutting key interest rates as the table 2.6 below shows, reaching the zero-lower bound even for Main Refinancing Operations (MRO).

These decisions were strengthened once again through the usage of the forward guidance policy. The ECB statement issued after policy meeting in March 2016 declaimed: "looking ahead, taking into account the current outlook for price stability, the Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time, and well past the horizon of our net asset purchases."

[45] Source: Articles from European Central Bank, "Asset purchase programmes".

TABLE 2.6: KEY INTEREST RATES FROM 2015 TO 2016

Date		Deposit Facility	Main Refinancing Operations		Marginal Lending Facility
			Fixed Rate Tenders	Variable Rate Tenders (Minimum Bid Rate)	
2015	9 Dec.	-0,30%	0,05%	-	0,30%
2016	16 Mar.	-0,40%	0,00%	-	0,25%

Moreover, a second series of four TLTROs were announced in March 2016 starting from June 2016, with a maturity of 4 years.

The following table summarizes the most important non-conventional monetary policies put in place by the European Central Bank since 2008.

Date	Non-standard Monetary Policy	Brief description
2007	Fine-tuning operations	Non-standard operations executed with the aim of smoothing interest rates fluctuations caused by liquidity shortages
	Longer LTROs	LTROs maximum maturity extended from 3 months to 6 months.
	Currency swap agreement	Supply of foreign currency, most importantly US dollars.
10/2008	Fixed-rate full allotment	Unlimited access to Central Bank liquidity at a fixed pre-established interest rate.
	Extension of collateral suitable	Widening of financial instruments accepted as collateral against liquidity operations.
	Longer LTROs	LTROs maximum maturity extended from 6 to 12 months.
	Currency swap agreement	Supply of foreign currency, most importantly US dollars.
	Covered Bond Purchase Program (CBPP)	Purchase of covered bonds for a total amount of €60 billion in one year.
05/2010	Securities Market Program (SMP)	Purchase of public and private debt securities.
2011	Two longer LTROs	Two LTROs of three years maturity with the option given to the counterparty to settle the transaction at any time after the completion of the first year.
	Reduction in reserve requirements	Reduction in the minimum reserve ratio from 2% to 1%.

Date	Non-standard Monetary Policy	Brief description
2011	Extension of collateral suitable	Widening of financial instruments accepted as collateral against liquidity operations.
	Covered Bond Purchase Program (CBPP2)	Additional purchase of covered bonds for a total nominal amount of about €17 billion in one year.
07/2012	Outright Monetary Transactions (OMT)	Extended purchasing program with an unlimited ex-ante focus on time and scope. The main targets are short-term government bonds of countries in financial distress.
From 07/2013	Forward Guidance	It consists in explicit statements made by the Central Bank about the likely path of future policy rates, with the aim of driving economic agents' expectations.
06/2014	Targeted Longer-Term Refinancing Operations (TLTROs)	Non-standard long-term operations to provide funds to financial institutions up to four years, with the final aim of strengthening the credit conditions offered to private sectors.
07/2014	Asset Backed Securities Purchase Program (ABSPP)	Purchase program of Asset-Backed Securities.
	Covered Bond Purchase Program (CBPP3)	Additional purchase program related to covered bonds.
03/2015	Private Securities Purchase Program (PSPP)	Purchase of nominal and inflation-linked government bonds as well as bonds issued by other recognized agencies, regional and local governments and international organizations.
From 2015	extended Asset Purchase Program (APP)	Extended asset purchase program that aims at stimulating the economy further, in a zero-interest rate environment. Mainly related to private securities but also extended to covered bonds, ABS and Corporate sector bonds.
03/2016	Corporate Sector Purchase Program (CSPP)	Purchase program of Corporate Sector bonds.
	Zero-interest rate for Main Refinancing Operations (MROs)	Zero lower bound on Main Refinancing Operations.
	Two Targeted Longer-Term Refinancing Operations (TLTROs)	Non-standard long-term operations to provide funds to financial institutions up to four years, with the final aim of strengthening the credit conditions offered to private sectors.

All these non-standard monetary policies, put in place since Lehman default, have deeply affected ECB's balance sheet. It may be interesting to see the picture 2.7 below to understand how the size of the European Central Bank's balance sheet evolved in the last ten years.

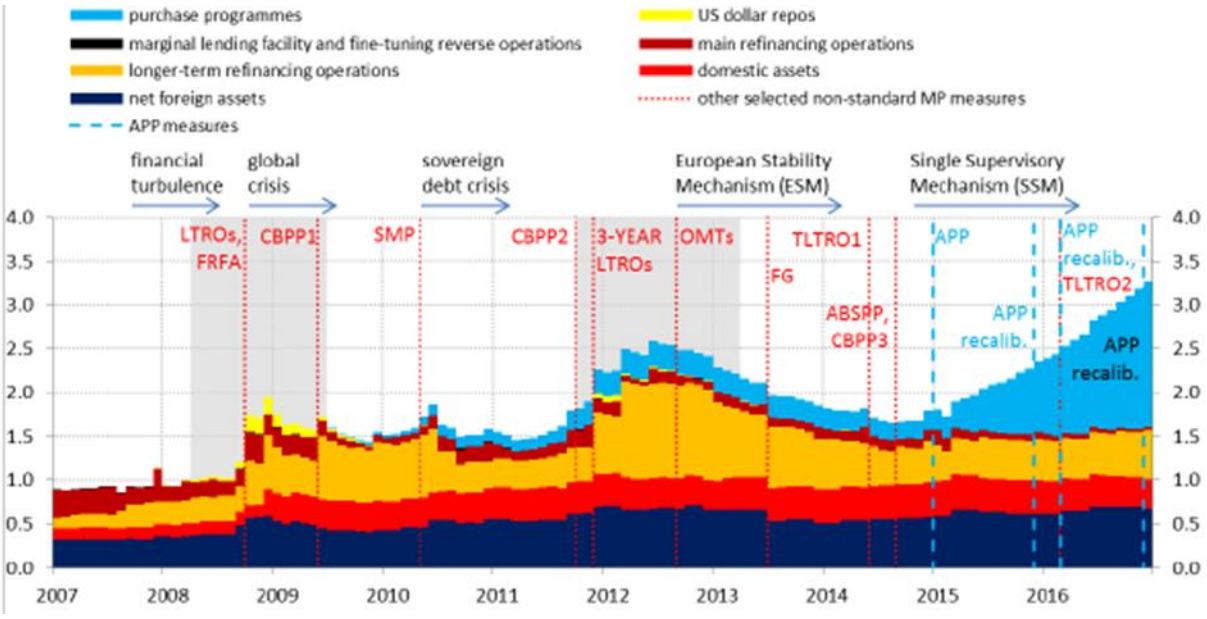

FIGURE 2.7: SIMPLIFIED EURO SYSTEM BALANCE SHEET ASSET COMPOSITION, FROM 2007 TO 2016 (IN € BLN)[46]

While several of the liquidity providing operations implemented at the very beginning of the financial crisis may be defined as passive central bank balance sheet policies, the following programs amended (i.e. extended asset purchase programs, credit easing etc.) saw the ECB acting a more active part in defining the size and the composition of its asset side balance sheet. In this framework the numerous purchase programs implemented by the ECB, ranging from the CBPP1 started in July 2009 to the CSPP in March 2016, represent a core component of the Euro-system active balance sheet policies having increased their relevance since 2010 until becoming central from 2015 onwards.

It is worth noting that the progressive shift towards riskier assets in the financial instruments accepted in the APP impacted also the composition of the ECB's balance sheet. This phenomenon is referred as qualitative easing.

[46] *Source:* Luca Gambetti and Alberto Musso (2017), "The macroeconomic impact of the ECB's expanded asset purchase programme (APP)".

As the Professor Willem Buiter explained "qualitative easing is a shift in the composition of the assets of the central bank towards less liquid and riskier assets (…)". Qualitative easing may be used by a Central Bank to stabilize a dismal financial system, by buying its troubled assets and injecting higher quality financial instruments.

The impact on the size of the central bank balance sheet is not only relevant per se, but is also fundamental in understanding changes in the monetary base.
In fact, Monetary Base (MB) may be defined as:

$$MB = Banknotes\ in\ circulation + Reserves\ of\ the\ Banking\ System$$

Please, note that *Banknotes in* circulation are referred only to be held by non-bank public.
Thus, given a simplified version of the central bank balance sheet as showed below:

ASSETS	LIABILITIES
Foreign exchange reserves	Banknotes in circulation
Securities	Deposit from Governments
Loans to MFI[47]	Deposit form commercial banks (Reserves)

And given that the asset side has always to equal the liability side; the huge increase (it almost tripled) in the ECB's asset side detailed in the previous figure 2.7 in the last ten years, has to be transmitted even to the liabilities side, thus to the monetary base, and eventually to the others monetary aggregates in the attempt to stimulate the interest rate channel.

[47] Monetary Financial Institutions (MFI) are resident credit institutions as defined in European Union law and other resident financial institutions whose business is to receive deposits (or close substitutes) to grant credit and/or to invest in securities to entities other than MFIs.

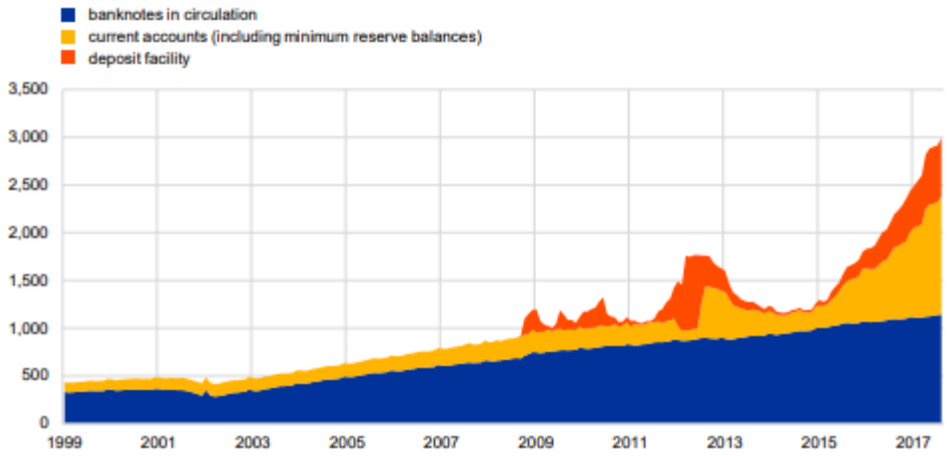

FIGURE 2.8: MEASURE OF THE MONETARY BASE (IN € BILLIONS) FROM 1999 TO 2017[48]

The figure 2.8 above gives a measure of the monetary base expressed in billion euro from 1999 in the Euro area.

One of the most prominent active program amended by the ECB has been the quantitative easing. This has largely impacted the ECB's balance sheet, playing a key role in turning its balance sheet into what is displayed in picture 2.7.
The program has had several effects even on other (than interest rate channel) monetary transmission mechanisms.

First, the general reduction of yields (followed by the large purchases operated by the ECB) may reduce the cost of external financing for both banks and non-financial corporations and together with the increase in deposits funding, may raise the supply of bank lending[49] which become a more attractive option for credit institutions rather than investing in securities.
It is worth remembering that the reduction in the cost of capital (due to the decrease of the external financing costs even for non-financial corporations), is another key determinant for the interest rate channel to properly function.

[48] *Source:* ECB. The latest observation is for August 2017.
[49] Consistently with the bank lending channel too.

Second, the exchange rate channel acts consistently. In fact, the general reduction in the interest rate environment after the ECB intervention, may lead to a depreciation of the exchange rate, with consequent effects in the net exports, import prices and/or repatriation of funds by non-residents.

Third, the expectations channel may be relevant as well. Indeed, the stance and the amount invested, furtherly strengthened by the forward guidance adopted, testifies the commitment by the ECB to definitely and ultimately act to reach its inflation target. This in turn may generate downward revisions in market expectations of future policy rates.

Finally, the balance sheet channel is also likely to be relevant and to operate through the increase in the asset prices induced by the asset purchases.

2.9 Recent measures and Tapering

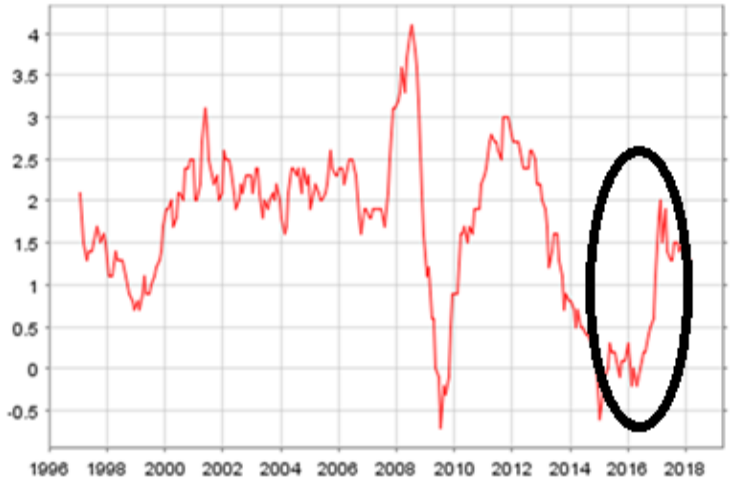

FIGURE 2.9: HICP VALUES THROUGHOUT 1996 TO 2018

Throughout the end of 2016 and 2017, ECB confirmed several times interest rates at the level showed in table 2.6 in order not to brake the inflationary momentum in the euro area (please, see figure 2.9 above). Reassuring data about private consumption, sustained by rising employment, and the amount of business investments undertaken[50], signal economic momentum in the Euro-area.

[50] *Source*: ECB economic bulletin, issued 7/2017.

However, “economic growth prospects continue to be dampened by a sluggish pace of implementation of structural reforms, in particular in product markets, and by remaining balance sheet adjustment needs in a number of sectors, notwithstanding ongoing improvements”[51].
Overall, the growing confidence in the gradual convergence of inflation towards the ECB’s target prompted adjustments in some of the unconventional policies adopted by the European Central Bank. In particular, on the 26th of October 2017 the Governing Council decided to reduce the monthly net investments to 30 billion euro in the APP, from January 2018 until the end of September 2018, or beyond if necessary.

This decision has fueled discussions about the exit phase of the quantitative easing program in Europe.
In US, Federal Reserve adopted a steady decreasing purchase phase (known as tapering[52]) as exit from its quantitative easing, which saw several reductions in the monthly net purchase from mid-2013 and throughout all the 2014 to definitely stop in October 2014.
As far as Europe is concerned, the Governing Council largely agreed on tapering as the tactic to be used for the exit phase[53] even though policy makers have not had a proper discussion about the topic yet, as Mario Draghi underlined. Moreover, it is worth highlighting that the ECB is continuing its forward guidance policy reiterating that “the net asset purchases are intended to continue (…) until the end of September 2018, or beyond, if necessary, and in any case until the Governing Council sees a sustained adjustment in the path of inflation consistent with its inflation aim.” Furthermore, clarifying that “if the outlook becomes less favorable, or if financial conditions become inconsistent with further progress towards a sustained adjustment in the path of inflation, the Governing Council stands ready to increase the APP in terms of size and/or duration.”
Despite these statements, analysts believe that the ECB will drastically diminish its net monthly investments at the end of 2018 to definitely stop the quantitative easing program in 2019[54].

[51] ECB Press Conference, speech by Mario Draghi and Vítor Constâncio, Tallinn 8 June 2017.
[52] Tapering is referred as a slowdown in the net monthly investments in financial instruments by a Central Bank. Ben Bernanke introduced for the first time the world Tapering in June 2013.
[53] *Source:* Bloomberg article, “ECB Officials Assume QE Will End in Short Taper”.
[54] Jean-Michel Six, chief economist at S&P in the annual press conference of S&P.
See also: “S&P: la Bce non alzerà i tassi prima di fine 2019, tapering al via in ottobre” from Il *Sole 24 Ore.*

A confirmation of what financial analysts predicted at the beginning of 2018 arrives on 14th June 2018. In fact, Mario Draghi confirmed how ECB had decided to diminish its monthly purchasing program to 15 billion euro per month from October to December, to definitely end in 2019 (provided that future data on inflation confirms to be close to 2%). Indeed, expectations about long-term inflation together with the increasing economy strength (supported by a moderate increase in wages), have led tail risks related to inflation to disappear[55]. Market reacted to the announcement sending euro below 1,17 dollars. Moreover, BTP-BUND 10 years spread peaked to 250 basis point (from 236 of the previous day).

Mario Draghi, in the ECB's press conference held in Frankfurt on 25th October, confirmed that net purchases under the quantitative easing program will stop at the end of December 2018. Moreover, he added that the principal payments from maturing securities bought under the APP program will be reinvested for an extended period of time, even after the end of the net asset purchases. In any case, key interest rates are expected to remain stable until at least the summer of 2019.

[55] *Source*: SOLE 24 ORE: "Bce: il QE si dimezza a 15 miliardi da ottobre e termina a dicembre. Tassi fermi per almeno un anno".

The impact of the recent monetary policy actions on the banking sector

After having detailed the key decisions made by the European Central Bank throughout its mandate together with the theoretical framework which they lay on, it is now proper to analyze impacts, results and counter moves that economic agents (the focus proposed is on banks) made as a consequence of conventional and unconventional monetary policies.

3.1 Impact of unconventional monetary policies

3.1.1 Bank business model in a low interest rate environment

A common and generalized monetary policy stance can have a different impact on the banking environment. The banking universe, in fact, is widely heterogenous, with completely different banks in terms of size, diversification (both geographical and financial), funding choices, organizational issues and activities.

The banking system has deeply changed in the last ten years, from the financial crisis on. A change driven by modifications in the regulatory and supervisory landscape, necessary to spot and correct weaknesses that eventually contributed to the beginning of the financial crisis, and by a never-seen macroeconomic environment (and consequently by the ECB unconventional monetary policies).

As far as regulation is concerned, a significant achievement may be highlighted: since 2012, Common Equity Tier 1 (CET1)[56] ratio of significant European institutions has improved on average from a 9% to almost 13%[57]. This has led to a higher resilience of the banking system.
On one hand, on average and other things being equal, this has decreased the profitability of the banking system (higher equity requirements given a certain amount of RWAs). On the other hand, on average, banks have become more capitalised. Well-capitalised banks are beneficial to the economy since they are able to finance real activities throughout the whole business cycle without abruptly stop lending in bad times.

[56] It is one of the most significant ratios (calculated over Risk Weighted Assets) that the banking environment uses to assess financial solidity of a financial institution.
[57] ECB Press Conference, speech by Daniele Nouy, Chair of the ECB's Supervisory Board: "Adjusting to new realities banking regulation and supervision in Europe." Frankfurt, 6 April 2016.

Moreover, another source of regulatory change may be identified. In 2014, banking supervision was brought from a national level to a European level. In fact, now ECB directly oversees the 129 largest European banking groups (they account for more than 80% of the total banking assets)[58].

This was one of the biggest steps in the European financial integration from the introduction of the Euro, leading to three main advantages. First, an ECB pivotal in the banking supervision assures that financial institutions are benchmarked according to a common, shared and high-level term of comparison. Second, European banking supervision benefits from the knowledge and expertise of 19 national supervisors and the ECB itself, enabling it to draw on the most cutting-edge experts available. Third, European banking supervision is free from preserving own national interests that may affect the decisional framework, with consequent suboptimal choices.

Another important step was undertaken in 2015, when Supervisory Review and Evaluation Process (SREP)[59] was standardised according to common European guidelines.

These changes of the regulatory landscape are framed by an extraordinary macroeconomic environment that unconventional monetary policies have contributed to create.

It is sufficient to look at the figure 3.1. The picture describes how yield curves have progressively shifted downward as time went by (from the financial crisis until the end of 2015).

The yield curves are extracted by daily market price data of AAA-rated sovereign bonds issued in the Euro area.

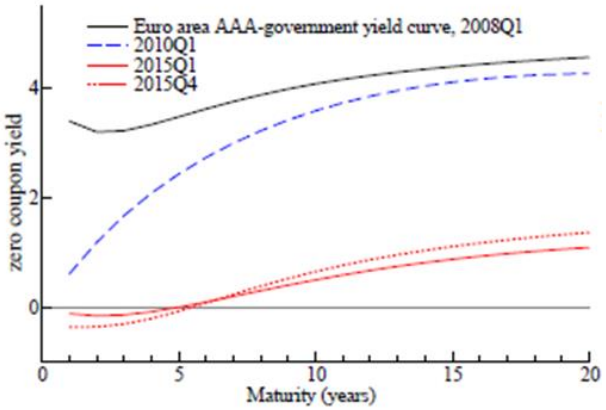

FIGURE 3.1: YIELD CURVES OF AAA-RATED GOVERNMENT BONDS IN THE EURO-AREA

[58] This data is referred to the end of 2016.

[59] SREP is considered as the most important instrument of banking supervision. It covers different range of analysis, from business model analysis, internal governance and controls to assessments of the adequacy of capital with respect to risks undertaken.

As said, yield curves surely reflect unconventional monetary policies carried on by the European Central Bank (in particular, the extended asset purchase program and the level of official rates set by the ECB, shown in tables 2.5 and 2.6).

However, changes in longer-term structural factors within the economy have played a pivotal part too. The long-term underlying factors at play are[60]:

- A generalized decrease in nominal bonds yields in all major economies since the 1980s, due to the much lower inflation expected by economic agents in the following periods. This testifies how central banks have managed to decrease inflation and inflation expectations within the economic system. Together with lower inflation expected, risk premium requested by investors diminished too.
- Demographic elements with rising net savings (and thus, lower consumption) as ageing populations plan for retirement.
- Less public expenditures made by governments, driven by the need to rebalance their budgets and reduce the relevant size of public debts that characterizes many developed economies (especially after the financial crisis).
- Imbalance between global saving and investments. This creates a pressure on the offer-side, as savers compete with each other to find someone willing to borrow their money, with a consequent decrease in interest rates.

A study conducted by Rachel, L. and T. Smith (2015) estimated how these factors have contributed to decrease long-term real interest rates of almost 400-450 basis point.

[60] ECB Press Conference, speech by Mario Draghi, President of the ECB: "Addressing the causes of low interest rates" Frankfurt, 2 May 2016.

3.1.2 Traditional bank business models

Traditionally, lending institutions maximize profit from the customer spread (i.e. the difference in the lending rate imposed to borrowers and the deposit rate guaranteed to savers). However, in reality, the sources of banks' profits are much more differentiated including also fees and commissions and trading activities. Moreover, universal banks are involved in several other activities such as securitization, hedging mainly through derivatives and asset management. Banking counterparties vary widely too, involving, large non-financial corporations, other banks, central banks, private citizens, SMEs etc. A banking simplified balance sheet is proposed below.

ASSETS	LIABILITIES
Cash and cash balances	Deposits
Financial assets held for trading	Debts owed to banks
Financial assets at fair value through profit and loss	Debt sicurities in issue
Available-for-sale financial assets	Financial liabilities held for trading
Held-to-maturity investments	Hedging derivatives
Loans and receivables with banks	Provisions for risks and charges
Loans and receivables with customers	Tax liabilities
Equity investments	Pensions
Tangible assets	Equity capital

FIGURE 3.2: BANKING BALANCE SHEET

First, it is interesting to see the relative importance of the different balance sheet aggregates and how they have varied from the financial crisis on. All the data below are taken from the statistical data warehouse of the European Central Bank, considering the banking aggregate of all the countries within the Euro area. When specified, the bank dimension is defined according to the following rule:

- Large: greater than 0,5%.
- Medium: between 0.5% and 0.005%.
- Small: less than 0.005%.

The first consideration is related to the amount of liquid cash and reserves held at the European Central Bank by financial institutions.

As the graph below shows, the total amount of cash has dramatically increased in the last ten years, from the financial crisis on.

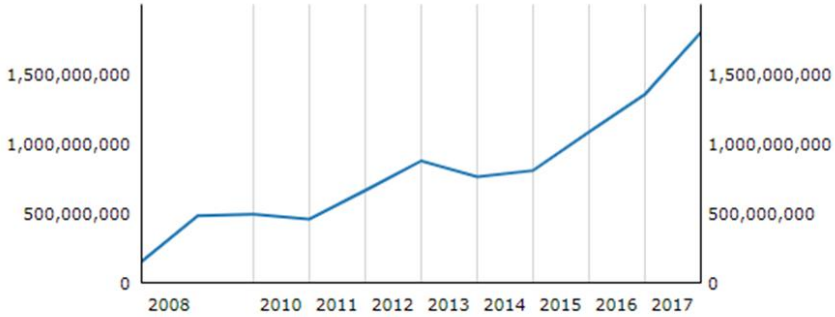

FIGURE 3.3: CASH RESERVES HELD AT THE ECB

The explanation is twofold. The high level of risk perceived by banks and the high-risk aversion displayed by financial institutions in the period ranging from 2008 to 2012 explain the first surge in total cash. In fact, banks increased the amount of liquid cash held in their balance sheet, to cope with risks such as an increase in the rate of withdrawals or even possible bank-runs, and potential further problems in the interbank market.
In this period the highest concentration of excess liquidity was found in the safest country, such as Germany, Luxembourg and Netherlands[61] consistently with the "flight-to-quality" phenomenon.

Subsequently, risk-aversion has generally played a less relevant role in liquidity banks' decisions, even though financial institutions still need to comply with strict internal risk limits and new regulations. Therefore, it is possible to state that the second sizeable increase, from 2015 to 2017, is largely supply-driven (i.e. the Euro system asset purchases) rather than demand-driven. Moreover, demand by financial institutions of central bank liquidity through refinancing operations has played a pivotal role too. In fact, the ECB has maintained its full allotment procedures and promulgated unconventional policies at attractive rates (such as the series of TLTROs).

However, if banks keep liquidity within their portfolios, without lending out money to households and corporations, the policy stances decided by the ECB may not be properly transmitted to the real

[61] *Source:* Luca Baldo, Benoît Hallinger, Caspar Helmus, Niko Herrala, Débora Martins, Felix Mohing, Filippos Petroulakis, Marc Resinek, Olivier Vergote, Benoît Usciati, Yizhou Wang, "The distribution of excess liquidity in the euro area", November 2017.

economy, and the monetary transmission channels may be impaired. This raises a serious issue. Therefore, to further stimulate the economy and push banks to actively manage their funds (i.e. extending new credit to the real economy), the ECB decided to fix a negative deposit marginal lending rate.

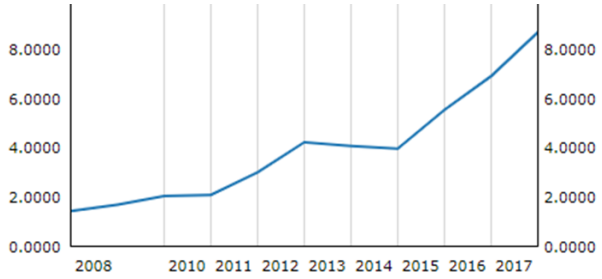

FIGURE 3.4: CASH AS PERCENTAGE OF TOTAL ASSETS, CAPITALIZED BANKS

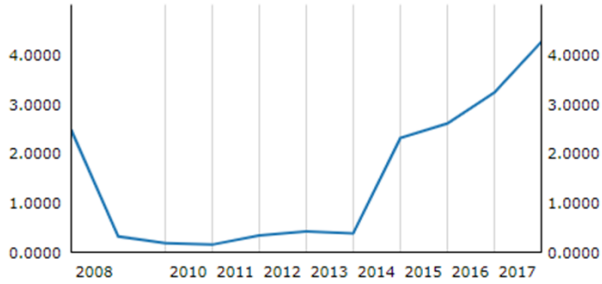

FIGURE 3.5: CASH AS A PERCENTAGE OF TOTAL ASSETS, HIGHLY LEVERED BANKS

When comparing the ratios of cash to total assets between financial institutions with solid capital ratios, above, and banks highly levered, below, another interesting topic arises. In fact, from the pictures 3.4 and 3.5. it is clearly visible how the banking capital channel operates: during distressed periods, banks with low net worth struggle to find and maintain a proper level of cash in their balance sheets.

Loans extended are another fundamental banking category. They account for nearly 60% of total assets and they play a pivotal role in the profitability of banks. In fact, net interest margin across Europe represents around 55% of the total income[62].

Anyway, relevant variations in this data are shown on a European level, mainly accountable to the different business models chosen. Generally, commercial banks show a higher relevance of net

[62] The provisional value reported by the European Central Bank for 2017 is 57.3708%.

income in theirs profit and loss than what investment banks do (their business models are mainly related to fees and commissions).

To make profit, banks exploit the commonly displayed positive slope of the yield curve. In fact, they borrow funds on a short-term basis and lend on a long-term basis (i.e. the average duration of assets is greater than the average duration of liabilities). In other words, they are involved in a practice known as *transformation of maturities*.

Therefore, a yield curve that approaches the zero level of interest rates for prolonged periods, as the one showed in the picture 3.1, may raise serious issues for financial institutions.

Mario Draghi emphasized this concept in his speech held in Frankfurt in May 2016: "Very low rates are not innocuous. They put pressure on the business model of financial institutions – banks, pension funds and insurance companies – by squeezing interest income".

Among the other assets, securities represent the most important. They account nearly for 15-20% of the total balance sheet size, with most of the securities held as government bonds (around 2/3 of securities) and just 10% in equity instruments.

On the liability side, deposits are by far the most important elements (60% of the total balance sheet size). Securities issued constitute the 15% of total liabilities, while own capital represents on average, nearly the 6%. The two graphs below report the total amount of equity as percentage of the total balance sheet size, and the total amount of CET1, as percentage of the Risk Weighted Assets (RWAs).

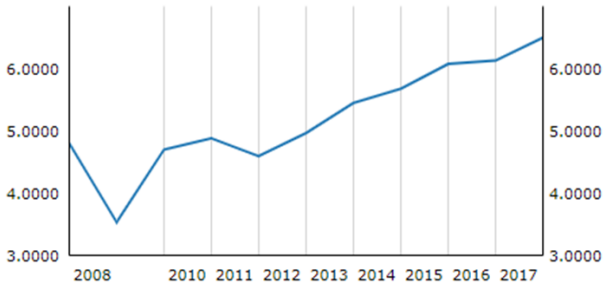

FIGURE 3.6: EQUITY AS PERCENTAGE OF THE TOTAL ASSET SIZE

FIGURE 3.7: CET1 AS PERCENTAGE OF RWAS

The two graphs confirm that the general trend within the banking environment is to reduce leverage and consequently raise the importance of own capital as a source of funds.
This choice, as already emphasized, is deeply conditioned by the new capital requirements imposed to financial institutions. Highly capitalized banks are by definition more stable and less risky, and therefore, they are expected to be beneficial for the general economic environment along the whole business cycle.

3.1.3 Literature review

Given the wide range of diversities within financial institutions, categorizing them under few groups represents a tough challenge. However, it is necessary to identify common characteristics and according to these, gather financial institutions, to have a comprehensive view of the overall banking sector.

A broad literature on banks' business model categories is available.
Some studies focus on different balance sheet ratios as proxies of strategic management choices to define banking categories. An example of this category is provided by Rungporn Roengpitya and Kostas Tsatsaronis (2014). In this paper they choose eight drivers (i.e. gross loans, trade, trading book, interbank lending, interbank borrowing, wholesale debt, stable funding and deposits all related to total asset size) to end up identifying three main banking business models:

- *Retail-funded banks* are characterized by a high share of loans on their balance sheets together with a deep reliance on stable funding sources and customer deposits (nearly two thirds of the overall balance sheet size).

- *Wholesale-funded banks* are characterized by a high share of loans as well, but different funding choices. In fact, they rely more deeply on interbank and wholesale debts on the liabilities side.
- *Trading banks* are more capital markets-oriented. In fact, they hold a sizeable part of their assets (sometimes, even more than 40%) in the form of tradable securities. Gross loans account just for 25,5% of the total balance sheet size for this category.

In general, researches owning to this category (see, also Ayadi and de Groen (2014)) deeply base their analyses on expert judgements, with the risk of being highly influenced by prior researches. In particular, the ratio choices to cluster data, and the clustering partition itself, present a high degree of arbitrariness[63].

A different approach is followed by Matteo Farnè and Angelos Vouldis (2017). They exploit data-driven techniques, such as big data analysis, to "let the data speak". In other words, they do not start from the ratios to classify data, but they start from the data to find statistically significant variables to identify clusters.

They label the four clusters identified, as follows:

- *Securities holding banks* are usually small in size. They have large portfolios of securities and strong cash buffers.
- *Traditional commercial banks* are medium sized financial institutions. As the name implies, they are mainly involved in credit financing, funding themselves primarily via costumer deposits.
- *Wholesale funded banks* are generally the largest banks with the asset side mainly composed by loans. Their most important source of funds are deposits, even though the relative importance of deposits as source of financing is lower than in the other clusters (they rely much more on banking debt). These banks are characterized by extensive usage of derivatives, both for hedging and speculative purposes.
- *Complex commercial banks* are medium-sized. They can be seen as a hybrid between the second and third cluster. In fact, they do not only exhibit a significant involvement in loan business but also sizeable portfolios of securities.

[63] *Source:* Matteo Farnè and Angelos Vouldis, "Business models of the banks in the euro area", (2017).

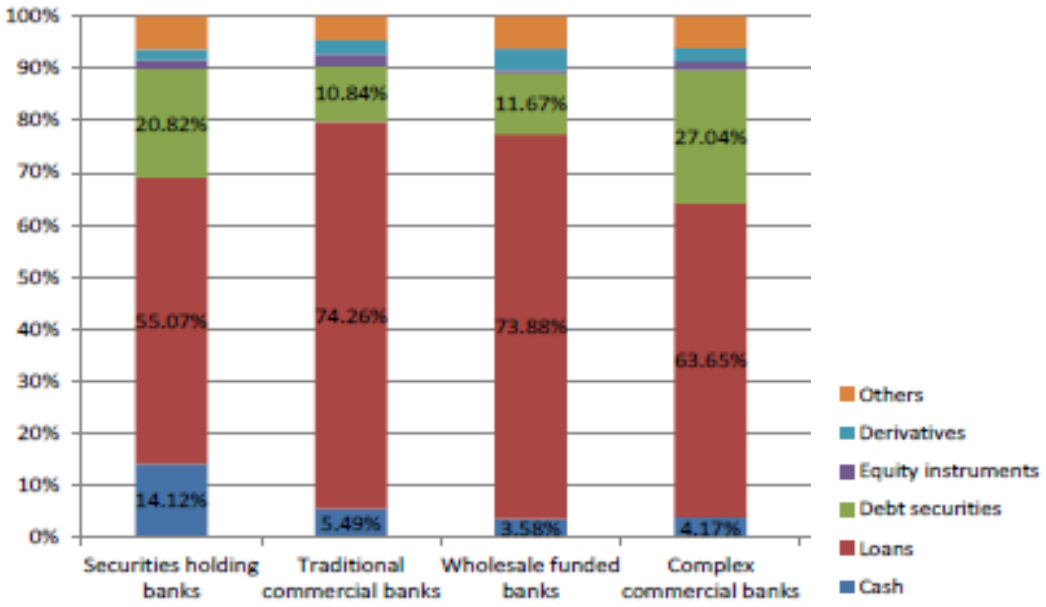

FIGURE 3.8: ASSET COMPOSITION OF THE FOUR CLUSTERS

Still another approach is followed by André Lucas, Julia Schaumburg and Bernd Schwaab (2017). They consider, in fact, a panel framework to extract information over time, instead of single (static) cross-sections of year-end data. This should lead to more accurate assessments.

Afterwards, the paper is in-depth analysed since it also provides interesting conclusions on how banking business models adapt to changes in yield curves. This topic is particularly of relevance, given the present macroeconomic conditions.

The research identifies six main business models:

A) Large universal banks, this category includes also globally systematically important banks (G-SIBs)[64]. They are the largest European financial institutions (total assets may even overcome €2 trillion for some globally systematically important bank). On average, their operating revenue is mostly related to interest-bearing assets (approximately 60%), with decreasing but still relevant importance of fee-related and trading businesses. In general, they are the most leveraged even though, their exposition (measured as the ratio between Total assets over CET1) has progressively decreased after the financial crisis. It is also worth highlighting that a sizeable part of their

[64] Note that for G-SIBs BASEL III imposed additional capital requirements.

operations is conducted on an international basis and that they own significant (both in absolute terms and with respect to their total assets) trading and derivatives books.

B) International diversified lenders. They are the second biggest group measured in terms of assets size (i.e. their typical balance sheet size ranges approximately between €100 – 500 bn per firm). They are strongly involved in international lending activities. In fact, the share of non-domestic loans over total loans is approximately 30%. They also operate trading securities and derivatives on customers' behalf, resulting in sizeable derivatives and trading books. A characteristic of this group of financial institutions is that they tend not to be deposit funded (loans-to-deposit may even overcome 200%).

C) Fee-based banks. As the name implies, this category of financial institutions achieves most of their income from fees and commissions (in some cases even more than 30%). Moreover, the net interest component over total operating income is quite low. Therefore, this group contains banks mainly focused on fee-based activities such as advisory, investment banking activities, transaction banking services and trade finance. The median size of their balance sheet is commonly below €100 billion per firm.

D) Domestic diversified lenders. This category accounts for the majority of banks sampled, nearly 27% of the total sample collected. Their dimension rarely overcomes €50 billion per bank. They are well-capitalised (leverage ratios are normally below 20) with small trading and derivatives books.

E and F) Domestic retail lenders and small international banks. They are the smallest firms with less than €25 billion in total assets. The most relevant source of income is related to interest-earning assets (mainly loans extended; in fact, risks arise mainly from credit expositions). Additionally, they are well-capitalised, and they do not display neither significant trading books nor sizeable derivatives books.

Domestic retail lenders differ from small international banks in two main ways. First, geographical focus. In fact, as the names imply the former is mostly focus on national lending activities, while the latter is highly focused on cross-border operations. Second, the asset composition. In fact, domestic retail banks focus almost exclusively on loans, while small international banks own relevant non-loan assets and serve non-retail clients too.

The following picture summarizes some characteristics of the six categories just described, showing some of the most important banking ratios and their evolution throughout the period considered.

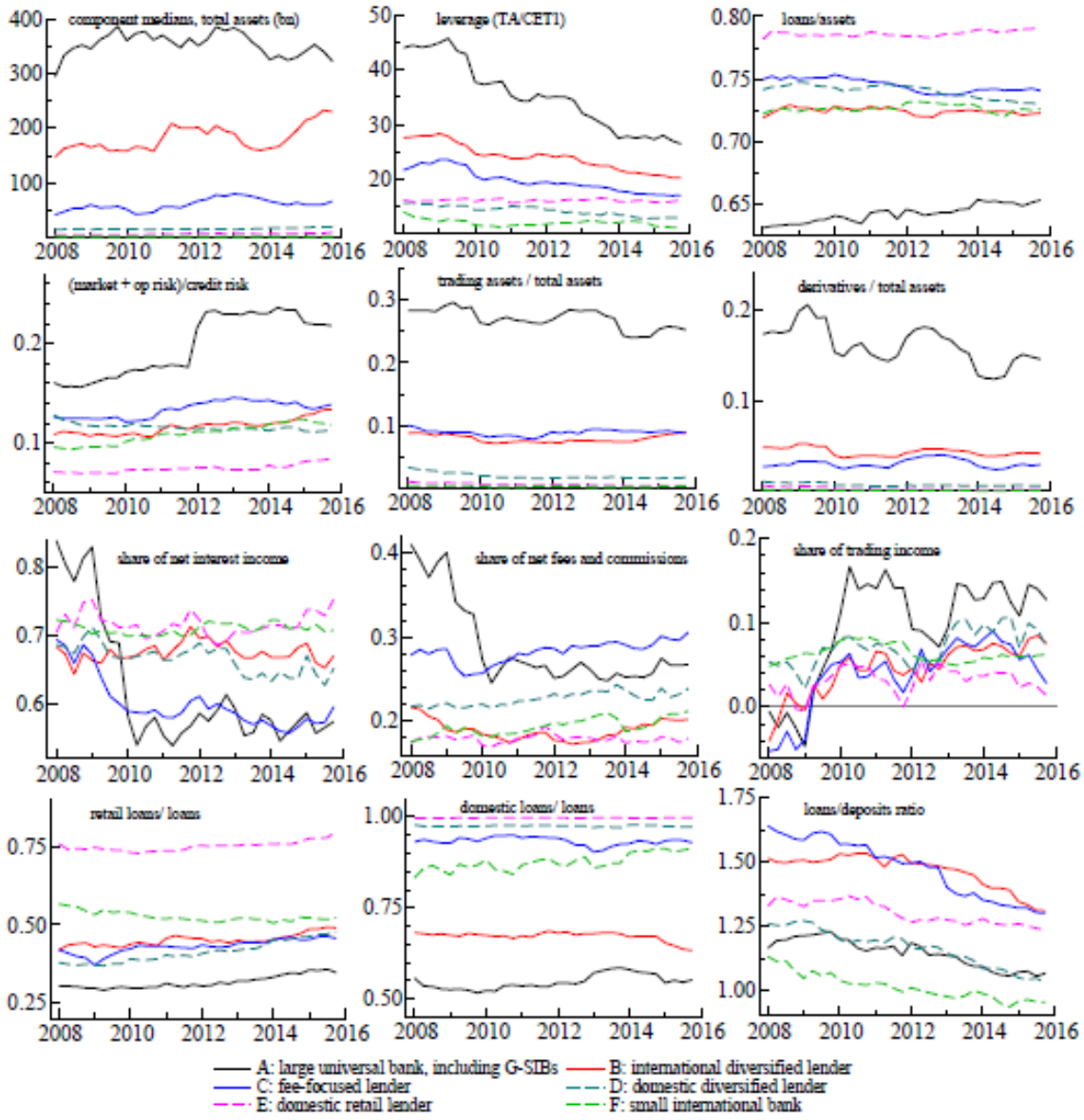

FIGURE 3.9: BANKING BALANCE SHEET RATIOS ACROSS THE PERIOD 2008-2016

The academic research details that, as long-term interest rates decrease, banks all (across each of the six business models described) tend to expand the size of their balance sheets to offset the reduction in net interest margins for new loans and investments. André Lucas, Julia Schaumburg and Bernd Schwaab estimate, through an econometric model, that this effect accounts for nearly 5% (increase) each 100-basis point drop in the yield curve level factor. Moreover, consistently with

the risk-taking channel, financial institutions tend to shift investments towards higher-yields (and so higher risk) assets.
Furthermore, bank leverage is predicted to increase when yield curve declines. However, it is worth highlighting that the leverage factor is deeply conditioned by change in regulations and capital requirements established by banking authorities. This consideration largely explains trends in pictures 3.6 and 3.7.

Moreover, some peculiarities for each of the six business models may be underlined.
First, yield curve factors affect asymmetrically the preferred banking balance sheet composition. In fact, on average, the loans-to-assets ratio decrease by approximately 2% (by each 100-basis points drop in long-term interest rates). However, this change is mostly driven by large universal banks (and G-SIBs), international diversified lenders and fee-focused banks (groups A, B and C). Moreover, the size of banks' trading and derivatives books tend to increase in response to a decrease in long-term yields. This is especially true for large universal financial institutions (group A).
Second, financial institutions are inclined to reduce their deposits-to-loans ratio in response to diminishing short-term rates. This characteristic may be observed for universal banks (and G-SIBs), international diversified lenders and domestic diversified lenders (groups A, B and D). For these categories a decrease of 100-basis points in short-term interest rates, on average, leads to a reduction of nearly 2-5% in deposits-to-loans ratio.

Therefore, banks' business models adapt to changes in the level and in the slope of the yield curve, in turn deeply affected by European Central Bank's policies. Banks, on average, (across all the business models previously detailed) tend to increase the size of their balance sheets and trading portfolios, and to some extent, increase leverage and decrease funding through customers deposits, as the level of long-term interest rates decrease. These reactions need to be further investigated, since may trigger financial instability.

3.2 Impact of unconventional policies on banking profitability

Changes in the regulatory framework and in the macroeconomic environment affect the composition of banks' balance sheets and, consequently, have deep effects on banking profitability too. Below is shown a simplified version of a banking profit and loss.

PROFIT & LOSS
Interest income and similar revenue
Interest expenses and similar expenses
Net interest income
Fee and commission income
Fee and commission expense
Net fees and commissions
Dividend income and similar revenue
Gains and losses on financial assets and liabilities held for trading
Gains and losses on disposal of financial assets
Operating income
Impairment losses on financial assets
Net profit from banking activities
Staff expenses
Other administrative expenses
Impairment on tangible assets
Operating costs
Profit (loss) of associates
Impairment of goodwill
Total profit or loss before tax from continuing operations
Tax expenses
Total profit or loss after tax from continuing operations
Total profit or loss after tax from discontinued operations
Net profit or loss for the year

FIGURE 3.10: BANKING PROFIT AND LOSS

Overall, changes in profitability are driven by three main categories: net interest income, non-interest income and provisions.

- *Net interest Income:* it is the difference between the interest income on interest-bearing assets and interest expenses on onerous liabilities. In particular, interest income and similar revenue voice accounts for interests earned from loans and securities investments, while, interest expenses and similar charge voice, accounts for interests paid on deposits, securities issued, and loans received.

Net interest income mainly reacts via a price channel (i.e. changes in interest rates of assets such as loans and securities, and of liabilities such as retail deposits, interbank and central banking loans and securities issued) and via quantity channel (i.e. changes in the quantity of loans extended or investments subscribed).

The level of short-term interest rates is positively related to banking interest income. Therefore, an increase in short-term interest rates leads to a corresponding increase in interest income gained by financial institutions from new investments undertaken. However, other variables contribute to explain NIM movements. Notably, apart from yield-curve related variables, the degree of competition faced by banks to attract deposits and extend loans and the volatility of interest rates are the most prominent, as emphasized by Bolotnyy, Edge, and Guerrieri in "Stressing Bank Profitability for Interest Rate Risk". In particular, the higher the competition the narrower the NIM, and the higher the risk (interest-rate volatility), the wider the NIMs set by banks to compensate the higher risk undertaken.

- *Non-interest Income:* it is driven by net fees and commissions, and gains from trading activities. It is mainly related to off-balance sheet activities, such as asset under management (AUM) fees, credit card fees and in general, investment banking fees (advisory fees, IPO discounts etc.).

  This area is especially of interest while analyzing the impact of quantitative easing, due to the appreciation of financial assets driven by lower rates.
- *Provisions:* mostly related to the quality of assets held in banks' portfolio. It is highly related to the macroeconomic environment, since default rates exhibit a high correlation with the general economic outlook.

Figures 3.11 and 3.12 show how the profitability of the banking environment has varied from the financial crisis on. The proxy analyzed is the Return on Equity (ROE), and data are taken from the statistical data warehouse of the European Central Bank, considering the banking aggregate of all the countries within the Euro area. The figures show how large banks (above) has consistently overperformed small banks (below) emphasizing the importance of the scale within the banking environment (this concept will be further analyzed later). Moreover, it is also worth remembering that, on average, changes in regulation have deeper effects on small banks, due to higher difficulties to raise equity capital.

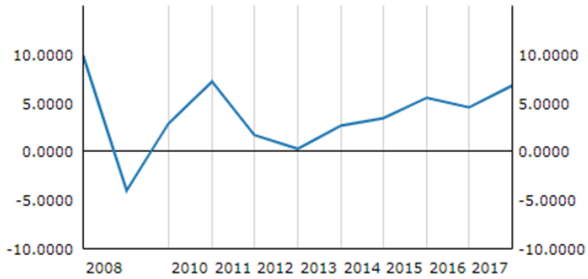

FIGURE 3.11: ROE, LARGE BANKS

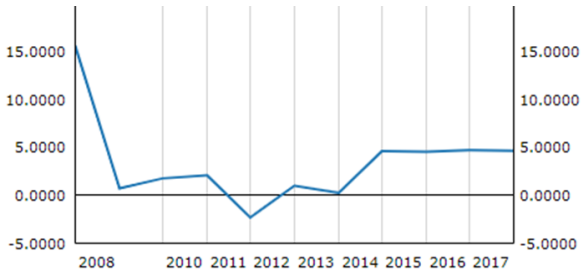

FIGURE 3.12: ROE, SMALL BANKS

Instead, considering the Return on Assets (ROA)[65] as a proxy for the profitability of the banking environment leads to results detailed in picture 3.13. Data are taken from a sample of 288 European banks from the early 2000 until the beginning of 2017[66].

[65] It is proper to consider ROA as a measure of profitability. Moreover, it is not directly related to changes in regulations (as it is ROE) and offers an overall perspective from the whole asset size owned by the bank.

[66] Data are taken quarterly, and they are referred to "Monetary policy and bank profitability in a low interest rate environment", written by Carlo Altavilla, Miguel Boucinha and José-Luis Peydró (October 2017).

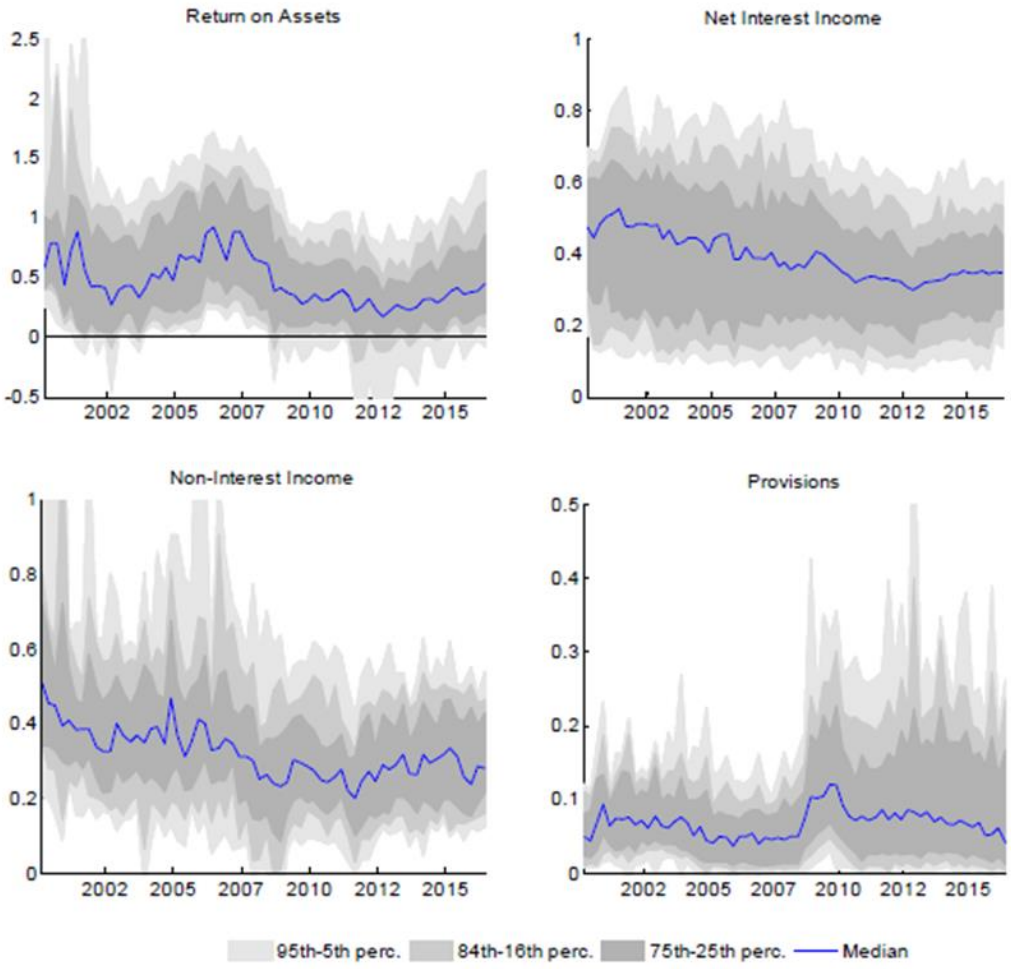

FIGURE 3.13: PROFITABILITY BANKING MEASURES

As the figure 3.13 above shows, in the last ten years ROA has been drastically lower than the pre-crisis level. This is due to a generalized decrease in income (both interest and non-interest related) and a generalized increase in provisions necessary to back a growing amount of non-performing assets. Recently, it is worth noting an increasing trend in ROA, sustained by a stable net interest income and a decreasing level of provisions, reflecting higher credit quality and lower defaults rate. Interestingly enough, the stable net interest income displayed in the last years (in a so low interest rate environment) is driven by positive effects in the quantity channel as well as savings in the cost of funding, that overall offset the lower income earned by interest earning assets.

Despite diversities within the banking environment (i.e. size, diversification, related both to the geographical presence and financial decisions, funding choices, organizational issues and activities)

that eventually lead to a wide range of different answers, it is possible to highlight three pivotal key points common to the profitability of all the banking business models.

3.2.1 Low interest rate environment

First, there is a broad consensus that financial institutions in general, suffer in a prolonged low interest rate environment. However, it is less clear which business models are hit the most, and how to quantitatively address these prolonged periods stated before.
The paper by Carlo Altavilla, Miguel Boucinha and José-Luis Peydró (2017) further investigates these topics. Two main factors are at play. On one hand, unconventional monetary policies have contributed to flatten the yield curve, and compressed margins gained by banking maturity transformation activities. On the other hand, lower interest rates on loans have boosted demand for credit.

The latter fact is especially of interest while addressing unconventional monetary policies. As the paper by Ugo Albertazzi, Andrea Nobili and Federico M. Signoretti (2016) shows, bank lending channel under unconventional monetary policies differs from the one under traditional policies, in one relevant way.
In particular, as expected, the transmission of conventional policies is stronger for weaker banks. Instead, for unconventional policies the result is surprisingly the opposite. In fact, the higher the Tier1 capital of the bank, the stronger the transmission mechanism of unconventional policy stances. This finding may be once again explained by the relevance of economic and regulatory constraints throughout the period beginning with the financial crisis. Therefore, as ECB has deployed its unconventional operations, monetary policy transmission has been stronger for better-capitalized banks and for banks with a more robust funding structure.

To assess the balance between a flattening yield curve and a stronger demand for credit, and the ultimate result on banking profitability, Altavilla et al. (2017) estimated the following multivariate regression analysis:

$$ROA_{i,j,t} = \propto_i + \beta_1 Level_t + \beta_2 Slope_{j,t} + \Omega X_{j,t} + \varphi Z_{i,j,t-1} + \Gamma_1\left(Level_t * Z_{i,j,t-1}\right) + \Gamma_2\left(Slope_{j,t} * Z_{i,j,t-1}\right) + \varepsilon_{i,j,t} \quad [1]$$

Where, ROA is the return on assets of the bank *"i"* in the country *"j"* at time *"t"*, used as a proxy for the banking profitability. β_1 and β_2 coefficients are respectively related to the short-term level of interest rates (proxied by the three-month OIS) and to the slope of term structure calculated country by country as the difference between the yields of government bonds with a residual maturity of ten years and two years. Moreover, $X_{j,t}$ represents a specific country control factor that includes the current and forecasted GDP, expected inflation, a measure of the stock market volatility (VIX) and a measure of the frequency of defaults (EDF); while $Z_{i,j,t-1}$ is a specific banking control and includes the non-performing loan ratio[67], Tier1 capital ratio, cost-income ratio (measured as operating expenses over operating income) and a measure of the liquidity of assets over total assets held by the bank. Furthermore, $\Gamma_1$and Γ_2[68] are vectors of 1 line and n columns whose sign depends on the relationship between the balance sheet variables considered. For instance, if Γ_1 is positive means that a low level of interest rates would positively affects efficient banks (i.e. the ones with a low cost to income ratio). Similarly, if Γ_2 is negative means that a flatten yield curve would be beneficial for banks with a high proportion of NPLs (considered in the control factor $Z_{i,j,t-1}$).

The results of the regression analysis show how monetary policy actions influence banking profitability in a statistically significant way and at any level of significance considered. Moreover, results emphasize that banks with a sizeable stock of NPLs are more exposed, than virtuous financial institutions, to monetary policies decided by the ECB.

Furthermore, to verify how an extended period of low interest rates damages banking profitability, the basic regression framework developed [1], is modified proposing three different models[69] with the addition of the following variables:

[67] Calculated as gross non-performing loans on total loans.

[68] Respectively, $\Gamma_1 = [\gamma_{11}, \dots, \gamma_{1k}]$ and $\Gamma_2 = [\gamma_{21}, \dots, \gamma_{2k}]$.

[69] At first, to capture the effects of monetary policies within a protracted period of low-interest rates, the regression framework is modified including a threshold on MRO or EONIA. However, to avoid the need to fix an *arbitrary* threshold, another modification is proposed. A forward-looking Taylor rule is built using Overnight Index Swap (OIS) as a proxy for the monetary policy instrument together with expected one-year GDP and expectations about future inflation. The negative residuals on the Taylor rule imply a period of lower (than suggested by the Taylor rule) interest rates.

1) "Low for long ($D_{MRO \leq 1.5}$)"; it counts the number of consecutive quarters in which MRO rate is below 1.5% threshold (column two).
2) "Low for long ($D_{EONIA \leq 1.25}$)"; it counts the number of consecutive quarters in which EONIA rate is below 1.25% threshold (column three).
3) "Low for long ($Taylor\ rule$)"; it counts the number of consecutive quarters in which residuals of the forward-looking Taylor rule are negative (column four).

Results are displayed in table 3.1.[70]

TABLE 3.1: REGRESSION RESULTS IN A LOW-FOR-LONG ENVIRONMENT

	(1)	(2)	(3)	(4)
ROA_{t-1}	0.413***	0.415***	0.415***	0.415***
	(0.0584)	(0.0594)	(0.0594)	(0.0592)
Short-term rate$_t$	0.00374	-0.0286	-0.0254	-0.0198
	(0.0148)	(0.0217)	(0.0210)	(0.0204)
Slope$_t$	0.00161	0.00142	0.00143	0.00131
	(0.00151)	(0.00149)	(0.00149)	(0.00148)
VIX$_t$	0.00266	0.000579	0.000687	0.00139
	(0.00183)	(0.00190)	(0.00190)	(0.00197)
Real GDP growth$_t$	-0.000249	0.00775	0.00740	0.00537
	(0.0101)	(0.0107)	(0.0107)	(0.0113)
Expected real GDP growth$_t$	0.107***	0.105***	0.105***	0.0978***
	(0.0169)	(0.0168)	(0.0168)	(0.0184)
Expected inflation$_t$	0.112**	0.0983**	0.0990**	0.104**
	(0.0494)	(0.0477)	(0.0478)	(0.0510)
Expected default frequency$_t$	-0.0557**	-0.0548**	-0.0548**	-0.0675***
	(0.0261)	(0.0254)	(0.0254)	(0.0255)
NPL ratio$_{t-1}$	-0.0108***	-0.00840**	-0.00848**	-0.00864**
	(0.00356)	(0.00378)	(0.00377)	(0.00368)
Regulatory capital ratio$_{t-1}$	0.00581	0.00687*	0.00677*	0.00629
	(0.00385)	(0.00401)	(0.00400)	(0.00413)
Cost-to-income ratio$_{t-1}$	-0.00251**	-0.00260**	-0.00259**	-0.00255**
	(0.00112)	(0.00114)	(0.00114)	(0.00114)
Low for long ($D_{MRO \leq 1.5}$)		-0.00682***		
		(0.00251)		
Low for long ($D_{Eonia \leq 1.25}$)			-0.00649***	
			(0.00246)	
Low for long (Taylor rule)				-0.00508**
				(0.00241)
Bank FE	Yes	Yes	Yes	Yes
Number of observations	2974	2900	2900	2885
R^2	0.604	0.607	0.607	0.604

[70] The dependent variable of the analysis is the Return On Assets (ROA). Moreover, data are taken quarterly from a sample of 288 banks during the period Q1 2000 – Q4 2016. Variables are marked with *"*"* according to the following criteria: * p<.1, ** p<.05, *** p<.01.

First, all the coefficients related to the three added variables are statistically significant and negative. This means that prolonged periods of low interest rates negatively affect ROA. However, it is also worth noting that the three-variable coefficients are small in absolute terms. This implies that several quarters are needed to have appreciable (negative) effects on ROA. In particular, each additional year of low interest rates, diminishes banking ROA by nearly two basis point.

The results of the fourth column are detailed further in figure 3.14. Blue line shows the cumulative impact on banking profitability, while holding macroeconomic conditions constant (therefore, not considering neither the increase in loan demand nor the lower amount of provisions set aside by banks due to the higher quality of assets, both stimulated by the enhanced macroeconomic environment).

Instead, the yellow line does not control for the macroeconomic environment. Note the difference between the two lines, and therefore, how a better macroeconomic environment enhances the outcome. In fact, improvements of the general economic outlook, spurred by easing monetary policies, delay negative effects on banking profitability to around five years. In fact, for the first five years the increasing loan demand together with the decreasing provisions set aside by banks, more than offset the negative consequences of a low-for-long environment.

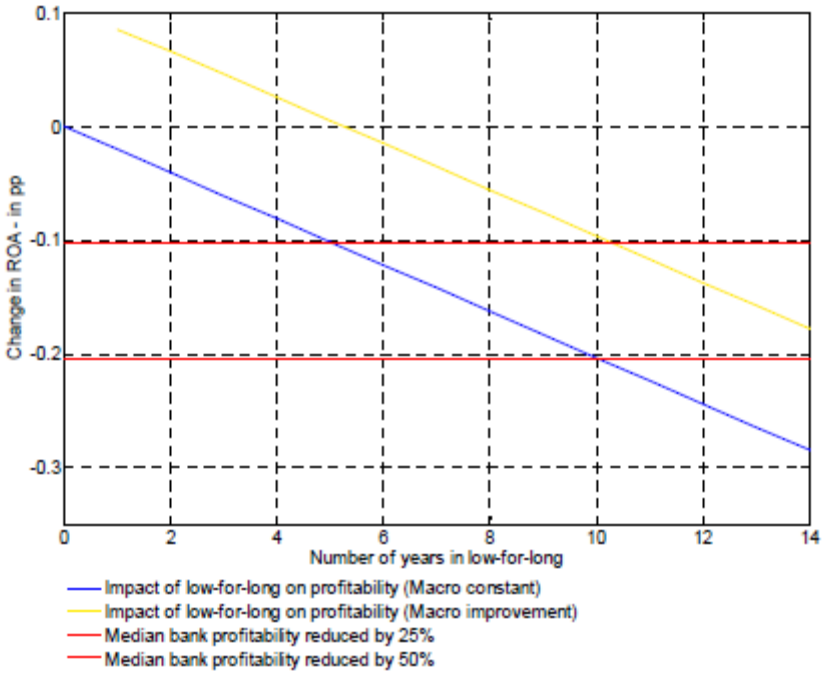

FIGURE 3.14: LOW-FOR-LONG, BANK PROFITABILITY AND MACROECONOMIC OUTLOOK

To summarize, prolonged periods of low interest rate per se (i.e. controlling for macroeconomic conditions such as the demand for credit and the quantity of provisions set aside by banks) negatively affect banking profitability. However, if changes in the macroeconomic scenario are considered, negatively effects are postponed nearly after five years for the sample analyzed. Indeed, in the first period, positive effects more than outweigh negative effects.

3.2.2 Economies of scale

The second common characteristic that banking sector exhibits as a whole, are strong economies scale.

Since the mid-1980s, a consolidation within the banking environment has been under way. The number of commercial banks has decreased, while, the average asset size per bank has progressively increased[71]. This consolidation has sped up in the last years, from the financial crisis on, due to the high fixed costs required to implement complex new regulations, and transition to new electronic banking platforms. Recently, the governor of the Bank of Italy, Ignazio Visco, has highlighted the need to drastically reduce the overall number of Italian banks from the current value of 600 different banking groups to nearly 100, within at most a couple of years, in order to improve the stability of the system.

There are different reasons why banking profitability is so close related to the banking dimension. First, banks are able to spread out fixed costs over a greater asset base, therefore, reducing the average costs and the relative importance of such costs on the overall profitability. Furthermore, some transaction costs are almost unrelated to the size of the transaction (i.e. commissions, in percentage terms on the total investment size, are much less for a 1 million € bond than for 1 thousand € bond). Moreover, banks are able to profit from the so-called "first-copy economies"[72]. Increase banks' asset size is generally associated with greater diversification too, and so stronger diversification benefits. Finally, as the scale increases, banks may be able to more easily attract and retain talents and improve efficiency by specializing inputs.

[71] *Source*: Kristen Regehr and Rajdeep Sengupta, "Has the relationship between bank size and profitability changed?".
[72] They are referred as the capability of an enterprise to produce just one, high-quality, product and reuse it several times, thereby reducing total costs. An example typical of the banking system, is the creation of contracts for mortgages, deposits etc. that are written just once, in a high-quality way, and then reused for several customers with the same request.

Overall, the aforementioned benefits explain why ROA is positively associated with the dimension of the bank. The figure 3.15 shows the mean ROAA (Return on Average Assets) according to different banking dimensions categories.

Size group	Sample	
	Mean	Std. dev.
All banks	0.78	1.38
Less than $1 billion	0.77	1.35
$1–$10 billion	0.86	1.69
More than $10 billion	1.09	1.38

FIGURE 3.15: ROAA ACCORDING TO DIFFERENT BANK SIZES

To give statistical relevance to what just stated, Kristen Regehr and Rajdeep Sengupta (2016), developed a multi variable regression model showing that the size variable is statistically significant at any level considered (1, 5 and 10 percent significance level) to explain ROAA. Moreover, they showed that profitability increases as size increases, but at decreasing marginal returns.
The relationship is described by the figure 3.16 below.

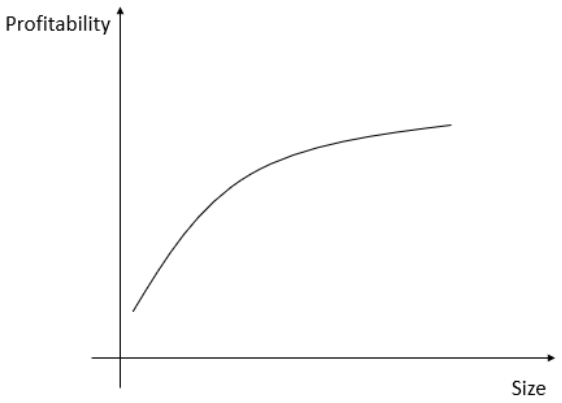

FIGURE 3.16: RELATION BETWEEN PROFITABILITY AND SIZE IN THE BANKING ENVIRONMENT

3.2.3 Maturity transformation

A third characteristic of the banking environment is related to the maturity gap, that is: "the difference between the (weighted average) repricing period of bank assets and liabilities" and it is calculated as:

$$GAPI_{i,j,t} = \sum_j \tau^j A^j - \sum_j \tau^j L^j \quad [2]$$

Where, τ_A represents the weighted average of the assets (A) maturity periods expressed in months and τ_L represents the repricing time of liabilities (L) expressed in months.

It is the most important characteristic that tightly links banking profitability and the differences among assets and liabilities.

The figure 3.17 below shows how maturity transformation deeply differs at European level. This, as already emphasized, is mainly caused by the different business models present within the financial environment.

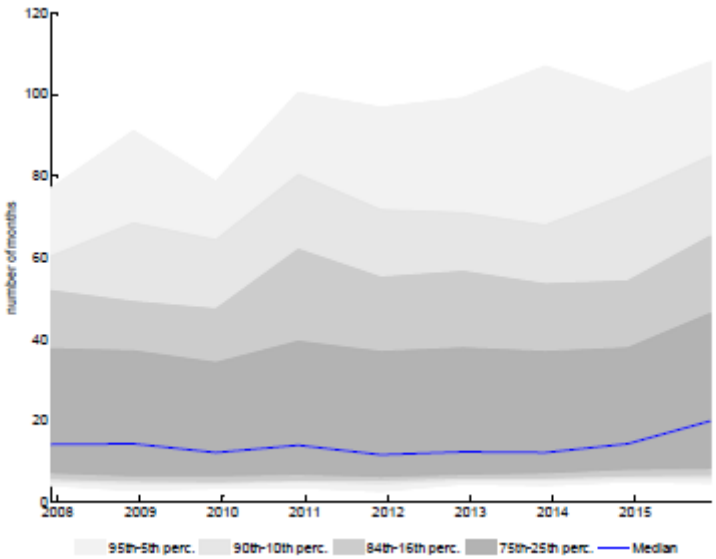

FIGURE 3.17: MATURITY GAP DISTRIBUTION WITHIN THE SAMPLE SELECTED

The basic regression framework [1] is modified to account for the GAP variable, as calculated [2]. The coefficient of the maturity gap is found to be positive and statistically significant. Therefore, the

higher the maturity transformation the higher the ROA. Furthermore, banks highly engaged in maturity transformation activities, experience a higher increase in ROA in relative terms, caused by a steepening yield curve. Note that this effect may be initially hedged out through the usage of derivatives (such as interest rate swaps).

This is intuitive. In fact, considering an upward sloping yield curve, the greater the difference between the maturity of assets and liabilities, the higher the spread gained by the bank (normally, interest rates are positively related to the maturity). However, this raises a serious issue that risk management must address. Indeed, duration is considered as a proxy of interest rate risk and, in general, the higher the duration exhibited by the bank's balance sheet, the higher the risk of a mismatch between cash out and inflows. Banks effectively manage the ultimate maturity risk position taken, through a variety of instruments consisting mostly of derivatives and through specialized divisions (namely, the asset-liability management (ALM) department).

The relative importance of pure net income accountable just to maturity transformation is nearly 10% of the overall net interest margin. This has been estimated by Raymond Chaudron (October 2016) in a study conducted on Dutch banks from the financial crisis until 2016. Moreover, the academic research shows how banks take strategically advantage of persistent excess long-term yields, while, hedging their exposure.

This fact has been highlighted also by Hoffmann et al. (2018), who study 104 European financial institutions and show that the average sensitivity of bank net worth is just -0.09 basis point relative to total assets. Therefore, given an average ratio of book equity over total assets of 6% and an interest rate increase of 1%, the bank capital would decline just of 1.5%. This testifies how banks are able to manage effectively interest rate risk (at least, given a small variation).

3.3 Bank equity valuation and credit risk

This section aims at understanding how monetary policies impact the expected future profitability of banks, measured as the overall market capitalization, and the credit risk (and therefore, credit spread[73]) required by the market, measured through CDS.

[73] Credit spread is the difference in yields between the risk-free government bond and the bank debt security with the same maturity.

It is important to note that stock returns and the perceived credit risk are strongly correlated. For instance, a positive and unanticipated news that testifies a strengthening financial position of a bank, is very likely to lead to a price appreciation (an increase in the demand for that bank's stocks) in the equity market, and therefore, to capital gains and so positive returns.

The figure 3.18 displayed below, shows market reactions and changes in CDS spread after some of the most important ECB's announcements throughout the last years.

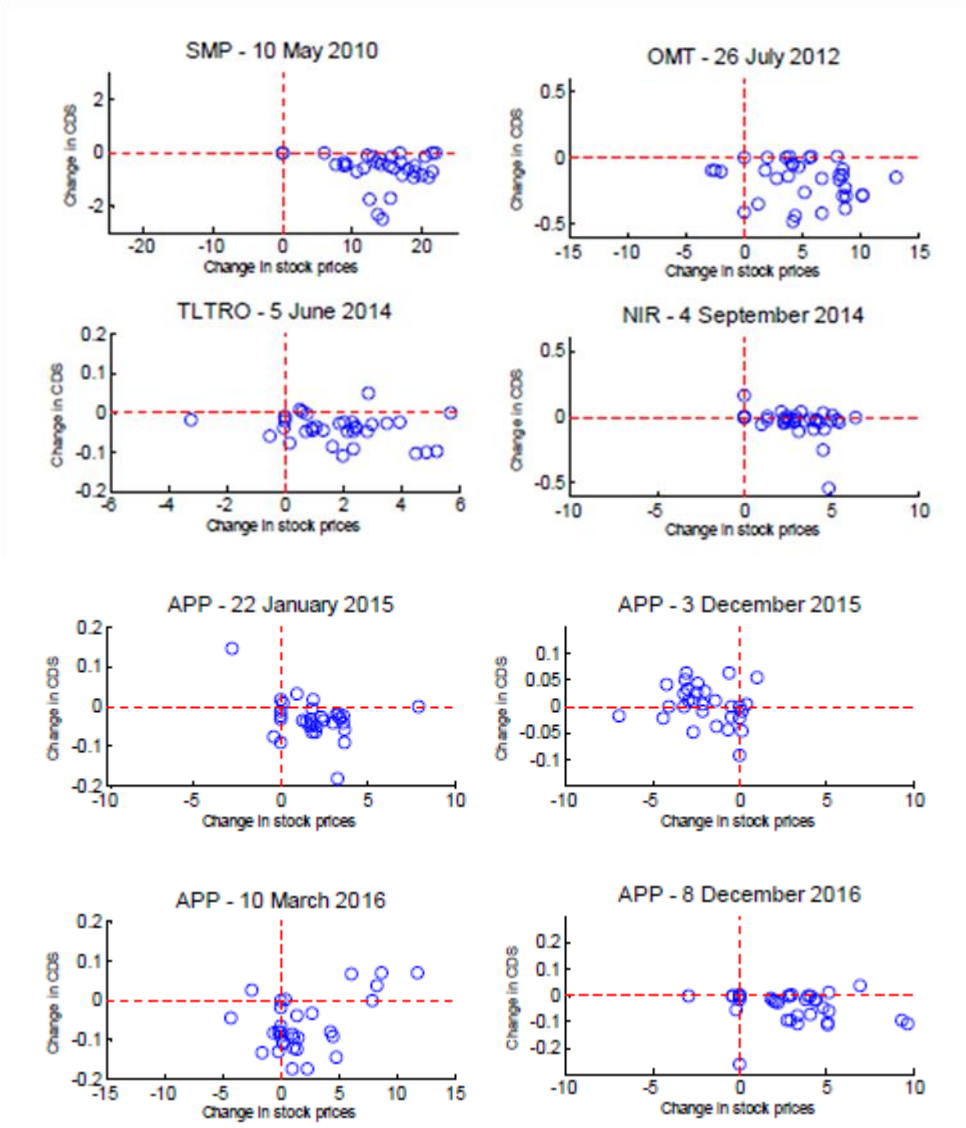

FIGURE 3.18: MARKET REACTIONS AFTER ECB'S ANNOUNCEMENTS

Evidences are clear: for the large majority of the sample[74], stock prices increased and CDS spreads narrowed following ECB's announcements. This implies that market positively discounted easing (unconventional) monetary policies declared by the ECB.

The only exception is related to the recalibration of the APP, announced on 3 December 2015. This announcement led to negative stock returns for most of the financial institutions within the sample. However, this happened since financial markets had previously discounted stronger easing monetary policy measures than those actually implemented. Therefore, these wrong expectations implied within market prices, adjusted after the announcement.

Moreover, as easily predictable, the banking environment is in general the one impacted the most by ECB's announcements (figure 3.19 below).

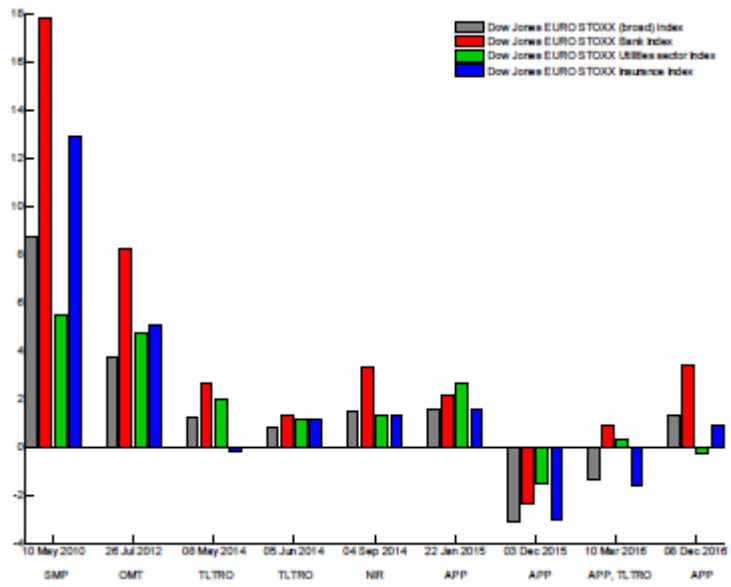

FIGURE 3.19: CHANGES IN STOCK PRICE INDICES FOR DIFFERENT AGGREGATES

There are different reasons why monetary easing policies lead to positive stock returns.

First, financial markets, in a low interest rate environment, offer less opportunities to earn appealing returns for banks. This may lead to higher expected dividends, that, in turns, are positively related to the intrinsic equity valuation of banks (i.e. consider Gordon growth model and in general DDM models).

[74] The sample considers a total of 54 banks for stock price movements and 57 banks for CDS changes. The banks analysed are the biggest ones (in terms of market capitalization size and daily exchanges) due to the availability of data. All the banks considered are listed in Europe.

Second, accommodative policies reduce the discount factor used to actualize future cash flows, therefore, increasing the intrinsic equity value.
Third, easing monetary policies may reduce equity premia requested by the market.

To give general value to what displayed in the picture 3.18, Altavilla et al. (2017) developed the following multivariate regression analysis:

$$r_{i,j,t} = \emptyset_0 + \emptyset_1 Surprise_{Level,t} + \emptyset_2 Surprise_{Slope,j,t} + \ni Controls_{i,j,t} + \delta_{i,j,t}$$

Where, $r_{i,j,t}$ represents the daily return of the bank *i* in the country *j* at time *t*. Please, note that *t* is referred to an ECB Governing Council announcement date. The surprise factors are both related to the level of the short-term interest rates (proxied by the 3-month OIS rate) and the slope of term-structure of interest rates (proxied by the difference between the yields of government bonds with remaining tenor of 2 and 10- years). $Controls_{i,j,t}$ refers to a set of bank's balance sheet indicators. The results are shown in the table 3.2.
As already said, unexpected ECB's announcements about easing monetary policies tend to positively affect stock returns. In particular, a decrease of ten basis points in short term interest rates (controlling for the slope variable), leads to a median positive stocks' returns of nearly 1.5%. Stock returns are positive affected by the slope variable too. In fact, other things being equal, a decrease of the same size (ten basis points) in the slope variable, leads to an increase in daily returns of 0.4%. Furthermore, as expected, a low bank asset quality negatively affects daily returns. In particular, a 1% raise in the NPL ratio, decreases stocks' returns of 20-30 bps on the announcement date. Moreover, as already emphasized in the previous paragraphs, banks highly engaged in maturity transformation, are the ones most affected by the announcements.

TABLE 3.2: BANK STOCK RETURNS AND MONETARY POLICY SURPRISES

	(1)	(2)	(3)	(4)
Short-term rate surprises	-13.40***		-15.93***	-15.64***
	(1.874)		(2.041)	(2.035)
Country-specific slope surprises		-2.458**	-3.807**	
		(1.164)	(1.526)	
Euro area slope surprises				4.761
				(3.178)
Sovereign spread surprises				-12.84***
				(1.802)
NPL ratio			-0.320***	-0.193***
			(0.0617)	(0.0610)
Regulatory capital ratio			0.0313	0.188*
			(0.0916)	(0.101)
Cost-to-income ratio			0.0161	0.00830
			(0.0163)	(0.0166)
Liquid asset ratio			-0.106	-0.0302
			(0.0695)	(0.0529)
Maturity gap			0.0998**	0.120***
			(0.0447)	(0.0428)
Bank FE	Yes	Yes	Yes	Yes
Number of observations	556	556	466	466
R^2	0.0672	0.0499	0.118	0.389

3.4 The effects of quantitative easing on the banking system

Quantitative easing program amended by the ECB in January 2015, has been already detailed in section 2 together with the several impacts it has had on the different transmission mechanisms. However, the focus is now on the results that it has achieved, and how it has impacted the European banking system.

It is necessary to anticipate that banks themselves have been critical about the impact of quantitative easing on their profitability and in particular on their net income[75] , admitting however, the positive effects it had on financial securities' appreciation. Figure 3.20 shows the expected

[75] *Source:* ECB Bank Lending Survey (April and October 2015, 2016).

impact of the quantitative easing program by financial institutions, with respect to net interest margin changes and capital gains and losses forecasted.

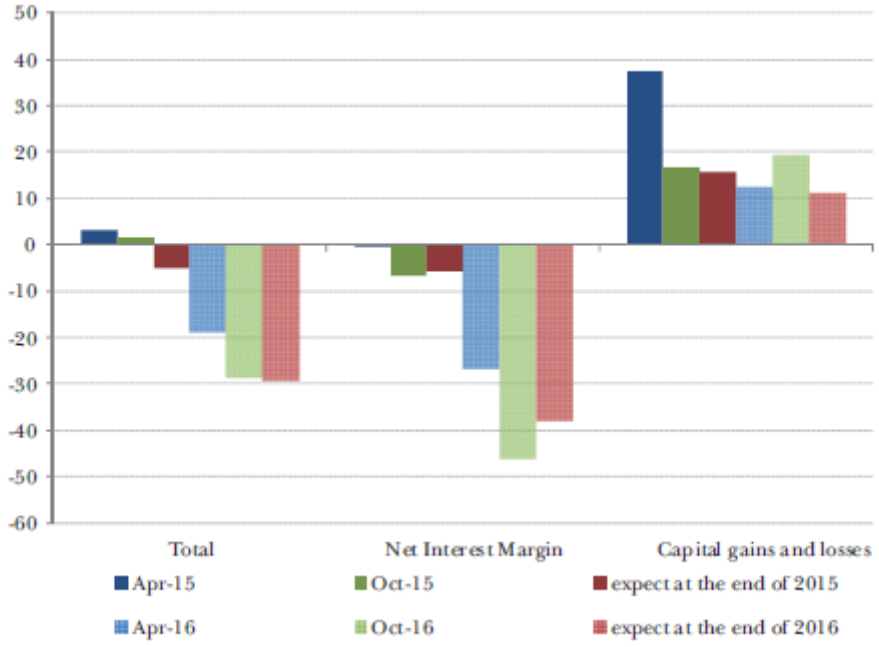

FIGURE 3.20: IMPACT OF THE EXPANDED APP ON EURO BANKS' PROFITABILITY

To summarize, as underlined by Maria Demertzis, Guntram B. Wolff and Bruegel (2016), quantitative easing affects the profitability of banks in three main ways.

First, it drives bond prices up, with a consequent appreciation of these financial instruments in bank balance sheets, and capital gains registered by financial institutions (for mark-to-market securities). Second, it generally decreases and flattens the yield curve. This leads to lower costs of the different funding sources that financial institutions use (i.e. interbank rates, strongly related to ECB key interest rates, interest paid on retail deposits and on securities issued) but also lower interest income that are generally achievable on banking assets (loans extended and yields on financial securities).

Finally, quantitative easing improves the economic outlook, and in turn helps banks extending a larger amount of loans profiting from the increase in loan demand driven by lower interest rates. This effect has been largely important in the last years in Europe. In fact, net demand for loans to enterprises has continued to increase in 2018 too, even though at a decreasing rate with respect to 2016 and 2017. The same applies to housing loans and consumer credit. In particular, a

strengthened loan demand is expected even in the fourth quarter of 2018 (11% overall); respectively, 11% increase for corporations, 18% for housing loans and 15% for the consumer credit[76].

Moreover, quantitative easing should alleviate problems related to Non-Performing Loans (NPLs)[77] due to the generalized improvements in the economic environment.

Therefore, understanding exactly how bank profitability reacts to quantitative easing program, means investigating how these three effects weight, and how they combine each other.

The first fact driven by the QE program too, has been the decrease and the flattening of the yield curve previously largely described. However, it has not been the QE alone to have caused this effect. In fact, forward guidance, key ECB's interest rates and expectations, have played a pivotal role in affecting the yield curve too. Other things being equal, the new configuration of the term structure of interest rates have damaged banks, especially the ones highly involved in maturity transformation activities. For instance, the customer spread[78] in the Euro area has visibly narrowed throughout time. As far as new lending is concerned, the customer spread amounted to 1.77 percent for households (Spread HHs) and 1.55 percent for non-financial corporations (Spread NFCs) at the beginning of 2017[79], as showed by the figure 3.21 below.

[76] *Source:* The euro area bank lending survey, first quarter of 2018.

[77] Non-Performing Loans are defined as loans against which the borrower has not made the scheduled payments (neither interests nor principal payments) for a period ranging from at least 90 to 180 days according to the different typology of the loan.

[78] The customer spread is defined as the difference between the average funding costs (in this case, the average rate on customer deposits) and the interest rate applied to loans.

[79] *Source:* "What impact does the ECB's quantitative easing policy have on bank profitability?". Written by Maria Demertzis and Guntram B. Wolff, Bruegel.

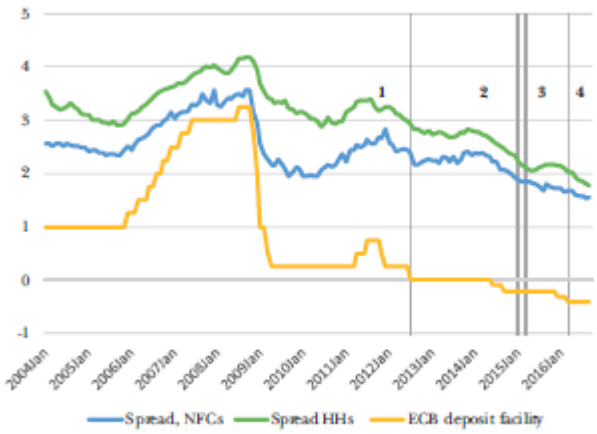

FIGURE 3.21: LENDING-DEPOSIT RATE SPREAD ON NEW CREDIT-EURO AREA BY SECTOR (%)

However, It is worth noting that loans extended to households have grown at a significant rate per annum[80], and non-financial corporate loans have showed a stronger demand throughout the last years.

The second fact driven by the quantitative easing is the reallocation at the asset level that banks have done to react to the changed interest rate environment. This is consistent with the banking risk channel and ultimately with what is known as "portfolio-balance effect". In fact, as banks sell their assets to the European Central Bank, they reallocate the cash obtained to riskier assets to create greater profit.

The third fact is the so-called "scarcity effect". This effect has been studied by Montecino and Epstein (2014)[81]. Starting from the imperfect substitutivity of banking assets related to different maturities and tenors, the growing Central Bank's demand for long-term securities creates the so-called *scarcity effect*: long-term securities are less available in the market, therefore, other things being equal, their price increases[82]. Montecino and Epstein (2014) estimated how the level of profitability of US banks that during the Large-Scale Asset Purchase (LSAP) sold their assets directly to FED, went up by 0.35 percent, with respect to comparable banks but not part of the Large-Scale Asset Purchase.

[80] *Source:* The euro area bank lending survey, first quarter of 2018
[81] Montecino J.a. and G. Epstein, December 2014, "have large scale asset purchases increased bank profits?" PERI Working Paper.
[82] This is possible since the European Central Bank is a huge player in financial markets.

To deepen the effects on bank profitability further, two main indicators are considered: total profit before tax and operating profit. The difference between the two indicators is that the former includes operating profit as well as impairment losses on loans, securities and financial assets in general, credit loss expenses and gain and losses on disposal of investments[83]. The figures 3.22 to 3.24 below break down operating profit into its main components (net interest income, net fee and commission, operating expenses and a residual component). Furthermore, they provide an interesting cross-section per banking size[84]. Note that according to the previous definition[81], the gap between total profit before tax and operating profit may be interpret as an indication of the quality of credits extended by banks in the period analyzed.

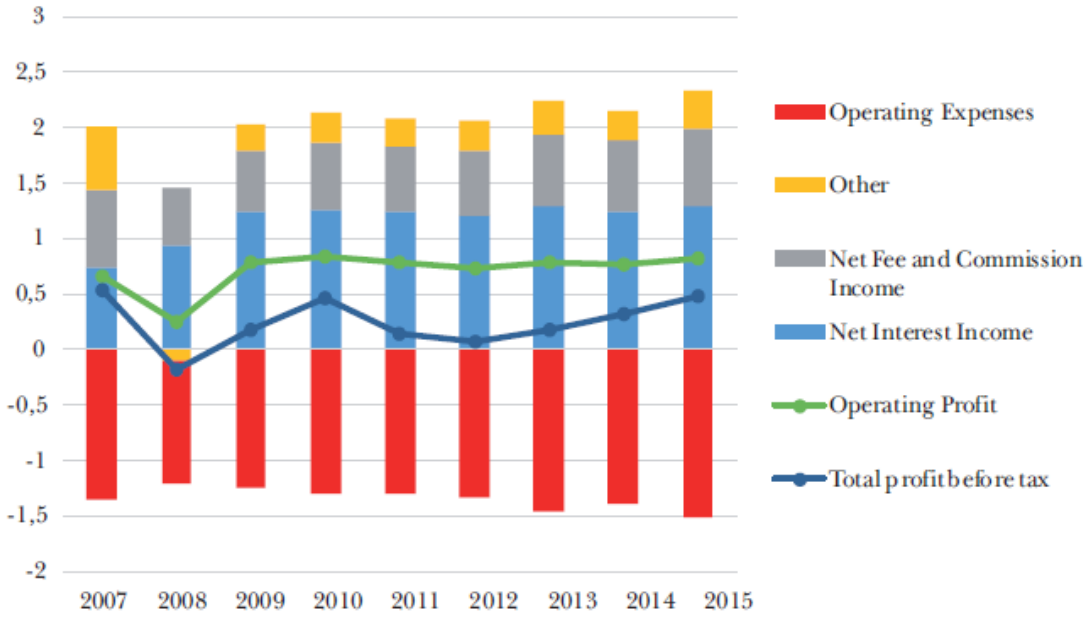

FIGURE 3.22: BANK PROFITABILITY AS PERCENTAGE OF TOTAL ASSETS FOR LARGE-SIZE BANKS

[83] The structure considered is the typical *reclassified balance sheet* for banks.

[84] The different categories are defined according to assets as percentage of total consolidated assets of European financial institutions. In particular:

- *Large size:* Greater than 0,5%.
- *Medium size:* Between 0.5% and 0.005%.
- *Small size:* Less than 0.005%.

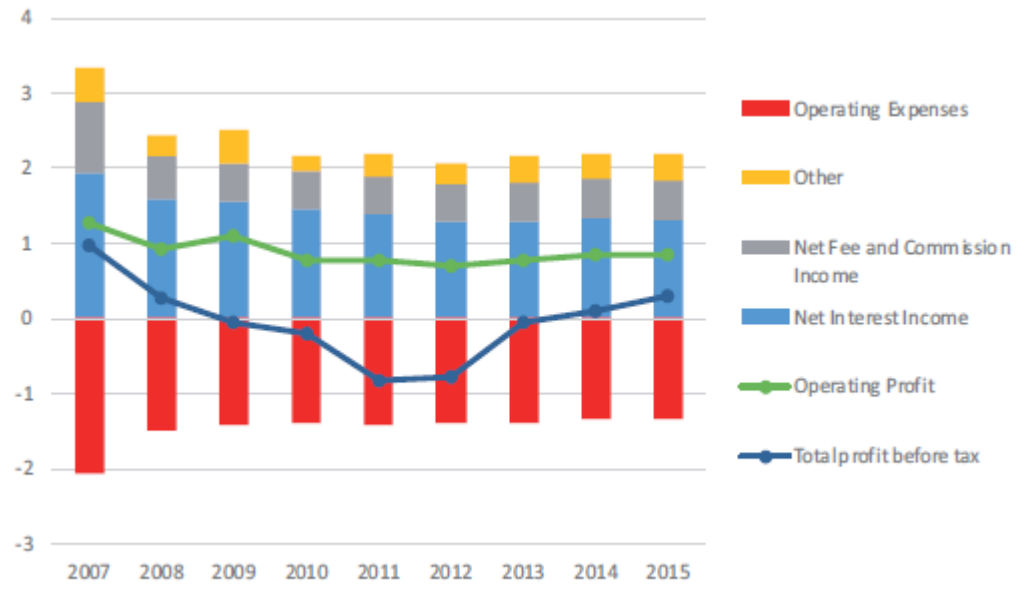

FIGURE 3.23: BANK PROFITABILITY AS PERCENTAGE OF TOTAL ASSETS FOR MEDIUM-SIZE BANKS

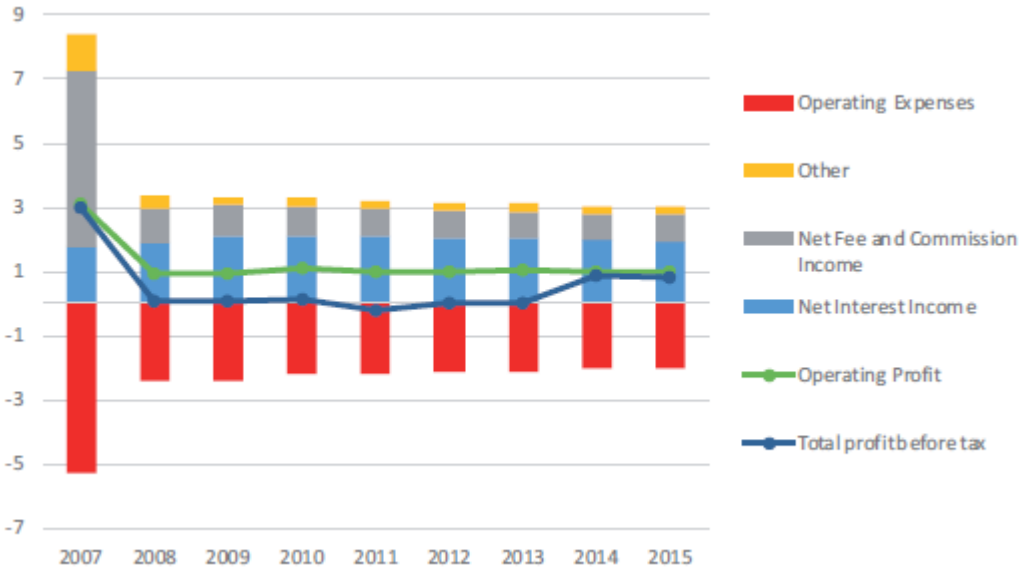

FIGURE 3.24: BANK PROFITABILITY AS PERCENTAGE OF TOTAL ASSETS FOR SMALL-SIZE BANKS

The figures show that, in contrast with the perception of banks[85] but in line with what previously shown also by Carlo Altavilla, Miguel Boucinha and José-Luis Peydró, net interest income (and

[85] *Source:* ECB Bank Lending Survey (April and October 2015, 2016).

operating profit) have been stable over the period analyzed. Note, that this consideration may also be extended until Q1 of the 2017, as showed by the picture 3.13. This may be explained by two factors.

First, a falling term spread applies only to new loans extended. This means that lower spreads only gradually affect banking net interest margin. Moreover, another possible explanation is that banks, to cope with the reduction in interest rates, succeeded in raising fees such as the ones related to loan origination[86].

Second, the increasing demand for loans stimulated by an improved macroeconomic scenario[87] (together with positive effects provided by the balance sheet channel), positively contributes to net interest margin.

However, total profit before tax has been volatile (and sometimes negative). Medium and small-sized banks have been hit the most (consistently with bank capital channel). This volatility and losses have been driven mainly by provisions for non-performing assets (especially, for non-performing loans). However, it is worth noting that these provisions have been diminishing over time, regardless of the bank size, testifying a higher quality of assets on bank's balance sheet spurred by the improved macroeconomic environment.

[86] Note, that loan origination fees, net of loan origination costs, are recognized as interest income.
[87] *Source*: The euro area bank lending survey, first quarter of 2018.

3.5 Conclusions

Exceptional macroeconomic conditions have originated since the beginning of the financial crisis in 2007. The financial turmoil has spread out from the United States, first to Europe, and then to different extents, worldwide. In 2008, the collapse of Lehman Brothers wreaked havoc in credit institutions and financial markets, impairing one of the most important source of liquidity for banks (i.e. the interbank market). The lack of liquidity, together with (and caused by) the sizeable exposure of Euro-banks to subprime mortgage obligations, and the relevant adverse balance sheet shocks for financial institutions, almost obliged banks to stop credit financing to the real economy.
Moreover, European debt crisis started at the beginning of 2010, further aggravated the overall economic outlook.

Therefore, to avoid disastrous economic and financial outcomes, the European Central Bank put in place several conventional and unconventional monetary policies.
Most importantly, it has progressively cut key interest rates. To give a measure, the main refinancing rate was 4.75% at the end of 2000, while from 2016 on, it has been confirmed at 0%. Moreover, it has adopted a series of active balance sheet unconventional monetary policies, with the aim of stimulating further the economy even in an environment close (or at) the zero-lower bound. It is worth reminding several purchasing programs, ranging from the three series of Covered Bond Purchase Program (CBPP, CBPP2 and CBPP3), Securities Market Program (SMP) and Asset Backed Purchase Program (ABSPP) to the well-known quantitative easing. Furthermore, it has progressively enlarged the collateral accepted in REPO transactions, the counterparties eligible to trade directly with the ECB to more homogenously spread ECB's policies across the economy, and different series of programs such as TLTROs, to adapt traditional Open Market Operations to the extraordinary current situation.

These policies, together with other underlying economic factors, such as the generalized reduction in government public expenditures, the global imbalance between saving and investing, population ageing and other general demographic elements, as described by Rachel, L. and T. Smith (2015), have had huge impact on the European (and global) economic environment.

First of all, they have completely reshaped government spot yield curve and ultimately, the overall level of interest rates.
Moreover, they have stimulated real economy and put inflation back on the track of 2%.
As far as real economy activities are concerned, GDP of most European countries have finally overcome (or are expected to do so within 2019) the level of pre-crisis GDP[88].
As far as inflation is concerned, it has been stimulated throughout several monetary transmission channels. Notably, the interest rate channels with the drastic reduction in interest rates and the credit channel (both trough the balance sheet channel and the bank lending channel).

One of the most impacted industries by this economic scenario, and whose performances are most related to overall level of interest rates and the general economic condition, is undoubtedly the banking system.
Therefore, it is not a surprise that an exceptional macroeconomic scenario has led to exceptional banking reactions. In fact, to cope with the just-described extraordinary macroeconomic environment, banks have made several adjustments to their business models.

Generally speaking, as far as their balance sheet is concerned, a period of extremely low interest rates leads to an increase in the average size of their assets. This is necessary to offset the decrease in net interest margin for new loans extended, and for new investments undertaken.
Moreover, bank leverage is predicted to increase as well, attempting to raise income per unit of equity invested. The size of banks' trading and derivatives books tend to grow too.
Furthermore, modifications in the level and in the slope of the yield curve, brings financial institutions to change their preferred composition of the asset and liability side.
In particular, as rates decrease, on average, loans-to-assets and deposits-to-loans ratios are expected to decrease.
These findings are backed by the paper written by André Lucas, Julia Schaumburg and Bernd Schwaab (2017).

As far as banking profitability is concerned, a period of prolonged extremely low interest rates leads to detrimental effects for banking activities. This has been emphasized by Mario Draghi himself

[88] Data are taken from IMF estimates for 2009 and forecasts for 2018.

during ECB's press conference held in Frankfurt (May 2016). For the sample analyzed, this prolonged period has been identified in 5 years (please, refer to the yellow line in figure 3.14 and the regression results shown in table 3.1). In fact, when accounting for the improvements of the overall macroeconomic scenario, the negative effects of a low interest rate environment (decrease in the customer spread for new loans extended and lower yields gained by new investments) are more than counterbalanced by the positive results of an improving economic landscape (decrease in the provisions necessary to back non-performing assets and increase in loan demand) and capital gains on financial securities due to decreasing rates.

This is true just for the first five years, then a low-for-long environment impairs banking profitability. Moreover, not surprisingly, it is important to stress that holding constant the macroeconomic scenario leaves just the negative effects of the low-for-long environment, immediately impairing banking profitability (please, refer to the blue line in picture 3.14).

These findings are testified by the paper written by Carlo Altavilla, Miguel Boucinha and José-Luis Peydró (2017).

Another topic that must be addressed to complete the view on the banking profitability is regulation. In fact, after the financial crisis, modifications in the regulatory landscape have obliged banks to become always more capitalized (refer to the new requirements on equity capital) and more liquid (see new ratios imposed by Basel III, such as NSFR and LCR). This has contributed to dampen further profitability ratios (i.e. consider ROE), for two main other reasons. First, increasing the denominator (i.e. the equity capital required) and second, decreasing the numerator (i.e. liquid assets are short-term in nature and therefore, given an upward yield curve, less profitable).

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