Master International Public Management and Policy

Master Thesis

Macroeconomic Stabilization Policy in the Euro Area following the Great Recession

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Abstract :

Following the 2008-2010 global recession, the Euro area has been stuck in a prolonged state of sluggish growth and low inflation with deep pockets of regional unemployment. This thesis provides a qualitative analysis of the fiscal and monetary policy response to this Eurozone crisis, its effects and transmission to the Euro economy. The aim is to gain a holistic understanding of the effectiveness of European stabilization policy in this context, and suggest future avenues for improvement, as the very structure of the Eurozone poses unique challenges for macroeconomic policy coordination. The case study design is used, with policy documents and research being the main source of data. The research observes, on one hand, the changes in the Eurozone fiscal stance, and on the other, the European Central Bank's crisis programs and the evolution of its balance sheet, while also accounting for hysteresis effects in the Euro economy. Results show that the coordinated fiscal consolidation of 2010-2013, aimed at curbing high public deficits, caused an estimated loss of 5.5 to 8.4 points of Eurozone GDP which hampered economic recovery, and led to persistent loss of potential GDP under hysteresis conditions. Monetary policy was successful in restoring financial stability during the "sovereign debt" crisis, but its Quantitative Easing program has had only a small macroeconomic effect, of 0.9 to 1.6 points of aggregate GDP, and 0 to 1 point of inflation overall. The findings furthermore suggest that, in a liquidity trap, monetary policy effectiveness is dependent on the stance of fiscal policy, which puts into question the appropriateness of a monetary-led stabilization regime. Instead, increasing the coordination of national fiscal policies and the aggregate fiscal stance, and cooperation between fiscal and monetary authorities, seems like a promising avenue to improve macroeconomic stabilization effectiveness, and warrants further attention from researchers.

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List of acronyms

ABSPP : Asset-Backed Securities Purchase Programme

BoE: Bank of England

BoJ : Bank of Japan

bp / b.p. : basis point(s)

CAPB : Cyclically-Adjusted Primary Balance

CBPP : Covered Bond Purchase Programme

CSPP : Corporate Sector Purchase Programme

DFE : Discretionary Fiscal Effort

DSGE : Dynamic Stochastic General Equilibrium (model)

EAPP : Expanded Asset Purchase Program

EFSF/ESM : European Financial Stability Facility / European Stability Mechanism

EMU : European Economic and Monetary Union

EURIBOR : European Interbank Offered Rate

ECB : European Central Bank

Fed : US Federal Reserve

GDP : Gross Domestic Product

GFC : (2008) Global Financial Crisis

GIIPS : Greece, Ireland, Italy, Spain and Portugal

HICP : Harmonized Index of Consumer Prices

IMF : International Monetary Fund

LTRO : Long-Term Refinancing Operations

MRO (rate) : (interest rate on) Main Refinancing Operations

NAIRU : Non-Accelerating Inflation Rate of Unemployment

NEER : Nominal Effective Exchange Rate

NEET : Not in Employment, Education or Training

NFC : Non-Financial Corporation

OMF : Overt Monetary Financing

OCA : Optimal Currency Area theory

OECD : Organization for Economic Co-operation and Development

OMT : Outright Monetary Transactions

QE : Quantitative Easing

pp / p.p. : percentage point(s)

PSPP : Public Sector Purchase Program

SMP : Securities Markets Program

(S)VAR : (Structural) Vector Auto Regression (model)

SPF : Survey of Professional Forecasters

SGP : Stability and Growth Pact

TFP : Total factor productivity

WEO : World Economic Outlook

ZLB : Zero Lower Bound (of monetary policy interest rates)

Chapter 1 - Introduction

September 2008 will be remembered in history as the breaking point of the first major global economic crisis of the twenty-first century. Starting with the unraveling of the U.S. subprime mortgage market, the world experienced the most severe financial shock since the Great Depression of 1929. The global recession that followed was of unprecedented magnitude, and so was the policy response to it. At the forefront of the fight for macroeconomic stabilization were advanced economies' central banks, which responded by lowering interest rates to levels ever closer to zero, entering mostly uncharted territory for policymakers.

In the Eurozone, the crisis had particularly profound effects, revealing deep weaknesses in the unique structure of the Economic and Monetary Union (EMU) which amplified the shock and triggered a sovereign debt crisis, starting in 2010. This is when the policy response in the Euro area diverged from other major economies. Whereas the US and Japan were pursuing aggressive fiscal expansion to fight the recession, the Eurozone began to revert to tightening budgets in order to rein in public deficits.

Overall, eight years after the initial financial crisis, the global recovery has been tepid, and multiple issues remain to be tackled. Central banks, pushed to the limits of their stabilization capabilities, have deployed large-scale unconventional measures, but a number of observers fear that they might face difficulties exiting from this "liquidity trap", when interest rates are at or close to zero, and risk running out of ammunition to fight the next economic shock. Meanwhile, prolonged weak economic performance risks putting the global economy in a permanent state of "new mediocre", as coined by IMF director Christine Lagarde. Nowhere are these problems more prevalent than in the Eurozone, which suffered from a comparatively weaker recovery and even experienced a double-dip recession between 2011 and 2013. Significant slack remains in the form of high unemployment, particularly in the peripheral Euro countries. Successful macroeconomic stabilization is made more difficult by the unique architecture of the EMU, requiring coordination of national fiscal authorities, and by the divergent economic conditions of the periphery and the core. Under these circumstances, studying the effects of post-crisis economic policy in the Eurozone is of great academic and public interest.

Aim and purpose

The main goal of this thesis is to examine how macroeconomic policy impacted the economic performance of the Eurozone following the 2008 crisis. Economic policy will be examined using the framework of McCulley and Pozsar (2013), by analyzing the aggregate stance of fiscal and monetary policy over the crisis. Conducting an empirical analysis of the evolution of Euro area economic policy, its effects and transmission mechanisms, this research will thus evidence how it affected the crisis recovery process and economic performance. The expected conclusion of the research is that the policy-mix is a large determinant of the economic performance of the Eurozone in the current context of a liquidity trap. Moreover, the remainder of this chapter will present how such research is socially as well as

theoretically relevant, by evidencing its contribution to the existing body of literature of public administration and to contemporary societal issues.

1.1 - Problem analysis

Following the fall of the American investment bank Lehman Brothers in 2008, the world experienced the most severe financial shock since 1929, with the collapse of global asset prices inducing a worldwide recession in 2008-2009 (**Figure 1.1**). In Europe, this financial meltdown revealed deeper problems within the Economic and Monetary Union. Masked by the common currency since its creation were excessive credit flows between core and peripheral member states which induced, in the latter countries, housing and consumption bubbles, current account imbalances, and ultimately the deterioration of their competitiveness (Baldwin et al. 2015). The 2008 Global Financial Crisis (GFC) triggered the collapse of these bubbles and a "sudden stop" crisis when banks in creditor countries (those with current account surpluses, i.e. the "core" countries") stopped lending to those in a current account deficit position. Strains in the Eurozone banking system morphed into a full-blown sovereign debt crisis as risk premiums rose and countries bailed out their banking systems, thereby transferring private liabilities onto public balance sheets. Whereas other advanced countries started recovering from the GFC in 2010, the Eurozone experienced a double dip recession (**Figure 1.1**).

The EMU has since then been stuck in a triple crisis: a banking crisis (with an overhang of private debt and damaged asset prices) combined with a sovereign debt crisis and a growth crisis, with all the characteristics of a self-reinforcing cycle (Shambaugh, 2012). The sovereign debt crisis, in particular, has damaged the EMU's fiscal capacity for macroeconomic stabilization, leaving monetary policy as "the only game in town" (El-Erian, 2016a). This is problematic as the magnitude of the 2008 shock is almost unprecedented. Indeed, advanced economies have been pushed into a "liquidity trap", a situation in which the lowering of interest rates by central banks to even their zero lower bound is not sufficient to stabilize the economy. This problem forces the monetary authority to resort to increasingly unconventional policies to further conduct macroeconomic stabilization.

In addition the European economic area exhibits unique characteristics, due to its institutional setup as a "monetary union without a fiscal union" (Verdun, 1996). The budget of the EU as a supranational fiscal entity is very

Figure 1.1: Crisis recovery in advanced economies and the Eurozone double-dip recession
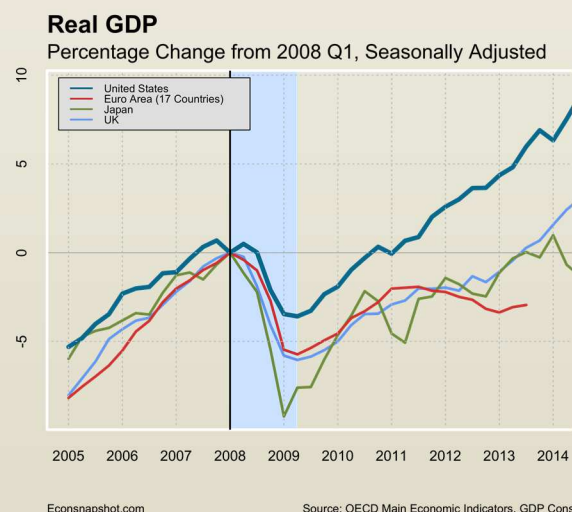

Figure 1.2: Unemployment in the Euro area versus the US.
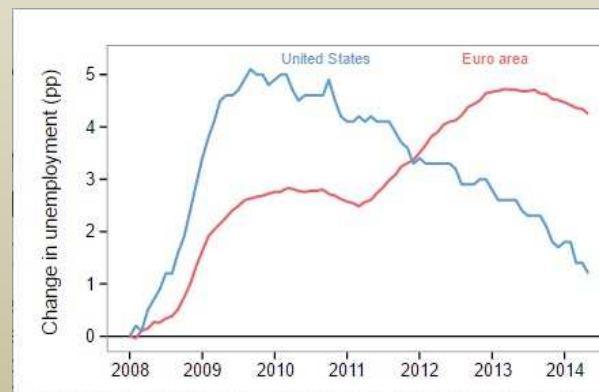
Source : Draghi (2014)

small, and fiscal policy at the Eurozone level is conducted through a coordination of national fiscal policies by a constraining framework that limits fiscal expansion by imposing limits on deficits and debt levels. This setup of a supranational monetary policy combined with constrained, national fiscal policy is unique, and thus presents unique challenges for macroeconomic stabilization. One of the greatest issues is one raised by the Optimal Currency Area (OCA) theory, which predicted that the EMU would have a hard time adjusting to an asymmetric shock, notably due to low labor mobility and the lack of fiscal transfers (as in a federal state, for example, in which the larger federal budget helps with the absorption and distribution of the shock throughout the economic area).

The macroeconomic response to the crisis, after an initial fiscal and monetary stimulus in 2008-2009, has consisted mostly of fiscal austerity throughout the area coupled with progressive monetary easing. The result has been a rather weak and incomplete recovery by all metrics[1], compared to past crises or to other advanced economies (**Figure 1.1 and 1.2**). This raises the question, to what extent is the economic policy since the crisis responsible for post-crisis economic performance? Indeed, failing to adequately stabilize the Eurozone economy could have dire consequences in this monetary-dominated policy regime, as the ECB could be "running out of ammunitions" to fight future shocks.

With a self-reinforcing dynamic between the Euro's three crises (Shambaugh, 2012), macroeconomic stabilization policy has a central role to play in resolving the Eurozone crisis as a whole. This mission is also of crucial importance for the European Union at its core, according to Baldwin et al. (2015), as "*the economic malaise is feeding extremist views and nationalistic tendencies*" which undermine the European sentiment and the foundations of the EU at a time when it is faced with numerous challenges.

Thus, the Central Research Question of this thesis is as follows: How can macroeconomic stabilization policy explain the performance of the Eurozone economy following the 2008 crisis?

Sub questions:

(1)-What has been the performance of the economy since the crisis?

(2)-How has the aggregate policy-mix evolved during the crisis?

(3)-To what extent can the Eurozone's economic performance be attributed to the policy-mix?

(4)-What underlying mechanisms explain the relationship between economic policy and performance?

(5)-What would be an appropriate policy-mix moving forward?

These questions will be answered in the thesis as follows. Chapter 4 (Fiscal policy) and chapter 6 (Monetary policy) will outline the post-crisis trajectory of their main target variable, respectively GDP and inflation **(1)**. Each chapter will then present the changes in fiscal/monetary policy (respectively)

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[1] Aggregate GDP has only recently exceeded its pre-crisis level, with significant output gaps remaining in some countries. On the side of inflation the ECB has been struggling to meet its target of close to 2% since 2013. Lastly, while aggregate unemployment is on a downward trend, it has remained above 10% until July 2016, and youth unemployment only dropped under 20% in 2017.

since the crisis, using the indicators developed in chapter 2 and 3, while the concluding chapter will graphically represent the path of the aggregate fiscal-monetary mix throughout the period **(2)**. Following, the chapters measure the effects of these policy changes on the target variables **(3)**, and offer a qualitative analysis of their transmission channels and impact. This discussion is furthermore supported by chapter 5, analyzing the relationship between short and long-term effects of policy, to answer subquestion **(4)**. Finally, Chapter 7 concludes on the findings of the thesis, identifying avenues for improvement and suggesting possible trajectories for the future path of macroeconomic policy **(5)**.

1.2 - Theoretical relevance

This master thesis will contribute to the body of knowledge on the Economic and Monetary Union by linking the existing theories with an empirical analysis of macroeconomic policy in the EMU in the years 2008-2016. The EMU, inspired largely by the Delors Report, finds the theoretical underpinnings of its architecture in two strands of the literature (Hix and Hoyland, 2011). The first is the theory of Optimal Currency Area, or OCA. The second is a combination of neoliberal and monetarist policy ideas. These theories are further discussed in the literature review of this thesis (**Annex 1**).

Neoliberalism as a political ideology has been mostly influenced by the Chicago school of economic thought, and particularly by Milton Friedman, the father of monetarism. In the political arena, it was first championed by Margaret Thatcher and Ronald Reagan. This movement advocated for a very specific set of economic policies. Among its prescriptions was a reduced role for fiscal policy and for the state in general, notably with the use of fiscal constraints to limit government spending and deficit, and so "keep the house in order". Such fiscal restrictions are perfectly exemplified by the EMU's Stability and Growth Pact (Ostry, Loungani and Furceri, 2016). With fiscal policy in the backseat, a strongly independent central bank focused primarily on managing inflation would be the dominant policy tool for macroeconomic stabilization, according to monetarists (Friedman and Schwartz, 1963).

This policy paradigm became the dominant consensus in the 1980s (McNamara, 1998). It has been central to the institutional architecture of the EMU since its inception and, indeed remains its frame of reference today for economic policy. This thesis will thus contribute to the body of knowledge of public administration by investigating how this policy regime has fared with respect to macroeconomic stabilization, in the case of the Eurozone crisis.

Along with the neoliberal consensus, the OCA theory (developed by Mundell, 1961; McKinnon, 1963; and Kenen, 1969) also exerted an influence on the creation of the EMU. The theory distinguished different criteria to assess whether a group of countries would benefit from a monetary union, which depends largely on their level of economic integration. In that regard, the "convergence criteria" put in place before the launch of the euro can be seen as a result of concerns brought by this theory. A main cost of joining a monetary union is the loss by the national authorities of monetary policy as a macroeconomic stabilization tool. Such a loss becomes especially damaging to economic stability if poorly integrated member states are hit by an asymmetric shock (a shock that affects parts of the currency union differently). This is exactly what happened to the EMU with the 2010 crisis.

Indeed, some researchers warned policymakers, on numerous occasions, that the EMU was not an optimal currency area yet (see e.g Eichengreen, 1990; Feldstein, 1992; De Grauwe and Vanhaverbeke, 1993). Divergent economies, the rigidity of labor mobility within and across countries, and especially the lack of shock-absorption mechanism due to an institutional setup of a "monetary union without a fiscal union" (Verdun, 1996) were all OCA criteria indicating a suboptimal union (Jager and Hafner, 2013). The current consensus view (Baldwin et al., 2015) of the causes of the Eurozone crisis sees it largely as a consequence of the EMU being a "failed" OCA. The monetary union acted as a catalyst by allowing the buildup of cross border imbalances between divergent economies without raising concerns; indeed, large capital flows from core to peripheral member states were seen as a desirable feature of the EMU. Furthermore, with the impossibility of currency devaluation, combined with the rigidity of labor and product markets, post-crisis competitive adjustment was made all the more costly in terms of output.

The OCA theory is particularly relevant to the current predicament of the EMU, and vice versa. Indeed, The EMU, though suboptimal, is the most in-depth example of cross-country monetary integration in the world; in other words, it is the closest attempt yet at forming an OCA. Furthermore, the phenomenon of the Eurozone crisis provides an exceptional example of an asymmetric shock in a currency area. Studying the macroeconomic policy of the EMU during this crisis and its effects should thus enrich the literature on the EMU as well as the OCA theory.

1.3 - Social relevance

Economic policy orientations decided at the EU level have been acutely important to European citizens since the crisis. Disagreements over the appropriate path for crisis management reflect a growing geographic divide between peripheral member states, which have suffered comparatively more from recession and unemployment, and "core" countries which have enjoyed comparatively more robust performance. Furthermore, if there is one thing researchers and policymakers seem to agree on, it is that optimally managing the Eurozone policy-mix will require further policy coordination, particularly between the national fiscal policies (see for instance De Grauwe and Ji, 2016; Corsetti, Higgins and Pesenti, 2016). Such coordination would require some degree of consensus over the appropriate policy-mix at the Eurozone level. The present thesis aims to contribute to such a consensual diagnostic in several ways. First, its social purpose is to present a narrative explaining how stabilization efforts during the crisis affected the EA economy and led to the current situation, in order to better understand the challenges facing policymakers today. It also aims at answering a socially relevant question, namely "was the crisis policy response so far effective? And if not, what could have been done better?". Answering this question should furthermore suggest an appropriate course of action moving forward.

Lastly, the present research will attempt to evaluate McCulley and Pozsar's (2013) proposal arguing for the appropriateness and effectiveness of "helicopter money", or the monetary financing of fiscal deficits, as a policy option to help solve the crisis, as proposed by a number of researchers (e.g Turner, 2013; Reichlin et al., 2015; Paris and Wyplosz, 2014; Buiter, 2014).

Chapter 2 - Theoretical framework: Macroeconomic stabilization policy during a liquidity trap

The Literature review included with this paper (Annex 1) investigated the practice of macroeconomic stabilization policy up until the 2008 global financial crisis, that is, when the economy was in a "normal" situation. However, this "business as usual" scenario does not apply anymore to the Eurozone and much of the developed world. Indeed, since the crisis, advanced economies have been stuck in a liquidity trap, which has important implications for the proper conduct of stabilization policy, as this chapter will show.

2.1 - What is a liquidity trap?

The most common definition of a liquidity trap is a situation in which conventional monetary policy becomes impotent because the short-term nominal interest rate are near or at their zero lower-bound (Krugman, 1998; Eggertsson, 2006). Liquidity traps typically occur after the burst of debt-fuelled asset price bubbles (McCulley and Pozsar, 2012). After the burst of the bubble, asset prices fall, but the debt used to finance them does not. This leads to a reduction in the private sector's net worth, and consequently, a reduction of its ability and willingness to borrow and spend, in a vicious, self-reinforcing circle. This event signals a shift in the private sector, from a secular leveraging cycle to a deleveraging cycle, also known as the "Minsky moment" (McCulley, 2009).

This deleveraging, when it is large enough, can lead the central banks to lower interest rates down to their zero lower bound, with the objective of stimulating credit demand and economic activity[2]. Liquidity traps are rare phenomena. The only two examples of such episodes in modern history are the US following the Great Depression, and Japan since the 1990s. They therefore pose a serious challenge to policymakers, who are not used to managing them. The available literature on the subject offers two main views on how to overcome a liquidity trap. The first is based on managing future inflation expectations. The second argues that fiscal expansion is the most effective solution to increase output and get out of the liquidity trap.

2.2 - Expectations view

The first view was first put forth in Krugman (1998) and Eggertsson and Woodford (2003), and asserts that central banks can still stimulate credit demand at the zero lower bound. By credibly committing to higher nominal money growth in the future, and therefore higher inflation, central banks can raise future inflation expectations, thereby reducing future real interest rates below their nominal zero bound and stimulating credit (and consequently, demand and growth). Krugman sums up this strategy as central banks "credibly promising to be irresponsible". According to this view, then, monetary policy is still effective in a liquidity trap, but through a different channel than usual, namely its impact on inflation expectations. Thus, according to Eggertsson (2006), a liquidity trap is a "true" trap only in the case where central banks cannot raise expectations of future inflation. This is the reasoning behind the

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[2] According to McCulley and Pozsar (2012), however, this is ineffective, since the demand for credit has now become inelastic as the private sector as a whole is deleveraging: net credit demand has become negative, even with interest rates at zero, due to agents being constrained by a debt overhang. In turn, the private deleveraging cycle depresses demand, leading to persistent shortfalls in income and enduring economic slack through high unemployment, causing risks of deflation.

programs of Quantitative Easing undertaken, one after the other, by all major central banks since 2008. Through unsterilized asset purchases on financial markets, central banks increase the supply of base money in the economy, leading to higher nominal money growth and thus inflation.

There is, however, one problem with this theory, as pointed out by McCulley and Pozsar (2012). Both Krugman (1998) and Eggertsson and Woodford (2003), in their research, relied on economic models in which all agents are alike and higher inflation expectations lead to an increased willingness to borrow in every sector. These models thus fail to take into account the assumption that some of the economic agents might be debt-constrained due to an already too high leverage.

Indeed, when taking into account this simple assumption, they reach vastly different conclusions. Krugman and Eggertsson (2010), in their subsequent paper, model a liquidity trap situation again, but this time with debt constraints on some agents[3]. In this case, then, negative (real) interest rates might not be a sufficient solution to a liquidity trap, since the existing debt overhang might prevent additional private borrowing. They conclude that these results "suggest that the current conventional wisdom about what policy makers should be doing now is almost completely wrong", contradicting their own previous research.

2.3 - Keynesian view

Krugman and Eggertsson (2010), in their seminal contribution, acknowledged that in a liquidity trap induced by a deleveraging shock, the famous Ricardian equivalence proposition doesn't hold, because debt-constrained agents cannot afford to be forward looking. Thus, there is no crowding-out of private spending by fiscal stimulus. In fact, as their results suggest, expansionary fiscal policy should be crowding-in private spending, highlighting the reemergence of Keynesian fiscal multipliers.

Delong and Summers (2012) further explore the effectiveness of fiscal policy as a stabilization tool in an economy facing a liquidity trap and enduring slack in the form of high unemployment. They argue that in this situation, expansionary fiscal policy is very likely to be appropriate, and even self-financing under three conditions: fiscal multipliers are modestly positive, borrowing rates for sovereigns are in the average range, and there is a small degree of hysteresis[4]. A short definition of hysteresis is presented in the text box below, while a more comprehensive discussion of the concept is offered in **Annex 2**.

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[3] As the authors note, this is a surprisingly powerful assumption, as it reveals the possibility of Fisherian debt deflation, the paradox of thrift, and high fiscal multipliers consistent with Keynesian propositions for expansionary fiscal policy.

[4] The available literature on the subject tends to concur with these assumptions. See, e.g., Romer (2011), Nakamura and Steinsson (2014), Auerbach and Gorodnichenko (2012) for studies of fiscal multipliers in liquidity-trap conditions; and IMF (2009), Clark & Summers (1982) or Davis & von Wachter (2011) for evidence of hysteresis.

According to Romer & Chow (1996:471), hysteresis exists when "one-time disturbances permanently affect the path of the economy". Phelps (1972) was the first to advance the idea that recessions can induce long-term scars on the economy even after they end; that is, they may permanently lower potential output. Later, Blanchard and Summers (1986) theorized how hysteresis could turn high cyclical unemployment into structural unemployment, thus affecting the long-term supply potential of the economy. Policy-induced shocks are also affected by hysteresis. Thus, with regards to macroeconomic stabilization, hysteresis can be defined as the relationship between short-term and long-term effects of policy changes on the economy. The more hysteresis is prevalent, the more forceful stabilization policy is warranted, as keeping the economy under potential will be costlier. (cf. **Annex 2** for a detailed analysis.)

With interest rates at their lowest in decades and positive multipliers, expansionary fiscal policy should, in principle, be a very appropriate tool for macroeconomic stabilization under current conditions. However, this strategy isn't exempt of flaws, as stressed by McCulley and Pozsar (2013). What academics prescribing fiscal expansion as the response to a liquidity trap fail to take into account are the political hurdles to further stimulus in economies with already high and potentially unsustainable debt-to-GDP ratios. The Eurozone perfectly exemplifies this reality, as it faces a double constraint impeding fiscal stimulus. Firstly, the advent of the sovereign debt crisis, combined with the lack of supranational fiscal capacity, means that the countries that would benefit the most from fiscal expansion (peripheral countries with higher unemployment and economic slack) are also the ones with the highest debt-to-GDP ratio and thus, the least room for stimulus, while no EU-level fiscal authority can substitute for their lack of fiscal space. And secondly, the EMU institutional setup, in the form of the now-reinforced Stability and Growth Pact (SGP), also provides a binding constraint that precludes any major fiscal easing over the foreseeable future.

2.4 - Combined monetary-fiscal cooperation: McCulley and Pozsar' (2013) framework

In light of the limitations outlined above facing the monetary and fiscal authorities on their own, a third stabilization strategy has recently gathered significant attention, and oftentimes support, in both academic and policymaking circles[5]. This rather radical policy option is known as "helicopter money", a term coined after Milton Friedman's (1968) famous analogy comparing this policy to dropping cash from helicopters onto the citizenry. The definition of helicopter money is "***a permanent/irreversible increase in the nominal stock of fiat base money rate which respects the intertemporal budget constraint of the consolidated Central Bank and Treasury***" (Buiter, 2014;1). In more practical terms, it involves coordinated monetary-fiscal cooperation, in the form of a fiscal stimulus financed by debt monetization from the central bank (i.e "permanent QE"). Furthermore, this policy is always effective in raising aggregate demand (Buiter, 2014)[6].

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[5] see, inter alia, Turner (2013), Paris and Wyplosz (2013, 2014), Muellbauer (2014), and Reichlin et al. (2013).
[6] "*There always exists – even in a permanent liquidity trap – a combined monetary and fiscal policy action that boosts private demand – in principle without limit. Deflation, 'lowflation' and secular stagnation are therefore unnecessary. They are policy choices.*" (Buiter, 2014:2)

Integrating the body of knowledge outlined above in this chapter, McCulley and Pozsar (2013) further develop this analysis, and propose a framework by which to assess western nations' stabilization policies since the eruption of the crisis. They argue (p.2), during the private deleveraging cycles that always accompany liquidity traps, that:

"(1) monetary policy on its own is ineffective as it lacks willing private borrowers to respond to monetary stimulus; that... ...

(2) fiscal policy is highly effective, but on its own it may be politically constrained to embark on meaningful stimulus; and that... ...

(3) fiscal-monetary cooperation under such macro constellations can help solve the problem that each authority faces on its own

(4) fiscal policy can solve monetary policy's problem of a lack of borrowers by becoming a borrower and spender of last resort, and

(5) monetary policy can solve fiscal policy's problem of too much government debt by monetizing some portion of this debt, and so

(6) give the sovereign's balance sheet a "facelift" and hence the political license and the balance sheet capacity to borrow.

What this means is that that during secular private deleveraging cycles what matters is not monetary stimulus per se,

(7) but whether monetary stimulus is accompanied by fiscal stimulus for as long as the private sector deleverages, and

(8) whether monetary policy is communicated in a way that helps allay concerns over the debt-to-GDP impact of ongoing fiscal stimulus

(9) which in turn is the surest possible way to generate the nominal income growth necessary for the private sector to deleverage. This cooperation framework is consistent with inflation (or nominal GDP) targeting frameworks at the zero bound."

Furthermore, McCulley and Pozsar's two-dimensional framework, illustrated in **Figure 2.1**, provides this research with a "policy map" on which to track the position of the EA fiscal-monetary policy-mix and map its evolution over the crisis. This will serve as a guideline to evaluate the impact of fiscal and monetary policies on macroeconomic performance, comparing data with theoretically-driven hypotheses[7].In order to get an in-depth understanding of the underpinnings of this theory, a detailed review of the framework and its predictions can be found in **Annex 3.**

To summarize, the matrix in **Figure 2.1** can be read as follows. On the vertical (y) axis is plotted the stance of fiscal policy, with the horizontal line in the middle of the axis representing a (cyclically-adjusted) neutral fiscal policy stance, or a Balanced Budget (noted BB). Thus, on the top-half of the matrix fiscal policy is expansionary, and on the bottom-half it is contractionary. The horizontal (x) axis

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[7] More specifically, for each quadrant of this matrix, corresponding to a specific combination of public and private debt dynamics, McCulley and Pozsar (2013) indicate the dominant policy concerns and the appropriate monetary policy response. They also predict the effects of the fiscal-monetary policy mix associated with each position on the matrix.

conversely represents the stance of monetary policy, with the vertical line in the middle of the axis representing the point where interests reach zero, noted ZB for Zero Bound. Thus on the left side of the matrix, interest rates are positive (and higher the further we go to the left), and on the right hand side they are at zero and "unconventional" policies (read: Quantitative Easing) become the main policy tool. The framework also distinguishes between different degrees of QE policies and their effects, with the three associated footnotes below the matrix (see **Annex 3** for details on these). The matrix then yields four policy quadrants representing broadly four different types of fiscal-monetary policy mixes, with their degrees of variation represented by their relative position in the quadrant.

Importantly, on the (x) axis is also plotted the state of private sector debt dynamics because, as the authors argue, it is what determines whether monetary policy operates on the left or right hand side of the matrix. Conventional, interest rate-based monetary policy (left side of the matrix) is associated with a long-term private leveraging cycle, which was the case in the advanced world from the 1950s to 2008. However, liquidity trap situations happen when the private sector shifts from leveraging to deleveraging following the burst of large credit bubbles (noted as the Minsky Moment, or MM, on **Figure 2.1**), thus forcing central banks to operate on the right hand-side of the matrix (cf. Chapter 2.1). The authors argue, like Eggertsson and Krugman (2010), that this private deleveraging also impairs the effectiveness of QE-based policies, and that fiscal policy is most effective as a stabilization tool (echoing the arguments of Delong and Summers (2012)). Consequently, policy-mixes in the top-right quadrant of the matrix are strictly superior to those in the bottom-right quadrant. According to the authors, the best monetary policy can do in this situation is support the fiscal authority in its "credible promise to be irresponsible" and run fiscal deficits to stabilize the economy, which is done with overt monetary financing of fiscal deficits, or "Helicopter Money" (on the top-right corner of the matrix).

Figure 2.1: Framework for macroeconomic stabilization policy in leveraging and de-leveraging cycles
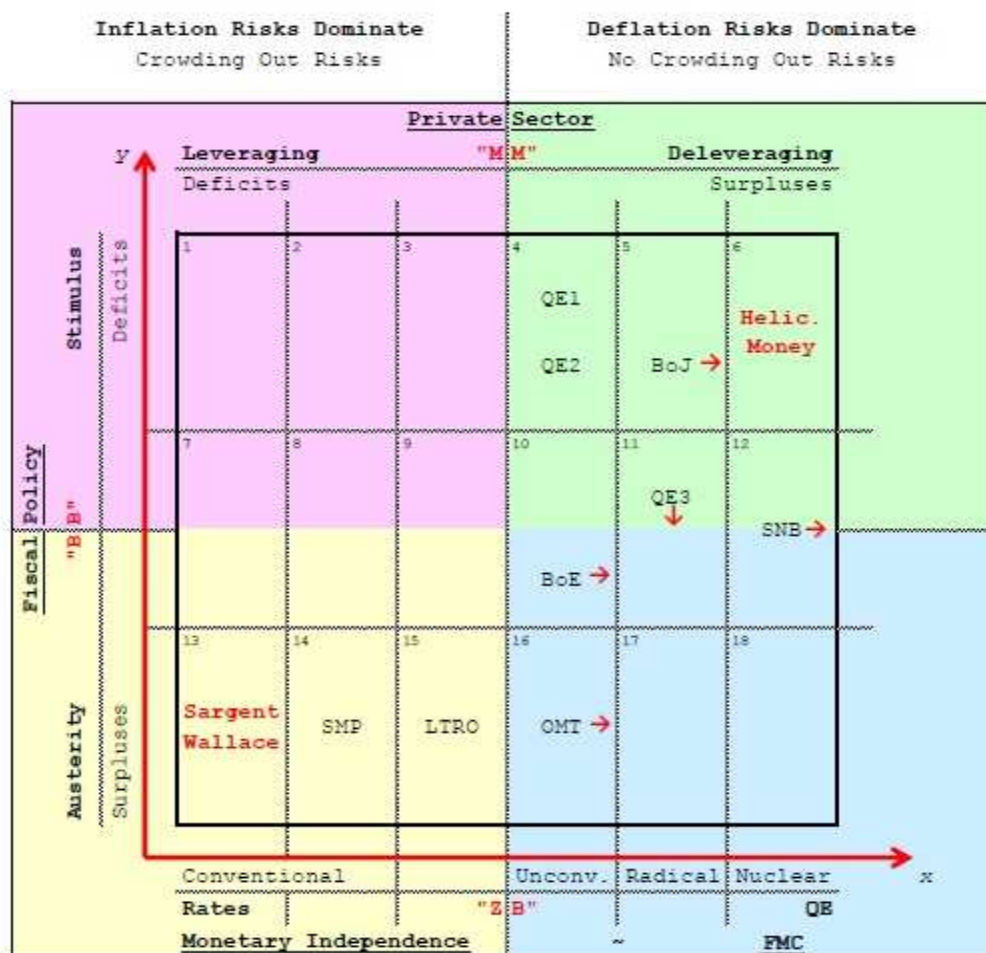
Source : McCulley and Pozsar (2013)

2.5 – What is the effective stabilization policy in a liquidity trap? Summary of the views

The following table offers a short summary of the views, in the body of literature presented in this chapter, regarding the optimal policy response to a liquidity trap scenario. For each paper, the table reports the prescribed policy response, whether fiscal or monetary expansion (or both), and whether and why it is thought to be effective.

Authors	Views on monetary policy	Views on fiscal policy
Krugman (1998), Eggertsson and Woodford (2003)	Monetary policy is effective in stimulating credit growth (and thus the economy) through the impact of QE on inflation expectations, allowing the central bank to push real interest rates below zero.	-
Eggertsson and Krugman (2010)	Monetary policy might be ineffective in raising credit demand if there is a debt overhang preventing the private sector from borrowing more.	A private sector deleveraging suggests stronger effects from expansionary fiscal policy, notably due to the paradox of thrift.
DeLong and Summers (2012)	-	In a depressed economy facing a liquidity trap and large supply-side slack, expansionary fiscal policy is highly effective, particularly if there is hysteresis.
McCulley and Pozsar (2013)	Monetary policy (QE) on its own is ineffective due to the private sector deleveraging, but it can be effective "in a different sense" by supporting fiscal expansion through overt monetary financing.	Expansionary fiscal policy is the most effective stabilization policy. The public sector needs to act as a "spender of last resort" to maintain the economy afloat while the private sector deleverages.

2.6 – Hypotheses

Sub-questions **(1)** and **(2)** of the research are descriptive questions which do not require hypotheses to be answered. To answer sub-questions **(3), (4)** and **(5)**, the theoretical expectations previously described are used to derive the following hypotheses :

H1 : Expansionary fiscal policy has a high positive impact on output at the ZLB. Conversely, fiscal consolidation has a large contractionary effect.

With an economy facing substantial slack and unemployment, additional government spending is neither neutralized by higher interest rate from the central bank (because of the ZLB) nor by supply-side bottlenecks (Delong and Summers, 2012), and stimulates in fact private spending from liquidity-constrained agents (Eggertsson and Krugman, 2010). Thus it is hypothesized that such a policy impacts output significantly and positively. The reverse proposition is derived from the paradox of thrift argument: if both the public and private sector attempt to deleverage and save more at the same time, aggregate demand and thus output will fall (Eggertsson, 2010; Eggertsson and Krugman, 2010).

H2: Unconventional monetary easing at the ZLB, without being accompanied by fiscal expansion, is ineffective in raising future inflation expectations, because credit constraints in the private sector impair the monetary policy transmission mechanism.

In the absence of lower nominal interest rates as a policy tool, monetary policy is thought to be effective through its impact on future expected inflation, thereby lowering real interest rates, stimulating credit demand and, ultimately, output (Eggertsson and Woodford, 2003). However if the private sector is debt constrained, as modeled in Eggertsson and Krugman (2010), even negative real interest rates might not be sufficient to induce credit growth. The central bank can influence the price of credit, but not the demand for it, only the fiscal authority can (McCulley and Pozsar, 2013:14). Thus, without fiscal expansion (higher public debt demand), the hypothesis is that the central bank will fail to create dynamics raising inflation expectations.

H3: Hysteresis effects induce permanent costs in the event of negative output gaps, lowering potential GDP and amplifying the negative effects of restrictive economic policy in the long term.

This last hypothesis derives from Delong and Summers (2012) as well as Blanchard and Summers (1986). Hysteresis is thought to affect potential output through a variety of channels related to the three fundamental determinants of potential output: labor (for instance through cyclical unemployment turning structural), capital (through diminished private and public investment), and total factor productivity (see **Annex 2**). It is an important proposition for the purpose of this research, as investigating it will yield valuable insights on how macroeconomic policy decisions in the short run affect the economy in the long-run. Hysteresis can thus be viewed as a phenomenon of path-dependency of the economy.

Together, these three hypotheses will help us understand :

-Whether fiscal and monetary policies had any macroeconomic effect (sub-question 3)
-Why these policies were or weren't effective (sub-question 4)
-What policies should be effective as long as the economy is at the ZLB (sub-question 5)

Chapter 3 - Research Design

This chapter will present the design of this research, the single case-study, laying out why this design is chosen and why it is preferred over other research designs. Furthermore, it will discuss the issues of construct validity, internal validity, external validity and reliability relating to the single case-study design, and present the methods of data collection and analysis.

3.1 - The single case-study

According to Yin (2009), a case study design should be considered under certain specific circumstances. It is most appropriate when the focus of the research is to answer "how" and "why" questions; when it analyzes a real-life phenomenon where variables cannot be manipulated; when context is important; and when there are not clear boundaries between the phenomenon and context[8]. This description fits well with the object of the present research, which aims to analyze Euro Area economic policy in the specific context of the Eurozone crisis and its defining characteristics (e.g. public and private debt overhangs, EMU setup, "liquidity trap" situation), and to understand the causal mechanisms between the independent and dependent variables (a "how" question). As such, this research design would be guided by the theoretical propositions developed from Chapter 2.

Yin (2009) distinguishes between exploratory, descriptive and explanatory case studies, as well as between single and multiple case studies. According to Baxter and Jack (2008, p.547), explanatory case studies are used when seeking "*to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link program implementation with program effects*". This corresponds to the objectives of the thesis, namely to explain the causal links between policy (implementation) and economic performance (effects). Furthermore, the unit of analysis here is the EMU, because it is the level (supranational) at which monetary policy is conducted and at which the fiscal policy coordination framework (i.e. the SGP) is set out. The case at hand focuses on a single entity with no comparable case, ruling out the multiple case study design[9].

Case studies are mostly associated with qualitative research, however in reality a case study can be based on any mix of quantitative and qualitative data (Yin, 2009; Creswell, 2013). In this instance the phenomenon studied is quantitative in nature, as illustrated by the variables developed in the previous chapter, however gaining an in-depth understanding of the phenomenon and its specific context in the Eurozone requires a qualitative approach. Therefore, this research will gather existing quantitative and

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[8] Thus, a case study is *'an empirical enquiry which is used when you want to understand a real-life phenomenon in depth, but such understanding encompasses important contextual conditions – because they were highly relevant to your phenomenon of study. It copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result it relies on multiple sources of evidence, and it benefits from the prior development of theoretical propositions to guide data collection and analysis'* (Yin, 2009, p.18).
[9] It is however true that a multiple case study would have been possible (and appropriate) if the unit of analysis was set at the national level instead, but this is a deliberate choice to better analyze the dynamics of the Eurozone economy as a whole, as well as for practical reasons related to the time-constraints of the research.

qualitative evidence from the relevant literature and policy documents, and use a qualitative analysis to interpret and enrich the data.

3.2 - Variables

Based on the hypotheses from Chapter 2, we can distinguish the variables of the research:

- **Independent variables –** fiscal policy and monetary policy. The stabilization objectives of fiscal and monetary policy are different; while fiscal policy only concerns itself with bringing output to potential (and, as a corollary, unemployment), the monetary authority's primary objective is safeguarding price stability, that is, containing inflation. Therefore, the evaluation of the effects of fiscal and monetary policy will be mainly focused on their respective policy goals.

- **Dependent variable –** economic performance. This variable reflects the objectives of macroeconomic policy, which are to promote price stability and to maintain output at the level consistent with full employment (i.e. its potential level).

- **Moderating variable –** Private sector credit constraints. According to the literature, a private sector deleveraging consistent with a liquidity trap situation strongly moderates the relationship between economic policy and output. It increases the stimulating effect of expansionary fiscal policy because debt-constrained agents aren't entirely forward-looking (Eggertsson and Krugman, 2010) and simultaneously decreases the effects of monetary stimulus by impeding it from generating additional credit demand. Thus, by distinguishing this moderating variable, consistently with McCulley and Pozsar's conceptualization, the research will better understand the specific constraints affecting economic policy during the crisis and how they impact its effectiveness.

- **Exogenous variable –** Hysteresis. Defined as the path dependency of economic performance, hysteresis is thought to be the mechanism by which the short term effects of economic policy (on actual output) affect long-run performance (potential output). Analyzing the relationship between short and long-term will thus allow this research to reach a better understanding of how the independent variables affect the dependent variable. A more detailed conceptual framework of hysteresis can be found in **Annex 2**.

3.3 - Flow Chart
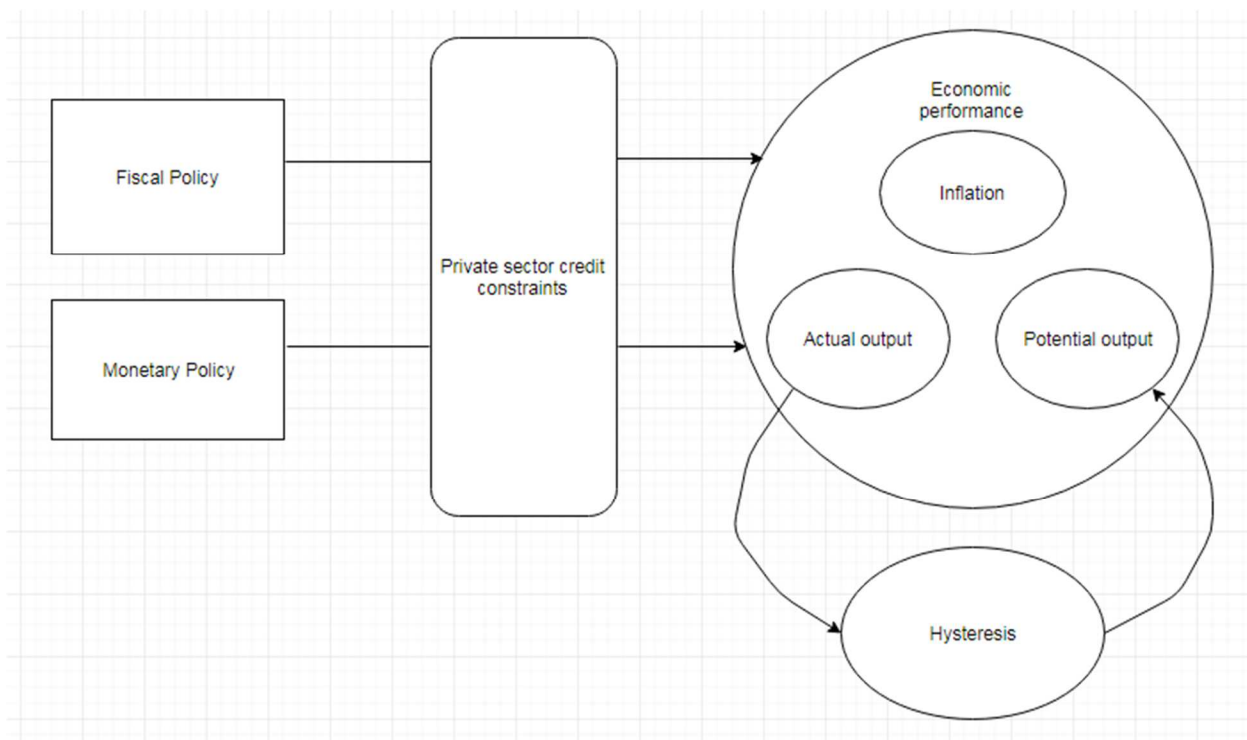
3.4 Operationalization, Indicators and Measurement

This section briefly presents how each variable presented above is operationalized into indicators, how these indicators are measured, and the relationship between them. A discussion of the methods, the validity and reliability of each indicator is offered in **Annex 4.**

First, the variable of **economic performance** is the simplest to operationalize, as the concept is at the very core of macroeconomic stabilization. The corresponding indicators used are *actual* and *potential GDP,* and the *inflation rate*, represented by the changes in the Harmonized Index of Consumer Prices. These indicators correspond to the targets of stabilization policy.

The variable of **fiscal policy** aims to capture the (aggregate) changes in national budgets decided as a result of the crisis, and not the fluctuations resulting from the movements of the business cycle; in other words, the discretionary policy changes, but not automatic stabilizers. The indicator used to represent this concept is the *exogenous change in the fiscal balance*. Two methods are used to measure this indicator. The first method uses data from the overall fiscal balance, and adjusts for the effects of the business cycle to obtain the cyclically-adjusted primary balance (CAPB, or interchangeably, structural balance); the changes in the CAPB then correspond to the indicator. The second method takes a bottom-up, narrative approach, and identifies discretionary (exogenous) policy changes from policy documents. For each method, the indicator is reported as a percentage of GDP. The ratio of change of the economy's GDP to an exogenous change in the fiscal balance is called the fiscal multiplier (Batini et al.,

2014), and thus measures the relationship between the independent and dependent variables, fiscal policy and economic performance. That is, how much GDP gain/loss is caused by a fiscal policy change of 1% of GDP.

 The variable of **monetary policy** is more difficult to adequately capture due to the prevalence of the liquidity trap during the crisis, when conventional policy becomes constrained as rates approach zero. Thus, the variable is operationalized into two indicators, the *ECB's main interest rate*, and the *size of its balance sheet*. The first indicator captures conventional policy changes, before the liquidity trap is binding, while the second identifies unconventional policy changes, when the space for interest rate cuts is lacking. The relationship between these indicators and those of the dependent variable is also less straightforward to establish, because of the liquidity trap and the financial instability caused by the Eurozone crisis, which impaired the transmission mechanism of monetary policy. Thus, the thesis will crucially rely on the analysis of the different transmission channels of policy decisions to establish the relationship between monetary policy and performance.

Hysteresis, as noted in Annex 2, refers to the relationship between the short-term and long-term effects of economic changes, whether these are policy-induced or not. Thus the concept relates actual GDP and potential GDP, or, following the works of Blanchard and Summers, actual and structural unemployment. Concordantly, the two indicators used to give an operational measurement of hysteresis are the ratio of changes in actual versus potential GDP, and the ratio of changes of actual versus structural unemployment. These two indicators follow the methodology and results of Ball (2014) and Logeay & Tober (2006), respectively. As a ratio between 0 and 1, both indicators provide an estimate of the potency of hysteresis. In turn, this estimate allows the research to evidence how policy impacts the economy in the long-term, i.e. how its short-term effects on GDP affect potential GDP.

Finally, the existence of a private debt overhang in the Euro Area, and thus of **private sector credit constraints** resulting from the deleveraging cycle that accompanies it, is considered a given[10], which means that this variable will not be operationalized. It serves to conceptualize the specific conditions affecting macroeconomic policy during the Eurozone crisis. Particularly, private credit constraints are associated with liquidity traps (McCulley & Pozsar, 2013), and thus distinguishing this variable will help enrich the qualitative analysis of the transmission and effects of fiscal and monetary policy.

3.5 - Validity and reliability

To evaluate the quality of a case study design, one needs to assess its construct validity, internal validity, external validity and reliability (Yin, 2009). This section will discuss the issues relating to the case study design in general and the specific strategy followed in particular.

Construct validity deals with identifying the correct operational measures for the concepts being studied. In case studies, a common criticism is that the operationalization uses "subjective" measures due to their usual focus on qualitative research. Thus in this research the fact that the indicators are

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[10] For an overview of the discussion and empirical evidence regarding the debt overhang and deleveraging cycle, see, inter alia, ECB (2013); Draghi (2015); Buttiglione et al. (2014); Blanchard et al. (2016); Jimeno et al. (2015); Rogoff (2015).

largely quantitative (and therefore more "objective") addresses this pitfall, while the triangulation of both sources and methods (Denzin, 1978; Patton, 1999) ensures the validity of qualitative inferences. In addition, the feedback of the thesis supervisor is used (Yin, 2009, p.42).

The concept of internal validity deals with establishing a valid causal relationship (Yin, 2009). The major problem impeding internal validity is due to inferences, i.e. the researcher will infer that a particular phenomenon has a specific cause. For that inference to be correct, it needs to be able to eliminate all rival explanations that could cause the phenomenon. There are several ways to ensure a strong internal validity. This research will use the pattern-matching logic (Trochim, 1985): this logic compares theory-derived, predicted patterns with the patterns resulting from the collection and analysis of empirical evidence. The more empirical outcomes "fit" with theoretically-predicted patterns, the stronger the internal validity of the case study. In addition, the "explanation building" logic, which is a specific type of pattern-matching logic (Yin, 2009) can also be used. Again, the explanations derive from prior literature, and the more they seem to fit the data, the stronger the internal validity[11].

External validity describes the degree to which the findings of the research can be generalized to other cases (Yin, 2009). Unlike internal validity, there are no particular methods to improve external validity. For this reason the external validity of a single case-study is limited, and the findings of this research will likely not be transferrable to other cases, as the Euro Area is a unique entity by its conception. However one way to overcome this limitation is to attempt to generalize the findings not to an actual population, but to a theoretical case. In that sense, a single case-study still has some degree of external validity.

The reliability of the case study depends on the extent to which researchers replicating the operations of a study will obtain the same results and reach the same conclusions (Yin, 2009). Thus the reliability of the research as a whole depends on the reliability of the indicators, and the degree to which operational steps are precisely described and documented.

3.6 - Data Collection

Six types of data sources can be used as case study evidence: documents, archival records, interviews, direct observation, participant observation, and physical artifacts (Yin, 2009). In the case of the present research, the last three are largely irrelevant. Interviews of qualified individuals (e.g. officials from the ECB or the European Commission's Directorate general for Economic and Financial Affairs) could yield valuable qualitative insights, however they are, in practice, difficult to put in place due to the limited availability of respondents and the time-consuming nature of the interview process.

This leaves archival records (such as the statistical data from Eurostat) and documents (e.g. minutes of meetings, administrative documents, policy proposals and reports, empirical studies and evaluations, newspaper articles) as the primary sources of data for this research. Yin (2009) states that the use of multiple sources of evidence is an important principle for case study data collection. Collecting and processing information using more than one data source, method or perspective achieves the

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[11] However, Yin (2009) warns that this method is extremely difficult and requires that the researcher possess a great deal of analytic insight about the case. Therefore, the explanation-building logic will only be used as a secondary mean of assessing internal validity, with the pattern-matching logic taking precedence.

triangulation of evidence, and increases the validity of the research. However, archival records and documents suffer from the same weaknesses as a source of evidence (accessibility, retrievability, reporting bias and biased selectivity if collection is incomplete), according to Yin (2009).

3.7 - Data Analysis

Developing an analytical strategy for the evaluation of empirical evidence is a critical aspect of case study research design. According to Yin (2009), there are two types of strategies: developing a case description and basing the analysis on that descriptive framework, or following the theoretical propositions that structure the research as a guideline for analysis, which helps to focus the attention of the researcher on certain data and ignore other. As mentioned above, this research will proceed with the second strategy, using the pattern-matching logic to analyze empirical data against theory-driven predictions. The explanation-building logic will furthermore be used as a secondary tool to guide the research, in order to better understand patterns of data which are not easily explained by existing theoretical propositions.

Chapter 4 – Fiscal Policy

This chapter will investigate the macroeconomic effects of fiscal policy changes implemented as a response to the crisis starting in 2008 in the Euro area. In the Economic and Monetary Union, fiscal policy has remained entirely a national responsibility. Without a fiscal authority at the center of the union, the coordination of fiscal policies in the EMU is achieved through the Stability and Growth Pact (SGP), a common fiscal framework by which national fiscal policies are assessed. Importantly, the SGP does not provide instruments to manage the aggregate (EMU-wide) fiscal stance, in opposition to fiscal federations such as the United States (ECB, 2016c). Nevertheless, fiscal policy is considered a common concern requiring policy coordination by member states, because fiscal decisions by any member can have repercussions on the others due to the close links between EMU countries.

The chapter is organized as follows. Section 1 first details the twin goals of fiscal policy, respectively the sustainability of public finances and macroeconomic stabilization, before presenting how output and national budgets evolved throughout the crisis. Section 2 presents the instruments of fiscal policy in conducting economic stabilization: automatic stabilizers and discretionary impulses. Focusing on the latter, the section presents the indicators used and the evolution of the fiscal stance in Euro Area member states throughout the crisis. Section 3 analyzes the available empirical evidence and reports on the measured economic effects of the Eurozone fiscal policy response. Section 4 concludes.

4.1. Policy Goals: Stabilization and Budget Sustainability

Throughout the ages, keeping sound public finances has been a vital requirement for the prosperity and stability of nations, and it remains a cornerstone of modern fiscal policymaking. Healthy public finances provide many benefits to the economy over the long term, such as more price stability, lower interest rates and higher growth (ECB, 2016c). Aside from this necessary goal, governments aim to foster a stable, prosperous economy, in other words, to maintain the economy at its maximum capacity. This is the macroeconomic stabilization goal of fiscal policy, contributing to high, sustainable growth and full employment. Successful stabilization requires the fiscal authority to mitigate the effects of the business cycles, the upswings and downturns in economic activity. To do so, it needs to tax more than it spends when the economy is overheating, and conversely, to spend more than it taxes during recessions to sustain economic activity. Combining those two objectives of sustainability and stabilization, fiscal policy thus aims to obtain a *"cyclically balanced budget"*, i.e. a budget that may be in surplus or deficit but is balanced over the economic cycle. Therefore, fiscal policy is most often assessed (including by the European institutions) with cyclically-adjusted data[12].

There is an obvious, inherent trade-off between these twin objectives of fiscal policy. While an increase in the budget surplus would be beneficial to the sustainability of public finances, it would also decrease economic activity (for example, a lower consumption after an increase in the VAT), and thus could be

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[12] In the SGP framework, for instance, *"member States set medium-term budgetary objectives (MTOs) which are intended to anchor progress towards sustainable public finances, while allowing budgetary room for manoeuvre. Adjustments required to meet the MTO are defined in structural terms (i.e. net of the impact of the cycle and one-off measures)"* (ECB, 2016c:69).

detrimental to stabilization objectives depending on where the economy is in the cycle. Conversely, a fiscal stimulus would boost output in the short run and thus help stabilize the economy if it is below potential, but it would also add to the existing debt and thus increase the risk to sustainability. Thus an appropriate fiscal stance is one that suitably balances these two objectives of fiscal policy, meaning that ***"there is thus usually not just one "appropriate" fiscal stance, but rather a range thereof, all of which balance stabilization and sustainability objectives, but with different weights on each objective."*** (ECB, 2016c).

According to ECB (2016c), while it is not clear from the available literature where the optimal spot is, sustainability concerns should hold more weight when debt levels are high, because in those cases the *"impact of fiscal adjustment on output stabilization is mitigated through confidence effects via the interest rate channel".* However, Delong and Summers (2012) offer a dissenting argument that, under economic conditions which are likely to prevail during the current crisis (large economic slack, liquidity trap situation, low sovereign interest rates, and hysteresis), fiscal expansion could, to the contrary, pay for itself. This means that fiscal stimulus would both increase output in the short term and lower debt to GDP ratio over the long-term, as the additional economic activity generates tax revenues which eventually pay for the cost of the initial stimulus. Thus, in this particular situation, fiscal expansion would be the optimal policy from both sustainability and stabilization perspectives.

Turning to the relevant dependent variables of fiscal policy, the stabilization objective targets output, and more specifically the output gap, which is the difference, in percentage points, between actual and potential GDP. Like potential GDP, it cannot be observed directly and is instead estimated through complex modeling by economic institutions such as the IMF, OECD and Eurostat. The stabilization goal is to maintain the output gap as close to zero as possible and promote sustained growth. The sustainability goal of fiscal policy, on the other hand, targets two variables, the debt-to-GDP ratio and the deficit-to-GDP ratio. There is no clear consensus as to where the limit beyond which debts become unsustainable is. Although some researchers (Reinhart and Rogoff, 2010) have argued crossing the 90% debt-to-GDP threshold led to lower growth rates, their conclusion and methodology has been disputed (Herndon et al., 2014). Within the EMU, the sustainability goal is defined by the framework of the SGP, which states that a sustainable fiscal position should aim for a debt-to-GDP ratio of less than 60%, with a deficit-to-GDP ratio no greater than 3%.

4.1.1 Economic and budgetary developments in the crisis

Looking first at the economic developments in the Eurozone, we can see (**Figure 4.1**) that after an initial recovery following the 2008 shock, the area fell into a "double dip recession" between 2011 and 2013, with growth falling and turning negative in 2012. After 2013, the economy started to recover, with an aggregate growth rate of 1.2% in 2014, increasing towards 1.8% in 2016. Looking at estimates of the output gap (**Figure 4.2**) yields a similar picture: after falling sharply into negative territory in 2009, the output gap gradually closed in 2011 but then worsened markedly between 2011 and 2013, and subsequently started to recover again. However, we can also see that this aggregate view masks quite high cross-country differences. Overall, peripheral Eurozone countries (the GIIPS) exhibit a much larger output gap than their counterparts from the core, and the difference between the two groups increases markedly during the double-dip recession: whereas output gaps in the core stay stable or worsen

slightly, they explode in peripheral member states. **Table 5.A** (in Annex) details the output gap estimates of the OECD for each Euro area member, as well as for the aggregate, from the beginning of the crisis until present.

Figure 4.1: Annual GDP growth in the Euro area

Source : Tradingeconomis.com, Eurostat.

Figure 4.2: Euro area output gap over the crisis and cross-country differences.
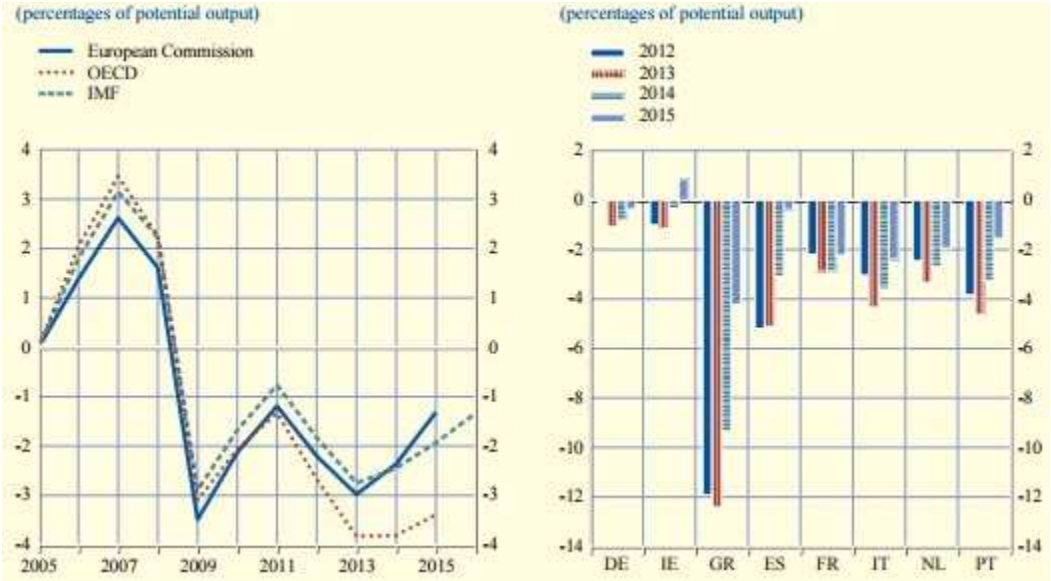
Source : ECB (2014b).

Furthermore, the macroeconomic situation presented by the above data might even be overly optimistic. Jarocinski & Lenza (2016) attempt to refine euro area output gap estimates by finding the macroeconomic model that would also be the most accurate in forecasting inflation. As shown on **Figure 4.3**, the estimates of the output gap are highly sensitive to the parameters used in the models and thus

are subject to a significant amount of uncertainty, particularly in real-time. Model 4 is found to be the most robust according to Jarocinski & Lenza's criterion, and according to the estimates derived from this model, the output gap was in fact much higher than what **Figure 4.2** shows. Instead of -3% in 2013, it is estimated by the model to be at -6%, keeping stable in 2014 and 2015 as opposed to **Figure 4.2**'s projection of a gradual closing. This would indicate that, from a stabilization perspective, fiscal policy is still far away from its goal.

Figure 4.3: Alternative output gap estimates of the Euro Area (in percentage points)
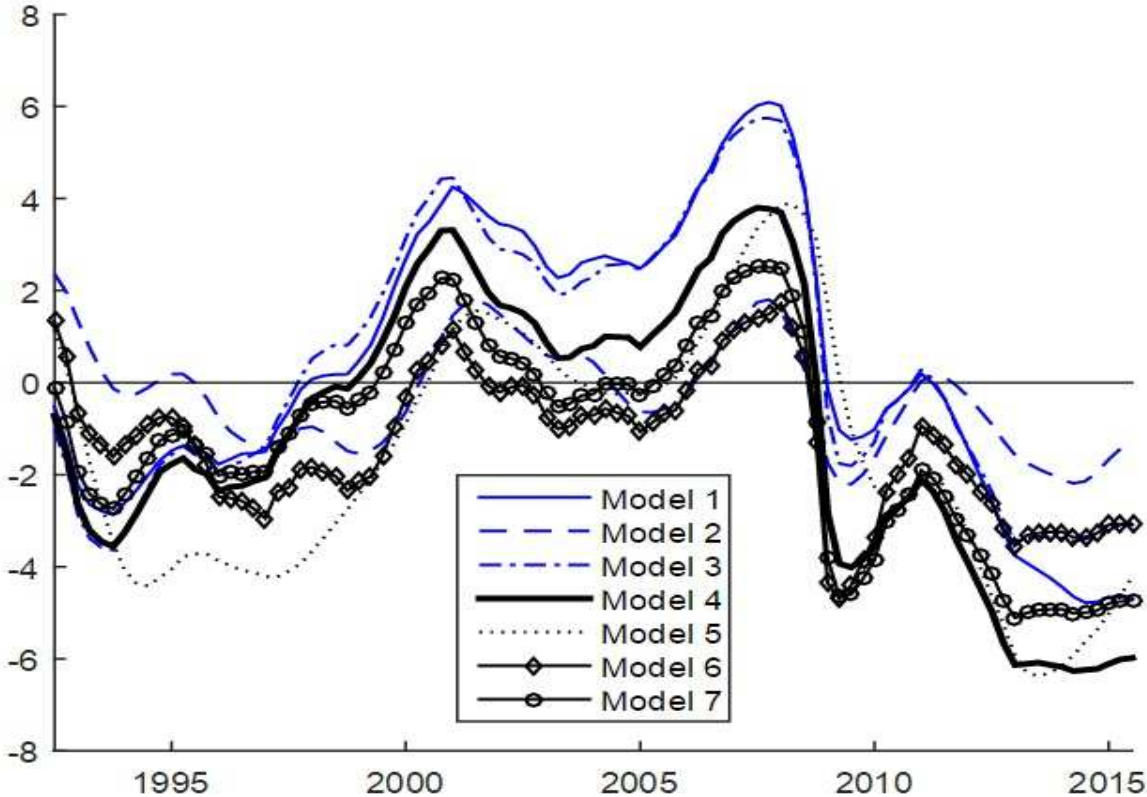
Source: Jarocinski & Lenza (2016)

Turning next to the evolution of public finances over the years, the data indicate ongoing challenges to meet the objectives of the SGP, from the crisis's start until today. Already in the years prior to the crisis, aggregate debt-to-GDP in the Euro area was above the recommended 60% (**Figure 4.4**). It increased markedly after 2008, peaking in 2014 at just above the 90% mark. This debt increase is explained by the movements in the budget balance, with the deficit going from 2% in 2008 to 6% in 2009 and 2010, then resorbing to about 2% by 2015. Interestingly, in the years before the crisis, when the economy was overheating, the budget balance should have been in surplus to stabilize the economy, but instead it was already in deficit. Since 2015 the aggregate euro area public debt ratio is forecast to shrink, but at a slow pace, hitting just 79.5% of GDP in 2026 (European Commission, 2015), still far away from the SGP objective of 60%. Regarding the disaggregated budget data, **Tables 4.B and 4.C** (in Appendix) present the budget balance of each Euro area member state throughout the crisis, both the headline budget

balance, the structural (cyclically-adjusted) balance, and the structural balance net of interest payments (primary). European Commission (2010) further indicates that, out of the "crisis" countries of the periphery, Portugal and Greece already were in deficit before 2008 (Greece even presented fraudulent accounting to cover their excessive fiscal deficits), but Ireland's budget was balanced and Spain was even running a surplus. Regarding the SGP objective, by 2016 forecasts indicate that most countries would be under the 3% deficit threshold, except for Spain, Greece and France.

Figure 4.4: Euro Area Debt to GDP ratio (left) and budget balance (right)

Source : Tradingeconomics.com, Eurostat.

4.2 Policy Instruments: Discretionary Measures and Automatic Stabilizers

The movements in a government budget balance can be differentiated as resulting from two categories of items: automatic stabilizers and discretionary measures. Automatic stabilizers result from the structure of government revenues and expenditures themselves, which react to the fluctuations in economic activity. Income taxes, for instance, tend to be somewhat progressive, while corporate taxes are usually based on firms' profits rather than gross revenue. When incomes drop due to a recession, households pay a lower average/marginal tax rate, and thus taxes fall faster than household incomes; similarly, corporate profits plummet faster than gross revenues, thus in a recession tax revenues tend to automatically fall faster than economic activity and increase the deficit. The reverse effect is observed with welfare spending (i.e. fiscal transfers) such as unemployment benefits, which increases during downturns; and conversely, during upturns in the cycle, the same items increase the budget surplus through the same mechanisms. Thus, automatic stabilizers are counter-cyclical components of the government budget, that is, they are balanced (in budget terms) when the economy is at potential (the output gap is zero), and they evolve in opposing directions to the economy (payments go up when the economy goes down, and vice versa). Stabilizers act as the primary tool for governments to dampen fluctuations throughout the economic cycle, but they do not reflect the decisions of policymakers as they require zero action on their part to take effect.

Rather, the fiscal "policy response" to the crisis that is measured in this thesis falls under the second category, that of discretionary measures. From a macroeconomic stabilization perspective, discretionary fiscal policy is generally considered to be poorly effective, especially compared to automatic stabilizers which are seen as "the first line of defense" against asymmetric shocks (ECB, 2016c). They suffer from implementation lag, tend to be difficult to reverse once implemented, and it is generally difficult to gauge the adequate size, timing and transmission of the fiscal impulse. However, they can be much more effective during exceptionally large crises, such as the current one[13]. Indeed, the Eurozone crisis combines all the elements susceptible to make discretionary fiscal measures more effective than usual. As mentioned in the previous chapter, this thesis uses two methods to measure the exogenous changes in the fiscal balance : the structural balance approach, using cyclically-adjusted data, and the narrative approach, which identifies fiscal measures through the analysis of policy documents.

4.2.1 Evolution of the aggregate fiscal stance

An authoritative source for the structural balance approach is the European Commission's AMECO database, from which its tri-annual European Economic Forecasts are published. **Figure 4.5** shows how the aggregate fiscal stance of the EU (left) and Euro area (right), as measured by changes in structural balance, evolved during the crisis. Negative changes in the structural balance correspond to fiscal expansion, while positive changes represent austerity. As illustrated, after the initial stimulus of 2008-2009, fiscal policy reversed its course in 2010 and became restrictive. The largest fiscal tightening is observed between 2011 and 2013, before the trend reverses towards a broadly neutral fiscal stance in 2015. According to European Commission (2015), between 2010 and 2014 the structural balance of the euro area improved by 3.9 points of GDP, compared with 3.4 and 2.4% in the EU27 and UK, respectively.

Figure 4.5: Budgetary developments in the EU (left) and the Eurozone (right)

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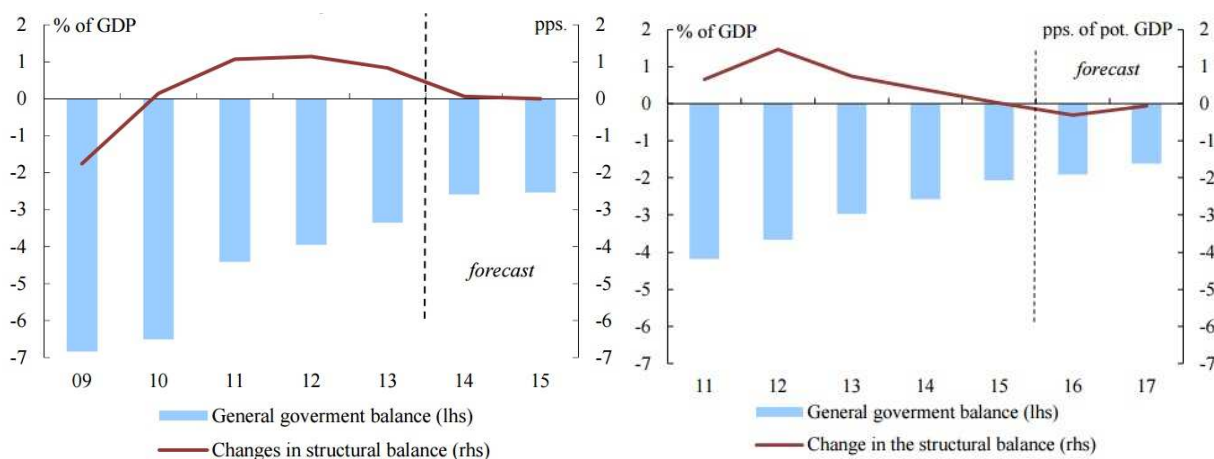
[13] *"under exceptional circumstances, automatic stabilizers alone may be regarded as insufficient to cushion the very detrimental and prolonged impact of deep swings in the cycle. At the same time, the effectiveness of a discretionary fiscal stimulus is generally larger in such circumstances. While there is considerable uncertainty surrounding the size of short-term fiscal multipliers, recent evidence indicates that multipliers may be larger in deep recessions or financial crises or when monetary policy is constrained"* (ECB, 2016c:73).

Due to the shortcomings of the structural balance approach in estimating fiscal efforts during downturns (see, inter alia, Guajardo et al., 2011), the narrative method can complement the picture presented by the structural balance data and offer a more complete and accurate view of the fiscal stance. Carnot and de Castro (2015) build upon this method to create a new indicator, the *discretionary fiscal effort* (DFE), measured, just like the structural balance, in % of GDP. This indicator combines a slightly adjusted structural balance approach on the expenditure side with a narrative approach on the revenue side based on data from AMECO and the EU's Economic Policy Committee. **Table 4.D** (in Annex) presents the changes in structural balance from 2004 to 2013 and compares them with the fiscal stance as measured by the DFE.

While fiscal austerity as measured by the structural balance amounted to 1.1% of GDP per year between 2011 and 2013 in the euro area, according to the DFE it actually amounted to 1.4% per year, or respectively 3.3 and 4.2% of GDP over the period. Thus the DFE points towards a larger fiscal contraction than what is evidenced by the structural data. **Figure 4.6** presents a graphical view of the fiscal stance in the euro area and EU from 2004 to 2013 based on these two metrics, plotting them against the output gap levels to identify whether fiscal policy was pro- or counter-cyclical.

Figure 4.6: The fiscal stance measured by the structural balance and the DFE over the economic cycle.
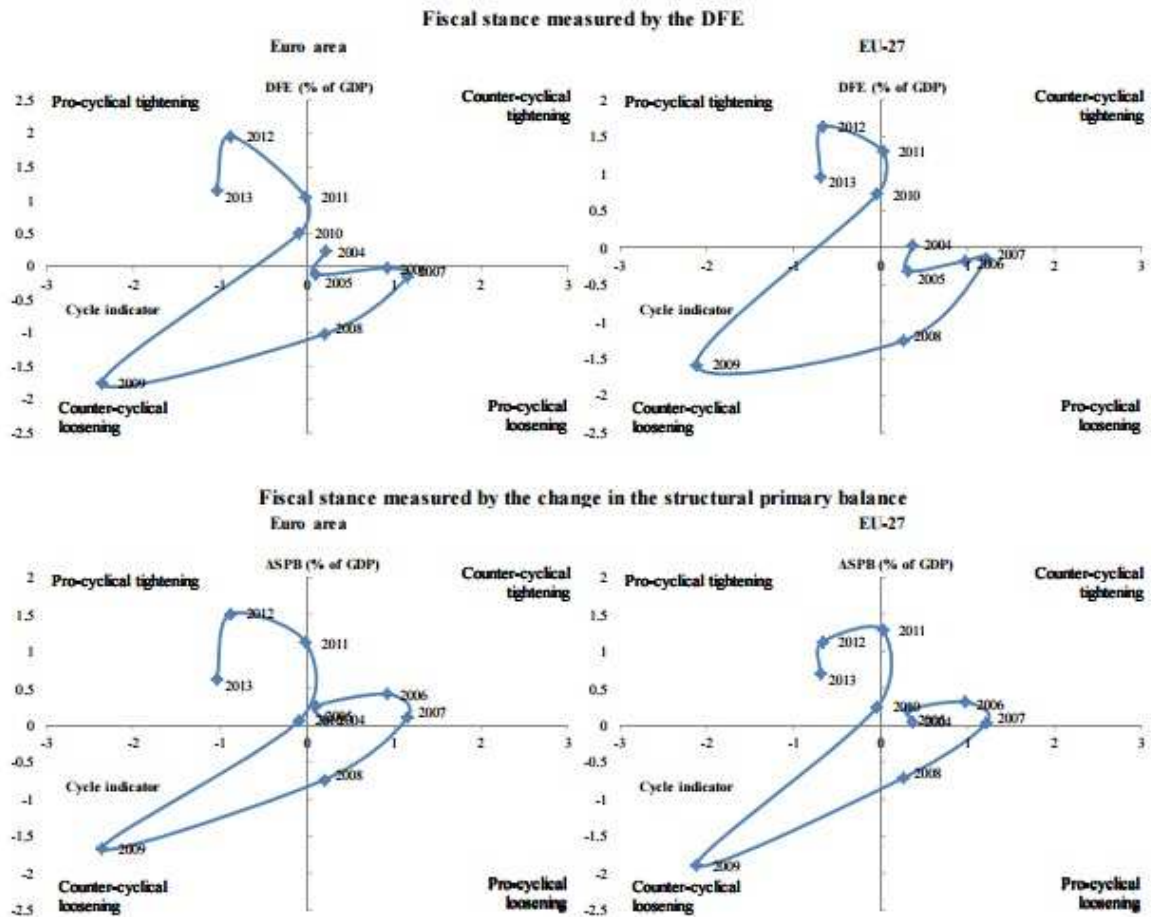
Source: Carnot and De Castro (2015), based on European Commission (2014).

As it turns out, fiscal policy has been pro-cyclical for much of the period observed, even prior to the crisis, when it was too loose. Only in 2009 has fiscal policy been overtly countercyclical, but as soon as 2010 it reversed its course and stayed in the pro-cyclical tightening quadrant for the rest of the period (and until later, since the Commission data indicate fiscal policy has only become neutral again in 2015). This can be explained by the fact that the initial fiscal stimulus implemented in 2009 had resolute economic stabilization as its only objective. But by 2010, the simultaneous tightening in Euro area country stemmed mostly from sustainability concerns, with balance sheets quickly expanding due to the recession, bank bailouts and the unwinding of prior imbalances. Whatever the motives, these changes in the fiscal stance had macroeconomic effects, which are measured by the fiscal multiplier and analyzed in the following section.

4.3 Policy Effects: Fiscal multipliers of discretionary impulses

4.3.1 Ouput effects
The fiscal multiplier is commonly defined as the ratio of change of (real) GDP to an exogenous change in

the fiscal balance (Batini et al., 2014). Thus in this thesis the fiscal multiplier quantifies the relationship between the independent variable of fiscal policy with the dependent variable of output. When the Eurozone started undergoing fiscal tightening in 2010, fiscal multipliers were thought to be low, in the range of 0.5 (e.g. IMF, 2010; European Commission, 2012). However, as discussed in the theoretical framework of the thesis, due to several factors (e.g. negative output gaps, private deleveraging and the constraints imposed on the central bank by the ZLB), it is hypothesized that fiscal multipliers were actually much higher. Indeed, using two DSGE macroeconomic models (the ECB's New Area Wide Model and the European Commission's QUEST III model), Rannenberg et al. (2014) show that, if households are liquidity constrained and the ECB is constrained by the ZLB, the cumulative multipliers over the years 2011-2013 can reach up to 1.3, implying that fiscal consolidation over the period caused cumulative losses of GDP up to 12%. This is of course only a "worst-case scenario" estimate highly dependent on the parameters used, but it nevertheless shows that the impact of fiscal policy can vary greatly with economic conditions.

Due to the magnitude of the crisis, both in the EU and other economies, the topic of fiscal multipliers has enjoyed a strong popularity in recent years, and so a fair amount of empirical evidence and estimates is available in the literature. Coenen et al. (2013) investigate the macroeconomic effectiveness of the initial fiscal stimulus implemented by Eurozone policymakers in 2008-2009, using the ECB's New Area Wide Model. According to their results, this stimulus, which peaked at 2% of GDP in 2009, increased quarterly (annualized) GDP growth by as much as 1.6%. Public spending and investment had associated multipliers above one, while tax cuts were associated with multipliers below one, thus the total stimulus package was estimated to have a multiplier slightly below unity. These results were found to be consistent with another analysis using several different macroeconometric models (Coenen et al., 2012). After this initial fiscal impulse, fiscal policy turned austere in 2010 (**Figure 4.6**). This period of fiscal consolidation, which lasted roughly until 2014, is where the bulk of the empirical evidence is concentrated in the literature, and many estimates of its macroeconomic effects are available, though they may fall within a wide range.

In't Veld (2013) for instance, using the Commission's QUEST model, finds that consolidation between 2011 and 2013 caused a cumulative output loss of 3.2 points of GDP by 2013. Holland and Portes (2012), using the National Institute Global Econometric Model, report results in a similar range, with cumulative losses amounting to 4% of GDP. Gechert et al. (2015), building upon their previous meta-analysis of fiscal multipliers (Gechert and Rannenberg, 2014), estimate the output losses due to consolidation at 4.3% of GDP in 2011, reaching 7.7% of GDP in 2013.

Carnot and de Castro (2015), using the DFE and the structural balance as their indicators, estimate the short-run (1 year) fiscal multiplier to be close to 1 on average, but with considerable variation between the expenditure and revenue multipliers, with the former being two to three times as large as the latter, as well as large variations depending on the level of the output gap (negative output gaps increasing the multiplier significantly.) Thus depending on the composition of consolidation and its cyclicality, multipliers can be well in excess of 1. This is consistent with the meta-analysis of Gechert et al. (2015), which indicates that during below average economic circumstances, the multipliers associated with expenditure items are all significantly above 1 (**Figure 4.7**). Independently, 17 economists (Coenen et al.,

2012) using nine macroeconometric (mainly DSGE) models used by policymakers and academics and reported "*considerable agreement across models on both the absolute and relative sizes of different types of fiscal multipliers*" in the current environment, both in the EU and the US. The multipliers are found to be significantly above unity for public consumption and targeted transfer measures, and even larger than 1.5 in the case of public investment. For tax instruments the multiplier ranges from 0.2 (corporate tax) to 0.7 (consumption tax).

Figure 4.7: Compound cumulative multipliers of fiscal impulses for different economic conditions
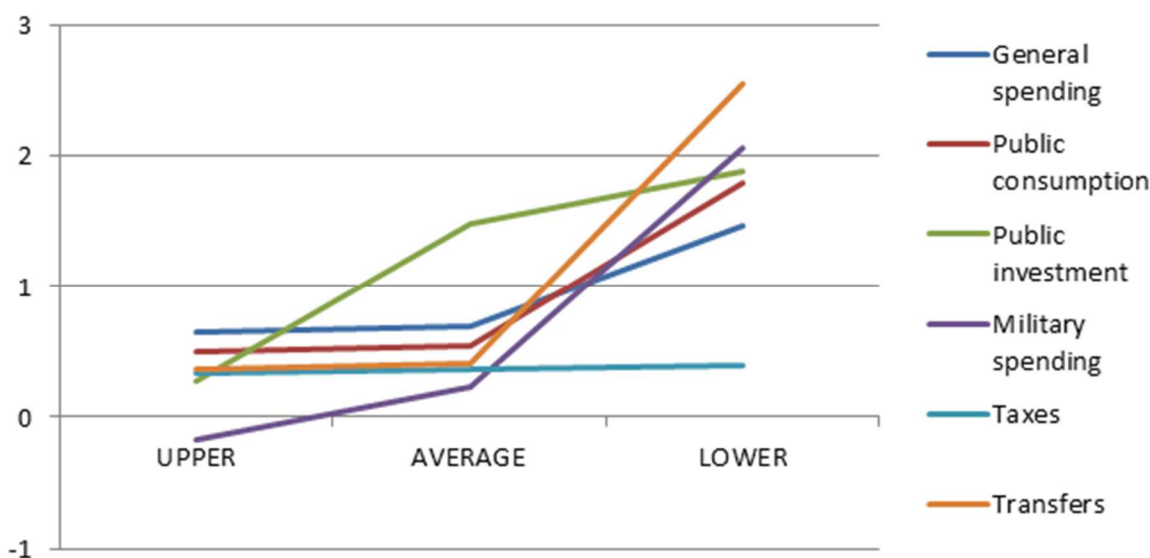
Authors' note: *Upper: above average economic circumstances; Average: average economic circumstances; Lower: below average economic circumstances.*

Source: Gechert et al., 2015.

Heimberger (2017) seeks to reconcile the findings presented above, and to establish a reasonable estimation for the output losses caused by fiscal consolidation. The author conducts an econometric analysis based on six sets of fiscal data obtained from the structural as well as the narrative approach (respectively: IMF (2015) and European Commission (2015) for the structural approach; European Commission (2015), OECD (2012) and Gainsbury et. al (2011) for the narrative approach). The results indicate cumulative fiscal multipliers between 1.85 and 2.09 for the structural balance data, and between 1.38 and 1.91 for the narrative approach data. Thus, a reasonable estimate of the output losses due to the Eurozone fiscal consolidation in 2011-2013 ranges from 5.5 to 8.4% of GDP (**Figure 4.8**). This estimate seems furthermore credible as it is at a middle ground between the lowest and highest estimates from the literature, and coherent with the meta-analysis of Gechert et al. (2015).

Figure 4.8: Estimating the cumulative output losses due to fiscal consolidation in the Euro area (2011-2013).
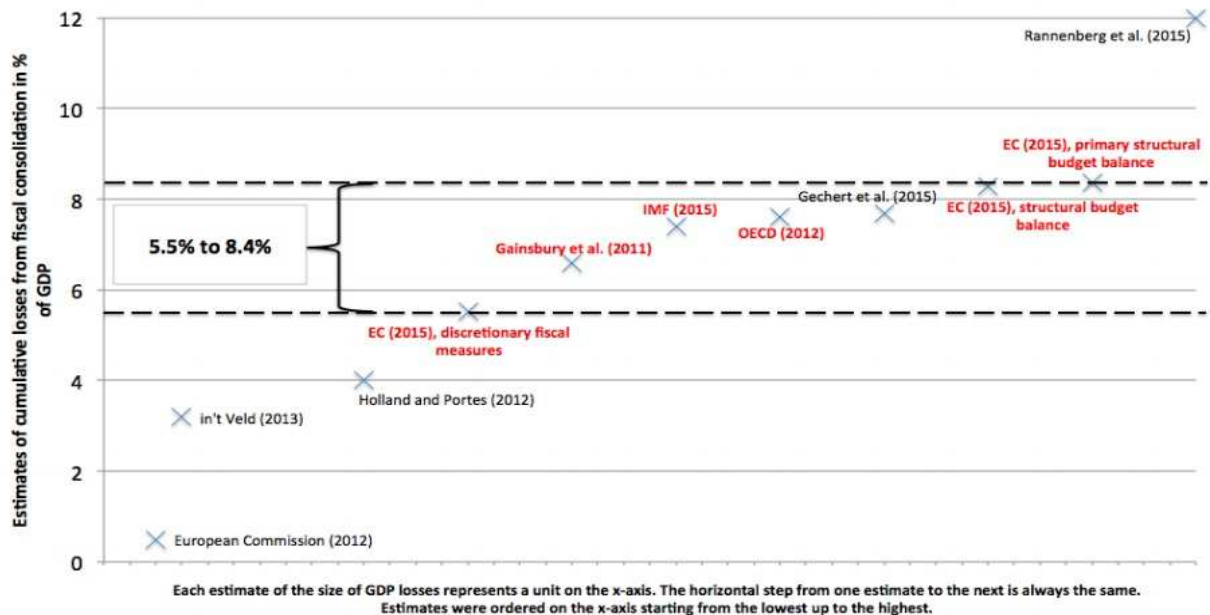
Source : Heimberger (2017)

Lastly, a seminal contribution to the literature on fiscal consolidation during the Eurozone crisis is that of Blanchard and Leigh (2013), who offered a novel and robust method to assess the impact of fiscal policy in the crisis. The paper estimates the actual fiscal multipliers by regressing the forecast error for GDP growth on the forecasts of fiscal consolidation used by the IMF World Economic Outlook (IMF, 2010), in which the assumed fiscal multiplier was 0.5. The authors report that a fiscal consolidation of 1% of GDP was associated with a subsequent loss of GDP in 2011 of about 1% more than anticipated by the forecasts, which means that fiscal multipliers were underestimated by 1 point (i.e. they were about 1.5 on average instead of 0.5). Taken together, the available data overwhelmingly support Hypothesis 1 in arguing that the Eurozone fiscal consolidation was costly in terms of output. And indeed, following the publication of Blanchard and Leigh (2013) among others, institutions such as the European Commission or the IMF recognized their mistake in prescribing too much consolidation too soon[14].

The reasons why fiscal multipliers were higher than anticipated can furthermore be coherently explained by the literature (Blanchard and Leigh, 2013b). The constraints imposed on the central bank by near-zero rates prevents it from correctly offsetting the fiscal shock by additional (conventional) monetary easing (Christiano et. al, 2011), while tighter credit constraints make the private sector more dependent on current income for consumption and investment (Eggertsson and Krugman, 2010), and economic slack compounds these effects (e.g. Auerbach and Gorodnichenko, 2012). These three factors

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[14] *"The IMF's record in surveillance was mixed. Its calls for global fiscal stimulus in 2008–09 were timely and influential, but its endorsement in 2010–11 of a shift to consolidation in some of the largest advanced economies was premature. At the same time the IMF appropriately recommended monetary expansion in these countries if needed to maintain the recovery. However, this policy mix was less than fully effective in promoting recovery and exacerbated adverse spillovers. As time progressed and the growth outlook worsened, the IMF showed flexibility in reconsidering its fiscal policy advice and called for a more moderate pace of fiscal consolidation."* IMF Independent Evaluation Office (2014:v)

thus lead to much larger multipliers than under normal conditions. In addition to high fiscal multipliers, the dangers posed by prolonged low growth as well as the threat of hysteresis suggest, according to Blanchard and Leigh (2013b), that a more back-loaded (i.e. delayed) fiscal austerity with a credible medium-term plan would have been a better policy choice, at least for the countries which didn't suffer from considerable market pressure in the form of high sovereign spreads that could lead to self-reinforcing bad equilibria (see, e.g. De Grauwe, 2012). Even for those countries (that is, mostly the peripheral members of the Eurozone), the proper amount of fiscal restraint is hard to balance. While reducing deficits appear to lower sovereign yield spreads, lower growth actually increase them (Cottarelli and Jaramillo, 2012), so fiscal austerity could actually *worsen* a country's sovereign debt problems if the negative effects from lower GDP growth outweigh the positive effect of an improved fiscal balance.

4.3.2 Inflation effects

There is also some empirical evidence that, through its depressing effect on GDP, austerity stoked deflationary pressures in the economy and contributed to the creation of a debt-deflation cycle in some peripheral countries (Mazzolini and Mody, 2014). The larger than expected contractionary effects of austerity (Blanchard and Leigh, 2013) resulted in higher debt-to-GDP ratios than anticipated in the EMU by the forecasts (as the denominator of the ratio shrank). Using data from IMF (2011, 2014), Mazzolini and Mody (2014) show that this unexpected surplus of debt-to-GDP correlates with lower than expected inflation (**Figure 4.9**). Thus there is a link between austerity and (dis)inflation: austerity causes lower GDP, which depresses demand and therefore decreases upward pressures on prices.The authors point out that lower inflation in peripheral countries, which are undergoing the most severe fiscal diets, is not necessarily a bad thing *per se*, as it can help these countries restore their competitiveness vis-a-vis the core countries. However, outright deflation is problematic as it increases the real value of existing debt and can create a self-reinforcing cycle that is hard for the central bank to get out of.

Figure 4.9: Unexpected debt-to-GDP ratio increase and associated deflation in the Euro area
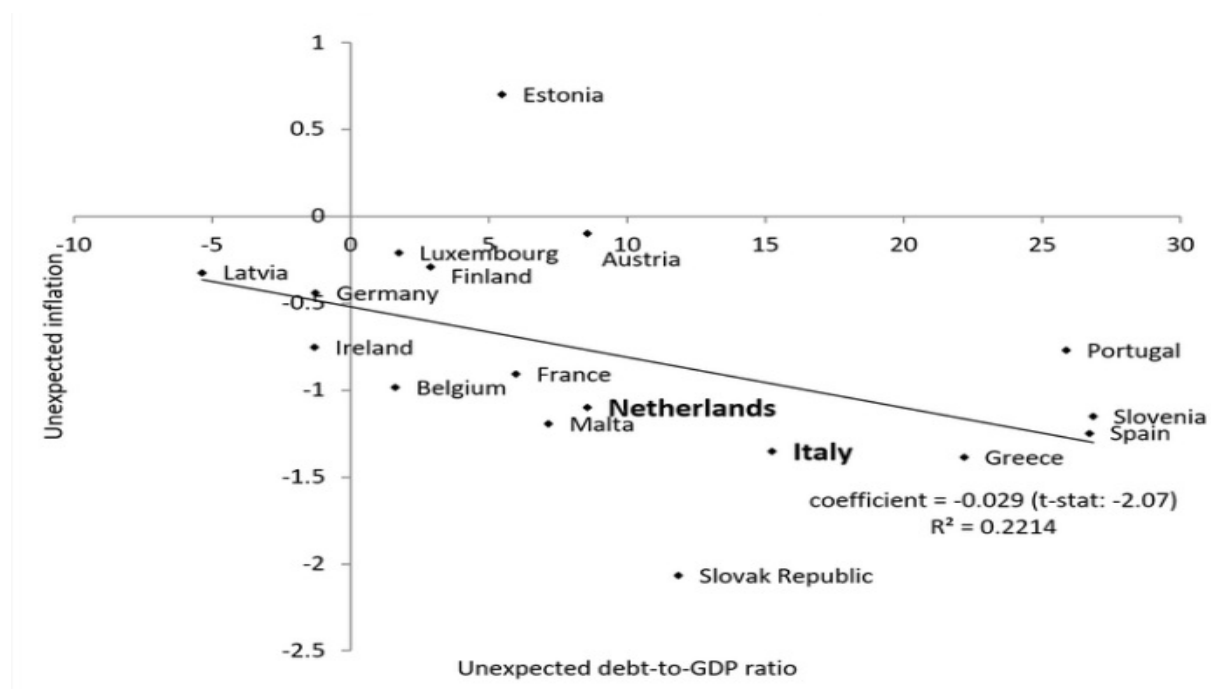
Source: Mazzolini & Mody (2014)[15]

4.3.3 Timing and spillovers: the case for a differentiated, delayed consolidation

Additional evidence on the negative spillovers between EMU members due to fiscal consolidation supports the case for a delayed consolidation in core countries. Indeed, the shift in 2010 towards austerity was followed by most of the member states, regardless of their actual fiscal position and sovereign yields. The evidence indicates that this simultaneous austerity increased its negative impact on output. According to the current Governor of the French Central Bank, Francois Villeroy de Galhau (2016), "*Both the European Commission and the NIESR have shown the large impact of simultaneous fiscal consolidation in Europe, with around 2% larger GDP declines due to intra-EA spillovers*". In't Veld (2013) indeed also reports that spillovers can add between 1.5 and 2.5 percentage points of GDP loss.

According to Mazzolini and Mody (2014), a country such as the Netherlands, which had a relatively low ratio of public debt to GDP but high levels of private debt, should have maintained fiscal expansion for longer before gradually consolidating, which, by contributing to raising incomes, would have helped the necessary deleveraging process of the private sector (an argument also presented by McCulley and Pozsar, 2013) and made the subsequent consolidation less costly (with a better cyclical position, fiscal multipliers would have been lower). Thus, while consolidation in the Netherlands only marginally improved public finances, it did considerably hamper the reduction of private debt, which, at 266% of GDP in 2015, is arguably a much greater issue for the country. Instead of front-loaded austerity, as

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[15] **Authors' note**: *"The unexpected inflation is calculated as the difference between the realized inflation in 2014, as reported in the 2014 WEO data release, and the projected inflation for 2014, as reported in the 2011 WEO data release. The unexpected debt-to-GDP ratio is computed similarly. If Cyprus is included, the relationship is even stronger."*

argued by in't Veld (2013), a temporary stimulus in countries with current account surpluses such as Germany could boost output in the Euro area, reduce the surpluses and help resorb peripheral countries' current account (and competitiveness) deficits. Mazzolini & Mody (2014) concur, arguing that a more modest pace of consolidation throughout the EMU, with active stimulus in a few core countries, would have been a much better aggregate fiscal stance (see also IMF, 2013b; Cottarelli and Jaramillo, 2012). According to Ostry et al. (2015), core countries should not even pursue austerity at all.

Merler and Pisani-Ferry (2012) demonstrate that in order to resolve the north-south competitiveness imbalances in the EMU, southern countries need to tighten fiscal policy more than in the north, so if fiscal policy is austere in the north, it has to be even more so in the south, further depressing growth and inflation and hampering proper debt deleveraging. Thus an optimal aggregate fiscal stance, which would seek to minimize the output costs of consolidation while still attaining the same sustainability targets, crucially depends on the stance of core members.

Blot et al. (2014) provide empirical, model-based evidence in support of a back-loaded austerity in the Eurozone. The authors employ a reduced-form model of 11 Euro area countries representing core and periphery (the GIIPS, France, Germany, the Netherlands, Belgium, Austria and Finland) with dynamic fiscal multipliers (evolving according to the size of the output gap) and the presence of hysteresis. They then attempt to find the optimal fiscal policy impulse for each county that would both maximize output and achieve a 60% of public debt-to-GDP ratio by 2032. Their results show that in six countries, it would be better to delay consolidation, while in the five others, the optimal fiscal impulse should even be (slightly) positive. This fiscal stance for the Euro Area would lead to higher aggregate growth, 2.4% annually in 2013-2017 compared to 1.7% in the baseline scenario. The higher growth effects would be even stronger for countries delaying austerity. Greece would for instance benefit from a yearly GDP growth 4.5% higher in 2013-2017, while Portugal, Spain and Ireland would add 0.5 to 0.6 points of annual growth in the same period. Furthermore, Blanchard, Erceg & Lindé (2016) also demonstrate that fiscal expansion in core countries with fiscal space would be beneficial for the Eurozone as a whole[16].

4.4 Conclusion

The following conclusions can be made using the evidence presented in this chapter. First, fiscal policy has been too pro-cyclical in the Euro area, both before and after the crisis. The fiscal stimulus of 2008-2009 was effective in cushioning the initial shock, and should have been prolonged, as recognized (much later) by the IMF. Instead, there was a damaging, premature shift to austerity in 2010 which killed the nascent recovery and caused the double dip recession of 2011-2013. The output cost of the 2010-2013 fiscal consolidation was large, with expenditures multipliers well above unity, causing an estimated loss

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[16] *"fiscal expansion by the core economies of the euro area would have a large and positive impact on periphery GDP assuming that policy rates remain low for a prolonged period. Under our preferred model specification, an expansion of core government spending equal to one percent of euro area GDP would boost periphery GDP by over 1 percent in a liquidity trap lasting three years, nearly half as large as the effect on core GDP. [...] Increasing core spending would generate substantial welfare improvements, especially in the periphery".* (Blanchard, Erceg & Lindé (2016).

of 5.5% to 8.4% of Eurozone GDP. Secondly, this demand-depressing fiscal policy exacerbated the downward pressures on inflation, particularly in peripheral countries.

Third, the simultaneous austerity throughout the Euro-area led to an unnecessarily restrictive aggregate fiscal stance, causing negative spillovers which amplified output costs. Instead, a more stabilization-focused, expansive fiscal stance would have delivered superior growth performance while being as effective from a debt-sustainability perspective. This reflects an important shortcoming of the SGP, in that it *"does not oblige those countries with fiscal room for manoeuvre to make use of it. There is therefore no guarantee that the coordination of national fiscal policies through the SGP results in an appropriate aggregate euro area fiscal stance."* (ECB, 2016c:69). This chapter indicates that properly managing this aggregate fiscal stance is of utmost importance in the resolution of the crisis.

Chapter 5 – Hysteresis

The previous chapter demonstrated that fiscal policy has been restrictive during a large part of the crisis, and has been sub-optimal from the perspective of macroeconomic stabilization. This chapter will research the presence of hysteresis in the Eurozone economy and investigate its effects as well as how it interacts with changes in (mainly fiscal) policy.

The concept of hysteresis in the economic literature revolves around two primary variables, unemployment and output (see Annex 2). Blanchard and Summers (1986) first theorized hysteresis as the phenomenon by which periods of high unemployment increased the structural rate of unemployment (NAIRU, for Non-Accelerating Inflation Rate of Unemployment) over time, as workers went from unemployed to unemployable. By extension, the concept now also refers to the damage caused by periods of economic slack on the long-term potential of the economy.

The chapter is organized as follows. The first section describes the developments in potential GDP and structural unemployment (NAIRU) following the crisis, while the second section attempts to measure, based on these variables, the level of hysteresis in the Euro economy. Section three then analyzes the interaction between economic policy and hysteresis during the crisis, and section four concludes.

5.1 – Potential GDP and NAIRU in the Euro Area

Two main trends can be identified when observing the evolution of Eurozone potential output data. First, there has been a marked decrease in the rate of potential GDP growth since the crisis, but this decline actually started in the years before it (**Figure 5.1**). This reflects both cyclical and structural factors; part of the decline can be directly attributed to the financial crisis and its aftermath, but there is also a longer term trend of declining potential growth, as noted by Praet (2015)[17].

Second, before the crisis the Eurozone economy was actually running above its potential levels, as previously shown in Chapter 4. In contrast, the trend since the crisis has been an Eurozone economy consistently below potential, with high cross-country disparities[18].

Figure 5.1: Potential and actual GDP growth in the Euro area (left); actual and structural unemployment rates in the Euro area (right)

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[17] *"Potential growth in the euro area has been declining since the late 1990s, driven mostly by a prolonged slowdown in total factor productivity growth, a trend decline in hours worked and the labour participation rate growing more hesitantly. Before the crisis, however, it seems that this deceleration went largely unnoticed"* (Praet, 2015).

[18] If the available data projects a gradual closing of the output gap, it should nevertheless be taken with caution, as the measurement uncertainty of real time output gaps could paint an overly optimistic picture (see Jarocinski and Lenza, 2016).
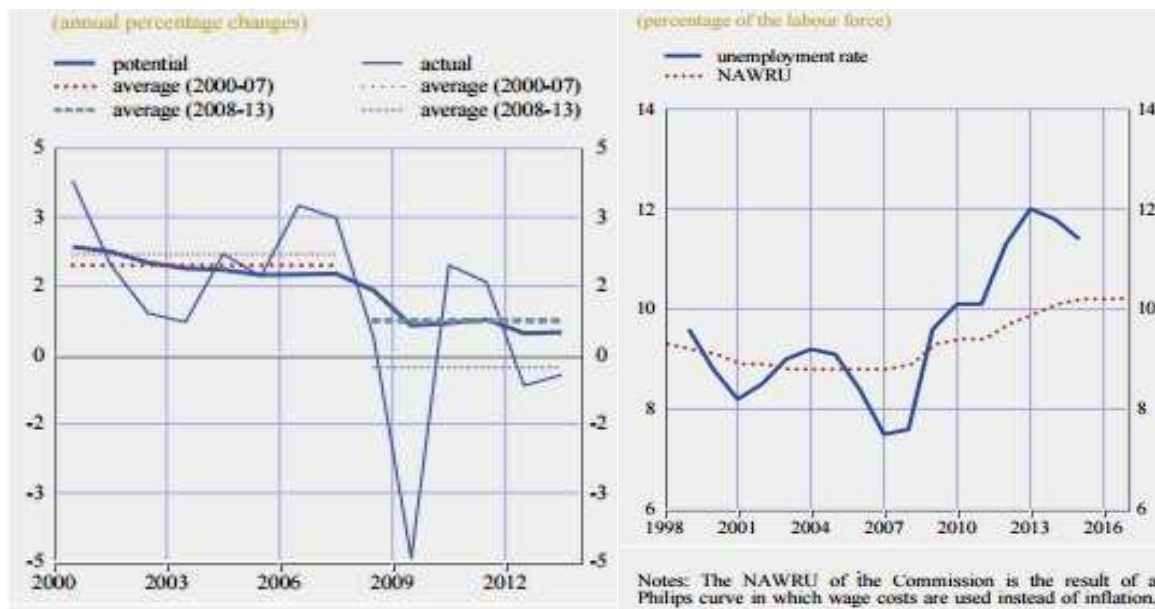
Source: ECB (2014), based on European Commission data.

Figure 5.1 (right) presents the evolution of actual and structural unemployment rates before and after the crisis, using a slightly different measure of the NAIRU in which wage inflation replaces actual inflation (thus called NAWRU for Non-Accelerating Wage Rate of Unemployment). As illustrated, unemployment peaked from 7.2% in 2008 to 12.1% in 2013, before reverting towards 10% as of 2016. We can furthermore distinguish two phases in the unemployment spike; the first wave immediately following the crisis in 2008, which stabilized in 2010 after a Eurozone-wide stimulus package, and the second wave from 2011 to 2013, while the area was mostly consolidating deficits.

The NAIRU was above unemployment pre-crisis, reflecting an overheating economy. After 2008, as unemployment rises above it, the NAIRU starts to increase from 9% to 10%, even as unemployment starts to decline. This reflects, according to the hysteresis hypothesis, cyclical unemployment turning structural overtime.

5.2 – Measuring Hysteresis in the Euro economy

There are two available ways to quantify the degree of hysteresis in the economy: either by analyzing the relationship between actual and potential GDP, or that between actual and structural unemployment.

Ball (2014) offers a good example of the first method. He examines the long-term effects of the Great Recession in 23 OECD countries, including 14 of the Euro Area member states, by comparing potential GDP trends (in OECD, 2007) from the pre-crisis period with actual and potential output from 2014 data (OECD, 2014). This method highlights the loss of potential and actual GDP since the crisis, and the ratio

of the two provides a measure of hysteresis, that is, for each point of actual GDP lost since the crisis, how much potential GDP was lost.

The results indicate that advanced economies suffered permanent damage from the Great Recession, as evidenced by a fall in potential output of 8.4% on average, with large degrees of variation between countries (**Figure 5.2A**). Euro area members lost even more potential than this average, with Spain, Ireland and Greece losing up to 30% of potential compared to pre-crisis trend.

Figure 5.2A : Potential output losses compared to pre-cris trends, 2015
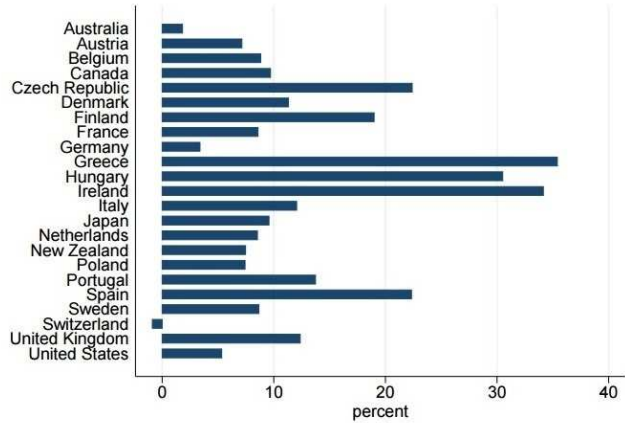
Source : Ball (2014), from OECD (2007, 2014)

Furthermore, losses of actual output are associated with losses of potential output almost on a one to one ratio (**Figure 5.2B**), meaning that each point of lost GDP in the short term correlates with a permanent loss of roughly equal magnitude, suggesting strong hysteresis.

Lastly, the permanent output loss is strongly correlated with a lower potential growth rate (**Figure 5.2B**). Countries that experienced more severe economic shocks also saw their potential growth shrink proportionately more. **Table 5.A** (Annex) presents a detailed breakdown of these results for each country analyzed. For the Eurozone as a whole, current IMF projections forecast that GDP will be 15% below its implied pre-crisis potential by 2019 (Blanchard, Cerutti and Summers, 2015).

Figure 5.2B: actual vs. potential output loss (left) / lost potential vs. growth depression (right)
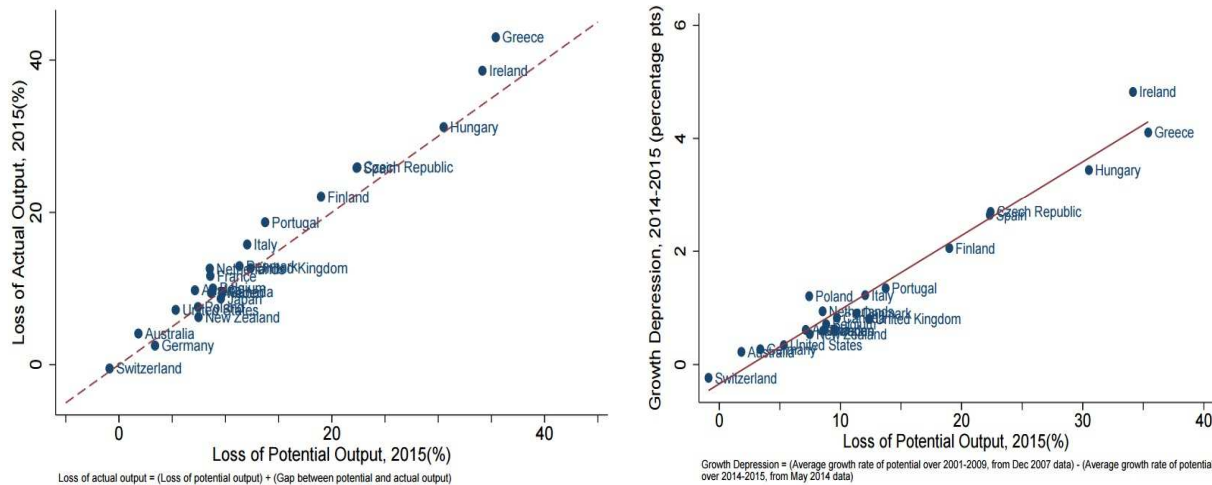
Source: Ball (2014).

However, if one can plausibly argue that these data point towards the existence of hysteresis, correlation does not necessarily imply causality. As argued by Blanchard, Cerutti and Summers (2015), there could also be concurrent explanations for these results, which they suggest could be either supply shocks or reverse causality. They test these three hypotheses further with a dataset analyzing 122

episodes of recessions in 23 advanced economies over the past 50 years. However, as compared to Ball (2014), they make several important methodological adjustments in order to obtain more robust results[19]. They report evidence supporting all three hypotheses, suggesting that, while hysteresis is an important factor explaining permanent loss of potential output, it is not the only one. Thus, while the paper supports Ball (2014)'s theoretical argument, it suggests caution regarding his quantitative measurement of hysteresis.

The use of the second method to estimate hysteresis, based on the evolution of unemployment and the NAIRU, offers a complementary view of the extent to which it affects the economy. However, most of the studies regarding hysteresis and the NAIRU tend to use variations of unit root tests, and their results are highly sensitive to the dataset and methodology used. Tartici (2015) offers a listing of such studies. These problems also apply to the more recent papers covering the Euro area: for instance, the results of Dogru (2015) and Bolat et al. (2014) are overall mixed (i.e. signs of hysteresis in some countries but not others), while those of Furuoka (2014) and Tartici (2015) support the hysteresis hypothesis. Nevertheless in general the body of literature tends to concur that hysteresis is more prevalent in the European Union than it is in other advanced economies such as the US (see e.g. León-Ledesma, 2002, or Logeay and Tober, 2006, for an overview).

Given the limitations of the unit root test studies, the most robust methodology uses the Kalman filter technique. Unfortunately, few papers using this method cover the whole Eurozone, and of those, Logeay and Tober (2006) is the most recent and oft-cited. Thus, their results, based on Euro area countries from 1975 to 2005, will be used as an approximate measure for the post-crisis period, since it is reasonable to believe the level of hysteresis has either remained constant or increased since the financial crisis (see Blanchard, Cerutti and Summers, 2015). The results state that hysteresis can explain between 40 and 65% of the variations in the NAIRU. This seems a more robust estimate than Ball's (2014).

5.3 – Relationship between Hysteresis, Fiscal Policy, and Potential Output

Having established the existence of hysteresis effects in the Euro area, an important question is whether and how much they interact with economic policy. For instance, to what extent are policy-induced losses of GDP permanent? Secondly, can restrictive policy (with hysteresis) also cause losses in potential growth? What mechanisms explain these effects? During the crisis, monetary policy has been ever-increasingly loose, whereas fiscal policy has been more restrictive, thus the remainder of the chapter will focus on fiscal policy effects on potential output.

Fatas and Summers (2015) attempt to measure the permanent effects of post-crisis consolidation in the EU and the Euro area, by using an extended version of Blanchard and Leigh's (2013) methodology. First,

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[19] First, they take into account the fact that the economy may have been above trend (overheating) prior to the recession, which would then lead to overestimating pre-crisis trend GDP, and thus exclude from the trend the two years before the recession and possibly more if there was excessive credit growth. They also adjust the slope of the trend by minus one standard deviation to account for the uncertainty of the trend estimate. Lastly, they also take into account the "secular" phenomenon of declining growth since the 1960s in advanced economies and adjust the log-linear time trends accordingly.

they show that the negative output effects of the consolidation measures of 2010-2011, identified by Blanchard and Leigh (2013), persist, and even increase throughout the forecasts for 2014 and 2019, suggesting long-term effects from austerity. They then investigate whether consolidation can also explain revisions in potential output from the 2014 and 2019 previsions. According to their findings, the initial 2010-2011 consolidation explains just about 40% of the forecast error of potential GDP in 2014 and 2019. Moreover, each point of austerity-induced GDP loss in 2010-2011 translates into a 1% decline of potential output by 2014, and even 1.7% by 2019. Thus the results indicate that the output losses caused by austerity are largely permanent, and provide support to the argument advanced by Delong and Summers (2012) that fiscal consolidation can be self-defeating under hysteresis.

To answer the second question, we need to investigate how economic policy can impact potential output and its growth. Potential output is not directly observable and can be computed with the use of the classical production function (ECB, 2014; see **Annex 2**). The potential GDP derives from the supply-side of the economy: the factors of production, labor and capital, as well as total factor productivity (TFP).

Potential growth has significantly dropped since the crisis (**Figure 5.1**). However, this gap is not caused by lower TFP growth; it has been on a declining trend pre-crisis and has only marginally fallen since (ECB, 2014). Instead, both the contribution of labor and capital to potential growth have diminished since 2008 (ECB, 2014). To examine how fiscal policy could have hampered potential from labor and capital, we will analyze (respectively) the effects of fiscal consolidation on unemployment and inequality (labor), and public investment (capital).

5.3.1 Unemployment and inequality
In all EMU countries, the size of fiscal consolidation is positively correlated to higher unemployment and material deprivation rates (Darvas and Tchekassin, 2015). Not only do fiscal consolidations in recessions increase unemployment, but this effect is long-lasting (Sturm, 2014). In turn, unemployment turning structural with hysteresis explains much of the decline in potential labor growth (ECB, 2014; Draghi, 2014).

Furthermore, unemployment, particularly long-term, is the single most powerful predictive factor for poverty (Matsaganis, 2013; Duiella & Turini, 2014). The OECD (2013) reports that relative income poverty in the EU post-crisis fell among the elderly, but increased among children, youth and adults. This reflects deeper fiscal cuts in education, training and social expenditures targeting the young (notably unemployment benefits). Thus, fiscal policy has amplified a growing generational divide between old and young, combined with a geographical divide between North and South (Darvas and Tchekassin, 2015)[20]. This issue can compound economic imbalances and debt problems in the EMU, as young and

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[20] The NEET (Not in Employment, Education or Training) rate increased by 8 to 10 points in the 15-29 age group in GIIPS countries between 2007 and 2013, while the increase in the EU28 was only 2.5 points. Unemployment in the EU28 increased by 4 points between 2008 and 2013, while in GIIPS countries it increased by 10 points to a high of 20% in the same period. Youth unemployment, specifically, has peaked from 15% in 2008 to 24% in 2013 in the Euro area, but in the GIIPS it peaked between 30% (Ireland) and 60% (Greece).

mostly qualified people can essentially "vote with their feet" by emigrating to countries with better economic prospects, reducing future potential growth (James, 2016).

This combined plight of youth unemployment and reduced spending on youths and education creates the risk of a "lost generation" in some member states. In his 2014 Jackson Hole address, ECB President Mario Draghi also acknowledged that the threat of hysteresis justified more aggressive demand management policies and a more expansive aggregate fiscal stance[21].

Overall, the evidence shows post-crisis austerity increased inequality. A meta-analysis by Ball et al. (2013) also reports that, for a fiscal consolidation of 1% of GDP, inequality measured by the Gini coefficient increases by 0.9 point on average, the share of wage income to GDP decreases by 0.8 point, and structural unemployment increases by 0.5 points in the medium term. While traditional macroeconomic literature (i.e. Okun, 1975) argued that there is an inherent trade-off in economic policy between equality and growth, latest evidence from IMF data (Ostry et al., 2014) suggests that inequality actually decreases potential growth. In the words of the authors (p.5), "*inequality can undermine progress in health and education, cause investment-reducing political and economic instability, and undercut the social consensus required to adjust in the face of shocks, and thus it tends to reduce the pace and durability of growth*". Instead (p.4), "*lower net inequality is robustly correlated with faster and more durable growth*" .

5.3.2 Public investment
"The prevailing view in many countries is that governments should not increase their debt levels lest they put a burden on future generations. The truth is that future generations inherit not only the liabilities but also the assets that have been created by the government. Future generations will not understand why these governments did not invest in productive assets that improve their welfare, while these governments could do so at historically low financing costs."

<div align="right">(De Grauwe, 2014)</div>

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[21] "*Demand side policies are not only justified by the significant cyclical component in unemployment. They are also relevant because, given prevailing uncertainty, they help insure against the risk that a weak economy is contributing to hysteresis effects. Indeed, while in normal conditions uncertainty would imply a higher degree of caution for fear of over-shooting, at present the situation is different. The risks of "doing too little" – i.e. that cyclical unemployment becomes structural – outweigh those of "doing too much" – that is, excessive upward wage and price pressures. [...] Unlike in other major advanced economies, our fiscal stance is not based on a single budget voted for by a single parliament, but on the aggregation of eighteen national budgets and the EU budget. Stronger coordination among the different national fiscal stances should in principle allow us to achieve a more growth-friendly overall fiscal stance for the euro area*". (Draghi, 2014).

Figure 5.3: Public and private investment as a share of GDP in advanced economies, 1995-2014
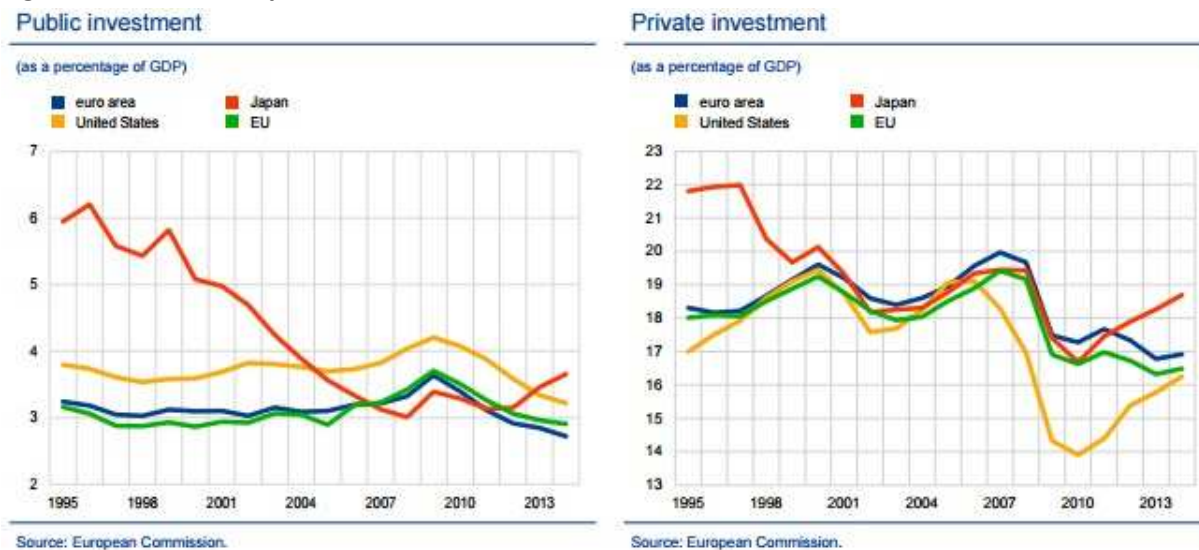
Source : ECB (2016b)

Following the Great Recession, public investment has fallen in the Eurozone, as has private investment (**Figure 5.3**), however the latter picked up after 2010 in other advanced economies, whereas it did not in the EMU. In the Euro Area, the fiscal consolidation planned since 2010 has contributed to the decline in public investment: *"since the crisis, public investment has fallen in a number of European countries, particularly those that came under market pressure"(ECB, 2016b).*

According to Dervis & Saraceno (2014), public investment has become, after the Maastricht Treaty, one of the preferred targets of governments' fiscal consolidations, because the negative effects of the spending cuts are only felt in the long run, making them politically easier to implement although they are actually more detrimental to the economy. Fiscal multipliers of structural public investment are indeed much higher than for other categories of government expenditure (Gechert et al., 2015). Barbiero & Darvas (2014) report that, despite those high multipliers, spending on public investment during the sovereign debt crisis has been drastically reduced throughout the EMU, even collapsing by more than one half in the most vulnerable countries of the periphery (i.e. the GIIPS). The same story is presented by in t' Veld (2013)[22].

Endogenous growth theory provides the framework of choice in the public finance literature to analyze how government policy can affect long-term growth (Barro and Sala-i-Martin, 1992; Rebelo, 1991), since in the neoclassical growth model long-term growth is set by exogenous and policy-invariant factors (IMF, 2015b). Baier and Glomm (2001), and de Hek (2006) present endogenous growth models showing that public investment contributes to increased TFP, and thus to higher long-term growth.

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[22] *"In the drive to consolidate public finances, government investment has been reduced, with major infrastructure investment plans scrapped and backlogs in deferred investment building up. Instead, low interest rates could have been locked in to finance an increase in public spending, by bringing forward public infrastructure projects which should, even if debt-financed, have a higher rate of return."* (in t' Veld 2013:15).

Public investment affects potential GDP and growth in three ways. It increases the capital stock (Haltmaier, 2012), crowds-in private investment, especially during times of slack, and spurs technological advances increasing TFP growth, these effects being self-reinforcing. As summarized by Abiad et al. (2015:2), *"increased public investment raises output, both in the short term and in the long term, crowds in private investment, and reduces unemployment. When there is economic slack and monetary accommodation, demand effects are stronger, and the public-debt-to-GDP ratio may actually decline".* Both Draghi (2014) and IMF (2014b) make a strong case for a EMU-wide public investment plan[23].

5.4 Conclusion

This chapter has shown the existence of significant hysteresis effects in the economy, whether measured by unemployment or GDP. According to the most conservative (and robust) estimate from the two indicators, hysteresis is responsible for about 40 to 65% of variations in the NAIRU.

These effects have large implications for the optimal conduct of macroeconomic policy, requiring a much more forceful stabilization approach under a liquidity trap (Draghi, 2014; Blanchard, Cerutti and Summers, 2015). This is particularly true for countries with significant output gaps and unemployment. Restrictive (fiscal) policy seems counterproductive under these conditions. Evidence shows hysteresis compounded the negative effects of fiscal consolidation on the long-term (Fatas & Summers, 2015). Particularly, austerity increased structural unemployment and inequality, thus lowering respectively potential GDP and growth, while it dramatically reduced public investment, which lowers both potential output level and growth.

Given that public investment can pay for itself under current conditions (IMF, 2014b, 2016b; Abiad et al., 2015), and with the added threat of hysteresis, policymakers would be well-advised to act forcefully and with speed to safeguard the long-term potential of the economy. Wolff (2014) suggests that many public investment programs have been deferred or canceled during the consolidation, and thus there exists a significant backlog of shovel-ready projects in many countries which could stimulate the Euro economy at virtually no cost. On the other hand, the tentative consensus that inequality lowers long-term growth should push fiscal policymakers to pay attention to the distributional consequences of their actions, as these consequences could also affect their stabilization objectives.

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[23] *"Increased public infrastructure investment raises output in both the short and long term, particularly during periods of economic slack and when investment efficiency is high. This suggests that in countries with infrastructure needs, the time is right for an infrastructure push: borrowing costs are low and demand is weak in advanced economies, and there are infrastructure bottlenecks in many emerging market and developing economies. Debt-financed projects could have large output effects without increasing the debt-to-GDP ratio, if clearly identified infrastructure needs are met through efficient investment."* (IMF 2014:75)

Chapter 6 - Monetary Policy

The present chapter investigates the effectiveness of the monetary policy response to the Eurozone crisis. Monetary policy is centralized at the supranational level under the responsibility of the European Central Bank (ECB), which is owned jointly by the National Central Banks of member states according to their country's weight in the Euro economy. Their governors sit on the ECB's Governing Council and jointly decide of monetary policy orientations for the whole area. Thus a main challenge of monetary policy has been to adequately respond to divergent economic conditions between member states with "one-size fits all" policy.

Section 1 presents the policy objectives of the ECB, as well as the crisis-related developments which impacted these objectives, notably the deterioration of credit conditions during the sovereign debt crisis. Section 2 discusses the policy instruments employed by the ECB in response to these developments. It presents the corresponding indicators used to measure the monetary policy stance in general, and distinguishes between the unconventional policies aimed at restoring the monetary transmission mechanism, and policies aiming to achieve more stimulus, namely, the ECB's Quantitative Easing program[24]. Lastly, the section presents the transmission channels of these unconventional policies. Following that, Section 3 discusses the effectiveness of policies enacted from 2008 to 2014. The QE program, introduced in 2015, is treated separately in Section 4. Lastly, Section 5 concludes.

6.1. Policy Goals: Stabilization subordinated to Inflation Targeting

According to Article 127 of the Treaty of Lisbon, the European Central Bank's primary objective is "to maintain price stability", defined by the ECB's Governing Council as *"a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below, but close to, 2%"*. In addition, as long as it doesn't interfere with its primary mandate*, "the ECB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union"* (Art. 127 TFEU)*,* which include balanced economic growth and full employment. Thus the stabilization mandate of the ECB is only secondary to its inflation mandate. Policy effectiveness shall therefore be measured with inflation and GDP as primary and secondary variables, respectively.

Before 2008, monetary policy was considered by most accounts to be effective. Inflation was broadly around 2%, with core inflation (excluding food and energy price changes) slightly below, consistently with the ECB's asymmetric objective. In July 2007, inflation began to shoot up, culminating at 4% in July 2008, before the Global Financial Crisis hit the market and caused a free fall of inflation, which reached negative levels a year later (**Figure 6.1**). Core inflation dropped by about 1 point. Following the policy response to the initial shock, inflation rebounded to a high of 3% in 2011, before falling precipitously again, to a low of -0.6% at the end of 2014. Core inflation followed the same pattern with less amplitude. Since 2015 both core and headline inflation have somewhat recovered but are still substantially below the ECB's policy objective.

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[24] A presentation of these programs is offered in **Annex 5**.

Figure 6.1: Eurozone headline and core inflation, 2000-2016
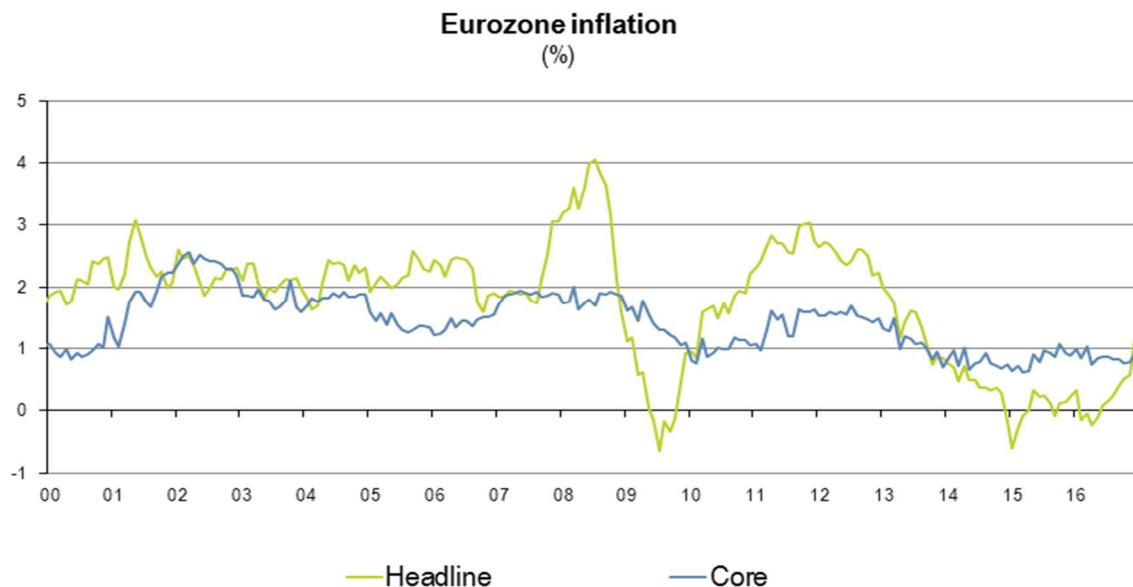
Source: Eurostat

In addition, the 2008 GFC revealed existing imbalances in the Eurozone which led to a full-blown public debt crisis (Baldwin et al., 2015). Two important issues arise from this fact, which are relevant to the conduct of monetary policy.

First, the GFC itself caused important damage to European banks, due to both the global recession and their exposure to US markets. It led to a loss of confidence in the stability of the banking system, as banks became wary of lending to other banks. This translated into major disruptions in the Euro area interbank lending market, particularly across borders (Abbassi et al., 2014). Combined with the damage of the crisis on banks' balance sheets, this liquidity freeze greatly impaired the transmission of credit to the economy, as bank lending represents about 80% of Eurozone corporate financing.

Secondly, this "banking crisis" soon was interwoven in what Shambaugh (2012) calls "the Eurozone's three crises", with the emergence of both a sovereign debt crisis, and a growth crisis, each of them reinforcing the others. This had a large impact on credit conditions. As countries bailed-out their banks (e.g. in Spain, Ireland), they transferred private liabilities into public balance sheets. With debts and deficits rising due to the recession, investors became concerned that these dynamics made the corresponding sovereign bonds riskier than what was originally assumed, and thus the wave of panic increased the cost of financing of peripheral sovereigns. It is here that the banking and sovereign debt crises become interwoven. Indeed, in most Eurozone countries domestic financial institutions were the largest buyers of their countries' public debt, making them comparatively much more exposed to losses

stemming from sovereign debt problems. This created a so-called "doom loop", or a vicious feedback cycle between banks and their governments[25] (Baldwin et al., 2015; Shambaugh, 2012).

This doom-loop dynamic contributed to significant fragility of the banking sector, particularly in the peripheral countries hit hardest by sovereign debt problems (Abbassi et al., 2014). Then, as sovereign yields rose, so did the yields for corporate bonds in the country, indicating the propagation of sovereign debt problems to the real economy due notably to increased uncertainty (see, inter alia, Caceres et al., 2010; Bedendo & Colla, 2015; De Bruyckere et al., 2013; Augustin et al., 2016).

These ruptures in the transmission of credit to the economy critically impair the main transmission channel of monetary policy, and restoring it constitutes a main policy goal for the ECB. Thus the analysis of policy effectiveness will also measure the effects on credit markets and bank lending.

6.2 Policy Instruments: Interest rates and Balance-sheet Measures

The two main indicators used to measure the stance of monetary policy in this research are the *ECB's rate on main refinancing operations* (MRO), and the *size of the central bank's balance sheet*. Each indicator captures a different part of the monetary policy toolkit; the main interest rate corresponds to conventional monetary policy operations, while the balance sheet measures additional monetary easing from unconventional measures.

Figure 6.2: ECB main interest rate (%), 2007-2017
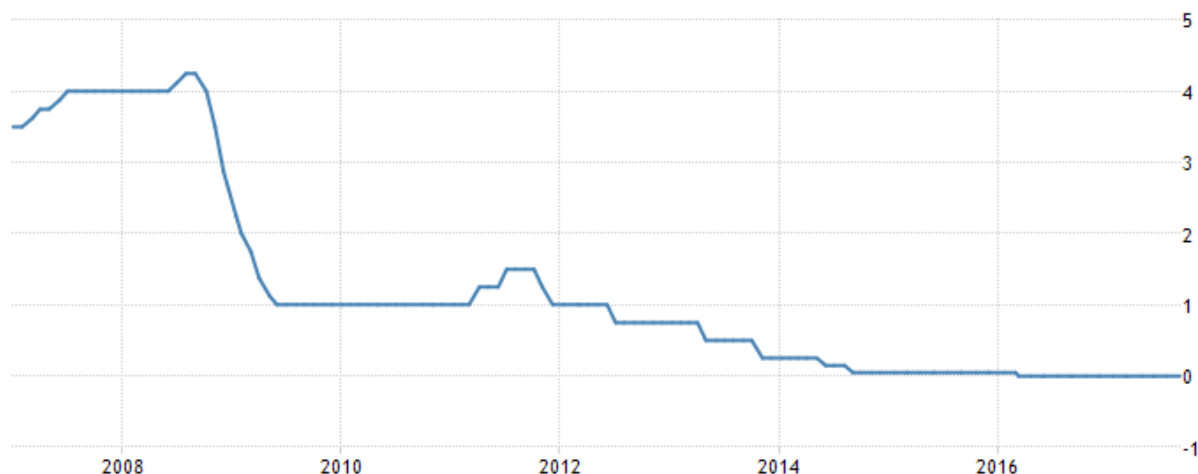
Source: Tradingeconomics.com, Eurostat.

The MRO rate (**Figure 6.2**) was set at 4.25% on July 9, 2008, the last rate hike before the crisis. Starting in October 2008, it started to fall sharply as monetary authorities responded to the Global Financial

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[25] Due to their sheer size and systemic importance, governments had no choice but to bail-out domestic banks, but by doing so they only increased tensions on their sovereign bond yields, which in turn damaged the banks' balance sheets further.

Crisis, settling at just 1% on May 13, 2009. After a short hike to 1.50% in July 2011, it resumed its steady decline, hitting 0.00% in March 2016.

Figure 6.3: ECB balance sheet (€ millions), 2007-2017

Source : Tradingeconomics.com, Eurostat.

The ECB's balance sheet was slightly above €1 trillion prior to the crisis, and steadily expanding (**Figure 6.3**). Following the shock, it immediately increased from €1.5 to €2 trillion as the ECB provided banks with emergency liquidity. ECB holdings remained around this level until the end of 2011, at the height of the "sovereign debt crisis", before reaching a high of more than €3 trillion in 2012 (induced by additional bank liquidity provisions), and then reverting back to €2 trillion at the end of 2014. In January 2015 the ECB started purchasing assets under its new Quantitative Easing program, first €60 billion per month then €80 billion since March 2016, putting the total ECB holdings above €3 trillion and ascending until the end of the program.

Together, these two indicators give a broad picture of the monetary policy response to the Eurozone crisis. We can distinguish three main policy shocks over the period 2008-2016. The first, in response to the 2008 GFC, consisted of a 3 points cut in the main interest rate combined with balance sheet expansion. During the second shock in 2011-2012, responding to the development of the sovereign debt crisis, the space for conventional monetary easing was lacking. Thus a much larger portion of the response from the central bank came from unconventional measures. Lastly, at the end of 2014 the ECB responded to weak inflation prospects and subdued growth with more stimulus, this time entirely unconventional (i.e QE), as the main interest rate was at the ZLB.

However, the size of the balance sheet does not entirely capture the nuances of unconventional monetary policies. Policies enacted between 2008 and 2014 primarily aimed at repairing the monetary transmission mechanism, and only some of them (i.e. liquidity assistance) increased the balance sheet. These increases should thus not be automatically equated with additional stimulus, and require a more granular, qualitative understanding. This is why these policies are analyzed in Section 3, while the Quantitative Easing plan, launched in 2015 to directly stimulate the economy, is discussed in Section 4.

6.2.1 The transmission channels of unconventional policy measures

The unconventional policy tools of central banks operate through a number of indirect channels on the macro economy. The ECB's toolkit can be separated into asset purchase programs, liquidity assistance and forward guidance, each of these categories operating through a varying mix of channels. **Figure 6.4** presents how these channels operate in the case of asset purchases.

Figure 6.4: The transmission channels of ECB asset purchases to the economy
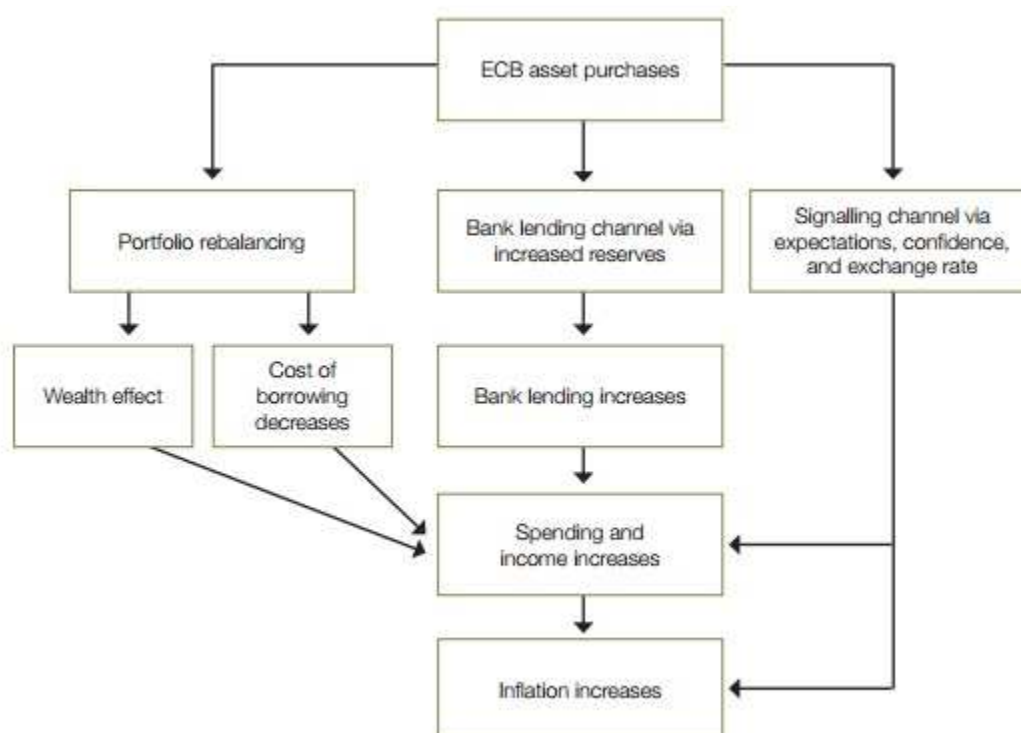
Source: Dunne et al., 2015.

The **Signaling channel** is an important transmission mechanism of all unconventional policies. The idea is that through announcing new, decisive monetary measures and committing to the achievement of its policy objectives, the ECB can produce positive effects on the economy by restoring business and market confidence, reducing uncertainty, and influencing individuals' expectations (notably for the pace of future inflation). Announcement of stimulus also drives exchange rates downwards. This would then translate into higher present credit growth, investment and consumption and increase the price of financial assets. Forward guidance (communication by the central bank on the future path of policy) for instance operates solely through the signaling channel, as it does not involve actual monetary operations but only communication of intent from the ECB.

The **Portfolio balance channel** refers to the transmission of central bank asset purchases to asset prices in financial markets. When it buys any asset on secondary market, the central bank bids up its price and diminishes its yield. As investors become "crowded out" of this particular asset segment, they rebalance their portfolio towards other similar assets, thus transmitting the initial asset price increase from the

ECB's purchase across asset classes (see, *inter alia*, Bernanke, 2009). With the increased asset prices, investors who hold them enjoy the "wealth effect" as their net worth increases, inducing them to spend more into the economy, while lower yields reduce market borrowing costs with similar end effects.

The **Bank lending channel**, as its name suggests, transmits the monetary stimulus to the real economy by increasing bank reserves and thus their capacity to extend additional credit. The increase in reserves can originate directly from liquidity providing operations (i.e. MROs and LTROs), or through the increase in asset prices of portfolios held by financial institutions.

Lastly, Fratzscher et al. (2014) identify two further important transmission mechanisms of unconventional policies: the **bank credit risk channel** and the **sovereign credit risk channel**. According to the authors, operations by the ECB aimed at addressing bank liquidity concerns might also have helped to lower credit risks in the banking system, decreasing risk premia in the overall economy. On the other hand, decreasing sovereign risk premia that were seen as excessive was a declared intermediate goal of the ECB, in its Securities Markets Program (SMP) and Outright Monetary Transactions (OMT) programs (described hereafter), to repair the monetary transmission mechanism.

6.3 Policy Effects : Unconventional Measures (2008-2014)

From 2008 to 2014, the ECB implemented a number of new programs to restore stability in key financial markets such as the interbank and sovereign bond markets, and thus restore a functional transmission of monetary stimulus. The central bank first conducted Long-Term Refinancing operations (LTROs) between 2008 and 2011, expanding its balance sheet to provide 3-to-12 months maturity loans to Eurozone banks. It then started buying sterilized sovereign bonds under the Securities Markets Program (SMP), from 2010 to 2012. Because the bonds were sterilized, the SMP did not cause an increase in the ECB's balance sheet. Neither did the Outright Monetary Transactions (OMT) program unveiled in 2012, which promised (conditionally) unlimited, sterilized purchases of sovereign bonds under market stress, but was never activated in practice. Lastly, from 2013 onwards the ECB started communicating about the future path of its main policy rate, a strategy known as forward guidance. A detailed review of each of these policies is offered in **Annex 5**, while the rest of this section will analyze the effectiveness of each program.

6.3.1 Long-Term Refinancing Operations (LTROs)

The ECB launched its long-term liquidity providing operations amidst rising tensions in interbank lending. Thus a good start to measure the effects of the LTROs is to look at how they influenced bank credit conditions (i.e. the bank credit risk channel). Several studies investigated the impact of the first wave of LTROs (those up to 12-months maturity) on interbank lending through regression analyses (Abbassi and Linzert (2012); Angelini et al. (2011); and Brunetti et al. (2011)). They found that these LTROs had no significant effect on the evolution of the Euro Interbank Offered Rate (EURIBOR), the benchmark rate for euro area interbank lending. In contrast, Szczerbowicz (2015) report that the announcement of the 3-year LTROs in 2012 did ease interbank credit tensions, lowering the EURIBOR-OIS (the most commonly used indicator of interbank market tension) spread by 22 basis points (bp), suggesting that the exceptionally long maturity of these 3-year LTROs helped make them more effective.

Evidence indicates that LTROs also operated through the sovereign credit risk channel and the portfolio channel. Fratzscher et al. (2014) report that sovereign risk (measured by 10-year bond yields) decreased more markedly in peripheral countries than in highly-rated member states[26]. Furthermore, both types of operations positively affected financial markets via higher equity prices. 12-months LTROs caused Eurozone equity indexes to rise by about 4%, while 3-year LTROs had a slightly bigger impact, at 5%, particularly affecting bank equities, which increased by 10% (Fratzscher et al., 2014). According to the author's counterfactual scenario analysis, in September 2012 sovereign yields in Spain and Italy would have been around 300 b.p. higher, while highly-rated sovereigns would have not been adversely affected. As for equity indexes, they would have been lower by 10 percentage points. These results concur with the conclusions of Boeckx et al. (2017), using a SVAR model to analyze the macroeconomic effects of the ECB's balance sheet expansion. They find positive effects on both financial markets and bank lending: equity prices and bank lending volumes rise, while sovereign spreads and interbank money market rates fall. There is a positive effect on inflation and output, but the latter is only significant in core countries. Overall, according to Stark (2009), LTROs helped restore the proper transmission of the ECB's main rate cuts to the economy following the financial crash. Doing so, the combination of LTRO and rate cuts contributed to the success of the ECB in restoring inflation around 2% between 2010 and 2012.

However, if LTROs have helped to ease bank lending conditions, credit transmission at the firm level might nevertheless have been impaired. Daetz et al. (2016) evidenced that, while euro area non-financial corporations indeed received additional funding as a result of LTROs, this extra cash was not always put to productive use. Rather than making new investments, there was a significant increase in firms' cash holdings. This cash hoarding effect was stronger for peripheral euro countries, and was positively correlated with the amount of liquidity injected in the country's banking system, that is, firms in countries that received the most LTRO funding tended to hoard more cash[27].

6.3.2 The Securities Markets Programme (SMP)

The SMP was introduced by the ECB to ease tensions on sovereign debt markets (specifically in the debt of peripheral countries), therefore one of its main intended transmission channels is the sovereign credit risk channel. Several studies attempt to measure the impact of the SMP on sovereign yields (specifically the spread with their German equivalent). It appears that SMP-related announcements from the ECB exerted a positive impact on sovereign yields through the signaling channel. Szczerbowicz (2015) reports that the announcement of the program in 2010 reduced the spread on the ECB's benchmark Eurozone 10-year bond by 16 bp. The effect is mostly concentrated in distressed peripheral sovereigns: while the French bond spread does not react to the announcement, those of Italy and Spain decline by 31 and 43 bp respectively, while the reported effect is -121 bp for Ireland, -202 bp for Portugal, and -485 bp in Greece. After the initial SMP purchases in 2010, the program became dormant in 2011. The

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[26] 12-months LTROs decreased sovereign yields by 24 bp in Spain and Italy at their peak in 2010, and by 5 bp in core countries. As for the 3-year LTROs, at their highest level (about 1 trillion euros) they decreased yields by 52 and 6 bp in the periphery and core, respectively.

[27] According to the authors, it is possible that firms chose to "invest" this liquidity in their sovereign debt market instead of real investments, as they benefitted from a "carry-trade" between the low cost of their debts and the high sovereign yields of peripheral countries.

announcement of the second round of SMP purchases, restarting the program in August 2011, led to a 26 bp decline of the benchmark Eurozone bond spread, with an impact several times higher in Spain (-104 bp) and Italy (-82 bp).

These announcement effects are corroborated by Eser and Schwaab (2013), Pattipeilohy et al. (2013) and Ghysels et al. (2016). In addition, studies investigate the marginal effect of the bond purchases themselves. De Pooter et al. (2012) report that the purchase of one percent of outstanding sovereign debt produces a reduction in spreads of -19.4 bp. However, out of this reported effect, the permanent reduction is only 4.6 bp, leaving temporary effects at 14.8 bp. Ghysels et al. (2016) report an immediate impact of a 100€ million SMP purchase between -0.1 and -25 bp on (10-year) yield spreads, depending on the size of the market for the specified sovereign. As for the long-run impact, it is estimated at 0.1 to 7 bp per 100€ million. Eser and Schwaab (2013) report that €1 billion purchases reduce spreads on 5-year bonds from -1 bp (in Italy) to -21 bp (in Greece), depending on the size of the market. Purchases of 1/1000 of the outstanding debt stock produces an average spread reduction of 3 bp. According to their estimates, the cumulated persistent effect of a €50 billion SMP purchase reduces yields by an average of 90 bp in large countries, and up to 1000 bp in the smallest countries. This translates into lower costs of debt servicing for governments as they roll over maturing debt.

Lastly, evidence indicates there was a significant interaction between the sovereign credit risk channel and the bank credit risk channel. SMP purchases diminished spreads on covered bonds (debt instruments issued primarily by banks and other financial institutions) by 19 bp throughout the Euro area (Szczerbowicz, 2015). Interestingly, sovereign bond purchases seem to have a larger effect on covered bond spreads than covered bond purchases themselves. Szczerbowicz (2015) argues that this reflects the importance of the sovereign-bank feedback loop due to the high exposition of banks to their sovereign. The disaggregation of the results also tend to confirm this argument; indeed, the SMP had a much larger impact on covered bond spreads in peripheral than in core countries. They were reduced by 163 bp in Portugal, 34 bp in Spain and 31 bp in Italy, while Germany and France only observed drops of 10 a 7 bp, respectively. Conversely, covered bond purchases by the ECB also diminished sovereign spreads, reflecting the feedback loop. Thus, the effects of the SMP were transmitted to the real economy in part through a reduced cost of bank financing. However, as Daetz et al. (2016) and Acharya et al. (2016) report credit hoarding behaviors from firms during other contemporary ECB programs, it is plausible that this behavior also impaired the effectiveness of the SMP, though there is no direct evidence to back-up this claim.

6.3.3 Outright Monetary Transactions (OMT)
The OMT program was unveiled in 2012 following heightened risks of a break-up of the Eurozone due to sovereign markets instability, which threatened to render peripheral countries insolvent as the market panic became a self-fulfilling prophecy. This threat prompted the ECB to promise unlimited support to distressed countries under an adjustment program[28].The most significant characteristic of the OMT program is that it has never been actually implemented. Therefore, if the OMT has affected macroeconomic developments, it is exclusively through the signaling channel. In that sense, it can be

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[28] As reflected by Mario Draghi's famous "Whatever it takes" speech on July 26, 2012.

understood as a particular form of forward guidance, where the ECB signals its willingness to enforce what it considers to be the normal equilibrium in sovereign markets, at any future date where it might be required.

De Grauwe and Ji (2012) examined how the tensions developed in European sovereign debt markets between 2008 and 2012. They report that significant part of the increase in the GIIPS countries' spreads was disconnected from the evolution in economic fundamentals. Instead, these increases were the result of negative market sentiment and heightened risk-aversion prevailing after 2010. Conversely, De Grauwe and Ji (2014) show that the large reduction in peripheral spreads between 2012 and 2014 was also mostly uncorrelated with fundamentals, and instead can be explained by a positive shift of market sentiment following Draghi's statements and the announcement of the OMT (**Figure 6.5**).

Figure 6.5: Sovereign 10-year bond yields following the "Whatever it takes" announcement
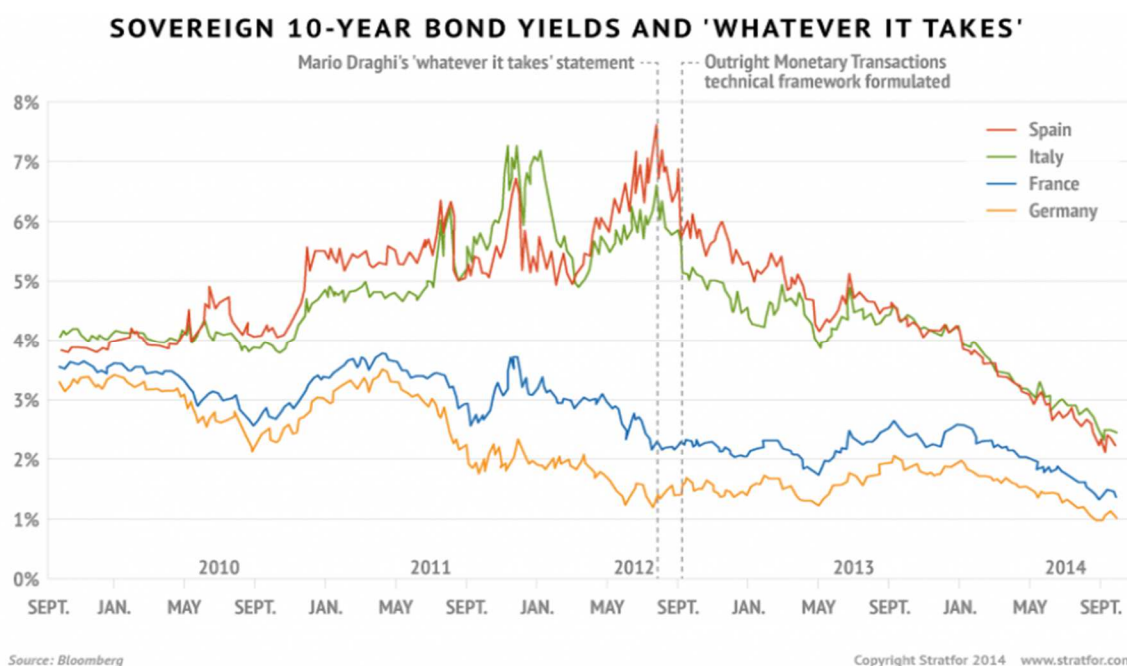
Source : Bosoni and Fleming-Williams (2014)

Fratzscher et al. (2014) attempt to quantify the effects of the OMT announcements. Using daily financial markets data, they report that the OMT announcements led do a cumulated -74 bp decline in 10 year government bond yields in Italy and Spain, while conversely the yields on bonds of highly-rated euro area countries increased by an average of 10 bp.

Altavilla et al. (2014) conducted a similar analysis, except their research is based on high-frequency intra-daily data, which is thought to more precisely capture announcement effects without suffering from endogeneity problems. According to their results, the OMT announcements decreased yields on the 2-year Spanish and Italian bonds by around 2 percentage points, while their German and French counterparts saw no significant change. As for the 10-year bonds, they estimate that the OMT

decreased their yields by 0.7 to 1.1 percentage points in Spain and Italy, which is in line with the results of Fratzscher et al. (2014). Again, the German and French bonds were unaffected.

Altavilla et al. (2014) also present a VAR model scenario analysis to evaluate The OMT's macroeconomic effects, which shows the OMT announcements had significant macroeconomic effects over a 3-year time horizon in Spain and Italy, while it only had a small effect on the economies of the core euro area such as France and Germany (**Figure 6.6**).

Figure 6.6: The Macroeconomic effects of OMT announcements - (VAR) scenario analysis

	Variables	Effect	Probability of Positive Effect
Germany	GDP	0.34	0.60
	Price	0.28	0.67
	Loans	1.08	0.90
France	GDP	0.46	0.64
	Price	0.28	0.68
	Loans	1.38	0.22
Italy	GDP	1.50	0.81
	Price	1.21	0.86
	Loans	3.58	0.82
Spain	GDP	2.01	0.80
	Price	0.74	0.65
	Loans	2.31	0.75

Note: The table reports the effects associated with OMT announcements in terms of percentage deviations in the OMT scenario relative to the no-OMT scenario at the end of the 3-year projection horizon. The last column reports the probability that the effects are positive.

Source : Altavilla et al. (2014)

Fratzscher et al. (2014) report that OMT also had a positive impact on financial markets, particularly in the periphery. In Italy and Spain, OMT announcements led to an increase of around 9% for equity indexes, while bank stocks rose by about 14%. In core Euro countries the effect size was much smaller. Lastly, the euro nominal effective exchange rate appreciated by 0.72% following the introduction of OMT.

However, Acharya et al. (2016) report that the transmission of OMT to the real economy was still impaired at the firm level. OMT announcements did improve banks' health, particularly for peripheral institutions with large sovereign exposure, and led to higher volumes of loans, but only for low-quality borrowers, which reflects a lowering of lending standards due to OMT. Unfortunately, this additional lending was overwhelmingly used by firms to build up cash reserves rather than investing it

productively. Thus the authors observe no significant macroeconomic effect on either investment or unemployment. These results echo those of Daetz et al. (2016) for the LTRO program.

6.3.4 Forward Guidance

The evidence regarding the effects of forward guidance of the ECB's interest rate has been mixed. On the one hand, the implementation of forward guidance by the central banks of advanced economies seem to have contributed in bringing down longer-term interest rates (Swanson and Williams, 2014), but on the other hand its macroeconomic effects seem to have been vastly overstated by conventional (i.e. DSGE) models and are actually quite limited (Del Negro et al., 2013). According to Benoit Coeuré (2013), a Member of the Executive Board of the ECB, the European forward guidance has had a three-pronged effect. First, it has dampened the impact of shocks exogenous to the Euro area (e.g. macroeconomic news from the USA or China). Second, it has reduced the uncertainty about the future path of monetary policy, which has had a positive effect on term premium in interbank credit markets. Lastly, it has also reduced the sensitivity of money markets to news and data surprises.

A main problem impeding the effectiveness of forward guidance is that while forward guidance leads to a higher level of consensus (on the part of the public) on the future path of the interest rate, it does not necessarily lead to a consensus about future macroeconomic fundamentals, i.e. inflation or GDP (Andrade et al., 2015). This is because the same announcement of future low interest rates can be interpreted positively (signaling more monetary stimulus) or negatively (signaling a degrading economic outlook and an economy stuck at the ZLB for longer). Thus, Andrade et al. (2015) show that whether forward guidance policies are effective depends largely on the extent to which the public interprets them as positive signs, and that forward guidance can even be detrimental (compared to the status quo) when interpretation are mostly pessimistic. Similarly, announcing the path of future interest rates is not sufficient to create a consensus of opinion on the desired monetary policy stance.

6.4 Policy Effects: The Quantitative Easing Programme (2015)

The Expanded Asset Purchase Program is the last of the major policy tools deployed by the ECB, being implemented in 2015, and is still ongoing. As such, due to long, variable and uncertain time lags in its transmission, a definitive, quantitative assessment of the impact of the EAPP on the macroeconomy is still premature (Hughes Hallett, 2016). Therefore, the empirical evidence gathered in this section will largely rely on the recent assessments of the EAPP commissioned by the European Parliament's Committee on Economic and Monetary Affairs (ECON) for the June 2016 session of the Monetary Dialogue (European Parliament, 2016)[29].

This section will first present an overview of quantitative studies evaluating the effects of QE policies, both in the EMU and other advanced economies, before investigating how the transmission channels of monetary stimulus operate in the case of the EAPP. It will then present and analyze the findings of the ECON studies on the macroeconomic effects of the ECB's Quantitative Easing so far. Lastly, the section

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[29] The corresponding papers are Hughes Hallett (2016), Demertzis and Wolff (2016), Bernoth et al. (2016), Gros (2016) and Gerba & Macchiarelli (2016).

will conclude with a discussion on the limits to QE effectiveness as well as its potential negative side effects.

In contrast to previous unconventional policies of the ECB, the EAPP was implemented specifically with the aim of jump-starting the economy in the face of prolonged low inflation, as indicated by Vice-President Constancio (2015)[30]. It also differs from previous asset purchase programs (SMP and OMT) in that purchases under the EAPP are not sterilized, and thus increase the ECB's balance sheet.

Indeed, when the ECB's QE plan was unveiled at the end of 2014, the macroeconomic situation was dire. *"Growth was low, inflation dynamics were weak with repeated downward revisions, savings were high and investment was meagre, falling well below pre-crisis investment trends. Overall, the signs of demand weakness were overwhelming pointing to a need for more stimulating monetary policies."* (Demertzis and Wolff, 2016:4).

Previous studies had documented the effects of Quantitative Easing in economies that implemented them before the ECB: the U.S, U.K. and Japan. IMF (2013c) provides an overview of the literature on the subject. As for the macroeconomic effects, most model-based studies typically find a relatively modest but positive effect on both GDP and inflation. Weale and Wieladek (2014) for instance report, using a VAR model, that asset purchases worth 1% of nominal GDP have positive effects on real GDP and inflation of 0.36 and 0.38 percentage points (p.p) in the US, and of 0.18 and 0.3 p.p in the UK, respectively. Early models for the ECB's QE yield similar, modestly positive results.

Sahuc (2016), employing a DSGE model, finds that the macroeconomic effects of the ECB's EAPP are potentially important when it is coupled with forward guidance, with the signaling channel being the most prominent transmission mechanism. When coupled with a 2-year forward guidance (i.e. the promise not to raise rates before two years), the EAPP causes a rise in inflation by 0.56 p.p in 2015, 0.6 p.p in 2016 and 0.2 p.p in 2017. It furthermore increases GDP by 0.9 p.p in 2015, 0.3 p.p in 2016, and lowers it by 0.3 p.p in 2017. These results are relatively similar to those disclosed by Draghi (2015) when asked during a press conference about the effectiveness of QE[31]. As of April 2016, the ECB staff counterfactual projects a positive total effect on GDP of 1.6% at the end of 2018 (Draghi, 2016).

However, as indicated by Sahuc (2016), the magnitude of the effects produced by QE is largely dependent on forward guidance in the DSGE model. This is quite likely to lead to an overestimation of the QE effects, as Del Negro et al. (2013) have shown that the models tend to overestimate the

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[30] *"Previous non-standard measures were mainly aimed at redressing impairments in the monetary policy transmission mechanism and fostering a regular pass-through of the monetary policy stance. Their implications for the ECB's balance sheet were accommodated in a merely passive way to satisfy the liquidity demand created by banks. In contrast, with the new measures implemented since June 2014, the Governing Council is more actively steering the size of the ECB's balance sheet towards much higher levels in order to avoid the risks of too prolonged a period of low inflation in a situation where policy rates have reached their effective lower bound."* (Constancio, 2015).

[31] *"So all in all, all these measures [QE] have had an effect on the economy. So let me give you a figure produced by our staff: in the absence of our measures, inflation would be at least half a percentage point lower next year, and about a third of a percentage point lower in 2017. But also the impact on GDP is very sizeable. Our measures are contributing to raise GDP by almost 1% in the years 2015 to 2017"*.

effectiveness of forward guidance (see also Andrade, 2015). Some studies (Kapetanios et al., 2012; Joyce et al., 2012; Bank of England, 2012) further report that in the case of the US, UK and Japan, the effects of QE on inflation were actually much more subdued than what the macroeconomic models indicate. Hughes Hallett (2016) argues that the effects of the EAPP will be similar if not weaker than those of other countries, and that arguably the qualitative effects of QE on financial stability and credit conditions will be more important.

From this preliminary review of the literature it appears that the macroeconomic effects of QE are difficult to discern, and its actual effects on inflation and expectations are uncertain. Therefore a more granular analysis of the EAPP is required, with the investigation of its transmission channels.

6.4.1 The transmission of QE: effects on yields, lending, exchange rate and portfolio balance

Previous evidence regarding asset purchase programs (see IMF, 2013c) points towards the preeminence of the signaling channel as the most significant transmission mechanism of QE. IMF (2013c) reports that the decrease of long-term yields due to the signaling channel has an effect on GDP about twice as large on average as that due to portfolio rebalancing effects. In addition to yields effects, the signaling channel can also influence the exchange rate. However, in the case of the Eurozone the portfolio balance channels have been stronger, notably the "scarcity" and "duration" channels (Altavilla et al., 2015). Nevertheless, Gerba and Macchiarelli (2016) argue that *"All in all, the medium to long-term effects of European QE may depend on the quality of market signalling by the ECB and the extent to which markets will react to it going forward."*

Effects on interest rates

The evaluation of the SMP and OMT programs provided preliminary evidence for the effectiveness of asset purchase programs on sovereign yields (see, for instance, Ghysels et al., 2016; Altavilla et al., 2014). Both these programs had substantial success in reducing yields on (peripheral) euro-area government bonds. This supports the view that the EAPP should be successful in lowering sovereign bond yields, and is consistent with studies on other countries' QE programs (e.g. Gagnon et al., 2011; Joyce et al., 2011). Nevertheless the ECB's EAPP was introduced at a time where sovereign financing conditions were much easier, with the spread of peripheral sovereigns significantly reduced since 2012. Demertzis and Wolff (2016) show that euro-area bond yields have steadily decreased since the launch of the EAPP (except during the Greek crisis in mid-2015), but that the spread between Germany and peripheral countries has not been significantly impacted. Using a VAR model, Bernoth et al. (2016) also find a reduction in sovereign yields following QE, with a more persistent effect for longer maturities. By extension, yields on other asset classes (e.g. corporate bonds) should also diminish through portfolio rebalancing effects.

Effects on lending

The growth of credit to households and Non-Financial Corporations (NFC) had turned negative since the second half of 2012, and credit to NFCs kept declining steadily until 2014 before recovering somewhat (**Figure 6.7**). Since mid-2014 and the first signals of QE, we can observe a recovery in both types of credit, more significantly so after the actual implementation of the program. Since then, household lending has grown from around zero to a more robust 2% a year, with a large proportion in the form of

mortgages (Demertzis and Wolff, 2016). Lending to NFCs has also stabilized although it is currently not growing significantly.

Figure 6.7: Euro area loans to households and Non-Financial Corporations, year-on-year change, in %
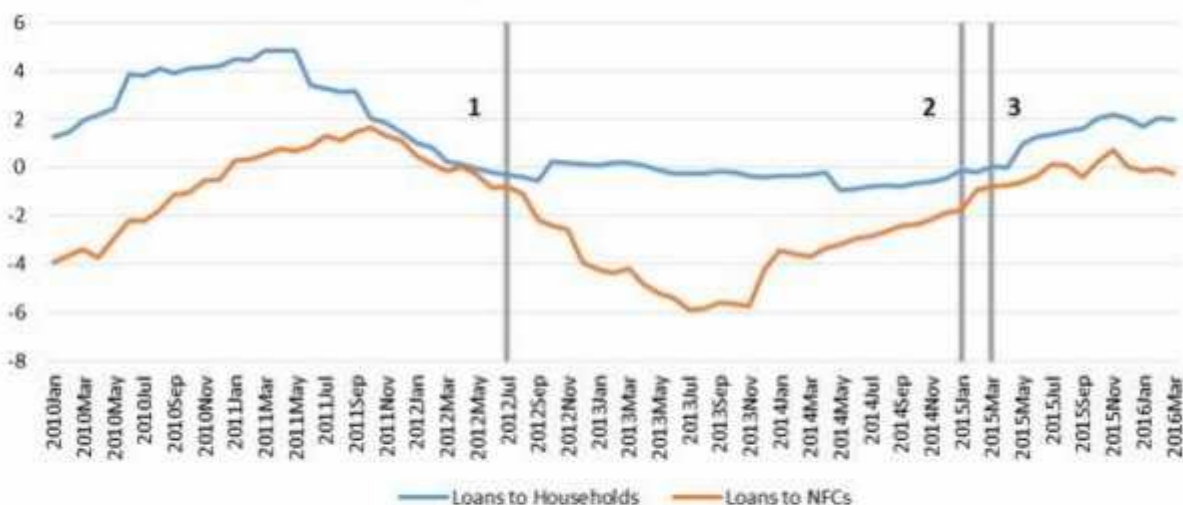
Source: European Central Bank
Note: 1) "Whatever it takes" 2) PSPP Announcement 3) Start of PSPP

Source : Demertzis and Wolff, 2016

However, Gerba and Macchiarelli (2016) argue that a closer qualitative analysis presents a different picture. Indeed, looking at the data obtained from the ECB's own bank lending surveys, the effects of QE seem much more limited. According to the April 2016 survey, 85% of banks report that QE has had no effect on their lending practices. Furthermore, many complain that razor-thin interest rates slash their profit margins. Thus, instead of affecting the bank's decision to grant (or not) a loan, QE's effect on lending might be felt more through the improvement of lending terms. According to Hughes Hallett (2016), this weak effect suggests an impairment of "*the transmission mechanism between liquidity provision and credit uptake*". The reason he advances is that investment spending is still low while many businesses or consumers still prefer to pay down their debts, which reflects the impact of the deleveraging cycle argued by McCulley and Pozsar (2013). In addition, problems with non-performing loans (particularly in Italy), which amount to about 9% of Eurozone GDP, also negatively impact banks' willingness and ability to lend (Mesnard et al., 2016).

Lastly, Gerba and Machiarelli (2016:17) report disparities between countries in the figures: *"while banks in the core countries are buying bonds from their own governments, the banks in the periphery (such as Spain, Italy, Portugal) are engaging in carry-trade opportunities by buying bonds from the core"*. This suggests that the transmission of QE through the portfolio balance channel is uneven across the Euro area, and the ECB should aim for a rebalancing of these dynamics if it wants the stimulus to be more effective. However, from the ECB's point of view the fact that peripheral banks are not increasing their exposure to domestic sovereign debt can probably be considered a good thing as it helps break the

sovereign-bank doom loop described in Shambaugh (2012) and Baldwin et al. (2015). Instead, the institution might want to incentivize greater peripheral exposure from core banks so as to increase sovereign risk diversification throughout the Eurozone.

Effects on the exchange rate

The Euro/Dollar exchange rate peaked at around 1.40 in the first half of 2014, before falling dramatically from mid-2014 to the first months of 2015 towards around 1.10. Since 2015 it has then stayed around that level, with fluctuations between 1.05 and 1.15. The fall coincides with Mario Draghi's Jackson Hole speech in August 2014. Thus the significant fall of the EUR/USD rate can be seen as resulting in good part from the signaling effect of QE (Demertzis and Wolff, 2016), the other main cause being the policy divergence between the Fed and ECB. While the ECB was shifting towards QE, the Fed prepared for an interest rate hike, and capital flows from EU to US pressured the exchange rate downwards (Demertzis and Wolff, 2016).

Looking at the Euro trade-weighted exchange rate (**Figure 6.7**), we see that it fell sharply following the launch of QE, but has since recovered a third of its losses since the last peak in 2014. According to Hughes Hallett (2016:106), *"many economists have concluded that the exchange rate channel is the most effective route by which QE can benefit the home economy. Support for this conclusion is provided by the fact that the transmission mechanism between asset purchases and higher investment or spending easily becomes damaged or ineffective and is hard to repair"*. Thus, in order for the EAPP to have the maximum macroeconomic impact, it should aim to depreciate the currency further, which will in turn *"crucially depend on whether it manages to turn the trend on the trade-weighted rate towards depreciation"* (Gerba and Macchiarelli, 2016:61). This might however not be an easy task, for ultimately currency depreciation is a zero-sum game in the world of central bankers. If every country can stimulate its economy through increased external demand by pressuring the exchange rate downwards, they might be tempted to engage in currency wars that would bring no benefit to anyone (see Kaletsky, 2016).

Figure 6.7: The Euro Nominal Effective Exchange Rate (NEER)
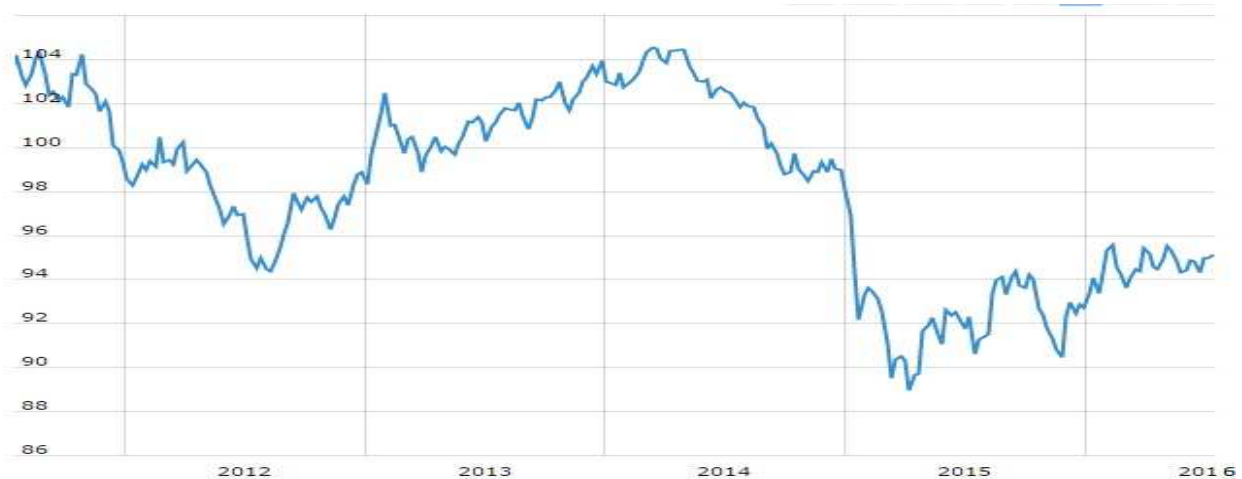
Source: European Central Bank.

Effects on portfolio balance

While the portfolio balance channel is much harder to evidence than other transmission channels of asset purchases, Hüttl and Merler (2016) suggest that the sovereign bonds purchased under the Public Sector Purchase Programme (PSPP, part of the EAPP) have mostly been acquired from non-bank and foreign entities, while banks of the euro area have mostly kept their exposure to sovereigns of the currency union. While the Eurosystem has purchased more than 700 billion euros of sovereign bonds from the start of the PSPP to April 2016, the sovereign bond holdings of euro area banks have only gone down by 82 billion euros during the same period.

6.4.2 The Macroeconomic impact of the EAPP: effects on inflation and GDP

Having analyzed the channels of transmission of QE to the real economy, we will now assess how these channels actually affected macroeconomic developments.

Inflation and inflation expectations

Actual inflation developments in the Eurozone have remained muted in 2016 (**Figure 6.8**), even when correcting for the fluctuation in energy prices (i.e. core inflation). From a low of 0.5 percent in January 2015, core inflation has only managed to hover around 1% since. While the recovery in energy prices might support further inflation developments, it seems that the ECB might have a hard time achieving its 2% inflation objective in the medium-term. The ECB itself has acknowledged that fact, and currently does not forecast inflation to stabilize at the 2% level until 2018. Despite robust inflation reports in the first half of 2017, the ECB (2017) judges that "*thus far, there had been no convincing signs of an upward adjustment in underlying inflation*." The latest estimates from ECB staff (Draghi, 2016) advance that the EAPP will have increased inflation by 0.8 points between 2016 and 2018.

Turning to inflation expectations, two metrics allow for proper evaluation. The first is the ECB's Survey of Professional Forecasters (SPF), the second is the market-based indicator of inflation linked swap rates. **Figure 6.8** shows both of these metrics with a 5-year time horizon.

Figure 6.8: Euro Area inflation and expectations five years ahead: Survey of Professional Forecasters and 5- year Inflation Linked Swap rates.
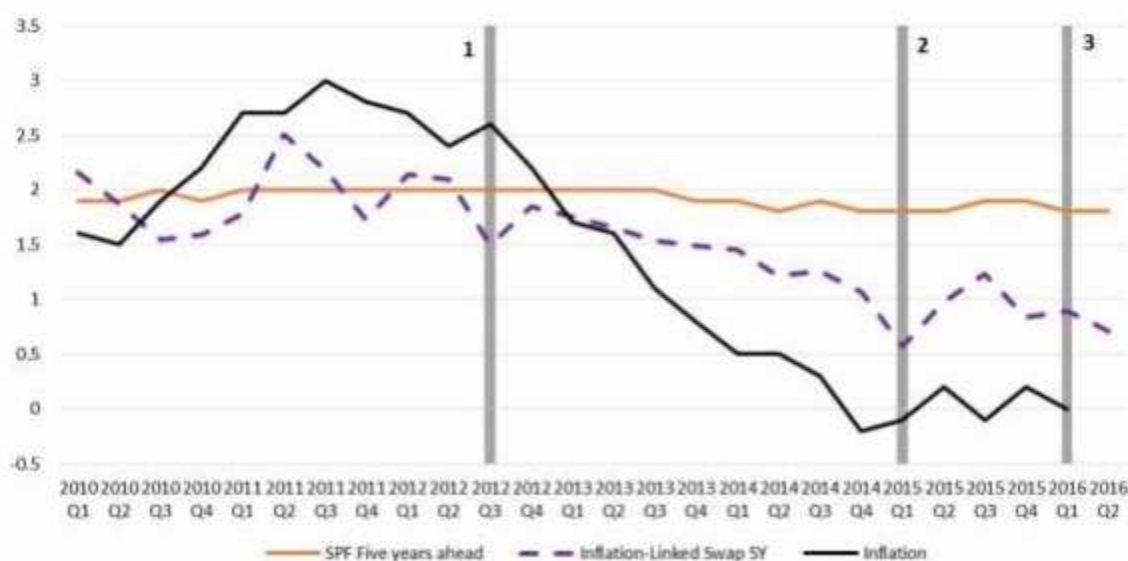
Source: Demertzis and Wolff (2016).

As shown above, the expectations of professional forecasters have been largely stable over time, and consistent with the policy objective of the ECB, close to but below 2%. This means that professional forecasters have confidence in the ECB's ability to deliver on its inflation objective in the medium-term. However market-based inflation expectations, after a rebound following the launch of QE, have been falling again since 2015Q3, despite the simultaneous rally in oil prices. According to Demertzis and Wolff (2016), this difference between the SPF and the market expectations signals that confidence is starting to wane, and indicates heightened uncertainty, as markets are quicker to react to perceived risks. Furthermore, yields and the exchange rate began to fall before QE was officially launched due to signalling effects and the anticipation of the program by market participants. However, market inflation expectations also kept on falling during the same period (mid-2014 to January 2015), which would mean that the signaling of QE had the opposite effect of what was intended (Gros, 2016). According to Gerba and Macchairelli (2016), the impact of QE on inflation seems indeed mixed. Based on the responses to the SPF, they report that (expected) positive future inflation developments are mostly attributed to the recovery in oil prices rather than QE, and professionals expect negative inflation prospects for 2017, stemming mostly from external downside risk. Gros (2016) argues, in light of these data, that QE has not been effective in achieving the ECB's inflation objective, and that this was to be expected[32].

A further explanation for why QE would be relatively ineffective in raising inflation is that the Euro area as a whole is still suffering from a high level of unemployment. This level is superior to the euro area

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[32] *"low interest rates increase the income of debtors, but reduce those of the creditors. The net impact on the economy of going from low to very low, and sometimes even negative rates should in any event have been expected to be small. Most evaluations of QE assume this problem by using standard models that imply, by construction, that lower rates stimulate the economy and increase output and inflation."* (Gros, 2016:72).

NAIRU (Demertzis and Wolff, 2016), the rate at which decreasing unemployment starts to significantly accelerate inflation. Thus as long as there is significant economic slack the additional monetary stimulus might not be enough to prop up inflation.

Gross Domestic Product

As illustrated in **Figure 6.9**, since the launch of the EAPP (noted '2' on the graph) GDP growth has been sustained mostly due to household consumption, investment, and to a lower extent fiscal policy. Investment has also picked up in the last three quarters of available data, which might be supported by the monetary easing. Referring to the previous analysis of the transmission of QE through credit channels, we can see that QE has contributed to an improvement in both consumption (through household credit) and investment (through NFC loans), though the impact on the latter is presumably lower as NFC credit growth is still almost zero.

Figure 6.9: Contribution to GDP growth in the Euro area
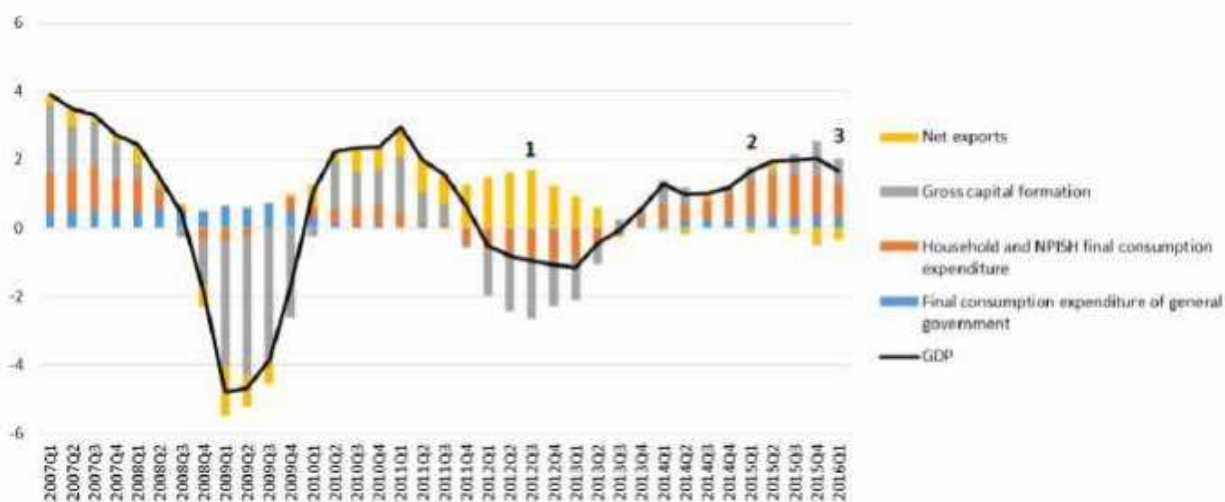
Source : Demertzis and Wolff (2016)

Hughes Hallett (2016) estimates the effect of QE on GDP to add 0.3 percentage points to growth annually, while the VAR estimates of Bernoth et al. (2016) are in a similar range. Meanwhile, the figures advanced by Draghi (2016) announced a total impact of 1.6 percentage points of GDP by the end of 2018. It is unclear to what extent these last estimates, based on macroeconomic models, are accurate (see, e.g., Del Negro et al., 2015), but they nevertheless give a plausible range of the effect size of QE on the economy. According to Gerba and Macchiarelli (2016), confidence is likely to be a significant component of how QE will impact the Eurozone recovery, but other factors will play an important role too, such as the long standing high unemployment and the geopolitical risks, like the unfolding of Brexit. Thus, they argue, *"the combination of QE with fiscal stimulus is crucial as monetary-fiscal interactions become more important over time"*.

6.4.3 The limits to QE effectiveness

Several factors can impair the different channels of transmission of QE (Hughes Hallett, 2016), and thus the effectiveness of the EAPP.

First among these problems is the ongoing deleveraging resulting from the accumulated debt overhang (Hughes Hallett, 2016; Demertzis and Wolff, 2016; Gros, 2016). In most countries at least one sector has built excessive levels of debt before 2008, and the subsequent deleveraging has been very slow (see Buttiglione et al., 2014; Ahearne and Wolff, 2012). Thus reducing the debt overhang weakens demand and puts downward pressure on prices.

Second, the banking system is still fragile. Particularly, non-performing loans remain problematically high (Mody and Wolff, 2015) and negative rates are harming banks' profit margins. Furthermore, the euro area is still subject to considerable political and economic uncertainty which negatively affect confidence (e.g. Brexit, migrant crisis...).

Third, there is a negative feedback loop between low growth, low inflation and high debt. With the ongoing deleveraging, deflationary pressures could lead to a debt-deflation cycle as theorized by Fisher (1933), or at least make further deleveraging more difficult, explaining why countries that are in the most need of deleveraging are finding it the hardest to do so (Demertzis and Wolff, 2016). This could particularly become a problem for the effectiveness of QE given the current signs of de-anchoring inflation expectations. Furthermore, most authors agree that fiscal policy has been insufficiently supporting the monetary policy objectives (Fratzscher et al., 2016) and growth in general (Gerba and Macchiarelli, 2016).

Finally, evidence indicates negative side-effects from QE (Hughes Hallett, 2016). It risks increasing inequality (Claeys, Darvas and Leandro, 2015) and undermining financial stability (Claeys and Darvas, 2015). Despite this, Claeys and Leandro (2016) judge that the benefits of QE still outweigh these side-effects, but that the much more prominent risk for the ECB is that of not achieving its inflation target and the de-anchoring of inflation expectations. This risk is even made more dangerous by the fact that Demertzis and Wolff (2016) find no impact whatsoever of the increase of the monthly EAPP purchases by 20 billion euros in 2016 on any variable.

6.5 Conclusion

To sum up, the analysis of monetary policy presented in this chapter yields the following results regarding the effects of unconventional measures. The LTROs, SMP and OMT program all eased tensions on sovereign bond markets, their main transmission channel with the signaling channel. The first rounds of LTROs did not significantly ease tensions in the interbank credit market, but the introduction of the 3-year LTROs in 2012 did. The reduction in sovereign yields from the LTROs, SMP and OMT were associated with a drop in corporate and covered bond yields through portfolio rebalancing and confidence effects. They also raised equity prices (banks particularly), and these effects were much stronger in peripheral countries. However, the transmission of credit was still impaired at the firm level, with significant hoarding and carry-trade behavior being observed. Thus, while their effect on GDP appears small, these policies, and particularly the OMT program, successfully restored financial stability. Indeed, *"Draghi's "whatever it takes" speech was a critical turning point for the euro area"* (Demertzis and Wolff, 2016:16).

Evidence on the effectiveness of the EAPP is also mixed. It has helped sustain the timid recovery in the euro area, contributing to growth through confidence effects and additional credit, though growth in firm credit is still near zero. A large part of its impact has been transmitted by a lower exchange-rate and confidence effects. However, the program suffers from important limitations. The scope for further easing via the exchange rate channel is limited, while several factors still hamper the effectiveness of the EAPP's transmission to the real economy: deleveraging, weaknesses of the banking sector, a "secular stagnation" cycle of low growth and low inflation, and insufficiently growth-supportive fiscal policies. Lastly, sustained QE might increase inequality and financial instability.

In the end, the macroeconomic effects of QE are positive but *"small in relation to the size and type of monetary policy interventions"* (Demertzis and Wolff, 2016:46). The effects on GDP are estimated to be between 0.9 and 1.6 percent over the life of the programme. On the side of inflation, the expected effects should also be small: the estimates range from zero (Hughes Hallett, 2016) to somewhere around 0.8 percent (Draghi, 2016). There are no signs that the expansion of the EAPP monthly purchases from 60 to 80 billion euros has had any impact on either of these variables (Demertzis and Wolff, 2016). This illustrates the limitations of current monetary policy, particularly since inflation expectations have begun de-anchoring and global macroeconomic perspectives indicate downside risks will dominate in the near future.[33]

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[33] *"Confidence is beginning to wane given the scale and unconventional nature of the measures taken and the absence of inflation. It is unlikely that confidence will be sustained for long in the absence of a visible increase in aggregate demand and inflation. Given also that the marginal benefits of more central bank action are disputable, more of the required stimulus would have to come from elsewhere."* (Demertzis and Wolff, 2016:46).

Chapter 7 – Conclusion

Following the empirical results gathered in the previous chapters, the present chapter concludes this thesis by answering the Central Research Question developed in Chapter 1. First, the evidence gathered throughout the thesis is synthesized to answer the sub-questions of the research, which guided the analysis. This synthesis will be used to evaluate the hypotheses derived from the theoretical framework (Chapter 2), which will be confirmed or rejected based on the pattern-matching logic. Afterwards, the chapter concludes on the central research question, states the limitations of the research, and ends with a discussion of the theoretical and practical implications of the present study. Doing so, it suggests areas of interest to researchers, and salient points to be considered by the public and policymakers alike.

7.1 Sub-questions and Hypotheses

Sub-question (1)-What has been the performance of the economy since the crisis?

After the initial shock of the global Great Recession in 2008-2009, the Eurozone economy has performed poorly, even when measured against the relatively slow recovery of other advanced economies. It suffered a double-dip recession from 2011 to 2013, before finally starting to grow again at a modest but accelerating pace since 2014. The economy in the Eurozone since the crisis is characterized by a persistent high level of slack and (structural) unemployment, particularly among peripheral countries and the youth. On the side of price developments, though inflation initially picked up in the first recovery period (circa 2010) and briefly exceeded the ECB policy objective, following the start of the second recessionary phase deflationary pressures started to build up from 2012 onwards. The inflation consequently dropped from around 3% to negative levels by the time the ECB launched its QE program in early 2015, and only started picking up noticeably in 2017. With core inflation still around 1%, the ECB does not yet see these developments as meaningful signs of improvement.

Sub-question (2) : How has the aggregate policy-mix evolved during the crisis?

Broadly speaking, on the fiscal side of the policy mix the Euro area shifted from an initial period of stimulus in 2008-2009 towards austerity, starting in 2010. The period 2010-2014 was marked by significant consolidation throughout the area, with a peak in the fiscal year 2012 and a gradual reversal towards a more neutral fiscal stance, roughly attained in 2015 and slightly expanding in 2016.

On the monetary front, the response at the start of the crisis was to cut rates from 4 to 1%, and to support the banking system with massive liquidity, then the sovereign debt markets with (sterilized) bond purchases. In 2011 there was a short-lived rate hike, which was hastily reversed and dragged the interest rate towards the effective zero lower bound from 2012 onwards, with progressive rate cuts from 2012 to 2015. This was complemented by the promise of unlimited (sovereign) asset purchases in 2012 under the OMT program, promise which itself proved effective in easing the tensions on sovereign debt markets. 2013 saw the implementation of forward guidance, while the ECB started hinting at a forthcoming QE in mid-2014, signaling its intentions to the markets. The program, called EAPP, was

launched officially in January 2015, with monthly purchases of 60 billion euros. It was last expanded in March 2016 when monthly purchases were propped up to 80 billion euros.

The evolution of the overall aggregate policy-mix in the period 2009-2016 is depicted graphically in **Figure 7.1** against McCulley and Pozsar's (2013) framework, which served as the theoretical basis for the research. The "policy path" thus described is not up to scale, and simply serves to represent conceptually the position of the policy-mix and its evolution over time within the framework. Furthermore, for monetary policy the framework cannot perfectly capture the nuances of policy around the ZLB and the fuzzy frontier that separates "conventional" and "unconventional" policy. For instance the LTRO and SMP program do not qualify as "right side" (unconventional) monetary policies in the framework as the first is a program of credit easing and not quantitative easing, and in the second case the asset purchases were sterilized and were thus not a tool for monetary stimulus per se. This imperfection reflects the fact that the ECB qualified these policies as aiming to repair the transmission mechanism of existing (i.e. conventional) stimulus and not being a stimulus in of themselves. Nevertheless, the policy path presented in **Figure 7.1** allows for a clearer visualization of the policy-mix and its evolution over the period. The movements of the policy-mix are described year by year in **Annex 6**.

Figure 7.1: The Euro area aggregate fiscal and monetary policy-mix during the crisis.
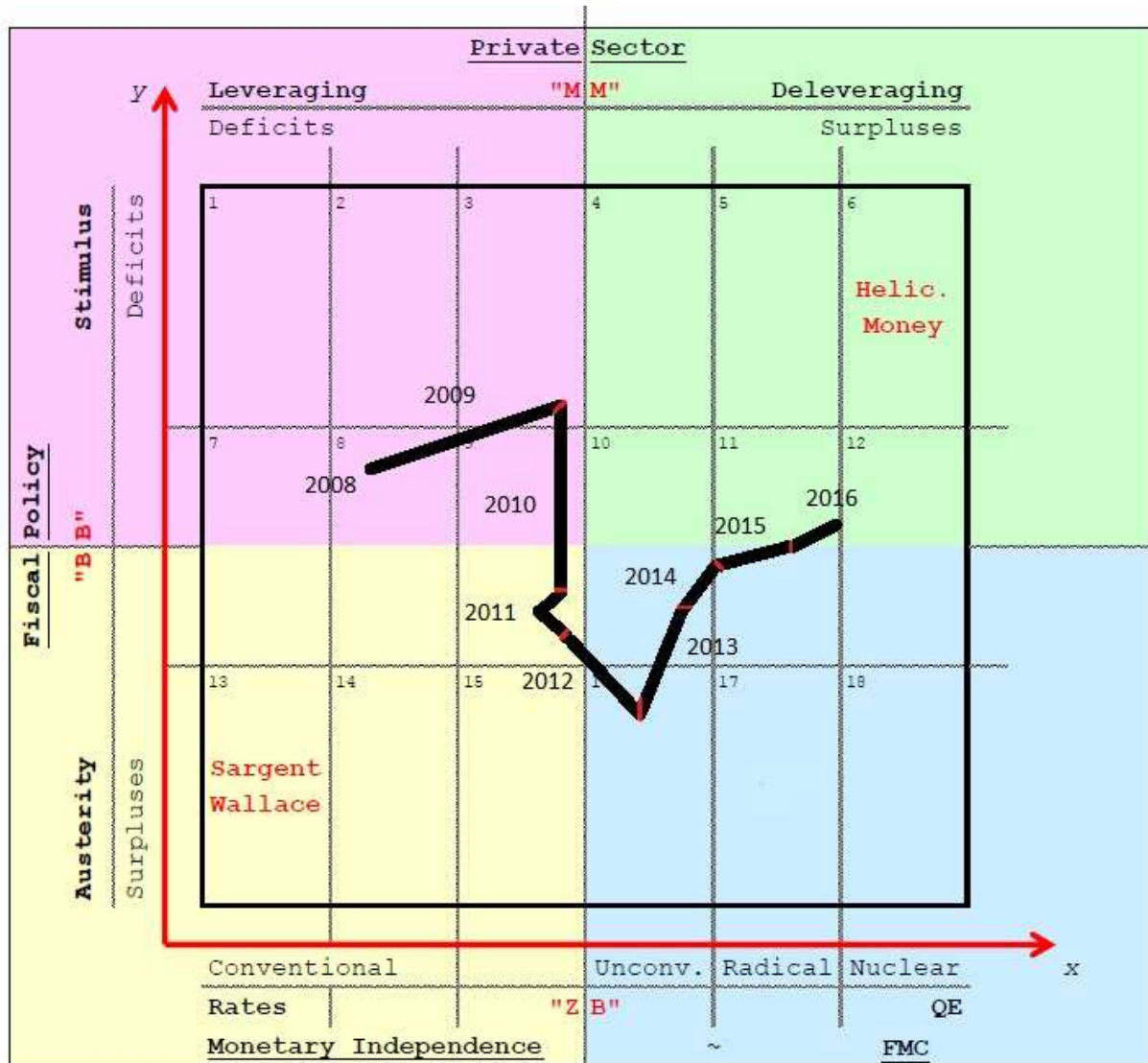
Source : McCulley and Pozsar (2013); author's research.

Sub-question (3)-To what extent can the Eurozone's economic performance be attributed to the policy-mix?

Overall, a good proportion of the performance of the Eurozone economy following the crisis can be explained by economic policy. Particularly, this thesis shows that fiscal policy had a large impact on GDP. The austerity conducted between 2010 and 2014 caused a loss of 5.5 to 8.4% of GDP in aggregate, and directly led to the double dip recession observed in 2011-2013. Furthermore, this loss of GDP induced by austerity will cause long-lasting damage to the economy due to the presence of hysteresis effects. With respect to inflation, there is also evidence that consolidation increased deflationary pressures and led the most vulnerable peripheral countries towards a debt-deflation cycle, making deleveraging more difficult. On the other hand, further analysis by the IMF, among others, revealed that properly targeted

fiscal expansion, particularly oriented towards public investment and infrastructures, would have been very effective at boosting GDP when financing costs were historically low and the economy suffered from a large amount of slack, and could very much have been a "free lunch". Thus the hypothesis H1 is **confirmed**:

H1 : Expansionary fiscal policy has a high positive impact on output at the ZLB. Conversely, fiscal consolidation has a large contractionary effect.

On the other hand, the thesis does not evidence such a strong impact of monetary policy on economic activity, reflecting the view that monetary policy is much less effective in a liquidity trap. The ECB's unconventional monetary policies have had positive but modest effects on the real economy. The main achievement of the ECB in the crisis has been its success in stabilizing financial conditions through programs targeting bank liquidity and interbank lending, as well as the sovereign debt markets.

Mario Draghi can be credited with resolving the acute phase of the sovereign debt crisis with his promise to do "whatever it takes". However, the effect of these targeted programs on GDP is uncertain, as evidence indicates a less than functional transmission of the added credit to the economy, mostly at the firm level. As for the QE program that started in 2015, it did have a positive but small impact on economic activity. Mostly, the impact of QE seems to have been channeled through signaling effects, and particularly the exchange rate which it contributed to lower significantly. Judging the program by the ECB's mandated objective of raising inflation and expectations towards 2%, the case for the effectiveness of QE is weak, with a total impact of 0 to 0.8 points of inflation over the period. Inflation expectations have also begun de-anchoring from the 2% objective, indicating a loss of confidence in the ability of the ECB to deliver on its promises. The evidence furthermore suggests that deleveraging is a significant factor impeding QE effectiveness, by limiting the potential growth of credit uptake and generally putting downward pressures on demand and inflation.

Thus hypothesis H2 is **confirmed**:

H2: Unconventional monetary easing at the ZLB, without being accompanied by fiscal expansion, is ineffective in raising future inflation expectations, because credit constraints in the private sector impair the monetary policy transmission mechanism.

Sub-question (4)-What underlying mechanisms explain the relationship between economic policy and performance?

Regarding fiscal policy, the larger-than-expected effects (i.e. fiscal multiplier) can be explained by four factors. First is the cyclical position of the economy. After a downturn such as the GFC, multipliers are much higher than average, particularly as the magnitude of the crisis was so large (Auerbach and Gorodnichenko, 2012). Second, the composition of fiscal impulses played a role. Various budget items are associated with different multipliers (Gechert et al., 2015), which also depend on the economic cycle. Tax-based impulses have lower multiplier than expenditure-based ones. Public investment has a high multiplier in general, while social transfers have a high multiplier only during slumps. Both were reduced during the Eurozone consolidation, and account for a significant part of austerity's economic

damage. Third, the presence of private debt overhangs also magnifies the impact of fiscal policy, due to the absence of Ricardian behavior from individuals, and the emergence of the paradox of thrift (Eggertsson and Krugman, 2010). The Eurozone aggregate (fiscal) stance also matters, and the conduct of simultaneous austerity across countries increased its cost for each state.

In addition to those factors, the presence of hysteresis in the economy made the damage caused by austerity largely permanent. According to DeLong and Summers (2012), this makes austerity self-defeating even for its purpose of improving debt sustainability, as the costs to potential output outweigh the gains from lower deficits. The findings show that austerity-induced losses of actual GDP led to equal or greater loss of potential GDP, and that consolidation might even have lowered the potential growth rate. The thesis furthermore evidences several plausible mechanisms by which consolidation caused lower potential GDP and GDP growth. Reduced spending on education and the youth, along with a rise in unemployment associated with austerity, caused long term damage to human capital and created a "lost generation" of the young in the peripheral countries who definitively lost a significant part of their lifetime earnings potential, lowering potential GDP. Consolidation is furthermore directly related to an increase in inequality, which was found to have a negative effect on potential GDP growth. Public investment, on the other hand, suffered deep cuts in many countries, which has likely had a negative impact on both potential GDP and potential growth. Public investment is overwhelmingly found to have a strong positive effect on current and potential GDP levels, even possibly paying for itself under the specific conditions of economic slack, low interest rates and moderate investment efficiency which are all prevalent in the current case. It crowds-in private investment, raising potential GDP through a higher capital stock, and spurs technological advances which increase factor productivity and thus potential growth.

Therefore, hypothesis 3 is **confirmed**:

H3: Hysteresis effects induce permanent costs in the event of negative output gaps, lowering potential GDP and amplifying the negative effects of restrictive economic policy in the long term.

As for monetary policy, a significant factor explaining its relative lack of effectiveness is the various impairments affecting the transmission mechanism of policy decisions. First was the issue of the sovereign debt crisis, which took several years to stabilize and affected lending conditions unequally across the Eurozone. It damaged the transmission of credit through the doom-loop between banks and sovereigns, and created incentives for credit hoarding by firms. The legacy of the crisis also left significant fragility in the banking sector of peripheral countries (e.g. Portugal, Italy), with large amounts of non-performing loans affecting the capacity of banks to extend more credit. The second main factor is the presence of a debt overhang in most countries reflecting the current conditions at the Zero Lower Bound, as theorized by McCulley and Pozsar (2013). This debt overhang and the process of deleveraging limit the ability of firms and households to take on additional credit, and thus impair the proper transmission of monetary policy. With ongoing deleveraging, the downward pressures on demand and inflation feed on each other as low inflation makes it harder to repay existing debt. Monetary policy alone can only do so much to spur inflation and demand and get out of the negative cycle of low growth, high debt and low inflation. Its large purchases of sovereign debt under QE have modest effects on

credit and GDP growth, but they keep public financing costs at an all-time low. For these reasons, fiscal policy can also be considered as impairing the effectiveness of monetary policy, as it has been insufficiently supportive (see e.g. Gerba and Macchiarelli, 2016) of the central bank's objectives.

Sub-question (5)-What would be an appropriate policy-mix moving forward?

Given that the expansion of the EAPP produced no effect and interest rates are at zero, monetary policy seems to have little room for maneuver on its own. On the other hand, there is a solid case for properly designed fiscal expansion in the Eurozone. The output gap may still be high (Jarocinski & Lenza, 2016), especially for peripheral countries facing ongoing high unemployment, and so fiscal multipliers should be high too. Stimulus in the core would further produce strong positive spillovers to the periphery (Blanchard, Erceg & Linde, 2016). With a Eurozone public investment gap still high (Wolff, 2014) and low interest rates, infrastructure spending currently is a "free lunch" (IMF, 2014). In addition to a high output impact, fiscal policy could contribute to the objective of a stable inflation around 2%, by reducing unemployment below the NAIRU to allow inflation to accelerate. Properly-targeted stimulus could and should also reduce inequality, fostering long-term growth, and contribute to resolving the private debt overhang, as argued by McCulley and Pozsar (2013), by acting as spender of last-resort. Even without significant expansion, the composition of public finances can be redesigned to be more growth-friendly, again by focusing on items that produce long-term benefits such as education and infrastructure, and by engineering a fairer, less distortionary tax structure (ECB, 2017b).

Crucially, a main take-away of this research is that policy coordination matters. On the fiscal side, member states should reinforce their cooperation to produce a more optimal aggregate fiscal stance. The asymmetric, coercion-based framework built around the SGP has shown its limits in the present crisis, as it only leads to one-sided adjustment on the part of the deficit countries, with no incentives for their partners to act as a counterweight. Indeed, there is no mechanism or procedure to force excessively austere countries to conduct fiscal stimulus, even if it were beneficial to the aggregate economy. On the monetary side, given that policy effectiveness depends on the support of the fiscal authorities during the liquidity trap, the central bank should explore ways to better cooperate with fiscal policymakers without reneging on its independence. According to McCulley and Pozsar (2013), the best way for the central bank to retain its effectiveness during a liquidity trap is to support the fiscal authority in providing the necessary amount of stimulus to exit the ZLB.

Indeed, the policy-mix suggested above, resolutely Keynesian, faces one main obstacle, the real or perceived lack of fiscal space. In this context, the policy proposals (e.g. Turner, 2013) arguing for the use of "Helicopter Money", or the overt monetary financing of fiscal stimulus, merit to be considered by the ECB as the logical "next step" to overcome its limitations during a liquidity trap. It would allow monetary policy to recover its effectiveness by giving it a highly effective transmission channel (government spending), and simultaneously solve the issue of a lack of fiscal space, as OMF clearly respects the intertemporal budget constraint of the consolidated government (Buiter, 2014). Although Mario Draghi has called helicopter money a "very interesting concept", there are no signs yet that the ECB is moving in that direction in the future.

7.2 Central Research Question

Having analyzed the hypotheses and answered the main sub-questions of the research, it is now time to conclude on the thesis's Central Research Question: "***How can macroeconomic stabilization policy explain the performance of the Eurozone economy following the 2008 crisis?***".

As demonstrated throughout this chapter, the Eurozone's economic policy can explain in large part the mediocre macroeconomic performance of the area following the 2008 GFC. The stabilization response to the crisis has been dominated by the central bank as "the only game in town" while fiscal policy was broadly restrictive, which proved to be a suboptimal policy-mix. In the conditions of post-crisis deleveraging cycle and liquidity trap, monetary policy lost a good part of its macroeconomic impact, whereas on the contrary fiscal stimulus would have been much more effective than usual to stabilize the economy, by acting as a spender of last resort. Policymakers on all fronts critically failed to understand these specific conditions at the time, which represented a paradigm shift compared to the previous decades. Thus fiscal multipliers were largely underestimated (Blanchard and Leigh, 2013) when Eurozone policymakers shifted from fiscal stimulus to austerity in 2010.

This shift, and the fiscal consolidation that followed between 2010 and 2014, is the largest observable policy determinant of economic performance during the crisis, causing an aggregate loss of 5.5 to 8.4% of Eurozone GDP. It explains, for a good part, the double-dip recession of 2011-2013, and the downward pressures on inflation observed from 2012 onwards. Although austerity was implemented to improve public finance sustainability across the area, its effectiveness on that front can also be questioned given its high output cost, furthermore magnified by the existence of hysteresis effects which made the damage largely permanent. The end of austerity in 2014 combined with the launch of the ECB's Quantitative Easing program in early 2015 allowed for a nascent economic recovery, but weaknesses remain, particularly on the side of (core) inflation. Future performance of the Eurozone should crucially depend on the effective coordination of fiscal and monetary policy to accomplish stabilization objectives.

7.3 Limitations of the research

As with any qualitative research, this thesis suffers from the researcher's own biases, notably the confirmation bias, which can lead the thesis to favor presenting evidence that supports rather than refute its hypotheses. This problem was mitigated throughout the thesis by relying on high-quality publications as source of evidence, multiple methodologies whenever possible, and the combination of qualitative and quantitative data.

There are furthermore limitations relative to measurements. In particular, the measurement of Quantitative Easing effects by macroeconomic models wasn't considered robust (Del Negro et al., 2013), while little evidence was available regarding the portfolio balance effects of QE. This suggests topics of interest for future researchers. Additionally, the measurement of hysteresis based on GDP had limited validity, due to methodological flaws in Ball (2014). The thesis therefore used the NAIRU-based measurement of Logeay and Tober (2006) as a second best alternative, which fit less well with the research variables but was more valid.

Lastly, with regards to the analysis, the thesis evidenced some interactions between fiscal and monetary policy but didn't analyze these interactions in a systematic way. This is due to the constraints of the research and the limited availability of relevant data, particularly regarding QE. Specifically, theory suggests that fiscal consolidation in a liquidity trap prevents deleveraging from the private sector, and thus impedes the ability of Quantitative Easing to stimulate credit growth, but the thesis only presented circumstantial evidence supporting this assertion. A thorough analysis of this interaction would require establishing a counterfactual scenario, but this was not feasible within this research, and none such analysis was found in the literature. Again, further attention from researchers on this area would be very welcomed.

7.4 Social and Theoretical implications

The results of this thesis have implications for future research as well as for the economic policy debate in the Eurozone. First, it has evidenced the very specific conditions under which policy operates presently, and the limits they pose to policy effectiveness. In particular, monetary stimulus seems to have reached its limits, and is struggling to achieve the ECB's policy objectives. McCulley and Pozsar, inter alia, suggest that the most important impediment is the ongoing debt overhang and deleveraging. Therefore, an important area for further research would be to analyze how to properly and orderly resolve this debt overhang and simultaneously strengthen the banking union, since banks also suffer from the debt overhang, e.g. with non-performing loans problems. This would go a long way in getting out of the liquidity trap, allowing monetary stimulus to regain effectiveness. Until this debt overhang is resolved, fiscal policy should remain the most effective macroeconomic stabilization tool. On this side of the debate, researchers can further contribute to the discussion by identifying the most effective avenues for fiscal stabilization and how to best coordinate the actions of the central bank with those of the national fiscal authorities.

Indeed, fiscal policy has been relegated to the backseat when it comes to macroeconomic stabilization since the neoliberal-monetarist consensus of the 1980s. The advent of a persistent liquidity trap and the return to a more "Keynesian" paradigm should thus lead researchers to question some tenets of monetarism underpinning the EMU and re-evaluate its architecture (Stockhammer, 2013), in order to achieve both a greater stabilization role for fiscal policy, and a greater coordination of fiscal and monetary policy to fulfill stabilization objectives. Throughout the crisis, a main difficulty has been to properly manage the aggregate fiscal policy stance in the face of widely divergent economic conditions, and a coordination system based on national and asymmetric constraints. This suggests areas of research in the field of OCA theory and game theory related to policy coordination.

From a practical and social point of view, the present thesis suggests that significant improvement in the Eurozone's economic perspectives will require major changes in economic policymaking, and possibly changes in the Treaties to deepen integration and complete the monetary union with a semblance of fiscal union. Although much progress has been made in certain areas such as the banking union, the Eurozone still lacks a common shock-absorption mechanism, as recommended by OCA theory, such as a common scheme for unemployment insurance.

The Stability and Growth Pact has delivered neither stability nor growth since the advent of the sovereign debt crisis, and has furthermore been shown to be politically difficult to enforce for both "weak" and "strong" member states. On one hand, the Commission in July 2016 decided not to impose fines on Spain and Portugal for their long-standing excessive deficits, which would have been difficult to justify given that these countries pursued deep austerity for years in accordance with the SGP's recommendations. On the other hand, Germany has had for years a trade surplus well in excess of the Macroeconomic Imbalance Procedure guidelines, which has been criticized repeatedly by the IMF and the Commission as hurting the growth of its European partners, yet no sanction has been taken there either, given the political and economic dominance of Germany in the Eurozone. This system of coordination by sanction has shown to produce a suboptimal (overly restrictive) aggregate fiscal stance, in no small part because there exists no mechanisms to induce countries with fiscal space to pursue stimulus if it would be beneficial to the aggregate economy. This thesis indicates that reforming this system of fiscal governance should be a priority for policymakers.

Unfortunately, progress in this area is unlikely as the dominance of German ordo-liberalism in the Eurogroup precludes any positive fiscal coordination, risk-sharing, or more generally a closer fiscal union which does not resemble a straightjacket. What is thoroughly missing from EU policymaking is a long-term vision including a bold agenda tackling the most pressing issues of our time, from sustainable and inclusive growth to climate change, terrorism and the migrant crisis; and most importantly, the means to achieve these objectives. This thesis indicates that there are clear opportunities by which economic policy could make crucial contributions in these areas, notably by investing in infrastructure, research and education and the energetic transition (see Creutzig et al., 2014). These contributions are much needed to reinstate the well-being of the people as the EU's primary policy objective (Fitoussi and Malik, 2016). However, they will likely necessitate a proper fiscal union or a higher degree of cooperation between fiscal and monetary authorities, for instance in the form of Overt Monetary Financing, as suggested by a growing number of economic and political observers (e.g. Irwin, 2016; Skidelsky, 2016; Martin, 2016; Barnato, 2016).

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Annexes

Annex 1 : Literature review: the role of fiscal and monetary policy in macroeconomic stabilization

The theory and practice of macroeconomic policy have evolved tremendously over the last fifty years, following the shifts and the crises that have affected Western and global economies during the same period. It is thus important, if one is to comprehend the situation at hand presently, to understand the paradigm shifts that underpin current policymakers' reasoning and reactions to the crisis. Such an analysis is offered in Allsopp and Vines (2005).

During the first decades of the post-World War II period, characterized by a "golden age" of growth, macroeconomic policy was decidedly Keynesian. Its primary goal was to support full employment, which it did through demand management policy. At the time, and although monetary policy was also used to impose capital controls and conduct nominal devaluation through the exchange rate, fiscal policy had the primacy as the preferred instrument of demand management. If policymakers wanted to stave off a recession, they would increase expenditures and/or lower taxes to increase demand (and thus output) and bring unemployment back to potential. Conversely, faced with an overheating economy and risks of inflation, governments would tighten the purse strings.

However, according to McCulley and Pozsar (2012), there was a crucial flaw with this policy regime, one that policymakers failed to grasp on time. Indeed, the Keynesian fiscal dominance was effective during the first few years after WWII, because the private sectors of advanced economies were still undergoing a process of deleveraging due to the debt overhang caused by the Great Depression of 1929. This process came to an end in the 1950s, and the private sector started to increase its leverage again. This secular leveraging cycle led to the private sector competing for funds with the government, which in turn led to crowding-out effects and overheating of the economy. By the 1970s, it became clear that the results of this continued "pump priming" by governments were having disastrous effects: both inflation and interest rates kept on rising, while growth often stagnated (Koo, 2009). Keynesian fiscal policy then lost much of its credibility, leading policymakers to turn to monetary policy as the primary tool for macroeconomic stabilization. This was illustrated in the US, for instance, by the Humphrey-Hawkins Act of 1978, which transferred the responsibility of promoting maximum employment and price stability from the federal government to the Federal Reserve, giving it its present mandate.

This period of "stagflation", when high inflation coincided with high unemployment and interest rates as well as slow growth, was the driving force behind the shift to the era of "unpleasant monetarist arithmetic", as coined by Sargent and Wallace (1981). The monetary authority was now charged with disciplining reckless governments maintaining unsustainable fiscal deficits, which it did by raising interest rates, thus increasing the burden of public debt interest payments, until the fiscal authority

blinked. The policy regime indeed proved to be effective: by the 1990s, inflation had receded from its double-digits high while government deficits resorbed and growth resumed its course.

These developments explain the consensus prevailing in macroeconomic policy at the time of the 2008 crisis. The policy regime is oriented towards fighting inflation as its primary objective, as illustrated by the monetary policy reaction function. When inflation rises, the monetary authority raises its interest rate by more than the rise in inflation, so that real interest rates rise, resulting in a fall in output and employment. This is known as the Taylor rule. The current policy framework is therefore one of "constrained discretion" (Bernanke and Mishkin, 1997; King, 1997; Ball 2001) based on inflation targeting. Macroeconomic policy commits, first and foremost, to medium term price stability and, subject to that constraint, to stabilizing the economy as much as possible in the short-run. The inflation-targeting policy regime, in practice, charges monetary policy to conduct these two objectives, with the central bank's short-term interest rate being the primary policy tool. As noted by Allsopp and Vines (2005), the inflation-targeting framework could, in principle, be pursued using fiscal policy tools instead (see e.g. Weale et al., 1989). Why is this not the case?

According to Allsopp and Vines (2005), two main strands of arguments have been put forth that help explain why fiscal policy has taken the back seat in the current consensus of macroeconomic management. The first is that fiscal policy is, in fact, ineffective, as argued for instance by Barro (1974). The second is that fiscal policy may well be effective, but is more hazardous to use and is inferior, for the objectives of the policy regime, to monetary policy.

Addressing this last point, it does appear that, at least during "normal" circumstances, monetary policy has substantial advantages over its fiscal counterpart (Allsopp and Vines 2005). Interest rates can be adjusted frequently and painlessly by the monetary authority, in contrast to fiscal policy which is harder to change and subject to lags in its implementation. Furthermore, fiscal demand management has often proved to be destabilizing in the past, and fiscal activism has often been associated with persistent deficits and an unsustainable buildup of public debt. Lastly, fiscal policy has to deal with more than just macroeconomic stabilization, notably its distributional effects and the sustainability of public finances. It is consequently highly politicized, in contrast to monetary policy which can be easily delegated to an independent central bank and shielded from political influence. In light of these factors, it becomes much clearer why monetary policy has been the preferred tool to conduct macroeconomic stabilization policy in recent years. Does that mean, however, that fiscal policy is ineffective?

The main proposition arguing in favor of this line of reasoning has been popularized, chief among others, by Barro (1974), and rests on the assumption of "Ricardian equivalence". Simply put, this proposition states that, for any given level of government expenditure, whether it is financed by taxes or by sovereign debt should make no difference for the behavior of private agents. Indeed, if individuals are forward-looking, they would correctly realize that a debt-financed deficit in the present would have to be matched by a corresponding tax increase at some point in the future, and discount it adequately, so that the net present value of the future tax burden would be equivalent to the burden imposed by current taxes if the deficit was tax-financed. Private agents would therefore reduce their spending now in prevision of the future taxes, in such a way that the debt-financed stimulus would have absolutely no

effect: public spending would exactly crowd-out private spending. If this is true, then fiscal policy has no role to play in macroeconomic stabilization and should just be concerned by "keeping the house in order", as it has been suggested, for instance, by Alesina et al. (2001) in their discussion of the EMU.

This proposition is however contentious, as it rests on a number of strong assumptions such as perfectly forward looking agents, perfectly functioning financial markets and no liquidity constraints. In a world where agents can be constrained by liquidity, however, the stimulating effects of deficit-financed public spending begin to appear again, which will prove important for the case at hand in the present paper. A more comprehensive criticism of the neo-Ricardian equivalence proposition can be found in Tobin (1980) and Solow (2005).

Annex 2 : A conceptual framework of Hysteresis

The concept of hysteresis is defined as the time based dependence of a system's output on current and past inputs. With respect to the economic performance of a country or group of country, it relates to the idea, first advanced by Phelps (1972) that periods of economic downturns in the business cycle continue to have long-term costs even after they end, particularly for unemployment. To formulate it differently, the hysteresis hypothesis states that recessions may permanently lower the level of potential output relative to trend. (Blanchard, Cerutti & Summers, 2015)

This idea was further explored in a seminal contribution by Blanchard & Summers (1986), who developed a theoretical explanation of the process by which previous periods of high unemployment lead to a higher natural rate of employment. When an adverse shock increases unemployment in an economy or industry sector, there are fewer employed workers in companies. Since employed workers have a certain degree of influence over wage-setting, their reduced number incites them to bargain for better wages as the economy improves, causing wages to move higher than the equilibrium point, and therefore creating permanent unemployment in the economy.

Furthermore, unemployment (especially long term) can erode worker's skills and ability to gain employment again, as well as their future income level, through a variety of mechanisms, including "*reduced labor force attachment on the part of the long-term unemployed, scarring effects on young workers who have trouble beginning their careers, reductions in government physical and human capital investments as social insurance expenditures make prior claims on limited public financial resources, reduced investment in both in research and development and in physical capital, reduced experimentation with business models and informational spillovers, and changes in managerial attitudes*" (Delong & Summers, 2012).

Hysteresis can be conceptualized more precisely, for the purpose of this research, with the help of the Aggregate Demand/Aggregate Supply model in macroeconomics (Blanchard and Johnson, 2013), illustrated below.

Figure A: The AD/AS model (Blanchard and Johnson, 2013)

97
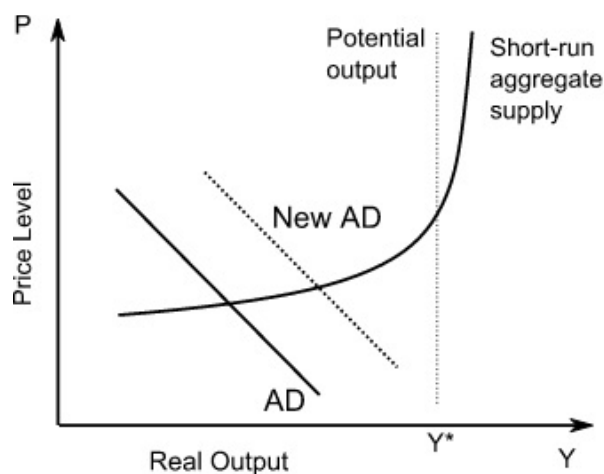
In this model, real (or actual) output Y is the intersection of aggregate demand (AD) and aggregate supply (AS), which represents the short-run situation. In the long-run, actual output Y is equal to potential output Y*, which is only determined by the supply-side factors of the economy. The long-run aggregate supply curve, thus, is a vertical line at the level of potential output Y*, exemplified by the dotted line above Y* in this graph.

In the short-run however, as in the situation at hand in the Eurozone, actual output Y and potential output Y* are not equal. The difference between the two is called the output gap. Since supply is under its potential productive capacity, output in the short-run, in the presence of significant output gaps, is determined by aggregate demand.

There are several components making up both aggregate demand and supply. The equation for aggregate demand is given as: AD = C+ I + G + (X-M).

C is consumption, or consumer spending, I is investment, G is government spending, and X-M is net exports, or exports minus imports. From this equation we can see that both fiscal and monetary policy have an impact on aggregate demand and thus on output in the short run, via their effects on components of AD (for instance, the direct effect of fiscal policy on government expenditure is a straightforward example). Thus a fiscal or monetary expansion will shift the AD curve towards the right ("New AD" on the figure).

With regards to aggregate supply, its essential components are conceptualized by the Solow-Swan growth model (Solow, 1956), in the spirit of the classical production function. Aggregate Supply, according to this model, is composed of labor, capital, and total factor productivity (TFP), also known as the Solow residual.

Thus, the hysteresis hypothesis can be conceptualized as the influence of aggregate demand components on the components of aggregate supply over time. In the presence of negative output gaps, this relationships progressively reduces potential output (the long-run aggregate supply line shifts to the left on the graph). For instance, low investment resulting from deficient aggregate demand can have an impact on the accumulation of productive capital, one of the components of AS. Similarly, low actual output negatively influences employment, which over the long-term decreases the supply of labor through cyclical unemployment becoming structural (for instance, with long-term unemployed giving up on finding a job). This relationship is consistent with Solow's (1998, p.11) statement: *"... the long-run aggregate supply curve may be vertical, but its location is endogenous to macroeconomic policy."*

Hysteresis as a topic has gained considerable interest from policymakers since the recent crisis, and although its mechanisms are still largely under scrutiny, there is a clear consensus that it has played a role in the case of the Eurozone crisis (ECB, 2015. See, in particular: Draghi, 2015; Blanchard, Cerutti and Summers, 2015; Gali, 2015; and Summers, 2015). The literature also evidences a growing understanding of the mechanisms linking hysteresis and its effects on labor supply, but for the other two factors (capital and TFP) the link is less clear.

Annex 3 : Detailing McCulley and Pozsar's (2013) framework

As mentioned in chapter two, the framework (Figure B below) developed by McCulley and Pozsar (2013) is central to this research, and will serve to guide analysis throughout the paper. The matrix shown below encompasses several dimensions and is heavily annotated, also the present section will explain in details how to interpret the matrix and what is meant by the legend and abbreviations. Furthermore, the predictions made by McCulley and Pozsar (2013) about the effects of fiscal and monetary policy,based on that analytical framework, will also be presented. The section will then conclude on how the framework will guide this thesis' research.

How to read the matrix

The first dimension of this framework plots, on the horizontal (x) axis, the state of the private credit cycle, depicted on Figure B at the top of the matrix. This transcribes the private sector's attitude towards debt as well as the more abstract Keynesian notion of "animal spirits", in this case that of the borrowers and lenders (representing respectively demand and supply of credit). On the left side of the matrix, the private sector is in a leveraging cycle, which means that as a whole it increases its debt; the "animal spirits" are positive. On the right side, the private sector is in a deleveraging cycle; it reduces debt and increases savings, animal spirits are negative.

The dynamic of the private debt cycle is driven mainly by asset prices, which in turn depend on interest rates and animal spirits. A switch from a leveraging to deleveraging cycle occurs when there is a collapse in the price of assets which serve as collateral for loans, because these loans must still be repaid in full. This reduces the private sector net worth and hence its ability and willingness to borrow and spend, and this dynamic is self-reinforcing. This asset price collapse is called the Minsky Moment (after the economist Hyman Minsky and his work on financial crises), and is depicted as "MM" on the matrix. The global financial crisis starting in 2008 can be seen as one such Minsky Moment for the United States.

As noted by the authors, the last deleveraging cycle in the advanced world ended in the period following World War II (McCulley and Pozsar, 2012), which means that macroeconomic policy since then has only been conducted during a private leveraging cycle. According to McCulley and Pozsar (2013), this is important because a deleveraging private sector has a large implication for both fiscal and monetary policy (and crucially so for the latter).
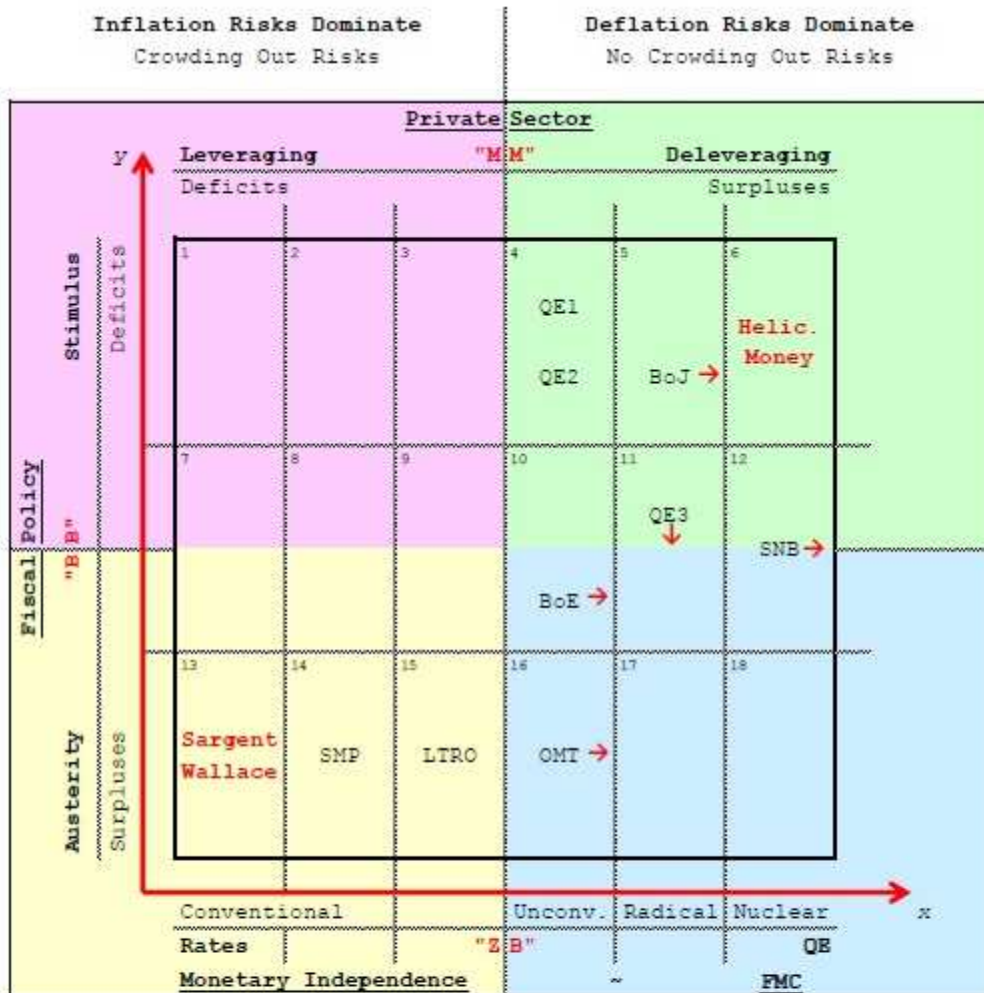
Figure B : McCulley and Pozsar's (2013) framework

Next, the framework is augmented with two new dimensions, monetary policy and fiscal policy, respectively plotted on the (x) and (y) axes, thus creating the matrix. On the vertical (y) axis, fiscal policy gets easier as we go up, going from surpluses (bottom half) to deficits (top half), while the midpoint on the (y) axis represents the point of Balanced Budgets, noted "BB" on the figure, where fiscal policy is neutral. This measure of the fiscal policy stance assumes cyclically-adjusted data. Thus, in the northern

half of the matrix fiscal policy is expansionary (stimulus) while in the southern half it is contractionary (austerity).

On the (x) axis, monetary policy gets easier as we move towards the right. Interest rates decrease until we reach the midpoint of the (x) axis, which corresponds to the Zero Lower Bound of nominal interest rates (noted ZB in the figure), the point under which policy rates cannot fall. The line that runs across the ZB point on the matrix divides it between a left and a right half. Thus on the left half monetary policy is conventional; interest rates are positive and used as the primary policy tool. On the right half, monetary policy turns unconventional; policy rates are (near) zero and influencing the quantity of money (i.e. with Quantitative Easing) is the main policy tool. From this framework it becomes clear that whether monetary policy has to be conventional or unorthodox depends directly on the state of the credit cycle: leveraging cycles are associated with the conventional toolbox, while deleveraging cycles lead central banks to hitting the zero bound and resort to unconventional policies.

The acronyms indicated on the matrix represent monetary policy responses implemented by central banks of advanced countries since the 2008 crisis, and their corresponding position on the policy map. QE1, QE2 and QE3 represent the three programs of Quantitative Easing successively implemented by the U.S Federal Reserve from 2008 to 2014. SMP (for Securities Markets Program), LTRO (Long-Term Refinancing Operations) and OMT (Outright Monetary Transactions) are programs of asset purchases (SMP and OMT) and credit easing (LTRO) put forth by the ECB, respectively in 2010, 2008 (ongoing) and 2012. BoE and BoJ respectively represent the monetary responses of the Bank of England and Bank of Japan, while SNB refers to that of the Swiss National Bank.

McCulley and Pozsar (2013) distinguish, among unorthodox monetary policies (i.e. the eastern half of the matrix), between unconventional, radical and nuclear options. These categories represent different "flavors" of QE, and are associated with the three footnotes below the matrix. In order to understand how these policy options differ and how to interpret the footnotes, it is necessary to explain the macro configuration and the varying policy concerns associated with each quadrant of the matrix, thus highlighting how monetary policy operates in the liquidity-trap situation, on the eastern side of the map. The footnotes are then discussed again in the second following subsection

Four quadrants and their associated policy concerns
McCulley and Pozsar (2013) explore the four quadrants of the policy map by first examining the state of the private sector debt cycle, and the fiscal policy stance associated with it. Taking the perspective of the monetary authority, they then examine what the dominant policy concerns are in each quadrant (Figure C), and how monetary authorities respond.

North-West
Their exploration begins in the north-west (purple) quadrant of the map. In this configuration, the private sector is in a leveraging cycle, thus running deficits; as is the public sector (that is, fiscal authorities). Under such a configuration, the macroeconomic risks are that of "overheating" the economy and raising inflation. In addition, excessive public spending might be crowding out private

spending as the government bids for funds and raises the interest rate. Finally, rational individuals seeing the government run a deficit might anticipate and discount future tax hikes to pay for current spending and thus lower their spending today in prevision; this is the Ricardian Equivalence effect. These policy concerns are reflected on the matrix, respectively above (inflation and crowding out risks) and below it, with footnote (3) indicating that Ricardian Equivalence applies.

In light of these dominating risks, the appropriate monetary policy response is to raise interest rates to tame inflation risks and discipline the fiscal authority from running counterproductive deficits. This cure of unpleasant monetarist arithmetic is what was prescribed by Sargent and Wallace (1981; cf. literature review in **Annex 1**) and tried successfully in the 1980s to end a period of stagflation. The effect of this policy, according to McCulley and Pozsar, is a cyclical recession. However, it does not impair the underlying leverage cycle; as soon as inflation risks recede and government deficits are resorbed, interest rates are lowered again and the cycle resumes.

South-West
The new business cycle then begins, but this time with the fiscal authority successfully disciplined by the central bank and running a surplus, it is located in the south-west quadrant of the map (indicated in Figure B as "Sargent Wallace"). With surpluses from the public sector, there is no crowding-out of private spending and in fact a reverse effect of crowding-in may take place, thus increasing private sector borrowings. In this configuration it is mainly private credit growth that can fuel inflation risks if it becomes excessive, thus the optimal monetary policy response is to tighten appropriately so as to reduce inflationary risks.

If monetary policy fails to rein in excessive private borrowing, a credit-fuelled asset price bubble can occur. Such was the case with the U.S. residential mortgage market bubble which triggered the 2008 global financial crisis. In the Eurozone, the bubbles originated in the peripheral member states due to excessive capital inflows from "core" countries and widening current account imbalances (Baldwin et al., 2015). A large share of these inflows was used unproductively to finance consumption and housing, leading to bubbles such as in the Spanish construction sector.

The collapse of the bubble marks the Minsky Moment and the switch to a deleveraging cycle, that is, a shift towards the right half of the matrix. From this moment on, net private sector credit demand becomes negative. The monetary authority responds with its traditional tool and lowers interest rates, even down to the zero-bound, but because of negative credit demand, the private sector is unresponsive to the stimulus. This explains why conventional monetary policy becomes ineffective in a deleveraging cycle: the transmission mechanism of monetary policy is impaired due to private sector debt constraints; in the words of McCulley and Pozsar (2013), the monetary authority loses its "usual partner" (the private sector) to stimulate.

Figure C: The dominant policy concerns under each quadrant of the matrix
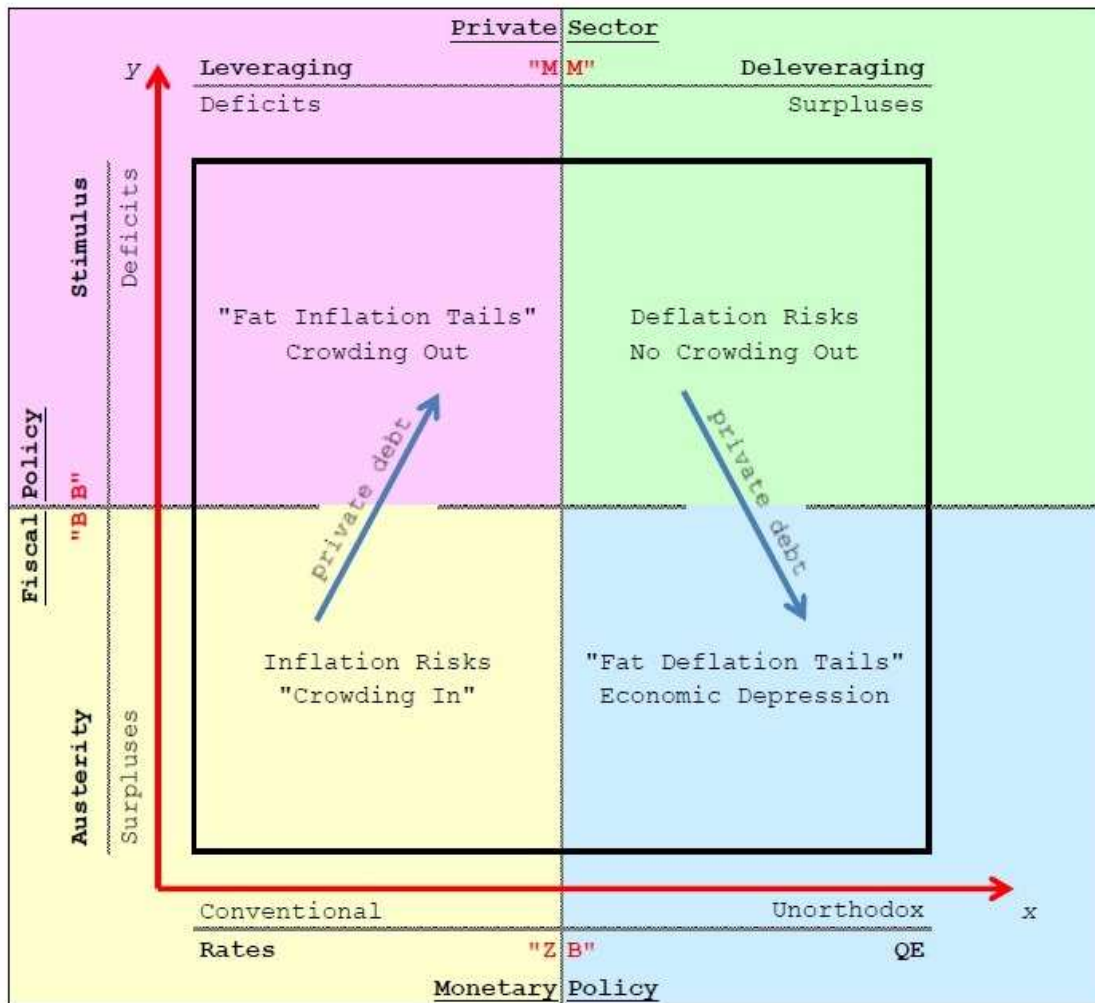
Source: McCulley and Pozsar (2013)

North-East

With the asset price collapse inducing a recession through the reduction in the private sector's ability and willingness to borrow and spend (as discussed in the previous subsection), fiscal policy turns expansionary, not necessarily, as the authors point out, because of activism on the part of governments, but simply because automatic stabilizers kick in and somewhat cushion the fall in economic activity at the expense of the public deficit. Thus, with monetary authorities facing a liquidity trap, the policy configuration on the matrix shifts to the north-eastern (green) quadrant.

In this situation, the dominant macro risks shift to deflation (as indicated in the legend on top of Figure B). There are also no more crowding-out risks; with the private sector reducing its debt on net, the government becomes the sole bidder for funds. Lastly, as (some) individuals are debt-constrained and rely on current income for their spending, they cannot afford to be perfectly forward looking with

regards to future tax burdens, thus the Ricardian Equivalence proposition does not apply, at least fully, anymore (footnote (3) on Figure B).

According to McCulley and Pozsar (2013), the monetary authority responds with unconventional stimulus in the form of Quantitative Easing, but even this is ineffective in turning net credit demand positive. This reflects the argument presented in Eggertsson & Krugman (2010; cf Chapter 2). With the private sector reducing its spending, only the public sector can compensate for it and maintain demand and thus output growth. This is crucial as growth is the single most important factor helping the private sector deleveraging process. Thus, as the central bank sometimes is called upon to be the lender of last resort, in the case of a liquidity trap the fiscal authority can conversely be seen as the spender of last resort (McCulley and Pozsar, 2013, p.14).

Therefore, this framework predicts that optimal fiscal policy is expansionary in a liquidity trap, as theorized by Delong and Summers (2012; cf. Chapter 2), with stimulus having a higher impact than average in the absence of crowding-out effects. This means that being in the green quadrant is strictly superior to being in the blue quadrant. In the view of its authors, and paraphrasing Paul Krugman (1998), the fiscal authority needs to "credibly promise to be irresponsible" just as Krugman suggested central banks should be in a liquidity trap. That means that governments need to keep running large deficits, even in spite of already high deficit and debt levels.

South-East
However, McCulley and Pozsar (2013, p.14) rightfully acknowledge that this promise to be fiscally irresponsible is most likely to be politically untenable, especially in the face of high existing debt-to-GDP ratios. In the case of the Eurozone, the Stability and Growth Pact (SGP), the EU's fiscal framework, requires countries to aim for a maximum of 60% of debt-to-GDP ratio over the medium term.

Thus, when fiscal authorities answer calls for austerity during a liquidity trap, the macro configuration switches towards the south-east, blue quadrant. Here, both the private and the public sector are simultaneously running surpluses. This marks the emergence of the paradox of thrift as predicted by Eggertsson and Krugman (2010): if everybody tries to save more at the same time, aggregate demand and output will fall and actually lower total savings. Under this paradox, not only does austerity lower output, it also impedes the deleveraging process of the private sector.

The dominant policy concerns in this case (Figure C) are the risks of depression and the "fat tail" risk of deflation, which refers to the probability of extreme events (here, a full-blown deflation spiral) being higher than assumed by a normal distribution. The monetary policy response, as in the upper-right quadrant, is stimulus via QE, and as in the previous configuration such stimulus is ineffective due to negative net private credit demand.

Thus, according to the authors (p.14), "*policymakers should try to avoid by all means falling into the blue quadrant, by ensuring that at least one sector of the economy is borrowing and spending*". The responsibility for ensuring this lies solely on the shoulders of the fiscal authorities. Indeed, central banks can attempt to influence the price of credit at the zero-bound via QE, but they cannot influence the public sector demand for credit.

Optimal monetary policy in a liquidity trap: a "trial and error" process

According to the framework, then, both conventional (rates) and unconventional (QE) monetary policy tools are ineffective during a private sector deleveraging cycle, because new stimulus fails to generate new net credit demand from the private sector. What, then, is the best possible course of action from the central bank?

In the eyes of its authors, ideal monetary policy in this situation has to be effective "in a different sense". Unfortunately, given that policymakers are not used to managing an economy in a deleveraging cycle and that much of the policy wisdom in that situation turns on its head (Eggertsson and Krugman, 2010; McCulley and Pozsar, 2012), the monetary authority is likely to reach the optimal policy response through a long process of trial-and-error. The likely path followed by the central bank corresponds to the classification of unconventional policy varietals established by McCulley and Pozsar (2013; see Figure B and Figure D). The main difference between those varietals lies primarily in how the policy is communicated to the public by the central bank.

Unconventional policy: plain asset purchases (QE)

As monetary policy turns unorthodox, it will first and foremost attempt "simple" unconventional policy: plain asset purchases, i.e. plain QE. In practical terms, the central bank "prints" new base money and uses it to purchase assets in secondary markets (such as sovereign debt or private securities), with the aim to lower the yield curve and raise the price of equities, thereby raising inflation expectations, which should spur additional private borrowing by reducing real interest rates. The end goal, as noted by McCulley and Pozsar (2013) is still to stimulate private credit, as the monetary authority still believes (rather mistakenly) the private sector to be in a leveraging cycle.

Furthermore, as the central bank usually does not want to be accused of monetary financing when it buys sovereign bonds, it communicates rather vaguely about an "exit strategy", that is, it promises that at some point in the future the monies will be "unprinted". In other words, the increase in the momentary base is only temporary, even though that is not always made explicitly clear. However, in order for Quantitative Easing policies to have a meaningful impact on aggregate demand growth at the ZLB, the increase in the monetary base needs to be permanent (Beckworth, 2014). Thus, as indicated by footnote (1) on Figure B, plain asset purchases ("unconventional" policy) are not supposed to be permanent. Footnote (2) considers the effects of the QE program on the debt-to-GDP ratio of the fiscal authority, in the case of sovereign debt purchase. When the central bank acquires government debt, it gains revenues in the form of interest payments; however it ultimately remits those revenues to the fiscal authority as seignorage. In other words, as long as sovereign debt is held by the central bank, it ceases to be debt in the sense that no net interest needs to be paid. But because is the case of "vanilla" QE the assets purchased will be resold eventually, it does not lead to a perceived reduction in the debt-to-GDP ratio of the fiscal authority. With the above-mentioned communication strategy, the transparency of the program regarding its effects on public debt ratios is rather low (footnote (1)).

Figure D: The different varietals of unconventional monetary policies
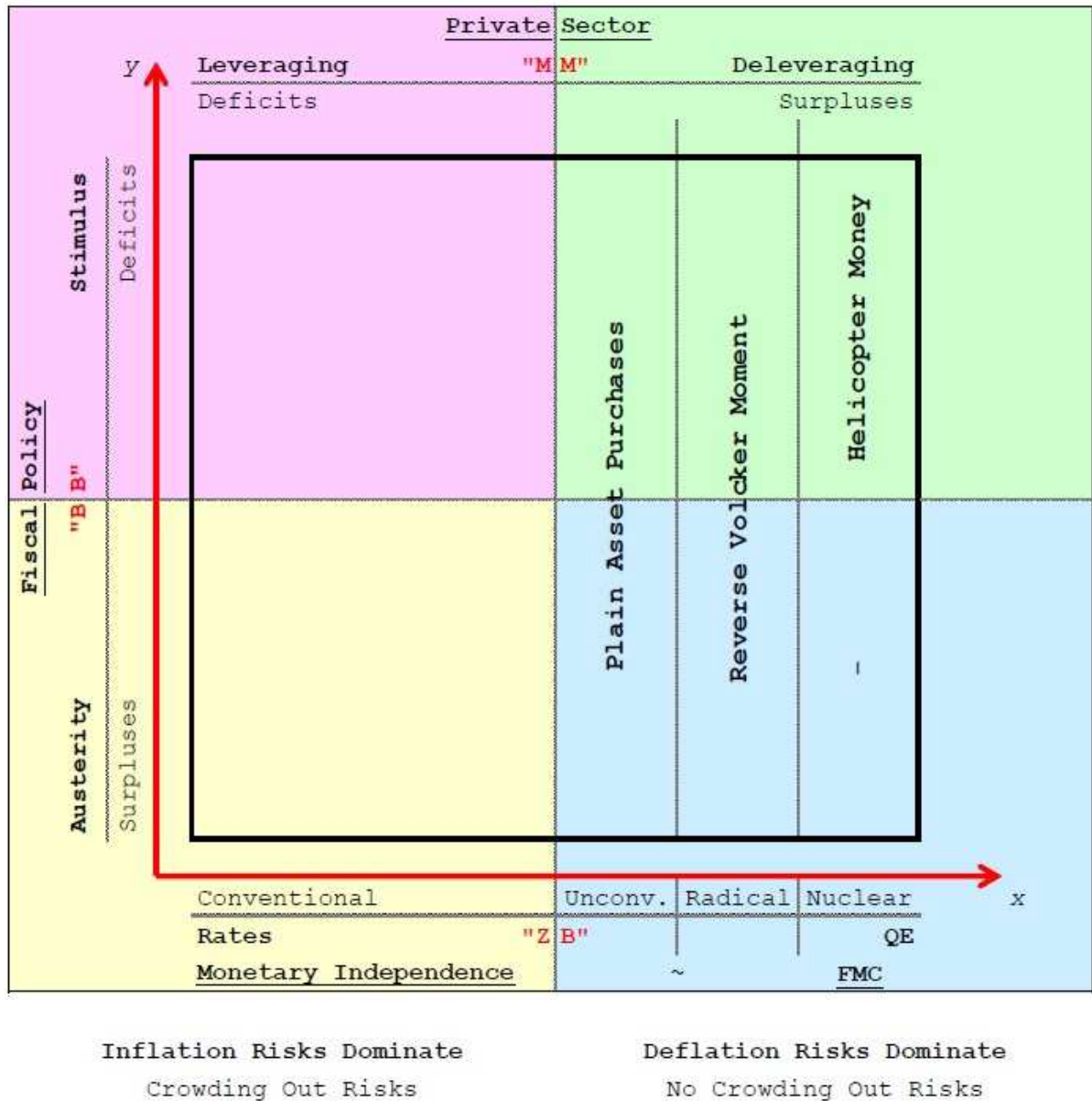
Source: McCulley and Pozsar (2013)

Radical policy: QE with forward guidance

When "plain" QE fails to generate a pickup in inflation expectations and credit growth, monetary policy then turns "radical". The difference between this policy and simple QE lies in the communication strategy. The aim of the asset purchases themselves are still the same (raise asset prices-> stimulate inflation-> induce credit growth), but QE is now accompanied by "forward guidance"; the central bank promises to keep the asset purchase program running even after the economy recovers, when it would

normally start to tighten interest rates. Thus the prospect of a looser-than-expected monetary policy in the future incentivizes agents to invest more in the present to reap the benefits. The forward guidance corresponds to a shift in the central bank's reaction function, and represents the elevation of the growth mandate compared to the inflation mandate (this observation applies to the U.S. Fed, which has a dual mandate; as for the ECB, its mandate has a single focus on price stability, but the logic of prioritizing growth over potential inflation risks still applies). McCulley and Pozsar call this shift a "Reverse Volcker moment" (**Figure D**), after Fed Chairman Paul Volcker's notorious prioritization of lowering inflation over growth in the 1980s.

A good example of a switch from "unconventional" to "radical" QE with forward guidance is the decision by the Fed in 2012 to "not raise interest rates until America's unemployment rate dropped to at least 6.5%, so long as inflation remained below 2.5%", which was followed by the Bank of England in 2013 (The Economist, 2014). Regarding the communication strategy corresponding to this policy varietal, policymakers are not more transparent about the monetization effects of the asset purchase, however talks of policy exit more or less disappear. Radical monetary policies suffer from the same pitfalls as unconventional ones, namely that the central bank's final objective is still to revive private credit demand.

Nuclear policy: Fiscal-Monetary Cooperation (FMC), or "Helicopter Money"
Only when the monetary authority has unsuccessfully tried all other policy options does it turn to the most extreme, "nuclear" policy tool. Whereas previous policies were independent of the fiscal policy stance and could therefore be conducted in either the blue or green quadrant (Figure D), the nuclear policy option involves an explicitly coordinated expansion of fiscal and monetary policy. Contrarily to what the central bank had been focused on previously, here its aim is not to stimulate private credit demand, but to support the fiscal authority in maintaining an expansionary stance (that is, stimulate **public** credit demand) for as long as needed in order to raise nominal demand.

The communication strategy of this policy is rather clear. It explicitly and transparently states that the increase in monetary base will be permanent, and thus that the policy will reduce the public debt-to-GDP ratio by monetization.

"At this stage the central bank has acknowledged that (1) the private sector is deleveraging; that (2) monetary policy on its own (that is, without willing private borrowers to respond to its stimulus) is ineffective; and, that (3) supporting fiscal policy in staying expansionary for as long as the private sector is deleveraging is the best it can do generate growth strong enough to eliminate slack and deflationary pressures." (McCulley and Pozsar, 2013, p.18).

Use for the present research
This annex has presented in details the theory developed by McCulley and Pozsar (2013) and the associated policy matrix. This framework will be used throughout the thesis to guide the empirical analysis. First, the fiscal-monetary policy mix of the Euro Area throughout the crisis will be mapped on the matrix, evidencing the path of economic policy over time. Then, using the predictions made by the authors concerning the effects of fiscal and monetary policy in a liquidity trap, the framework will yield a

rough prediction of how economic policy affected economic activity based on the policy path drawn previously. Finally, this prediction will be compared to the empirical evaluation of the data, judging the degree of fit with the theory and thus the validity of the hypotheses used to answer the central research question.

Annex 4 : Discussion of the indicators

Independent variable : fiscal policy

This variable aims to determine the changes in the aggregate fiscal stance of the Euro Area over the crisis period, reflecting discretionary changes in fiscal policy among each of its member states. Thus, an adequate indicator for this variable would measure the "*exogenous changes in the fiscal balance*". However, measuring this is difficult because of the "endogeneity problem" (Carnot and De Castro, 2015). Indeed, the fiscal balance is affected by the fluctuations of economic activity: for instance, a recession leads to a decrease in tax revenues and an increase in government spending due to automatic stabilizers, such as unemployment benefits. Thus, the fiscal balance worsens (improves) in the case of a recession (expansion) without any actual change in fiscal policy itself. Using changes in the overall fiscal balance to measure changes in fiscal policy would therefore be inappropriate, since it would lead to estimates biased towards finding expansionary effects of fiscal consolidation on economic activity (Guajardo et al., 2011).

Two methods can be found in the literature (Carnot and De Castro, 2015). The first, conventional approach is to look at changes in the cyclically-adjusted (structural) data. This is the approach taken by most quantitative studies on the topic as well as the IMF and European Commission. The basis for this method is to adjust the overall fiscal balance for the effects of the business cycle on public revenues and expenditures. To do so, the IMF and European Commission estimate what the fiscal balance would be if the output gap (the difference between actual and potential output) was zero. This in turn yields to the cyclically-adjusted primary balance (CAPB, hereafter). They then also discount the effects of one-off measures such as the government bailouts of financial institutions, which yields the structural budget balance. However, the structural balance approach has been increasingly criticized as an indicator in recent years (see, among others, Hers and Suyker, 2014; Darvas, 2016). One of the main issues, critics argue, is that the CAPB also reflects nonpolicy factors correlated with developments affecting economic activity. Guajardo et al. (2011) report the example of Ireland during the present-day crisis, when "*a collapse in stock and housing prices in the context of a deep recession induced a fall in the CAPB in 2009 despite the implementation, as reported in contemporary policy documents, of fiscal consolidation measures exceeding 4.7 percent of GDP.*" (p.7). They also argue that the structural balance approach oftentimes fails to identify episodes of fiscal consolidation followed by adverse shocks. For those reasons, this method tends to overstate the expansionary effects of fiscal consolidation (Guajardo et al., 2011).

The second method, called the narrative approach, has been popularized by a seminal contribution from Romer and Romer (2010). It is a more bottom-up method, in that it attempts to obtain data about the size and timing of fiscal efforts from budgets, policy papers and documents. This approach has been argued to be more robust than its structural balance counterpart (Ramey, 2011b; Guajardo et al., 2011). The main issue with this method, however, is that it is unclear whether one can infer the neutrality of the policy stance when no discretionary fiscal measures have been identified. Therefore the use of both methods combined can solve the shortcomings of either approach on its own (Carnot and De Castro,

2015).The indicator is considered to be reliable when using the structural balance or the narrative approach, as any researcher using the same data should be able to produce identical results.

As for the validity of the indicator, the structural balance indicator suffers from the endogeneity problem while the narrative-based indicator suffers from the indeterminacy problem. These problems somewhat diminish the construct validity of each indicator on its own, but the combination of the two yields a high construct validity overall, since they can correct each other's biases.

Independent variable: monetary policy

The "monetary policy" variable of this research aims to capture the policy changes stemming from the ECB over the crisis. The main challenge to achieving this objective is the fact that the conduct of monetary policy is significantly impacted when interest rates reach the Zero Lower Bound. Indeed, setting the interest rate is the main conventional tool of monetary policy, and this tool becomes obsolete at the ZLB because the monetary authority cannot push it significantly below zero. Thus, when the ZLB is reached, the ECB can conduct monetary easing not by influencing the price of money (the interest rate), but by influencing the quantity of money in circulation in the economy, through measures such as Quantitative Easing (McCulley and Pozsar, 2013).

For this reason, in order to properly measure the evolution of monetary policy during the crisis, two separate indicators need to be used. The first indicator corresponds to the "conventional" policy arsenal of the central bank, when the economy is not at the ZLB. This indicator is the *ECB's main interest rate*, also called the "interest rate on the main refinancing operations". After the economy reaches the ZLB (corresponding to a shift towards the right side of McCulley and Pozsar's framework), the second indicator is used to capture the changes in the quantity of money induced by monetary policy. This indicator is the *size of the ECB's balance sheet*, expressed as a percentage of GDP.

With regards to the reliability of these two indicators, it can be considered high. Both of them are public data compiled by Eurostat with a clearly defined and stable methodology, and thus any research using the same indicators should reach identical conclusions. Furthermore, the indicator of the main interest rate accurately represents the construct "monetary policy" outside the ZLB, as policy is conducted almost exclusively through changes in this indicator, and the other policy rates of the ECB evolve concurrently with the main rate. For this reason, this indicator is highly valid. As for the second indicator, the size of the ECB's balance sheet, assessing its validity is less straightforward. At the ZLB, unconventional monetary policies such as QE affect the economy through diverse, less direct transmission channels, such as signaling effects, the liquidity channel, the exchange rate channel, and portfolio-rebalancing effects (Janus, 2015). This indicator would not be effective in identifying signaling effects, since, for instance, the announcement of a Quantitative Easing program would have effects that would not correspond to any immediate increase in the balance sheet (as announcement precedes implementation). While this diminishes its construct validity, the indicator can nevertheless be considered valid, as it offers the most comprehensive measure of actual policy changes at the ZLB.

Dependent variable: economic performance

This variable seeks to measure the performance of the Euro Area economy since the crisis, with the aim to evaluate it against the objectives of macroeconomic policy. These objectives are to maintain price stability (defined as an inflation rate of close to but below 2%) and promote steady and sustainable economic growth by ensuring the economy is running close to its potential level, which is the level consistent with full employment. Thus the corresponding indicators will be used, namely the inflation rate, represented by *changes in the Harmonised Index of Consumer Prices (*HICP*)*, and the *Gross Domestic Product* (GDP), itself separated into two indicators, *actual (real) GDP* and *potential GDP*.

All three of these indicators are compiled by Eurostat with a clear methodology harmonized between the different Euro Area member states, meaning the data are highly reliable. The indicators are also valid since they are used by virtually all of the academic literature and institutions across the world.

Exogenous variable: Hysteresis

As noted in **Annex 2**, this exogenous variable aims to capture the extent to which short-term fluctuations in economic activity can have permanent consequences. The literature identifies two ways to attempt to measure this concept. The first method is related to the strand of literature which focuses on hysteresis effects in the level of unemployment (e.g Blanchard and Summers, 1986; Ball, 2009), by observing the concurrent behavior of the NAIRU (Non-Accelerating Inflation Rate of Unemployment, considered to be the long-term equilibrium rate) and the actual unemployment rate, using an econometric tool known as the Kalman filter to establish the relationship between the two. This method is considered the most robust to measure unemployment hysteresis, and is thus considered reliable. It is also a valid measure of how short-term changes affect long-term economic activity, as the NAIRU represents the level of unemployment at which the economy is at its potential. Thus hysteresis measured by the change in the NAIRU is directly related to changes in potential GDP (with a higher NAIRU, potential GDP is lower, *ceteris paribus*).

The second method examines the relationship between actual and potential output following periods of economic downturns (e.g Ball, 2014; Blanchard, Cerutti and Summers, 2015). After extrapolating the level of potential GDP if the economy had followed its pre-crisis trend, this indicator will measure the *ratio of the loss of potential GDP compared to actual GDP (from pre-crisis trend)*. That is, it measures for each percentage point of lost (actual) GDP, how much the economy permanently loses output (potential GDP).In the same fashion as discussed for the moderating variable indicators, this indicator can be considered reliable, since it is directly derived from the previous indicators and the data originate from a reliable source. Similarly, to the extent that GDP is a valid indicator of economic activity, this ratio is a valid indicator for the concept of hysteresis, as it clearly links the short-term and long-term effects of fluctuations in economic activity (cf. **Annex 2**).

Annex 5 : The ECB's unconventional policy arsenal

Long-Term Refinancing Operations (LTRO)

Before 2008, the ECB provided two types of refinancing facilities for commercial banks. The Main Refinancing Operations (MRO) were, as their name suggests, the main liquidity-providing arrangements, with a loan maturity of 1 week. The ECB also provided a Long-Term Refinancing Operation (LTRO) with longer maturities of three months. In March 2008 the ECB expanded the range of its refinancing facilities by introducing LTROs with a six months maturity. Between 2008 and October 2011, the institution conducted twenty such operations, with the largest allotting 50€ billion. In May 2009, the ECB further announced twelve-months LTROs, of which it conducted four between 2009 and the end of 2011. These operations were much more in demand from the banking sector; indeed the largest 12-months LTRO allocated 442€ billion, and their total peaked at around 660€ billion compared with 160 for the 6-months LTROs. The total amount of all refinancing operations by maturity since the crisis is shown in **Figure E**. In December 2011, amidst a spiraling sovereign-debt crisis and the further deterioration of banks' balance sheets, the ECB unveiled its longest LTRO yet, with a maturity of three years. Over two such operations, the central bank refinanced about one trillion euros in total. The last type of LTRO unveiled by the ECB is the Targeted-LTRO (TLTRO) introduced in September 2014, which provides liquidity through a "funding for lending" scheme according to the size of banks' loans to the non-financial private sector (Merler, 2014). It currently provides around 400€ billion in liquidity.

Figure E: Eurosystem refinancing operations by maturity, in € billion
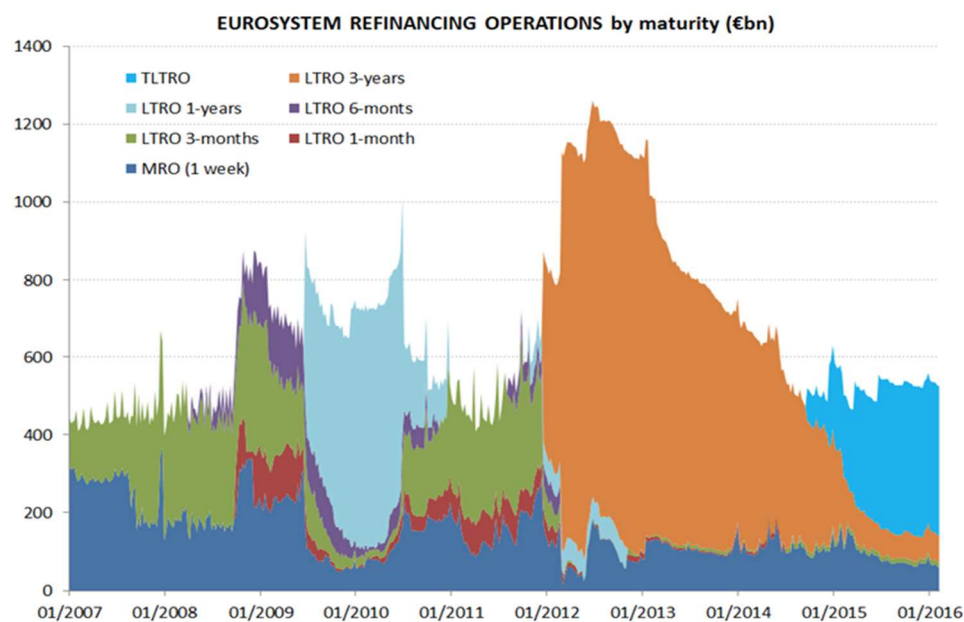
Source: Eurostat.

Figure F shows how much each country's banking sector made use of the ECB's refinancing operations. As we can see, while before the crisis Germany was the largest user of ECB liquidity facilities, following

the crisis (and particularly the sovereign debt phase) the GIIPS countries increasingly became the dominant source of demand for funding.

Figure F : Country use of MRO and LTRO, in € billion

Sources: National central banks, Bruegel
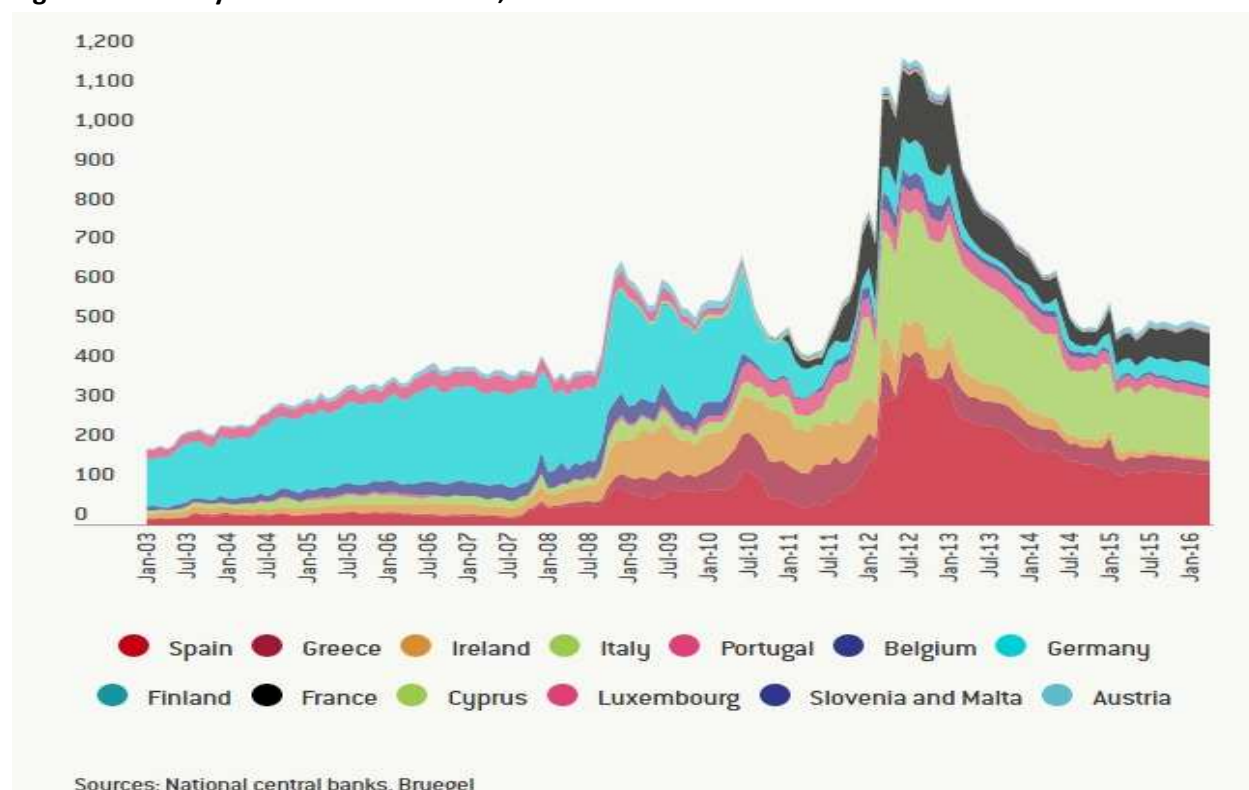
Securities Markets Program (SMP)

On May 10, 2010, the ECB announced its Securities Markets Programme, a plan by which the central bank would directly purchase sovereign government bonds in secondary market while sterilizing those purchases with liquidity-absorbing operations (Fawley and Neely, 2013). The bonds purchased were to be held until maturity, and there was no commitment on the part of the central bank to roll over the bonds as they matured. Starting in May 2010, purchases consisted exclusively of Greek, Portuguese and Irish sovereign bonds, but in August 2011 the program was expanded to include Italian and Spanish debt. The last purchase round happened in February 2012, at this time the holdings of the ECB under the SMP totaled 220€ billion. The program was officially terminated in September 2012, with the introduction of the Outright Monetary Transactions (OMT) program that replaced it. Though in the SMP, the ECB could potentially purchase bonds every day, with no predetermined limits of either price or quantity, in effect the program was "dormant" for several extended periods of time. Market conditions would usually determine the purchases on a daily basis, with the ECB adapting its purchases to intraday volatility (Fratzscher et al., 2014). After the launch of the program in May 2010, the SMP became dormant in 2011 before being reactivated in August of that year. As market conditions improved in Early

2012, the SMP became dormant again following the February 2012 round of purchases, until its deactivation in September 2012.

Outright Monetary Transactions (OMT)

On 26 July 2012, Mario Draghi pronounced his now famous "*Whatever it takes*" speech at the Global Investment Conference in London. In doing so, he was responding to deep sovereign bond markets instability that threatened the very survival of the Euro. A few days later, on 2 August 2012, the ECB announced in a press conference that it would intervene through outright transactions in secondary sovereign markets in the aim of "***safeguarding an appropriate monetary policy transmission and the singleness of the monetary policy.***" In September 2012, the ECB officially unveiled the Outright Monetary Transactions (OMT) program, which consisted in the possibility of unlimited sovereign bond purchases of up to 3 year maturity issued by countries under a macroeconomic adjustment program from the EFSF (now ESM, European Stability Mechanism). The aim of the program was both to repair the transmission mechanism of monetary policy by containing the "redenomination risk" (i.e. the risks associated with a possible break-up of the Euro area and the return by member states to national currencies), and to avoid a self-fulfilling bad equilibrium in the sovereign market (De Grauwe and Ji, 2012). The conditionality of the program on EFSF/ESM adjustment programs was meant to address concerns regarding the distortion of incentives for governments to conduct structural reforms if their sovereign debt problems were being supported by the monetary authority (Fratzscher et al., 2014). Interestingly, as of 2016 the OMT was never actually implemented (that is, no bond purchases from the ECB were conducted under this program), nevertheless the announcement of the ECB's potentially unlimited "big bazooka" was sufficient to ease tensions on distressed member states sovereign bonds.

Forward Guidance

Forward Guidance is not an unconventional policy measure *per se*, as it was used before the crisis in several advanced economies (like the Fed in 2003). Nevertheless, while it used to be relatively rare, it is now part of the standard toolkit of monetary authorities in a liquidity trap environment. Forward guidance consists in the "*specific and systematic verbal communication about the policy inclinations of the central bank going forward*" (ECB, 2014b:67). Thus it is not a policy program involving actual intervention, but merely a communication strategy aimed at helping to fulfill the objectives of the monetary authority. Through signaling to the general public that it is very unlikely interest rates will be raised in the near future, the ECB influences investors' expectations of the future level of the short-term interest rate, and by doing so, it creates pressure for the longer term interest rates: if the forward guidance credibly asserts that rates will not go up for three years, then the market valuation of the three-year interest rate will fall towards the short-term interest rate. Thus, forward guidance participates in the extraction of duration risk from the market (ECB, 2014b). The second way by which this policy affects the economy is by preventing adverse developments impairing the monetary transmission mechanism. Specifically, it aims to prevent the negative influence of market (and interest-rate) volatility on the policy stance of the ECB and the transmission of the monetary stimulus.

On 4 July 2013 the ECB started providing forward guidance on the path of interest rates, announcing in a press conference that it expected "*the key ECB interest rates to remain at present or lower levels for an extended period of time. The Governing Council's expectation is based on the overall subdued outlook for*

inflation extending into the medium term, given the broad-based weakness in the real economy and subdued monetary dynamics." The ECB has since then maintained its forward guidance until the present day, and even reinforced it on several occasions by specifying more precisely under what conditions interest rates would be maintained at their zero levels.

Forward Guidance in the Eurozone was introduced at a time when market interest rates were rising as well as increasingly volatile. This increased volatility reflected a high sensitivity on the part of the markets to shocks unrelated to the underlying economic conditions of the euro area. These developments effectively caused a tightening of the monetary policy stance compared to what was intended by the ECB's Governing Council, impairing the recent stimulus measures. Thus forward guidance was the policy response of the ECB to restore stable conditions for the proper transmission of monetary easing: *"Achieving a firmer anchoring of market expectations was especially important at a time when markets were tending to react with excessive sensitivity to economic news unrelated to euro area fundamentals or to news that only confirmed the Governing Council's assessment of risks to price stability."* (ECB, 2014b:69)

There are different types of Forward Guidance, characterized along a spectrum from vague (commitment to maintain low rates for an unspecified amount of time) to more explicit (with a specific timeline or outcomes defining under which conditions rates will be kept low). In that order, the different types of forward guidance are (1) pure qualitative, (2) qualitative conditional on a narrative, (3) calendar-based, and (4) outcome-based. For a review, see ECB (2014b:68). The ECB's forward guidance has evolved across this spectrum over time, towards more precise, calendar-based timelines. For instance, on 2 June 2016, the institution stated that "*We continue to expect [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.*", while further indicating that asset purchases will continue until March 2017 at the very least, or until the Governing Council sees a marked improvement in inflation developments.

Expanded Asset Purchase Program (EAPP)

On 22 January 2015 the ECB unveiled to the public its plan for a massive expansion of its asset purchase program, which started in September 2014 with the Asset-Backed Securities and the Covered Bonds Purchase Programs (ABSPP and CBPP3). Supplementing those purchases, the Expanded Asset Purchase Program (hereafter referred to as EAPP or QE, interchangeably) introduced the Public Sector Purchase Program (PSPP), under which the ECB would start buying sovereign bonds of euro-area countries as well as debt from supranational institutions such as the European Investment Bank. The purchases from the PSPP started in March 2015, and the initial announcement from the ECB indicated that monthly purchases from QE would total 60€ billion, and last until September 2016 at least, or be open-ended until the Governing Council saw *"a sustained adjustment in the path of inflation which is consistent with the aim of achieving inflation rates below, but close to, 2 percent over the medium term".* **Figure G** provides details about the composition of the EAPP purchases as well as their implementation according to the plan unveiled in January 2015 by the ECB. In addition to conducting most of the purchases through the national central banks according to their capital key in the Eurosystem, the Governing Council imposed limits in the amount of its holdings to ensure the EAPP could not be seen as breaching

the prohibition of monetary financing (Claeys et al., 2015). However, these limits could also constrain the program going further (Claeys et al.,2015).

In March 2016, the ECB extended the duration of the EAPP to at least March 2017 while keeping it open-ended. At the same time, the institution increased its monthly purchases to 80€ billion, and unveiled a last addition to the EAPP in the form of the Corporate Sector Purchase Program (CSPP), under which the ECB would buy high-rated Eurozone corporate debt. The total holdings of the central bank under the EAPP as of June 2016 can be found in **Figure H**. The column "APP" indicates the total. Evidently, the PSPP represents the bulk of the purchases under QE, followed by the CBPP, while the purchases of ABS and Corporate Sector bonds are so far marginal.

Figure G: Allocation of monthly asset purchases by the Eurosystem as announced in January 2015
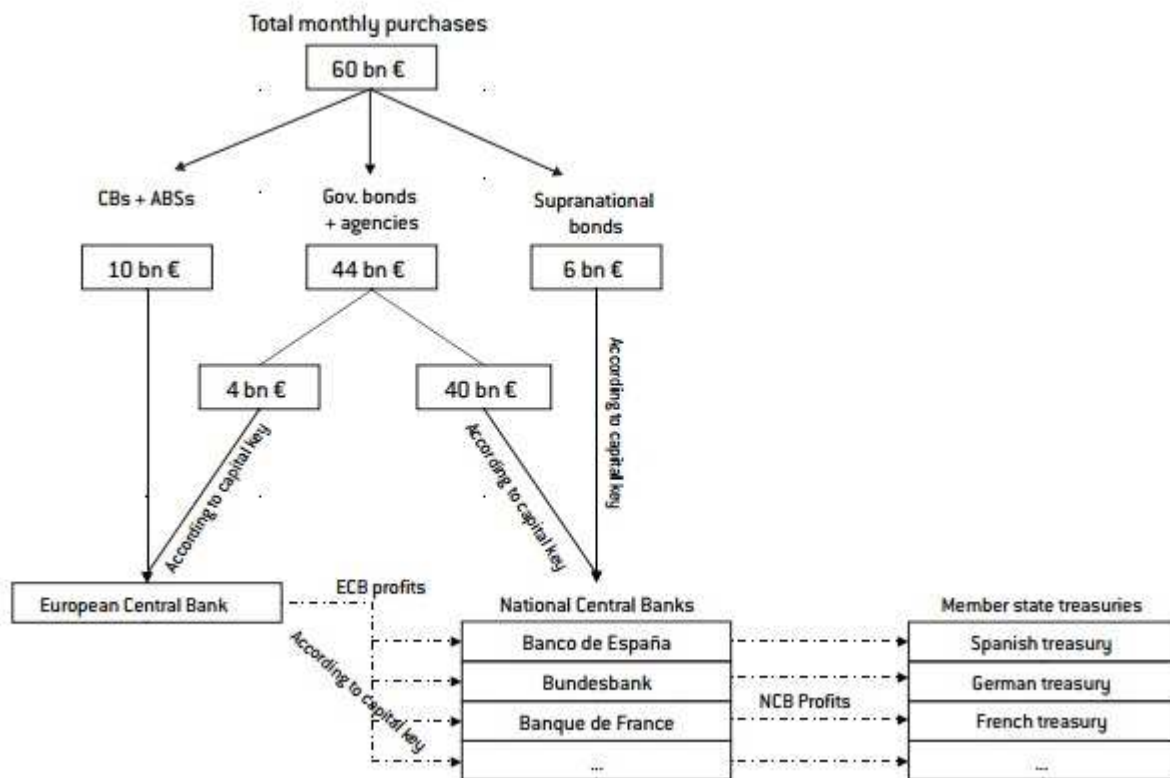
Sources: ECB, Claeys et al. (2015)

Figure H: Eurosystem holdings under the expanded asset purchase program as of July 2017

Changes of holdings (last two months)	ABSPP	CBPP3	CSPP	PSPP	APP
Holdings* June 2017	24,135	222,630	96,620	1,609,327	1,952,712
Monthly net purchases	481	2,472	5,606	51,875	60,434
Quarter-end amortisation adjustment					
Holdings* July 2017	24,616	225,103	102,226	1,661,202	2,013,147

*At amortised cost, in euro million, at month end.

Source: ECB.

Annex 6 : Mapping the path of the policy-mix on McCulley and Pozsar's framework

2008: before the start of the Global Financial Crisis, the ECB's interest rate was 4%, while the aggregate (cyclically adjusted) fiscal position of the Euro area was expansionary with a net stimulus of about 0.7 to 1% of aggregate GDP (depending on the indicator of reference, structural balance or DFE). This is taken as the starting point on the framework. The interest rate started to drop in October 2008.

2009: From 4% in October 2008, the interest rate was already at 2.5% on January 1 2009. It kept decreasing at a steady rate, so that by May the main interest rate reached 1% and would not budge until 2011, translating into a marked shift rightwards on the framework, close to the ZLB. At the same time, the fiscal stimulus increased to almost 2% of GDP as governments across the world made a coordinated crisis response package, inducing a shift upwards on the matrix.

2010: In 2010 the ECB maintained its interest rate, but the stance of fiscal policy brutally shifted from large stimulus to moderate austerity in the summer of 2010 following the revelation that Greece had cooked its books, which marked the start of the sovereign debt crisis proper as panic on financial markets spread to other troubled peripheral countries such as Ireland. The aggregate fiscal position in 2010 was at -0.5% according to the DFE, which translates into a marked shift downwards from the 2009 levels on the framework, thus shifting the position of the policy mix from the northwest to southwest quadrant.

2011: As fiscal consolidation plans of member states were being fully implemented, the level of austerity gradually increased throughout 2011, to 1% of GDP according to the DFE, reflected by a shift downwards of the policy-mix on the matrix. At the same time, the ECB decided to increase interest rates to contain slightly above target inflation, to 1.5% in July, but quickly reversed this decision by the end of the year as deflationary pressures were increasing with the Eurozone entering a double-dip recession. This is reflected in **Figure 7.1** with a small "spike" leftwards.

2012: With the negative inflation dynamics faced by the ECB, the institution kept on decreasing its interest rate at a steady pace, though the room for manoeuver was getting shorter. 2012 saw only one actual interest rate cut by 25bp in July, and in fact the actual zero bound would only be attained in 2016. Nevertheless, on **Figure 7.1** the policy-mix is depicted as entering the right-hand side of the matrix, "below" the zero lower bound and in the realm of unconventional policy. This is for two reasons. First, 2012 is the year Mario Draghi unveiled the OMT program. Contrarily to the SMP, which preceded it, under the OMT the ECB could conduct purchases of sovereign bonds without sterilization, i.e. the purchase of the bonds would increase the money supply, which would qualify as a form of quantitative easing and thus put the policy-mix in the "unconventional" half of the matrix. Second, while the interest rate was stable at 1% since the beginning of the crisis, 2012 is the point at which it started to drop below that before finally reaching zero. This means that in 2012, there was need for more monetary stimulus but the already very low interest rate would probably not provide enough space for optimal and conventional monetary policy, so at this point and although the rate was not yet *actually* at zero, the

liquidity trap conditions and the ZLB were *effectively* binding, justifying a shift towards the right side of the framework.

Regarding fiscal policy, the year 2012 was "peak austerity" in the Euro area, with the aggregate fiscal stance measured by the DFE going from -1 to -2% of GDP. Consequently the policy-mix also evolves downwards on the matrix.

2013: The ECB introduced forward guidance in 2013, adding to its policy arsenal. Although at this point the central bank had not conducted actual QE, the introduction of forward guidance signals a shift towards more unconventional policy in the future. According to McCulley and Pozsar (2013), QE coupled with forward guidance is the next step after "plain" asset purchases, which they qualify as "radical" (see **Annex 2**). Consequently the policy-mix evolves rightwards on the matrix, towards the radical section of the quadrant. On the fiscal side, austerity begins to ease back to its 2011 level, at about -1% of GDP on aggregate, and the policy mix thus reverts to a higher position.

2014: The dynamics of easing austerity and a gradual evolution towards radical monetary stimulus continue in 2014. The aggregate fiscal position for the year is about -0.5%, reflected in a shift upwards again. In August 2014 Mario Draghi made his famous Jackson Hole speech and hinted at upcoming monetary stimulus, i.e. QE. Therefore the policy-mix also goes right towards the frontier of radical policy, which is QE coupled with forward guidance.

2015: The ECB's QE plan, the EAPP, is unveiled in January 2015 and launched in March of the same year, thus putting the policy mix firmly in radical territory, while at the same time the fiscal position becomes cyclically neutral.

2016: Projections for 2016 indicate that the aggregate EU economy should have a slightly expansionary fiscal stance, thus putting the policy-mix in the green north-east quadrant. In March 2016 the EAPP was also expanded by 20 billion euros of additional purchases every month, consequently the mix evolves towards the right again.

Appendices

Table 4.A: Output gap in Euro area countries, 2008-2017 (forecast)

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Austria	2.815	-2.366	-1.964	-0.373	-0.943	-1.869	-2.526	-2.788	-2.546	-2.076
Belgium	1.951	-1.675	-0.146	0.478	-0.471	-1.466	-1.305	-1.187	-1.241	-1.023
Estonia	5.297	-11.135	-10.119	-4.907	-2.122	-2.500	-1.561	-2.154	-2.136	-0.923
Finland	4.583	-4.682	-2.186	-0.059	-1.871	-2.942	-3.926	-3.736	-3.145	-2.466
France	1.409	-2.546	-1.551	-0.468	-1.232	-1.571	-1.971	-1.831	-1.618	-1.347
Germany ⓘ	1.811	-4.745	-1.902	0.595	0.095	-0.527	0.027	0.152	0.373	0.735
Greece	8.565	4.499	0.061	-7.464	-12.605	-14.153	-12.413	-11.964	-11.778	-10.049
Ireland	2.823	-5.579	-7.153	-6.312	-7.806	-7.766	-4.514	0.604	2.726	3.348
Italy	1.337	-4.214	-2.433	-1.529	-3.886	-5.015	-4.753	-3.712	-2.397	-0.854
Netherlands	3.513	-1.523	-1.109	-0.367	-2.280	-3.454	-3.351	-2.457	-1.954	-1.098
Portugal	0.626	-2.951	-1.500	-3.463	-6.988	-7.659	-6.767	-5.480	-4.438	-3.192
Slovak Republic	7.065	-2.150	-0.156	-0.594	-1.955	-3.016	-2.907	-1.924	-1.522	-1.133
Slovenia	7.891	-2.159	-1.796	-1.706	-4.887	-6.465	-4.746	-3.298	-3.137	-2.251
Spain	4.011	-1.152	-2.092	-3.733	-6.668	-8.510	-7.558	-4.971	-2.755	-1.175
Euro area (15 countries)	2.343	-3.097	-1.874	-0.996	-2.413	-3.221	-2.889	-2.165	-1.476	-0.727
OECD - Total	1.038	-3.935	-2.460	-2.004	-2.237	-2.506	-2.174	-1.717	-1.460	-0.953

Source : OECD Economic Outlook, June 2016. Data for 2016 and 2017 are forecasts.

Table 4.B (Annex): Budget balances of Euro Area countries, 2008-2012

	Budget balance					Structural balance					Structural primary balance				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
BE	-1.3	-5.9	-4.1	-3.7	-4.2	-1.9	-3.6	-2.9	-2.8	-3.7	1.9	0.0	0.5	0.6	-0.3
DE	0.1	-3.0	-3.3	-2.0	-1.2	-0.2	-0.8	-1.9	-1.4	-0.8	2.5	1.8	0.5	0.9	1.6
EE	-2.8	-1.7	0.1	-0.6	-2.4	-4.0	-0.2	-0.4	-0.9	-1.1	-3.8	0.1	-0.3	-0.7	-0.8
IE	-7.3	-14.3	-32.4	-10.5	-8.8	-7.4	-10.0	-10.5	-9.5	-8.5	-6.0	-7.9	-7.2	-5.7	-3.9
EL	-9.8	-15.4	-10.5	-9.5	-9.3	-9.5	-14.0	-8.6	-7.4	-7.9	-4.6	-8.9	-3.0	-0.7	-0.4
ES	-4.2	-11.1	-9.2	-6.3	-5.3	-3.8	-8.6	-7.0	-4.3	-3.9	-2.2	-6.8	-5.1	-2.1	-1.4
FR	-3.3	-7.5	-7.0	-5.8	-5.3	-3.5	-5.6	-4.9	-3.9	-3.7	-0.7	-3.2	-2.5	-1.3	-0.8
IT	-2.7	-5.4	-4.6	-4.0	-3.2	-3.4	-3.9	-3.1	-2.7	-2.3	1.8	0.8	1.4	2.1	2.8
LU	3.0	-0.9	-1.7	-1.0	-1.1	2.3	1.5	0.1	0.3	-0.4	2.6	1.9	0.5	0.8	0.1
NL	0.6	-5.5	-5.4	-3.7	-2.3	-0.5	-3.6	-3.7	-2.5	-1.3	1.7	-1.4	-1.7	-0.4	0.9
AT	-0.9	-4.1	-4.6	-3.7	-3.3	-2.2	-2.9	-4.0	-3.2	-2.9	0.4	-0.1	-1.3	-0.4	0.0
PT	-3.5	-10.1	-9.1	-5.9	-4.5	-3.5	-8.8	-9.2	-5.4	-3.1	-0.5	-5.9	-6.1	-1.2	1.7
SI	-1.8	-6.0	-5.6	-5.8	-5.0	-4.6	-3.5	-3.0	-2.9	-3.3	-3.5	-2.2	-1.4	-1.1	-1.3
FI	4.2	-2.6	-2.5	-1.0	-0.7	2.5	0.7	0.3	0.8	0.7	3.9	1.9	1.4	2.0	2.1
MT	-4.5	-3.7	-3.6	-3.0	-3.0	-5.6	-3.4	-4.3	-3.1	-3.1	-2.4	-0.2	-1.3	0.0	0.0
CY	0.9	-6.0	-5.3	-5.1	-4.9	-0.1	-5.8	-5.1	-4.6	-4.8	2.7	-3.3	-2.9	-2.1	-2.4
SK	-2.1	-8.0	-7.9	-5.1	-4.6	-4.2	-7.5	-7.3	-4.8	-4.8	-3.0	-6.1	-5.9	-3.3	-3.1
EA-17	-2.0	-6.3	-6.0	-4.3	-3.5	-2.5	-4.3	-4.0	-3.0	-2.6	0.6	-1.4	-1.2	0.0	0.6

Source: European Commission Public Finances in EMU, 2011. Data for 2011 and 2012 are forecasts.

Table 4.C: Budget balances of Euro Area countries, 2012-2016

	Budget balance					Structural balance					Structural primary balance				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
BE	-4.1	-2.9	-3.1	-2.7	-2.6	-3.4	-2.7	-2.8	-2.5	-2.1	0.1	0.6	0.3	0.4	0.7
DE	-0.1	-0.1	0.3	0.9	0.5	-0.1	0.3	0.8	0.9	0.7	2.2	2.3	2.6	2.4	2.1
EE	-0.3	-0.1	0.7	0.2	0.2	-0.1	-0.4	0.3	0.3	0.2	0.0	-0.3	0.4	0.4	0.3
IE	-8.0	-5.7	-3.9	-2.2	-1.5	-6.4	-4.3	-3.2	-3.0	-2.1	-2.4	0.0	0.8	0.3	0.9
EL	-8.8	-12.4	-3.6	-4.6	-3.6	-0.4	2.0	0.6	-1.1	-0.3	4.7	6.0	4.5	3.2	3.8
ES	-10.4	-6.9	-5.9	-4.7	-3.6	-3.3	-1.9	-1.8	-2.5	-2.6	-0.4	1.5	1.6	0.6	0.3
FR	-4.8	-4.1	-3.9	-3.8	-3.4	-4.3	-3.5	-2.8	-2.7	-2.4	-1.7	-1.3	-0.6	-0.7	-0.3
IT	-3.0	-2.9	-3.0	-2.6	-2.3	-1.3	-0.9	-1.1	-1.0	-1.5	3.9	4.0	3.6	3.3	2.6
CY	-5.8	-4.9	-8.9	-0.7	0.1	-5.1	-1.7	2.0	0.4	0.2	-2.2	1.4	4.9	3.2	2.7
LV	-0.8	-0.9	-1.5	-1.5	-1.2	0.0	-0.9	-1.8	-2.1	-1.9	1.6	0.5	-0.3	-0.8	-0.6
LT	-3.1	-2.6	-0.7	-1.1	-1.3	-2.6	-2.3	-1.4	-1.2	-1.4	-0.6	-0.5	0.2	0.4	0.1
LU	0.2	0.7	1.4	0.0	0.5	2.5	2.1	2.1	0.7	0.9	3.0	2.5	2.5	1.1	1.3
MT	-3.6	-2.6	-2.1	-1.7	-1.2	-3.6	-2.5	-2.4	-2.1	-1.7	-0.7	0.4	0.5	0.6	0.8
NL	-3.9	-2.4	-2.4	-2.1	-1.5	-2.3	-0.9	-0.5	-1.1	-1.4	-0.6	0.6	0.9	0.3	-0.2
AT	-2.2	-1.3	-2.7	-1.9	-1.6	-1.8	-1.2	-0.7	-0.6	-1.0	0.9	1.4	1.8	1.8	1.2
PT	-5.7	-4.8	-7.2	-3.0	-2.9	-3.1	-2.5	-1.4	-1.8	-2.3	1.8	2.3	3.5	3.1	2.2
SI	-4.1	-15.0	-5.0	-2.9	-2.4	-2.1	-2.2	-2.7	-2.7	-2.5	-0.1	0.4	0.4	0.3	0.4
SK	-4.2	-2.6	-2.8	-2.7	-2.4	-3.6	-1.7	-2.1	-2.1	-2.0	-1.8	0.2	-0.1	-0.5	-0.5
FI	-2.1	-2.5	-3.3	-3.2	-2.7	-1.1	-1.0	-1.8	-1.7	-1.5	0.3	0.3	-0.5	-0.6	-0.4
EA-19	-3.7	-3.0	-2.6	-2.0	-1.8	-2.1	-1.4	-1.0	-1.1	-1.2	0.9	1.4	1.6	1.4	1.2

Source: European Commission Public Finances in EMU, 2015. Data for 2015 and 2016 are forecasts.

Table 4.D: The changes in the structural primary balance and the discretionary fiscal effort, 2004-2013.

	DFE (1)				Change in the structural primary balance (2)				Difference (1)-(2)			
	Average 2004-2007	Average 2008-2010	Average 2011-2013	Average 2004-2013	Average 2004-2007	Average 2008-2010	Average 2011-2013	Average 2004-2013	Average 2004-2007	Average 2008-2010	Average 2011-2013	Average 2004-2013
BE	-0.2	-1.2	0.0	-0.4	-0.4	-0.8	0.3	-0.3	0.3	-0.4	-0.3	-0.1
BG	-1.2	1.7	0.3	0.1	-0.1	-0.8	0.4	-0.2	-1.1	2.5	-0.1	0.3
CZ	1.1	-0.1	1.8	1.0	0.8	-0.4	1.5	0.7	0.2	0.3	0.3	0.3
DK	-0.4	-1.1	0.3	-0.4	0.3	-0.8	0.2	-0.1	-0.7	-0.2	0.1	-0.3
DE	0.6	-1.0	0.4	0.1	0.6	-0.5	0.8	0.3	0.1	-0.5	-0.4	-0.2
EE	-1.6	2.2	0.0	0.0	-0.5	0.3	0.1	-0.1	-1.0	2.0	-0.2	0.1
IE	-1.6	1.1	2.2	0.3	-0.7	-1.7	1.5	-0.3	-0.9	2.7	0.6	0.7
EL	#N/A	#N/A	5.8	#N/A	-0.6	0.0	3.1	0.7	#N/A	#N/A	2.7	#N/A
ES	-0.7	-1.1	3.3	0.4	0.3	-2.5	1.9	-0.1	-0.9	1.3	1.4	0.4
FR	-0.4	-0.6	1.1	0.0	0.0	-0.5	0.9	0.1	-0.4	-0.2	0.2	-0.1
IT	0.2	-0.3	1.9	0.6	0.5	-0.2	1.2	0.5	-0.3	-0.1	0.7	0.1
CY	0.6	-1.6	4.2	1.0	2.4	-2.8	1.1	0.4	-1.8	1.3	3.1	0.6
LV	-1.6	4.9	0.5	1.0	-0.7	0.8	0.7	0.2	-0.9	4.1	-0.2	0.8
LT	-1.9	1.0	1.6	0.0	-0.5	-0.1	0.8	0.0	-1.3	1.1	0.8	0.0
LU	#N/A	#N/A	0.2	#N/A	0.2	-0.3	0.4	0.1	#N/A	#N/A	-0.1	#N/A
HU	#N/A	#N/A	-2.3	#N/A	0.6	0.8	0.8	0.7	#N/A	#N/A	-3.1	#N/A
MT	0.4	0.0	-0.3	0.1	0.7	-0.5	0.6	0.3	-0.2	0.4	-0.9	-0.2
NL	0.4	-0.9	1.7	0.4	0.1	-1.1	0.9	0.0	0.3	0.2	0.9	0.4
AT	0.0	-0.8	0.8	0.0	-0.3	-0.5	0.7	-0.1	0.3	-0.3	0.1	0.1
PL	-0.3	-1.3	2.2	0.1	0.1	-1.6	1.5	0.0	-0.5	0.4	0.7	0.1
PT	0.2	-1.7	2.9	0.4	0.6	-1.6	2.4	0.5	-0.4	-0.1	0.4	0.0
RO	-2.7	1.6	2.5	0.4	-1.1	-0.1	1.5	0.0	-1.7	1.7	1.0	0.4
SI	-0.5	-1.1	2.4	0.3	-0.1	-0.6	1.1	0.1	-0.3	-0.5	1.3	0.2
SK	0.1	-0.8	1.7	0.3	-0.9	-1.0	2.0	-0.1	0.9	0.1	-0.3	0.3
FI	-0.9	-2.0	0.2	-0.9	-0.2	-1.4	0.1	-0.5	-0.7	-0.6	0.1	-0.4
SE	-0.1	-0.4	-0.4	-0.3	0.4	-0.5	-0.4	-0.1	-0.6	0.1	0.1	-0.2
UK	-0.6	-0.7	1.2	-0.1	-0.1	-1.1	1.1	0.0	-0.5	0.3	0.1	-0.1
EA-17	0.0	-0.8	1.4	0.2	0.2	-0.8	1.1	0.2	-0.2	0.0	0.3	0.0
EU-27	-0.2	-0.7	1.3	0.1	0.2	-0.8	1.0	0.1	-0.3	0.1	0.3	0.0

Source: Carnot and de Castro (2015), based on European Commission (2014)

Table 5.A: Loss of potential GDP and potential growth rate in each country

Country	Loss in Potential, 2013	Output Gap, 2013	Loss in Potential, 2015	Output Gap, 2015	Growth Rate of Potential, Pre-Crisis	Growth Rate of Potential, 2014-2015
Australia	1.40%	1.60%	1.83%	2.27%	3.33%	3.11%
Austria	6.02%	2.75%	7.14%	2.64%	2.36%	1.75%
Belgium	7.54%	1.73%	8.82%	1.19%	2.07%	1.36%
Canada	8.24%	0.75%	9.71%	-0.16%	2.90%	2.08%
Czech Republic	18.24%	3.58%	22.40%	3.52%	4.62%	1.92%
Denmark	9.73%	2.93%	11.32%	1.63%	1.76%	0.86%
Finland	15.66%	2.63%	18.99%	3.08%	3.09%	1.04%
France	7.50%	2.68%	8.58%	3.08%	2.08%	1.48%
Germany	2.87%	0.56%	3.39%	-0.87%	1.52%	1.25%
Greece	29.98%	9.33%	35.40%	7.59%	3.96%	-0.15%
Hungary	25.69%	1.93%	30.51%	0.69%	4.42%	0.98%
Ireland	27.70%	6.32%	34.15%	4.45%	5.75%	0.93%
Italy	9.88%	5.04%	12.05%	3.74%	1.34%	0.11%
Japan	8.47%	-0.15%	9.57%	-0.89%	1.40%	0.79%
Netherlands	6.83%	4.01%	8.53%	4.09%	2.14%	1.20%
New Zealand	6.50%	0.29%	7.47%	-1.22%	3.07%	2.53%
Poland	5.24%	0.66%	7.42%	0.16%	4.11%	2.91%
Portugal	11.41%	6.42%	13.74%	4.98%	1.83%	0.49%
Spain	18.21%	4.37%	22.33%	3.52%	3.47%	0.83%
Sweden	7.58%	1.75%	8.66%	0.76%	3.02%	2.41%
Switzerland	-0.42%	0.76%	-0.88%	0.39%	1.81%	2.04%
United Kingdom	10.98%	2.14%	12.37%	0.32%	2.66%	1.85%
United States	4.70%	3.35%	5.33%	1.87%	2.57%	2.23%
Weighted Average	7.18%	2.56%	8.38%	1.49%	2.39%	1.68%

Loss in Potential = (Y**-Y*)/Y**
Output Gap =(Y*-Y)/Y**
Growth Rate of Potential, Pre-Crisis: Average for 2001-2009 (December 2007 data)
Growth Rate of Potential, 2014-2015: Average for 2014-2015 (May 2014 data)
Weighted Average: Weights proportional to Y** in 2015

Source: Ball (2014).