U.PORTO

FEP FACULDADE DE ECONOMIA UNIVERSIDADE DO PORTO

The Housing Market, Business Cycles and Macroeconomic Policy

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Dissertation

Master in economics

Supervised by

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Date of Delivery

14th of September of 2021

Acknowledgements

First and foremost, I am extremely grateful to my parents and my sister for all their emotional support through these five academic years and for their tireless efforts in providing all the necessary resources for me to achieve my goals.

I would also like to express my sincere gratitude to my supervisor Prof. Manuel António Mota Freitas Martins for his invaluable advice, continuous support, and patience during my dissertation. His immense knowledge and plentiful experience have encouraged me in all the time of my academic research and daily life.

Finally, to my friends who accompanied and supported me throughout all my academic path.

Abstract

The excessive leverage and risk-taking present in the housing market has played a central role in the Great Financial Crisis. Since then, many reforms in the financial system regulation and supervision structures have emerged to mitigate the build-up of risks and to ensure financial stability. This dissertation describes the developments made by central banks to control and mitigate risks in the housing sector. We review the evolution of the macroprudential framework regarding the housing sector and discuss possible improvements in this policy. We address the debate about the role of monetary policy when a macroprudential framework is in place. We conclude that, regardless of all the progress made, the current regulatory structure does not perfectly assure the stability of the financial system. We also conclude that besides continuing to develop macroprudential measures, there is scope to re-think the role of monetary policy in helping to ensure financial stability.

JEL Codes: E51; E52; E58; G51

Keywords: Housing Market, Monetary Policy, Macro-Prudential, Financial Stability

Resumo

A alavancagem excessiva e a acumulação riscos no mercado imobiliário desempenharam um papel central na Grande Crise Financeira. Desde então, as estruturas de regulação e supervisão do sistema financeiro sofreram muitas reformas de modo a mitigar o crescimento e acumulação dos riscos e, ainda, garantir a estabilidade financeira. Esta dissertação descreve os avanços feitos pelos bancos centrais para controlar e reduzir os riscos no setor imobiliário. Desta forma, revimos a evolução da política macroprudencial em relação a este setor e discutimos possíveis melhorias. Abordamos, ainda, o debate sobre o papel da política monetária quando uma estrutura macroprudencial está em vigor. Assim, concluímos que, independentemente de todos os avanços alcançados, a atual estrutura regulatória não garante de forma perfeita a estabilidade do sistema financeiro. Concluímos, também, que além de se continuar a desenvolver medidas macroprudenciais, há espaço para repensar o papel da política monetária no auxílio à estabilidade financeira.

Códigos JEL: E51; E52; E58; G51

Palavras-chave: Mercado imobiliário, política monetária, política macroprudencial, estabilidade financeira.

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Abbreviations and acronyms

CCyB - Countercyclical Capital Buffer

DTI - Debt-to-income

DSTI - Debt-service-to-income

ECB - European Central Bank

EU - European Union

EWI - Early warning indicators

GATT - General Agreement in Tariffs and Trade

GDP - Gross Domestic Product

GFC - Great Financial Crisis

G10 - Group of Ten

G20 - Group of Twenty

GSE - Government Sponsored Institutions

IMF - International Monetary Fund

LAW - Leaning against the wind

LGD - Loss given default

LTI - Loan-to-income

LTV - Loan-to-value

OTC - Over the counter

ST - Stress test

SRB - Systemic Risk Buffer

UK - United Kingdom

US - United States

WWI - World War I

WWII - World War II

1. Introduction

In the wake of the great financial crisis (GFC), the consequences of excessive risk-taking and excessive credit growth, especially mortgage loans, have climbed to the top of the agenda for macroeconomists and policymakers. The increase of credit-to-GDP ratios in advanced economies in the twentieth century has been first and foremost a result of the rapid rise in mortgages. The importance of this category of loans in banks' total lending portfolios has nearly doubled over the past century - from about 30% in 1900 to about 60% today (Jordà, Schularick, & Taylor, 2016). As a result, the causes of house price fluctuations and their effect on household spending, residential investment, wealth of financial intermediaries, and ultimately on real economic outcomes (such as price stability and output) has become a top research priority (Jordà, Schularick, & Taylor, 2015).

The association between excessive credit growth, household's overconfidence and financial crises has been pointed out several times in the past. A historical analysis of advanced economies states that credit is associated with the most severe financial crises and the most prolonged recessions (Reinhart & Rogoff, 2008).

Although central bank's reaction to financial crises has changed throughout time, the GFC made clear the debilities of the traditional policy responses. Before the GFC, central banks typically ignored credit and financial bubbles. In fact, central banks only reacted to financial imbalances if these negatively affected their ability to achieve the inflation target and to stabilize the real economy. The consensus was that central banks should "clean up the mess", rebuilding the economy after the burst, rather than trying to prevent it. The GFC made it clear to policymakers that price stability was not a sufficient condition for financial stability (Badarau & Popescu, 2014). The GFC also demonstrated that the micro-prudential framework was insufficient to deal with the build-up of risks in the overall market. The focus on the risk in each individual institution led policymakers to neglect the aggregate effects of widespread individual risks, the systemic risk (Angelini, Neri, & Panetta, 2014). The central bank's concern with financial stability was imperfect, as they sought to address multiple goals with a single instrument. Against this background, there was the development of macroprudential policies, which became an essential mechanism to monitor and limit systemic risks, therefore reducing the probability of financial instabilities and mitigating the economic impact of financial crises. Several macroprudential tools focus on the housing market, which should not come as a surprise, given its role in financial crises. Central banks

created capital-based and borrower-based macroprudential mechanisms to mitigate the build-up of risks in the housing market and subsequently in the financial system. Alongside with the creation of new tools, the coordination and communication of these measures are fundamental to improve their effectiveness.

A thorough understanding of how central banks should control risks in the housing market to prevent aggregate financial and economic effects, requires a discussion of the role of monetary policy when a macroprudential framework is in place. The relationship between monetary policy and financial stability is still an ongoing debate. On the one hand, some authors (such as L. E. Svensson (2012b) and Benoit, Colliard, Hurlin, and Pérignon (2017)), defend the "separation principle", according to which monetary policy should deal exclusively with near-term output and inflation stabilization, while macroprudential policy should focus on financial stability. On the other hand, some writers, for instance, Filardo and Rungcharoenkitkul (2016), Adrian and Liang (2016), support the idea that monetary policy should have an active role in ensuring financial stability. In their view, given the flaws still present in macroprudential tools, monetary policy should complement it, improving its efficiency (Lambertini, Mendicino, & Punzi, 2013).

The motivation to address this topic in the present dissertation has arisen from its importance and urgency. This dissertation pretends to expose and understand how should central banks monitor and mitigate the build-up of risks in the housing market, given their potential to create financial crises and deep and prolonged recessions. This issue is still highly debated in the literature, especially in what regards the role of monetary policy, given that central banks have developed macroprudential policies alongside microprudential regulation and supervision. More specifically, we pretend to answer the following research questions: Is there a link between credit, the housing market, and the financial crisis? (ii) Which measures should central banks adopt to control the risks of the housing market? (iii) Should macroprudential policy alone ensure financial stability, or should monetary policy also take the floor? (iv) What is the state of the art on this subject, and the path for further research?

The topics in this dissertation have been addressed by means of an extensive literature review. Our choice of this methodology was motivated, on the one hand, by the complexity of the topics, and on the other hand by their encompassing nature. Indeed, the dissertation comprises several perspectives, from a historical view of housing and financial crises to a theoretical view of the relation between housing, credit and crises, to a more policy

view of how central banks have acted traditionally and more recently, and a more theoretical discussion of the role of monetary policy in a world in which central banks also conduct a macroprudential policy.

The dissertation is organized in the following way. In the second chapter, we describe how the housing market is unique and present a historical background to explain the relation between credit and the worst crises and most prolonged recession, especially focusing on the Great Financial Crisis. In chapter 3, we address the central bank's response to crises and how modern regulation and supervision have emerged. In the fourth chapter, we describe the macroprudential measures related to the housing market and discuss their flaws. We also address the debate on how should monetary policy act regarding the housing market, to ensure financial stability. Lastly, the final chapter presents some conclusions and discusses how this issue may develop in the future.

2. The importance of Housing and Credit in Crises

2.1. Theoretical background

The housing market is a central concern to the monetary policy since policymakers realize that to achieve financial stability, it is essential to understand the role of housing in the monetary transmission mechanism. In this section, we will describe the reasons beyond the uniqueness of the housing market and the transmission mechanisms that could influence the economy.

Housing has several features that cannot be found anywhere else. Firstly, a house is "illiquid asset", in the sense that it takes a reasonable amount of time to change its supply in the market. Also, houses represent the main source of pledgeable capital against households. Therefore, a housing investment is considerably more leveraged than investments in other financial assets (Davis & Van Nieuwerburgh, 2015). The house value limits the amount of leverage of the household's portfolio, a condition that suffers some adjustment throughout time. If not anticipated, sudden shocks or fluctuations in the housing market can bring devastating results to the economy. Consequently, the government and central banks have recently started to monetarize and interfere in this market, creating new mechanisms and strategies to ensure its stability. The main objective of these entities is to forecast the fluctuations in the housing market to prevent losses. Changes in the housing market have a tremendous impact on the economy due to the large share that this sector represents in the overall economy. The housing market represents a significant share of household expenditure (Greenwood & Hercowitz, 1991).

The value of the residential capital stock is larger than business capital. So, housing is not a "normal" consumption good, slight fluctuations in its price will imply significant variations in household's wealth. In fact, the market value of the United States (US) residential property stock is approximately equal to the annual average Gross Domestic Product (GDP). As a comparison to see the dimension of housing, the value of real balance for M1 and M2 in the US is about 30 and 60% of the GDP, respectively (Leung, 2004). Therefore, the constant growth of house prices raised concerns about the build-up risks created in the market.

The excessive leverage and risk-taking present in the housing market lead the central banks to question the reasons behind this growth. One of the reasons debated was the land-use restrictions, which generated substantial fluctuations in home-price appreciation during

the past several decades (Mishkin, 2007). The land-use restriction is a law that controls the maximum number of houses that can be constructed in a specific area. With a limitation of a supply the price of that good will obviously increase, ceteris paribus. The real price of residential land in the United States grew 270 percent between 1975 and 2006 (Davis & Heathcote, 2007). Although this can have an impact on house prices, it was not the main reason for price fluctuations in the last years. Central banks understood that to find an answer to the question: "how can monetary policy deal with the uncertainty concerning housing-related monetary transmission mechanisms?" is essential to understand the monetary transmission mechanisms involving the housing market.

The monetary transmission mechanism explains how fluctuations in the nominal money stock or the short-term nominal interest rate influence real variables, such as the output gap, employment and housing market (Favero, Giavazzi, & Flabbi, 1999). The monetary transmission channels operate through monetary policy's impact on interest rates, exchange rates, equity and real estate prices, bank lending, and firm balance sheets (Ireland, 2010). Despite the variety of monetary transmission channels, the focus will be attached to housing-related ones.

The main housing-related channels of the transmission mechanism can have distinct impacts. On the one hand, there are mechanisms linked with the change in housing prices, such as interest rates and credit-channel. On the other hand, the fluctuation of the housing prices triggers several effects (wealth effect, balance sheet effect, confidence effect, saving effect and rents) that will impact the household consumption (Giuliodori, 2005). We will concentrate our description on the channels correlated with the housing prices since they have more impact.

The interest rate channel is fundamental in the sense that it can have an impact on the supply and demand for houses. Regarding the supply side, a fluctuation in the interest rates, mainly the short-term interest rates, directly impacts the construction of houses. So, higher short interest rates will increase the construction costs and consequently slow the supply of houses. In contrast, a fall of the interest rates will boost the construction of new houses (McCarthy & Peach, 2002). Additionally, this channel also plays an important role with the demand side. The oscillation of interest rates modifies the agent's willingness to buy a house. Consequently, if the interest rates rise, the demand for houses plunges, and the inverse happens when rates decrease.

Secondly, the relation between credit and the housing market needs also to be considered (Greenwald, 2018). The main issue in the credit market is the existence of asymmetry of information. Despite the credit scores and other evaluations of the mortgagor, it could be insufficient sometimes to overcome this challenge. Therefore, to minimize the risk, the banks usually require a guarantee in case the borrower could not honour his debt. The restrictions settled to concede credit can have an enormous impact on credit behaviour. In fact, the number of mortgages granted to the economy is dependent on the credit constraints that can be made. B. S. Bernanke, Gertler, and Gilchrist (1999) explained how the inclusion of a guarantee could be promoting financial instability through the financial accelerator framework. The addiction of collateral into the mortgage gives the opportunity to the borrower to change the amount of the credit, considering the adjustments that can happen in the value of the guarantee. As an illustration, when the price of houses rises, it allows the mortgagor to increase his lend. This happens because higher house prices reduce the probability of default, in the sense that the collateral also increases its value. Therefore, with the relaxation of credit constraints, the borrower can ask for more credit, stimulating consumption spending (Qi & Yang, 2009). So, the financial accelerator will boost the demand for housing and increase even more the prices, and the process described starts all over again. The same mechanism also performs impelling the reverse behaviour, when the price of houses decreases, the financial accelerator will operate, pushing the prices even further down (Bianchi, 2011).

2.2. Historical background

This sub-section provides some historical background to describe what main forces have driven financial crises in the past, allowing us to subsequently highlight whether these forces have changed in the recent crisis. Credit has always been linked to the increase of risk, leading to financial crises and to deepest and more prolonged recessions (Jordà, Schularick, & Taylor, 2013). The major difference between past crises and the Great Financial Crisis (GFC) seems to be the degree of globalisation and financial liberalization – which contributed to the magnitude of the GFC. In this examination, we will focus on two eras that are remarkably different, from 1870 to 1939 (excluding the years of 1914 -1918 and 1939-1945)[1] and from 1945 until the present. This distinction reflects the different monetary

[1] The elimination of the period of World Wars I and II is crucial, due to the instability lived during this time, that could influence the outcome of this historical review.

and regulatory frameworks after World War II (WWII), such as the shift from the gold standard to fiat money, the greater responsibility for macroeconomic policies, the larger importance on bank supervision and deposit insurance (Schularick & Taylor, 2012).

In the first period, between 1870-1939, money and credit were volatile, but over the long run they maintained a stable relationship with GDP (Schularick & Taylor, 2012). In this era, there were two main episodes of great contraction of money and credit: the 1880s crisis and, to a greater extent, the Great Depression of 1930s. In this period, the classical gold standard was the exchange system in force (M. D. Bordo & A. P. Murshid, 2002). The capital could float freely, without restrictions, and the exchange rate system followed the gold standard (Michael D Bordo, Taylor, & Williamson, 2019). In this system, each currency was defined by a specific weight in terms of gold, and so each country's currency had a market value determined by the price of gold. The main reason for countries to accept this system were exchange-rate stability and access to capital at favourable interest rates. However, only the countries with a healthy balance of payments could honour the gold at a fixed parity for a long period of time. The evidence of this effect is the large number of currency crises on this period.

In the 1880s there were significant capital flows from the advanced countries of Western Europe to develop the infrastructure of emerging markets (such as Argentina, Uruguay, and Brazil). The capital outflow happened due to shrinkage of domestic demand in the developed countries of Europe (Michael D Bordo & Landon-Lane, 2010). The high volumes of credit granted to the periphery market were only possible due to generous bank lending by Western banks. However, the unexpected stop of this capital outflow led to a banking crisis, debt default, and currency crisis in the emerging markets (Michael D Bordo, 2006). As most of the core countries in Western Europe had exposure to the Latin-American market, this also led to a banking crisis, with several bank panics on Europe. As an example, during this period several countries had twin crises – a combination of banking crisis with currency crisis – such as the United States, Brazil, and Russia. The contagions between the core and periphery countries unleash evidence of how their economic relation could increase the risk of a global financial crisis (M. D. Bordo & A. Murshid, 2002); M. D. Bordo and A. P. Murshid (2002).

The Great Depression had a tremendous impact on the overall economy, indeed being one of the worst crises of all time. In the 20s, the American economy lived a golden

period, with strong development of the manufactory and, in particular, the automobile industry. The expansion of this segment as well as the increasing demand for consumer goods, could only be fulfilled with credit. The concept of buying now and paying later caught on quickly. Therefore, at the end of the 1920s, 60% of cars and 80% of radios were bought using credit. Between 1925 and 1929 the total amount of outstanding instalment credit more than doubled from $1.38 billion to around $3 billion (Gusmorino, 1996). This lending created unnatural demand for goods that individuals could not normally afford. However, this dynamic was dependent on optimism and confidence in the continuous growth of the U.S. economy (Brunner & Meltzer, 1968). If conditions were to take a downturn (as they did with the market crash in 1929), this spending and investment would come to a halt. The easy access to credit combined with over-optimism led to mass stock market speculation in the late 1920s.

In the aftermath of World War I, the United States were attempting "to be the world's banker, food producer, and manufacturer, but to buy as little as possible from the world in return." (Gusmorino, 1996, p. 4). This effort to have a constantly positive trade balance could not succeed for long (Temin, 2016). The United States kept high trade barriers in order to protect American businesses. However, if the United States would not buy from European counterparts, then the reverse would hardly take place. The weakness of the international economy certainly contributed to the Great Depression. Europe was dependent upon U.S. loans to buy U.S. goods, and the U.S. needed Europe to buy these goods to grow. When foreign countries became reluctant to buy U.S. goods, U.S. exports fell 30% instantly. Therefore, investors anxious with the fall in prices, began to sell their stocks quickly (overpriced as described previously), causing the collapse of the stock market. The downfall of the market created devastating results in the economy, with the excessive leverage of households and the industry contributing to an even worse recession. Even though monetary policy could actively respond to the crisis, the gold standard system made this option almost impossible (B. Bernanke & James, 1990). Moreover, given the youth of the Federal Reserve System, there was not much experience in using monetary policy to active tackle financial and economic crises. The Federal Reserve approach, at the time, adopt a "benign neglect" strategy, where the monetary policy only acts to "clean up the mess".

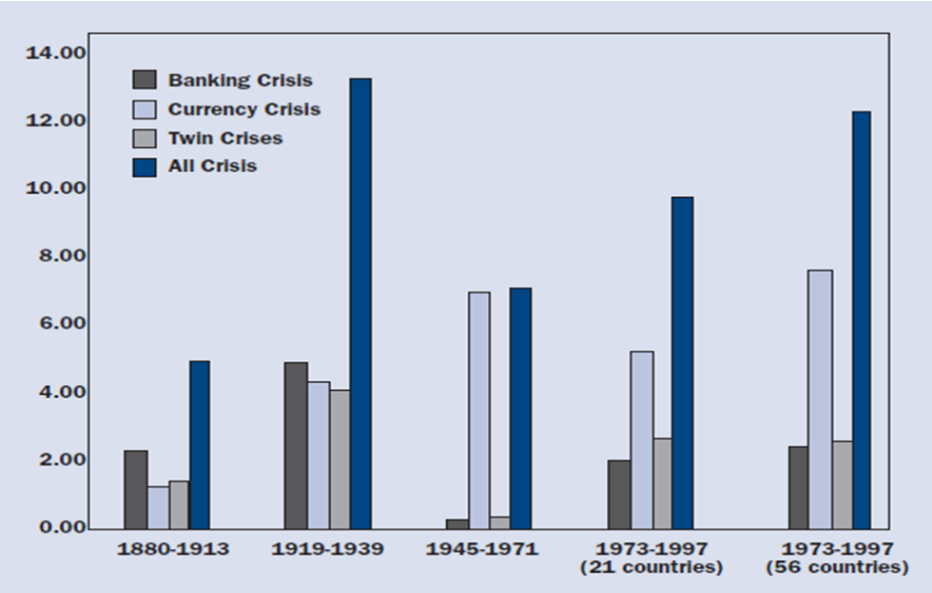
The subsequent era, since 1945, can be divided into two distinctive periods: the Bretton Woods system (1945-1973) and Financial Liberalization (since 1973).

In the aftermath of World War II, the Bretton Woods Conference created a new international monetary system aiming at reinforcing financial and international payments stability. The gold standard period saw frequent financial crises, culminating in the Great Depression. The figure 2 represents the crisis frequency, in percentage, through the different periods, it also identifies the currency and banking crises. Nurkse (1944, pp. 137-138) established his position against floating exchange rates on the interwar experience: "If there is anything that inter-war experience has clearly demonstrated, it is that paper currency exchanges cannot be left free to fluctuate from day to day under the influence of market supply and demand (...) If currencies are left free to fluctuate, speculation in the widest sense is likely to play havoc with exchange rates-speculation not only in foreign exchanges but also, as a result, in commodities entering into foreign trade". Bretton Woods created a new exchange-rate system, characterised as a dollar-gold-parity, with international capital controls and tighter financial regulation, with the objective of reducing the frequency of crises. The adjustable peg system was implemented, after 1933, to avoid the possibility of beggar-the-neighbour devaluations, trade restrictions, exchange controls, and bilateralism (Michael D Bordo, 2007). This new system combined the favourable features of the fixed exchange rate gold standard and flexible exchange rates. The Bretton Woods had become a gold dollar standard whereby the United States pegged the price of gold, and the rest of the world pegged their currencies to the dollar (Michael D Bordo, 2007). Therefore, the dollar appeared as the main reserve currency in this phase, reflecting both its use as an intervention currency and an increasing demand by the private sector for dollars as international money.

In this period, the developed countries' governments understood that closing the economies to the international markets was not the appropriate path to follow. Consequently, several arrangements and institutions appeared that were created to achieve international coordination (Findlay & O'rourke, 2009). The most relevant examples are the creation of the International Monetary Fund (IMF), the World Bank, and the General Agreement in Tariffs and Trade (GATT). As Jordà et al. (2013) stated, with these features, the Bretton Woods period was "an oasis of calm" and no countries within its regime experienced any financial crisis until the 1970s. Figure 1 illustrates this line of reasoning, showing that in 1945-1971 the probability of frequency of crises is the smallest (considering that in our analysis we merge the 1880-1913 and 1919-1939 in a single period). Despite the absence of banking crisis, figure 1 presents a great number of currency crisis during gold-dollar period.

Indeed, the problems for Bretton Woods started well before its collapse. The critical problem of the gold dollar system was how to maintain confidence. Michael D Bordo (2007) explain that if the growth of the monetary gold stock were not enough to finance the increase of world real output and to maintain U.S. gold reserves, the system would become dynamically unstable. The reasoning is the same when aiming for the misaligned parities of countries. Indeed, due to the lack of confidence, there were several examples speculative attacks on the states that had skewed pegs. Michael D Bordo and Eichengreen (2019) state some attacks leading to the revaluation of currencies. For instance, the UK devaluation of 1949 that was followed by that of 23 countries, the Canada devaluation in 1949, the France devaluation in 1957, 1958 and 1969, Italy devaluation in 1961, Germany revaluation in 1961 and 1969. These examples prove that although the frequency of financial crises was nearly zero, the currency crisis happened with a high frequency.

Figure 1: Crisis Frequency (Percent probability per year)



Source: M. D. Bordo (2002, p. 8)

The measures described above, including the formation of new institutions and commercial agreements as well as the development of new technologies, contributed on a large scale to the development of the world economy. Hence, these globalization policies (promoting international trade such as GATT) rapidly increased international trade output. It is crucial to highlight that, in this period, despite the tight financial regulation, it was possible to develop international trade.

The Bretton Woods System collapsed for three main reasons. First, the gold exchange standard placed the United States constantly under the threat of a convertibility crisis. In particular, it required that the U.S. kept its inflation controlled and its international competitiveness consistent with an equilibrium of the balance of payments. A mission that U.S. monetary policy was unsuitable for (B. Eichengreen & Bordo, 2002). Once the regime had grown into a dollar standard, the duty of the United States was to maintain price stability. Instead, it conducted an inflationary policy that ultimately destroyed the system (Michael D Bordo, 2007, p. 80). A second flaw was the regime of adjustable peg, which in principle was thought to be beneficial, but did not turn out to be so. Given the difficulties in credibly managing adjustments in pegs, the system gradually evolved into a reluctant fixed exchange rate system without any efficient adjustment mechanism (Michael D Bordo, 2007). Third, the surplus countries were progressively reluctant to adjust. The more developed countries were unwilling to absorb dollar balances and revalue their currencies. The growing gap between the sovereign interests of the United States and the other major industrial countries in part reflected the decline in U.S. power (B. Eichengreen & Bordo, 2002). The stage was set for a decentralized system.

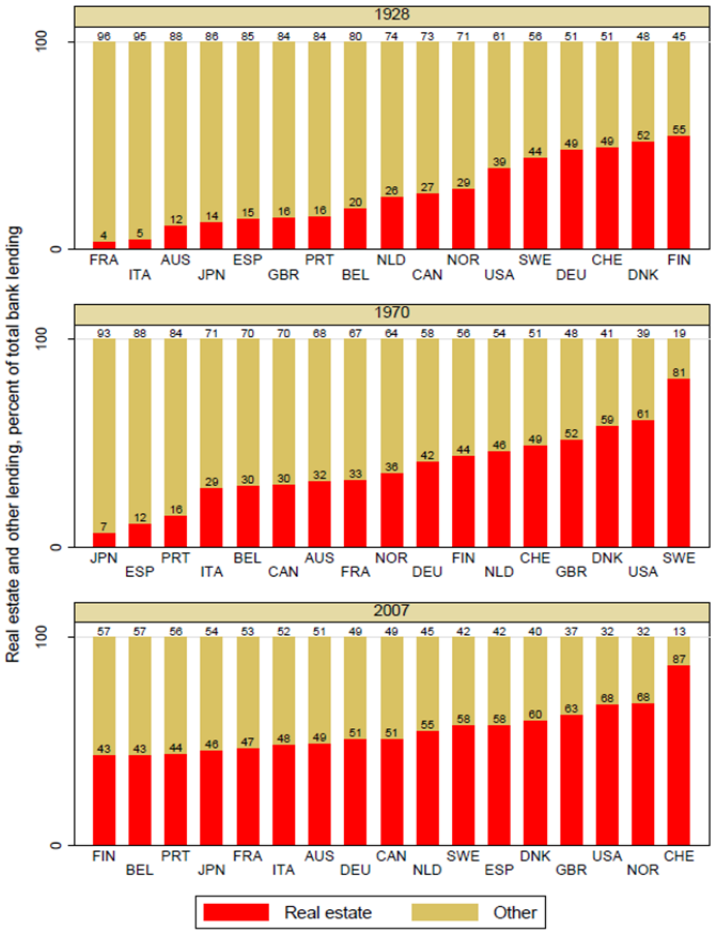
Since the beginning of the second period (since 1973), capital controls have been removed in most of the countries. The system adopted after the fall of Bretton Woods was one of managed floating exchange rates, which has been compatible with monetary autonomy and open capital accounts. Alongside with the transformation of exchange rate system started financial liberalization, a process that consisted in the abandonment of most of the constraints influencing the financial market. The 1970s represent a turning point in the history of the world economy, as a new era in which investors could easily trade assets from different countries. Such liberalization was then further deepened in the 1980s. The combination of globalization with financial liberalization created a framework never seen before. The role of credit gained even more importance after this major event. In fact, after this movement, the ratio of Credit/GDP had a fast increase due to the relaxation of credit constraints (Schularick & Taylor, 2012).

The sharp increase in the credit-to-GDP ratios of advanced economies in the 20th century has been first and foremost a result of the rapid growth of loans secured on real estate, i.e., mortgage lending. Figure 2 shows that the share of mortgage loans in banks' total lending portfolios has roughly doubled over the course of the past century—from about

30% in 1900 to about 60% in 2007 (Jordà et al., 2016). Bank lending on average roughly doubled relative to GDP between 1980 and 2009 as average bank credit to GDP increased from 62% in 1980 to 118% in 2010. Moreover, this is only a lower bound estimate as it excludes credit creation by the shadow banking system, which was significant in some countries, such as in the U.S. and the U.K.(Jordà et al., 2016).

The openness of the world market combined with the mobility of capital implied a greater probability that a domestic crisis could become a world crisis due to the connection of different markets. In the following sub-section, we will present the Great Financial Crisis as an example of this new form of crisis.

Figure 2: Three snapshots of the real estate share of baking lending: 1928,1970 and 2007



Source: Jordà et al. (2016)

Subtitle: France (FRA); Italy (ITA); Australia (AUS); Japan (JPN); Spain (ESP); United Kingdom (GBR); Portugal (PRT); Belgium (BEL); Netherlands (NLD); Canada (CAN); Norway (NOR); United States (USA); Sweden (SWE); Germany (DEU); Switzerland (CHE); Denmark (DNK); Finland (FIN).

2.3. The Great Financial Crisis

The Great Financial Crisis is unique, in the sense that it is the first global depression fueled by the combination of globalization and financial liberalization. The creation of new assets, alongside with the relaxation of credit constraints, contributed to the allocation of a large amount of capital and increased the probability of speculation and risk-taking in the market. In this section, there will be a special focus on explaining the reasons that led to the boom (2000-2006) and bust (2006-2010) of the housing markets and subsequent financial crisis. This major event has raised several questions, such as "What happened, why did it happen, and will it happen again?". To answer these questions, is crucial to recall what occurred to cause this "perfect storm". Only a combination of particular factors made possible a development of a global financial crisis of this magnitude. In this sub-section, we will firstly describe these causes (such as the financial liberalization, the securitization, and the period of low for long interest rates) and the relation among them[2]. Additionally, we will address the consequences that this burst brought to the economy.

In the last years, we have witnessed the financial liberalization of equity markets across the world. Bekaert, Harvey, and Lundblad (2005) emphasized that equity market liberalizations give foreign shareholders the opportunity to invest in domestic equity securities and national investors the right to trade in foreign equity securities. For the first time, investors can have a portfolio with a majority slice dedicated to foreign equity. The openness of markets allows for improving risk sharing, and consequently a decrease in the cost of equity capital and, so, an increase in overall financial investment (Bekaert & Harvey, 2000). In fact, financing constraints make external finance more expensive than internal finance and cause investment to be vulnerable to cashflows (Gilchrist & Himmelberg, 1998). Equity market liberalization, in turn, directly reduces financing constraints because more foreign capital becomes available. The financial-sector liberalization has also increased the pro-cyclicality of financial systems by promoting more aggressive lending practices from banks (Goodhart & Hofmann, 2008). Indeed, the bank lending relative to GDP rose substantially between 1980 and 2013, increasing from 62% in 1980 to 114% in 2013 in the United States (Jordà et al., 2016). Thus, the financial liberalization brought two important

[2] Although there are many additional causes that can also explain the Great Financial Crisis, in this subsection we only considered the most general and relevant from a macroeconomic point of view, disregarding more specific and microeconomic causes.

factors: the openness of the markets, making available the external financing; and this increase of investment and bank lending.

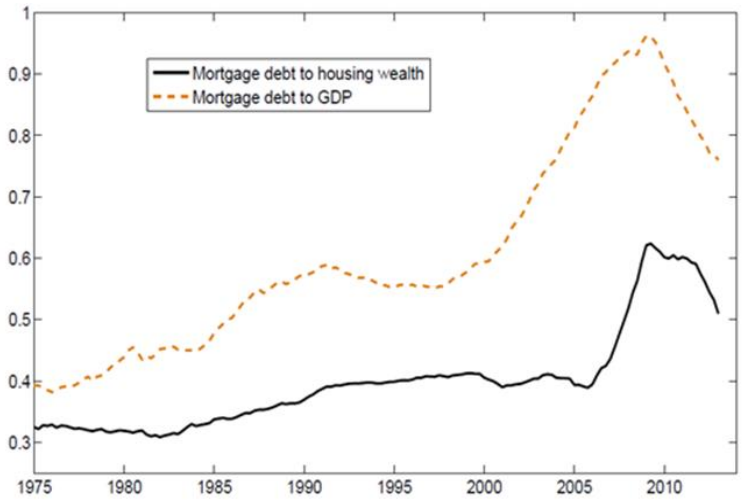
The financial liberalization combined with globalization brought this new perspective that shareholders can invest in any market in the world. The countries with a surplus, found with this innovation, the opportunity to invest their savings in more profitable markets, instead of the domestic ones. Asian countries, in particular, recorded a systematic balance of surplus payments (due to several factors, such as industrialization and lower cost of labour) which created an excess of overall savings that needed to be invested. Those savings flew to the western world given their lack of domestic financial allocation (Jagannathan, Kapoor, & Schaumburg, 2013). The Asian financial crisis of 1998 intensified this growing liquidity critical situation, increasing even more the capital outflow – which was destined mainly to the United States. Both financial liberalization and the dynamic financial engineering that occurred in financial markets were crucial to absorb these "search for yield" capitals stemming from emerging markets. Indeed, with such a large capital inflow to the United States, there was the need to develop new financial products to match the investor's requirements. The initial inflows were mainly dedicated to US treasury bonds; foreign holding of the US government debt increased from 18% of the total government debt of $5.66 trillion in December 2000 to 28% of total government debt of $9.5 trillion in June 2008 (Jagannathan et al., 2013). However, the decreasing American government financing needs and the low treasury yields made alternative government backed investments, such as GSE (Government Sponsored Institutions) mortgage pools, more attractive due to the spreads these investments initially offered (Ashton, 2009).

With this capital direction pointing towards the housing market, the financial institutions created new financial products with the intention of reaching this demand for yield. In particular, there has been a strong development of financial instruments backed by mortgage packages. This led to the sudden growth of the subprime mortgage in the United States. The securitization of the prime and sub-prime markets has clear differences. On the one hand, prime lenders usually sell mortgage loans in the secondary market to Government Sponsored Enterprises (GSEs), who afterwards sold them to investors with a grade established by rating agencies (Agarwal, Chang, & Yavas, 2012). On the other hand, subprime loans are held by a different type of lenders, such as private issuers and investment banks. These institutions packed and sold the subprime loans again to investors. Among

many others, (Bajaj, 2006, p. 1) offers the flavour of what was happening in those days: "Bonds backed by subprime mortgages are offering yields of 5.48 percent for the AAA class, 6.33 percent for the BBB class and 7.23 percent for BBB-rated bonds, said Anthony V. Thompson, a managing director at Deutsche Bank in New York. By comparison, a 10-year Treasury note had a yield of 4.78 percent on Monday". Clearly, the yield of these packages was more profitable than the usual treasury bond.

The growth of subprime mortgage lending was only possible by expanding credit into new segments of the market. The lower credit score did not represent a problem for lenders, because the loans with credit scores[3] below 600 still accounted for a third or more of the market. These trends can be seen in Figure 3, which depicts the overall level of household indebtedness as a percentage of GDP; whereas household indebtedness grew from 61.4% of GDP at the end of 1990 to 67.2% in 1999, it had mushroomed to 90.1% by the fourth quarter of 2005 (Ashton, 2009). The boost of this market had also microeconomic influences, in the sense that dealers earned a transaction fee ranging from 2% to 6% or more of the loan, which was clearly an incentive for brokers and originators. Moreover, higher servicing costs and the need for specialized mortgage insurance also offered attractive returns to specialist firms (Ashton, 2009).

Figure 3: Mortgage Debt 1975-2013 in the United States



Source: Davis and Van Nieuwerburgh (2015)

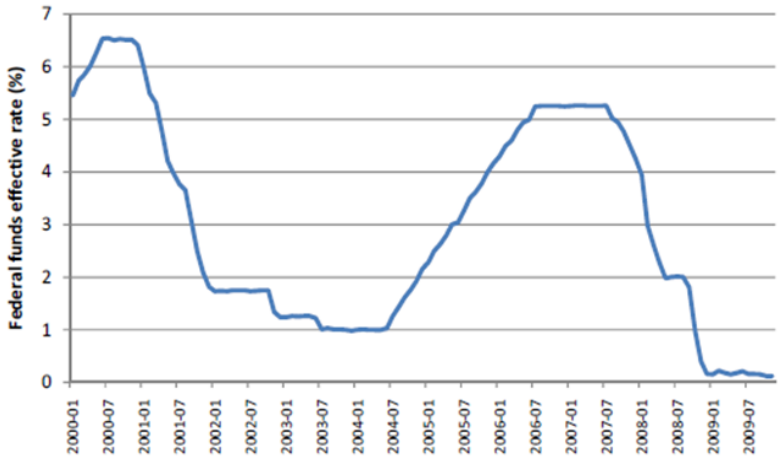
[3] The base FICO® Scores range from 300 to 850, and FICO defines the "good" range as 670 to 739. FICO®'s industry-specific credit scores have a different range—250 to 900. For a deeper understand on the credit scores, see https://www.stlouisfed.org/education/continuing-feducation-video-series/episode-1-understanding-how-a-fico-credit-score-is-determined.

Notes: The figure plots mortgage debt relative to real estate wealth of the household sector (solid line) and mortgage debt of the household sector relative to GDP (dashed line) in the United States.

The last cause of the three most important ones for the boom in the housing market – alongside the two already described the financial liberalization (globalization), and financial development (securitization) – is the "too low for too long" interest rates. After the recession of 2001, following the burst of the so-called 'dot.com' bubble, the US monetary authorities aggressively reduced the policy interest rate to unprecedented levels and thus fueled a debt-financed consumption boom that led the way to a boost in global aggregate demand (Verick & Islam, 2010). The figure 6 represents US Interest Rate (monthly Federal Funds effective rate), since 2000 until 2009, showing the sudden drop in interest rates. Overall, the combination of domestic issues (for instance US monetary policy) and global imbalances (the glut of savings flowing from surplus countries to deficit economies) were the causes for the low interest rates for so long. Alongside with these factors, there was no macroeconomic reason to raise interest rates, the inflation was stable and controlled, and the employment was high. Therefore, the combination of low-interest rates and relaxation of credit constraints boosted in great measure the demand for credit, specifically mortgages. In fact, too low for too long interest rates worked as a spark starting a fire.

The boom of the housing market ended in 2007 with a burst of the bubble. The Federal Reserve started increasing interest rates in 2005 and did so until 2007 (figure 4), thus ending the low-interest rate period that was one of the causes of the housing market's growth (Astley, Giese, Hume, & Kubelec, 2009). The first piece of the house of cards had fallen, the increase of interest rates showed that investors had been taking excessive risks. The rise in non-performing loans subsequently led to the failure of several US mortgage lenders (Jagannathan et al., 2013). Households with poor score mortgages become unable to repay their lending, so they needed to deliver the collateral to the Bank. On the other side, Banks did not want to have houses in their balances, so started to sell them on the market to minimize the losses from these not performing loans. However, this policy increased the supply of houses on the market bringing further down its price, leading to even more defaults.

Figure 4: US Interest Rate (monthly Federal Funds effective rate)



Source: https://www.federalreserve.gov/datadownload/Choose.aspx?rel=H15

The burst of the housing market happened as a cause-effect dynamic. The mortgage market had been financed extensively through structured financial products that in act were a new complex form of securitization by means of packages of mortgages. Yet, the regulation and rating agencies failed to consider the real risk presented by those packages of mortgages (Jagannathan et al., 2013). The rating agencies based their evaluation on the law of big numbers, in the sense that in the past these assets did not default simultaneously, assuming that such pattern would hold in the future. The problem relied on the fact that packages that were considering triple-A had incorporated riskier mortgages. Overall, the environment was one of over-confidence and assumption of extremely high levels of risk. Over 2007, hedge funds were hit hard by the defaults and subsequent unwinding of the sub-prime market. A negative spiral then begun, with a "fire-sale" of the assets related to the housing market, now considered toxic, as investors wanted to minimize the losses and the exposure to this market. Financial engineering, which had helped bring about the housing bubble in the first place through the creation of new financial instruments to fulfil the search for yield, also played an active role in the bursting of the bubble (Jagannathan et al., 2013).

Thus, the combination of these three particularities - financial liberalization, securitization and "too low for too long" interest rates - was the fatal receipt for the rise of the bubble in the housing market in the United States and its consequent burst. The interconnectedness of financial institutions and markets associated with financial globalization, in addition, made this originally U.S. crisis a global one -- the Great Financial

Crisis. The consequences of the Great Financial Crisis were disastrous and brought almost to the ground the biggest economies in the world.

Overall, this event made it clear that it is fundamental to understand how the policy of Central Banks failed and how the housing market could be regulated to avoid the build-up of risks as it happened in this depression. These matters will be the focus of the remaining of this dissertation.

3. Credit, Crises and Central Bank's Behviour

3.1. Central Bank's policies in retrospect

The history of central banking has been characterised by temporary successes and tragic failures. It is the saga of an endless unfulfilling search for a "Holy Grail"[4] that has proved beyond reach. In this subsection, we will describe the main amendments in the behaviour of Central Banks when addressing past crises. We aim to understand what has changed in central banks' reaction to crises and comprehend what must be adjusted to ensure that future responses to financial crises become more effective. In our retrospective analysis, we will address the problem since the beginning of the 1900s because the creation of most Central Banks only occurred in this period (except for very few, which had been created earlier, such as the Bank of England and the Sveriges Riksbank)[5]. The historical responses of Central Banks to crises are quite dependent on the specific circumstances lived at the time, as illustrated in table 1. The successive crises helped central banks to understand the mechanisms that most influence the emergence of crises, such as the acceleration of credit and excessive risk-taking (Aikman, Haldane, & Nelson, 2015). Furthermore, with the previous financial crises episodes, the policymakers comprehended the flaws on the past policies responses. In fact, they have improved the design of these policies with the knowledge gained in the past.

Table 1: Monetary and Financial Stability across regimes

	Regime		Stability	
	Financial	Monetary	Financial	Monetary[1]
Classical gold standard	liberalised	gold/credible	no	yes
Inter-war years	liberalised	mixed/mixed	no	mixed[2]
Bretton Woods	repressed	increasingly fiat non-credible over time	yes	lost over time
Post-Bretton Woods	liberalisation	fiat increasingly credible	no	regained over time

[1] In terms of price stability. [2] Price stability prevailed in the run-up to the Great Depression in the United States.

Source: C. E. Borio (2014)

[4] To reach price and financial stability.

[5] For more details on the evolution of the banking system, and subsequently the history of Central Bank, see for example Grossman (2010)

One of the first recipes for the response to crises was stated by Bagehot in his book Lombard Street (1873), where he formulated what came to be known as Bagehot's rule, which can be summarised as "lend without limit to solvent firms, against good collateral at high rates" (Rosas, 2006). At the beginning of the 1900s, economists typically advised central banks to adopt Bagehot's rule when handling financial crises. The consensus was that central banks would limit moral hazard and discourage risk-taking if they committed to this strategy. Higher rates would mitigate the possibility of moral hazard since the institutions that had to engage into emergency borrowing from the Central Bank faced a sanction, which would set an example of what would happen to institutions committing a high risk-taking strategy. Despite the influence of several economists, most central banks usually did not follow this rule – even though some, such as the Bank of England, the Banque de France, and the Federal Reserve, sought at first to pursue some versions of Bagehot's rule (Mishkin & White, 2014).

From 1900 until 1945, with the Gold Standard in place, central banks followed a specific approach to respond to financial crises. As described in the previous chapter, the Gold Standard was a system in which the value of a currency was defined in terms of gold, for which the currency could be exchanged. The convertibility into gold acted as the single anchor for both monetary and financial stability. Monetary stability was defined as keeping convertibility, both internal and external; there was no explicit price stability goal. In turn, the convertibility constraint would typically give way during financial crises, when deposits could no longer be turned into gold at par (C. E. Borio, 2014).

An illustration of a central banks' reaction to crises during this period is the response to the Great Depression (1929-1933). The lack of effectiveness in central banks' responses to this crisis has two main reasons: the absence of any previously developed strategies to combat financial crises, and the adoption by central banks of passive strategies as a rule. On the one hand, the poor institutional design of central banks and the still relatively limited knowledge about the effects of monetary actions implied a lack of experience in dealing with financial crises (Mishkin & White, 2014). On the other hand, central banks tended to keep interest rates stable unless the convertibility constraint came under threat, at which point they would be raised. However, acting only when the convertibility constraint became binding was not sufficient to prevent waves of financial instability in the wake of excessive credit expansion, often accompanied by sharp asset price increases, especially housing prices, as it happened

in the Great Depression (Goodhart & Delargy, 1998, pp. 261-287). Indeed, countries saw the parity implied by the Gold Standard as an instrumental rule – a constraint of policy appearing when a central bank agrees to set a policy instrument to a particular value or values that depend on states of the economy and are easily verified.

In the beginnings of the Great Depression, before 1931, consciously chosen policies by some major central banks played an essential role in the boost and in the burst of the crisis (Hamilton, 1987). Between 1926 and 1931, the world's major economies adhered to a gold standard with fixed exchange rates, under which monetary policies of all countries in the regime are inextricably connected with each other. In response to the crisis, central banks could have chosen two different paths, leave the price-specie flow mechanism do its corrective work undisturbed, or act as "lenders of last resort", providing emergency liquidity assistance as banks so required (Moessner & Allen, 2011). Instead, central banks followed the passive strategy inherent to the Gold Standard regime to ensure interest rates and gold conversion stability.

This choice stemmed from the risks associated to the alternative. Assuming the "lenders of last resort" position, central banks would risk violating their legal obligation to preserve gold backing for their liabilities. That is true, although the risk could be mitigated by increasing their discount rates, by international borrowing to supplement the central bank's gold reserves, or when governments assure that the central bank would be temporarily relieved of its gold standard obligation. However, such measures could not have worked in 1929-1933. In fact, if a central bank's gold reserves were close to the legally stipulated minimum, then it could not lend to banks with liquidity problems (or, in fact, to anyone else) without breaking the rules (Moessner & Allen, 2011). Moreover, under the *status quo*, with large banks failing in several countries where gold reserves were limited, a temporary suspension of the rule could not also have been credible. Therefore, many central banks could not serve as "lenders of last resort" and could not help their commercial banks while accepting the gold standard rule. As B. J. Eichengreen (1995, p. 393) remarks, "Even the provision of liquidity to a banking system in distress might cast doubt over the official commitment to gold, prompting the transfer of bank deposits out of the country and aggravating the problem of domestic financial instability.". So, the main problem associated with this form of regulation was its rigidity. The legislative process to change the gold value

of money was slow, so the system could not respond to a financial crisis or a sudden shock quickly.

The Bretton Woods era was characterised by financial repression to avoid financial instability (Table 1). For a while, the system delivered monetary and financial stability, but at growing costs in terms of resource allocation (C. E. Borio, 2014), as described in the previous chapter. During the Bretton Woods regime, there was no report of significant global financial crises that central banks needed to face (B. Eichengreen and Bordo (2002) and Reinhart and Rogoff (2009) Appendix A3). Indeed, as shown in figure 1, the number of banking crises was almost zero in this period. Therefore, our analysis now addresses the period after the fall of the Bretton Woods regime in 1973.

Given its dimension and strength, the Great Depression gave fresh inputs for policymakers worldwide to rethink their responses to financial crises. After the abandonment of Bretton Woods, the world economies lived a completely different environment from that of lived during the Great Depression. Central banks had understood that a too rigid rule could not overcome sudden shocks, so they changed the exchange rate system to a more flexible regime – typically, managed floating exchange rates. The combination of financial liberalisation and globalisation represented a further shift in the world economic environment. For the first time, agents could freely invest in different markets without tight capital controls, given financial deregulation (Michael D Bordo et al., 2019). However, this transformation in the world economy brought an increased risk to global markets. Then, a substantial financial instability surfaced from the ashes of the Bretton Woods system, so financial cycles re-emerged as frequent and major economic phenomena (Drehmann, Borio, & Tsatsaronis, 2011)

Central banks had learned from past crises that pursuing multiple objectives was not an effective approach to conduct monetary policy. Therefore, they changed their policy by following one only goal, namely price stability. Such behaviour change is consistent with the Tinbergen principle, which states that to pursue N independent objectives, policymakers need to have N independent instruments (Del Rio & Howlett, 2013). Central banks chose the mandate of price stability, controlling inflation through a single instrument, the interest rate policy (Cobham, 2012). Given the increasing consensus in Macroeconomics that price stability promoted a high and sustained real economic activity. However, as an evolution from previous experiences, it did not adopt any binding instrumental rule. Instead, central

banks chose a mandate with a priority of ensuring price stability. In this case, a target rule, which is more flexible and allows for reacting to unforeseen shocks or changes in the economy's structure. The "flexible inflation targeting" as B. S. Bernanke, Laubach, Mishkin, and Posen (2018, p. 144) describes, allows for short-run deviations from the target, depending on the state of the economy.

The independence of central banks – which became widespread in the developed economies after the 1990s – reinforces their mandate and commitment to honour it. Traditionally, governments directly influenced central banks' decisions, as they were essentially departments of the ministries of finance. Typically, governments chose policies that featured an inflationary bias, as they pursued a high level of growth and employment for electoral reasons (Cukierman, 2008). Independent central banks, in turn, have better-specified mandates -- with a clear focus and priority to price stability, and a secondary concern, at best, with sustained growth. Moreover, independent central banks were formally more transparent and accountable (Cobham, 2012).

From the fall of Bretton Woods until the great financial crisis of 2007-08, central banks focused almost exclusively on controlling price inflation. The problem was that by planning to achieve a narrow price stability objective, central banks came to neglect developments in credit growth and asset prices. The misperception of risk on the economy led to a build-up of credit and leverage in the system that proved unsustainable over a longer horizon, creating speculation on the price of assets. Such problems have arisen in the stock market crash of 1987, in the dot.com crisis of the early 2000s and, more recently and more severely in the Great Financial Crisis (GFC) of 2007-08 (Nier, 2009).

The crisis of the stock market crash in 1987 is one example of how this negligence for financial factors could bring devastating results. The biggest economic problem of the crash did not arise from the decline in wealth resulting from the crash itself, but rather from the threat to the clearing and settlement system in the stock and futures markets (Mishkin & White, 2014). The policy response to this crisis was clearly stated by the New York Federal Reserve Bank president, who announced the Federal Reserve System's "readiness to serve as a source of liquidity to support the economic and financial system" (Zaretsky, 1996, p. 1). At the same time, the FED stimulated crucial banks to lend freely to their brokerage firm customers. Banks would face losses if their loans to firms were to default. So, the Federal Reserve used banks to reduce moral hazard risk-taking (Mishkin & White, 2014).

The crisis of 1987 was essential for central banks to understand the problem associated with the excessive risk on the economy, thus creating awareness of the need for regulation and supervision to control those risks. Undeniably, the episodes of financial instability gave momentum to international efforts to reinforce international prudential standards (C. E. Borio & Toniolo, 2006).

3.2. Regulation and Supervision

Financial crises showed the potential harm of banks not being safe and sound. As a result, the objective of ensuring a secure environment for banks, and avoiding acute financial crises, became increasingly relevant. The higher frequency of financial crises, typically associated with excessive risk-taking and credit growth (mainly mortgages), led to heated debates about rules and regulations for the financial sector (Singer, 2007, p. 1). It became increasingly clear that central banks needed to revamp regulation and strengthen supervision – the two fronts where policymakers and financial authorities must act. As stated by Lautenschläger (2018), "Without supervisors, rules would have little effect; without rules, supervisors would have no job – or at least no firm basis for doing their job. You can't have one without the other: regulation and supervision need to be aligned." [6].

Moreover, the intensification of globalisation implied that the collapse of a financial institution in one country might easily and rapidly trigger sequential failures of financial institutions in other countries. Therefore, there has been an increasing awareness that financial regulation should be international and globally harmonized.

The G-10 countries[7] formed a committee at the Bank for International Settlements (BIS) in 1975, called the Basel Committee on Banking Supervision (BCBS), to respond to the consequences of the downfall of Bretton Woods and combat the problems associated with excessive risk-taking and leverage in the aggregate economy (Shakdwipee & Mehta, 2017). The committee created the Basel Accords, which formally prepare supervisory standards and guidelines and recommend best practice statements.

[6] Regulation - Bank regulation refers to the written rules that define acceptable behaviour and conduct for financial institutions. In the case of the United States, the Board of Governors, along with other bank regulatory agencies, carries out this responsibility. Bank supervision refers to the enforcement of these rules. Retrieved from: https://www.stlouisfed.org/in-plain-english/introduction-to-supervision-and-regulation

[7] The G-10 countries are Belgium, Netherlands, Canada, Sweden, France, Switzerland, Germany, United Kingdom, Italy, United States and Japan.

3.2.1. Basel Accords: Basel I

Basel I, launched in 1988, tried to address the committee's concerns relative to capital adequacy in the banking sector through banking regulation. In it, the committee focuses mainly on the micro-prudential level, advising commercial banks to hold a minimum level of capital and to obey several capital requirements to promote banking solvency. After its inception, the effectiveness of Basel I changed markedly, as financial circumstances across the world evolved substantially because, over the following years, (Shakdwipee & Mehta, 2017). Such development had two leading causes, namely the great moderation (the period 1984-2007) and financial liberalisation. On the one hand, during the great moderation, the volatility of output growth and inflation in all OECD economies declined substantially (Giannone, Lenza, & Reichlin, 2008). The credibility of monetary policy led to a decline in inflation volatility, as inflation expectations became increasingly anchored (see, e.g., Stock and Watson (2002) and Cogley and Sargent (2005)). On the other hand, during this low inflation and low-interest rates period, the "search for yield" became more intense than ever. Financial liberalisation was crucial to feed such demand for yield. Therefore, there was an introduction of newer financial institutions alongside with more innovative products – which led to a change in the nature of financial risks.

The evolution of the financial world made Basel I inadequate to deal with the new challenges. A major criticism of Basel I was that capital requirements were not enough to assess and mitigate the potential risk of banks. Another flaw was its focus on financial risk metrics while completely ignoring the need for a robust risk management process. In response to the lack of effectiveness of Basel I, the international Basel Committee on Bank Supervision launched Basel II in 2004. Essentially, Basel II converted the Basel I capital adequacy rules into a more general risk management regime. In order to do so, it converted the one-size-fits-all rule into a more elastic, institution-specific set of requirements (Shakdwipee & Mehta, 2017).

3.2.2. Basel Accords: Basel II

Basel II was based on three mutually reinforcing pillars. The first pillar focused on capital adequacy requirements and ratios to control banks' equity and assets. The assets were evaluated according to three risks: credit risk, market risk, and operational risk (Shakdwipee & Mehta, 2017). The second pillar incorporated the supervisory process for bank activity, including the responsibility for the assessment mode conducted by banks, improving the

bank-supervisor dialogue, and the rapid intervention to prevent the decline in capital and other measures.[8] Lastly, Basel II proposed more detailed reporting requirements regarding ownership structure, risk exposures, and capital adequacy (Shakdwipee & Mehta, 2017).

Basel II was not able to circumvent all the flaws of the previous accord. Furthermore, the drastic changes in the global financial environment, which led to the Great Financial Crisis (GFC) in 2007-08, highlighted its various additional shortcomings. Moreover, it may even be argued that the GFC demonstrated that Basel II may have been itself a trigger for the crisis.

Basel II gave a false sense of security to economic agents as it led them to believe that if the agreement's rules were followed, banks would be prepared to withstand a crisis. Even worse, agents were led to believe that Basel II had been designed well enough that, provided that financial institutions complied with it, a systemic meltdown was remote or even almost impossible. This illusion led to an excessive risk-taking by agents and induced bubble-like behaviour (C. E. Borio and Shim (2007) and C. E. Borio and White (2004)).

The major weakness of the first two Basel Agreements was that they approached the solvency of each institution independently, completely neglecting systemic risk. The 2007-08 GFC highlighted the crucial role of systemic risk, where the failure of one large institution could cause the failure of one or more of its counterparties, then triggering a chain reaction. Indeed, under Basel I and II, central banks could not manage the systemic risk that eventually had devastating results in the GFC.

The reliance on rating agencies was also an evident flaw in Basel II that allowed for the build-up of the mid-2000s financial bubble and then worsened the consequences of its burst in the GFC. Indeed, rating agencies played a significant role in the subprime crisis of 2007-08, as described in the previous chapter: in the time leading up to the crisis, they failed to evaluate the risk of certain innovative financial assets, being overall too generous in granting out top ratings to securities backed by subprime loans –which was done, in retrospect, to please their clients. The dependence of Basel on credit rating agencies was inconsistent: while Basel was meant to anticipate problems, agencies were backwards-looking rather than forward-looking, in their assessments (Hawkins & Turner, 2001), therefore tending to follow market trends rather than anticipating them (Rodríguez, 2002, pp. 14-17).

[8] For a more detailed analysis of the rules implemented with Basel II see third chapter of Chernobai, Rachev, and Fabozzi (2008, pp. 35-66).

Another shortcoming of Basel was the pro-cyclical effect of most of their regulations. To see why, first consider that banking is itself a pro-cyclical business, in the sense that banks tend to squeeze their lending activity in recessions and expand it in booms (Moosa, 2010). With Basel II and its risk-sensitive capital requirements, banks were even less capable of lending in recessions and more able to do so in booms, as these capital requirements increase when the estimates of default risk are higher, and vice versa (Allen, 2004).

3.2.3. Basel Accords: Basel III

In November 2010, still recovering from the GFC, the member states of the Group of Twenty (G20)[9] officially approved Basel III, which represented a clear deviation from the philosophy and substance of Basel I and II. Given the problems described above with the previous Basel Accords, it came as no surprise that Basel III aims to increase the quality and quantity of capital that banks must hold and reduce the cyclicality of the banking system and its regulations.

The most innovative and controversial measure of Basel III was establishing a set of system-wide macro-prudential measures (Hannoun, 2010)[10]. The macroprudential overlay is an entirely new way of thinking about capital and has been designed to address systemic risk in the global financial system. The new dimension of the capital framework in Basel III consists of five elements.

Firstly, the leverage ratio, which is a measure of capital that supplements the risk-based ratio and restricts the build-up of leverage in the system. Second, a countercyclical capital buffer, which ensures additional capital is in place to absorb losses when risks materialise. These first two additional capital buffers intended to serve as further defences against future losses. These innovative solutions emerged as the GFC demonstrated that losses experienced in the banking sector could be extremely large when a downturn was preceded by a period of excess credit growth. Easy credit creates a build-up of loans alongside with an increase on prices that often lead to bubbles, as happened in the housing market. When these bubbles eventually burst, prices go down, loans go unpaid, and banks begin to limit borrowing. As

[9] The G-20 countries Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States, and the European Union.

[10] The Basel III reinforce also as no surprise the micro-prudential tools present in the previous Basel Accords. For instance, the increase of capital requirements for common equity and tier 1 capital, from 2% to 4.5% and from 4% to 6% respectively. For more detail, see King and Tarbert (2011)

the reduction of credit availability pushes asset prices further down, the level of defaults increases even more. (Hannoun, 2010). The assumption underlying both buffers is that banks should build up funds of capital during "good times," periods of solid growth, that can be drawn down during the inevitable "bad times" when losses occur (Wellink, 2010).

Third, the macroprudential regulation aims to mitigate the negative externalities from limited liability, limited enforcement, and asymmetric information in the market. Due to these limitations, the agents propagate risks through increasing leverage, expanding balance sheets and relying on short-term liquidity (Kenç, 2016). The interconnected environment lived in the financial system propagates even further the systemic risk. We can have three different negative externalities in the market that the macroprudential policies must aim, such as strategic complementarities, interconnectedness, and pecuniary externalities (Aikman, Haldane, Hinterschweiger, & Kapadia, 2019). The strategic complementarities externality results from financial institutions' propensity to take on exposures to credit and liquidity risk, including maturity mismatches, during upturn phases of the financial cycle, and minimize their balance sheets by selling off similar assets during the downturn phases (Constâncio et al., 2019). The interconnectedness externality results from financial institutions' direct and indirect relationships, such as holdings of each other's assets or mutual liquidity funding. Lastly, we have the pecuniary externalities which are produced by fire sales in the asset market (Benoit et al., 2017). The collateralised borrowing leads to externalities because the agents do not assume the fact that increasing debt in good times increases the probability that they will be forced to sell assets following adverse shocks, leading to a downturn on prices, tightening collateral constraints and worsening recessions (Aikman et al., 2019). Therefore, this theory embraces the ideology that private borrowing in good times is greater than a social planner would choose.

Fourth, Basel III includes a framework to address the risk arising from systemically important markets and infrastructures – more precisely the over the counter (OTC) derivate market. And finally, the macro-prudential overlay aims to improve the capture of systemic risk and tail events in the banks' own risk management framework through risk modelling, stress testing and scenario analysis (Hannoun, 2010).

Despite representing an essential step in the right direction, the implementation of Basel III has been controversial, as some observers believe that some of its features could slow down the economic recovery from the GFC. To address these objections, the Basel

Committee has designed an implementation calendar with the hope of minimizing any deleterious effects on the recovery, whereby the full implementation of Basel III only occurred in 2019 (Basel, 2009).

While there has been enormous progress on the knowledge about the mechanisms that can jeopardise financial stability, central banks and policymakers, in general, are still far away from a consensus on what should be the best way to deal with episodes of acceleration of credit and abnormal increases in asset prices (particularly house prices). Ultimately, this matter is about the inter-relation between macro-prudential and monetary policy.

Against this background, in the next chapter, we will analyse in detail how should central banks conduct their policies, given the existence of macro-prudential mechanisms. The key issue is what are the implications of the interaction between monetary and financial policies in what regards the emergence and virulence of financial cycles; in particular, how does such interaction affect the size and amplitude of credit and asset price booms and their subsequent busts, with a special emphasis on house prices. We will describe the different insights from the literature, sequentially addressing two topics. First, we will look at how should macro-prudential policy be set and conducted to ensure financial stability. Secondly, we will look at whether monetary policy should be conducted with a 'leaning against the wind' approach, given that there is a macro-prudential apparatus in place. Overall, our literature analysis should reveal whether optimal policies are a combination of an active but traditional monetary policy (aiming at price and macroeconomics stability) with robust macro-prudential tools (aiming at financial stability).

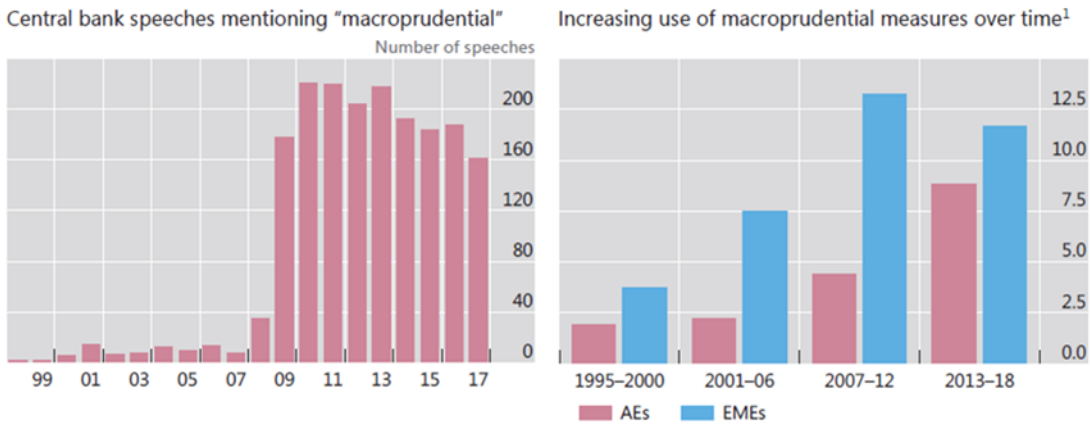
4. Re-thinking Central Bank's policies on the Housing Market

4.1. Macro-Prudential policy

After the Great Financial Crisis (GFC), central banks worldwide understood that monetary policy could not ensure financial stability by itself. The new macro-prudential approach appeared to solve the loophole left by monetary policy. In this section, we will address the importance of macro-prudential policy, especially in the prevention of sudden fluctuations in the housing market. We will also discuss the challenges this new framework must face and discuss how it may be improved to ensure stability of the housing market.

Although the term "macroprudential" had been mentioned in the past, it only caused a stir in most countries when BIS General Manager Crockett (2000) called for a "macroprudential" approach to ensure financial stability. In the same public speech, he distinguished the macroprudential dimension of financial stability – the financial system's stability – from the micro-prudential dimension – the stability of individual institutions (BIS, 2018, pp. 63-90). Figure 5 clearly shows the increase in the relevance of macro-prudential frameworks in recent years, especially after the GFC.

Figure 5: Macro-prudential orientation moves to the mainstream



[1] The bars show the average number of macroprudential measures per year and per 10 economies in each group of economies.

Source: BIS (2018, p. 64)

Subtitle: AE – Advance economies; EME - Emerging Economies[11]

Following the economic catastrophe caused by the GFC, central banks worldwide have recognised the importance of ensuring the stability of the overall financial system and designed policies to achieve this objective. On the one hand, some central banks, like the

[11] The sample has in total 55 countries, for more detail on each country present on the study see BIS (2018)

European Central Bank (ECB)[12], added or reinforced their mandates to address this new priority.[13] The awareness of economic agents about the benefits of financial stability implied that even when central banks do not have an explicit financial stability mandate, agents still believe they are responsible for the overall stability of the financial system (Constâncio et al., 2019). In the same line of reasoning, the Federal Reserve also reinforced its macroprudential framework, despite not having such a specific mandate.

The housing market soon was recognised as particularly important. As Powell (2017) stated, "The Federal Reserve is not charged with designing or evaluating proposals for housing finance reform. But we are responsible for regulating and supervising banking institutions to ensure their safety and soundness, and more broadly for the stability of the financial system. A robust, well-capitalised, well-regulated housing finance system is vital to achieving those goals, and to the long-run health of our economy. We need a system that provides mortgage credit in good times and bad to a broad range of credit worthy borrowers.". So, after the GFC, the housing market's stability became a priority to ensure the solidity of the financial system.

In what follows, we will describe how the macroprudential framework was implemented, considering the challenges in identifying risks, selecting the instruments, and communicating the new measures to ensure the housing market's stability.

After the GFC, the central banks recognized how crucial it was to early identify the build-up of risks. To accomplish this objective, central banks have started using two mechanisms to identify and limit systemic risk: early warning indicators (EWIs) and stress tests (ST). The EWIs are typically calibrated based on their ability to predict past crises. Their trends in past crises provide some indication that credit and asset prices are starting to deviate from long-run trends and breach critical thresholds. Such information can help to identify unsustainable booms with reasonable precision several years before a full-blown crisis actually develops (BIS, 2018). However, historical results cannot accurately predict future outcomes, so these tools have strong limitations.

[12] In this section, we will manly focus on the European Central Bank (ECB) and on Federal Reserve (FED), because they are the biggest ones, so they represent the pioneer advances in the macroprudential field.

[13] See Article 127(5) of the Treaty on the Functioning of the European Union: "The European System of Central Banks (ESCB) shall contribute to the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system."

In turn, STs cannot be considered an entirely new measure, as they already existed before the GFC. Traditional bank stress tests suffered from several limitations as they were simply reproductions of the impact on the bank capital ratio of selected adverse scenarios (Constâncio et al., 2019). Additionally, they did not include integrated shocks to overall liquidity and did not consider the interconnection with other financial institutions or economic agents (systemic risk). STs have additional flaws when monitoring large and global crises. Although they can help evaluate the immediate impact of declines in house prices and the increase in mortgage defaults on bank balance sheets, they were less good at capturing second-round effects arising from fire sales and the lower market liquidity that follows such financial shocks. In the post-GFC reinforcement of macro-prudential policies, there was a reform of stress tests aimed at expanding their scope towards a systemic perspective[14] (Henry et al., 2013). Despite this reform, these two mechanisms alone cannot control overall financial risks, so central banks developed other mechanisms to complement the identification and limitation of aggregate risk.

As discussed in the recent policy analysis made by the European systemic system board (ESSB)[15], most countries took macroprudential policy actions (both capital and borrower-based measures). These measures had the objective of mitigating the identified financial stability risks related to the residential real estate sector (ESRB, 2020).

On the one hand, the capital-based macroprudential measures can be defined as a regulatory capital requirement for banks' exposures to real estate, including risk-weight floors, loss given default (LGD) floors or targeted capital buffers (ESRB, 2020). The risk-weight floor is a measure to limit the average risk weight of mortgage loans falling any further and to ensure the resilience of the banks to the risks associated with housing loans. Further, the LGD represents the amount of money a financial institution loses when a borrower defaults on a loan, represented as a percentage of total exposure at the time of the default (Frye, 2004). Lastly, the capital buffer framework represents one of the main new elements of the Basel III regulatory framework (Behn, Rancoita, & Rodriguez d'Acri, 2020). The

[14] As an example of this reform, we have the ECB publication on ECB Macroprudential Bulletin of October 2016 of EBA stress tests, the first application of such a macroprudential exercise.

[15] The description of all the macroprudential measures will focus the ECB plan, however considering the number of countries included in the program, we can say that can easily represent the behaviour of the developed countries as an all.

objective of these capital buffers is to enable banks to absorb losses while maintaining the provision of key services to the real economy.

On the other hand, the borrower-based instruments directly affect loans' availability, terms, and conditions. In contrast to capital-based, which are set by the ECB, the borrower-based instruments depend on national law, in the case of Europe. They include limits on loan to value (LTV), debt-service-to-income (DSTI), debt-to-income (DTI) and loan-to-income (LTI) ratios, amortization and maturity requirements (ESRB, 2020). The LTV is a ratio that directly links the mortgage loan's size with the appraised value of a house[16]. The DSTI represents a measure of the amount of debt service payments relative to total disposable income. In the case of mortgages, it is used to assess the financial obligations of mortgage-indebted households and their ability to repay debt. This ratio is also useful for evaluating the household's vulnerability to changes in interest rates[17]. The DTI is the percentage of households' gross monthly income that goes to paying their monthly debt and is used by lenders to determine their borrowing risk. Lastly, we have the LTI, a percentage of the amount borrowed to the total annual income of a borrower.

Despite the measures already stated, other macroprudential instruments designed to counter broader-based systemic risk, can also mitigate risks of spillovers from the real estate sector. This is the case for large exposure limits, liquidity measures or additional general capital requirements such as the countercyclical capital buffer (CCyB) or the systemic risk buffer (SRB)(ESRB, 2020). Explaining in more detail, the CCyB[18] intended to ensure that credit institutions accumulate sufficient capital during periods of excessive credit growth to be able to absorb losses during periods of stress[19]. Similarly, the SRB[20] is also a capital buffer applied to the financial sector to prevent and mitigate long-term non-cyclical systemic or macroprudential risks. The results of the ST are crucial role for policymakers to understand how they need to (re)calibrate these buffers.

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[16] Retrieved from: https://www.ecb.europa.eu/services/glossary/html/glossl.en.html

[17] Retrieved from: https://www.ecb.europa.eu/services/glossary/html/glossl.en.html

[18] It has been implemented in Europe via Article 130, 135-140 CRD IV and it amounts to 0-2.5% of total risk exposure amount and must be met with CET1 capital, but it can be set at a higher level under certain procedures. Retrieved from: https://www.ecb.europa.eu/services/glossary/html/glossl.en.html#1000

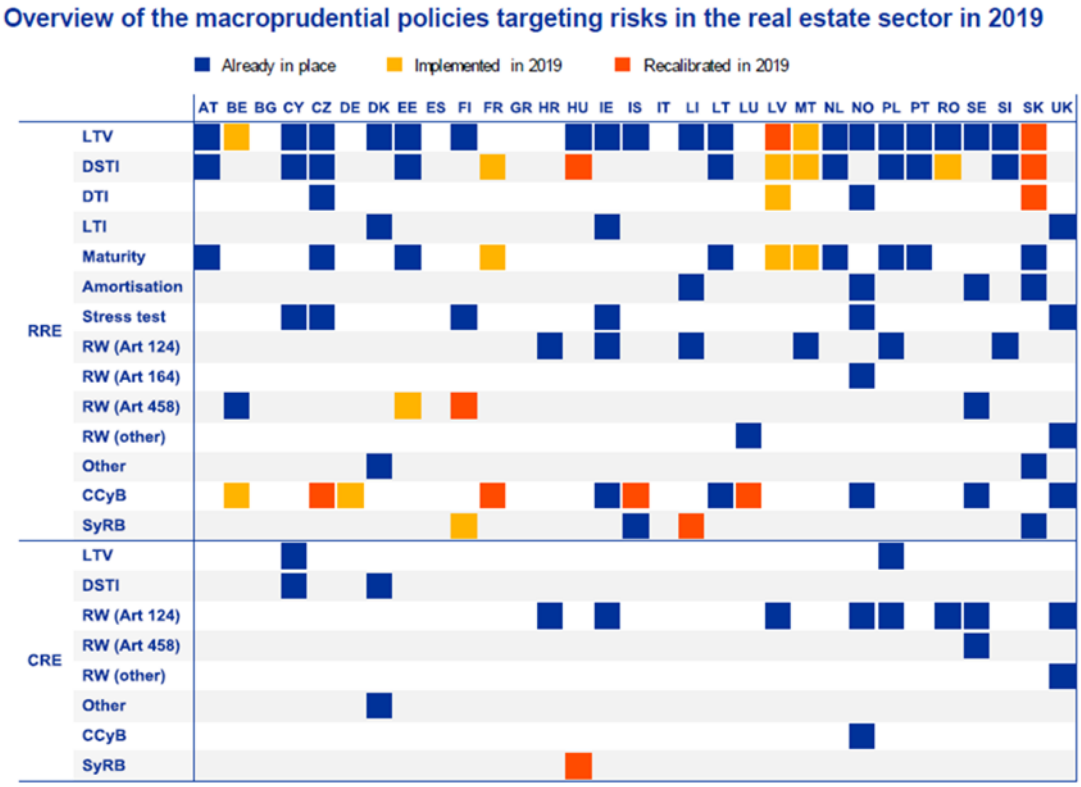
[19] Retrieved from: https://www.ecb.europa.eu/services/glossary/html/glossl.en.html#1000

[20] It has been implemented in Europe via Article 133 CRD IV and must amount to at least 1% of the targeted risk exposure amount to be met with CET1 capital and can be applied to all exposures or to a subset of exposures. Retrieved from: https://www.ecb.europa.eu/services/glossary/html/glossl.en.html#1000

In 2019, the majority of macroprudential measures in place in Europe were borrower-based measures (ESRB, 2020). Capital-based instruments were also employed to alleviate systemic risks from the real estate sector but to a lesser extent. The weight of the capital-based measures is less easy to distinguish from those targeting the real estate sector since capital buffers are used to mitigate risks from all sorts of exposures. However, there is evidence that some countries in Europe have strengthened the capital-based measures (i.e., CCyBs and SRBs) with the apparent purpose of targeting real estate-related risks.

Table 2 provides an overview of the macroprudential policies targeting risks in the real estate sector on the European Union countries and demonstrates how the measures need to be updated to improve their efficiency.

Table 2: Overview of the macroprudential policies targeting risks in the real estate sector in 2019[21]



Source: ESRB (2020)

[21] Article 124 - Exposures secured by mortgages on immovable property Source: https://www.eba.europa.eu/regulation-and-policy/single-rulebook/interactive-single-rulebook/3201
Article 164 - Institutions shall provide own estimates of LGDs subject to requirements as specified in Section 6 and permission of the competent authorities granted in accordance with Article 143. For dilution risk of purchased receivables, an LGD value of 75 % shall be used. Source: https://www.eba.europa.eu/regulation-and-policy/single-rulebook/interactive-single-rulebook/1628

Notes: The table reports on both the stock and the flow of measures in 2019. A measure is considered "implemented in 2019" if at least one of the three following conditions apply: (i) the measure was decided and applied in 2019; (ii) the measure was decided in 2018, but applied in 2019; or (iii) the measure was decided in 2019, but applied in 2020 or subsequent years (ESRB, 2020).

The combination of the sectoral tools is meant to reinforce their efficiency and mitigate the flaws of single measures. As shown in Table 2, most of the countries use a combination of the tools described above, particularly the LTV with the DSTI. For instance, the LTV limits may become less efficient when houses increase. However, in such circumstances, the DSTI caps continue to limit the credit to households (He, Nier, & Kang, 2016). The macroprudential framework implemented for the housing market contributed to the correction of negative externalities - such as strategic default, fire sales and contraction in the supply of credit - that increase the risk of the market (Kenç, 2016) .

As in most policymaking, effective communication is critical for the success of the macro-prudential policy. In this regard, the combination of sectoral tools can increase the efficiency in targeting risks, but it also has its drawbacks, as it can easily become complex and challenging to communicate. Therefore, accurate communication should explain agents the objectives, strategy, and policy process and thus build political support for these policies (Patel, 2017). For instance, the release of the buffers is not devoid of issues. Without effective communication, the market may view a discretionary waiver of capital or liquidity buffers during a downturn as a signal of expectations that the worse is still to come, rather than a tool to stabilise the financial system (CGFS, 2016).

4.1.1. Challenges to Macro-Prudential policy

Despite their recent development, macroprudential policies are still in their childhood, and especially in developed countries. As such, several challenges are still open issues. For example, the risk from the non-bank financial sector, the debate on whether or not targeting house prices, and the calibration and implementation of these new measures – to which we turn in the following paragraphs.

The systemic risk from the non-bank financial sector - a sector typically referred to as "shadow banking" - played a crucial role during the GFC. Yet, the focus of macro-prudential policies has been put on strengthening the regulatory framework for the banking sector, which has potentially incentivised some further migration of financial activity to non-banks, especially within Europe (Constâncio et al., 2019). The low-for-long interest rates

environment has been applying a downward pressure on fixed income returns, as it happened in the United States before the GFC. The value of the assets on the non-bank sector has grown significantly, from 19 trillion on 2007 to around 33 trillion of euros in 2017 (Muñoz, 2020). The increase demand for the non-bank sector relies on the incentives to search for yield in alternative markets, especially on the real estate sector. Since 2012, institutional investment in euro area real estate assets has more than quadrupled in absolute terms and as a share of total housing investment (Constâncio et al., 2019). Notably, a significant proportion of this funding is being provided in the form of non-bank lending (where the market is not regulated by the new macroprudential framework, as with LTV limits). Moreover, the real estate funds are generally not subject to leverage limits in the EU and there is significant uncertainty surrounding their actual leverage, because, among other explanations, such funds often lever up synthetically through the use of derivatives[22] (Muñoz, 2020). Therefore, although the macroprudential framework can provide a safety net to the banking sector, it also could generate a new systemic risk with the migration of investments to the non-banking sector, which may also justify a macroprudential response. Therefore, central banks should remain flexible in what regards designing and introducing new tools as risks develop and evolve (BIS, 2018).

The second challenge that the new macroprudential framework faces is the current debate on targeting house prices. On the one hand, some authors, like Constâncio (2016), argued that it might be more suitable to target real estate prices than other financial asset prices. Financial asset prices are undeniably tricky to control with targeted policy intervention. However, regarding mortgages, policy tools such as LTV or DSTI ratios need to be part of the macroprudential measures to regulate effectively or, at least, influence real estate asset prices, as these are among the most critical drivers of the financial cycle. On the other hand, others have defended that it is not the role of macroprudential authorities to control house prices (Cunliffe, 2015). In this author's perspective, the high level of debt to income made the UK[23] vulnerable to shocks as seen in the post-crisis recession. However, there was a spontaneous significant market correction, following the crisis, that has improved sustainability. Although the economy remains exposed to the resumption of credit growth, driven by the housing market "Trees cannot in the end grow to the sky" (Cunliffe, 2015, p.

[22] Real estate funds operating in the European Union fall within the category of funds that are subject to the AIFMD (Alternative Investment Fund Managers Directive), for which no leverage limits apply.
[23] The UK is used as an example by the author but represent the behaviour of developed countries.

2). The bottom line is that before any abnormal increase in house prices materializes and persists, credit would necessarily start growing faster than Gross Domestic Product (GDP), and credit growth-related mechanisms of regulation would handle the potential financial stability risks, without the need to explicitly control house prices.

Lastly, an approach of combining sectoral tools is consistent with the classic theory of policymaking under uncertainty, after Brainard (1967) which recommends that policymakers should cautiously use all available tools to mitigate the effects of uncertainty. Nevertheless, there is a debate on how different instruments might interact and in which circumstances they might be jointly deployed. For instance, when might it be appropriate to implement a sectoral capital buffer rather than the aggregate counter-cyclical buffer? When targeting housing sector exposures, what are the trade-offs between increasing risk weights on mortgage lending, on the one hand, and seeking to restrict such lending directly with the use of LTV or LTI restrictions, on the other hand? (Constâncio et al., 2019). Thus, important questions remain with no answer on how macroprudential policy should handle uncertainty and how resilience should be balanced against credit supply when deciding how to release macroprudential requirements during a downturn (Aikman et al., 2015).

The implementation and development by central banks of a macroprudential approach represented a highly relevant step forward, in both identification and mitigation of financial stability risks. It involved a major cultural shift in the concept of risk by acknowledging the limitations of market prices as risk indicators as well as recognising the importance of self-reinforcing financial booms and busts (BIS, 2018). Notwithstanding, this new approach cannot alone be the solution. The mission of ensuring financial stability is clearly complex. Reliance on one set of tools, even when based on solid arrangements, is most likely not enough. This suggests that macroprudential frameworks should be embedded in a more holistic, comprehensive, and balanced macro-financial stability framework, combined with a set of monetary and structural policies. Moreover, macroeconomic stabilization is still at the core of central banks' mandates, and monetary policy is still primarily associated to such goals. Should monetary policy also have concerns for financial stability? Should monetary policy be different than otherwise, now that central banks also conduct macroprudential policies (in addition to their microprudential regulatory and supervision obligations)? We now turn to these sort of questions.

4.2. Monetary policy in a Macro-prudential Environment

The behaviour of monetary policy in financial crises has changed since the Great Financial Crisis (GFC). The pre-crisis monetary policy approach regarding asset prices and credit booms was best characterised as "benign neglect", whereby central banks only reacted to movements in asset prices and credit aggregates that affected inflation and output. (Filardo & Rungcharoenkitkul, 2016). This consensus was essentially due to the difficulty to distinguish fundamental movements from speculative bubbles in real-time. Monetary policy would only "clean up the mess" after financial crisis rather than incur in the risk of depressing the economy and bringing inflation below target with unjustified pre-emptive actions that could turn out not to be justified.

The GFC re-ignited the debate over "lean versus clean", that is, whether monetary policy should react to unexpected fluctuations in asset prices and excessive credit. The GFC was a grave reminder that financial crises are costly, and policy should aim at reducing the likelihood of crises, not only rely on dealing with their ex-post repercussions. In fact, policymakers understood that price stability is not enough to ensure macroeconomic stability (IMF, 2015).

Central banks develop macroprudential policies to overcome this problem. The emphasis of these mechanisms is containing systemic risk, as detailed in the previous section. However, there is still the concern that even the robust combination of micro and macroprudential policies currently in place may not be sufficient to contain financial stability risks (IMF, 2015). Therefore, at least for some observers, there is still an ongoing debate about whether monetary policy should actively help to tame financial crises. The questions are the following. Should monetary policy pursue a financial stability objective in addition to its primary mandate of price stability? In the case of adopting such an objective, in which circumstances and how should it be employed? This subsection will discuss these crucial questions, focusing on how this debate has developed in the literature.

The discussion on "leaning against the wind" (LAW) – using monetary policy to curb financial imbalances and overvaluations in asset prices and excessive credit – has intensified since the late nineties. The literature has suggested two different approaches. On the one hand, some authors (such as Bean, Paustian, Penalver, and Taylor (2010) and L. E. Svensson (2012a)) emphasise the idea that monetary policy should not have a financial stability objective. Williams (2015), former president of the San Francisco Federal Reserve, is also on

this side of the debate: "monetary policy is poorly suited for dealing with financial stability concerns, even as a last resort.". On the other hand, others have defended the use of the LAW to ensure the financial stability (such as Filardo and Rungcharoenkitkul (2016), Adrian and Liang (2016)). Some central banks also defend and implement this position: for instance, Olsen (2015), Governor of the Norges Bank— Norway's central bank—stated that "we have been leaning against the wind.". This shows how the debate is far from consensus.

The first argument rests on the principle that macroprudential policy is the most effective tool for safeguarding financial stability and that monetary policy should only be deployed as a "last line of defence" if at all (Kohn, 2015). Macroprudential instruments directly deal with excessive leverage and do not have negative spillovers as "leaning against the wind" policy. These authors emphasize that it is impossible for monetary policy to aim both at price stability and financial stability without costs. For instance, the consideration of financial stability could lead to a deflationary bias, moral hazard, and welfare reductions, as a tighter policy may either be too late to stop a credit boom or unwarrantedly curb credit growth that reflects technology gains rather than speculative borrowing (Adrian & Liang, 2016). Furthermore, the LAW might damage the credibility of the central banks, thus affecting the effectiveness of monetary policy, including a de-anchoring of inflation expectations. The credibility of central banks stems from transparency, consistency, and observable success. By contrast, LAW requires policy actions based on distant events that are difficult to forecast, or even to define precisely. This argument is related to the intrinsic nature of LAW as an intemporal trade-off, in the sense that the central banks rise interest rates in the current period, accepting a higher unemployment rate and deviations on inflation to lower the probability of a financial crisis in the future (Adrian & Liang, 2016).

To evaluate the efficiency of LAW, some authors, like M. L. E. Svensson (2016), developed a cost-benefit analysis, concluding that the costs of LAW exceed its benefits by a substantial margin (L. E. Svensson, 2017). In other words, the cost of higher unemployment as a result of monetary policy tightening outweighed by far the benefits of the reduced probability and severity of financial crises (L. E. Svensson, 2017). His conclusions may result from the assumptions in his model. In this framework, LAW works through traditional mechanisms, and since there are no asset prices, neither lender nor borrower behaviour in the model, a too expansionist monetary policy does not raise risk premia nor leads to an increase of risk-taking. Consequently, LAW does not reduce much the severity of a possible

crisis and it only reduces the probability of a crisis by a minimal amount in this model (Gourio, Kashyap, & Sim, 2018).

The opposite perspective on this debate arrived from some authors at BIS, emphasizing that the central bank's policy should not be the "only game in town" (Caruana, 2016). Although there are arguments against LAW supported by both theory and empirics, (Adrian & Liang, 2016), it may be argued that these arguments do not describe the real world completely. Macroprudential policies are the first-order defence against such build-up of vulnerabilities but are not free from flaws, as described in the previous chapter. For instance, macroprudential policies only directly affect a limited set of financial institutions due to the existence of shadow banking, and also have limited international reach. Despite the improvements and constant revision of its tools, it cannot deal with financial stability with total efficiency (Adrian & Liang, 2016). Monetary policy, on the other hand, has a much more global reach, in the sense that it affects funding conditions for all intermediaries. So, as Yellen (2014), former chair of the Board of Governors of the U.S. Federal Reserve Board stated, "Monetary policy faces significant limitations as a tool to promote financial stability… [However,] it may be appropriate to adjust monetary policy to "get in the cracks" that persist in the macroprudential framework.". Therefore, despite its limitations, monetary policy may be very relevant to ensure financial stability in some circumstances (C. Borio, 2016).

The model presented by L. E. Svensson (2017), like many others within the same approach (as Gerdrup, Hansen, Krogh, and Maih (2016) and Alpanda and Ueberfeldt (2016)), seems to underestimate the benefits of LAW. These analyses tend to neglect the risk-taking channel by assuming that the costs of financial crises are one-off, assuming that monetary policy works just as well in the aftermath of a crisis as in a normal recession and assuming that leaning against the wind lowers only the probability of crisis but not its cost (Caruana, 2016). These analyses also consider that there are no benefits to LAW unless crises do occur and that waiting before acting as financial booms develop has no costs. The relaxation of these assumptions might indicate that pre-emptive LAW, as part of a response of monetary policy to the financial cycle, can generate significant economic benefits (Caruana, 2016).

Does this imply that monetary policy should "lean against the wind" and curb excess credit growth, even at the cost of higher output and inflation volatility? In the literature, there are at least two models that attempt to answer this question, namely Gourio et al. (2018) and

Filardo and Rungcharoenkitkul (2016). Each of these models highlights a different perspective on LAW. On one side, authors as Gourio et al. (2018) argue that LAW can be beneficial but only under specific circumstances. On the other hand, authors such as Andrew Filardo slightly diverge, arguing that LAW might be better thought of as an intrinsic part of the monetary policy framework.

The first model compares monetary policy rules that react to the output gap with rules that respond to excessive credit. In such analysis, LAW might be appealing depending on several factors such as the severity of financial crises, the sensitivity of crisis probability to excess credit, the volatility of excess credit and the level of risk aversion (Gourio et al., 2018). The model incorporates several scenarios and possible crises. The main result is that LAW can be beneficial only when three conditions are met: financial crises have important output effects; financial shocks are important (its variance, as well as that of the associated swing in inefficient credit, are large enough), and financial crises are endogenous (for example they are caused in part by inefficient credit) (Gourio et al., 2018). Their results may be summarised as follows. In the case, where there are no financial shocks, even if there are financial imperfections in the economy, the model suggests that stabilizing inflation is a sufficient condition for maximizing welfare. If there are financial shocks, but financial crises are exogenous, a simple rule that puts weight on the output gap still outperforms credit-based rules, because targeting the output gap is a more direct way to eliminate undesirable fluctuations in output and inflation (Gourio et al., 2018). The bottom line is that the case for LAW rests on the acceptance of higher volatility of inflation and output, in exchange for reducing the risk of crises. A corollary is that if the central banks follow this path, they should invest in good communication of their strategy, explaining this trade-off to the public, to ensure the efficiency of the policy.

Filardo and Rungcharoenkitkul (2016), in turn, emphasizes that the benefits of LAW are better appreciated in a model that acknowledges the endogenous process leading the slow build-up of financial imbalances, which could culminate in a crisis, and the systematic influence of policy over the entire financial cycle. These authors propose a dynamic model for evaluating LAW in the presence of recurring financial cycles and find that leaning systematically over the whole financial cycle outperforms policies of "benign neglect" and "late-in-the-cycle" discretionary interventions. This conclusion is robust to a wide range of alternative assumptions and supports a shift in monetary policy frameworks to a joint

consideration of price and financial stability. The main advantage of using the LAW is, as in the alternative model reviewed above, reducing the likelihood and severity of financial cycles over time.

Central banks have not reached a consensus regarding this debate. Even though further research is needed, relying on the literature presently available suggests that LAW deserves serious consideration. Indeed, important research has found that macroprudential tools work best when they are used as complements to the monetary policy stance (Caruana, 2016). The debate will surely continue and will hopefully clarify when and how should LAW be implemented, to prevent the likelihood and severity of financial cycles over time.

5. Conclusions

The Great Financial Crisis (GFC) has been a milestone in what regards how central banks view the macroeconomic consequences of excessive leverage and risk. In particular, given its key role in the GFC, monitoring and controlling speculation in the housing market and its financial and economic spillovers became a policy priority. As a result, macro-prudential policies were greatly developed after the GFC, some of which directly or indirectly related with the housing market, focusing on controlling systemic risk and ensuring financial stability. Also, there has been a re-thinking of monetary policy.

Against this background, this dissertation has three main goals. First, to describe the key role of the housing market in financial crises, historically and in theory. Second, to understand central bank policies aiming at the stability of the housing market and financial stability overall, before the GFC. Third, to discuss the re-thinking of central bank policies originated in the GFC.

The second chapter of this dissertation addresses the relationship between credit, the housing market and financial crises. To this end, we define housing and explain why this asset is distinctive from the other main assets. Additionally, we build a historical background to analyse how credit is linked with financial crises. In particular, we highlight that the GFC was very much due to the crucial role of the housing sector in the build-up of risks and consequent triggering of the crisis. Finally, we conclude that credit is linked to the worst financial crises and more prolonged recessions.

In the following chapter, the third, we analyse central banks' responses to financial crises throughout time. We focus on understanding the *status quo* of different periods and analyse the response of central banks to financial crises in historical retrospect. Afterwards, we describe how supervision and regulation have arisen as key policy frameworks for financial and macroeconomic stability. We also analyse their implementation, starting with Basel I until the application of Basel III. In this chapter, we conclude that central banks clearly changed their response to financial crises. The introduction of macroprudential measures alongside with microprudential instruments has been a key step forward in mitigating financial risks with marked macroeconomic consequences.

The fourth chapter concentrates on two objectives: the description of macroprudential measures designed for the housing sector and, then, the discussion of how should monetary

policy be conducted in the presence of a macroprudential framework. On the one hand, we concluded that macroprudential measures focusing on the housing sector have developed at a high pace. Although macroprudential measures need to be constantly revised (not only due to new developments of the market, but also because of some intrinsic flaws that they feature), it is clear that systemic risk arising from the housing market is considerably more controlled now than before the GFC. On the other hand, we analysed the role of monetary policy in promoting financial stability when there is a macroprudential framework in place. Our review shows that the debate on this topic is far from ending. On one side, some authors argue that monetary policy needs to focus only on price stability, stating that macroprudential policy should be the sole tool designed to ensure financial stability. In contrast, others argue that macroprudential policies are not free from flaws, and only monetary policy can fill in all the cracks of financial crises. Therefore, they defend that there should be a "leaning against the wind" policy complementing the actions of macroprudential measures.

At the end of this dissertation, we have enough information to answer the research questions that conducted our work: (i) Is there a link between credit, the housing market, and the financial crisis? (ii) Which measures should central banks adopt to control the risks of the housing market? (iii) Should macroprudential policy alone ensure financial stability, or should monetary policy also take the floor? (iv) What is the state of the art on this subject, and the path for further research?

With this dissertation, we can conclude that macroprudential measures focusing on the housing market reduce the build-up of vulnerabilities in the sector, in spite of having some flaws that need to be overcome. The historical background provided was fundamental to understand how housing market risks are created and how different policies have been and can be adopted. The role of monetary policy when co-existing with a macroprudential framework is still an open debate. The dissertation has led to the acknowledgement that although recent developments point to a “Leaning against the wind” (LAW) policy; there is still not a consensus among policymakers on this issue. In fact, if LAW is the correct path to follow, several questions still need to be answered. For instance, should LAW be adopted in all circumstances? How precisely should it be incorporated in the monetary policy framework? Surely, further research on such topics is needed, to eventually achieve some agreement among economists and policymakers.

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