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"The Monetary Policy Transmission Channels and Household Debts"

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INTRODUCTION

How the transmission of monetary policy works in real economy is a fundamental question in macroeconomics. "*Most economists would agree that, at least in the short run, monetary policy can significantly influence the course of the real economy. (…) There is far less agreement, however, about exactly how monetary policy exerts its influence (…). To a great extent, empirical analysis of the effects of monetary policy has treated the monetary transmission mechanism itself as a "black box".*" (Bernanke and Gertler 1995). During the past decades, researchers have tried to understand the linkage between the central banks' actions and their final output. By analyzing the complexity and the ever-changing of the global economy, studies might reach this goal.

 The recent big crisis, such as the Great Recession of 2008, have demonstrated that economists' efforts should be directed on continuously improving the strength of policy design, given that such troubles may be recurrent.

In traditional macroeconomics theories, the primary transmission mechanism is the interest-rate channel. By affecting inter-temporal substitution, changes in interest rates have more effects on saving rather than on consuming. However, some studies conducted on policy designs have enhanced that shifts in real economy caused by monetary policy are more powerful than predicted by the interest rate channel. The analysis of the above mentioned Crisis, suggests that there are other effective transmission ways working together, such as the balance sheet channel and the cash flow channel. The first one is connected to changes affecting asset values, which in turn affect consumer spending of goods; the second one is, contrarily, related to variations in the amount of consumption and spending that households have access to. Currently, in a moment in which a large number of households have debts, throughout such monetary policies, people spending habits can be affected. As a result of the transfer of income between borrowers and lenders, a direct impact on aggregate household spending decisions can be seen. In fact, it is acknowledged that changes in cash flows usually affects consumption, in particular for households that are more financially constrained. Normally it happens in high-debt states. Remember that the debt position of a country as well as the

one of a household is measured as "debt-to-income ratio". This implies that the outcome of a monetary policy would be different in agreement with the level of indebtedness of the country.

This thesis focuses on when the effectiveness of the monetary policy transmission is linked to the degree and type of household indebtedness. It reasons on whether changes in interest rates affect household consumption by changing the amount of cash that they have to spend. Families have different balance sheet and obviously different obligations, therefore the final impact of monetary policy on each individual will be different. More specifically, investigating on different types of interest rates contracts, the study of monetary policy effects on consumption will be more definite, thus the analysis of the household cash-flow channel of monetary policy is relevant.

To further understand in which way mortgage variables react to monetary policies, markets will be divided into FRMs and ARMs. The first abbreviation stands for fixed-rate mortgages whereas the latter represents adjustable-rate mortgages. As stated in ''Housing finance and monetary policy'' (Calza et. al 2013), the transmission mechanism of monetary policy is stronger in high debt-to-GDP ratio's countries, mostly if they are characterized by ARM markets. If a market is dominated by a fixed-rate mortgages (FRMs), as USA is, the cash flow channel will not be very suitable, while in countries such as UK, so based on adjustable rates (ARMs), the cash-flow channel might be very pertinent to the transmission of monetary policy.

In order to rationalize these findings, this essay will provide a clear comparison between the two cited states: USA taken as representative of FRMs countries and UK as ARMs country. The research will be carried through the approach of all micro and macro data, such as expenditures, income, mortgage payments and balance sheet composition.

The main purpose of this thesis is to give the reader a precise idea of what monetary policies are about.

Moreover, it will provide an answer to the general question: "Are monetary policies more effective in fixed-rate mortgages or in adjusted ones?"

The thesis is structured as follows.

In Chapter 1 an academic description is provided. It starts with a definition of what monetary policies are, giving a deep focus on the variety of transmission channels. Then the main topic is presented: households. They are firstly theoretical pictured and secondly differences among their financial position are described. Given the fact that monetary policies are implemented through the use of transmission mechanisms, the third paragraph provides a comparison between two household credit channels. The first one refers to adjustments in the balance sheet while the latter to cash flows. Until this section, the thesis focused on conventional monetary policies, but they might be enforced also by unconventional actions, which leads the reader to the last paragraph of the chapter. Despite the great variety of transmission channels, they have the same purpose: stabilizing the economic activity. In Chapter 2 the thesis goes more in dept. The housing market, with its main characteristics, is discussed. Later, through the use of related literature, the two most important contracts are presented: FRMs and ARMs. This section studies the impact of the monetary policy on such contracts. It does it specifically by evaluating the effects on the American market (example of fixed-rate market) versus the effects on the English market (example of the adjusted-rate market). The chapter terminates with an empirical analysis, on high-debt households, since the monetary impact on the market does not depend only on mortgages' features, but also on their distribution across families.

In the last part, the evidence is reviewed and conclusions are driven.

Great part of the research is concentrated on the behavior of the mortgage markets with respect to the implementation of monetary policies. It is as such mainly because of the huge amount of information this market provides, in contrast with other financial markets. The empirical outcome of this thesis confirms what scholars state: the transmission of monetary policy designs is stronger and more effective in countries with more flexible markets, symbolized by a higher prevalence of ARMs.

1 THE MONETARY POLICY TRANSMISSION CHANNELS AND HOUSEHOLDS' FINANCIAL POSITION

The process through which monetary policy actions affect the economic activity, specifically the price level, is commonly known as the transmission channel of monetary policy[1].

It manages how aggregate demand, expected inflation, and the real rate of inflation is affected by changes in the central bank policy rates.

Before dealing with the main topic of the thesis, the monetary policy effects on households, in particular on their spending or saving habits and their net asset positions, it is important to give a detailed overview of what monetary policy transmission channels are. In doing so, the literature that appeared in the recent years is very helpful.

1.1 Monetary Policy Transmission Channels

Important structural changes in the economy, particularly due to institutional, regulatory, and technological developments have occurred over the past two decades. Drove by these revolutionary transformations, the influence of financial markets and financial intermediaries on the output of the real economy has been highly recognized. The innovational progress has altered the nature and stability of the mechanisms through which monetary policy affects the level of economic activity, leading to the formulation of different transmission channels.

The plurality of channels, which characterizes the economic world, operates by adjusting various features. On one hand, the transmission of monetary policies acts through the influence of prices, which in turn leads to a reaction of other components of the aggregate demand. On the other hand, it affects the amount of credit allowed by the financial institutions, leaving economic agents, such as households and firms, with a restricted supply of financing. Identifying which mechanisms the central bank is dealing with is usually complicated by the fact that, as said before, economic growth is influenced by shocks coming from a wide range of sources. For instance, adjustments in financial

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[1] ECB (2011), "The monetary policy of the ECB"

asset prices and exchange rates may alter the aggregate demand and therefore price developments. Similarly, changes in oil or commodity prices may have a direct impact on inflation. So monetary policies should first focus, before being implemented, on these examples of exogeneous distress, to not let them interfere with the transmission of such policies.

Figure 1 generally pictures all the monetary policy factors that will be explained throughout this section.

Figure 1: "Monetary Policy Transmission Channels"
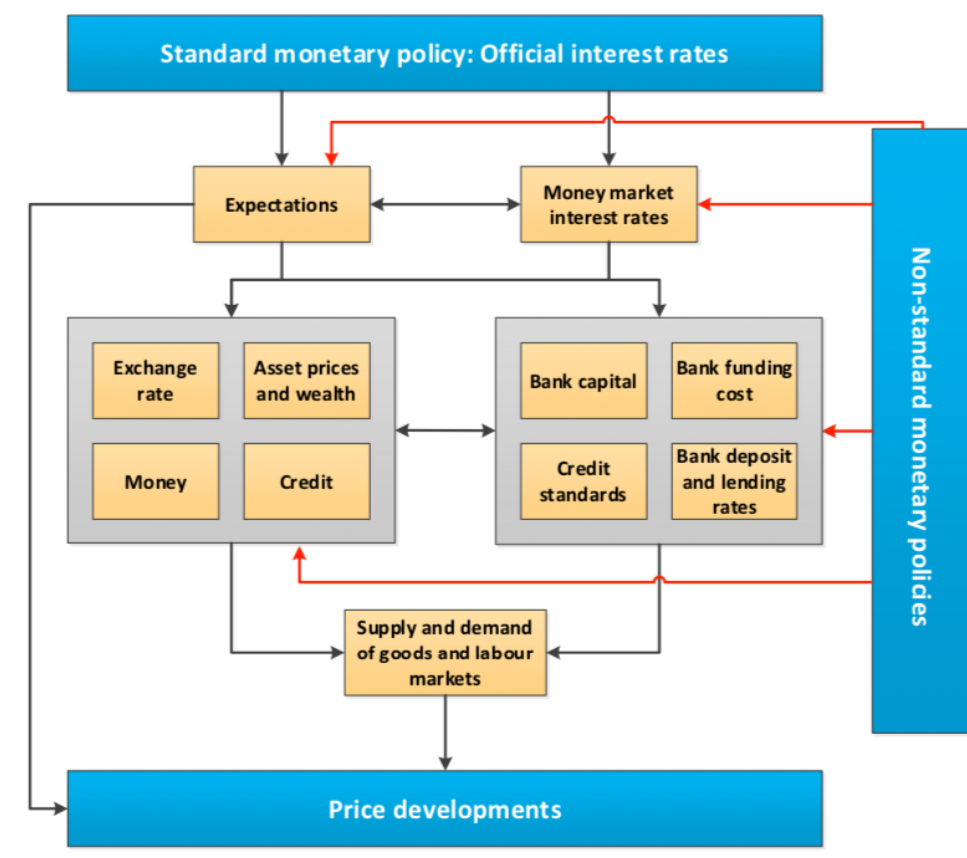
Source: ECB (2015)

Scholars, throughout the years, carried a lot of studies to understand the origin and development of the transmission mechanisms. From the analysis of the distinct channels, two specific views emerged. Historically, the first one is the traditional view, also known as the conventional view or money view, and is in line with the Keynesian model. It is built on the idea that policymakers use short-term interest rates to influence the cost of capital, which in turn affects spending on durable goods and thus the level of production and inflation via its influence on the aggregate demand. Through the adjustments

of official interest rates, expectations and the condition of financial markets are influenced, leading to a great impact on economic activity and price levels. This view follows two assumptions. Firstly, policymakers use their leverage over short term interest rates and, through open market operations, affect real short-term interest rates. Secondly, the cost of capital, that is the variable impacting both aggregate demand and level of production, must follow the movements of the real interest rates. Therefore, if these two key assumptions hold, the traditional view is working.

During the 1970s and 1980s, the importance of the role of banks and intermediaries came out and it was theorized as the credit view. It emphasizes the impact of monetary policy on the amount and conditions of credit. This new theoretical analysis is built on the presence of information failures in financial markets. Banks are credit institutions specialized in project screening activities, therefore they try to overcome these information failures. As a consequence, financial institutions may provide financing to creditworthy borrowers who perhaps would not have had access to external finance. Thus, changes in the loan supply behavior of banks alters the transmission of monetary policy.

It is important to underly that the perspective on traditional view versus credit view is not seen as a dichotomy between interest rate and credit effects, rather as a different approach to the source of interest rate changes. Romer and Romer (1990) suggest that the money view represents the fall in bank reserves which causes interest rates to increase because a lower supply of transaction deposits faces a stable demand for money. With respect to the credit view, they assume that the same decrease in bank reserves leads interest rates to rise due to the lower supply of bank loans that now faces a stable loan demand based on the uniqueness of bank credit. According to this theory, money is merely seen as a financial asset with many substitutes.

All theories about monetary policy transmission on the real economy have a common feature: every action starts with a change in the level of bank reserves. Monetary policies posit the existence of some form of nominal rigidity possibly combined with information asymmetry. The latter, also called price-stickiness or wage stickiness, is a situation in which nominal prices are resistant to variations. Same applies to wages. It is so relevant since, without it, a change in the nominal quantity of money would

not have a direct impact on real interest rates. For this reason, Borio (2002) states that financial contracts are set in nominal terms. In "The General Theory of Employment, Interests and Money" Keynes (1936) affirms that nominal wages face a downward rigidity, which means that workers are unwilling to accept reductions. In the case of monetary shocks, they may face distortionary impacts on the real economy and the 2008 crisis is the most conspicuous example of such a situation.

Monetary policies are powerful tools arising from central banks or other financial institutions' decisions. Their main purpose is to stabilize the economic activity, referring to the reduction of unemployment and the promotion of price and financial stability. To have the desired effect, the authorities must have an accurate understanding of the mechanisms through which monetary policies are implemented.

According to the assumption that the traditional view holds, its outcome has three main effects on investments. The first directly from interest rates, the second through the adjustment of the exchange rate, and the third comes from other asset prices.

The interest rate channel is the key transmission channel in the basic Keynesian model. According to Frederic S. Mishkin (1995), who was the first person theorizing all the transmission mechanisms using a cause-effect scheme, it can be synthesized as follows:

$$i \text{ off}\uparrow, i \text{ MM}\uparrow, i \text{ loans-dep. }\uparrow, i \text{ real}\uparrow, I\downarrow, Y\downarrow$$

(or on the contrary, if the central bank is dealing with an expansionary policy). An increase in official interest rates leads to an increment firstly in money-market interest rates and secondly in bank loan rates. This rise also influences real interest rates, letting them rise as well. Higher real interest rates trigger higher costs of capital, which may affect investment decisions. So, a decline in investment spending happens, since now there are lesser investment available at the higher required rate of return, thereby leading to a fall in output[2]. John Taylor (2009) emphasizes that the interest rate channel in the main component describing how the effects of monetary policy decisions affect the real economy.

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[2] Stephen G. Cecchetti (1999), "Legal structure, financial structure, and the monetary policy transmission mechanism"

Even though Keynes focused his model just on investment spending, developments in monetary policy studies argued that also residential housing, consumer durable goods and inventory investment are crucial elements in the decline of aggregate demand, since they are also factors influencing investment decisions[3]. Despite it had great support, the interest rate channel has been highly criticized, in particular by Ben Bernanke and Mark Gentler[4] (1995). They believed that the evidence available did not support strong interest-rate effects operating through the cost of capital. Indeed, they defined a failure in this channel, since theoretical and empirical studies pointed out some lack of components, leaving economists with the stimulus of looking for other transmission channels to get a resolution. The explanatory theory, known as the credit view, will be described later in this section. The second item familiar with the traditional view is the exchange rate channel. It owes its development to the growth of international trade and the advent of flexible exchange rates. Same as before, this channel involves interest rates. When domestic real interest rate increases, domestic currency appreciates, leaving on the domestic market goods more expensive than the foreign ones. Therefore, the value of net export (NX) falls as well as the value of output.

$$i_{domestic}\uparrow, E\uparrow, NX\downarrow, W\downarrow$$

Of course, the more open is the market, the more effective and relevant is this channel.

A common disagreement with the Keynesian theory, applied to both channels, is that it concentrates only on interest rates and exchange rates, while new aspects should have been taken into consideration. This is the reason why recently economists have focused economic studies on different elements, emphasizing two other transmission mechanisms: one involving the Tobin's q variable and the other targeting wealth. Assuming that monetary policies affect the equity price, these latter mechanisms analyze how firms, with the first channel, and households, with the second one, react to such changes.

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[3] Frederic S. Mishkin, (1995), "Symposium on the Monetary Transmission Mechanism"
[4] Frederic S. Mishkin, (2007), "The Economics of Money, Banking and Financial Markets" 8th edition, Pearson

The Tobin's q transmission mechanisms, also referred to as the equity price channel, is another component of the traditional view. It provides an explanation by which monetary policy affects the economy through its effects on the valuation of equities. Tobin (1969) defines its variable q as an indicator of the market value of the company divided by the replacement cost of capital.

$$q = \frac{Market\ value\ of\ firms}{Replacement\ cost\ of\ capital}$$

If the market value reflects only the assets of a company, then the q ratio will be equal to 1. Enterprises use such a ratio to decide the issuance of new equity: when q is greater than 1, then it is convenient for the firm, since its market price is high relative to the replacement cost of capital, and new capital appears cheap relative to the market value. The opposite happens when q is low. With a tighter monetary policy, equity price will fall, decreasing the q ratio, thus companies will not spend in the stock market and investment spending will be lower. The same conclusion is also driven by applying the Keynesian view: the rise in interest rates coming from the contraction of the economy makes bonds more attractive than equities, by that pushing the price of equities down.

$$i_{off}\uparrow, i_{MM}\uparrow, P_{equity}\downarrow, q\downarrow, I\downarrow, W\downarrow$$

The equation makes clear that final output will decrease after the contraction of the economy.

For what concerns households, Modigliani (1971) was the first economist to introduce consumption as a relevant variable in the analysis of monetary policy transmission. The main concept discussed is that individuals try to smooth out their consumption over time, according to their lifetime resources. Households' private wealth is the main element of such resources.

$$i_{off}\uparrow, i_{MM}\uparrow, P_{equity}\downarrow, wealth\downarrow, consumption\downarrow, W\downarrow$$

Individuals respond to the negative effect caused by the reduction of P_{equity} by lowering consumption. As common stocks represent the great portion of their financial wealth, changes in stock prices will be then reflected in consumption paths.

Although it has been the stronghold in monetary policy transmission, the traditional view was found to have anomalies in its theory. The dissatisfaction was moved primarily by the disagreement over

the explanation of interest-rate effects on monetary policy. Timing, magnitude, and composition of

economic reaction were crucial issues in the new analysis. *Figure 1* shows the dynamic responses of

relevant GDP variables to an unanticipated restriction in monetary policy. The picture is generated

using the technique of vector autoregression (VAR)[5]. Each variable regressed has its own equation,

which is made up of the lagged value of both itself and the other variable, and an error term.

As shown in *Figure 1 panel a*, the components analyzed tend to react to the tightening of monetary

policy several months later. For instance, as pictured in *Panel b*, all spending components follow the

contraction, contributing to the fall of final demand (*Panel c*)[6]. An interesting result provided by this

analysis is the spending outcome. Since monetary policy has its most direct effect on short-term rates,

it would be reasonable to have a significant impact on inventories and consumer durables. Definitely

this is not the case, as the most rapid and strongest reaction is on residential investments, which should

be most long-term rate sensitive.

Figure 1, Panel a: " Responses of Output, Prices and Federal Funds Rate to a Monetary Policy Shock"
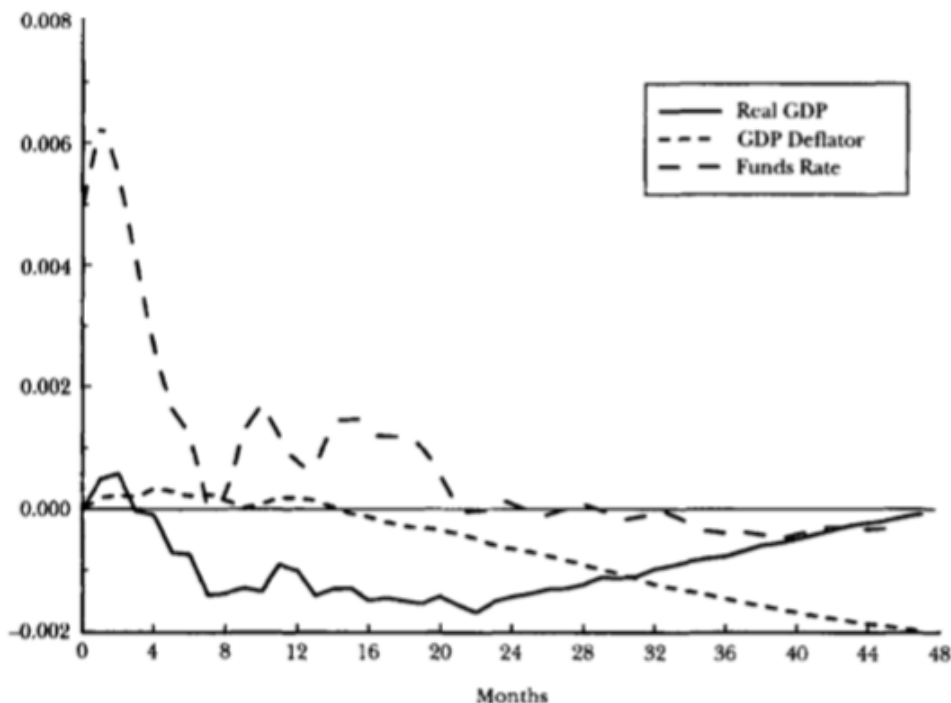
Figure 1, Panel b: "Responses of Spending Components to a Monetary Policy Shock"
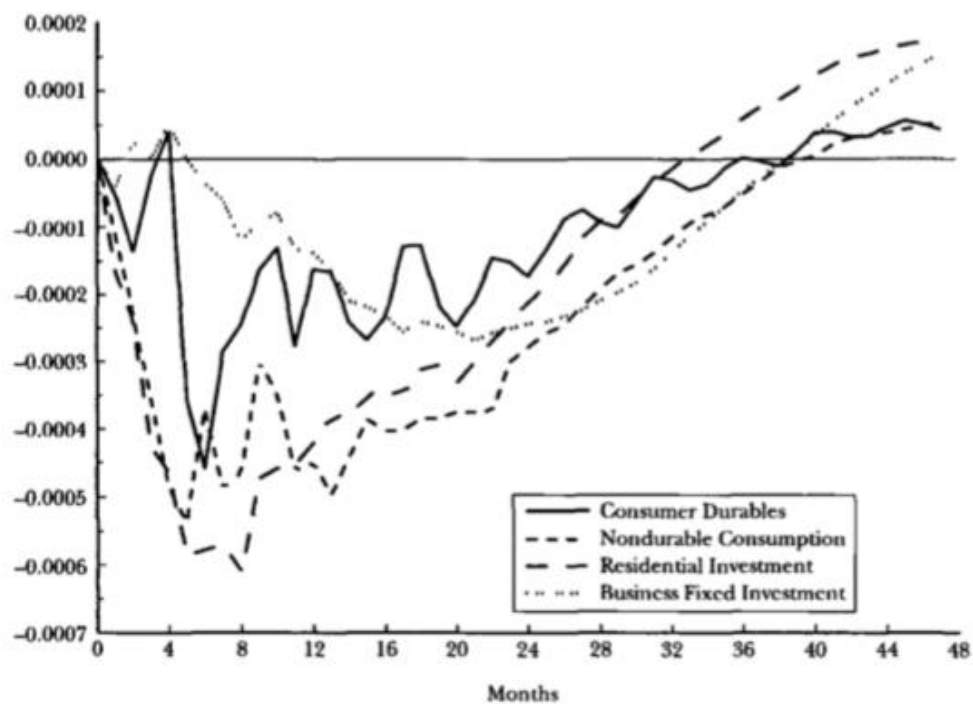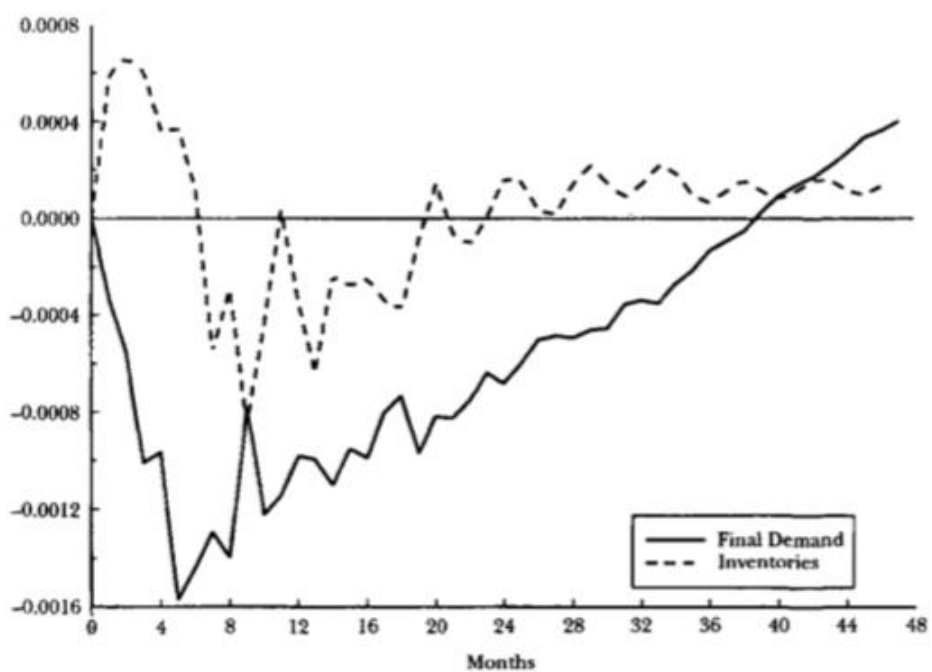

Figure 1, Panel c: "Responses of Final Demand and Inventories to a Monetary Policy Shock"

Source: Bernanke and Gertler (2005)

All these gaps of the conventional view suggest that *"The textbook story is incomplete is several ways"* (Bernanke and Gertler 2005). Financial markets were considered to work perfectly and this is the reason why they were not needed in the analysis of monetary policy transmission. Instead, economists based their new studies on asymmetric information and other financial frictions, thus theorizing the credit view.

The credit channel is based on the assumption that frictions smooth the functioning of financial markets, then increasing the dead-weight loss associated with the principal-agent problem between lenders and borrowers. The result is a wedge, called external financial premium (EFP), which reflects the lender's expected cost of evaluation and monitoring; the "lemons" premium that results from the fact that borrowers have better information; the borrower's cost of distortion due to moral hazard restrictions[7]. Economists have identified two mechanisms linked to the credit channel, namely the bank lending channel and the balance sheet channel. Before explaining them, it must be underlined that the credit channel is not an independent alternative to traditional mechanisms, but rather an amplified one.

Banks play a special role in the financial system because they are very well suited to solve asymmetric information problems in credit markets. The bank lending channel acts through the shifts of supply of bank credit. If banks do no face a perfectly elastic demand for their liabilities, then an open-market operation will be sufficient to affect the bank's costs of funding, which in turn impacts the supply of loans.

$$bank\ deposits{\downarrow},\ bank\ loans{\downarrow},\ I{\downarrow},\ W{\downarrow}$$

This transmission channel will be more suitable in countries where firms are more bank dependent, thus the effects would be stronger.

Contrarily to the bank lending channel, which focuses on the lender's side (bank), the balance sheet channel studies how monetary policy influences the external finance premium by looking at the

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[7] Ben S. Bernanke, Mark Gertler (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission"

borrower's side (firm). It is based on the prediction that the EFP a borrower faces depends on his financial position, meaning that the lower is the borrower's net worth, the higher are adverse selection and moral hazard problems. Hence, a fluctuation in the borrower's balance sheet influences his investment decisions. The balance sheet channel arises because the central bank can influence the financial position of borrowers. Indeed, an increase in interest rate directly impacts financial asset prices, thus shrinking the value of the borrower's collateral.

$$i_{off}\uparrow, i_{MM}\uparrow, P_{equity}\downarrow, financial\ assets\downarrow, consumption\downarrow, W\downarrow$$

Besides, a contractionary monetary policy may affect the net cash flow, lowering the amount of liquidity of the firm (better known as the cash flow channel). This channel is actually a direct extension of the previous one.

$$i_{off}\uparrow, cash\ flow\downarrow, consumption\downarrow, I\downarrow, W\downarrow$$

1.2 The Financial Position of Households: Marginal Propensity to Consume and Balance Sheet Composition.

The above-described study of the credit channel focused on enterprises and their reaction to monetary policy. Now this section will extend the analysis to the definition of households and how they react to the implementation of monetary policies. Analyzing their behavior, such as spending on housing and consumer durables, means understanding consumption movements, which is a crucial element in the aggregate demand. Therefore, the study of families helps to catch the impact of monetary policy on aggregate demand.

Households, as just said, are the key component of the aggregate demand. They are influenced by all transmission channels, especially by the effects of the alteration of the interest rates, which in turn impact consumer credit conditions. Families truly depend on the credit channel, therefore their balance sheet is the element most affected by the implementation of monetary policies.

Households can be split among them into two categories: borrowers and lenders. The first one is defined as borrowers if the amount of debts exceeds the one for assets (income lower than spending). Conversely, lenders are households with opposite structure.

Hence, it is evident that households do not differ among them just because of their age or geography, but most importantly due to their composition of wealth, assets, income, debt, and employment. Since households with various income sources and labor supply elasticity react differently to monetary shocks, understanding such level-data is the key part in modeling an adequate macroeconomic policy. The elements taken into consideration for estimating a specific situation for households, focusing principally on European families, highlight some quantitatively important dimensions of heterogeneity, thus can be divided into two categories[8].

Firstly, the level and volatility of households' income varies according to their socio-economic structure. Same happens for wages. Such differences not only matter for analyzing how individuals respond to economic shifts, but they suggest an explanation about the aggregate level of wage growth. *Figure 3 Panel a*[9] decomposes the overall increase in mean income into earnings heterogeneity and income composition. It shows that, one year after an expansionary monetary policy, the increase in income is more considerable for households with low-income quintiles. This happens because such people are more likely to be unemployed, thus they will be the first to benefit from the creation of employment pushed by an economic expansion. This disproportionate increment in income facilitates the reduction of income inequality across societies. The figure also shows that the extensive margin, therefore the variable for earnings heterogeneity, is particularly strong for bottom income quintile's families, where wage growth is not so relevant.

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[8] Philip R. Lane, (2019), "Households and the transmission of monetary policy", ECB website
[9] The chart shows the percentage change in mean income across income quintile, employment, and wages four quarters after the impact of an expansionary policy. The number in brackets reflects the initial level of household income in each quintile. Countries considered are France, Germany, Italy, and Spain, year 2018.

Figure 3 Panel a: "Effect of Monetary Policy on Household Income by Income Quintile"
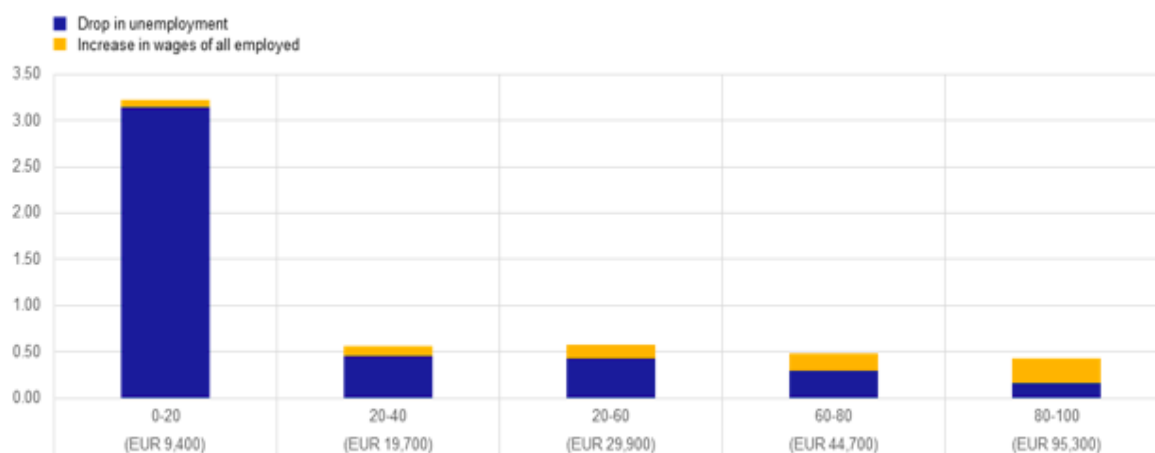

Source: ECB (2019). Derived from: Lenza, and Slacalek (2018)

Secondly, as said at the beginning of this section, there is a substantial difference in the size and composition of assets and liabilities of households. *Figure 3 panel b*[10] pictures that almost 60% of households tested in the "Household Finance and Consumption Survey" are homeowners and a third of them have mortgages. Independently from their value, the chart makes evident the fact that almost all households own financial assets. To the extent that the latter have short maturities and typically mortgages are featured with adjustable rates, households will have an unquestionable different feedback to a reduction in interest rate (the opposite occurs if a tighter policy is implemented). Nevertheless, it is worth keeping in mind that the degree of homeownership may be considerably diversified across individuals, which means that the more concentration of equities and debts is present in households balance sheet, the more their economic reply to monetary shocks will be consistent to such shifts.

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[10] The chart shows the average value of assets and debt per household across five income quintiles for the Euro area. The top quintile is further broken into two deciles."Housing wealth" is composed of the individuals' main residence and other real estate. "Other assets" include households' vehicles, voluntary pension insurance, shares, valuables, bonds, and money owed to households.

Figure 3 panel b: "Household Assets and Debt by Income Quintile"
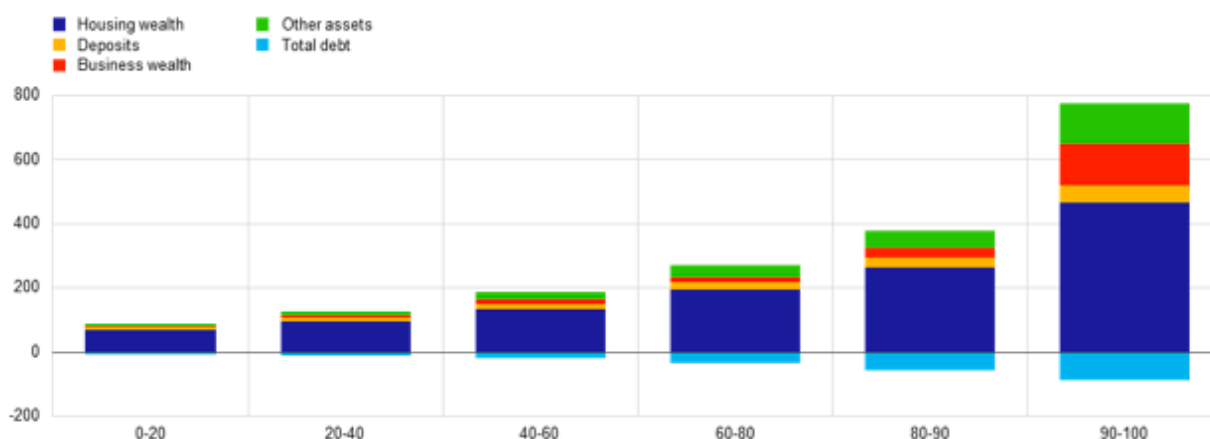
Source: ECB (2018). Derived from De Bond (2016)

As the graphs presented explain, the Household Finance and Consumption Survey (HFCS) provides an insight into the distribution of assets, liabilities, and incomes across households. Even though a precise and detailed description of the household's balance sheet will be presented later in this paragraph, clearly it is evident that the majority of spending is addressed to residential investments. Differences across households and their reaction over credit channels are also determined by a variable never mentioned before, the marginal propensity to consume (MPC). Households with high-leverage debt, which means with higher MPC than those with fewer mortgages, will face a greater distortion in their balance sheet. Indeed, hypothesizing a restrictive monetary policy, due to the increase in the rate of interest, the value of financial activity drops, leading to a tightening of credit conditions. People react by decreasing their spending habits, because now debts are more expensive and thus there is more credit rationing. Therefore, to even capture the indirect effects of monetary policy, a realistic analysis and distribution across borrowers and lenders of the MPC is needed. Concerning the previous assumption that relies on the importance of the marginal propensity to consume, *Figure 4* is then presented. It plots the distribution of the MPC, and it appears that a non-trivial percentage of families strongly react to income variations.

Figure 4: "The Distribution of the Marginal Propensity to Consume"
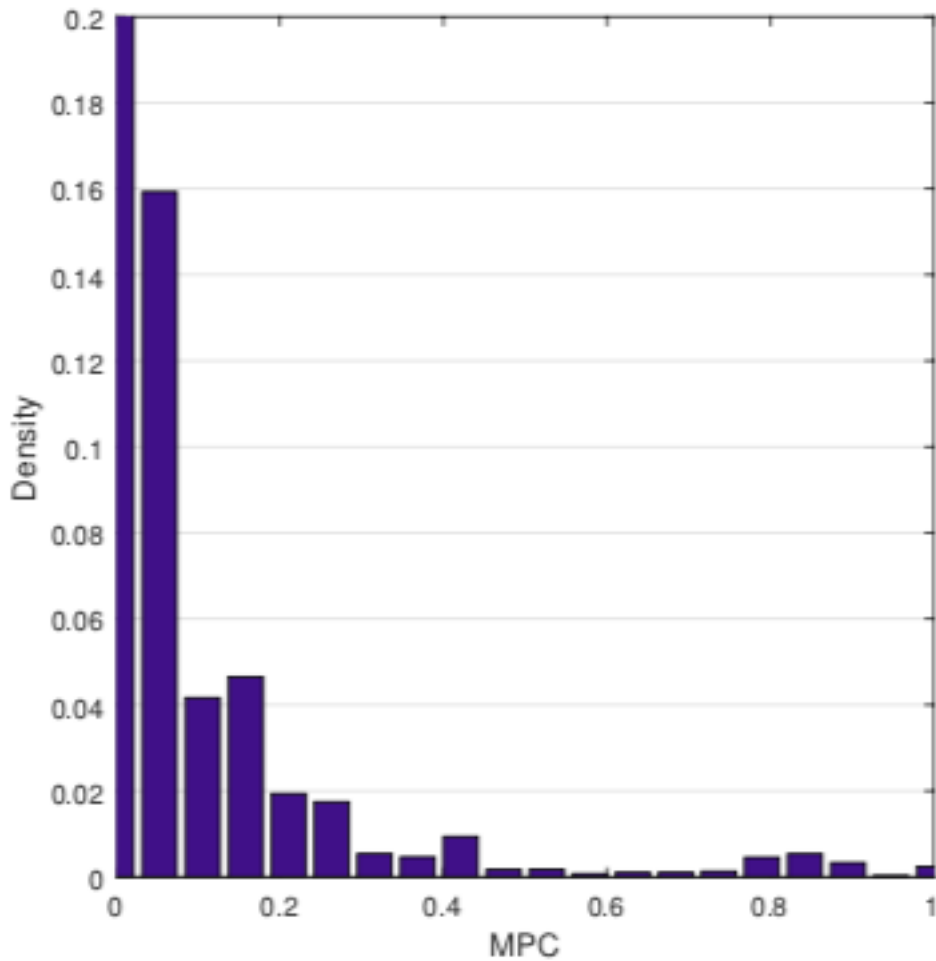
Source: Aaron Hedlund et. al (2017)

Detailed analysis provided in "Monetary Policy, Heterogeneity, and the Housing Channel" (2017) shows the presence of considerable heterogeneity in marginal propensity to consume, which is driven primarily by differences in wealth, leverage, and liquidity-access across households. It is therefore evident that it plays an important role in shaping the transmission of monetary policies. All of these debt features' differences of individuals, according to ECB (2019), can be divided into two main groups: (1) limited financial assets and (2) adequate financial assets. The composition of the liabilities of these two groups of households varies substantially. Homeowners with limited financial assets usually have larger mortgages than the others and have less possibility to simplify their consumption over time, since they have little liquid wealth to smooth income transaction. The relevance of the MPC can also be seen in the redistribution of wealth across households. Moreover, since it determines

the aggregate consumption, and the amount of production depends on price rigidities, the heterogeneity also contributes to the formulation of the final output[11].

Understanding the composition of a household balance sheet is crucial for a correct implementation of economic policies. The allocation of assets and debts influences household exposure to monetary shocks, and studies carried in the "Global Financial Stability Report" (Chap III) found that its analysis is strictly correlated with the one of an individual's risk profile. The assessment of the latter helps to look at how people have managed their balance sheet, along with returns and associated risks. Usually, data provided by the government to compute household balance sheet takes into account just financial assets, liabilities, and nonfinancial assets. However, it is important to consider also the likely future assets and obligations, in order to fully capture the additional costs that may increase savings and investments, thus influencing the balance sheet composition. For example, innovation in the financial markets have increased the amount of product available to households for their long-term investments or savings wishes. With these new products, such as long-term and index-linked bonds, investors can spread their savings across a wider range of investments, creating higher diversification and liquidity. In such a manner, they are allowed with a powerful tool to manage their savings. Obviously, households differ in their exposure to interest rates, asset prices, and risk, thus the structure of the balance sheet will greatly vary. Moreover, individuals with portfolios containing a wide range of assets have larger diversification gains from those with more specific and concentrated holdings. Clearly, this diversification is the key factor influencing the volatility of balance sheets.

The asset side reflects all of those elements that influence household behavior, such as market structure, regulation, and cultural preferences (James B. Davies et. al 2007). The average net worth for households has grown really fast in the past decades, in particular, due to the increase in the value of real estate and equity holding.

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[11] Aaron Hedlund, et. al, (2017), "Monetary Policy, Heterogeneity, and the Housing Channel"

For instance, home is generally the most relevant asset in the household portfolio. Focusing on a worldwide view, most countries have a percentage of nonfinancial assets, such as housing, around 40 and 60 percent of the total amount of assets. Sebastian Schich and Jung-Hyun Ahn (2014) observe that the volatility of all market-sensitive assets is lower if the real estate is included. It happens because the latter is found to be uncorrelated with equities and other financial assets. Since this market takes a great proportion of total assets, it explains why volatility in net wealth has declined over time. Thanks to decades of financial progress, housing wealth has grown very quickly, leading to a substantial increase in net worth, which in turn has been accompanied by a greater development in mortgage debt. The ratio of mortgage debt over household disposable income has risen over the past few years, even though in some countries this increase has been offset by a reduction in other forms of debt. This higher level of liability creates a higher exposure to price fluctuations for households. Some of them are considered more vulnerable to housing market shifts than others, in particular all first-time purchasers of homes, who may have recently incurred in high debts and low-income positions. Housing has always been seen as an attractive investment, since it represents an important consumable asset, a safe place where to live, the reason why almost every individual has it in his balance sheet.

Other assets needed to be taken into consideration in this analysis are financial holdings, such a saving deposits, investments in equity, pensions funds, shares, and bonds. All of them represent an important part of the total household balance sheet, carrying revenues both if used as property income or if sold in the market. There is a meaningful variation in the distribution of household financial assets across countries, which is important for the economic consideration of potential household vulnerability. Data provided by the OECD report, show that in 2018 the greatest amount of financial assets was in the United States, with 260753.3 US dollars/capita, meanwhile, in Turkey it was only 12165 US dollars/capita. As a matter of fact, individuals have different holdings according to the environment that surrounds them.

Focusing on the liability side, households nowadays tend to take more obligations, especially because of the increase in life expectancy. This may lead to an underestimation of the long-term risks faced, which is also related to an overestimation of their future income growth. Thus, they may choose types of investment patterns not adequate over medium and long-run. The amount of liabilities taken by people is also linked to the degree of MPC of housing of each individual. Households with different levels of wealth have different marginal propensity to consume, thus different reactions to losses in the economy. For example, a possible decline in housing prices is less tolerated by households with equity claims with respect to others with debt claims. In fact, the poorer the households the higher is the MPC. Recent studies carried over this topic found that household with income lower than $35 thousands have a marginal propensity to consume three times larger than household much richer[12]. The same reasoning applies also to the level of leverage: MPC is higher for highly leveraged homeowners. On this basis, it is evident that external factors have strong aftermaths on the balance sheet debt position, thus an appropriate liability management tool is required for these people. Nevertheless, financial studies discovered that the majority of households can manage better their liabilities rather than their savings or investment. As previously described, homes are the most important asset and therefore home mortgages are the largest available liability, which implies that a household's skill to manage debts has enhanced over time. A wide range of mortgages, followed by an equal ability to customize them, has provided households different options for managing their liability side.

 Generally speaking, individuals' debts are considered all liabilities that require a fixed payment in fixed dates to creditors. Despite the above description focused mainly on mortgage loans, also consumer credits and other accounts payable should be taken into account when formulating a precise calculation of liabilities.

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[12] Atif Mian, Kamalesh Rao, Amir Sufi, (2013), "Household Balance Sheets, Consumption, and the Economic Slump"

Economists use leverage in order to understand the strength of a balance sheet, needed to analyze the business cycle that stands behind a crisis' recovery. Such a variable is defined as the ratio of assets to total net worth and the higher it is, the weaker is the balance sheet. If an asset value decreases, it is followed by a drop in net worth, leading to a rise in leverage. When it is high, households tend to increase their savings to repair the balance sheet. Definitely, economic theory explains that switching to savings reduces consumption, which in turn affects negatively economic activity causing slower recovery after contractionary shocks. Using historical data, leverage was extremely high during the 2008 crisis, whose recovery was, indeed, very sluggish.

The following *Figure 5* shows the differences and the consequent diversification of balance sheets across households. It posits a comparison between the already mentioned Europe and another economically developed country: United States. Both Panels explain how actual balance sheets look like and how they have changed in 20 years. *Panel a*[13]contains US information, including assets, liabilities, and net worth, while *Panel b*[14] is provided by the ECB reports. As commonly known, the effects of the 2008 financial crisis have not been seen only in America, but rather it was a global crisis affecting other countries such as Europe. Indeed, both charts highlight an economic expansion, with a peak reached in 2007 and then a sharp decline; in 2010 the recovery from the Great Recession seems working, as the household balance sheets rise again. After the crisis, both the value of liabilities remained roughly the same, in contrast with the strong increase in the number of assets: at the end of 2019 it was more than doubled.

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[13] Assets are shown as positive numbers above the x-axis and liabilities as positive numbers below the x-axis. Net worth equals assets minus liabilities.
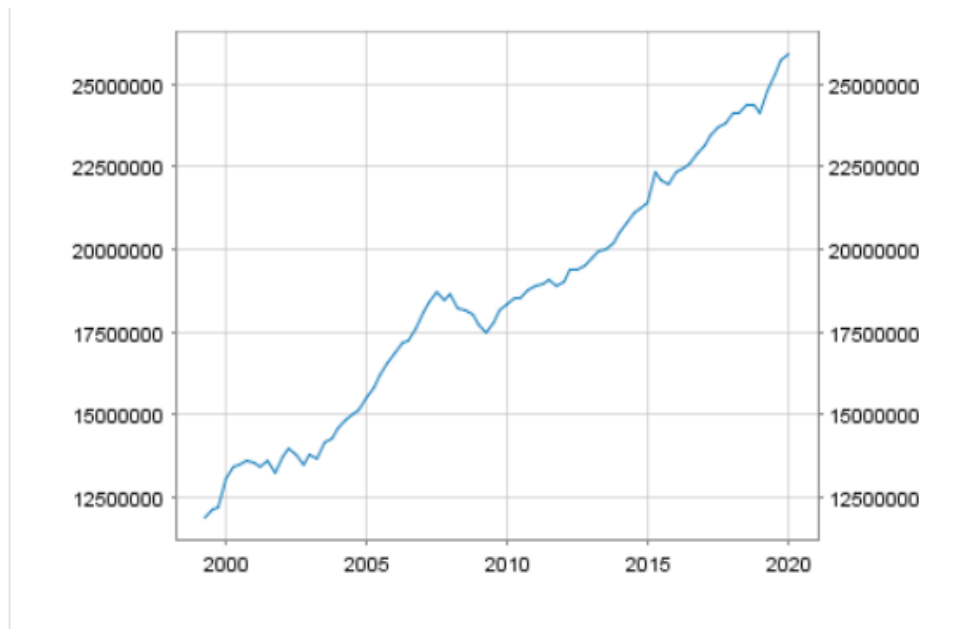[14] The x-axis plots the years while the y-axis reports the value of the closing balance sheet position.

Figure 5 Panel a: US Households Balance Sheet
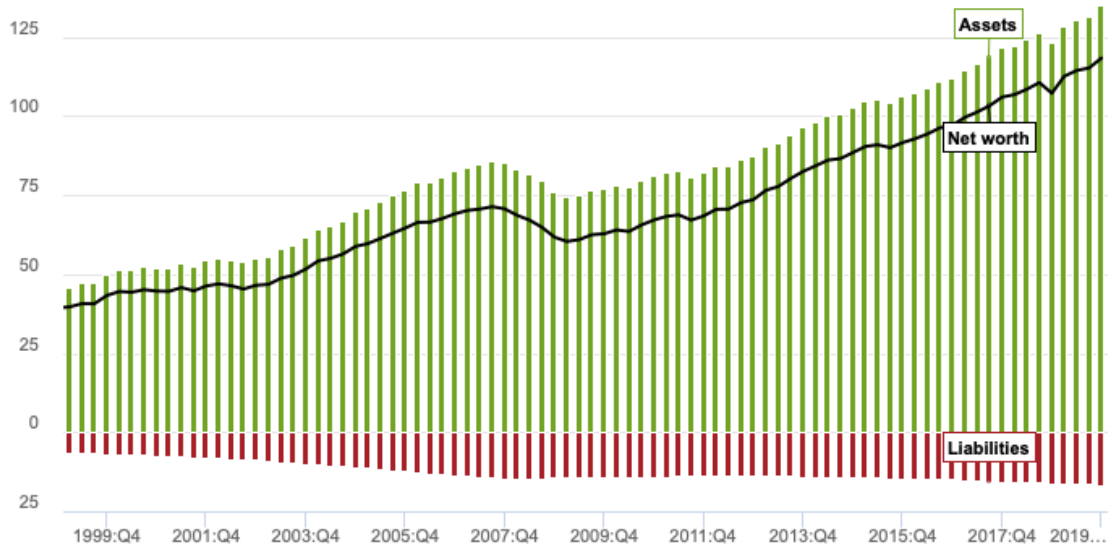
Source: FED (2020)

Figure 5 Panel b: EU Households Balance Sheet

Source: ECB (2020)

1.3 Households and Monetary Policies

1.3.1 Balance sheet channel

As explained in section 1.1, the balance-sheet channel is one of the key items of the credit view, whose importance has increased in the recent years. It deeply analyzes the role that financial position of private agents plays in the transmission mechanism.

Shifts in monetary policy affect not only market interest rates but also the economic activity of economic agents. In fact, changes in interest rates have important impacts on balance sheets and net worth of banks, companies and households. Specifically, this transmission mechanism shows how monetary policy affects the credit portfolio of financial intermediaries as well as the one of other economic principals.

The main purpose of the balance sheet channel is studying the impact of monetary and economic conditions on loan granting by including interactions between changes in the interest rates and GDP growth with bank capital and liquidity ratios. Therefore, it links monetary policies to the demand for loans. After a tightening economic shock, higher interest rates increase debt services while reducing the present value of assets and collateral. This squeeze on borrowers worsens their creditworthiness and forces banks to reduce their credit supply. Thus, lower credit growth is followed by a slowdown in output.

This channel stresses the potential consequences of the implementation of monetary policy on households by affecting, both directly and indirectly, their balance sheet and income statements.

Considering a restrictive monetary policy, families' balance sheets are directly weakened because rising interest rates increase interest expenses, lowering their financial position and shrinking collateral's value.

The indirect effect is, conversely, related to the inventory and investment spending. Still focusing on a tightening action, the theory described before suggests that a reduction in costumers' spending decreases firm's revenues, while its fixed-costs will not follow such a drop in the short-run.

Recent studies found a profound and natural correlation between the balance sheet channel and the main component of households' portfolio: housing. This linkage is explained through the "mortgage burden" variable[15] (Boldin 1994). He assumes that it strongly influences housing demand, since it is highly sensitive to even small changes in interest rates, moreover given that Boldin's mortgage burden variable has a positive correlation with the federal funds rate. This relationship is given by the effects of rising nominal interest rates and falling household income, which consequently help to understand the strong impact of monetary policy on housing demand.

Empirical researches relying on the balance sheet channel affirm that credit market imperfections are relevant aspects for the distribution of the transmission model. Indeed, informational asymmetry between borrowers and lenders lead to a positive EFP which, as described in section 1.1, is inversely related to the borrowers' net worth with respect to the obligations on the loan.

In conclusion, to assess the validity of the balance sheet channel, it is worth to keep in mind that the income effect arises from movements of official interest rates on liabilities denoted both in national and exchange currency[16]. The size of this specific effect clearly depends on the individual's distribution of assets and liabilities. The composition of the balance sheet, together with the degree of the MPC, is the main factor in determining also the amount of the wealth effect. Hence, these two effects are the key outcome of the balance sheet transmission channel and help to analyze its most important aftermaths on households.

After this theoretical description, it is useful also to analyze how countries are practically affected by balance sheet shocks. For this purpose, *Figure 6* shows euro-area individual's reactions to the implementation of the monetary policy transmission channel. *Figure 6 Panel a* describes that output, after a balance sheet shock, strongly reacts in Germany, Austria, Finland, Estonia, Ireland, and Luxembourg. Instead, the effects are more subdued in France, Italy, Austria, Belgium, and the Slovak

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[15] Mortgage burden defined as the ratio of mortgage payments to income for the median new home buyer.
[16] José M. González Mínguez, (1997), "The Balance- sheet Transmission Channel of Monetary Policy: the Cases of Germany and Spain".

Republic. For Greece, there is evidence for a negative response, while in Spain, the Netherlands, Portugal, Slovenia, and Cyprus the impact in negligible.

Figure 6 Panel a: "Impact of Balance Sheet Shocks on Output in Individual Member Countries"
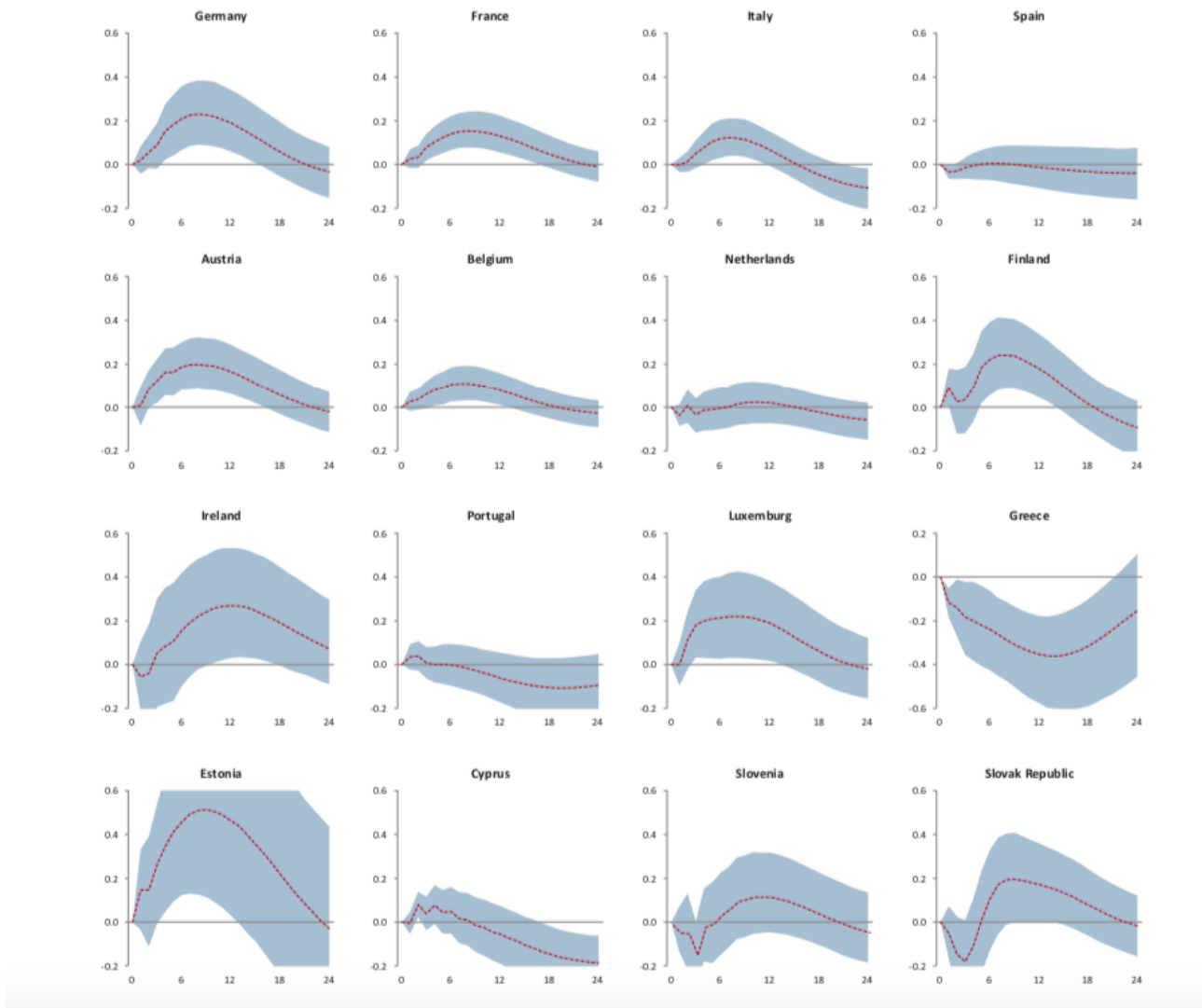
Source: Boeckx, Dossche, and Peersmanc (2017)

On the other hand, as shown in *Figure 6 Panel b*, the outcome of a monetary policy triggered by the balance sheet transmission channel on consumer prices are much more similar across countries. Therefore, in countries where output reacts more also inflation follows this intensive reaction, and vice versa.

In conclusion, it is evident that output and prices turn out to be positively correlated with monetary policy shifts, and the different reaction of output across countries is strongly supported by the degree

of capitalization of the national banking sector. Thus, final output increases more in countries with a relatively better capitalized banking sector.

Figure 6 Panel b: "Impact of Balance Sheet Shocks on Consumer Prices in Individual Member Countries"
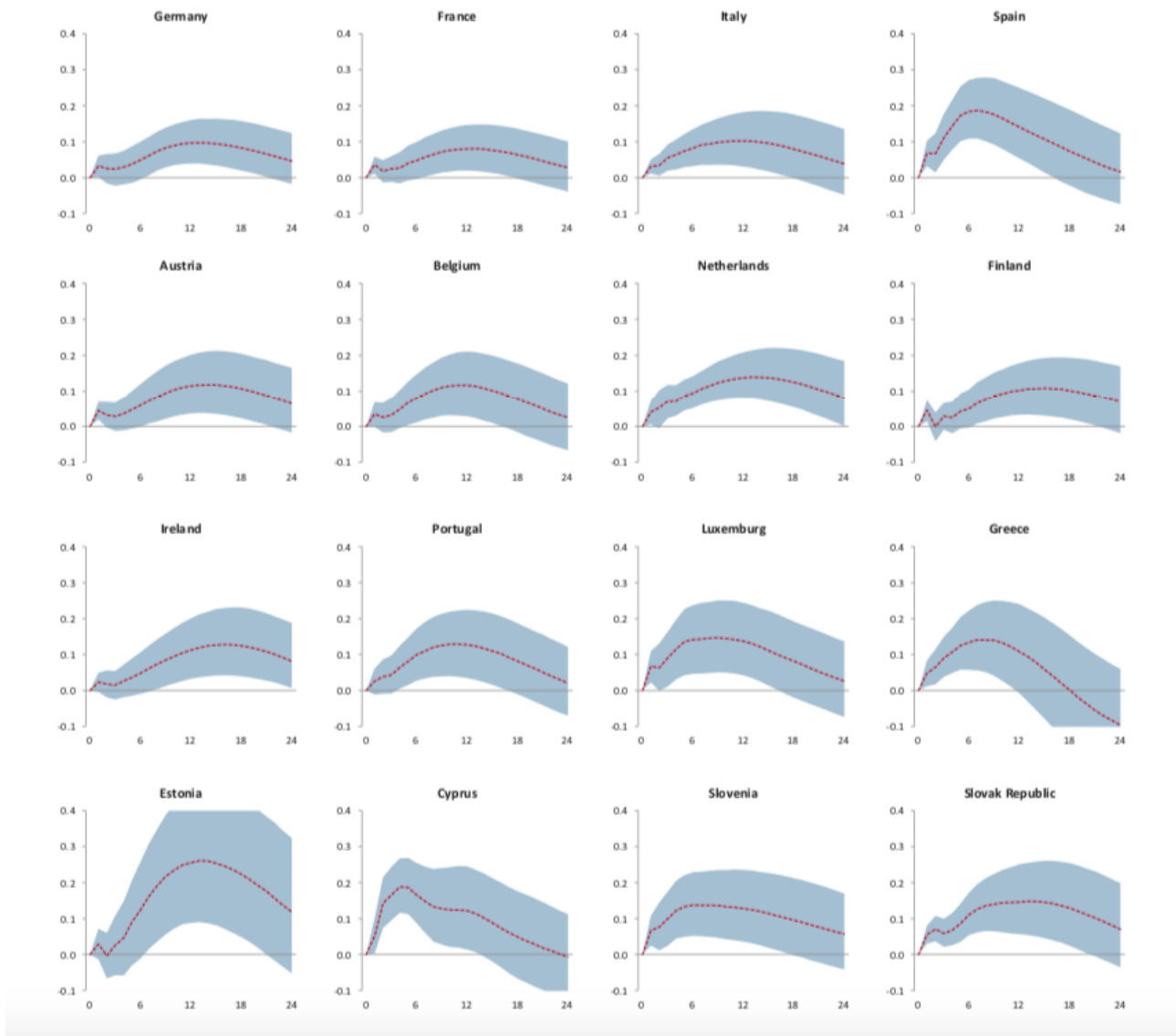
Source: Boeckx Dossche, and Peersmanc (2017)

1.3.2   The Cash Flow Channel

The cash flow channel, as already said, is a linear ramification of the balance sheet transmission model. Data about families' financial position suggest that it works both for net borrower household as well as net lender. The difference among these two features is that the first one is a household who

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holds more interest-bearing debt rather than interest-earning liquid assets. A net lender household is therefore the opposite.

The real strength of the cash flow channel depends on a different variety of factors, such as the distribution of debt across the country and more in depth across households, and how elastic market rates are compared to changes in monetary policies. Indeed, there is a natural connection between the cash flow transmission mechanism and consumption. All things being equal, a rise in policy rate reduces disposable income, which in turn affects spending decisions, leading to a contraction in an individual's consumption.

The household cash flow channel consists mainly of three steps. Changes in cash rate are transmitted to loans and deposit rates faced by households, then, by modifying the required repayment for borrowers and the net interest earnings for lenders, their cash flow composition is affected, which in conclusion influences household spending decisions. If households are forward-looking, with a good access to financial markets, they would not suffer this tangible shift in consumption. Instead, relevant responses will be seen in myopic and liquidity constrained, or "hand-to-mouth", families (households holding a sizable amount of illiquid assets.

As Gianni La Cava (2016) states, the power of the cash flow channel is based on the households' sensitiveness to changes in their cash flow, which relies on liquidity constraints. A common method for identifying hand-to-mouth households, therefore to understand how the cash flow channel will be impactable after its implementation, is based on the estimation of people's liquid holdings: all of those assets that can be easily and quickly sold. By the estimation of Greg Kaplan (2014), financially constrained households are more likely to report experiences of financial stress, difficulty in saving money and in raising emergency funds. As *Figure 7*[17] evidences, there is a difference between "wealthy hand-to-mouth" and "poor hand-to-mouth". The former has a great amount of illiquid assets, which yield higher return, thus they have a larger MPC with respect to the latter households.

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[17] The picture shows the fraction of poor hand-to-mouth and wealthy hand-to-mouth in United States (US), Canada (CA), Australia (AU), UK (UK), Germany (DE), France (FR), Italy (IT) and Spain (ES). Data are from 2014.

Figure 7: "Fraction of Hand-to-mouth Households across countries"
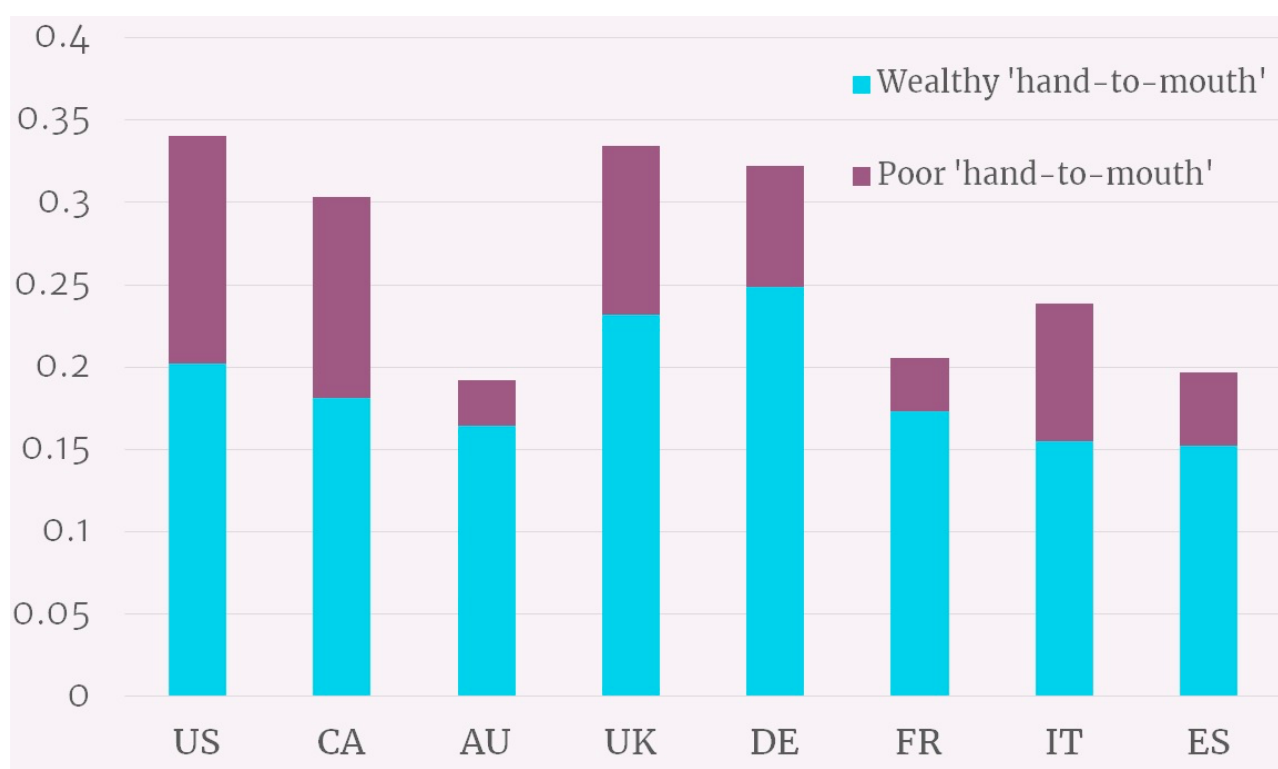
Source: Kaplan et. al (2014)

From the analysis of this picture, it is evident that in United States the percentage of wealthy hand-to-mouth families is almost twice as the one of poor hand-to-mouth. This phenomenon is even more evident in the European countries and in Australia, in which the fraction of wealthy among total hand-to-mouth households exceeds 2/3. This means that the impact of the cash flow channel is much more significant in the latter countries. It happens mostly because the greater part of illiquid assets present in households' portfolios is made of houses, which are financed with long-term nominal debts. This implies that, by increasing or decreasing refinancing activities, movements in interest rates will affect disposable income, changing the household's durable spending. Definitely, it is arguable that the cash flow channel links shifts in real household consumption to shifts in nominal interest rates and cash flows[18]. Therefore, because of the importance of the distribution of assets, mortgage debts and wealth across the economy, the cash flow transmission channel is the most accurate way to implement monetary policies and to have the desired shifts in households' financial position.

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[18] Gianni La Cava, Helen Hughson, Greg Kaplan, (2016), "The Household Cash Flow Channel of Monetary Policy"

1.4 Unconventional Monetary Policy

The previous three sections focused on the transmission of conventional monetary policies. From more or less ten years, it has been discovered that the economic world is managed also by other features: the unconventional monetary policies (UMP).

In period of deep recession, conventional monetary actions may become limited in their usefulness. After the subprime crisis the situation changed dramatically, and the effects were globally seen. Thus, unconventional monetary policies gained distinction at the beginning of the global financial crisis (2008), since traditional monetary policy proved less effectiveness. Indeed, once nominal be interest rates are lowered close to zero, the economy risks the fall into a liquidity trap, that is the moment when people are no longer incentivized to invest. Therefore, in period of extreme economic crisis, conventional policy tools may no longer be adequate in achieving their goals, thus the intervention of unconventional actions is needed. Even though they have also been seen on the spotlight of the euro-area in recent years, it is not surprising that during the Great recession they attracted the attention of policymakers and academics studies. As an example, Mark Gertler and Peter Karadi (2009) report that unconventional balance sheet operations provided a way to re-stimulate the economy after it reached the peak of the zero lower bound. In conclusion, UMP can be defined as a response to crisis. Still focusing on ECB data, during recessions Europe allows more generous actions, both for avoiding the excessive increase of interest rate and also for granting the liquidity needed to survive. Therefore, even though this unconventional implementation started in the United States, Europe experimented a considerable plurality of UMPs[19].

One of these is the implementation of the "securities market programme", which was announced by the Governing Council on May 2010.[20] . It is intended to ensure depth and liquidity in some malfunctioning segments of the debt securities markets with the aim of restoring an appropriate

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[19] Fernando Avalos and Emmanuel Mamatzakis, (2018), "Euro Area Unconventional Monetary Policy and Bank Resilience"
[20] ECB, (2010), "Monthly Bulletin of June 2010"

functioning of the monetary policy transmission mechanism. Indeed, the widespread confidence crisis in the securities issued by the PIGS countries (Portugal, Italy, Germany, Spain) led to the raise of interest rates, impairing transmission models and weakening banks. So, the ECB intervened by purchasing corporate and government bonds, thus sterilizing the monetary interventions.

Further unconventional measures are "longer-term refinancing operations" (LTROs), firstly introduced in December 2011. They are associated with a reduction in the required reserve ratio, with a maturity of three years. Then there is also the "targeted longer-term refinancing operations" (LTROs) which is derived from the previous one. It provides refinancing to credit institutions for periods up to four years, thus it was scheduled until 2018. More specifically, they offer long-term funding at attractive conditions in order to stimulate bank lending to the real economy.

Even though the "outright monetary transaction" (OMT) was never implemented, thus its effects were never reflected in the ECB balance sheet, it is famous for being another type of unconventional monetary policy. It was created in 2012 and its main purpose was to control the purchase of government securities in the secondary market.

Since 2009, several programs of asset purchases (APPs) have been implemented with the main objective of sustaining growth across the euro area and keeping the inflation rate below, but close to, 2%. The most famous of these programs is the Quantitative Easing (QE), whose main objective is to tackle economic stagnation and combat deflation. It is based on the purchase of ABS, covered bonds and government securities already purchased in the secondary market. The acquisition of financial assets financed by central bank money should initially increase money holdings, then push up asset prices and finally stimulate expenditure by lowering borrowing costs and increasing wealth, thus augmenting the quantity of money available in the banking system. The QE gained a lot of support since the ECB tried to break the liquidity trap by bringing liquidity out of the banking system, therefore dealing not only with banks but also with non-monetary financial institutions that commonly do not participate in refinancing activities. The overall effect of the implementation of the

QE can be split into two stages: the "initial impact phase" and the "adjustment impact phase"[21]. During the first one, the acquirement of the assets described above changes the composition of private agents' portfolios, increases the holding of broad money and decreases those of medium and long-term gilts. Since these two elements are perfect substitutes, this action leads to an initial imbalance. However, asset prices continue to rise as well as the demand for cash and the supply of long-term assets. Therefore, the initial imbalance in the money and assets markets will be reduced (adjustment phase). This action is exacerbated by the presence of lower credit costs and higher wealth, which lead to an increase in asset demand, therefore in consumer price levels, which continue to rise by smaller amounts. In a deficit situation, asset purchases accelerate the return of the economy in equilibrium, thus the whole process continues until the real money stability is reached. Coherently to the theory just described, empirical studies demonstrate after the implantation of the QE that there are similarities between the Europe and UK. Nevertheless the UK is out of the ECB's control, *Figure 8*[22] shows all the steps just described, suggesting that the QE asset purchases have economically significant effects.

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[21] Michael Joyce et. al, (2011), "The United Kingdom's quantitative easing policy: design, operation and impact"
[22] Data come from the Bank of England. Over the period March 2009 to January 2010, £200 billions of assets were purchased, representing around the 14% of annual GDP.

Figure 8: "The qualitative impact of QE"
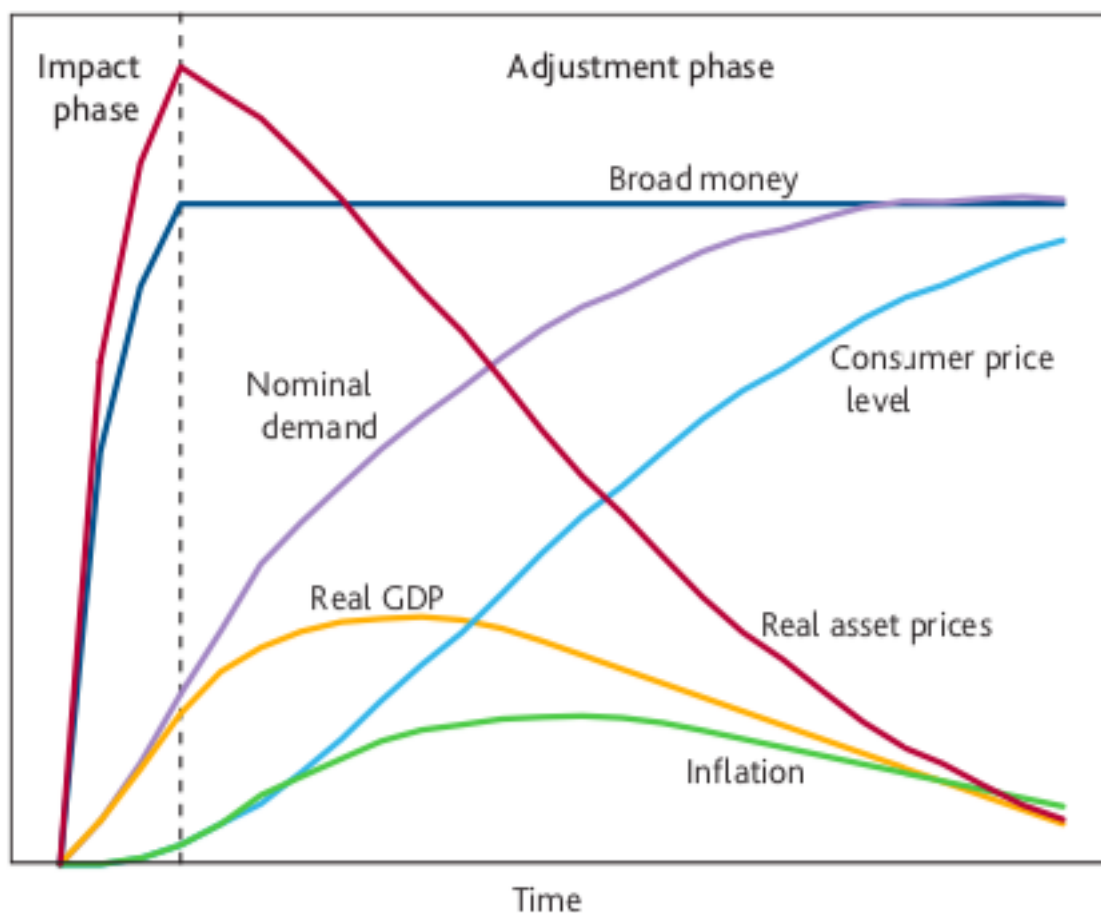
Source: Joyce et. al (2011)

The transparency of monetary policies and the communication tools of central banks gained important weight because both measures provide effectiveness to the implementation of monetary policy. By providing more information, the central bank's accountability is influenced and it helps the central banks is managing better future expectations of agents. Indeed, if the central bank is better informed about the economic outlook than the general public, or if the latter is unable to fully anticipate the central banks' intentions, then communication becomes an additional unconventional monetary policy instrument. An example of this action is represented by the "forward guidance", which are information provided by the central banks about their future intentions, according to the forecast of future prices. The ECB started to use forward guidance statements in July 2013, when the Governing Council announced that it expected that the benchmark interest rates would remain low for an

extended period of time. Since then, they have been reformulated in several occasions, leading to the establishment of the Delphic forward guidance and Odyssean forward guidance. The former's goal is to publish forecasts about interest rates while the latter focuses on maintaining the interest rates at the given level.

To conclude, the forward guidance, as well as the other forms of unconventional monetary policies pictured above, gained an increasing role in the recent years and are nowadays relevant alternatives to central bank's conventional actions.

2 MONETARY POLCY, HOUSING PRICES AND THE HOUSEHOLD CREDIT TRANSMISSION CHANNEL

2.1 General Introduction

As discussed in Chapter 1, the household credit channel is an effective and relevant part of the monetary transmission mechanism. Many empirical studies document how monetary policy influences aggregate consumption via housing prices and mortgage loan conditions (interest rates, credit availability). This chapter surveys some of these studies, focusing on the impact of financial frictions and different types of mortgage loan contracts on monetary transmission.

The relationship between consumption and house prices, whose analysis is provided in the first section, suggests that the household credit channel does not concerns only housing, but also consumer credit. Despite its great importance, the latter variable has not been examined, therefore this chapter investigates just on how housing features are affected by the implementation of monetary policies. It does so mainly in two steps. Firstly, it focuses on the mortgage market, scrutinizing whether fixed rate mortgages or adjustable rate mortgages have different reactions to economic shocks. This section is helped by the use of recent literature on the topic. Secondly, an empirical evidence is provided in order to test if a monetary policy is more effective for high debt households rather than for others. High levels of debt relative to income and assets can reduce families spending growth, therefore people holding such feature usually are more sensitive to income and housing equity shocks than low debt ones. Since this effect is even stronger in times of adverse shocks, studying a restrictive monetary policy is the best solution to understand its real impact on the housing market.

2.2 Housing Prices, Household Consumption and Financial Frictions

A common debate posed by many scholars investigates if house prices are an accurate reflection of macroeconomic conditions. Specifically, they question about the possible importance of financing frictions on households' consumption and decisions. Accordingly, studies (e.g. Aoki et. al 2002)

demonstrate that since all housing variables are strongly cyclical, they substantially affect the households' collateral position over the business cycle, which is closely related to the amount of secured borrowing. Another important result assumes that the spread of mortgage rates over the risk-free ones varies in accordance with the collateral situation of each single person. Therefore, the idea behind this theoretical description is that credit and financing frictions may be important elements in understanding the true relationship between interest rates, house prices and housing investment and consumption.

Hence, throughout the past century, many dynamic models have been presented, principally analyzing whether these possible frictions amplify outcome responses to shocks.

One relevant study is provided by Iacovello (2005) in which endogenous variations in firms' balance sheets are tested to assess the validity of the "financial accelerator". It is defined as a process by which adverse economic shifts may be amplified by worsening financial market conditions, therefore propagating macroeconomic downturns. According to this framework, the financial accelerator is considered to be the main variable enhancing business cycles. Indeed, a negative economic shock leads to a decrease in housing demand, thus in house prices and finally in homeowners' net worth. This reaction is followed by an increase in the external finance premium which contributes to a further decline in housing and consumption demand. Practically, when house prices fall, households have smaller deposit available to purchase their home than before and then they will obtain less favorable mortgage interest rates. As said before, house prices are significant variables affecting the collateral values of houses, thus fluctuations in prices determine the borrowing conditions of households, since they are used to be exposed to the idiosyncratic risk of these variations[23].

Still referring to Iacovello (2005), to better estimate the impact of a dynamic shock on households' consumption, two other features are added to the analysis: collateral constraints tied to real estate values and households' nominal debts[24]. A large proportion of borrowing is secured by real estate,

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[23] Kosuke Aoki, Gertjan Vlieghe, (2002), "House prices, consumption, and monetary policy: a financial accelerator approach"

[24] Matteo Iacovello, (2005), "House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle"

with the aim of lowering agency costs related to borrowing: reason explaining why housing needs collateral constraints. Furthermore, it is important to underline that nominal debts are required in this model because in low-inflation countries the majority of obligations are set in nominal terms. The first variable's effects on households allow a positive match between spending and housing prices shifts, while the introduction of nominal debts yields an improved output-inflation variance trade-off for central banks, which happens mostly because during a downturn resources are transferred from lenders to borrowers. This empirical evidence suggests that the interaction between house prices and the business cycle causes a negative result of nominal and real housing values and GDP with respect to a tight in money and a positive inflation disturbance. It also shows a definite co-movement of asset prices and output in response to a negative shock. These results are pictured in *Figure 9*[25]. According to the previous description, the picture presents economic responses of the real GDP (y), the GDP deflator (π), real house prices (q) and Fed Funds rate (R) after the implementation of a restrictive policy.

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[25] The VAR analysis estimates USA data from 1974 to 2003. The dashed lines indicate 90-percent confidence bonds with respect to the baseline. The variables R, π, q and Y are expressed in percentages and in quarterly rates.

Figure 9: " VAR Evidence in the United States"
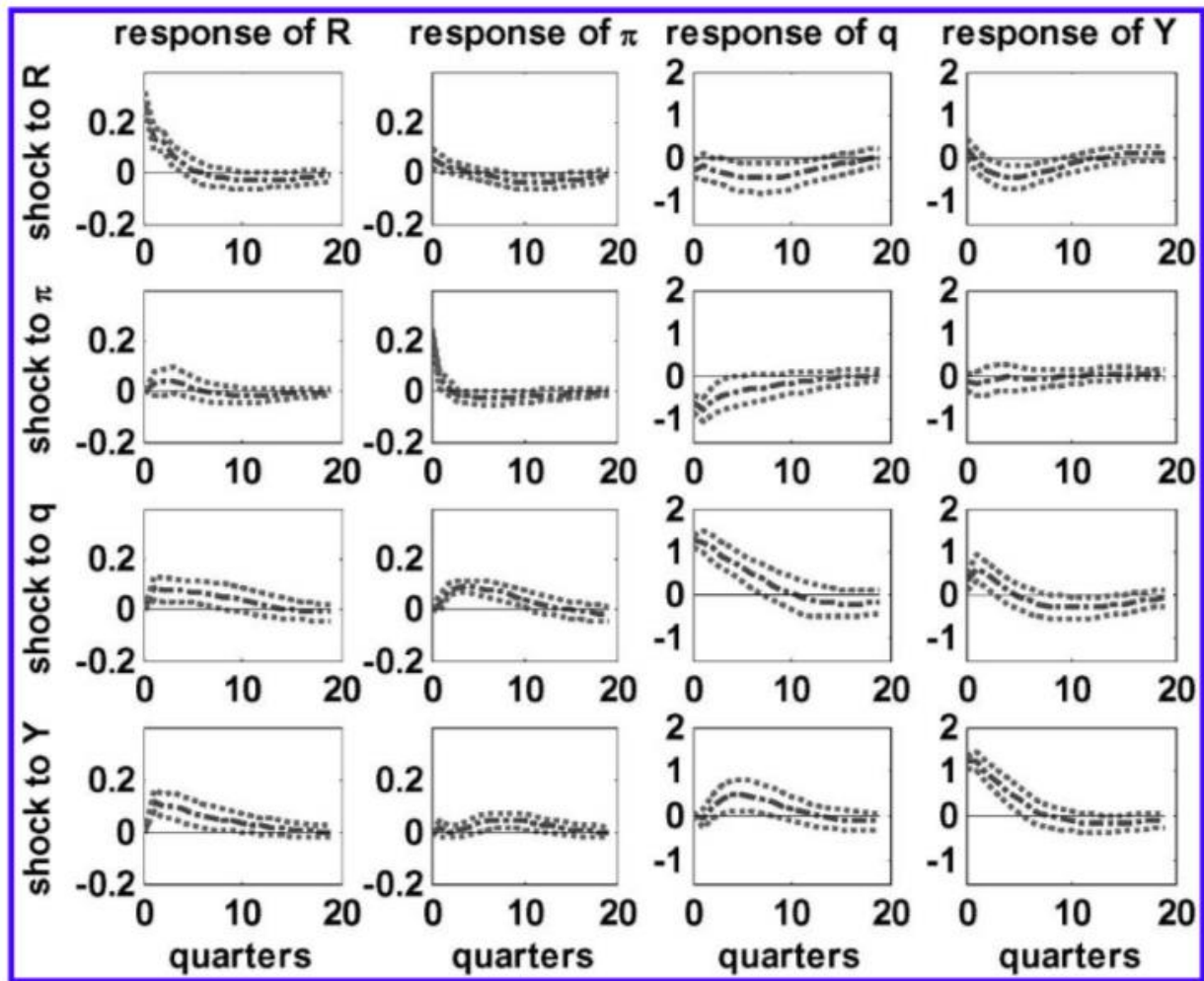
Source: Iacovello (2005)

Subsequently, with regards to a deeper study of this picture, scholars made a step forward in the analysis of collateral effects on consumption and house prices.

Still focusing on the traditional business cycle model, an exogenous fall in house prices, associated with liquidity-constrained households, might be fundamentals in decreasing their consumption above the equilibrium level, thus leading to a negative effect on aggregate demand. Coherently, the BGG model is applied, since it represents a useful method to understand how housing variables interact with investment and consumption decisions. In order to avoid the complexity of modelling the features describing families bounded by liquidity constraints, but without losing the essence of the financial accelerator, the BGG theory split them according to their behavior. On one hand there are

homeowners. They borrow funds from financial intermediaries to purchase houses (using partly their net worth and partly the borrowing) and rent them to consumers. On the other hand, there are consumers. As their name suggests, they are the ones who consume goods and housing services, thus in this case they rent housing services from homeowners. As it happened between borrowers and lenders in the previous analysis, also these two types of agents are linked by the transfer rule, by means of consumers paying homeowners. As the *Figure 10* shows, households use their housing equity to finance both consumption and investments, since consumers and homeowners are part of the same "household group".

Figure 10: "Flow of Funds"
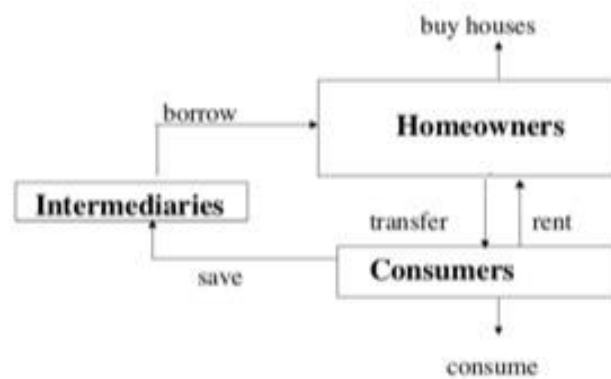
Source: Aoki and Vlieghe (2002)

The BGG evidence therefore confirms the fact that market frictions amplify and help the propagation of tightening economic shifts in the real estate sector.

To conclude, in addition to the linkage with collaterals and frictions, it is evident that there are many other reasons explaining the co-movement of house prices and consumption. Indeed, if households are optimistic about economic future actions, then the likelihood of increasing their consumption of housing goods is alike. Moreover, since movements in house prices are followed by movements in housing transactions, the latter have direct effects on consumption, as people often buy goods necessary for their houses.

2.3 Structure of Mortgage Market: Related Literature

As chapter one pointed out, recently households have become highly leveraged agents, due primarily to the increase in their mortgage demand. The analysis of the mortgage market is therefore needed in order to capture the exact shift in families' consumption triggered by adoption of monetary policies. In particular, the study of institutional details is relevant, such as the difference between fixed rate mortgages (FRM) and adjustable rate mortgages (ARM). Even if it does play a significant role, this comparison is not necessarily the most important aspect of the mortgage market after the implementation of a policy. Equally important could be the examination of whether households end up being debt constrained or their ability to freely extract equity (Kaplan 2014). Nevertheless, this thesis investigates just on FRM versus ARM.

Several recent contributions to the literature on monetary policy transmission focus on the cash flow channel and how it works in combination with different types of mortgage backed loans

Carriga et. al (2013) questions about the strength of the transmission mechanisms by comparing US, which is a country where FRM loans prevail, and the UK, where ARM loans prevail. US mortgages conventionally carry a fixed nominal interest rate and prescribe constant nominal installments for the entire life of the loan, usually 30 years. ARMs are still defined in nominal terms, but the installments are calculated each period so that the loan is expected to be fully repaid by the end of its life (15-30 years). By analyzing both countries and how their markets react to a restrictive monetary policy, results suggest that there is a larger effect on housing investments under ARM rather than under FRM. The author explains it by stating that price and wealth effects reinforce each other under floating rates, while tend to be offset under fixed rates. Specifically, shifts in nominal interest rates directly impact the required monthly payment, even without immediate adjustments in the price level. Thus, other things being equal, higher nominal interest rates are likely to have larger effect on houses financed by adjustable mortgages: they will be larger the longer is the time horizon for the mortgage's life.

Cloyne et. al (2018) confirm these findings. They start by assuming that more than half of UK and US population has mortgages. Therefore, relying on the theory that the former country represents

FRMs and the latter ARMs, dataset containing households' expenditure information are analyzed. By focusing on the dynamic effects of changes in monetary policy in US and in UK, this paper studies how the structure of the mortgage markets affects the transmission of monetary policy. Firstly, ARMs are found to be more attractive to unconstrained households when the inflation risk is abundant with respect to the real interest rate risk. Contrarily, they are unattractive to risk-averse people with borrowing constraints. The study moves forward by focusing on economic effects triggered by a restrictive monetary policy. Thus, after a monetary shock, the fall in mortgage payments is significantly higher in UK, explained by the prevalence of the use of variable interest rates. Consistently, *Figure 11* shows that after a 25 basis point of unanticipated interest rate cut, the response of mortgage payment is larger and quicker in UK than in US. The cumulative effect on mortgage payments by UK households is almost three times larger than the response in the United States ($166 vs $56).

Figure 11: "Response of Mortgage Payment After an Interest Rate Cut."
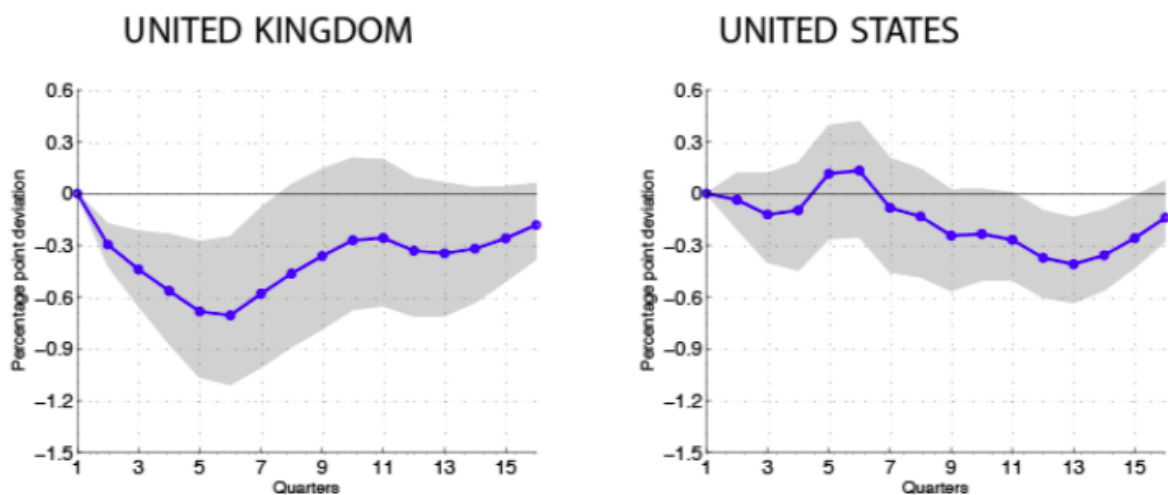
Source: Cloyne et. al (2018)

As the above cited papers, also Song (2019) investigates the relationship between monetary policy and households' different interest payments. More precisely, he examines whether the consumption by borrowers with ARMs is more sensitive to an expansionary monetary policy than consumption by households with FRMs. Empirical results show a significant impact on consumption of ARM

borrowers, since these types of mortgages are considered riskier. This study relies on the identification of cash flow channel, assuming that if it works, people with floating rates will face higher mortgage interest reductions that those with fixed rates. The results are presented in *Figure 12*[26], in which adjustable rate borrowers present a great correlation between their cost of fund index (COFIX) and their mortgage rates. The purpose of all the regressions presented in the picture is to observe the interaction between the COFIX variable and adjustable rate mortgages.

Figure 12: "Interest Rates and Consumption of Mortgage Borrowers"

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		All		Single Mortgage		All		Single Mortgage
COFIX	-2.088***	0.067	1.119	1.098				
	(0.214)	(0.920)	(0.966)	(0.987)				
COFIX × ARM			-1.478***	-1.352***				
			(0.430)	(0.439)				
Mortgage Rate					-1.470***	-0.518***	0.33	0.21
					(0.162)	(0.176)	(0.260)	(0.264)
Mortgage Rate × ARM							-1.142***	-0.996***
							(0.345)	(0.350)
Income		0.021***	0.021***	0.021***		0.021***	0.021***	0.021***
		(0.002)	(0.002)	(0.002)		(0.002)	(0.002)	(0.002)
Credit Card Limit		0.059***	0.060***	0.061***		0.059***	0.060***	0.060***
		(0.004)	(0.004)	(0.004)		(0.004)	(0.004)	(0.004)
Credit Score		0.028***	0.028***	0.027***		0.028***	0.027***	0.027***
		(0.004)	(0.004)	(0.004)		(0.004)	(0.004)	(0.004)
Constant	53.122***	-4.597	-4.581	-4.294	54.133***	-1.192	-1.308	-0.659
	(0.535)	(5.309)	(5.306)	(5.421)	(0.686)	(3.767)	(3.765)	(3.834)
Year Dummy	X	O	O	O	X	O	O	O
Season Dummy	X	O	O	O	X	O	O	O
Age Dummy	X	O	O	O	X	O	O	O
Overall R^2	0.001	0.25	0.24	0.24	0.01	0.249	0.232	0.235
Observation	106,236	106,236	106,236	101,288	106,236	106,236	106,236	101,288

Source: Song (2019)

It shows that the decrease in the COFIX, triggered by an expansionary monetary policy is translated into a drop in adjustable mortgage's payment, which leads to an increase in their consumption. Borrowers under fixed rates are less sensitive to such a shift. This result implies that in case of positive monetary policy, the cash flow channel is valid only for ARM households, while other "households'

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[26] The table shpws the effects of interest rates on credit and debt card purchase. The dependent variable is the total amount of card purchases. The COFIX variable is a reference rate of mortgage rates. The Mortgage Rate is the borrower-level rate. Single Mortgage refers to people who only have a single mortgage loan. *, ** and *** indicate respectively the 10%. 5% and !% of significance level. Standard errors are described by parenthesis.

channels", such as the balance sheet and the wealth channels, operate in a similar fashion for both types of mortgage structure.

2.4   Empirical Evidence on Monetary Policy Transmission for High Household Debt

The macroeconomic impact of the risks derived from household debt depends not only on the characteristics of mortgages, but also on their distribution across families. Different levels of household debt have different but direct implications on aggregate consumption, depending on their allocation[27]. As argued above, changes in interest rates affect individual cash flows which in turn may have an impact on consumption, in particular for households that are financially constrained.

Families are more likely to be financially constrained in high-debt states, therefore they will face larger MPC than lenders. Moreover, in high household debt states, the impact of a monetary policy is much larger if implemented by the cash flow channel. Indeed, a recent theoretical survey advises that the cash flow mechanism of monetary policy is more effective in high-debt states, specifically it is even stronger if the policy implemented is a restrictive one (Alpanda and Zubairy 2016).

To test the real strength of monetary policy on households an interacted panel VAR methodology is the most accurate model. For example, the VAR model of Youngju Kim and Hyunjoon Lim (2019) investigates the effectiveness of monetary policy by varying different degrees of households indebtedness. The analysis is based on quarterly data of 23 countries[28], from 1985 to 2015. They are chosen according to the availability of data, the geographical diversity and financial market development. To capture all the effects, macroeconomic variables, such as investment, consumption and real house prices are included in the econometric specification.

Furthermore, thought the same analysis, they also test the asymmetry in the cyclical response to a monetary policy shock by inserting additional interaction terms and dummy variables to identify a

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[27] Elena Loukoianova, Yu Ching Wong, and Ioana Hussiada, (2019), "Household Debt, Consumption, and Monetary Policy in Australia".

[28] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxemburg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

monetary policy position. In conclusion, the sample is split according to the predominant type of interest rate applied to mortgages. As defined in the latter section, the impact of a monetary policy is greater if implemented on an adjustable rate mortgage. Therefore the floating rate is added to the regression in order to test whether a higher share of loans with this feature may amplify the economic outcome on the financial sector.

The potential implication of the level of household debt on the effectiveness of monetary policy is controlled by this variable: $X_{i,t} = MA_4\left[HP_{cc}\left(\frac{HD}{GDP}\right)_{i,t-1}\right]$ [29]. It denotes the q-quarter moving average of lagged household debt-to-GDP ratio and is used as interaction term in the coming empirical regression. Household debt is considered in the form of percentage of GDP, since it allows a better evaluation of whether the macroeconomic aftermaths vary with exogenous structural features. After having estimated this parameter, which is considered as an exogeneous factor acting as a response from economic shocks, they continue with their empirical study. The linkage between monetary policies and the degree of households' debts is evaluated by comparing impulse response functions measured at the 20th and 80th percentiles of their respective distributions (Figure 13)[30]. It shows the impulse responses of each variable to a contractionary monetary shock. It is evident that the effects on investment and consumption are significantly large in high-debt state, which are found to have larger deficits with respect to low-debt states. Therefore, these findings support the theory that the impact of a monetary policy shock is considerably important for high-debt countries.

Hence, through this path how much output and inflation react to monetary policy are clearly captured. The extended equation can be expressed as follows:

$$X_{i,t} = \alpha_0 MA_4\left[HP_{cc}\left(\frac{HD}{GDP}\right)_{i,t-1}\right] + \alpha_1 D_{i,t} + \alpha_2 D_{i,t} MA_4\left[HP_{cc}\left(\frac{HD}{GDP}\right)_{i,t-1}\right].$$

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[29] t = 1, …, T and I = 1, …, N.

[30] The gray shaded area depicts the variables and the horizon on which sign restrictions are imposed. The impulse responses reported are evaluated at 80% and 20% of the gap ratios of households indebtedness. The variables taken into account are: real investment (RINV), real private consumption (RCON), the current account as a share of GDP (CA), the consumer price index (CPI), the real house prices (RHP), the real credit to private non-financial sector (Credit), nominal short-term interest rate (SIR), nominal long-term interest rate (LIR), real share price (Prices).

This formula considers another interaction term: $D_{i,t}$. It denotes a vector of three indicators, $D_{i,t} = \left[D_{i,t}^{exp}, D_{i,t}^{con}, D_{i,t}^{neu}\right]$ which describes the stance of policy: expansionary ($D_{i,t}^{exp}$), restrictive ($D_{i,t}^{con}$) or neutral ($D_{i,t}^{neu}$). Empirical evidences provided by this term show that the impulse response is considerably larger after the implementation of a restrictive monetary policy.

Figure 13: "Differences in Impulse Responses to a Monetary Policy Shock by the Degree of Household Indebtedness."
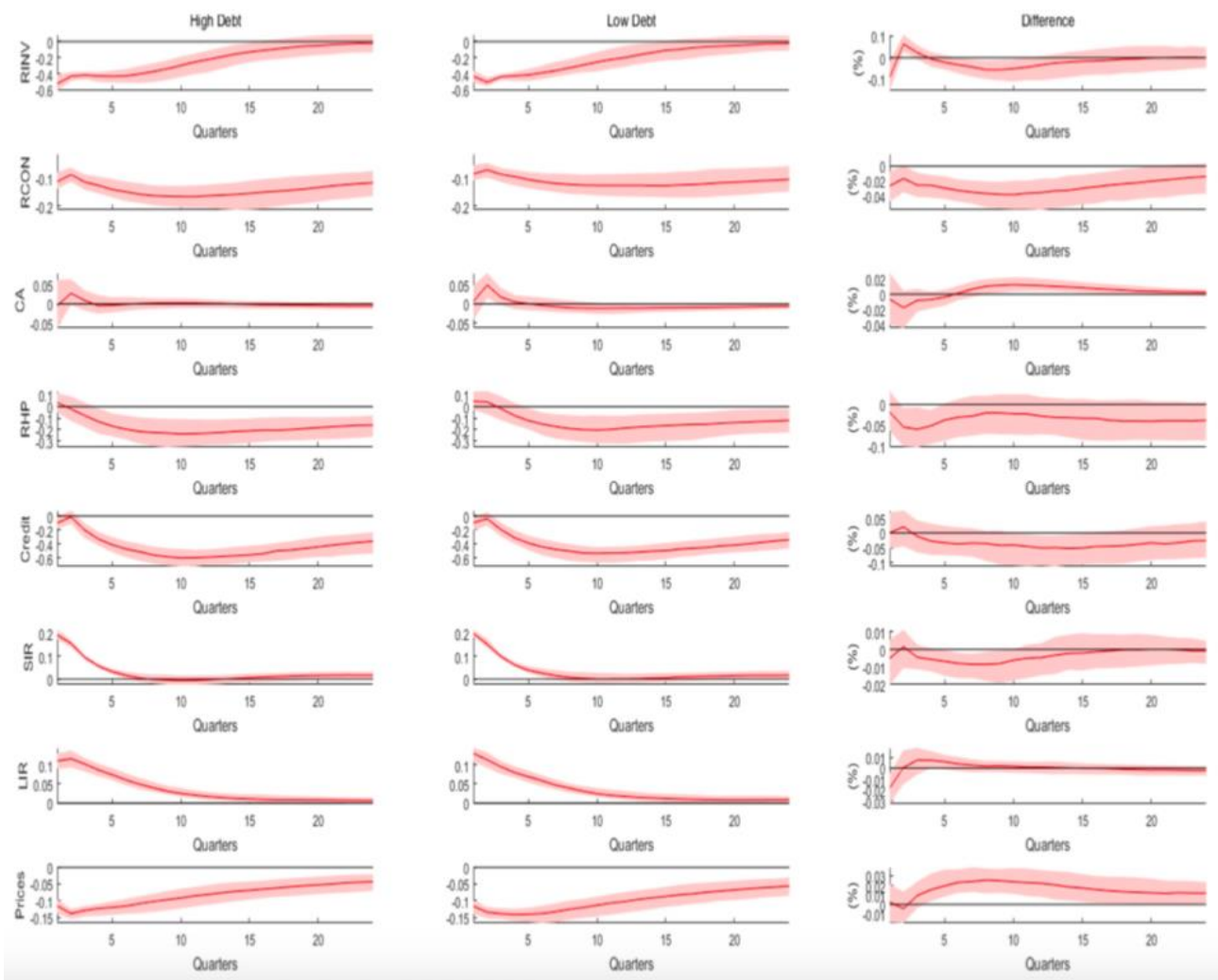
Source: Kim and Lim (2019)

Since this estimation also confirms the presence of asymmetry in the transmission of monetary policies, the study goes more in depth by including the ARM variable. It is defined as being the 70% of the whole mortgages market share, since it is predominant in six of the 23 economies being analyzed. The outcome of the analysis indicates that the higher the share of adjustable-rate debts, the

greater is the impact of a monetary shock on the real economy. Furthermore, a more interest result is found. Half of the cash flow effect of monetary policy is absorbed through adjustment of consumption for highly indebted ARM holders. For low and medium degree of indebtedness, the VAR analysis finds evidence too, obviously lower. Therefore, the final conclusion states that monetary policies, through the cash flow channel, will have stronger effects in a high-debt economy where the prevalence of ARMs is relevant.

CONCLUSIONS

Over the past decades, the monetary economics has been the most successful research area. Particularly, since the 2008 financial crisis, great part of scholars' effort has been put in understanding all the features of central bank's actions.

This thesis studies the transmission mechanisms of monetary policy and its relationship with households' debts.

The plurality of the channels, described at the beginning of the first chapter, operates mainly in two ways. Firstly, the monetary policy works by influencing prices, thus all components of the aggregate demand. Secondly, it affects the amount of credit allowed by financial institution, leaving households in a modified economic environment. The latter agents are defined as the key component of the monetary world, since all transmission methods have aftermaths in household's balance sheet, especially due to the alteration of the interest rate, which leads to a change in credit conditions. Therefore, through the presentation of the credit channel, the reader is provided with a precise overview on the households' economic shifts triggered by the implementation of a monetary policy.

The analysis of the composition of families' balance sheet gives evidence that houses are the most relevant asset. Mortgage debts are a central issue in modern economy, mostly due to their incredible rise started at the beginning of the last century. Indeed, the effects on households' consumption and spending depend on the structure of the housing market. For this reason, the thesis poses as its research question: "Are monetary policies more effective in fixed-rate mortgages or in adjusted ones?".

Trying to answer, it firstly provides the difference between FRMs and ARMs and secondly investigates on whether the impact of a monetary policy is higher. The study of related literature is extremely helpful. For example, Carriga el. al (2013), by focusing on both markets, finds more evidence on the strength of ARMs rather than FRMs. This result is confirmed also by Cloyne et. al (2018), in which after a monetary shock, variable interest rate mortgage's payments are found to experience a greater shift.

After having demonstrated that ARMs suffer major changes following a policy implementation, the thesis tries to give a deeper answer. By providing an empirical evidence, it founds that the effectiveness of monetary policies depends upon the distribution of households' debts. Specifically, the magnitude of responses of macroeconomic variables is greater in states where the concentration of mortgage loans is high. Therefore, the two results are put together and whether there is correlation between ARMs and high degree of debts is tested. The VAR analysis indicates that the higher the percentage of variable-rate mortgages, the greater is the impact of monetary policies on the real economy. Furthermore, the impact is higher the larger is the concentration of debts.

Therefore, the thesis concludes that the transmission of monetary policy is more powerful when households are highly indebted and have adjustable-rate contracts.

This result should be beneficial for policymakers, who need to consider as many factors as possible, in order to get the desired outcome and avoid unexpected consequences across countries.

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