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## INTRODUCTION

In today's increasingly globalized financial world, an effective awareness of the relationship between the financial system and the real economy requires a proper understanding of the nature of finance. Considering finance entails distinguishing things that are too often confused such as money and credit. Given the complexity of such a phenomenon, this dissertation tackles the crucial role that finance plays at both the national and international level by connecting to the post-Keynesian treatment of finance as reliant on money creation by traditional banks. The framework that is used to evaluate this treatment of finance is that of endogenous money. The idea of endogenous money is the cornerstone of post-Keynesian economics approach. According to the endogenous money theory, "commercial banks can create as much money as the economy needs, with the obvious assumption that banks deal with creditworthy borrowers." (Bougrine, 2020, p. 108). In this context, my emphasis is that money arises from the social relation between borrowers and lenders, therefore money is understood as a structure of credit/debt. In this system, money comes into existence once credit is issued and lends itself to destruction once debt is paid off. In a capitalist economy, such a relation is essentially between firms and banks. Money is injected into the economy by banks in the form of credit-loans to finance production and commerce, and withdrawn from it as those loans are paid back. This understanding of money, which is somebody's debt and somebody else's credit, led to the development of the theory of endogenous money (Bougrine, 2020).

The thesis consists of three independent chapters on the role of endogenous money on shadow banking and international finance.

- The first chapter: "Endogenous Money, Eurodollar and the Shadow Banking System"
- The second chapter: "The shadow banking system in a stock-flow consistent framework"
- The third chapter: "Repo lending and its implications for the central bank monetary policy and government debt issues"

In the first chapter (*Endogenous Money, Eurodollar, and the Shadow Banking System*), I examine the consequence of endogenous money for banks and shadow banks at both the national and international level by considering the importance that the Eurodollar market played in the emergence of shadow banking. The questions I ask in this chapter are: Has money always been endogenous? Where does the endogeneity of money come from? To begin with, I argue that post-Keynesian authors identify two approaches to these questions which they label, the 'evolutionary' and 'revolutionary' views. To take my position, I contrast the two views of the 'evolutionary' and 'revolutionary' positions on money endogeneity. According to evolutionary view, endogeneity of money depends on the historical period considered and presence of modern monetary institutions. Therefore, money only became endogenous once fully modern

institutions, especially central banks, were in place. In short, the existence of modern monetary institutions is the necessary condition for money to be endogenous. By contrast, the revolutionary view of endogenous money holds that money was always endogenous with or without central banks. The main point of this alternative view is that money is endogenous by its very nature, in the sense that its endogeneity is not tied to specific institutions and therefore to specific historical periods. To take my position in favour of this alternative view (as opposed to the evolutionary view), I delve into the nature of money to solidify the point that money was always endogenous irrespective of the historical period and specific institutional arrangements. In this context, Section 3 is my starting point to explore and answer the following questions: How did money begin? What is money? Why did money originate? From an analytical point of view, as opposed to historical, this section is divided by the 'money in orthodox theories' and 'money in heterodox theories.' This distinction is useful and allows me to address whether money has always been endogenous, or whether its endogeneity is the result of recent events, in particular of the evolutionist view of monetary developments. Accordingly, orthodox economic thinking on money with its metallic theory of money is based on the concept of a simple barter economy. According to the orthodox story of the origin of money, the invention of money is to reduce the transaction costs that arise in barter. Such conception of money in the orthodox theories is defined as a medium of exchange and that money is essentially a commodity used to lubricate the market mechanism. In other words, such perspective of money in orthodox theories conceptualizes money as a 'neutral veil' wherein money has no other role other than to overcome the inconvenience of barter and does no more than to lubricate the transaction process. Orthodox economic theoretical understanding of money is that both historical origins of money and the logical condition of its existence are explained as the result of economic exchange in the market that evolved because of individual utility maximization (Ingham, 2004).

In contrast to the orthodox thinking on money, the view taken here is that heterodox theories of money reject the conjecture that money evolved to overcome the efficiency of barter. Heterodox theories see money as a non-neutral 'force of production'. Therefore, money stemmed from the needs of production. Money in heterodox economic analysis is a necessary result of a debt relationship between a borrower and a lender. Therefore, the alternative view provides a framework for understanding money as a social relation of credit and debt in a money of account, fully consistent with the endogenous money theory. Then, in Section 4, the question of what precisely endogeneity of money means becomes my starting point to explain the notion of credit and money, and how they interact in the real economy. To begin with, I consider money to be endogenous when its quantity is demand-determined. In other words, endogeneity implies that the supply of money is not independent of the demand. From this standpoint, it must be clear that the creation of money is driven by the demand for it and money is created endogenously as a response to the need for money. Moreover, the working definition used for endogenous money in this study is: loans make deposits and deposits make reserves. Accord-

ing to the endogenous money approach, commercial banks can create as much money as the economy needs, with the obvious assumption that banks deal with creditworthy borrowers. In the next sections, I proceed to examine the consequence of endogenous money for banks and shadow banks at both the national and international level by considering the importance that the Eurodollar market played in the emergence of shadow banking.

The standard definition of Eurodollars are simply dollars on deposit in a bank or bank branch located outside the United States. The term Eurodollar is a misnomer. The prefix 'euro' has nothing to do with Euro or Europe. In addition to the standard definition of Eurodollars which is related to the offshore component of Eurodollars, I argue that Eurodollars are actually even more than simple dollar deposits. In this context, I focus on the short-term wholesale component of Eurodollar. Therefore, the Eurodollar system is offshore plus wholesale. "Short-term wholesale funding includes borrowing from other banks, short-term repos, or funding from affiliates outside the United States" (McCauley and McGuire, 2014, p. 90) The repurchase system (repos) used by banks to facilitate short-term funding played a key role in expanding the wholesale component of the Eurodollar market. This second component of the Eurodollar system is important for my analysis to connect the so-called shadow banking system.

While the existing literature focuses on shadow banking starting from the 1970s, I argue that the Eurodollar market was a predecessor of the modern shadow banking system. Indeed, the Eurodollar market was the driver behind cross-border financial flows in the 1950s and 1960s, and thus, it is the product of the Bretton Woods system. This market functioned through the deposit of Eurodollar, but its operation was outside of the monetary authority and traditional banking regulations. It is exactly this last feature – the unregulated nature –that makes the Eurodollar market the predecessor of the *modern* shadow banking system. Therefore, studying Eurodollar is an important contribution to international finance and the shadow banking system. This is an important phenomenon to be included in my analysis, which had been largely overlooked by previous attempts to understand the origin of shadow banking. We argue that it is in fact almost impossible to begin studying shadow banking without first exploring how the Eurodollar market came about in the 1950 and 1960s. This transformation of the financial system is a result of the changing nature of the Eurodollar market that has embedded itself in the shadow banking system, and the shadow banking system has effectively replaced the Eurodollar market as the global banking for cross-border financial flows. In this context, I argue that there are two important developments that led shadow banking system to replace the Eurodollar market. First, the role of banks in asset securitization. Second, borrowing from US money markets through repos and investing in asset-backed commercial papers originated by shadow banking in the US. Then, I analyze the crucial link between the Eurodollar market and the emergence of shadow banking. In what follows, I present detailed activities of shadow banking and explain the most recent financial innovations such as securitization and collateralized debt obligations. I argue that the cross-border linkages between commercial banks and

shadow banks play a prominent role in the context of the provision of international liquidity.

The global financial crisis erupted on August 9, 2007. This date is a pivotal moment because it is the day when the mortgage crisis went global. To begin with, the mortgage crisis or housing bubble before 2007 was the result of transformation of the financial system that started from the development of Eurodollars and the shadow banking system. In this regard, it is important to pay attention to the Eurodollar and its transformation into the banking system which played an incredibly important role in the global financial crisis. To reiterate, at the beginning of this transformation, a significant amount of these Eurodollar products (ABCPs, repos, MMFs) was taking place in the shadows. Therefore, the term 'shadow' is appropriate to describe the activities which occur in an unregulated banking system. The fact is, shadow banking did not come out of nowhere. It did not just spring up in the 2000s. It must be clear that it was a process that had started back in the period when Eurodollar came into existence. Starting from the period 1960s to the 2000s, the banking system underwent a dramatic transformation. The transformation of the banking system from "originate and hold" (what it used to be) to "originate and distribute" (what it has become) played an important role for the shadow banking. The consequence of endogenous money creation by banks enabled shadow banking to expand their credit intermediation in the financial system. Specifically, the securitization process played a distinctive role in the whole story. Commercial banks and their ability to create money endogenously in the act of lending and then packing their assets and selling them in the financial markets through securitization enabled a rapid expansion of the shadow banking system. Moreover, the rise of securitization led to the exponential growth in the repo market. The repo is essentially a collateralized loan. Therefore, collaterals became an important part of the financial system. For example, during the housing bubble, Mortgage-Backed Securities (MBSs) became an enormous portion of the repo market and the way in which banks were funding their balance sheets through the repo system using that as collateral. The repurchase system used by shadow banks to facilitate short-term funding played a key role in expanding the wholesale component of the Eurodollar market.

The rise of securitization and the need for collateral in the shadow banking system were crucial factors behind the mortgage and housing bubble before the global financial crisis. In such a system, expansion for the sake of expansion led ordinary households to take out mortgages for their housing investment. On the other hand, commercial banks were busy to package these mortgages and sell them to shadow banks through securitization. With securitization, these mortgages become complex financial products such as MBSs and tradable instruments within the financial system. Before the financial crisis, many of these securities were perceived very safe with no risk. The investors who invested in these securities did not know or did not consider that these securities were pool of mortgages, and a huge part of the structure were illiquid mortgages. Needless to say, all these complex structures were used as collateral in the repo market. And the repo market is a global market in which not only investors in the United

States were investing in these securities but also investors from outside the United States, especially European banks. However, this expansion for the sake of expansion was not endless. The housing bubble burst in the end, and inherent risks in the mortgage securities were revealed. August 9, 2007 was a trigger where everything started to freeze up. Investors such as Money Market Mutual Funds (MMMFs) who invested in these toxic securities (for example, MBSs the collateral backing the ABCPs) declined to value them because these investors realized their exposure to the subprime mortgages. Suddenly, asset-backed commercial paper (ABCP) which was one of the primary innovations of the shadow banking and the largest U.S. short-term debt instruments with more than 1.2 trillion outstanding, completely collapsed. Confidence crisis spread to banks, and they ceased to lend to each other. Therefore, in the interbank, there was a breakdown of trust to lend each other liquidity (credit crunch). Banks also ceased to extend credit to households and firms in this period. The subprime crisis that erupted in 2007 transmitted to the real economy due to the reduction of bank credit to households and firms. The conclusion of this analysis is that it was far beyond the ability of the Fed to control it on the way up because everything had been created decades before. There was also no response when the Fed started to increase the short-term interest rates in a recessionary sense to reduce the economic activity in the middle of 2000s. The effective rate did not follow the federal funds target rate. Monetary transmission mechanism was not working because there was no response to what the Fed was doing. There was a breakdown in the system (breakdown of interbank market), and it was working against the Federal Reserve monetary policy.

In the second chapter (*The shadow banking system in a stock-flow consistent framework*), I develop an SFC model that includes complex financial markets and important components of the shadow banking sector, which enables us to explore the relationship between core commercial banks and shadow banks. Building a complete financial sector and its interaction with the real sectors within an SFC framework allowed us to shed light on the role that shadow banking plays in the origination of credit. In Section 3, I identified two channels through which shadow banks find sources of funds to involve in credit intermediation process. Accordingly, I described two different sources of funds in the shadow banking system. The first source of funds of the shadow banking relies on commercial banks. Shadow banks require existing stock of loans previously made by commercial banks to obtain funds if they want to grant credit. I noted that while the funds made by commercial banks represent the first step of the credit creation, the agent (worker households) who obtains funds from the commercial bank needs to spend these funds so that shadow banks can enter the process of credit intermediation. Contrary to the first channel of funds in the shadow banking system, the sources of funds in the second channel does not rely on the first step in which commercial banks are the originators of funds. However, I showed that this does not mean that commercial banks do not play any role in the second channel. Commercial banks still play a crucial role in the entire shadow banking system. With the process of securitization, commercial banks involve in the business of pack-

aging and reselling loans that are sold to the shadow banks, namely Special Purpose Vehicles (SPVs). In turn, SPVs act as intermediaries in arm-length relation between commercial banks and shadow banks such as Broker and Dealers. This is exactly the place where I delved into the important role of broker and dealers in the second channel of shadow banking. Brokers and dealers take advantage of this second source of funds to invest in new assets and acquire additional funds to finance the expansion of their balance sheets. I showed that a simple activity of granting a loan to worker households and funding these loans on balance sheets previously conducted by commercial banks can be divided into a long chain of activities that involve several institutions and structures. In this regard, the consequence of endogenous money - loans create deposits - and financialization allowed worker households to benefit from an increasing amount (then securitized) of mortgages. In Section 4, I explained the motivation behind my modelling concept, that is based on post-Keynesian stock-flow consistent (PK-SFC) framework (Godley and Lavoie, 2007). I argue that SFC models are powerful tools if one is interested in a complete picture of an economy in which the real economy is depicted with complex modern financial sectors. In Section 5, I have presented the specific properties of the model. In this, I split the household sector into workers and rentiers, where rentiers allocate their wealth according to rates of return on assets, while workers borrow from banks to finance their house purchases. Inclusion of the housing sector represented an important feature of our model to capture the role of mortgages for financing the investment in housing. Furthermore, I explicitly take into account several pieces of the shadow banking system to capture the role played by the most recent financial institutions (e.g. Special Purpose Vehicles, Broker-Dealers and Money Market Mutual Funds). In Section 7, I presented the behavioural equations of the system in which we define the interaction and the financial transactions between sectors. Finally, in Section 8, I presented the results that I obtained from the simulation experiments.

In attempting to simulate the model, I concentrate on two exogenous developments. The first exogenous shock that I focused on is a change in the regulatory framework regarding ability of the commercial banking sector to securitize their assets. The second exogenous shock that I wanted to explore its effects is the role that credit rating agencies play in repo markets through their evaluation of the quality of private-label securities (MBSs). With respect to the first exogenous shock to securitization, the model shows that an increase in the degree of securitization, a process through which mortgages are packed into securities (MBSs) leads to an increase in the capital adequacy ratio of commercial banks. In turn, I showed that higher capital adequacy ratio for commercial banks improves their credit availability conditions. In consequence, with securitization of mortgages, the shadow banking system, notably the SPV sector as the main actor in the securitization process, increased the elasticity of the commercial banking sector by relaxing capital requirements (CAR). As selling mortgages to the SPV sector, commercial banking sector act more aggressively to lend while the SPV sector obtains more assets to issue securities backed by mortgages.

With respect to the second exogenous shock, the model shows that an increase in the price of securities (MBSs) increases the net worth of the broker-dealer sector, which allows an increase in leverage. Most importantly, to benefit from the rise in the price of MBSs, the broker-dealer sector must find new assets to invest in and acquire additional funds to finance the expansion of their balance sheets. With such result, we confirm the pro-cyclical behaviour of the broker-dealer sector. "Leverage is large when total assets are large" (Adrian and Shin, 2011, p. 2011). What is even more important here is that the margin of adjustment in the fluctuation of balance sheet of the broker-dealer sector is through collateralized borrowing transactions such as repo. In this way, changes in leverage of the broker-dealer sector are achieved through expansions and contractions in the collateralized borrowing.

In the third chapter (*Repo lending and its implications for the central bank monetary policy and government debt issues*), I examine the transformation of money markets over the past four decades and the implications of this transformation for the implementation of monetary policy and government debt issues. The unsecured (interbank) market collapsed due mostly to the financial crisis and there has been a clear shift from an unsecured to a secured (repo) market since the Global Financial Crisis. The repo market, where banks and shadow banks exchange short-term liquidity for high-quality liquid assets, has become an increasingly important component of the money markets. In other words, the repo market became more important than the unsecured interbank market. "Due to this shift, collateral supply has become an important factor in money market dynamics" (Sissoko, 2020, p.1 ). This transition from an unsecured core money market to a collateralized market has important implications for the central bank monetary policy implementation. I show that monetary policy implementation changed with the recent financial crisis. The question I ask then is: How did central banks adapt their policy framework to an evolving financial system? To provide an answer to this question, I explain the changes in monetary policy implementation by comparing the pre-crisis monetary policy framework with the post-crisis monetary policy framework. Accordingly, pre-crisis monetary policy implementation was conducted by setting a policy rate that determined US banks' cost of borrowing on an unsecured basis. Determination of this short-term rate (the federal funds rate) influences longer-term interest rates, which then affect the economic activity more generally. The federal reserve successfully implemented its monetary policy under the corridor system wherein the supply of reserves was limited. However, since the crisis, the federal funds market has stopped serving as an effective venue for implementing monetary policy. The chapter points out that it was a feature of the crisis that unsecured interbank lending collapsed and was replaced by the kinds of repurchase agreements or repos that banks already used with shadow banks pre-crisis. In this context, I connect this transition to the instability in the repo market. Despite the presence of collateral in repo markets, the contractual structure of such lending creates safety for the lenders –at the expense of the borrower – and the source of instability. The problem with repo markets is that they provide liquidity in normal times, but



this source of liquidity evaporates when prices are expected to fall. In other words, in times of stress, it is ever more costly to borrow, because the collateral that is being asked gets an ever lower value such that more good collateral is required in order to get a loan of a given amount. As there is more stress in the financial markets, borrowers, in order to keep their loans, are required to provide additional collateral. "During these liquidity events, repo borrowers realize losses. That is, the same contractual structure that empowers lenders also drains liquidity from the financial system" (Sissoko, 2019, p. 19).

In addition to this shift in the conduct of monetary policy, I show that central banks in major advanced economies started to introduce the so-called unconventional monetary policies such as lending facilities and large-scale asset purchase programmes. Before delving into the details of unconventional tools, the importance of this section for my analysis is that I wish to address two big macro phenomena: (1) governments have run big budget deficits, leading to a steep rise in government debt outstanding after the Crisis; and, (2) central banks purchased large quantities of government debt under the unconventional monetary policies. In so doing, as a contribution, I add the role of government debt for the financial system and connect monetary policy under the unconventional tools to repo markets.

In examining unconventional tools, I argue that the distinction between credit easing and quantitative easing (QE) is important to understand the different effects of these operations on the financial system and on the balance sheet of the central bank. Then, I focus on answering the following question: what is the difference between the open-market operations (buying or lending against government debt held by banks) previously used by the central banks and these new lending facilities through unconventional monetary policies? To provide an answer to this question, my starting point is to connect monetary policy to repo markets where shadow banking plays a critical role. To begin with, the main purpose of these lending facilities was to alleviate the stress in the funding markets. The most important difference is that with new lending facilities, central banks increased the range of collateral to be accepted and broadened the set of institutions (including shadow banks) that could participate in operations. This is an important point to recall the shift to the repo markets or towards unregulated form of finance and its repercussion for monetary policy implementation. In the pre-crisis, funding liquidity was available to the banks in the interbank market through the central banks' liquidity with their role as "Lender of Last Resort". In the post-crisis, central banks expanded its backstop not only to the banks through interbank market but also started to intervene in government bond markets via large-scale asset purchase programmes. To repeat, these purchases aimed to ease private financing by backstopping government bond market liquidity with "Market-maker of Last Resort". The reason behind this intervention in the repo market, a market that critically supports the liquidity of the bond market, is that central bank connected repo markets to financial stability. With (shadow) monetary financing, central banks organised around collateral aim to preserve the stability of financial system which is heavily reliant on liquid government

bonds. It follows that central banks recognised government debt issuance to be a money market phenomenon which needs to be managed actively. The conclusion of this central banks with their interventions in bonds market is to restore market liquidity. In my analysis, market liquidity referred to the ability of bond holders to buy and sell bonds without generating price volatility. Given that there is a shift to the repo markets and collateral plays a crucial role in such collateral-based financial systems, market liquidity matters.

Furthermore, to get a better understanding of central banks' increase holding of government bonds since the Crisis, it is important to consider government debt with a different perspective. Government debt is not what it used to be in the financial system. The shift to the repo markets and the essential role of collateral in the money markets brought in government debt as the cornerstone of the financial system. In the pre-crisis, shadow banking was a factory of collateral for the market liquidity and this was perceived safe with no risk up until the Crisis. In the post-crisis, the core money market was collateralized and government securities became important for the repo market since an increase in government debt (demand for safe) means an increase in collateral supply. From this perspective, the government became a collateral factory for the collateral-intensive financial system and government debt became a money market phenomenon. However, there are two consequences of government debt issuance for the financial system and central bank monetary policy operations. First, as it is well known, the issuance of government debt creates settlement pressures in the money market and the central bank needs to offset the effects of debt issuance. Second, newly issued government debt means new collateral in the money market that generates on-going funding pressures in the money market in addition to the settlement pressures that arise when the debt is first issued. The main conclusion is that this is an important difference from an environment in which the money market is unsecured and is not affected by government debt issues (or in other words, collateral supply).



# Chapter 1

## ENDOGENOUS MONEY, EURODOLLAR AND THE SHADOW BANKING SYSTEM\*

### ABSTRACT

This chapter discusses the origin of money and the post-Keynesian theory of money. The aim is to show that credit creation by banks is fully consistent with the money creation in the real world. I will then discuss the money creation by commercial banks and its consequences for banks and shadow banks at both national and international level. In the second part of this chapter, I will introduce the Eurodollar market consider that the Eurodollar system was shadow banking of the day. Therefore, this part also deals with the shadow banking system. It tells that it is crucial to begin with how the Eurodollar came about in the 1950s and 1960s in order to understand the shadow banking system and it explore the important role that the Eurodollar market and the shadow banking system played in the emergence of housing bubble in the 2000s. Besides looking at the historical record, building on the literature, I claim that the shadow banking system has effectively replaced the Eurodollar market as the global banking for cross-border financial flows. The chapter presents the main actors and activities of the shadow banking system and it explores the ties between commercial banks and shadow banks. The chapter also focuses on the the cross-border linkages between commercial banks and shadow banks play a prominent role in the provision of international liquidity. The existence of a link between endogenous money, Eurodollar, and shadow banking enables us to get a better understanding of the nature of international finance and its important role in the mechanics of cross-border financial flows.

**Keywords:** Endogenous Money, Credit, Eurodollar, Shadow banking, Securitization

### 1.1 Introduction

In a world of endogenous money, commercial banks play an important role in creating money ‘out of thin air’ by lending. More precisely, a commercial bank can create money by crediting the account of the borrower with the loan against an increase of its assets by the borrower’s obligation to repay the loan. In this, most money is created by commercial banks making new loans to household and firms. In this context, the decision to lend does not necessarily depend on prior savings that savers place with them. In other words, commercial banks are able to

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create loans (money) without having first accepted deposits, independent of savings. Thus, the quantity of money is endogenous, being determined by the demand for loans. The focus of this chapter is to examine the consequence of endogenous money for banks and shadow banks at both the national and international level by considering the importance that the Eurodollar market played in the emergence of shadow banking. I argue that the Eurodollar market was a predecessor of the *modern* shadow banking system. This market functioned through the deposit of Eurodollar, but its operation was outside of the monetary authority and traditional banking regulations. It is exactly this last feature – the unregulated nature – that makes the Eurodollar market the predecessor of the modern shadow banking system. Therefore, studying Eurodollar is an important contribution to the international finance and shadow banking system. This is an important phenomenon to be included in my analysis, which had been largely overlooked by previous attempts to understand the origin of shadow banking. I argue that it is in fact almost impossible to begin studying shadow banking without first exploring how the Eurodollar market came about in the 1950 and 1960s. This transformation of the financial system is a result of the changing nature of the Eurodollar market that has embedded itself in the shadow banking system, and the shadow banking system has effectively replaced the Eurodollar market as the global banking for cross-border financial flows.

It is argued that, in the late 1950s, the U.S. dollar began to extend its domain. [McCauley \(2020, p. 423\)](#) provides empirical evidence that nonbanks outside the U.S. carried \$12.7 trillion in dollar debt, or about 18% of the world's GDP in 2019 according to the Bank for International Settlements. The so-called shadow banking system played a major role in the Global Financial Crisis (GFC) of 2007-08. A related question is whether the U.S. dollar outside the U.S (Eurodollar) played a role in the emergence of the shadow banking system to create such an explosive growth in leverage and liquidity risk outside the purview of the Federal Reserve.

While the existing literature focuses on shadow banking starting from the 1970s, we argue that the Eurodollar market was a predecessor of the modern shadow banking system. Indeed, the Eurodollar market was the driver behind cross-border financial flows in the 1950s and 1960s, and thus, it is the product of the Bretton Woods system. This market functioned through the deposit of Eurodollar, but its operation was outside of the monetary authority and traditional banking regulations.

Before turning our attention to the Eurodollar market and the shadow banking system, we begin by describing the implications of endogenous money creation using a set of accounting entries. In doing so, we tackle banks as central actors in the financial system because of their ability to create new deposit money for households and firms. Then, we analyze the crucial link between the Eurodollar market and the emergence of shadow banking. We delve into the detailed activities of shadow banking and explain the most recent financial innovations such as securitization and collateralized debt obligations.

In addition to the Introduction, Section 2 starts with a brief overview of the history of en-

ogenous money view. In this section 2, I contrast the two views of the ‘evolutionary’ and ‘revolutionary’ positions on money endogeneity. Section 3 delves into the origins of money and presents money in both orthodox and heterodox theories. Section 4 describes endogenous money creation. Section 5 introduces Eurodollars. Section 6 identifies three views on the creation of Eurodollar. Section 7 reviews Eurodollar market and the role it played in the the Global Financial Crisis. Section 8 explains shadow banking system and its main activities namely, securitization and repo channel. Section 9 concludes.

## 1.2 A brief overview of the history of endogenous money view

It is argued that the origins of the endogenous money theory view go back to at least 150 years ago<sup>1</sup>. (Wray, 1990, p. 90) explains that ‘endogeneity implies that the supply of money is not independent of the demand.’ The debate between currency school and banking school as represented by Thomas Tooke and John Stuart Mill, whether the supply of money is exogenous (monetary authority - central bank - control the supply of money) or endogenous (the quantity of money is determined by the demand of money) is proper starting point to delve into the roots of endogenous monet theory. The debate took place during the period nineteenth century and centered on the ability of the Bank of England to control the supply of money and on the relation between supply of money and England’s external balance<sup>2</sup>. Wray (1990, p. 100) argues that the debate between these two schools is like the debate between monetarists and Keynesians, notably post-Keynesians. Wray (1990, p. 109) explains these similarities:

“The banking school is also ancestrally related to the endogenous money approach because it focuses on the use of credit to finance expenditure.” While advocates of banking school as predecessor of endogenous money view, clearly insisted on the endogeneity of the supply of money, currency school claimed that the supply of money was exogenous. In particular, the Banking School, like the endogenous money approach, rejects the simple notion that tight money policy would directly decrease the quantity of money (broadly defined), and rejects the notion that a decline in the quantity of money would lower prices. The quantity of money privately issued can never be ‘excessive’ because the needs of circulation determine how much money actually circulates. Any quantitative of private debt issue above this would increase ‘reflux’ and thereby destroy money. Tight money policy only operates indirectly through interest rates, and, by disrupting credit markets, through aggregate demand.”

From such deep analysis by Wray (1990), I believe that the debate between Banking School and Currency School in the nineteenth-century contributed to the development of endoge-

<sup>1</sup>See, for example, Wray (1990). In his book ‘Money and Credit in Capitalist Economies, The Endogenous Money Approach, L. Randall Wray devotes a full chapter on the brief overview of the history approach.

<sup>2</sup>Wray (1990) analyze the debate between banking school and currency school in more detail.

nous money view. For Keynes, one may argue that his conception of money as endogenous/exogenous vary when reading the *Treatise on Money and the General Theory*<sup>3</sup>. In this regard, the concept of money in his exposition in the *General Theory* leaves an ongoing debate about his assumption on the exogeneity of money. However, the importance of money in his ‘Theory of a Monetary Economy’ shows that he accepted the endogeneity of money although there may be some statements in contradiction with endogenous supply of money in the *General Theory*. Needless to say, money plays a crucial role in Keynes’ theory in which he criticizes the orthodox view of money as a medium of exchange and defines money as unit of account. Wray (1990, p. 123) points out that endogenous money combined with Keynes’ theories of effective demand and liquidity preference together provide the basis for a post-Keynesian general theory, which I will come to in a moment. Endogenous money is the cornerstone of post-Keynesian macroeconomics. For a long time, post-Keynesian authors like Kaldor (1970); Lavoie (1984, 1992); Minsky (1957); Moore (1988); Robinson (1956), emphasize that the supply of money is endogenous, determined by the demand of money. All these authors focus on the theory of endogenous money and point out that the money supply process is therefore critical for macroeconomic theory. To begin with, all these authors accept the endogenous money approach and criticize the monetarists’ claims on the quantity theory of money. They all emphasize that the demand for loans determines the supply of money, and banks and central bank determine the short-term interest rate, not the quantity of money (more on that below). Next, I will focus on answering two questions: (1) has money always been endogenous? (2) where does the endogeneity of money come from? To begin with, I argue that post-Keynesian authors identify two approaches to these questions which they label, the ‘evolutionary’ and ‘revolutionary’ views. To take my position, I contrast the two views of the ‘evolutionary’ and ‘revolutionary’ positions on money endogeneity.

### 1.2.1 Evolutionary view of endogeneous money

Lavoie (1996) turns explicitly to the question of What is the most important characteristic for money to be endogenous? In this regard, he makes a clear point to get a better understanding of endogenous money: ‘this endogeneity is not a matter of institution but rather one of logical necessity’. (Lavoie, 1996, p. 533). This point is important to criticize the evolutionary view put forth by Chick (1992) according to whom money is endogenous or exogenous with respect to the historical period considered. In this view, the banking system has developed continuously, and it is this development that leads Chick (1992) to identify five stages in the assessment of the endogenous nature of money in line with the evolution of banking system. Accordingly, in Stage 1, Chick (1992, p. 195) argues that:

“Banks are numerous and small, and geographically semi-isolated. Bank liabili-

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<sup>3</sup>See Moore (1988) for a discussion on the Keynes’s treatment of money that has different recognition in the *General Theory* comparing with the *Treatise*.

ties are not widely used as means of payment. Banks were thus chiefly repositories for savings; transactions balances did not circulate through them to any great extent. These features implied that an expansion of lending would entail a substantial loss of reserves even to the system as a whole. Banks are thus dependent on deposits for reserves and on reserves for lending capacity." Chick (1992, p. 195)

In Stage 1, This perspective views the use of money as a lubricant which facilitates the process of exchange. Banks are defined as intermediaries between those who want to save their deposits and those who wants to borrow these deposits. This role of banks is similar to that of banks functioning in mainstream economics. Their ability to lend money is reliant on the pre-existing funds. To lend, banks have to obtain funds that savers place with them. In short, in Stage 1, the dependence of banks on the existing sources of funds for lending capacity makes money exogenous as the direction of causality runs from deposits (savings) to loans.

In Stage 2, Chick (1992) continues to take a position in which she linked developments of banking system to a more improved banking system with respect to banks in Stage 1:

"The banking system has demonstrated its viability and won the public's confidence. The number of banks is fewer and the average size of banks is larger. Branching is developed, contributing to risk-spreading, reducing the loss of deposits after loan expansion, and contributing to the convenience of deposits as means of payment. The consolidation of clearing arrangements further encourages the shift to deposits as means of payment." Chick (1992)

There is no change in the lending activity of banks in Stage 2. Banks are still intermediaries and their ability to create money depends on the existing quantity of funds just as banks lend in Stage 1. However, there is now the recognition of their deposits as means of payment. This recognition of their deposits arises from the public's confidence. Furthermore, "bank deposit multiplier" is another development that Chick (1992) views in Stage 2. The ability of banking system to lend is now extended to multiple reserves. The 'bank deposit multiplier' is a relevant theory in which the banking system can now lend to a multiple of reserves, subject to a conventional or imposed reserve requirements; deposits are consequence.' (Chick, 1992, p. 195). In Stage 3, Chick (1992, p. 196) argues that:

"Interbank lending mechanisms develop, supplementing the call money mechanism and contributing to the efficient use of such reserves as are available. The possibilities open to individual banks even more closely approach those of the system as a whole. The causal mechanism of Stage 2 still applies; the 'bank deposit multiplier' acts even more rapidly." Chick (1992, p. 196)

The developments of banking system in Stage 3 do not differ very much from the previous stage (Stage 2). As she argues in the passage, the banks are still in the process through which



they act as merely intermediaries and operate with bank deposit multiplier. The focus of this stage is that the use of reserves between banks through interbank lending mechanism improves the way banks act in lending based on deposit multiplier. In Stage 4, [Chick \(1992, p. 196\)](#) explains:

“This Stage may have been approached simultaneously with Stage 3. The lender-of-last-resort principle is now firmly established in situations far short of the crisis in which [Bagehot \(1873\)](#) recommended its use. To put it another way, the central banks has fully accepted responsibility for the stability of the financial system.” [Chick \(1992, p. 196\)](#)

In Stage 4, there is an explicit presence of central bank within the banking system and its lender-of-last-resort principle is linked to the stability of the financial system. This stage tries to complete a system in which banks do not operate on their own way and manage a situation when things go bad. Central bank has a responsibility to use its lender-of-last-resort principle as [Bagehot \(1873\)](#) recommends in times of crisis. Importantly, in this stage, banks are constrained by the pre-existing funds when they expand their lending capacity. [Chick \(1992, p. 196\)](#) explains: ‘lending may now expand beyond the reserve capacity of the system’. What makes such transition from ‘bank deposit multiplier’ to lending beyond the scarcity of the reserves in the system is that central banks provide lending facilities so that banks can access reserves when they need to. However, such reserves through central bank lending facilities are not free and its price (penalty rate) is higher than market interest rates. This higher interest rate on the central bank reserves may affect the profitability of banks and hence, the threat of this may constraint their performance in lending. To repeat, the arrival of this stage and the developments of banking system transformed the behaviour of banks in lending as banks creates loans without relying on reserves in the system.

Stage 5 is the last stage in the development of the banking system in which [Chick \(1992, p. 198\)](#) argues that it differs from the previous stage (Stage 4) because banks actively manage both sides of their balance sheets:

Banks develop ‘liability management’. “Until this stage all adjustment, regardless of causal structure, took place on the asset side of banks’ balance sheets. Deposits, after Stage 1, were largely the passive consequence of bank lending policy subject to the availability of reserves. In Stage 5, banks have actively sought to attract to retain as deposits savings which might have been held in other financial institutions or as government or corporate institutions.” [Chick \(1992, p. 198\)](#)

In this last stage of the transformation of the banking system, according to [Chick \(1992\)](#), there is financial innovation that motivate banks to expand their capacity in lending. Banks are innovative and can expand the supply of credit in this last stage because such financial innovations enable banks to increase their lending capacity in case the central bank would not

fully accommodate the demand for bank reserves. Importantly, the result of both stages (Stage 4 – Stage 5) is that banks operate in an endogenous money world. In other words, to lend, banks no longer depend on deposits or central banks reserves. To conclude her analysis of banking system, [Chick \(1992\)](#) argued that the endogeneity or exogeneity of money is understood by considering the historical period. In this context, there are some periods that made banks to operate in an exogenous money world in which banks have to collect deposits from savers so that they can lend. However, there are periods that makes banks to function in an endogenous money world in which loans create deposits and deposits create reserves. Therefore, banks do not have to await deposits from savers to lend.

### 1.2.2 Revolutionary view of endogenous money

[Rochon and Rossi \(2013\)](#) notes that there are many post-Keynesian authors who confirm the evolutionary view of banking system put forth by [Chick \(1992\)](#). For example, [Minsky \(1991\)](#) argument on endogenous/exogenous money is consistent with the evolutionary banking system. According to [Minsky \(1991\)](#), endogenous/exogenous supply of money depends on economic condition and history. Therefore, in the money supply process, there can be periods for money to be supplied endogenously and there can be other periods for money to be largely exogenous. Like Minsky, another influential post-Keynesian author, ([Moore, 1991](#), p. 89) endorsed such view that money is endogenous or exogenous. [Rochon and Rossi \(2013](#), p. 216) cites that although all these authors share the same view on banking system and its role to create money endogenously, they neglect the point that [Lavoie \(1996\)](#) puts: ‘endogeneity is not a matter of institution but rather one of logical necessity’. Following [Lavoie \(1996\)](#), I believe that understanding the logic of endogenous money is crucial to accurately describe the banking system, irrespective of historical periods or developments of institutions. To solidify our view on the nature of endogenous money, in the next section I present an alternative view put forth by [Rochon and Rossi \(2013\)](#).

This alternative view is useful to understand the misconception of endogenous money put forth by [Chick \(1992\)](#). Recall that the main conclusion of [Chick \(1992\)](#) analysis is that one can define supply of money as endogenous/exogenous according to the historical time considered. This alternative view rejects that money can be considered endogenous or exogenous based on the historical period being considered. It is, therefore, a challenge on evolutionary view and it considers that money has always been an endogenous phenomenon. To solidify this point, I will delve into the nature of money and provide anthropological and archaeological evidence on the nature of endogenous money. In such context, I wish to explore and answer the following questions: how did money begin<sup>4</sup>? What is money? Why did money originate? Why is money used and what is the nature of money?

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<sup>4</sup>Philip [Grierson \(1977\)](#) is one of the most cited numismatists when studies dealing with coinage.

### 1.3 Origins of money

It is generally accepted that the first true coins date from c. 640 BC in the Near Eastern Kingdom of Lydia<sup>5</sup> (now Western Turkey). Two questions are important in this regard: (1) Why were the first coins in the Near Eastern Kingdom of Lydia struck? (2) Were coins the first money? According to Grierson (1977, p. 2), the question of ‘how did coinage begin?’ significantly differs from the question of ‘how did money begin?’ What is even more important for Grierson (1977, p. 6), as a numismatist, is that scholars mainly concern with the questions of ‘where’ and of ‘when’ in studying the origins of coinage, while they are more concerned with ‘how’ and ‘why’ when dealing with the origin of money. From a heterodox theory of money, the point on the nature of money made by Grierson (1977) makes a lot of sense and the distinction between money and coin is crucial to understand the nature of money.

Grierson (1977) argues that the evidence is against the earliest coins having been used to facilitate trade of some kind. The reason is that ‘money lies behind coinage’ (Grierson, 1977, p. 6). In other words, money predates the usage of coins: ‘behind the phenomenon of coin there is the phenomenon of money, the origin of which are not to be sought in the market but in a much earlier stage of communal development, when worth and wergild were interchangeable terms’ (Grierson, 1977, p. 33).

Here, Grierson suggests that the origin of money as a standard of value must be sought in institution such as wergeld<sup>6</sup>. For example, Goodhart (1998, p. 413) notes this view of Grierson (1977) on the role that wergeld played wherein predated money served as a medium of exchange: “One early crucial function of money, wergeld, was to set a tariff, whereby (the relatives of) the initial offender could recompense the damaged party. This practice<sup>7</sup> spread to other inter-personal relationships, (bridge-price, slaves), in some cases before formal markets and the use of money in trade arose.” (Ingham, 2004, p. 183)

For Hudson (2014, p. 99), it is the role played by the temples and palaces of Sumer (Southern Mesopotamia), the largest economic institutions of their day, during the third millennium BC. Importantly, Hudson (1992, 2004) gives an explicit importance to Mesopotamia, according to whom ‘it is this region that civilization’s early monetary and commercial institutions are to be traced’ for they shaped the practices of classical antiquity and, via Greece and Rome, the modern world.’ (Hudson, 2004, p. 101). According to Hudson (2004, p. 100), these institutions (temples and palaces) introduced money prices mainly for their own administrative purposes

<sup>5</sup>See, for example, Cook (1958) Ingham (2004). In his book: ‘The Nature of Money’, Geoffrey Ingham (2004, p. 98) argues that coinage starts from Near Eastern of Lydia and spread to Ionia and the Greek mainland.

<sup>6</sup>Grierson (1977) pays attention to the term wergeld that early societies used a scale for evaluating personal injuries when he studied The Origins of Money. See also Hudson (2004 p. 101) for a discussion wergild-type fine. Hudson (2004, p. 101) argues that “among the early social processes requiring monetary means of settlement other than for the market exchange of commodities were wergild-type fines for personal injury -hardly ‘commodity transactions’ in which broken noses and manslaughter were negotiated through the market place”

<sup>7</sup>For Ingham, wergild expressed two fundamental elements of social structure: (1) the utilitarian and (2) the moral evaluation of social roles and positions.

and the introduction of money ‘occurred more than two thousand years before the first coins were struck’. He argues that the early monetary units that these temples and palaces developed, was generated for administrative purposes: “the public institutions established their key monetary pivot by making the shekel-weight of silver (240 barley grains) equal in value to the monthly consumption unit, a ‘bushel’ of barley, the major commodity being disbursed” (Hudson, 2004, p. 111). At this point, there are two important results from the analysis of Hudson (2004): (1) Money first existed as a unit of account and (2) unit of account come before the coins. Wray (2012, p. 21) notes that:

“Hence, rather than the intrinsic value (or even the exchange value) of precious metal giving rise to the numeraire, the authorities established the monetary value of precious metal by setting it equal to the numeraire that was itself derived from the weight of monthly grain consumption unit. This leads quite readily to the view that unit of account was socially determined rather than the result of individual optimization to eliminate the necessity of a double coincidence of wants” (Wray, 2012, p. 21).

### 1.3.1 Money in orthodox theories

According to the orthodox story of the origins of money, the invention of money is to reduce the transactions cost that arise in barter. The conception of money in the orthodox theory of money is defined as a medium of exchange. For orthodox economists, money as a medium of exchange was essentially material and tangible that its creation is to ‘eliminate the necessity of double coincidence of wants which allows barter to take place.’ (Wray, 1990, p. 2). Therefore, the orthodox economic theoretical understanding of money is essentially barter exchange economy in which money is essentially a commodity and can be used to lubricate the market mechanism<sup>8</sup>. In this concept, money acts as a ‘neutral veil’ wherein Pigou argues: “Monetary facts ... have no direct significance for economic welfare. In this sense money clearly is a veil. It does not comprise any of the essentials of economic life.” Pigou (1949, p. 14).

For example, Paul A. Samuelson, an influential author from the standpoint of the orthodox theory presents his views on the origins of money in a section ‘Money: the lubricant of exchange’ of his Economics textbook as follows:

“If specialization permits people to concentrate on particular tasks, money then allows people trade their specialized outputs for the vast array of goods and services produced by others. What is money? Money is the means of payment or exchange that is, the currency and checks that we use when we buy things. But more than that, money is a lubricant that facilitates exchange ... just imagine how

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<sup>8</sup>See, for example, Smithin (2002); Wray (1990) for orthodox economic thinking on the origins of money. Smithin argues that money in orthodox economic theory act as a ‘neutral veil’ or ‘lubricant’ hence, money has no role in the economy and “it does not make a difference – rather, it merely enables us, according to Mill, to do more easily that which we could do without it.” Smithin (2002, p. 17)

complicated economic life would be if you had to barter goods for goods every time you wanted to buy a pizza or go to a concert. What services could you offer Sal's Pizza? And what about your education – what could you barter with your college for tuition that it needs? Because everyone accepts money as the medium of exchange, the need to match supplies and demand is enormously simplified.” (Samuelson, 1998, p. 32)

This perspective views the use of money as a lubricant which facilitates the process of exchange. To repeat, in the orthodox conception, money is a ‘neutral veil’ and it has no other role other than to overcome the ‘inconvenience of barter, and it does no more than lubricate the transaction process’.

Summing up, orthodox economic understanding of money is based on commodity-exchange theories just as Samuelson argued that ‘we should naturally follow the age of barter by the age of commodity money.’ For (Ingham, 2004, p. 19), ‘Both money’s historical origins and logical conditions of existence are explained as the outcome of economic exchange in the market that evolves as a result of individual utility maximization.

However, as I will discuss later, archaeological and historical record shows that there is no such evidence that money evolves ‘naturally’ out of barter as in orthodox theory of money. Hudson (2004, p. 100) argues that such economic thinking on the nature of money ‘has been imagined on the ground of abstract logic at odds with the archaeological and historical record.’

### 1.3.2 Money in heterodox theories

Wray (1990) points out that the treatment of money in orthodox theories as a simple barter with a monetary veil stems from the concentration on the use of money, rather than concentration on the source of money. In contrast to barter economy of orthodox theory and its focus on the use of money, there exists heterodox theories that concern with the sources of money, dealing with questions regarding what money does, how money is created, and how money enters an economic system.

Orthodox economists concentrate on money as neutral, or money as veil. Heterodox theories reject such neutrality of money and see money as a non-neutral ‘force of production’ (Minsky, 1986). For heterodox economists, money is a ‘social relation of credit and debt denominated in a money of account’. (Ingham, 2004, p. 12). In orthodox theories, money is tied to private exchange transactions. Heterodoxy argues that production starts with credit: “Money is introduced into the economy through the productive activities of the firms, as these activities generate income. There can be no money without production.” (Lavoie, 1984, p. 774).

Table 1.1 presents general distinctions between orthodox and heterodox thinking on money to illustrate the contrast between the two views. As I have previously discussed, orthodox economic analysis is based on the concept of a simple barter economy. Their analysis on the

TABLE 1.1: *Comparison of orthodox theories money and heterodox theories of money*

Features	Money in Orthodox Theories	Money in Heterodox Theories
The origins of money are to be found in	A hypothesized exchange society based on barter	A unit of account or the term in which debts are written
Development of money	From barter to commodity money to virtual money	All money is essentially credit
Money is ...	Exogenous	Endogenous and demand-led
Use of money	Lubricates the process of money exchange	Social relations (Credit/debt)
Concentration of money	'Neutral Veil'	'Non-neutral'
Money is tied to ...	Private exchange	Need of production
Market is ...	A place of barter	A place for earning the means of settling debt, i.e., money
Money is based on ...	Commodity	Credit
Monetary causality	Deposits make credits	Credits make deposits
Role of banks	Financial intermediaries between savers and borrowers	Money creators in the of lending
Role of government	Does not necessarily enter et all	The state or any other authority plays important role

origins of money, therefore, abstracts from historical and institutional details. By contrast, origins of money in heterodox theories are based on 'unit of account'. [Wray \(2012\)](#) argues that money develops as a unit of account, or, as the term in which debts are written, citing 'A money of account comes into existence along with debts ... Money proper in the full sense of the term can only exist in relation to a money of account' ([Keynes, 1971](#), p. 3). Another distinction between the two views is related to the development of money. Heterodox theories reject the sequence of orthodox understanding of money that its development begin, as usual, from barter to commodity money to virtual money. Heterodox theories claim that such sequence that starts from barter to commodity money, and then find their way to credit fiat money does not square with the historical record. For example, Charles Goodhart criticizes the sequence evolution of money in orthodox theory:

"Once the close link between money creation and taxation and of both to the underlying structure and stability of government is understood, the move from metallic currency to a fiat, paper, currency becomes much more straightforward to understand. Even if one should accept the M theory (Metallists) of the evolution of metallic coins as money, it is problematic to use that same theory in its pure form to explain why agents should suddenly all be willing to jump from using paper notes which were ultimately claims on precious metals (i.e., private or public sector bank notes convertible into such precious metals) to paper notes which were backed by no specific assets. Instead those notes were, and are, backed by the power of government (e.g., legal tender laws) and its ability to impose taxes payable and often only payable in that fiat currency (as well as legal tender for the discharge of all other payments within the country)" [Goodhart \(1998, p. 417\)](#).

One of the most important distinction between these two theories is whether supply of money is endogenous or exogenous. The notion that the supply of money is, or could be, carefully controlled is rejected by all heterodox theories of money. In contrast to the exogenous treatment of orthodox theories, the money supply is always endogenous and demand-determined in the heterodox conception of money. Heterodox theories consider money to be endogenous when its quantity is demand-determined. (More on that below). "The historically singular development of what post-Keynesian economists were to call the 'endogenous'

creation of money – that is to say, by the creation of money deposits through bank lending and transferable debt.” (Ingham, 2004). It is important to understand why endogenous money approach essentially differs from such economic thinking on money, which I will come in a moment.

## 1.4 Endogenous money creation

The question of what precisely endogeneity of money means is my starting point to explain money creation process in line with endogenous money view. To begin with, endogenous money means that money supply is demand-determined. According to (Wray, 1990, p. 90), endogeneity implies that the supply of money is not independent of the demand. In what follows, I consider money to be endogenous when its quantity is demand-determined. Therefore, when I introduce the concept of endogenous money, the stock of money taken is equal to the demand for money. From this standpoint, it must be clear that the creation of money is driven by the demand for it and money is created endogenously as a response to the need for money. (Bougrine, 2020). Moreover, the working definition used for endogenous money in this paper is the following: Loans make deposits and deposits make reserves<sup>9</sup>.

$$\text{Loans} > \text{Deposits} > \text{Reserves} \quad (1.1)$$

It is clear that (commercial) banks play a central role in endogenous money view due to their special role in creating money consistent with endogenous money. Banks create loans in the act of lending. In a world of endogenous money, commercial banks play an important role in creating money ‘out of thin air’ by lending. More precisely, a commercial bank can create money by crediting the account of the borrower with the loan against an increase of its assets by the borrower’s obligation to repay the loan. In this, most money is created by commercial banks making new loans to household and firms. Banks can ‘create’ money because they have such special ability in the financial system when they find creditworthy borrowers.

It follows that creditworthiness is the only constrain for banks to be able to create money. Once banks have confidence in the credibility of the borrowers, the (credit) money is about to appear in the economy. The process of money creation in the economy starts with banks when they find creditworthy borrowers. Therefore, credibility and trust are the key elements in the financial system, especially when banks are ready to create money. Consider that there is a creditworthy borrower who demands for money. It is the ability of the bank and logic of endogenous money to meet this demand for money by the creditworthy borrower. The beauty lies in the fact that the creation of money (or bank deposit) by banks is possible when a bank grants a loan. Hence, loan creates deposits.

Fundamentally, there is no need for pre-existing deposits in the bank so that a bank can

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<sup>9</sup>See for a similar definition adopted by Wray (2007) wherein he refers to Lavoie (1984) for such a proper definition.

grant a loan. This is the money-multiplier view of the orthodox theory in which central bank creates reserves and these reserves determine the amount of deposits (thus loans) in the economy. The money-multiplier view of central banking implies that central bank can determine the monetary base, which enables it to adjust the aggregate money supply through a multiplier effect determined primarily by required-reserve ratio. (Fullwiler, 2017).

$$\mathbf{Reserves > Deposits > Loans} \quad (1.2)$$

The main assumption of the money multiplier view of central banking is that an increase in the central bank reserves allows deposit creation by banks. When central bank reserves decrease, given the fixed money multiplier, the level of bank deposits (or bank lending) will decrease as well. Post-Keynesian economists, have long argued that the money-multiplier adopted in the textbooks is false. They have long argued that banks create loans when they lend. As Lavoie (2019a, p. 94) repeatedly points out, advocates of endogenous money completely rejects the money-multiplier view of central banking and argues reverse causation argument (*loans > deposits > reserves*) is fully consistent with endogenous money creation.

This sharp distinction between neoclassical model of banking and banking model in endogenous money view is also recognized by some policy economists in central banks. For example, McLeay et al. from Bank of England explains:

“Another common misconception is that the central bank determines the quantity of loans and deposits in the economy by controlling the quantity of central bank money — the so-called ‘money multiplier’ approach. In that view, central banks implement monetary policy by choosing a quantity of reserves. And, because there is assumed to be a constant ratio of broad money to base money, these reserves are then ‘multiplied up’ to a much greater change in bank loans and deposits. For the theory to hold, the amount of reserves must be a binding constraint on lending, and the central bank must directly determine the amount of reserves. While the money multiplier theory can be a useful way of money and banking in economic textbooks, it is not an accurate description of how money is created in reality” McLeay et al. (2014, p. 15)

One can find a similar statement from Bundesbank (2017) paper that explains the reality of how money is created differs from the description found in some economic textbooks: ‘A bank’s ability to grant loans and create money has nothing to do with whether it already has excess reserves or deposits at its disposal’ (Deutsche (Bundesbank, 2017, p. 13).

“What the stylised example of the creation of money shows particularly clearly is that a bank can grant loans without any prior inflows of customer deposits. In fact, book money is created as a result of an accounting entry: when a bank grants a loan, it posts the associated credit entry for the customer as a sight deposit by



the latter and therefore as a liability on the liability side of its own balance sheet. This refutes a popular misconception that banks act simply as intermediaries at the time of lending – ie that banks can only grant loans using funds placed with them previously as deposits by other customers” ([Bundesbank, 2017](#), p. 17).

It is the decision of granting a loan when simultaneously deposits come into existence. As a matter of accounting, the bank then expands its balance sheet on both sides when it grants a loan, creating a loan asset and a deposit liability on their balance sheet. As Sheard points out that “it is credit “creation” -credit is created literally out of thin air (or with the stroke of a keyboard). The loan is not created out of deposits: Loans create deposits, not the other way around” [Sheard \(2013, p. 7\)](#).

This logic of endogenous money, or of loans create deposits, is the crucial point to understand how money is created in the economy. Once this point, and the fact that banks do not need deposits to create loans are clear, one can inquire the role of central bank in the economy, especially in money creation. The example above is a starting point of how money creation occurs and depends on key factors such as credibility and trust between banks as creditors and households or firms as debtors. We have already explained how credit creation happens, that is, how banks lend in the economy. However, we have not assigned any role to the central bank when banks create credit money. But how do central banks fit in the money creation process?

To answer this question, we begin with the role of central bank reserves or reserve balances for banks. To correctly understand the role of central bank reserves for banks, two questions need to be answered: When do banks hold central bank reserves and why do banks need central bank reserves? Above all, banks do not need to reserve for their lending decision, meaning credit creation happens by banks without the presence of central bank reserves in the first place. In the real world, banks need reserves after granting loans. Simply put, banks look for reserves after they grant loans. As for the second question, following [Fullwiler \(2017, p.51\)](#), the reason why banks hold reserve balances is only for two purposes. First, banks need central bank reserves to settle payments. Second, banks hold reserve balances to meet reserve requirements (where applicable). What is important here is that these two purposes of reserve balances held by banks have nothing to do with credit creation by banks. In other words, reserve balances are not there to constrain credit creation by banks. More importantly, banks do not need central bank reserves in the first place because loans are not created out of reserves.

To get a better understanding of what determines the level of central bank reserves, Table 1.2 shows a very simplified balance sheet of the central bank<sup>10</sup>. Note, however, that the composition of a central banks’ balance sheet would be more complicated in the real world since my representation here abstracts many other possible minor items. However, I believe this simple presentation of the central banks’ balance sheet enables us to show how reserves enter the

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<sup>10</sup>For example, [Bindseil \(2004a\)](#) devotes a whole chapter to explain a more detailed balance sheet composition of a central bank.

TABLE 1.2: *A simplified central bank balance sheet*

Assets	Liabilities
Assets (A)	Reserves (R)
	Banknotes in Circulation (C)
	Government Deposits (GD)

credit creation picture<sup>11</sup>

Considering the composition of a central bank's balance sheet (Table 1.2), we can write down the central bank balance sheet identity:

$$Assets(A) = Reserves(R) + Banknotes\ in\ circulation(C) + Government\ Deposits(GD)$$

In flow terms or in change terms, we can re-write this identity:

$$\Delta A = \Delta R + \Delta C + \Delta GD$$

To leave Reserves on the left-hand side of this equation, we arrange the identity:

$$\Delta R = \Delta A - \Delta C - \Delta GD$$

From the final version of this identity, it is evident that the level of reserves ( $\Delta R$ ) at aggregate level depends on its assets ( $\Delta A$ ), the amount of cash or banknotes ( $\Delta C$ ), and government deposits ( $\Delta GD$ ) at the central bank. Therefore, changes in reserves only occur in three ways: (1) when there is increase or decrease in its assets, (2) when the public increase or decrease the amount of banknotes (cash) it wants to hold, (3) when the government reduces or increases its deposits at the central bank. More importantly, there is nothing related to the credit creation by banks that can change the amount of reserves at the aggregate level since credit creation or bank lending does not appear in the central bank identity. The point is to explore the link between credit creation by bank and later, their need for reserves arising from reserve requirement (set by the central bank) and demand for banknotes the public wants to hold. Banks acquire additional reserve balances once they have extended credit, that is, they look for reserves later. Fullwiler (2017, p. 52) points out 'the act of extending credit and the act acquiring reserve balances to meet reserve requirements should be quite separate.' In short, the quantity of reserves that a bank looks for comes after a bank extends credit. The reserve balances do not constrain the ability of the bank to create credit. The existence of creditworthy borrowers is a sufficient reason for a bank to extend credit. Now we turn to the balance sheet mechanics of a bank to understand how bank lending fits in central bank reserves.

Table 1.3 shows the aggregate balance sheet of the banking system. As was the case with the balance sheet of the central bank (Table 2), the composition of the banking system we present is

<sup>11</sup>Here I follow a similar representation of balance sheet mechanics of a central bank following Sheard (2013).

TABLE 1.3: *Banking system's simplified balance sheet*

Assets	Liabilities
Reserves (R)	Deposits (D)
Loans (L)	Equity (E)
Bond holdings (B)	

highly simplified, abstracting many other possible minor items. Nonetheless, this description with such simplified composition enables us to understand how credit creation by banks is related to central bank reserves. Again, we start with writing down the identity linking the two sides of the balance sheet of the aggregate banking system:

$$\text{Reserves}(R) + \text{Loans}(L) + \text{Bond holdings}(B) = \text{Deposits}(D) + \text{Equity}(E)$$

In flow terms or in change terms, we can re-write this identity:

$$\Delta R + \Delta L + \Delta B = \Delta D + \Delta E$$

From this, credit creation in the banking system happens in this way:

$$\Delta L = \Delta D, \quad \text{with} \quad \Delta R = \Delta B = \Delta E = 0$$

Credit creation by banking system happens simultaneously when banks make loans, creating deposits in the process ( $\Delta L = \Delta D$ ). It is this ability that banking system can create credit out of thin air. There is no need of existing reserves or that of deposits in the banking system to extend credit. The direction of causality run from loans to deposits, not the other way around. We have already emphasized that the banks look for reserves after granting loans. On the one hand, consider, there is a certain amount of reserve requirements that banks need to hold against their deposits. As I have previously explained, banks create deposits when they make loans. From this point, we can infer that central bank reserves are not constraint for banks to create deposits in the first place. They look for reserves after creating deposit because a certain amount of central bank reserves needs to be held against them (if reserve requirements applicable). At this point, the central bank enters the picture because it supplies reserves. On the other hand, households or firms (creditworthy borrowers) in our example, borrows money in order to spend. It is their decision to hold that bank money in the form of cash (banknotes) or leave it in the form of bank deposit at the banking system. In the real world, borrowers can decide some combination of both cash (banknotes) and deposit at the banking system. This is how most money is created and then circulated in the economy.

Recall that banknotes or cash from the balance sheet of bank (Table 1.2) is one of the three factors that can determine the level of reserves. The public's decision to hold some part of their newly obtained deposits as cash determine the amount of reserves at the central bank. As banknotes are sourced from reserves, reserves go down (at the central central bank) because there

is demand for banknotes by the public. From these examples above, it must be clear that demand for central bank reserves follows credit creation by banks when the reserve requirements are applicable or when borrowers take the money they borrowed out of the bank and part or all of the money remains in cash, rather than being re-deposited in the banking system (Sheard, 2013, p. 7).

The fact that these two purposes for bank to hold reserves do not have any direct link between loans and reserves reiterates the point that banks do not need reserves to make loans in the first place. Moreover, one can ask where deposits come from. By answering this question, we go beyond the standard textbook description of bank lending and that of money creation according to which banks first collect funds (deposits) and then lend these deposits out. In the real world, banks do not function in such a passive role as intermediary between savers and borrowers. Instead, they can lend without collecting deposits that savers place with them. All they need is to find creditworthy borrowers. Essentially, deposits come from only two places. First, as explained above, when banks make loans, that is, new lending creates deposits. Second, deposits come from government deficit. In addition to bank lending, governments also create deposits when they run budget deficit because they are putting more money into the public's bank accounts than they are taking out. These net flow create new deposits in the banking system, which has its counterpart on the bank's balance sheet as an increase in reserves Sheard (2013, p. 8):

$$\Delta D = \Delta R, \quad \text{when} \quad \Delta L = \Delta B = \Delta E = 0$$

And on the central bank's balance sheet,

$$\Delta R = -\Delta GD, \quad \text{when} \quad \Delta A = \Delta BK = 0,$$

To sum up: lending decision by banks is independent of deposits; and reserves are not there to constrain their lending ability. Whenever government runs deficit, it leads to deposit creation. Finally, and most importantly for the role of endogenous money approach within current macroeconomics, bank create deposits in the act of lending and look for reserves later.

## 1.5 The Eurodollar System: Shadow banking in the day

### 1.5.1 Definition

The standard definition of Eurodollars are simply dollars on deposit in a bank or bank branch located outside the United States. The term Eurodollar is a misnomer. The prefix 'euro' has nothing to do with Euro or Europe. Eurodollar got their name originally from US dollar deposits in European banks. Today, however, they are dollar deposits in any bank outside of the US. Therefore, dollar deposits in London and in other European markets are all part of the Eurodollar market. In short, dollar deposits are called Eurodollars regardless of where they are

deposited. Let us take an example<sup>12</sup> to get a better understanding of this standard definition of Eurodollars. If a U.S. investor transfers its \$1 million of deposits from a New York bank to the London branch of a U.S. bank, to the London branch of any French, German, or any other foreign bank and receives in exchange a deposit denominated in dollar, then the Eurodollar deposits come into existence.

In addition to the standard definition of Eurodollars which is related to the offshore component of Eurodollars, I argue that Eurodollars are actually even more than simple dollar deposits. In this context, I focus on the short-term wholesale component of Eurodollar. Therefore, the Eurodollar system is offshore plus wholesale. Short-term wholesale funding includes borrowing from other banks, short-term repos, or funding from affiliates outside the United States (McCauley and McGuire, 2014, p. 90). The repurchase system (repos) used by banks to facilitate short-term funding played a key role in expanding the wholesale component of the Eurodollar market. This second component of the Eurodollar system is important for my analysis to connect the so-called shadow banking system. Importantly, the second component of Eurodollar which includes the transformation of banking system away from of “originate and hold” (what it used to be) toward “originate and distribute” (what it has become) into a wholesale model that repurchase agreements or repo plays an important role.

To begin, dollar-denominated deposits that are not subject to U.S. banking system and its regulations and they were held almost exclusively in Europe. Hence, the name Eurodollars. “Regardless, of where they are held, such deposits are referred to as Eurodollars” (Goodfriend, 1998, p. 48). “The term Eurodollar dates from an earlier period when the market was primarily located in Europe” (Goodfriend, 1981). Eurodollars are a sum of deposit liabilities denominated in US dollar outside of the US banking system. In short, they are credit in dollars held outside the United States, not in the physical form of metal or paper money, but in the form of deposits in banks that are not subject to US jurisdiction, even though they operate in dollars. These banks are known as ‘Eurobanks’ Put differently, these banks were beyond the local banks and Eurobanks (or shadow banks) represents global banking.

I have started to define the Eurodollar as dollar denominated deposits that are placed with banks outside the United States. In addition to this, there is also an active market for Eurodollar deposits inside the United States. U.S. branches of foreign banks and U.S depository institutions form an important part of Eurodollar in the U.S. (Cipriani and Gouny, 2015). The U.S. branches of foreign banks played two roles in the Eurodollar market. Firstly, they indirectly borrow in Eurodollars by accepting Eurodollar deposits through offshore branches. Secondly, “U.S. branches of foreign banks transfer the fund (Eurodollar deposits) onshore mostly through their Caribbean branches (usually located in the Bahamas and the Cayman Islands). Foreign branches of U.S banks have played an important role in the Eurodollar market and have contributed to the bidding up of interest rates on deposits and increasing deposit volume” (Gibson,

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<sup>12</sup>It follows example given by (Stigum and Crescenzi, 2007)

1971, p.650).

Eurocurrency is another term that need not to have any relation to Europe or Euro. A Eurocurrency is a deposit liability issued by or *held by* a bank located in a given monetary jurisdiction but denominated in the unit of account of another country's currency. In other words, Eurocurrency refers to bank deposits denominated in a foreign currency. The term Eurocurrency is actually broader, meaning that Eurocurrency markets include Eurodollars. In addition, Eurobanks, despite the name, are simply a source of funding in the interbank market and today are located all over the world. In this context, offshore currency deposit is a broad term to generalize the Eurodollar including other externally held currencies. For example, "a Eurosterling deposit is a pound-denominated bank deposit held outside Britain. Likewise, Euroyen deposit is a Japanese yen deposit held outside Japan" (Levi, 2009, p.501).

In order to understand its origins, we refer to Leimone (1968)'s description that "such deposits are created when a British exporter holding a dollar deposit at a bank in the United States transfers it to a foreign bank or branch of U.S. bank in London" Leimone (1968). In this example, the British exporter receives a dollar claim on the London bank (usually as a time deposit). Then, the London bank becomes the owner of the original dollar deposit at the bank in the U.S. In this case, the original dollar deposits remain in the American banking system while a Eurodollar deposit is created outside the United States. To sum up, the term Eurocurrency markets refer to international markets for short-term wholesale bank deposits and loans. Eurocurrency market includes Eurodollar market and historically, Eurodollars accounted for the largest share of Eurocurrencies. It is not surprising that the emergence of these markets (mainly in Western Europe) coincides with the emergence of Eurodollar in the late 1950s. Therefore, Eurodollars were the first and more prominent example of Eurocurrency<sup>13</sup>. Battilossi (2020, p. 270) defines Eurocurrencies: 'a form of bank money: an unsecured short-term bank debt denominated in a currency (for instance, US dollars) but issued by banks operating offshore, in a geographical location or a legal space situated outside of the jurisdiction of the national authorities presiding over that currency (for instance, the Federal Reserve) – in order to fund short-term loans.'

### **A brief history of Eurodollar**

Next, I will address the following question: where did Eurodollar actually come from? Its is generally argued that the story of Eurodollar starts in 1944. This date coincides that the US dollar was chosen to serve as the world reserve currency at the Bretton Woods Conference. For De Cecco (1987, p. 184) the Eurodollar is the product of the Bretton Woods System:

The international payments system was rebuilt after the Second World War as a fixed exchange-rate system, where parity changes were permitted but only as a

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<sup>13</sup>See, for example, Stefano Battilossi (2020) for the link between the origins of Eurodollar and Eurocurrencies.

result of what the IMF Articles of Agreement defined as 'fundamental disequilibria'. At the insistence of the United States, no institution was created to perform the rôle of world central bank (against the better advice of H. D. White and J. M. Keynes). As a result the dollar was, in practice, ratified as world reserve currency and almost sole supplier of international liquidity. (De Cecco, 1987, p. 184-185)

In order to better appreciate and understand what Eurodollars is telling us about today's International Monetary System, we need to go through its origin and its history. It is important to have an idea on how the Eurodollar mechanism actually works in today's increasingly globalized financial world. In doing so, we make sense of how the Eurodollar system evolved during the period of its development and why it broke during the 2007-08 Financial Crisis. We anticipate that the presence of Eurodollar is realized in the 1950s and 1960s although we do not know when and where the Eurodollar first came into existence. (Kindleberger, 1970) argues that *the Euro-dollar or short-term money market came into being more or less by accident*. Helleiner (1994) argues that the Euromarket created in the late 1950s and based primarily in London in the 1960s allowed international financial operations to be conducted relatively freely transactions could be made in nonlocal currencies, especially dollars, completely free of regulations. However, there is evidence that Russians and the Chinese kept dollar deposits abroad for fear of seizure during the Cold War. In this regard, the common supposition is that the term Eurodollar originates by the fact that Soviet Union was placing US dollar deposits in European banks. Historically, the pound sterling was playing an important role in world trade. Therefore, trade among British Commonwealth and Commonwealth nations as well as with the rest of the world was denominated in British currency (Stigum and Crescenzi, 2007, p.219). Furthermore, one of the most important factors behind the rise of Eurodollar and its rapid development after Cold War is the weakness of the British currency, pound sterling in the 1950s. In the 1960s, the rapid growth of international trade was largely financed in dollars and consequently there was a need for dollar loans and deposit services (Karlick, 1977, p.3). Besides this, the regulatory arbitrage consequences played an important role in understanding the rapid expansion of the Eurodollar Market in the 1960s (Dufey and Giddy, 1994; McKinnon et al., 1977). At that time, Regulation Q was another factor that contributed to the rise of the Eurodollar Market. Particularly, the main reason behind the rapid growth of the Eurodollar market in 1968 and 1969 is the credit crunch in the U.S and Regulations Q ceilings on the interest rates.

### **Development of Eurodollar**

Battilossi (2020) identifies four main stages to analyze the long-term pattern of the development of the Eurodollar market: "A long phase of almost uninterrupted expansion (with a temporary setback between 1982 and 1985), which brought the size of the market to 4 trillion dollars (expressed in real terms as 2010 USD) in 1990; a mild and short-lived reversal in the early 1990s; a new phase of exponential growth between the mid-1990s and 2007, when its size almost tripled

in real terms, approaching 11 trillion dollars; and a sharp and long-lasting contraction during and after the Great Financial Crisis of 2007 – 2009, when the market failed to recover its pre-crisis level.” (Battilossi, 2020, p. 279).

According to Schenk (1998), the Midland’s exchange deals were the first stage of the financial innovation which produced the Eurodollar market in late 1950s. As Catherine Schenk explains:

“These deposits were not traditional deposits of clients related to their business with the bank. The foreign exchange was not deposited with Midland’s American accounts or converted through the foreign exchange reserves. The deposits were attracted to solve specific liquidity constraints and in response to profitable investment opportunities in the U.K. In this sense they were a new product for the bank’s clients and represented a new source of funds for investment.” (Schenk, 1998, p. 226)

Figure 1.1 is taken from Murau et al. (2020, p. 7). From figure 1.1, we can see the evolution of the US monetary area and the emergence of Eurodollar deposits. Accordingly, offshore USD creation started with the emergence of the Eurodollar market in the 1960: among other things, “‘Roundtrip transactions’ from the US via London back to the US became the dominant feature He and McCauley (2012), turning the Eurodollar market into what it effectively is today: an extension of the US onshore interbank market, the Fed Funds market, into the offshore segment” (Murau et al., 2020, p. 8). In the 1970s, there was a widespread use of Eurodollar which coincided with the collapse of Bretton Woods system.

In the 1980s, shadow banking replaced the Eurodollar by introducing new instruments such as ABCPs through a more complex process – securitization – in the shadows. The period between the 1980s and 2000s was the period we observe the explosive growth of shadow banking activities that led to the financial crisis of 2007-08. Finally, the period after the crisis, the Federal Reserve (the Fed) established temporary emergency USD swap lined with 14 partnering central banks in the 2010s: this put partnering central banks de facto in the position to create offshore USD as public money on their own balance sheets and lend it on to banks domiciled in their jurisdiction (Baba et al., 2009, p. 209) cited in Murau et al. (2020, p. 9).

## Volume

Schenk (1998) argues that it was not easy to understand an exact amount of Eurodollar when the Eurodollar market started to grow dramatically in the late 1950s. She also notes that BIS published the size of the market in 1963 for the first time. Therefore, the origin of Eurodollar market is less understood due to the unknown size of the market. In fact, “the tremendous growth of the Eurodollar market in the last two decades has largely resulted from efforts to move dollar financial intermediation outside the regulatory jurisdiction of the United States”



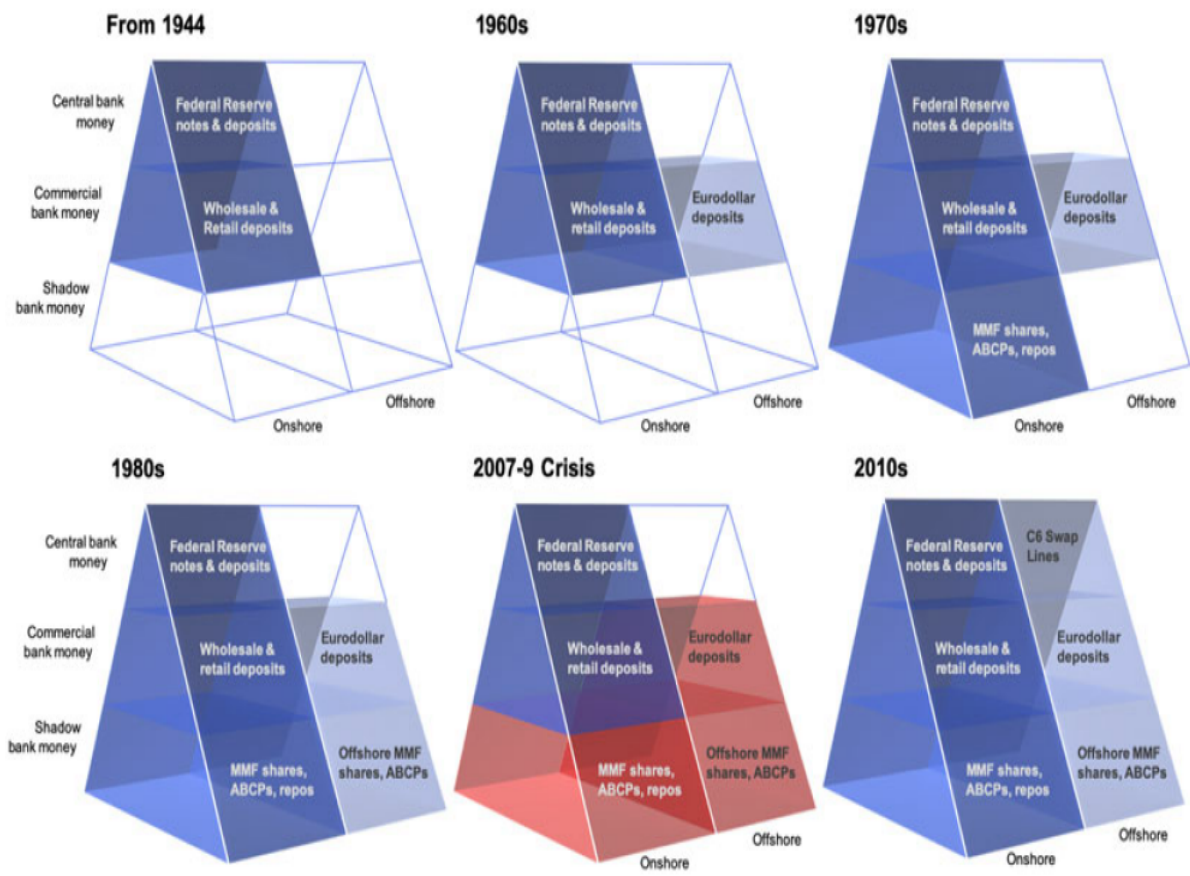


FIGURE 1.1: *The development of Eurodollar deposits*

(Goodfriend, 1998, p. 57). Moreover, BIS (2009) reported that the foreign offshore claims of global banks in all jurisdictions grew from \$10 in 2000 to \$34 trillion by the end of 2007.

The question one could ask is why the Eurodollar system is so important. In response, Awrey (2017) argues that a significant proportion of international trade outside the United States is invoiced and settled in US dollars. This trade is often supported by short-term US dollar trade financing provided by foreign banks and other financial institutions. In effect, Eurodollar market is essentially international, and it represents a key source of liquidity for the global economy. In this context, the dollar is central to all our view<sup>14</sup>. Given its origins, the tendency is obvious to view the Eurodollar market purely as a creature of regulatory arbitrage Awrey (2017, p.950). Therefore, the particular focus on US dollar is motivated by its crucial role in international trade and thus, in global liquidity. In fact, US dollar is the world reserve currency. Hence, the volume of dollars in the world determines the volume of world money Kindleberger (1970, p.225).

## 1.6 Views on the creation of Eurodollar

The existing literature on Eurodollars can be studied through three different views: The first strand of literature explains Eurodollar through the conventional theory in which they apply the concept of deposit-multiplier to explain the creation of Eurodollars (See, for example, Fowler (2014); Friedman (1971); Stigum and Crescenzi (2007)). For example, Friedman (1971) demonstrates the multiplier mechanism through which the Eurodollar system had created 30 billion dollars outside of the US banking system. Battilossi (2020, p. 274) argues that ‘the key intuition of the multiplier approach, as formulated by Friedman (1971) and formalized by Fra-tianni (1972), was that the Eurodollar system operated similarly to a domestic banking system of fractional reserves. As a consequence, the expansion of the market was understood as the consequence of a credit or deposit multiplier mechanism, through which a portion of the liquid funds lent by banks to nonbank borrowers was redeposited with other banks in the system, thus generating an endogenous process of credit creation.’ By contrast, Battilossi (2020, p. 274) argues that there is an alternative approach – portfolio approach – which was based on the financial intermediation theory adopted by Gurley, Shaw, and Tobin among others). In this alternative approach, there is nothing new because banks and other financial institutions (they are defined as merely intermediaries) ‘compete for loanable funds with securities markets by issuing liabilities and purchasing claims from borrower’. According to Battilossi (2020, p. 274), the portfolio approach is useful to capture two important features of Eurodollars. Accordingly, there is ‘near money’ which is feature does not mean that it is means of payment but rather as closed substitutes for money held in anticipation of payments. Second, their use was imperfect substitutes of domestic deposits and money market assets.

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<sup>14</sup>Awrey (2017) argues its origins and summarize the key role that Eurodollar plays in the international financial system.

The second strand of literature argues that Eurodollars are created endogenously as Eurobanks increase their cross-border financial credits. (See, for example, [Gabor and Vestergaard \(2016\)](#); [Murau et al. \(2020\)](#); [Pozsar \(2014\)](#)). The authors in the second strand adopt a Money View<sup>15</sup> of Perry Mehrling and address the creation of Eurodollars via a swap of IOU. According to this view, Eurobanks as globally active banks and shadow banks, can issue their liabilities (increasingly short-term) to take positions in assets like traditional commercial banks. Therefore, they do not see any difference between regulated commercial banks (US banking system) within a monetary jurisdiction and largely unregulated shadow banks in the global space when they create dollars. In this sense, shadow Eurobanks can create money endogenously when their foreign currency denominated liabilities are accepted. The ability of these Eurobanks to create money is not constrained by the existing funds to intermediate between savers and borrowers. Credit-debt relationship between Eurobanks make creation of foreign currency denominated (for example US Dollar) assets possible. In this view, Eurobanks fund their position in dollar assets in practically the same way that shadow banks do. Accordingly, shadow banks and commercial banks create credit when they expand their balance sheets to simultaneously extend a loan and issue credit money as their liability ([Murau et al., 2020](#)). They note that within a monetary area, three types of public and private financial institutions (central, commercial, and shadow banks) create such credit money.

According to this view, besides traditional banks and their special role in the financial system in issuing their own liabilities, shadow banking issue short-term debt-instruments to take positions in long-term riskier assets and thus they provide liquidity. This is the point in which this view put forward the liquidity creation by shadow banking. [Michell \(2017\)](#) distinguish two different views when he analyzes shadow banking system according to which there is market view and money view. While the market view of shadow banking focuses on activities and financial transaction within the system and emphasizes such activities as dealing in securitized debt, advocates of the money view see shadow banking as an analogue to the traditional banking system because shadow banking functions such as maturity and credit transformation. To put it simply, according to this view, shadow banking liabilities are the new form of money such as Repos, ABCPs and MMMF shares ([Claessens et al., 2012](#); [Gabor, 2016](#); [Gorton and Metrick, 2012](#); [Mehrling, 2011](#); [Murau, 2017, 2018](#); [Pozsar, 2013, 2014](#); [Ricks, 2016](#)). The issuance of such liabilities implies swapping IOUs of different maturities. For example, Special purpose vehicles swap ABCPs as short term IOUs against ABSs as longer-term IOUs on their balance sheet. For the advocates of this view, there are three criteria for such liabilities to be considered a new form of money. First, from the supply side perspective, it must be short-term liability

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<sup>15</sup>See for example, [Gabor and Vestergaard \(2016\)](#); [Mehrling \(2012\)](#); [Murau et al. \(2020\)](#); [Pozsar \(2014\)](#) for their analysis via Money View perspective. According to these authors, money view is market-based credit theory of money and assumes that money creation can be created privately outside the public monetary realm and that private actors are able to develop new form of credit money. The advocates of the Money View argues that shadow banking system can create short-term IOUs, just as traditional commercial banks issue their own liabilities. They describe this process by which non-bank financial institutions involve credit creation via a swap of IOUs.

that has been created on the basis of a swap of IOUs different maturities. Second, from a demand side perspective, this new form of money is held as an asset by agent who considers it cash. Third, this short-term liability constitutes a promise to pay higher ranking money to be converted on demand at par. The idea of hierarchy of money plays role here in which hierarchy of money highlights distinction between credit and money. Therefore, money does not look equally in the monetary system and ‘always and everywhere, monetary systems are hierarchical’. (Mehrling, 2012, p.394). As argued by Michell (2017), such short-term liabilities-issued by shadow banking system are not used as means of payment and final settlements among these institutions can be only made using central bank reserves. Knowing that these liabilities of shadow banking system cannot be used as means of payment or final settlement, what does make a liability of shadow banking to be considered a new form of money? Advocates of this view would definitely answer in a way that these liabilities by shadow banking system constitute a promise to trade at par on demand in which it is convertible instantaneously or almost instantaneously convertible on demand at par. However, as will be discussed below, this is not sufficient condition for shadow banking liabilities to be considered a new form of money. For Jo Michell, “while convertibility of these liabilities at par into ‘money proper’ plays an important role in making deposits acceptable as means of payment, it is necessary but not sufficient condition.” (Michell, 2017, p.12). From this perspective, these liabilities of shadow banking cannot be considered money. (Michell, 2017)

“As shadow banking is geared towards circumventing banking regulations in various way, it is hard to find specific definitions that apply broadly across space and time. Whether or not a given institution is a shadow bank may easily be subject to contestation, and also some commercial banks act as shadow banks.” (Murau et al., 2020). The difference between such private liabilities created outside the regulated banking system (Eurobanks) and regulated banking system liabilities is that private liabilities of Eurobanks whose par convertibility is not guaranteed by the state, will be more or less ‘acceptable’ promises to pay, depending on the confidence of economic agents on their par convertibility to final means of payment (See, for example, (Murau et al., 2020).

In summary, according to this second strand of literature which is based on Money View (Perry Mehrling, Zoltan Pozsar and Stefan Murau), when foreign banks (Eurobanks) finance positions in assets by short-term debt, they create Eurodollars.

In attempting to study money creation by the Eurodollars (in the shadow), I consider the special role of traditional banking and its main role for the financial system and thereby the modern economy as whole. This role of traditional banks is crucial for understanding of monetary production economy. From a post-Keynesian point of view, I will analyze both traditional banks and shadow banks to define differences and connections between them. This will lead me to define peculiar role of traditional bank and characterize the shadow banks and their reliance on the traditional banks. According to endogenous money, (commercial) banks create

deposits *ex nihilo* whenever they want to grant loans. Considering a financial system where banks and shadow banks exist as two different part of the system, it is important to understand when shadow banks enter the picture in this financial world. For my analysis, it is worth noting that one should track once a loan initially originated at the beginning. For Unger, "loan origination in our first step to analyze shadow banking sector, is understood here as the provision of a means of payment to the agent taking out a loan." (Unger, 2016, p. 6) As will be discuss below, loan origination by traditional banks become beginning of everything before delving into shadow banks' activities. As Unger pointed out that "it is not till then that the shadow banking sector enters the picture." Unger (2016, p. 7) Therefore, our analysis will tirelessly give importance to this role of traditional banks and their crucial role of making loan so that shadow banks will finally enter our description of the financial system.

Let us suppose that a non-financial agent needs deposit in order to purchase a house. Depiction of our financial system begins when a bank grants loan to the non-financial agent that wanted to buy a house. It is the logic of the endogenous money: whenever a bank makes loan it simultaneously creates matching deposit, expanding balance sheet on both sides. It is obvious that the bank is able to make the loan without pre-existing deposit that savers place with them before making a loan. To continue depicting our financial system and understand what happens after money is created *ex nihilo* by bank, we suppose that non-financial agent transfer its deposits to another non-financial agent to purchase the house. Now, the link between the ultimate borrower of the deposit (non-financial agent) and the ultimate lender (wealthy agent) comes to the picture. Note that the newly created deposits handed out a wealthy agent who is the owner the house and has a bank account in the same bank. Now, the wealthy agent has deposits in his bank account and he decided to transfer its deposit to invest in MMMF in exchange for money-claims. Here is the point we are about name the shadow banking sector for its part because the wealthy agent transforms the deposits into a shadow bank liability such as money market fund shares. Considering balance sheet of wealthy agent and MMMF, while the bank account of wealth agent debited, MMMF possess the previously created deposit in the traditional banking system and therefore its balance sheet is credited. As a result of the deposit transfer in exchange for MMMF shares, deposits entered shadow banking system so that shadow banks are able to intermediate credit in the financial system. Imagine MMMFs involves in short-term reverse repo transaction with a broker-dealer. As argued before, a repo is secured by collateral. Considering two sides of repo, namely cash and collateral, MMMF transfers its deposits to the broker-dealer against a security as collateral. Note that collateral has been called the cash of shadow banking. The deposit in the system now transferred to the broker-dealer so that the deposits can be intermediated with another institution. Broker-dealer can lend its deposit to a special purpose vehicle in exchange for ABS. Special purpose vehicle plays a central role in securitization process in which previously created loans are pooled and packaged to be sold. What is important for the depiction of the financial system that it began

with creation of loan by bank, expanding its balance sheet on both side and it ends when special purpose vehicle decided to buy loans from the bank, shrinking its balance sheet on both side. With this last move, the loans created for non-financial agent to buy a house at the beginning are moved off the balance sheet and deposit created in the first step is destroyed. (Bouguelli, 2019, p.15)

To summarize the financial system we depicted in which there is consequences of endogenous money for shadow banking and its activities for the rest of the financial system, two points are important to underline. First, it is obvious that shadow banking entered the picture and played role in providing liquidity by intermediating after deposit is created ex nihilo by traditional banking system. Second, shadow banking and its intermediary role in the financial system came into play when non-financial agent decided to transfer its existing deposits in exchange for shadow banking liabilities. Importantly, while traditional banks are able issue their own liabilities, shadow banking is not able to issue its own liability. Botta et al. (2015, p.207) rightly point out that banks create money but the remaining financial sectors such as shadow banks do not.

However, this study differs from the existing literature and provides an alternative view on the creation of Eurodollars in the shadows. My approach to credit creation within the Eurodollar system (or in the shadow banking system) rejects the two views that deals with credit creation in the Eurodollar system. Unlike first view and its focus on banks as mere intermediaries of loanable funds, I consider the special role of commercial banks (or regulated traditional banks) and their ability to create credit in the act of lending. In this regard, I examine both commercial banks and shadow banks to define the key differences and connection between them. This allows to define peculiar role of commercial banks and characterize the shadow banks and their reliance on traditional banks. This alternative view makes a sharp distinction between regulated commercial banks and unregulated shadow banks within the financial system. My view on credit creation in the shadows (Eurodollar and shadow banking system) is important to understand the consequences of endogenous money for banks and shadow banks because shadow banks come into existence once a loan initially originated by commercial banks. In short, the key difference between the regular commercial banks and the unregulated shadow banks is this: Commercial banks create credit (loans) by creating deposits, whereas shadow banks transform these existing assets and liabilities and refinance them in a longer and more complex intermediation chain rather than being able to create new ones.

In this regard, I study Eurodollar market as a predecessor of the modern shadow banking system. This market functioned through the Eurodollar deposits at the beginning, but its operation was outside of the monetary authority and traditional banking regulations. It is this alternative view that I wish to contribute to the international finance. This alternative view is important to understand the consequences of endogenous money for banks and shadow bank at both the national and international level. In this context, I will highlight the period of 1950s

when the dollar got out of the United States in line with Catherina Schenk, according to whom it was in 1957 that the first dollar account appeared in London. The aim is to show that this was sort of the ‘shadow banking’ in the day. In doing so, the development of Eurodollar plays an important role to get a better understanding of how shadow banking system came into existence.

As will be seen in the next section, there are two important developments that led shadow banking system to replace the Eurodollar market. First, the role of banks in asset securitization. Second, borrowing from US money markets through repos and investing in asset-backed commercial papers originated by the shadow banking in the USA. Then, we analyze the crucial link between the Eurodollar market and the emergence of shadow banking. We delve into the detailed activities of shadow banking and explain the most recent financial innovations such as securitization and collateralized debt obligations. We argue that the cross-border linkages between commercial banks and shadow banks play a prominent role in the context of the provision of international liquidity.

## 1.7 The Eurodollar Market and the Great Financial Crisis

I have described the evolution of financial system and what happened over time, especially from the late 1950s forward. Particularly in the 70s, 80s and 90s forward, the shadow banking system has effectively replaced the Eurodollar market. This transformation of the financial system was a result of the changing nature of the Eurodollar market has embedded itself in the shadow banking system, and the shadow banking system has effectively replaced the Eurodollar market. Importantly, what I have described here is almost an entire massive complete system, monetary that existed offshore component of Eurodollar or wholesale component (repo) Eurodollar in the shadows. All these happened outside of regulatory authority. There was no monetary and government authority over the conduct of this system. It was essentially a self-contained system in which the instability was inherent as in Minsky’s financial instability hypothesis: ‘stability ultimately destabilizing because of the asset price and credit excesses that stability begets’ (([McCulley et al., 2009](#), p. 261). In July 2007, the Citigroup chief executive told Financial Times: ‘when the music stops, in terms of liquidity, things will be complicated, but as long as the music is playing, you’ve got to get up and dance, we’re still dancing<sup>16</sup>.’ Shortly after, in August 2007, there was a particular failure so, the music stopped and the system broke down leading into the great financial crisis. Put differently, what goes up must come down.

Starting in June 2004<sup>17</sup>, the Federal Reserve was going to tighten monetary policy through the federal funds rate, which was supposed to transition into the rest of the credit system. The reason behind this is that the Fed understood the banking system just went off the rails after

<sup>16</sup>In July 2007, Charles Prince, the Citigroup chief executive, told the Financial Times.

<sup>17</sup>For the role of the Eurodollar in the financial crisis, I find it very useful to listen to ‘Eurodollar University’ (Season 1 and Season 2) on the MACROVoices where Erik Townsend and Jeffrey Snider ([Snider and Townsend, 2018](#)) discuss many details of the Eurodollar market.

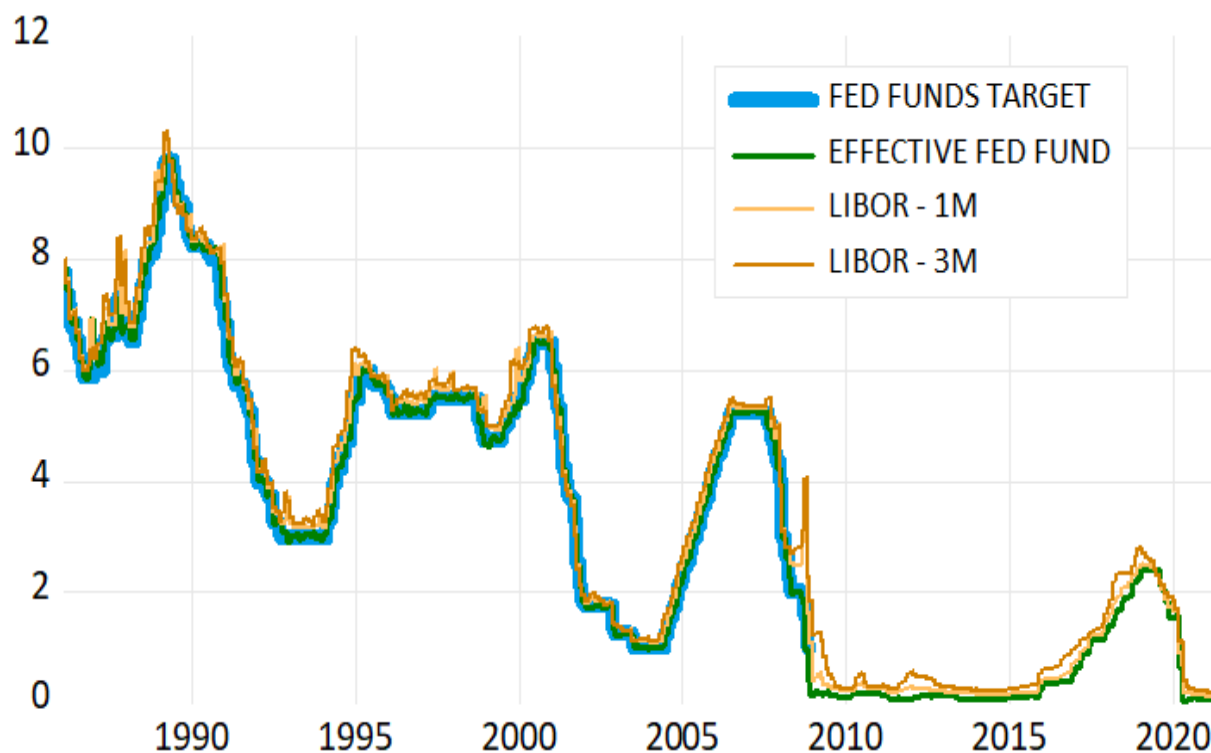


FIGURE 1.2: Eurodollar and US money markets

rise of securitization and of repo market.

I have previously noted that the system started with Eurodollar and then found itself into the shadows. That is to say, the system evolved outside of the Federal Reserve. So, the Federal Reserve was not there during the evolution of the system, especially when the Eurodollars in the shadows took off on itself. I will show that it was far beyond the ability of the Fed to control it on the way up because everything had been created decades before and there was no response to what the Fed was doing in the middle of 2000.

Figure 1.2 shows the evolution of federal funds rate and LIBOR rates (London Interbank Bid and Offer Rates) during the last 40 years. LIBOR refers to the rate at which major international banks are willing to offer term Eurodollar deposits to each other. In this way, the LIBOR is the Eurodollar market's average interest rate (Goodfriend (1998); Stigum and Crescenzi (2007)). For example, Stigum and Crescenzi (2007, p. 240) argue that the LIBOR rate played an important role for the 'true global cost of money'. The main characteristic of both LIBOR rates (1 month and 3 month) and the overnight federal funds rate is that during this period they stay connected to each other. In other words, the LIBOR rates tracked the federal funds rate whenever the federal reserve changes its monetary policy stance through changes in the overnight federal funds rate. Such characteristics can be observed in Figure 1.2. It is important to note that while the federal reserves determine the cost of short-term funding, Eurodollar is really a global



currency and hence LIBOR rates determine the cost of global money. For the Fed, the idea of controlling the short-term interest rate in the money markets was believed to be a universal one (Snider and Townsend, 2018).

What is the most important factor that led to the causal relationship between the US money markets and global markets? The answer is the arbitrage or interest parity. It is the role of arbitrage that led LIBOR rates, which are these Eurodollar-related rates, to stay connected with the federal funds rate and they operated in a monolithic way during this period. The idea behind arbitrage is simple. Consider that at some point there is a rise in the LIBOR rate. Given that the cost of money in the global markets is high now, a bank, instead of borrowing from the Eurodollar market at an increased price, could take advantage of the US money market. Our bank in the example will then borrow the federal funds in New York, then transfer these funds into London where it will lend them into Eurodollars.

In order for arbitrage to work in the global markets, money dealers have to be stationed both inside the US (to take advantage of the federal funds) and offshore (to take advantage of Eurodollar-related rates, or LIBOR rates). The reason arbitrage worked well up until a permanent break in 2007 (I will come to this in a moment) was the presence of money-dealing banks operating in both places, taking advantage of the differential interest rates on a global basis. Battilossi (2020, p. 292) points out that it is the consensus view that ‘the main determinant of both premium and covariance lies in the increasing efficiency of the mechanism of international arbitrage.’ Next, I will show the timelines to approach the break in the Eurodollar system, that is August 9, 2007. To begin, let us start with the Federal Reserve in the mid 2000s. Figure 1.3 shows that the Fed started to increase the federal funds rate from 1% in June 2004 to 5.25% in June 2006. Note that the Fed changes (basis points) the federal funds rate by 25 basis points. Remember how the Fed implements its monetary policy primarily by influencing the federal funds rate, the interest rate that banks charge each other for loans in the US overnight money market for reserves. Determination of this short-term rate (the federal funds rate) influences long-term interest rates, which ultimately affect the cost of borrowing for business and customers. Therefore, the Federal had thought that this rate influences the economic activity. While the Fed reduces (ease) the interest rate (the federal funds rate) to stimulate the economy in an expansionary sense, it raises (tight) the interest rate to increase the economic activity.

Figure 1.3 focuses on the period between 2000 and 2007. Consider that this period is critical for the housing bubble before the financial crisis. The Fed raised the rates during this period to influence the economic activity in a restrictive sense. In the middle 2000s, the Fed aggressively increased the federal funds rate by 17 rate hikes. The Fed brought the rate from 1% to 5.25%. The federal funds rate was very low at that time. All the way up, this rate reached 5.25% by the middle of 2006. Doing 17 rate hikes (each one of those was 25 basis points), was supposed to be a tremendous amount of tightening during this period. In Figure 1.3 we see what happens with the Eurodollar rates when the Fed was aggressively tightening.

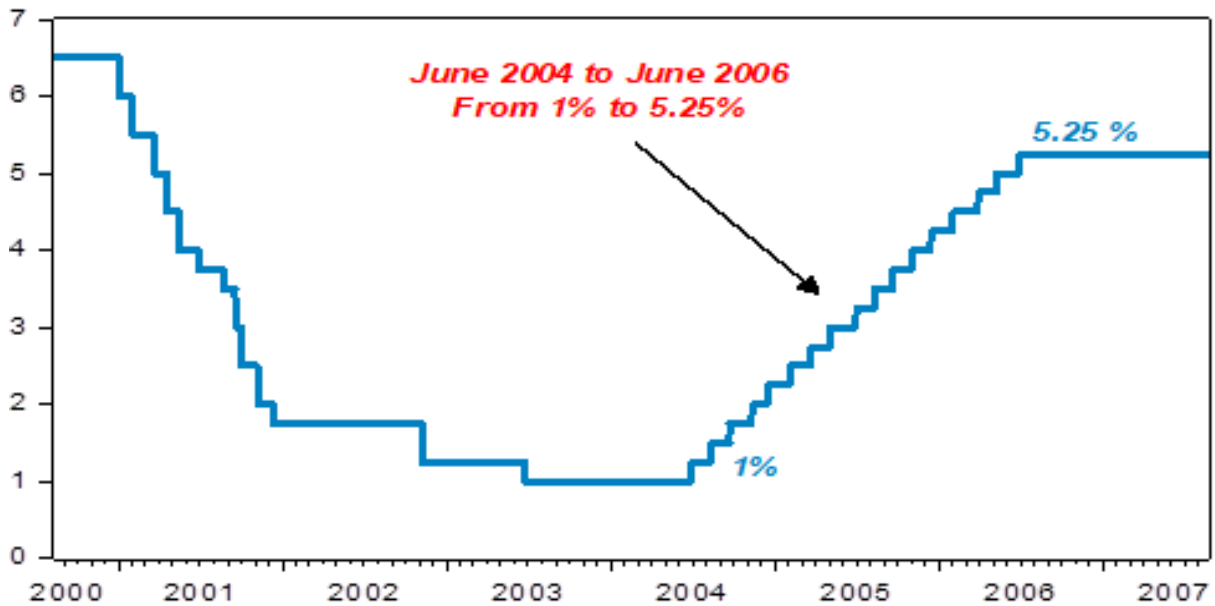


FIGURE 1.3: The raised the federal funds target rate 17 times between June 2004 to June 2006

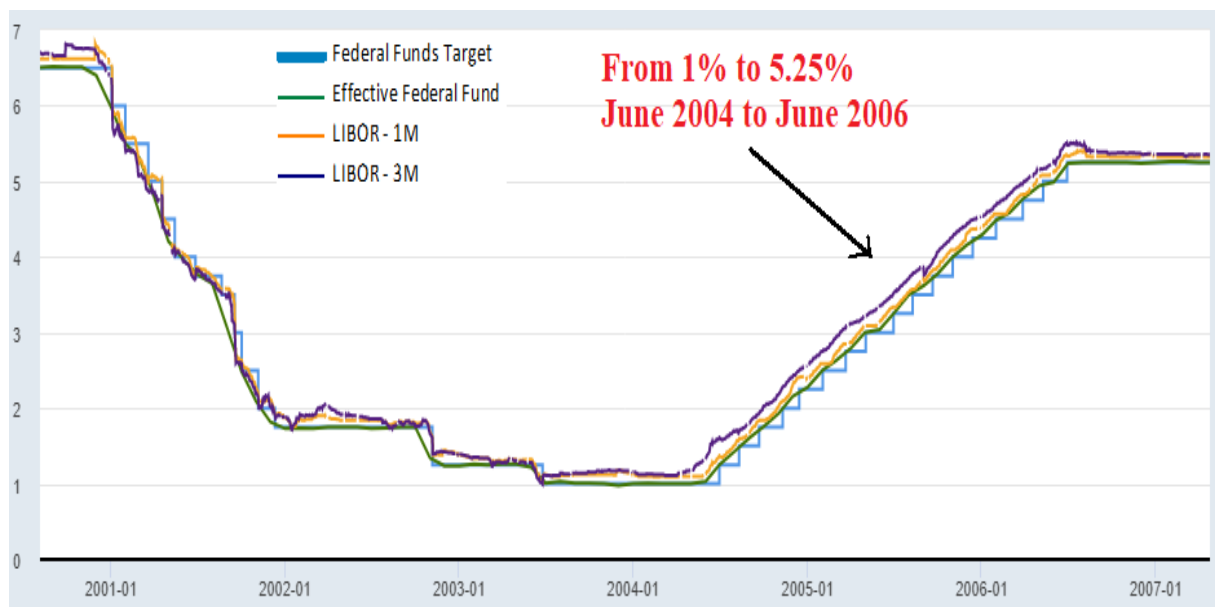


FIGURE 1.4: Global Dollar Markets. Eurodollar responses to the Federal Fund Rate before August 9, 2007

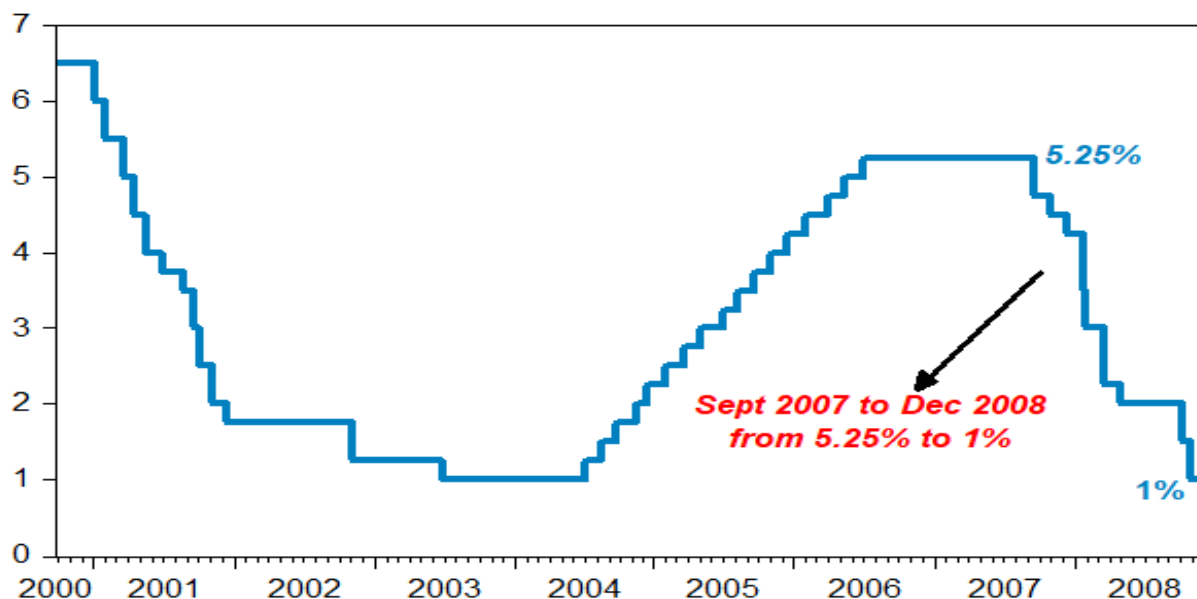
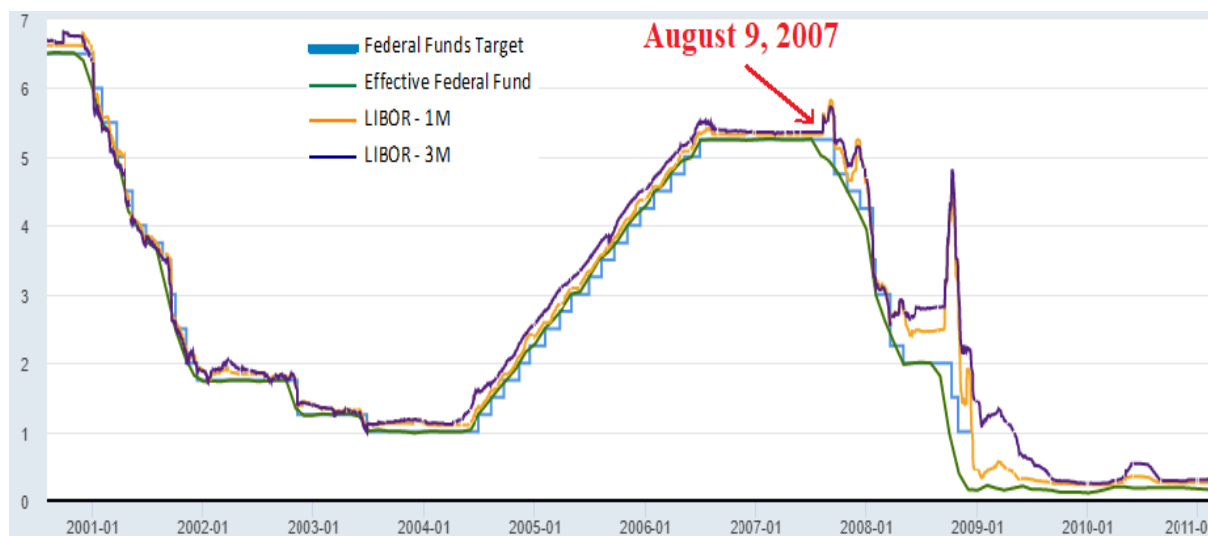


FIGURE 1.5: *Global Dollar Markets. Eurodollar responses to the Federal Fund Rate before August 9, 2007*

At first glance, we observe that the Eurodollar rates (LIBOR – 1M and LIBOR 3M) followed along with the federal funds rate closely. The reason these global dollar rates operated in the same direction that LIBOR rates tracked the federal funds rate was because of arbitrage. Next, I will turn to the Fed to understand for what happened after 17 rate hikes. Figure 1.4 shows that the Fed started to cut federal funds rate starting from 5.25% back to 1% in an attempt to stimulate the economy after a tremendous tightening by reducing (easing) the monetary policy.

Importantly, on the way down, we observe that there is something very different that happened as opposed to on the way up. Figure 1.5 shows that there is a breakdown in the system and Eurodollar operates against the Fed monetary policy. Consider the Eurodollar-related rates (LIBOR-1M and LIBOR-3M) and the federal funds rate no longer follow each other. The LIBOR rates was no longer connected to the federal funds rate on the way down when the Fed cut the interest rate. This tells us that there are problems in the system such that these markets no longer act as a singular whole. What is even more important here is that, not only did the federal funds rate and LIBOR rates divorce after August 9, 2007, but also the effective federal funds rate went another direction. The other rate – the effective federal funds rate is important for the implementation of monetary policy because the effective federal funds rate is the weighted average of all transactions among the banks within the federal funds market. Basically, the Fed sets a target rate, and the effective federal funds rate is supposed to match the target rate, or reasonably close to the target rate. The importance of such close connection between the federal funds rate and the effective federal funds rate implies that things in the money market are going in the right direction, meaning that the fed’s monetary policy implementation is working effectively . What we observe in early August 10, 2007 is that the effective federal funds rate

FIGURE 1.6: *Global Dollar Markets after August 9, 2007*

dropped significantly below the target rate and at the same time, the LIBOR rate was too high with respect to federal funds rate. Now we have a situation in which neither the effective federal funds rate nor LIBOR rate follow closely the Fed monetary policy rate which was believed to be universal for global dollar markets up until August 9, 2007.

What is even more important here is that, not only did the federal funds rate and LIBOR rates divorce after August 9, 2007, but also the effective federal funds rate went another direction. The other rate – the effective federal funds rate is important for the implementation of monetary policy because the effective federal funds rate is the weighted average of all transactions among the banks within the federal funds market. Basically, the Fed sets a target rate, and the effective federal funds rate is supposed to match the target rate, or reasonably close to the target rate. The importance of such close connection between the federal funds rate and the effective federal funds rate implies that things in the money market are going in the right direction, meaning that the fed’s monetary policy implementation is working effectively<sup>18</sup>. What we observe in early August 10, 2007 is that the effective federal funds rate dropped significantly below the target rate and at the same time, the LIBOR rate was too high with respect to federal funds rate. Now we have a situation in which neither the effective federal funds rate nor LIBOR rate follow closely the Fed monetary policy rate which was believed to be universal for global dollar markets up until August 9, 2007.

To summarize, basically everything was working well in terms of international monetary system in accordance with the monetary policy up until August 9, 2007. I have showed the linkages between monetary policy and monetary system by plotting the Eurodollar-related rates and the federal funds rate during the last 60 years. What we observed was that these

<sup>18</sup>In normal times, when the effective federal funds rate differentiated from the target rate set by the Fed, it required the Fed to intervene through open-market operations to either buy or sell treasury bills so that the Fed get effective federal funds rate back to the target rate

rates were operating in a monolithic way until a particular failure in 2007. Moreover, until it all breaks down, we showed that the effective federal funds rate was perfectly tracing the target rate set by the Fed. Suddenly, on August 9, 2007, the federal reserve lost the control on its monetary policy to hit the effective federal funds rate. In other words, the Federal Reserve Bank of New York was not able to control the effective federal funds rate and get back to its target rate. The interbank market stopped lending to each other because of the breakdown of trust between banks. Then, what happened on August 9? What is the significance of this date for these rates acting differently on the way down when the Fed cut the interest rate? The short answer is that this was the date when the system broke. To address these questions and understand in more details, I will go into more detail about what happened on August 9.

### 1.7.1 August 9, 2007: The Day the Mortgage Crisis Went Global

Indeed, August 9, 2007 was a critical moment. Let us look at the two statements<sup>19</sup> by Ben Bernanke before and after the pivotal moment. The first testimony was to US congress on March 28, 2007:

“At this juncture, however, the impact on the broader economy and financial markets of the problem in the subprime market seems likely to be contained.”  
([Bernanke, 2007](#))

The second comment was to New Yorker Magazine Interview on December 1, 2008:

“I and others were mistaken early on in saying that the subprime crisis would be contained. The causal relationship between the housing problem and the broad financial system was very complex and difficult to predict.” ([John, 2018](#))

Ben Bernanke was thinking that the subprime was contained before August 9, 2007. And this made him confident that things were going fine at that time. He thought that it was a minor issue so there was no need to worry about the subprime before August 9, 2007. His contrasting second statement is that he admitted that he was wrong about all that and things were a bit more complex than he thought. Remember that the Fed brought the interest rate from a very low level (1%) in June 2004 to a very high level (5.25%) in June 2006. The notion for the raise in the federal funds target from 1% to 5.25% was tightening the interest rate. Therefore, the level of interest rate was high shortly before August 9, 2007. This is a critical point in which everybody started getting worried because this period was when the adjustable-rate mortgage resets, given that the interest rate was enough for a period before August 9, 2007. Now, if you have a fixed-rate mortgage, one need not worry about mortgage reset but if you have an adjustable loan then one needs to worry about mortgage reset. Mortgage reset means that there

<sup>19</sup>These two statements cited in [Snider and Townsend \(2018\)](#) ‘Eurodollar University’ Season, Par 1. August 9, 2018.

is a specific time at which the mortgage rate and its payment will change. The Fed was aware of these mortgage resets that cause defaults. The concern about defaults due to higher interest rates led the Fed to cut interest rate so that it prevents problems related to these mortgage resets. Finally, and most importantly, on August 9, things changed. It was essentially a trigger where everything started to freeze up. If we want to date the beginning of the financial crisis then August 9, 2007, is the most appropriate. But what exactly happened? In fact, in August 2007, there were many things happening but one of the most important that we want to focus on is the French bank BNP Paribas. Needless to say that BNP Paribas was a key figure in the crisis. August 9, 2007, was the day the mortgage crisis went global. Now I will look at the problems exposed by the events that day. On August 9, in the very early European trading day BNP Paribas said<sup>20</sup> that:

“The complete evaporation of liquidity in certain market segments of the U.S. securitization market has made it impossible to value certain assets fairly, regardless of their quality or credit rating,” ... BNP Paribas Investment Partners has decided to temporarily suspend the calculation of the net asset value as well as subscriptions/redemptions, in strict compliance with regulations, for these funds.”  
(Reuters, 2007)

This is exactly what happened on August 9, 2007: There were three BNP Paribas’ Funds that already invested in commercial paper of US ABSs. on August 9, these funds decided that they were going to freeze their investment. They froze 1.6 billion euros worth of funds on that day. By freezing these funds, BNP Paribas implied that they declined to value them. BNP Paribas as the sponsor of the money market fund (MMF) decided that it is no longer going to value its money market fund. It is this point where money market investors started to panic because that indicates things are not the same as it was before August 9. This was the trigger indeed. As they said in their statement, there is a problem in the money market funds, which was supposed to be safe itself and now it is exposed to subprime (Snider, 2018). As for the MMF, two points are important. First, MMFs have a requirement in which they must value their assets on a daily basis. Second, they also have to make sure that the values of their assets are completely safe. To understand this breakdown in the system and how we got to where we were before August 9, I will delve into the shadows.

## 1.8 Shadow Banking System

I have previously showed how money market fund (MMF) was exposed to subprime mortgages on August 9, 2007. This happened when BNP Paribas decided to decline the calculation of the net asset value, showing its inability to assess the value of the mortgages and other investments held by the funds. This meant that MMF no longer had a value of \$1 per share –

<sup>20</sup><https://www.reuters.com/article/us-bnpparibas-subprime-funds-idUSWEB612920070809>

a common rule in the money market industry. To solidify the dramatic consequence of this event, let us look at the US asset-backed commercial paper market<sup>21</sup>. Commercial paper is a short-term debt instrument issued by large corporations (Kacperczyk and Schnabl, 2010, p. 29). This is a market in which MMF had invested in and figured it out when safe proved risky<sup>22</sup>. As shown in Figure 1.7, in August 2007, the volume of asset-backed commercial papers (ABCPs) which is one of the primary innovations of the Eurodollar system exploded. At the beginning of 2007, ABCPs was the largest U.S. short-term debt instrument with more than 1.2 trillion outstanding. Note that this period coincides during the period of 2004-2007 when the Fed started to raise the interest rate. The Fed was implementing a monetary policy which was tightening but the ABCPs did not respond to the Fed monetary policy and continued growing during this period. The market participants in the ABCPs market considered commercial paper as safe assets and invested in, regardless of the collateral backing the ABCPs. They did not consider the collateral behind these instruments. This was a danger because the collateral behind these instruments were subprime mortgages. The problem was that the investor in this market segment (read MMF on the buying side) did not invest in the actual mortgage. They were investing in the super senior part of these various mortgage structures. Suddenly, with the events on August 9, 2007, MMF realized its exposure to the subprime mortgages. Hence, these money market funds started to reject ABCPs because investors found out that there was exposure in the market, and investors have stopped investing in it. Therefore, the ABCP market collapsed entirely on August 9, 2007. Figure 1.7 is very useful to see the size of the ABCP market before the financial crisis, from its explosive growth to its calamitous collapse. It refers to the run on the ABCP market, the near death of Bear Stearns in March 2008, and the actual death of Lehman Brothers in 2008 (McCulley et al., 2009).

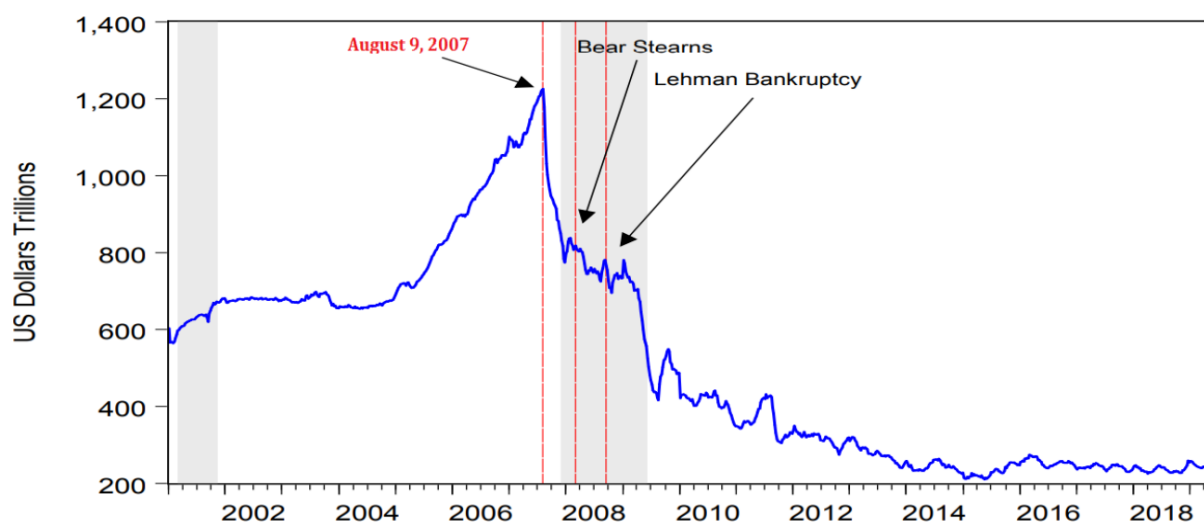
As for the supply side, asset-backed commercial paper is issued by off-balance sheet<sup>23</sup> conduits of large financial institutions (Kacperczyk and Schnabl, 2010, p. 32). The process of securitization is incredibly important to understand the issuance of asset-based commercial papers (ABCPs). Securitization is a process by which banks transform their loans into securities and then serve these securities to the financial market. In doing so, the securitization process allows different types of loans, say mortgages, which are: (1) transformed into multiple financial instruments with different characteristics of risk and return (e.g., prime, alt-A, mezzanine, and sub-prime), and (2) such packaged loans are sold to other financial institutions (e.g. issuers of asset-backed securities, investment banks, broker and dealers). In effect, the first and second activities are the starting point of a complex securitization model. The creation of complex

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<sup>21</sup>Depending on the issuer, there are three categories of commercial paper: (1) asset-backed; (2) financial; and (3) and corporate commercial paper. See, for example Kacperczyk and Schnabl (2010) for a detailed discussion of commercial paper

<sup>22</sup>Kacperczyk and Schnabl (2010) "When safe proves risky: Commercial paper during the Financial Crisis of 2007-2009"

<sup>23</sup>"Off-balance sheet" means that the assets and liabilities of the conduits are not included on the financial institutions' balance sheets. See Kacperczyk and Schnabl (2010)

FIGURE 1.7: *US asset-backed commercial paper outstanding*

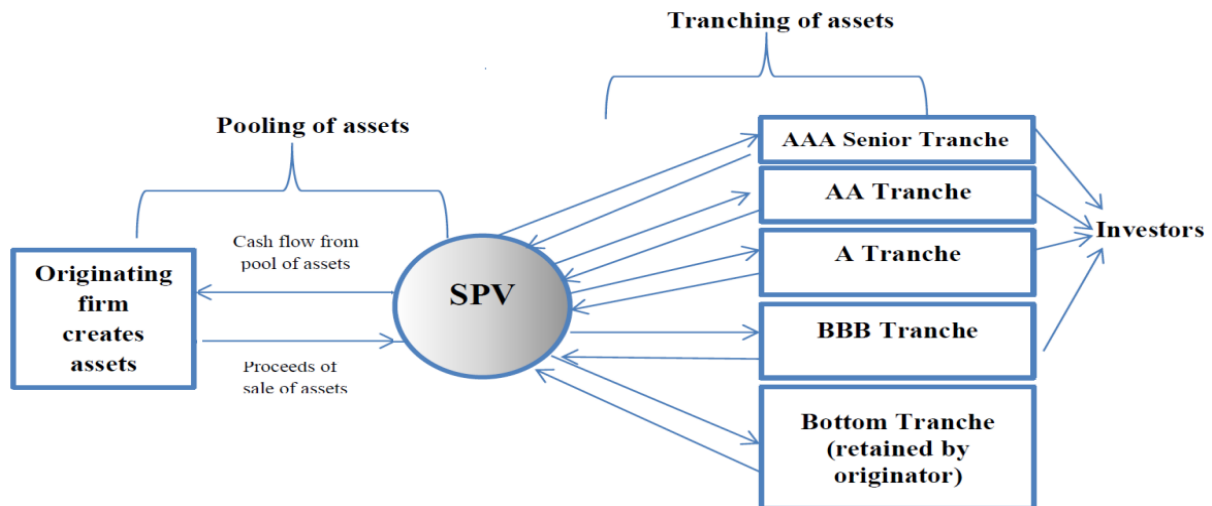
structured financial instruments such as mortgage-based securities (MBS), asset-based securities (ABS), collateral debt obligations (CDOs) through securitization constitutes the main collateral behind ABCPs. For example, the MBS is a pool of mortgages that is securitized by the Special Purpose Vehicles (SPVs) to be sold in the financial markets. Figure 7 shows the securitization process.

### 1.8.1 Securitization (ABCP channel)

Figure 1.8 is based on [Gorton and Metrick \(2010\)](#) which demonstrates systematically how the securitization process works. Accordingly, there are four main actors that play in the securitization process: (1) commercial banks as provider of assets or ‘raw materials’ in line with [Caverzasi et al. \(2019\)](#); (2) Special Purpose Vehicles (SPVs); (3) rating agencies; and, (4) investors on the buying side. The process inevitably starts with the creation of bank loans in the commercial banking system. These loans become raw material for securitized assets such as ABCPs and MBSs. To repeat, the commercial banks play a crucial role as creators of money at the very beginning. From this perspective, without bank loans which are created endogenously within the traditional banking system, there is no such process to start securitized assets. In effect, it is through the role of commercial banks and their ability to create loans when borrowers demand for a process that the so-called shadow banks enter. The main conclusion is, therefore, it is the consequence of endogenous money creation and securitization practice that enables shadow banks to create complex financial product, not money (more on that below).

Let us look at the Figure 1.8 that shows the process of securitization. The originating firm (bank) create assets (deposits when bank makes loan). The first necessary step, then, is banks are supposed to create loans and ready to sell these loans. If these two conditions are met by banks, then in the second step, the SPV enters the picture to transfer these assets away from



FIGURE 1.8: *Securitization Process*

the bank's balance sheets to its balance sheet. In this step, loans bought from banks are pooled. In the next step, these pooled loans are split into several tranches based on their risk-level and assembled into securities. These securities are classified into tranches as [Gorton and Metrick \(2010\)](#) depicted in the Figure 1.8 wherein tranching of assets are ranked by seniority and rated accordingly ([Gorton and Metrick, 2010](#), p. 270). Finally, rating agencies such as Moody's, Standard and Poor's (SP), and Fitch are important players in this complex system which give these securities their triple-A stamp of approval in order to facilitate ease to sell as low-risk assets, irrespective of the fact that the underlying loans are low quality ([Prates and Farhi, 2015](#), p.575). In the end of this complex process, there is an investor who purchases these securities. For example, Moody's and SP would put an A-1/P-1 rating on the commercial paper, which in turn would be bought by money market funds ([McCulley et al., 2009](#)).

In short, this complex system started through credit creation by banks via their crucial role in creating loans then transformed in the production of complex structured financial instruments. [Caverzasi et al. \(2018\)](#) refer to this process as 'commodification of credit position'. [Cetorelli and Peristiani](#) of Federal Reserve Bank of New York argues that: "Under securitization model, lending constitutes not the end point in the allocation of funds, but the beginning of a complex process in which loans are sold into legally separate entities, only to be aggregated and packaged into multiple securities with different characteristics of risk and return that will appeal to broad investor classes. And those same securities can then become the inputs of further securitization activities." ([Cetorelli and Peristiani, 2012](#), p. 47)

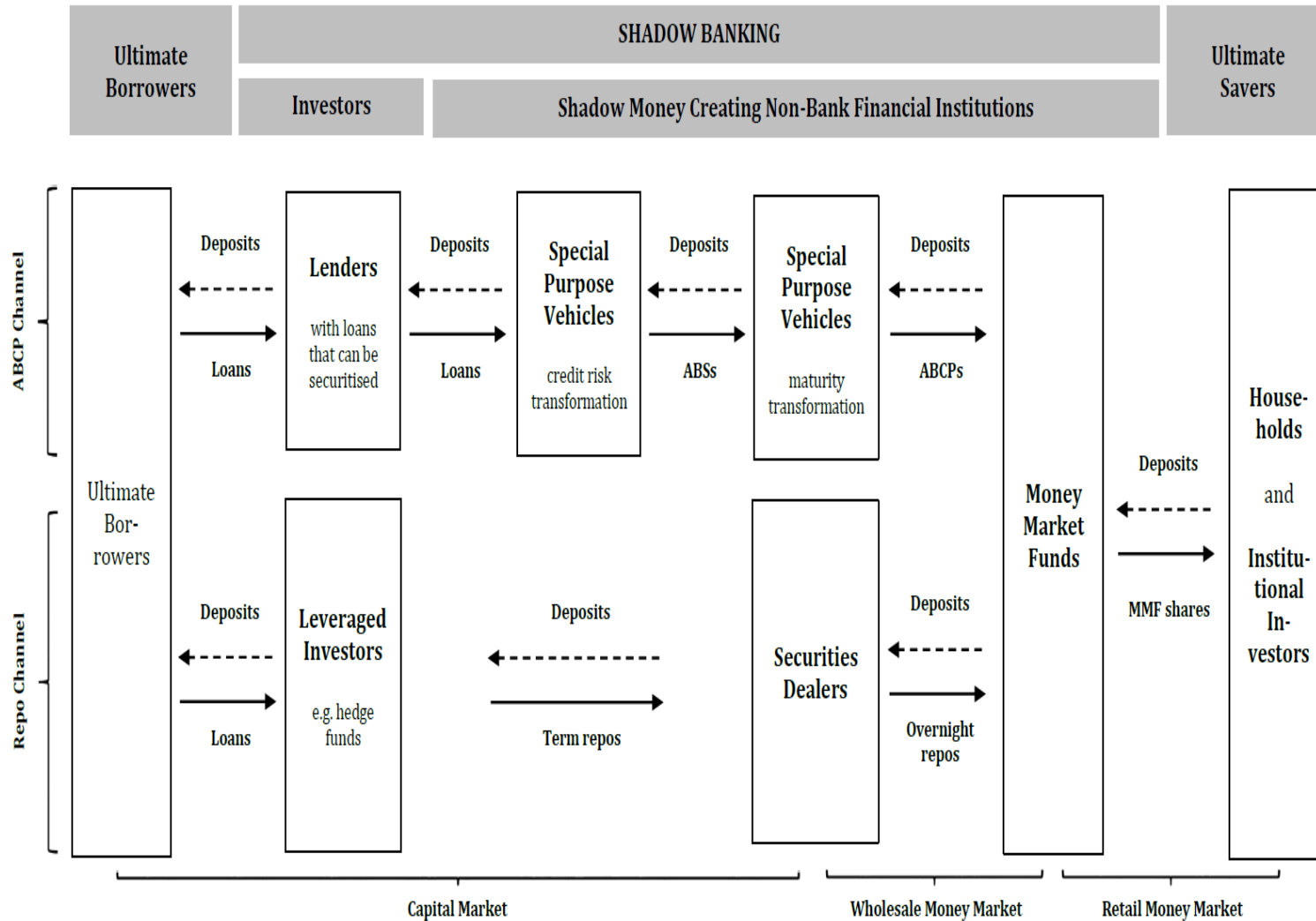


FIGURE 1.9: the stylized shadow banking system

### 1.8.2 Collateral intermediation (Repo Channel)

According to [Claessens et al. \(2012\)](#), there are two important channels of the shadow banking system: securitization (ABCP channel) and collateral intermediation (Repo channel) (See Figure 1.9). In this context, securitization plays a critical role in this first channel of shadow banking. It lies between commercial banks and other investors such as MMF. ([Claessens et al., 2012](#), p. 19) define the first channel of shadow banking as ABCP channel: ‘which transforms risky assets into safe and liquid claims through the tranching of claims and the use of puts from the main banking system’. Importantly, we pay attention to the commercial banks in this first channel of shadow banking because it is important to know how these loans originated in the first place. ‘The vast majority of credit and money claims in the ecosystem begin life as a loan and the creation of a demand deposits in equal amounts.’ ([Pozsar, 2014](#), p. 33). This logic of endogenous money lies behind the nature and function of nature shadow banking. Recall that endogenous money view: when a bank makes a loan, it simultaneously creates a deposit of the same amount. More precisely, a bank can create money by crediting the account of the borrower with the loan against an increase of its assets by the borrower’s obligation to repay the loan. In this, most money is created by commercial banks making new loans to household and firms. After creating money, the borrower will draw on that account and spend the cash in it. What needs to be emphasized here is that some loans remain in the banks and some are securitized. To underpin that point, [Caverzasi et al. \(2018\)](#) stress the role of bank loans in playing financial commodities or raw materials. This consists of the standardized input for the production process of securities. Crucially, one needs to understand the dual role of banks’ activities in the shadow banking system. On one hand, banks create money in the form of deposit. On the other hand, loans issued by banks are then converted into securities through securitization to produce more complex structured financial instruments such as ABCPs.

With the analysis of the securitization as a backdrop, we turn now to the second channel of shadow banking: Repo channel, which is another important activity within the shadow banking system (see [Claessens et al. \(2012\)](#)). This channel is also called ‘collateral intermediation’ channel: ‘which re-use collateral to reduce counterparty risk between borrowers and lenders. In the second channel, the concern is about the repo market.

What is repo? A repo is a loan backed by collateral. From this basic definition of repo, we can make inferences that collateral is a crucial side of repo. From this perspective, repo promises to pay secured against collateral<sup>24</sup>. Collateral intermediation refers to a range of activities through repo market ([Gabor 2013a](#)). In effect, collateral intermediation in the shadow banking system enables the demand of agents for safety by reducing counterparty risk [Claessens et al. \(2012, p. 6\)](#) and proves within the system a wide range of financial transaction<sup>25</sup>. However, collateral is scarce most of the time and shadow banking system is collateral-

<sup>24</sup>Secured against collateral means that where collateral is used to mitigate risk.

<sup>25</sup>Demands that comes from secured funding, securities lending, and hedging

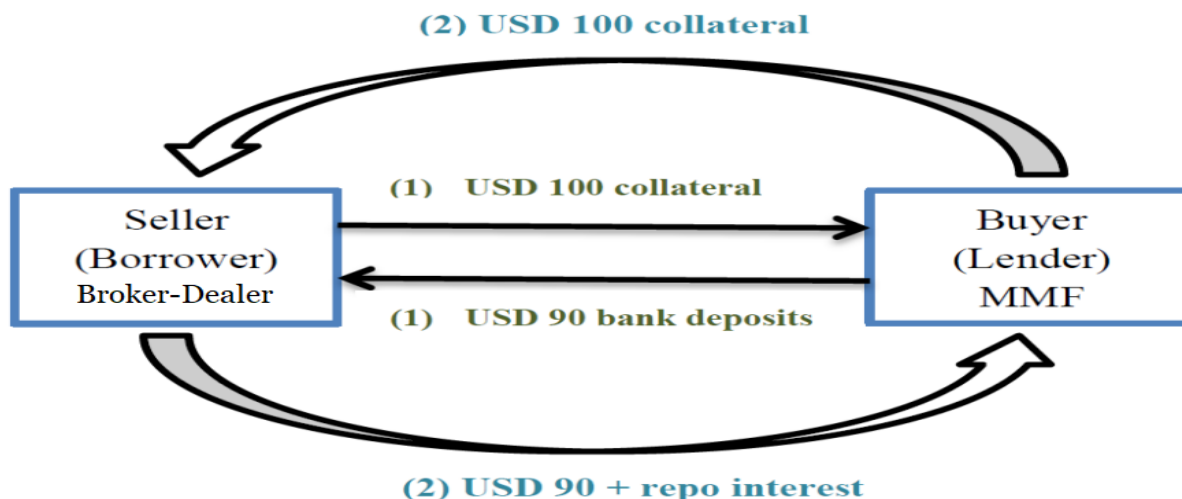


FIGURE 1.10: A repo transaction

intensive as the re-use of collateral is usual and it enables a large volume of transactions. In its collateral intermediation, the role of brokers and dealers (investment banks) is important. This sector is at the heart of the shadow banking system as it intermediates among its components. In this regard, investments banks borrow through repos from commercial banks or money market mutual funds (MMMFs) [Claessens et al. \(2012\)](#). In its collateral intermediation in the shadow banking system, repos are the key form of credit between financial institutions and are used by MMMFs. [Adrian and Ashcraft \(2012\)](#) document the money market sector peaked at around \$3.5 trillion in 2008.

### Repo channel

According to [Gabor and Vestergaard \(2016\)](#), repo have grown rapidly since the 1980s reaching USD 10 trillion in the US and Europe by 2008. Adrian and Shin argue that “the U.S. tri-party repo market represents a major source of funding for security broker-dealers. Their estimation for the market peaked at slightly above \$2.8 trillion in 2008 and is currently slightly below \$1.7 trillion.” ([Adrian and Ashcraft, 2012](#)) In attempting to analyze the repo transaction, one needs to understand the way this transaction occurs. This is our task here to provide an example between the sale and the repurchase. In doing so, the example offers a better way of thinking about repo transaction. Figure 1.10 demonstrates the simple way to grasp the mechanics of a repo transaction.

The mechanics of a repo transaction depicted in the Figure 1.10 shows the role of seller (Broker-Dealer) which represents the borrower of cash, and buyer (MMF) which represents the lender of cash. From the perspective of the broker-dealer, this is a repo, while from the perspective of the MMF, it is a reverse repo. As can be understood from the depiction, it is lending cash against collateral. Importantly, a repo is essentially a collateralized loan. In

this example, a broker-dealer needs to borrow cash to finance their securities. On the one side of the transaction, there is an MMF who represents lender (of cash) and looking for safe placement for its cash. On the other side of this transaction, the borrower (of cash) is looking for funding to finance its portfolio of securities. In what follows, the transaction starts with the seller transferring its collateral (MBS worth of 100\$ in our example) and then, receiving the cash from the buyer (MMF). Note that the loan made by MMF in exchange for collateral (MBS 100\$) is smaller than the value of collateral. In a repo transaction, the borrower of cash sells securities used as collateral for a price below the current market price on the day of transaction, knowing that it will buy it back on the following day or in the future at some specified date. The spread between the market value of the transferred securities and the purchase price is called the “haircut”. In our examples, the haircut on the securities is 10% and hence, the broker-dealer obtains 90\$ of deposits (cash) in return for the securities (MBS 100\$) it pledged for the repo loans. To do so, the broker-dealer issues a collateralized promise to pay. That is, the borrower of cash promises to pay backed by collateral. Therefore, the broker-dealer gets the use of cash through a repurchase agreement. In this transaction, those securities (MBSs) bonds represent collateral as they are for the promise to pay. In addition, the buyer (MMF) gets legal title to the assets received in exchange for the cash it has paid. Through the mechanics of a repo transaction, the MMF holds the assets in the first instance as collateral. As lender of cash, there is no need to concern about the counterparty risk if the seller defaults on repurchase because the buyer has collateral and can liquidate the assets to recover most or all of its cash. Gabor (2013) calls this ‘repo magic’ since the move from counterparty risk to collateral risk means that both parties care about how much price it tends to move, and the volatility of the collateral that will be received as security for the cash.

Furthermore, re-hypothecation is an important activity through collateral intermediation. Re-hypothecation is the reuse of securities (following previous example, say MBSs) in repo transactions. In other words, buyer – MMF (lender of cash) – can actually lend the security it obtained through the repos transactions out to somebody else at the same time that MMF uses it. In fact, MMF can re-lend not just to one somebody, but often to multiple somebody. Indeed, in the repo market, “collateral managers can lend and borrow the same piece of collateral repeatedly” (Gabor, 2013) unless legal restrictions on the re-hypothecation are defined. In short, re-hypothecation is essentially the multiplier of securities in repo transaction that the same asset is pledged as collateral more than once.

Like ABCPs, in the years before the financial crisis, repos played an important role as funding source for the shadow banking system. Since the MMF is connected to both the ABCP and repo channel, there was the “run on repo” after the investors (MMF) lost their confidence to lend cash against private-label securities (ABSs and MBSs). According to Gorton and Metric (2012 p. 6), it was the haircuts that constitute the run on repo. Despite the presence of collateral

in repo lending, there are monetary consequences of collateral when there is contradiction in the repo market. In the event of a decline in collateral value, repo borrowers may be forced to sell the collateral and this consequence makes repo market fragile. When there is more stress in the repo market such as the events on August 9, 2007, attempts to fire sales of collateral (securities) lead to an evaporation of liquidity in the repo markets. Gorton and Metrick (2012) investigates these dynamics in the repo market in August 2007 and notes that uncertainty led to increase in the repo haircuts<sup>26</sup>, meaning that the lender is no longer willing to provide credit (short-term finance) at the usual spreads and low haircuts.

## 1.9 Conclusion

Orthodox economic theoretical understanding of money is that both historical origins of money and logical condition of its existence are explained as the result of economic exchange in the market that evolved because of individual utility maximization. In contrast to the orthodox thinking on money, the view taken here is that heterodox theories of money that reject the conjecture that money evolved to overcome the efficiency of barter. Heterodox theories see money as a non-neutral 'force of production'. Therefore, money stemmed from the needs of production. Money in heterodox economic analysis is a necessary result of a debt relationship between a borrower and a lender. Therefore, the alternative view provides a framework for understanding money as a social relation of credit and debt in a money of account, fully consistent with the endogenous money theory. Furthermore, in attempting to analyze the Eurodollar in the shadow banking system I have argued that there is crucial role of endogenous money. The question of what precisely endogeneity of money means was my starting point to explain the notion of credit and money, and how they interact in the real economy. I considered money to be endogenous when its quantity is demand-determined. In other words, endogeneity implies that the supply of money is not independent of the demand. From this standpoint, it must be clear that the creation of money is driven by the demand for it and money is created endogenously as a response to the need for money. Moreover, the working definition used for endogenous money in this study was: loans make deposits and deposits make reserves. According to the endogenous money approach, commercial banks can create as much money as the economy needs, with the obvious assumption that banks deal with creditworthy borrowers. Furthermore, I examined the consequence of endogenous money for banks and shadow banks at both the national and international level by considering the importance that the Eurodollar market played in the emergence of shadow banking. I argued that the Eurodollar market was a predecessor of the modern shadow banking system. This market functioned through the deposit of Eurodollar, but its operation was outside of the monetary authority and traditional

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<sup>26</sup>Gorton and Metrick (2012) documents a "haircut index" from 2007 to 2008 which is an average haircut for collateral used in repo transactions, not including U.S. treasury securities. Importantly, they show that this index increased from zero in early 2007 to nearly 50 percent at the peak of the crisis in late 2008. They also note that it was this period that several classes of assets stopped entirely from being used as collateral.

banking regulations. It is exactly this last feature – the unregulated nature –that makes the Eurodollar market the predecessor of the modern shadow banking system. Therefore, studying Eurodollar is an important contribution to the international finance and shadow banking system. This is an important phenomenon to be included in my analysis, which had been largely overlooked by previous attempts to understand the origin of shadow banking.

## Chapter 2

# THE SHADOW BANKING SECTOR IN A STOCK-FLOW CONSISTENT FRAMEWORK\*

### ABSTRACT

This paper develops a stock-flow consistent model to provide a formalization that includes complex financial markets that allow us to explore several pieces of the shadow banking sector. Its main objective is to capture the role played by the complex financial institutions (e.g. Special Purpose Vehicles, Broker-Dealers and Money Market Mutual Funds) and practices (securitization and repo or collateralized borrowing) in the context of credit intermediation through shadow banking system. The model pays particular attention to the nexus between core commercial banks and shadow banks. Understanding this nexus better, and exploring the relationship between the commercial banking and shadow banking enables us to show the process through which shadow banks find sources of funds to intermediate credit or expand their balance sheets. The paper also shows that a simple activity of granting a loan to worker households and funding these loans on balance sheets previously conducted by commercial banks can be divided into a long chain of activities that involve several institutions and structures. In this regard, the consequence of endogenous money - loans create deposits - and an era in which loans are packaged into securities allowed worker households to benefit from an increasing amount (then securitized) of mortgages. With the aid of simulation experiments, it explores that an increase in the degree of securitization of mortgages increases lending activity of the commercial banks through relaxing capital requirements while it allows the Special Purpose Vehicles to issue more securities in the financial markets. Moreover, the combination of securitization and the role of securities in the repo market have greatly expanded the creation of “fictitious” liquidity.

**Keywords:** Securitization, shadow banking, stock-flow consistent modelling, repo, collateral, income distribution.

## 2.1 Introduction

The shadow banking activities played a major role in creating explosive growth in leverage and liquidity risk that led to the Global Financial Crisis of 2007-08. [Adrian and Ashcraft \(2012, p. 9\)](#) provided empirical evidence that the gross measure of shadow banking liabilities grew to a size of nearly \$22 trillion in June 2007. They also compared it with total traditional banking

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liabilities, which were around \$14 trillion in 2007. Given its role in creating enormous amount of liquidity and role in the financial crisis, it is important to understand the mechanism by which shadow banking interact with traditional banking, pointing out the similarities with that of traditional banking if any, and sharp differences between their ability in creating credit.

In a recent paper, [Bellofiore and Garibaldi \(2020\)](#) point out that financial interconnection feeds and shapes industrial interconnection, through the mechanism of supporting indebted consumption via asset price inflation. It is the role of finance or financing that agents can obtain more and more easily and in the very short term on the money market to invest long term, expanding their 'leverage' in ever-higher percentages, without seemingly giving rise to financial stability risks. This financing which includes the so-called shadow banking was annihilated in no time, from the subprime crisis in 2007 to the bankruptcy of Lehman Brothers in 2008. Over-consumption through debt or capital market inflation had an enormous impact on the real economy. To a large part, recent asset price bubbles were caused by over-extended lending, often for speculative activity on the financial market and real estate markets ([Khalil and Kinsella, 2015](#)). Shadow banking activities such as securitization played an important role in speculative lending and allowed banks to have a lower overall capital to asset ratio, which increased the rate of return [Lavoie \(2019a, p.121\)](#) and the profitability of financial investment while obscuring risks. [Minsky \(1982, 1986\)](#) argues that crises are mainly rooted in extended euphoria on financial markets, financial innovation, and increasing leverage of financial and non-financial firms.

Existing literature emphasizes that credit creation through the shadow banking system is much like that through a traditional bank, showing that they are similar in many ways. (See, for example, [Noeth et al. \(2011\)](#); [Adrian and Shin \(2009\)](#); [Gorton and Metrick \(2012\)](#); [Pozsar \(2013\)](#)). The main reason behind this view according to which "shadow banking is really banking"<sup>1</sup> is to consider banks as intermediaries. In such context, traditional banks firstly need to collect funds from savers in the form of deposits so that they can provide funds in the form of loans. It is this feature of banking, which define banks as intermediaries that makes these authors argue shadow banks as financial intermediaries that conduct functions of banking.

This study differs from the way in which existing literature, based on banks and shadow banks as intermediaries, approaches shadow banking. Because this study refers to the post-Keynesian endogenous money literature, it makes a sharp distinction between banks and shadow banks. According to this literature, the presence of shadow banks heavily depends on credit creation by traditional banks. (See, for example, [Lavoie \(2014\)](#); [Lavoie \(2019a\)](#); [Michell \(2017\)](#); [Bouguelli \(2019\)](#)). To begin, banks are defined as credit creators, not financial intermediaries. Credit creation by traditional banks happens when they make loans. They do not wait, and they do not depend on the existing sources of funds to lend. They create loans and deposits in the act of lending. To repeat, loans create deposits. As for shadow banking or shadow banks,

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<sup>1</sup>See the provocative title of [Noeth et al. \(2011\)](#), "Is shadow banking really banking?"

such credit creation *ex nihilo* is not true. To lend, shadow banking needs to obtain funds. The process through which shadow banks obtain funds and create “fictitious” liquidity involves a much more complicated process.

Given the complexity of such a phenomenon, this study attempts to formalize the role that shadow banking played in the origination of the US credit boom before the financial crisis of 2007-08. In this regard, there are two main objectives of this study. First, I wish to explore how shadow banking or shadow banks became increasingly important in financing credit within a complex financial system. In this context, I focus on the broker-dealers and their importance to create “fictitious” liquidity<sup>2</sup>. Repo markets have increased in step with securitization - a technique that transforms illiquid assets into liquid marketable securities. From this standpoint study, securitization, in its widespread form, is crucial to understand how banks remove loans from the asset side of their balance sheets and then sell them to other financial actors, such as broker-dealers. With the present paper, I aim to explore the link between securitization and the leading role of repos in fuelling the expansion of the balance sheet of broker-dealers in a complex financial system. Against this background, there are two research questions: (1) What are the major reasons behind such enormous amount of creation and growth of shadow banking? (2) How can the nexus between the shadow banking system and the core commercial banking system be used to explain the origination of the US credit boom before the financial crisis of 2007-08?

Primarily, the main contribution of this study is to describe the process of credit intermediation in the shadow banking system, using a stock-flow consistent (SFC) framework. This paper shows that the simple activities of granting loans to worker households and of funding these loans on balance sheets previously conducted by commercial banks can be divided into a long chain of activities that involve several institutions and structures. Therefore, I wish to capture the role played by recent financial institutions (e.g. Broker-Dealers and Money Market Mutual Funds), and practices such as securitization and repo or collateralized borrowing in the context of the shadow banking system.

This study draws inspiration from the post-Keynesian approach. The methodology is based on the stock-flow consistent technique (Godley and Lavoie (2007)) to take on this issue and provide a formalization that includes important elements of the shadow banking system such as securitization, repos and MMMF shares. In attempting to build such a model to investigate the issues related to shadow banking, I carefully analyze the recent studies that incorporate issues about shadow banking within the stock-flow consistent modelling. (See, for example, Zezza (2008); Botta et al. (2015); Nikolaidi (2015); Sawyer and Veronese Passarella (2017); Botta et al. (2018); Caverzasi et al. (2019), Botta et al. (2019)). It is not surprising that all these studies paid attention to some parts of the shadow banking sector and its relationship with other sectors to

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<sup>2</sup>See Kregel (2014) and Lavoie (2019a) for liquidity creation by banks and shadow banks and the important distinction between “true” and “fictitious”, respectively.

provide a complete picture of the economy. For example, [Botta et al. \(2015\)](#) attempt to formalize almost all elements of the shadow banking in a fairly complex model in which the economy includes many sectors and assets. However, they do not provide behavioural equations to simulate such a complex model (See Appendix B in the appendix for a stylized depiction of the functioning of the shadow banking system taken from [Botta et al. \(2015\)](#)). In another study, [Botta et al. \(2019\)](#) focus on the relationship between shadow banking and its interaction with income and wealth inequality. They formalize their model in a hybrid agent-based stock-flow consistent framework (AB-SFC), including securitization activities. However, the absence of the housing sector and one single sector that performs many activities of shadow banking system limits their model to explore the crucial role of the repo market and its potential ties with the securitization to expand the liquidity. I intend to fill this gap. That is, I want to give an explicit importance to the repo market, a market in which shadow banks such as broker-dealers and different actors interact with the securitization to create "fictitious" liquidity.

Credit creation in the shadow banking system depends on the traditional banking system. Shadow banks can involve in credit intermediation once credit have been granted by the commercial banks. It is only then that shadow banks can access the sources of funds to extend credit. In this context, I identified two channels through which shadow banks involve in financing credit within the financial system. These two channels are directly associated with the securitization process and the repo market, a market in which shadow banks play an increasing role. The growth of the repo market in combination with securitization greatly expanded "fictitious" liquidity.

The succeeding sections of this paper is structured as follows. Section 2 provides a relevant literature review about shadow banking, describing three different views on the credit creation by the shadow banking system. Section 3 identifies two channels to describe the process of credit intermediation in the shadow banking and depicts an economy in which there are six sectors. This section illustrates transactions between these sectors and the distribution of assets and liabilities through simple T-Accounts. Section 4 presents a brief history of stock-flow consistent modelling. Section 5 develops the stock-flow consistent modelling of shadow banking, through the balance sheet matrix and its main characteristics. Then, in section 6, I define the behavioural equations of the system for each sector. Section 7 presents four simulation experiments to show the effects of the shock on the reaction of sectors. Section 8 concludes.

## 2.2 Literature review on shadow banking

There is an ongoing debate in the economic literature about the relationship between regulated traditional banks, or commercial banks and unregulated non-bank financial institutions, also known as shadow banks. While the role of commercial banks in money creation is well known when they grant credit, the way shadow banks create credit in the financial system is subject

to reasonable limitations. The former creates credit in the act of lending, meaning that lending creates deposits. Such ability of credit creation in the financial system makes commercial banks “special”. They are special because they do not act simply as intermediaries, lending out the deposits that savers place with them (McLeay et al., 2014). As for the latter, how do shadow banks create credits?

This study aims to provide a clear answer as to how shadow banks create credits. Let us turn now to the existing literature which focuses on shadow banking and its role in credit creation.

The literature on shadow banking can be analyzed in three different ways, the two views of which study shadow banking and its role in the financial system as being similar to the traditional banking system. The first group of this literature focused on both shadow banking and traditional banking as mere intermediaries of loanable funds that are constrained by pre-existing funds to lend (Acharya et al., 2010; Adrian and Ashcraft, 2012; Adrian and Shin, 2010b; Claessens et al., 2012; Gorton and Metrick, 2012; Pozsar, 2013; Pozsar et al., 2010; Ricks, 2010; Stein, 2010). The second group approaches shadow banking as being similar to the traditional commercial banks as creators of money (Nersisyan and Dantas, 2017). Advocates of the view that banks and shadow banks are creators of money argue that, similar to the traditional banks, shadow banks take short-term liabilities to take positions in long-term assets, highlighting their role in maturity transformation. According to this view, besides traditional banks and their special role in the financial system in issuing their own liabilities, shadow banking issues short-term debt-instruments to take positions in long-term riskier assets, and thus providing liquidity. This view puts forward the liquidity creation capacity of shadow banking. In their work, Nersisyan and Dantas (2017) attempt to extend the post-Keynesian endogenous money theory so that the logic of endogenous money can be applied to shadow banks besides commercial banks. According to these two authors, “the ability of the financial sector to create liquidity is much more elastic than the endogenous money theory allows for” (Nersisyan and Dantas, 2017, p. 297). For Nersisyan and Dantas (2017), non-bank financial institutions such as investment banks and money market mutual funds (MMMFs) are similar to banks in terms of their activities. The authors argue that these institutions issue their own liabilities such as repurchase agreements (repo) and money market mutual fund shares. This is why Nersisyan and Dantas (2017) believe that, besides banks, all financial institutions participate in the process of liquidity creation. This point is detailed in their paper:

“Nor do we claim that nonbanks face no restrictions on their ability to grow their balance sheets. Rather, we argue that savings, or the existing stock of some particular financial asset, such as bank deposits, constrains NBFIs ability to create liquidity no more than the existing stock of bank reserves constrains bank lending.” (Nersisyan and Dantas, 2017, p. 292)

While [Nersisyan and Dantas \(2017\)](#) believe that banks and non-banks show great similarities, they admit that unlike non-banks, banks have access to the discount window of Federal Reserve. Moreover, although both banks and non-banks create liquidity, they distinguish this in their work: “true” and “fictitious”, noting that these terms are taken from [Kregel \(2014\)](#). Accordingly, banks create “true” liquidity as they point out that the value of their liabilities is independent of market conditions. As for non-banks they create “fictitious” liquidity because it exists in good times but it becomes elusive and may disappear during periods of market stress.

Finally, there is a third view that makes a sharp distinction between shadow banking and traditional banking. This view interprets the shadow banking system from a post-Keynesian endogenous money perspective ([Botta et al., 2015](#); [Bouguelli, 2019](#); [Caverzasi et al., 2018](#); [Lavoie, 2014, 2019a](#); [Michell, 2017](#); [Unger, 2016](#)). [Michell \(2017\)](#) distinguishes two different views when he analyzes the shadow banking system: there is a market view and a money view. While the market view of shadow banking focuses on activities and financial transactions within the system and emphasizes such activities as dealing in securitized debt, advocates of the money view see shadow banking as an analog to the traditional banking system because of shadow banking functions such as maturity and credit transformation. To put it simply, according to this view, shadow banking liabilities are the new form of money such as REPO, ABCPs, and MMMF shares ([Claessens et al., 2012](#); [Gorton and Metrick, 2012](#); [Mehrling, 2012](#); [Murau, 2017, 2018](#); [Pozsar, 2013](#); [Ricks, 2016](#)). The issuance of such liabilities implies swapping IOUs of different maturities. For example, special purpose vehicles swap ABCPs as short-term IOUs against ABSs as longer-term IOUs on their balance sheet. In this, the idea of the hierarchy of money plays a role here in which the hierarchy of money highlights the distinction between credit and money ([Mehrling, 2012](#), p. 394). As argued by [Michell \(2017\)](#), such short-term liabilities-issued by the shadow banking system are not used as means of payment and final settlements among these institutions can be only made using central bank reserves. Knowing that these liabilities of the shadow banking system cannot be used as a means of payment or final settlement, what makes a liability of shadow banking to be considered a new form of money? Advocates of this view would answer that these liabilities of the shadow banking system constitute a promise to trade at par on demand; they are convertible instantaneously or almost instantaneously convertible on demand at par.

However, as will be discussed below, this is not a sufficient condition for shadow banking liabilities to be considered a new form of money. For [Michell \(2017\)](#), “while convertibility of these liabilities at par into ‘money proper’ plays an important role in making deposits acceptable as means of payment, it is a necessary but not sufficient condition.” ([Michell, 2017](#), p.12). From this perspective, these liabilities of shadow banking cannot be considered money. In attempting to study the shadow banking sector, post-Keynesians consider the special role of traditional banking and its main role for the financial system and thereby the modern economy as a whole. This role of traditional banks is crucial for the understanding of the monetary

production economy.

From a post-Keynesian point of view, we analyze both traditional banks and shadow banks to define differences and connections between them. This will lead us to define the peculiar role of traditional banks and characterize the shadow banks and their reliance on traditional banks. From an endogenous money perspective, banks are not mere intermediaries between savers and borrowers. A bank can create money by crediting the account of the borrower with the loan against an increase of the bank's assets by the borrower's obligation to repay the loan. Thus, most money is created by banks making new loans to households and firms. In this context, the decision to lend does not necessarily depend on prior savings that savers place with them. In other words, commercial banks can create loans without having first accepted deposits.

Following [Unger \(2016\)](#), loan origination in our first step to analyze the shadow banking sector is understood here as the provision of a means of payment to the agent taking out a loan. This first step is important because the existing literature – the aforementioned first view - on shadow banking does not focus on the crucial role of traditional banks in creating a loan ex nihilo. As will be discussed below, loan origination by traditional banks becomes the beginning of everything before delving into shadow banks' activities. [Unger \(2016\)](#) pointed out that it is not until then that the shadow banking sector enters the picture. Therefore, our analysis will tirelessly give importance to this role of traditional banks and their crucial role in making loans so that shadow banks will later enter our description of the financial system.

From a methodological point of view, my aim is to focus on most recent studies in which the authors attempt to model financial markets that is shadow banking, besides commercial banking within the SFC framework. In doing so, we intend to have a clear picture of the current state of the art of shadow banking system and their interaction with other sectors such as household sector and housing sector. Moreover, we wish to explore the main feature of these models and improve our understanding of their features to capture the dynamics of shadow banking sector in the SFC framework. In this regard, Appendix A in the appendix presents a table which includes all these recent studies that attempted to formalize the shadow banking within the SFC framework. Such literature review on SFC model of shadow banking in a short glance enables us to assess the potential of these models and grasp their limitations that we wish to overcome in our modelling of shadow banking.

It is important to note that our aim is to carefully analyze these recent works so that we can build a detailed model of the financial market that includes a complete picture of the shadow banking system. The table in Appendix A shows that the attempts to include several assets and sectors naturally increases the level of complexity of the models. Indeed, the choice of such complexity comes from authors who want to model a more realistic financial market, rather than a simple productive sphere of the economy namely productive sector and household sector ([Caverzasi and Godin, 2014](#), p. 4). Note that these papers motivated their analysis

to describe such complex financial markets after the housing bubble that led to the global financial crisis of 2007-08. Therefore, the starting point of our taxonomy can be dated to 2007, considering the publication of Monetary Economics (the main reference for PK-SFC approach, [Godley and Lavoie \(2007\)](#)) and the fact that all papers that attempted to deal with shadow banking system in their model appeared after the phrase ‘shadow banking’ was put forward in 2007<sup>3</sup>.

All of these papers discussed above have concentrated on the issues of shadow banking and endeavors to incorporate problems relating to financialization issues and the consequence of shadow banking for macroeconomic variables such as income distribution. Examples of such models include ([Botta et al., 2019, 2015, 2018](#); [Caverzasi et al., 2019](#); [Nikolaidi, 2015](#); [Zezza, 2008](#)). For example, [Zezza \(2008\)](#); [Fontana and Godin \(2013\)](#) built a model that focused on the housing market and the mechanism by which purchase of houses by worker households were financed by mortgages. The relevant features of [Fontana and Godin \(2013\)](#) for our analysis is that their model introduces the role of securitization (of mortgages) and the repercussions of these securitized assets for other financial markets. Similarly, [Nikolaidi \(2010, 2015\)](#) developed a model wherein the presence of securitization with wage stagnation generates an instability which can be viewed as two main roots of the global financial crisis. In her model, [Nikolaidi \(2015\)](#) explicitly shows that investor household buy shares from the institutional investor and also that the securitization of loans increases the credit availability of commercial banking sector.

In short, most of the papers have attempted to study some aspects of the shadow banking sector that can generate instability for the financial system, affect redistribution of income away from workers towards rentiers, or have important consequences for some sector such as housing sector. However, these do not address to explore how shadow banks create credit in the complex financial system. To the best of our knowledge, up to now, there is no study that explicitly focuses on the sources of funds in the shadow banking system and the credit creation by specific shadow banking institutions such as Broker-Dealers. In this context, repo market in which securitized assets and the broker-dealers play an important role when creating credit within the shadow banking system. The stock-flow consistent modelling technique ([Godley and Lavoie, 2007](#)) take on this issue. Following a post-Keynesian framework, we will provide a formalization that includes a detailed shadow banking sector to support our formalization. We aim to construct a macroeconomic model on this literature but extend the model to adequately show the shadow banking sector and its interaction with the other sectors of the economy.

The next section provides a framework in which we explicitly describe the role that shadow

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<sup>3</sup>The term ‘shadow banking’ was coined by McCulley (2007) during the meeting of the US Federal Reserve in Jackson Hole in August 2007. Since then, there are several definitions of the shadow banking have been provided by the literature. The Financial Stability Board defines to ‘shadow banking’ as “credit intermediation involving entities and activities outside the regular banking system”. The fact that the terms related to shadow banks or shadow banking were never fully described or fully investigated. [Bouguelli \(2019\)](#) calls it ‘metaphor’ as he argues that there is still no generally accepted definition of shadow banking.

banks play in the economy and their limitation on credit creation due to their dependence on commercial banks. Moreover, the description of such economy that we depict below includes sectors like both workers and rentier households in addition to the financial system or commercial and shadow banks such as MMMFs, SPVs, Broker-Dealers. The transaction between sectors will be discussed through T-Accounts to get a better understanding of the linkages between sectors. Note that this depiction shown in Figure 2.1 represent the general framework of our SFC modelling.

### 2.3 Brief history of stock-flow consistent modelling

In their paper [Caverzasi and Godin \(2014\)](#) argue the main characteristics of post-Keynesian stock-flow consistent (PK-SFC) models<sup>4</sup> and ask two important questions that this section aims to answer: What are PK-SFC models and where do they come from? To answer the first question, following [Caverzasi and Godin \(2014\)](#):

[W]e can say that PK-SFC models are a specific kind of post-Keynesian macro model that follows distinctive accounting rules, ensuring the consistent integration of the stocks and flows of all the sectors of the economy. This led to reaching three important achievements: first, the consistency of the overall economy, since one sector's outflow is always another sector's inflow just as one sector's liability is always another sector's asset; second, the integration of the real and the financial side of the economy; and third, the construction of the long run as a chain of the short run. Nothing is lost, neither in space nor in time." ([Caverzasi and Godin, 2014](#), p. 4)

With respect to the second question, the SFC approach goes back to the 70s and 80s. [Backus et al. \(1980\)](#), [Tobin \(1969\)](#) and [Godley and Cripps \(1983\)](#) were important figures for the development of SFC approach. Moreover, [Zezza \(2018\)](#) points out that [Turnovsky \(1977\)](#) and [Fair \(1984\)](#) are also worth mentioning for the contribution of the development of SFC approach. Besides this, one can say that the PK-SFC approach has recently seen a revival in the literature after publication of *Monetary Economics - An Integrated Approach to Credit, Money, Income, Production and Wealth* by [Godley and Lavoie \(2007\)](#).

[Caverzasi and Godin \(2014\)](#) identify two main components of the SFC models. Accordingly, the accounting framework is the first component of such models, and it includes balance sheet matrices, transactions, and capital gains. To get a balance sheet matrix correctly is a necessary step to build an SFC model since this component shows the number of assets and sectors that play in the economy. The second component of an SFC model is a system of equations that

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<sup>4</sup>In this paper we use both terms (PK-SFC or SFC) interchangeably, following the call of [Caverzasi and Godin \(2014\)](#)



represent behaviors of the sector when they become economic agents for transactions. It thus models all the transactions that is defined by the modeller. [Caverzasi and Godin \(2014, p. 5\)](#) argue that the accounting component of the SFC represents the framework, “which then becomes a post-Keynesian model once the behavioural equations come into play.” Therefore, one may argue that in the case of two SFC models in which in both cases the accounting framework, more specifically the list of assets that circulates in the economy, and its set of sectors that involves in economic transactions can be exactly the same structure while the outcome of these models may significantly differ because of the specific determination of the behavioural equations of the models. The two components of an SFC approach constitute a starting point to build a model. In what follows three steps can be defined to develop a framework to be considered SFC model. Accordingly, (1) the accounting framework becomes beginning of everything when we are about to build an SFC approach; (2) defining the transaction and specific relationships between sectors via the behavioural equations; and (3) solving the model that shows outcome obtained in the end. We have already mentioned the first two necessary steps about an SFC approach. The third step – solution of the model – reflects the system of equations on the economy that evolves in time given their specific behavioural definitions. Therefore, it is at this last stage that the modeller arrives to observe the outcomes of the model. To reinforce the accounting framework, let us look at the methodology adopted by [Godley and Lavoie \(2007\)](#). This methodology is based on three matrices that can be seen throughout their reference book for current PK-SFC practitioners, which includes (i) a stock matrix, that is to say a matrix shows the initial stock of the economy; (ii) a flow matrix, representing all flows which result in initial stocks and that emerges by transaction decisions of the sectors in the economy; and (iii) a stock re-valuation matrix, showing how the flows of the period are determinants of different stocks at the end of period. To have a clear idea of this accounting consistency, referring to [Godley and Lavoie \(2007\)](#), [Zeza and Zeza \(2019\)](#) and [\(Nikiforos and Zeza, 2017, P. 4\)<sup>5</sup>](#), we identify three main accounting principles of SFC macroeconomic modelling.

### 2.3.1 Flow consistency

First, they begin with ‘flow consistency, implying that every monetary flow comes from somewhere and goes somewhere. It is this particular feature that ensure ‘no black holes’ in the system. An example to solidify this point can be the case in which worker household wage bill which is income for them is a payment for the non-financial firms. Likewise, if a country exports, then its exports represent the imports of another country. This way of accounting consistency is called ‘horizontal’ consistency<sup>6</sup>. Besides horizontal consistency, there is ‘vertical’

<sup>5</sup>In [Nikiforos and Zeza \(2017\)](#) one can find four principles as accounting consistency: (1) flow consistency; (2) stock consistency; (3) stock-flow consistency; (4) quadruple entry. In our taxonomy of accounting principles, flow consistency includes the quadruple entry principle and thus we identify three

<sup>6</sup>([Nikiforos and Zeza, 2017, p. 4](#)) called this type of low consistency as ‘horizontal’ in line with the System of National Accounts (SNA).

consistency which underlines that each transaction includes two entries to record changes in the balance sheet of the sector. ‘Credit’ and ‘debit’ relationship enables us to grasp the nature of vertical consistency. For example, when a household obtains income, it is this receipt that is credited by the same amount on the balance sheet of the household. Moreover, the first and second type of flow consistency accounting principles imply the *quadruple-entry system* developed by Copeland (1949)<sup>7</sup>. The idea of quadruple entry is that every transaction that occurs between agents or sectors must involve a quadruple entry in accounting. An example to solidify quadruple entry system is to think of a household and non-financial firm in the economy in which purchases of a product by the household increases the revenue of the firm while this expenditure decreases at least one asset of the household or increases in a liability. In other words, in accounting this transaction leads an entry for an increase in the asset side of the household’s balance sheet and entry for an increase in the asset side of non-financial firm.

### 2.3.2 Stock consistency

This type of consistency ensures that the sum (net) financial wealth of the economy as a whole is equal to zero. In other words, the financial assets of a sector are financial liabilities of some other sector in the system. Therefore, the financial assets of a sector should match financial liabilities of another sector(s). For example, when a household take out a loan from a commercial bank in the system, the loan then appears as a liability for the household and an asset for the commercial bank.

### 2.3.3 Stock-flow consistency

The stock-flow consistency principle implies that flows define or affect stocks. This principle suggests that the impact of flow on stock is important to get stock-flow consistency right, given that there are capital gains and or (loss) due to the change in the price level of that particular asset and these gains or (loss) must be correctly included when calculating stocks.

To repeat, the accounting consistency is an important step to get better understanding of the way we want to address problems in economics. For Taylor (2004, p. 206), to get accounting consistency right is ‘the best way to attack a problem in economics’. Moreover, Nikiforos and Zezza (2017, p. 2) point out that it is the result of careful accounting which leads to interesting conclusion in its own right since it imposes certain constraints and reduces the degrees of freedom of the model. Considering the above accounting principles and their importance to build an SFC model is a very important part of SFC framework. Moreover, the question of how many assets and sectors to include into the model is directly related to the research question to be explored. An SFC model can or must include many assets together with many sectors to develop more realistic facts that the model can potentially capture. However, there is a cost

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<sup>7</sup>(Caverzasi and Godin, 2014, p. 5) study the root of PK-SFC models and argue that their roots go back to late 1940s, noting that the work of Morris A. Copeland (1949) ‘is the father of the flow of funds.’

of such large models given the possibility to have an overly complicated and less intuitive models in the end. To sum this point, when this first and necessary step of doing accounting right is done, the modeller is ready to consider the closure<sup>8</sup> and the behavioural specification of the model. It is thus the consideration of closure and behavioural specification that determine the conclusions of a model. In this regard, the SFC literature includes post-Keynesian closure. For example, economic activity within SFC models is determined by demand side and finance plays a central role<sup>9</sup>. Similarly, the role of aggregate demand is indeed central and that sets the tone for the economic system both in the short run and long run (Nikiforos and Zezza, 2017, p. 8).

Up to now, we have discussed the importance of accounting consistency and that of closure for SFC methodological approach. Behavioural equations of the model represent another crucial part of the model. Assume that a model includes  $n$  endogenous variables with  $k$  independent accounting identities. Solving this model requires  $n-k$  equations. To repeat, the equation of the model comes from the specific behavior of the agents or sectors when they involve in economic transactions within the model. Moreover, it is generally accepted that there are five broad categories of behavioural assumptions that one needs to make<sup>10</sup>. Accordingly, the first assumption is related to specify how the agents or sectors determine their expenditure function in the economic model. This can be a consumption function for household sector or an investment function for firm sector. Given that the modeller defined the consumption function or investment function through the first category of behavioural assumption, the second category concerns about how the agents finance their expenditure. Let us think about the case in which household consume and decide how much of their expenditure will be financed through bank loans. It is possible that the modeller will formulate such function according to their research questions. For example, (Godley and Lavoie, 2007, ch. 11) formulate that the demand for bank loans by household sector is a constant function proportion of their disposable income. Similarly, the formulation of investment function for firms can be a simple linear form in which firms finance a fixed proportion of their investment by issuing new equities. The third category of behavioural assumptions is about allocating the wealth. Consider households when they decide to allocate their wealth. The question then is how households allocate their wealth when there are various possible assets. Before attempting to answer the question, two points must be clarified: (1) the determination of wealth allocation by households not only stems from their decision on how much to consume and borrow in the current period but also (2) arises from their stock of wealth from the previous period and possible capital gains. These

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<sup>8</sup>Our treatment of SFC models includes post-Keynesian closures that the direction of causality when the modeller wants to impose over the variables. For example, post-Keynesians would impose the direction of causality that runs from effective demand to economic growth both in the short and in the long run when they build their models.

<sup>9</sup>See (Nikiforos and Zezza, 2017, p. 8) for an argument of closure in Keynesian school and neoclassical macroeconomic models.

<sup>10</sup>See e.g. Caverzasi and Godin (2014); Nikiforos and Zezza (2017)

two points define the quantity of wealth to be allocated. Let us suppose that there are  $m$  possible assets that households can consider for the allocation of their wealth. In this case, the modeller can define the demand for  $m-1$  of them, knowing that the demand for the last one becomes a residual asset.

We turn now to the question of how household allocate their wealth. Following [Godley \(1999\)](#); [Tobin \(1969\)](#), ([Godley and Lavoie, 2007](#), ch. 5), an agent (read household) allocates its wealth according to ‘Tobinesque’ portfolio allocation principles, depending on expected rates of return<sup>11</sup>. We now come to the fourth set of behavioural assumptions, implying productivity growth, wages, and inflation issues. According to ([Nikiforos and Zezza, 2017](#), p. 10), the productivity issues are limited within the SFC literature. It is this limitation or the obvious lack of attention to deal with productivity issues that led to productivity being assumed constant or in some cases assumed to grow at an exogenously given rate<sup>12</sup>. Inflation is another issue that is the result of the conflict between workers and capitalists (their employments). The former enters the labour market by selling their labour power in return for wage income. Note that it is the production decision of firms that brings about demand for labour and then the wage bill is determined by capitalist and exogenous wage rates ([Godley and Lavoie, 2007](#), ch. 10 p. 319). As a result, the issue of determination of price level is directly linked to a mark-up on the production cost (([Nikiforos and Zezza, 2017](#), p. 10).

Finally, we now deal with the last (fifth) set of assumptions that concern with the behaviour of the financial system. As mentioned above, the SFC approach is special when one wishes to analyze an economy in which both real and financial sides are included in an integrated fashion. It is this reason that the behaviour of the financial side, in particular the role of banking system (banks and central bank) together with other financial institutions is important. Therefore, the modeller needs to make assumption such that it provides good reasons for having the crucial role of banks, monetary policy, and other financial system. For example, throughout the book by [Godley and Lavoie \(2007\)](#), one can see the special role of commercial banks in supplying loans on demand by the firms or households. Indeed, this role of banks within SFC models makes a sharp distinction from the neoclassical treatment of the banks in their model in which banks are intermediary, collecting deposits from savers and lending them out. Furthermore, central bank operations and monetary policy deserve more attention when a modeler specify their behavioural assumptions. In contrast to neoclassical monetary theory, central banks in SFC models accommodate demand for high powered money (HPM) and demand for advances by banks. Therefore, central banks exogenously set the interest rate and determine the quantity of money endogenously. Besides this, as this is the case in most models in the SFC models,

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<sup>11</sup>See [Nikiforos and Zezza \(2017\)](#) for specifying the asset allocation in more formal way.

<sup>12</sup>See ([Godley and Lavoie, 2007](#), ch. 11 p. 388) for the treatment of productivity issues in their model, the growth rate of trend labour productivity being assumed by an exogenous variable.

central banks are residual purchaser of government bills<sup>13</sup>. In other words, central banks buy any quantity of government bills that are not demanded by the private sector (Nikiforos and Zezza, 2017, p. 10). All in all, SFC models are powerful tools if one is interested in a complete picture of an economy, that is an economy in which the real economy is depicted with an active financial system where banks, central banks play a central role in shaping the economy. We conclude this section with the emphasis of Nikiforos and Zezza (2017) on the usefulness of SFC models:

“ The accounting skeleton ... together with the demand-led closure, and the behavioural assumptions for the components of aggregate demand, and the explicit treatment of financial assets allows for an integrated analysis of the real and the financial sides of the economy. These kinds of models are diametrically opposed to models that have dominated macroeconomic discourse over the last three decades, where the real variables are independent from the monetary variables. In SFC models, decisions made by the agents of the economy on debt, credit and assets and liabilities allocation have an impact on the determination of the real variables and vice versa. As the recent crisis made very clear, this is a better way to understand a modern capitalist economy.” (Nikiforos and Zezza, 2017, p. 10).

## 2.4 Sources of funds in the shadow banking system

In this section, we identify two channels to show how the process of credit intermediation in the shadow banking system looks like. Accordingly, the two channels describe two different sources of funds in the shadow banking system. The first source of funds of the shadow banking relies on commercial banks. The logic of endogenous money is the starting point to understand why shadow banking needs to obtain funds previously made by commercial banks if they want to grant credit. It is important to note that while the funds made by commercial banks constitute the first step of the credit creation, the agent who obtains funds from the commercial bank needs to spend this fund so that shadow banking can find its way to enter the process of credit intermediation.

Contrary to the first channel of the shadow banking system, the source of funds in the second channel does not rely on the first step in which commercial bank creates funds. However, this does not mean there is no role of commercial banks in the second channel. Commercial banks still play a crucial role in the entire shadow banking system. On the one hand, they create funds and these funds may be channelled towards to the shadow banking system after being spent by a non-financial agent. On the other hand, with the process of securitization, commercial banks involve in the business of packaging and reselling loans that are sold to

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<sup>13</sup>See (Godley and Lavoie, 2007, ch. 10-11) and Zezza (2008) for such formulation that central banks act as a residual purchaser of government bills.

Special Purpose Vehicles (SPVs). In turn, SPVs act as intermediaries in arm-length relation between commercial banks and shadow banks such as Broker and Dealers. This is exactly the place where we delved into the important role of broker and dealers in the second channel of shadow banking. Brokers and dealers take advantage of this second source of funds to invest in new assets and acquire additional funds to finance the expansion of their balance sheets. In the second channel, broker-dealers hold the mortgage-backed securities (MBS) issued by SPV which in turn fund securitized loans originated by commercial banks.

[Adrian and Shin \(2009, 2010b\)](#) study the behavior of broker-dealers that includes the major Wall Street investment banks in the US and argue that the take-off of broker-dealers can be explained by the changing structure of the US financial system and in particular by the changing nature of the residential mortgage market and growing importance of securitization. Their main conclusion is that there is a strong positive relationship between changes in total assets and changes in leverage and broker-dealers may be seen as a barometer of the overall funding conditions in a market-based financial system. In their investigation of the broker-dealer sector and its role in the shadow banking system, they look at the balance sheet of Lehman Brothers and report end of the 2007 financial year. Their observation for that time is that total assets were \$691 billion. Importantly, the collateralized lending (repo) constituted Lehman's role as a prime broker to other entities in the shadow banking system and consisted of reverse repos and other types of collateralized lending. A repo is secured by collateral, that is, a loan of cash against security as collateral. In the case of Lehman and the largest class of assets were collateralized lending which was short term, often overnight. Repos, which Lehman already used with shadow banks pre-crisis were the largest class of assets on their balance sheet. However, if one looks at the same asset side of the balance sheet of Lehman it is striking how small the holding of cash is. The cash holding is \$7.29 billion out of a total balance sheet size of \$691 billion. The second channel of shadow banking in our description of the process of credit intermediation in the shadow banking system will explore how the broker-dealers sector expands its balance sheet with such a small holding of cash. To understand this, the pro-cyclical behavior of the broker-dealers ([Adrian and Shin, 2009](#)) plays an important role. [Adrian and Shin \(2009, 2010a,b\)](#) show this pro-cyclical behavior of broker-dealers by focusing on the change in leverage of the five stand-alone US investment banks (Appendix D in the appendix shows an illustration of their finding on pro-cyclical behaviour of broker-dealers). According to their study, the leverage of these institutions is pro-cyclical because an improvement in economic fundamentals increases the market value of their assets and thus their net worth, which allows them to expand their balance sheet. Finally, [Adrian and Shin \(2009\)](#) consider growth in leverage - as measured by the change in assets minus the change in equity - and argue that the adjustment in leverage primarily takes place through expansion and contractions of the balance sheet rather than through the raising or paying out of equity ([Adrian and Shin, 2009, p. 8](#)). This finding provides information about the expansion of broker-dealer balance sheet and

in particular how they expand their size with a small or constant growth of equity. We can understand the fluctuations in leverage in terms of the implicit maximum leverage permitted by creditors in collateralized borrowing transactions such as repurchase agreements (repos). Importantly, they point out that the margin of adjustment on the balance sheets of broker-dealers is through repos and reverse repos. In other words, repos are important financing activities that provide the funds and securities needed by broker-dealers to take positions in financial markets, and “changes in leverage are achieved through expansion and contractions in the collateralized borrowing and lending ” (Adrian and Shin, 2010b, p. 18). The following section shows how credit intermediation occurs through two channels of shadow banking, which we report below along with the relevant T-Accounts.

### 2.4.1 Credit intermediation in the shadow banking system

Considering Figure 2.1, we depict an economy in which there are six actors or sectors: worker households, rentier households, money market mutual funds (MMMFs), Broker-dealers (investment banks), Special Purpose Vehicles (SPVs), and commercial banks. To get a better understanding of the transaction between these sectors and the distribution of assets and liabilities among the sectors, we illustrate all steps with simple T-Accounts. As can be seen from Figure 2.1, there are six steps to explore the sources of funds and how credit intermediation occurs in our representation of the shadow banking system. We assume that assets include mortgages, bank deposits, MMMF shares, mortgage-backed securities (MBS), and bank loans.

We start with the first step (Step I) in which there is a move between commercial banks and worker households. In our depiction, we assume that the worker household want to buy a house from rentier household. This first move is the description of how worker households get into debt to buy a house from rentier households. What we see from the Step I is that the commercial bank makes a loan (read mortgage) so that a worker household can purchase a house from the rentier household. This first step aims to show the worker household owns a house with a mortgage. For concreteness, let us assume that the house is worth \$100 and the mortgage value is 100.<sup>14</sup> Here loan origination is understood as the provision of a means of payment to the household taking out a loan. The logic of endogenous money reflects on both sides of the balance sheet of a commercial bank. More precisely, whenever a commercial bank makes a loan it simultaneously creates a matching deposit, expanding the balance sheet on both sides. It is important to note that the commercial bank can make this loan without having pre-existing deposits that savers place with them. With this move, the commercial bank created a deposit by crediting the account of the household with the loan against an increase of the bank’s assets by the borrower’s obligation to repay the loan. Before moving to the next step, there is a crucial role of the commercial bank and its ability to endogenously

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<sup>14</sup>We assume that households can get a mortgage which is the exact amount of the house that they want to buy. However, we are aware that in reality, that loan made is smaller than the value of houses and households needs to have a net worth (equity) that can cover the difference between the mortgage value and the house price.

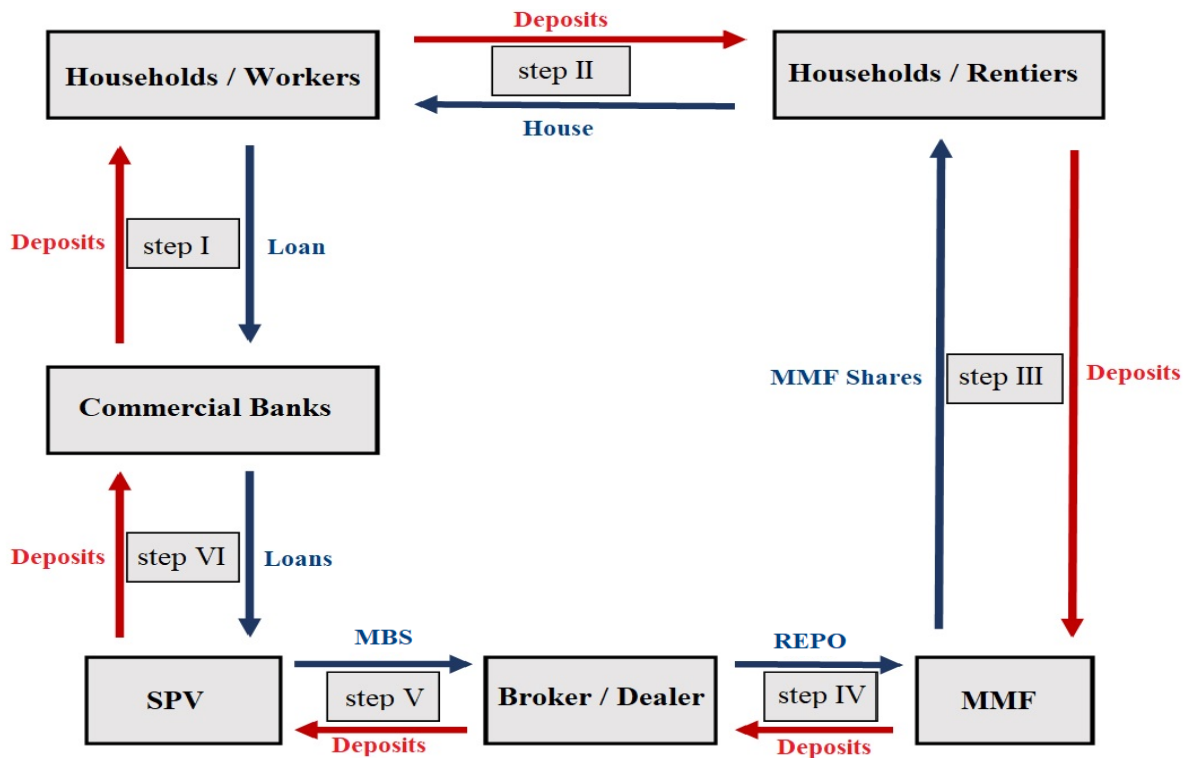


FIGURE 2.1: The process of credit intermediation in the shadow banking system

TABLE 2.1: The bank creates money by granting a loan (100) to the worker household

Commercial bank		Worker Household	
Assets	Liabilities	Assets	Liabilities
+100 Loan	+ 100 Deposit	+100 Deposit	+ 100 Loan

create money, allowing households to obtain deposits to be able to own a house financed with a mortgage. Such a financial relationship can be seen on the liability side of worker households and the asset side of the commercial bank balance sheet. Table 1 illustrates how the first step looks like through a simple T-Accounts of both commercial bank and worker household.

Step II shows a move between worker households and rentier households. A rentier household in this step represents the seller of the house. As a consequence of Step I, the worker household has a deposit (\$100) to buy a house whose value is \$100 from the rentier household. With a newly obtained deposit, the worker household owns a house. With this move, the deposit of worker household is transferred to the rentier household. In return, the house is handed over to the worker household<sup>15</sup>. Table 2.2 displays the transaction when the worker household purchases a house from the rentier household and the transfer of deposit by the commercial

<sup>15</sup>Again, to avoid unnecessary complications, for the transfer of deposit from worker household to rentier household, we assume that both worker and rentier household have a bank account with the same bank. We are aware that it is more likely than not that the rentier household's account will be with a different bank to the worker household. However, for the sake of simplicity, we assume that both households have a bank account with the same bank.



TABLE 2.2: *Worker household purchases a house from rentier household*

<b>Commercial bank</b>			
Assets		Liabilities	
(100) Loan (worker)		-(100) Deposit (worker)	
		+(100) Deposit (rentier)	
<b>Worker</b>		<b>Rentier</b>	
Assets	Liabilities	Assets	Liabilities
(0) Deposits	(100) Loan	+(100) Deposits	
+(100) House		-(100) House	

bank on behalf of the worker households to the rentier household. The final composition of the balance sheets is the following: the deposits is transferred to the rentier household. In return, the house which the rentier household had is giving to the worker household. As seen from the T-Accounts in Table 2.2, the worker household is left with a new asset in the form of a house and the liability in the form of loan from the Step I. The rentier household is left with money in the form of bank deposits instead of a house.

Step III shows the financial relationship between rentier households and MMMFs. We assume that rentier households exchange bank deposits for MMMF shares. With this move, the shadow banking enters to our depiction of the economy. It is important to emphasize the shadow banking (MMMF sector) story starts when the rentier household uses his deposit in exchange for the MMMF shares. This will represent the first channel of the shadow banking system in which the MMMF sector plays an important role.

Table 2.3 illustrates the financial relationship between rentier households and MMMF. The T-account of the rentier household says that his deposit decrease by \$100, while the rentier household now holds \$100 MMMF shares. Table 2.3 also gives the final composition of the MMMF sector which is credited with \$100 in bank deposits, while issuing liabilities for the same amount<sup>16</sup>. Note that the MMMF entered our depiction of credit intermediation in the shadow banking system once loans originated by commercial banks in the first place. After being created, loans need to be spent on the purchase of a house and willingness of the rentier household who holds the newly obtained deposit in return for selling a house, to convert deposits into shadow banking liabilities such as MMMF shares. As a result of this move, the MMMF becomes a sector that can transform existing financial claims against ultimate borrowers that have been originated by commercial banks.

In this first channel of shadow banking, the MMMF obtains funds from a fixed stock of existing means of payment – bank deposits if they want to involve in credit intermediation. Unger (2016) documents pieces of evidence on this point that only 12 percent of loans granted before the explosion of the financial crisis have been originated by the shadow banking system. Unger (2016) shows that the process of credit intermediation in shadow banking, taking

<sup>16</sup>See Botta et al. (2015) for a similar depiction.

TABLE 2.3: *Rentier buys MMF's shares*

Commercial bank			
Assets		Liabilities	
100 Loan		-(100) Deposit (rentier)	
		+(100) Deposit (MMF)	
Rentier		MMF	
Assets	Liabilities	Assets	Liabilities
(0) Deposits		+(100) Deposits	+ (100) Shares
+(100) MMF Shares			

explicit account of commercial banks' role as the creator of means of payment. According to Unger (2016), the largest part of the shadow banking system merely transforms existing financial claims against ultimate borrowers that have been originated by traditional banks. In this context, the assets held by shadow bank (the MMMF in our depiction) are financed by converting ultimate lender's deposits (rentier household), which have been created by the commercial banking system in the process of loan granting, into shadow bank liabilities (MMMF shares).

Step IV describes the move of how MMMF uses its deposits for a (reverse) repo agreement. Broker-dealer represents another sector who involve in repo agreement with an MMMF to obtain a deposit. A repo, or sale and repurchase agreement, is a short-term transaction (usually overnight) between two parties in which one party borrows cash from the other by pledging financial security as collateral. What is important to emphasize here is that a repo has two sides: cash and collateral, that is, a loan of cash against a security as collateral. While the fundamental purpose of repo transactions is to lend and borrow funds, collateral is crucial repo transactions. In a repo, the lender (of cash) receives securitized assets as collateral. The borrower provides collateral today and agrees to buy it tomorrow or at some other specified date. It should be noted that in a repo transaction the borrower (of cash) sells securities used as collateral for a price below the current market price on the day of the transaction, knowing that the following day or in the future at some specified date it will buy it back. The spread between the market value of the transferred securities and the purchase price is called the "haircut". In our examples, MMMF represents the lender of cash and the broker-dealer provides securities used as collateral in the repo transaction. With a repo transaction, the MMMF exchanges its deposits for a repo asset. While the broker-dealer sells a private-label asset (MBS) to MMMF in exchange for cash (deposit) and agrees to repurchase it at a future date, the MMMF transfers its deposits to the broker-dealer becomes a legal owner of the collateral. Table 2.4 displays this move.

Step V is a financial relationship between SPVs and broker-dealers. SPVs are the main securitizing sector in our depiction of the economy. SPVs are used in the securitization process of creating asset-backed securities such as MBSs. In other words, the special purpose vehicle plays a central role in the securitization process in which previously created loans are pooled

TABLE 2.4: *The MMF involves in a (reverse) repo with a broker-dealer*

Commercial bank			
Assets		Liabilities	
100 Loan		-100 Deposits (MMF)	
		+100 Deposit (Dealer)	
Broker-dealer		MMF	
Assets	Liabilities	Assets	Liabilities
+100 Deposit	+100 Repo	-100 Deposit	100 Shares
		+100 Repo	

and packaged to be sold to broker-dealers. In the process of securitization, they bundle the mortgages and loans into a security (MBS) that is then sold to broker-dealers. Before delving into the transactions that SPVs involve with commercial banks and broker-dealers, it is important to explain how and where do the SPVs get initial finance to buy the mortgages and the loans.

In our depiction of the credit intermediation in the shadow banking, we assume that the SPVs have advances from the commercial banks for the first time. We perceive the SPVs have this line of credit to have money at the beginning, which comes from the commercial banks. The use of advances from the commercial banks enables us to get a better understanding of how the SPV does functioning at the beginning. SPVs produce MBSs and sell them to broker-dealers. In turn, broker-dealers use these MBSs through repos to obtain liquidity from the MMMFs. In our representation of the shadow banking, broker-dealers and the way they obtain liquidity through repos represent the second source of funds in the shadow banking system. In this second source of funds, repo market in which the shadow bank (broker-dealer) plays an increasing role to obtain liquidity. Unlike the first sources of funds in Step III, broker-dealers do not transform existing deposits into shadow banking liabilities. In other words, broker-dealers do not obtain deposits by issuing liabilities as MMMF does. To obtain liquidity they need to have collateral. Before illustrating the T-Account of the broker-dealer in Table 2.5, it is important to answer how the broker-dealers find new assets to invest in and acquire additional funds to finance the expansion of their balance sheet. We assume that broker-dealers start at time  $t_0$  with their own funds, their equity, whose counterpart is some government bonds (which they acquired as primary dealers). This starting point of broker-dealers is important to explain how they obtain a deposit from the MMMF for the first time. Now assume that at time  $t_0$ , broker-dealers with these bonds of 100 they get a collateralized loan (repo) worth \$98 (if the haircut is 2%) with which they buy 98 MBS. Note that the loan made is smaller than the value of the collateral. Then, at time  $t_1$ , we assume that broker-dealers with these 98 MBS get another collateralized loan of \$96 with which they buy 96 MBS and so on. Following [Adrian and Shin \(2010b\)](#), we consider an adjustment in leverage primarily takes place through expansion and contractions of the balance sheet rather through the raising or paying out of equity. This finding

provides information about the expansion of broker-dealer's balance sheet and in particular how they expand their size with a small or constant growth of equity. Importantly, the margin of adjustment on the balance sheets of broker-dealers is through repos and reverse repos. So depending on the haircut and on the risk that broker-dealers are ready to take, with own funds of 100 at time  $t_0$ , broker-dealers can increase their balance sheet to 5000, less so apparently in current conditions, say around 2000. Therefore, in the end ( $t_0, t_1, t_2, t_3 \dots t_n$ ) the assets are 100 government bonds, 1900 MBS, while on the liability side, you have own funds 100 and 1900 repos. This is how broker-dealers finance themselves with small equity. Table 2.5 displays the move between the SPV and the broker-dealer. The broker-dealer has a deposit and it exchanges this deposit for MBS.

Step VI is the last step of our depiction of the economy to describe how money (credit) created in Step I is destroyed. The financial relation between SPVs and commercial banks is the following. The commercial banks grant mortgages and then bundle the mortgages to remove them from their balance sheet - from the "originate and hold" practice to the "originate and distribute" model of banking. SPVs as a main securitizing process is a practice that allows commercial banks to transform their loans (mortgages) into securities and then sell these securities in the financial market. Such financial relationships inevitably start with bank loans (mortgages) to worker households in our depiction of the economy, creating assets (deposits) when commercial banks grant mortgages. Following the creation of assets, these loans -say mortgages- are pooled. Then, these pooled assets are sold to the SPV. Table 2.6 illustrates this move between the commercial bank and the SPV. The commercial bank sells its assets (a part) to SPVs that in turn pay asset purchases by extinguishing their own bank deposit. With this move, bank assets are thus moved off their balance sheet. As [Botta et al. \(2015\)](#) pointed out in a numerical example in their study, "bank money created at the beginning is destroyed, the corresponding assets are still around in the economy." ([Botta et al., 2015](#), p. 227).

To summarize the first channel of shadow banking that we depicted here, it is obvious that there are consequences of endogenous money for shadow banks and their activities for the rest of the financial system. Two points are important to underline. First, it is obvious that shadow banking entered the picture and played a role in providing liquidity by intermediating after the deposit is created ex nihilo by the commercial banking system. Second, shadow banking and its intermediary role in the financial system came into play when a non-financial agent (rentier household in our example) decided to transfer its existing deposits in exchange for shadow banking liabilities. Importantly, while traditional banks can issue their own liabilities, shadow banking is not able to issue its own liability. "the difference is that banks create money and the remaining financial sectors do not." ([Botta et al., 2015](#), p. 207)

TABLE 2.5: *Broker-dealer buys MBS from SPV*

Special Purpose Vehicle		Broker-dealer	
Assets	Liabilities	Assets	Liabilities
+Loans	+ MBS	- Deposit	+ Repo
		+ MBS	

TABLE 2.6: *SPV buys packages of loans from the commercial bank*

Commercial bank		Special Purpose Vehicle	
Assets	Liabilities	Assets	Liabilities
$\Delta$ Loans	Deposit	+ Loans	+ MBS
+Fee		-Deposit (Fee)	

## 2.5 The Model

Nine macroeconomic sectors constitute our macroeconomic model: worker households, rentier households, non-financial firms (NFFs), commercial banks, special purpose vehicles (SPVs), money market Mutual funds (MMMFs), broker-dealers, the government, and a central bank. As can be seen from the Balance Sheet Matrix (Table 2.7), high powered money (HPM) deposits (D), loans (L), mortgages (M), houses (H), MMMF shares (SH), MBSs, ABCPs, REPOs, Productive capital (C), Treasury bills (TB) and central bank advances (A) are financial assets in our model. Houses (H) and real capital (K) are the only non-financial assets that have no liability counterpart in the model. Houses held by households and real capital held by firms. The last row that can be seen in the balance sheet matrix represents the net worth of the sector and it is the difference between assets and liabilities for each sector. For the transaction flow matrix see Appendix C in the appendix.

Households are divided into two groups where the workers take out mortgages from commercial banks to finance purchase of new houses while the rentiers buy shares from MMMF and invest in T-bills. We assumed, following [Zezza \(2008\)](#), that the behavior of the first group of households is to go into debt through mortgages so that they finance their housing investment. Rentiers are assumed to receive distributed profits from both banks and firms besides earning from investing MMMF shares and T-bills. Firms take out new loans from commercial banks to implement their production decisions, invest in ABCPs as wells as investment in productive capital, and produce goods. They pay wages to worker households. Their dividends go to rentiers. In our model, it is the banks that issue loans to accommodate demand for loans by households and firms. Furthermore, we assume that banks operate under a monetary system where reserve requirements are in place. Banks also get advances from the central banks if they need to fulfill the demand for loans or mortgages.

SPVs are used in the securitization process of creating mortgage-backed securities (MBSs). SPVs lay between the supplier of the assets which are banks in our model -the creators of loans - and the broker-dealer sector. The securitization process is a practice that allows banks to

transform their loans into securities and then sell these securities in the financial market. In our model, housing plays an important role. The assets behind the MBSs are home mortgages (ultimate collateral) that constitute the most prominent securitized asset class. As can be seen in the balance sheet matrix, a fraction  $z$  of previously originated mortgages by commercial banks are securitized and sold to the SPV sector. SPVs issue MBSs that are backed by mortgages and MBSs are purchased by other financial operators. Note that the process of securitization can take a more complex turn by repeating the transformation of existing assets into more structured credit products. For instance, [Botta et al. \(2015\)](#) includes collateralized debt obligations (CDOs) in their detailed formalization of shadow banking sector. CDOs are secured by loans or bonds, often other MBSs. In other words, securitization and re-securitization of MBS tranches lead to the issuance of new structured credit products that are funded in short-term debt markets such as REPO and ABCP. However, in our model, we focus on the role of MBSs, thus there is no inclusion of CDOs. The choice we make between MBSs and CDOs is to avoid further complications that may arise from credit default swaps (CDSs). [Botta et al. \(2015\)](#) point out that investment funds after investing in ABSs/CDOs may try to make their financial position safer by taking positions in derivative markets, buying CDSs from insurance companies. Despite we believe this is to be an important element when modeling shadow banking and its complete activities in the financial system, we focus particularly on the importance of MBSs used as collateral for collateralized borrowing, REPOs and MMMF shares because they are systematically connected credit creation by shadow banking. Government expenditures are financed by issuing treasury bills. The important link between banks and the central bank in our models is that the central bank accommodates the demand for advances from the bank. Moreover, central bank interest income is paid to the government. Therefore, the central bank has zero net saving.

TABLE 2.7: Balance Sheet Matrix

Assets/ Sectors	Workers	Rentiers	Firms	Banks	SPVs	MMMFs	B-D	Gov	Central Bank	$\Sigma$
HPM		$+HPM_r$		$+HPM_b$					$-HPM_{cb}$	0
Deposits		$+D_r$		$-D_b$		$+D_{mmmf}$				0
Loans			$-L_f$	$+(1-\omega)L$	$+\omega L$					0
Mortgages	$-M_w$			$+(1-z)M$	$+zM$					0
Houses	$+p_H H_w$									$+p_H H$
MMF shares		$+v \cdot SH$				$-v \cdot SH$				0
ABCP			$+p_{abcp} \cdot ABCP_f$		$-p_{abcp} \cdot ABCP_{spv}$	$+p_{abcp} \cdot ABCP_{mmmf}$				0
MBS					$-p_{mbs} \cdot MBS$		$+p_{mbs} \cdot MBS$			0
Repo						$+REPO_d$	$-REPO_s$			0
Equities		$+OF_r$	$-OF_f$	$-OF_b$						0
Prod. Cap			$+pK$							$+pK$
T-Bills		$+TB_r$		$+TB_b$				$-TB_{gov}$	$+TB_{cb}$	0
CB Adv				$-A$					$+A$	0
Net Worth	$V_w$	$V_r$	$V_f$	$V_b$	$V_{spv}$	$V_{mmmf}$	$V_{b-d}$	$V_{gov}$	$V_{cb}$	$+pK$ $+pH$

TABLE 2.8: *The Balance Sheet Matrix (Reduced version)*

Assets/ Sectors	Worker	Rentier	NFF	Bank	SPV	MMMs	B-D	Gov	Central Bank	$\Sigma$
HPM		$+HPM_r$		$+HPM_b$					$-HPM_{cb}$	0
Deposits		$+D_r$		$-D_r$						0
Mortgages	$-M_d$			$+(1-z) \cdot M_s$	$+z \cdot M_s$					0
Houses	$+p \cdot H$									$+p \cdot H$
MMF shares		$+SH_d$				$-SH_s$				0
MBSs					$-MBS_s$		$+MBS_d$			0
REPOs						$+REPO_d$	$-REPO_s$			0
Pr. capital			$+pK$							$+pK$
T-Bills		$+TB_{rd}$		$+TB_{bd}$				$-TB_s$	$+TB_{cbd}$	0
CB Advances				$-A_d$					$+A_s$	0
Net Worth	$-V_w$	$-V_r$	$-V_f$	$-V_b$	$-V_{spv}$	$-V_{mmf}$	$-V_{bd}$	GD	0	$-pK - pH$



## 2.6 Behavioural Equations

Next, behavioural equation of each sector is considered. Note that the behavioural equations of the system is based on the reduced form of the balance sheet matrix (Table 2.8).

### 2.6.1 Worker households

In our model, worker households play crucial role when they interact with commercial banking sector to go into debt for housing investment. The model explicitly show that it is this first step that worker households obtain mortgages thanks to the special ability of the commercial banks to first create mortgages on demand and then sell these mortgages to the shadow banking system. To repeat: allowing workers households to take on loans from the commercial baking sector in order to finance their housing investment constitutes the first step of our artificial economy to show how shadow banking come to existence.

$$YD_w = WB - i_M \cdot M_{-1} \quad (2.1)$$

$$C_w = \alpha_1 \cdot YD_w + \alpha_2 \cdot V_{w-1} \quad (2.2)$$

$$V_w = V_{w-1} + YD_w - C_w + CG_H \quad (2.3)$$

$$CG_H = \Delta p_H \cdot H_{-1}^d \quad (2.4)$$

Worker households' income comes from their wage bill when they participate in the production process. They take on mortgages from the commercial banking sector to fully finance their investment in housing. Therefore, the formulation of the disposable income of worker households ( $YD_w$ ) is equal to the total wage bills ( $WB$ ) minus the interest payments they pay on mortgages ( $i_M$ ). The consumption function of worker households ( $C_w$ ) depends on disposable income ( $YD_w$ ) and past wealth ( $V_{w-1}$ ). The net worth ( $V_w$ ) depends on positively accumulated past wealth ( $V_{w-1}$ ), positively on the disposable income ( $YD_w$ ), negatively on the consumption ( $C_w$ ) and positively on the capital gains ( $CG_H$ ). The capital gains on houses is given by the change in the houses prices ( $\Delta p_H$ ) multiplied by the number of houses held at the beginning of the period ( $H_{-1}$ ).

### Housing market

$$\Delta H^d / H_{-1}^d = \beta_0 - \beta_1 \cdot p_{H-1} + \beta_2 \cdot \Delta p_H / p_{H-1} - \beta_3 \cdot i_M \quad (2.5)$$

$$\Delta H^s / H_{-1}^s = h_1 + h_2 \cdot p_{H-1} / c_H \quad (2.6)$$

$$M^d = M_{-1} + M_{w-1} \cdot (\beta_4 - \beta_5 \cdot i_m) \quad (2.7)$$

$$p_H = M_w / H_w \quad (2.8)$$

The growth rate of the demand for houses by worker households ( $H^d$ ) is a negative function of the price of houses and it depends positively on the rate of change in housing prices ( $\Delta p_H / p_{H-1}$ ), and negatively on the rate of interest rate on mortgages ( $i_M$ ). The supply side of the housing market in our model, following [Eatwell et al. \(2008\)](#); [Nikolaidi \(2010\)](#) the growth rate of the supply of houses ( $H^s$ ) is related positively to the ratio between the price of housing ( $p_H$ ) and the cost of production of housing ( $c$ ). When we introduce the housing market, we assume that worker households do not face any credit restrictions in the model. Hence, credit is freely available in the housing market<sup>17</sup>. Worker households finance all purchase of housing units ( $\Delta H^d \cdot p_H$ ) through mortgages ( $\Delta M$ ). Therefore we formulate that the whole amount of demanded mortgages is used by households in order to buy new houses ( $\Delta M = \Delta H^d \cdot p_H$ ). The equilibrium in the housing market, following [Nikolaidi \(2015\)](#), we assume that the demand for houses is equal to the supply of houses ( $H^d = H^s$ )<sup>18</sup>.

## 2.6.2 Rentier households

$$YD_r = i_D \cdot D_{r-1} + i_{TB} \cdot TB_{r-1} + PF^D + PB^D + PM^D \quad (2.9)$$

$$YD_r^e = YD_{r-1} \quad (2.10)$$

$$V_r = V_{r-1} + YD_r - C_r \quad (2.11)$$

$$V_r^e = V_{r-1} + YD_r^e - C_r \quad (2.12)$$

$$VH_r = V_r - HPM_r \quad (2.13)$$

$$VH_r^e = VH_{r-1} \quad (2.14)$$

$$HPM_r = h1 \cdot C_r \quad (2.15)$$

<sup>17</sup>For the models that consider credit restrictions in the housing model and explicitly formulate the effect of credit rationing on the behaviour borrowers, see [Eatwell et al. \(2008\)](#); [Nikolaidi \(2010, 2015\)](#)

<sup>18</sup>This equilibrium mechanism can be understood the mechanism for the equity market in ([Godley and Lavoie, 2007](#), ch. 11)). For a similar formulation see [Nikolaidi \(2015\)](#)

$$C_r = \alpha_1 \cdot YD_r^e + \alpha_2 \cdot V_{r-1} \quad (2.16)$$

*Portfolio choice*

$$\frac{SH_r}{VH_r^e} = \lambda_{10} + \lambda_{11} \cdot i_{SH} + \lambda_{12} \cdot i_D + \lambda_{13} \cdot i_{TB} + \lambda_{14} \cdot \frac{YD_r^e}{VH_r^e} \quad (2.17)$$

$$\frac{TB_r}{VH_r^e} = \lambda_{20} + \lambda_{21} \cdot i_{SH} + \lambda_{22} \cdot i_{TB} + \lambda_{23} \cdot i_D + \lambda_{24} \cdot \frac{YD_r^e}{VH_r^e} \quad (2.18)$$

$$\frac{D_r}{VH_r^e} = \lambda_{30} + \lambda_{31} \cdot i_{SH} + \lambda_{32} \cdot i_{TB} + \lambda_{33} \cdot i_D + \lambda_{34} \cdot \frac{YD_r^e}{VH_r^e} \quad (2.19)$$

$$D_r = VH_r - SH_r - TB_r \quad (20a)$$

$$i_{SH} = \frac{PM^D}{SH_{-1}} \quad (2.20)$$

Rentier households derives their income ( $YD_r$ ) from the profits of the firms ( $PF^D$ ) and of the commercial banks ( $PB^D$ ), dividends paid out by the MMMF sector ( $PM^D$ ), and interest received on its deposits and Treasury bills. Note that ( $i_D$ ) is the interest received on deposit accounts and ( $i_{TB}$ ) is the interest on Treasury bills. Furthermore, ( $YD_r^e$ ) gives the expected disposable income of rentier households, which we assume, following [Nikolaidi \(2010\)](#), adaptive expectations. The net worth of rentier households is determined by the previous period's wealth, plus the disposable income of the current period minus their current period of consumption. ( $VH_r$ ) is the wealth net of cash flow, which is wealth of rentiers ( $V_r$ ) minus the high-powered money they hold in the current period ( $HPM_r$ ). Moreover, ( $VH_r^e$ ) is the expected wealth net of cash flow. Rentier demand for high-powered money ( $HPM_r$ ), that is demand for cash, is a proportion ( $h_1$ ) of its consumption. The consumption of rentier households ( $C_r$ ) is given by their expected disposable income and the previous period's wealth ( $V_{r-1}$ ).

Rentier households allocate their expected wealth net of cash between deposits, Treasury bills and money market mutual funds' shares. Deposits act as a buffer therefore, we replace this equation in the computer. ( $i_{SH}$ ) is the rate of return on MMMFs' shares ( $i_{SH}$ ).

### 2.6.3 Non-financial firms

$$Y = C_w + C_r + I + G + \Delta H^s \cdot p_H \quad (2.21)$$

$$I = PF^U \quad (2.22)$$

$$PF^U = (1 - s_f) \cdot PF_{-1} \quad (2.23)$$

$$PF = Y - WB \quad (2.24)$$

$$PF^D = PF - PF^U \quad (2.25)$$

$$WB = \mu \cdot PF_{-1} \quad (2.26)$$

$$H^d = H^s \quad (2.27)$$

In this model one can easily understand that the firm sector included at a simple level. The reason behind this simplification is that we want to focus on the financial side of the economy, namely, commercial banking and shadow banking activities. For example, in the reduced version of the model firms do not take loans from the commercial banks and thus they undertake investment without using external finance.<sup>19</sup> Another simplification in the model is that there is no taxes by the government and we do not consider price inflation. In such a simple mechanism in our model, the firm sector provides consumption for both household sectors, government services, besides producing new houses for worker households. In this way, the output of the economy is determined by the consumption of the households ( $C_w + C_r$ ), the investment in physical capital stock ( $I$ ), the government expenditures ( $G$ ) and houses sold ( $\Delta H \cdot p_H$ ). The firm investment ( $I$ ) is equal to the undistributed profits ( $PF^U$ ), because we assume that they can not take out loans from commercial banks. The undistributed profits depend on the total profits ( $PF$ ) of the previous period.  $s$  defines the amount of total profits that are distributed to investor households. The firm derives its profits  $PF$  from the total output ( $Y$ ) minus the wage bill  $WB$  that it pays to its workers. The distributed profits ( $PF^D$ ) is defined by the total profits minus the undistributed profits. The wage bill for workers ( $WB$ ) is a proportion ( $\mu$ ) of the lagged profits.

#### 2.6.4 Commercial banks

$$M^d = M^s \quad (2.28)$$

$$M^{sSEC} = z \cdot M \quad (2.29)$$

$$M^{sNSEC} = (1 - z) \cdot M \quad (2.30)$$

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<sup>19</sup>See [Nikolaïdi \(2010\)](#) for a similar hypothesize that firms undertake investment without accessing loans commercial banks.

$$PB = i_M \cdot M_{-1} + i_{TB} \cdot TB_{b-1} + FEE - i_D \cdot D_{b-1} - i_A \cdot A_{b-1} \quad (2.31)$$

$$K_b = K_{b-1} + PB \quad (2.32)$$

$$CAR = \frac{K_b}{M^{nsec}} \quad (2.33)$$

$$NM = k_{ava} \cdot M^d \quad (2.34)$$

$$k_{ava} = k_{ava0} + k_{ava1} \cdot (CAR_{-1} - NCAR) \quad (2.35)$$

$$HPM_{bd} = h_2 \cdot D_r \quad (2.36)$$

$$TB_b^N = K_b + D_b - M_b - HPM_b \quad (2.37)$$

$$A_b^N = M_b + HPM_b - K_b - D_b \quad (2.38)$$

$$A_b = z_3 \cdot A_b^N \quad (2.39)$$

$$z_3 = 1 \quad \text{iff} \quad A_b^N \geq 0; \quad \text{otherwise} \quad z_3 = 0 \quad (2.40)$$

$$TB_b = z_4 \cdot TB_b^N \quad (2.41)$$

$$z_4 = 1 \quad \text{iff} \quad TB_b^N \geq 0; \quad \text{otherwise} \quad z_4 = 0 \quad (2.42)$$

*The determination of interest rates*

$$i_M = i_A + Spread_M \quad (2.43)$$

$$i_D = i_A + Spread_D \quad (2.44)$$

$$i_{MBS} = i_A + Spread_{MBS} \quad (2.45)$$

In our model commercial banking sector plays a central role for the housing sector and shadow banking sector. First, they create new mortgages when worker households want to buy

new houses. Second, once commercial banks have granted mortgages to worker households they involves in securitization process, that is, they pool and package mortgages to remove from their balance sheets onto the balance sheet of SPVs.<sup>20</sup> The amount of mortgages issued by the commercial banking sector ( $M^s$ ) is equal to the amount of mortgages demanded by the worker sector ( $M^d$ ). The securitized amount of mortgages ( $M^{SEC}$ ) is determined by an exogenous proportion ( $z$ ) of whole stock of mortgages ( $M$ ). These securitized mortgages are then transferred to the SPVs. ( $M^{NSEC}$ ) is the non-securitized amount of mortgages that are retained in the balance sheet of the commercial banking sector.<sup>21</sup> The commercial banking sector derives its profits from the interest on non-securitized mortgages ( $i_M$ ), the interest on Treasury bills ( $i_{TB}$ ) and the fees  $FEE$  when they sell their mortgages through securitization process, minus the interest it pays to the holders of deposits ( $i_D$ ) and the interest on advances from the central bank ( $i_A$ ). The capital of the commercial banking sector ( $K_b$ ) is defined by the capital from the previous period ( $K_{b-1}$ ) plus their profits  $PB$ . In our model there is no consideration of the non performing loans and hence there is no such (non performing) loans by household that may erode the capital of commercial banking sector.<sup>22</sup> shows the default on loans. In their model, therefore, they consider proportion of the loans, that is, non performing loans to erode the capital of commercial banking sector. For a similar formulation, see Nikolaidi (2010, 2015). NW formulates the effective amount of new mortgages as a proportion of desired amount of new loans. Parameter ( $k_{ava}$ ) gives the credit availability and it is reliant on the difference between capital adequacy ratio (CAR) of commercial banks ( $CAR_{-1} - NCAR$ ).

Following Nikolaidi (2015), the demand for Treasury bills occurs only when there exist sources of funds that have not been used for the provision of loans and for the holding of the adequate reserve requirements. Otherwise, commercial banking sector manage to their balance sheet constrain by getting advances from the central bank<sup>23</sup>. In the model, the commercial banking sector demands Treasury bills ( $TB_b^N$ ) when the sum of capital ( $K_b$ ) and deposits ( $D_b$ ) is higher than the sum of mortgages ( $M_b$ ) and cash  $HPM_b$ . We allow our model to restore the fluctuations in the assets and liabilities of the commercial banks are captured by the specific conditions. For instance, if the possibility that the stock of Treasury bills turn to negative will induce the commercial banks get advances from the central bank. The condition ensures that the stock of Treasury bills held by commercial banking sector will not become negative.

The interest on mortgages ( $i_M$ ), deposits ( $i_D$ ) and securities ( $i_{MBS}$ ) are determined through a simple mechanism on the interest rate on central bank advances. With such mechanism in our model the interest move with the central bank interest rate on advances ( $i_A$ ) by their respective spreads. Note that all interest rate spreads ( $Spread_M$ ), ( $Spread_D$ ) and ( $Spread_{MBS}$ ) are set exogenously and fixed.

<sup>20</sup>See, for example, Eatwell et al. (2008); Fontana and Godin (2013); Nikolaidi (2015)

<sup>21</sup>See e.g. Nikolaidi (2010, 2015).

<sup>22</sup>(Godley and Lavoie, 2007, ch. 11)

<sup>23</sup>See (Godley and Lavoie, 2007, ch. 10 p. 336-337)

## 2.6.5 SPVs

$$\Delta MBS \cdot p_{mbs} = \Delta M \quad (2.46)$$

$$FEE = fe \cdot M^{SEC} \quad (2.47)$$

$$PS = i_M \cdot M_{-1}^{SEC} - i_{MBS} \cdot MBS_{-1}^s - FEE \quad (2.48)$$

$$K_{spv} = K_{spv,-1} + PS \quad (2.49)$$

$$MBS^s = MBS^d \quad (2.50)$$

In this stage of our model we consider the behavior of the shadow banking system. This sector has interaction with the commercial banking sector and the broker-dealer sector. It purchases packages of mortgages from the commercial banking sector to transform these loans into securities (ultimate collateral). Then, it sells these securities to the broker-dealer sector. In so doing, the SPV sector becomes the core of securitization process, that is, transformation of an illiquid asset into a security. Importantly, a consequence of securitization is that the commercial banking sector gets rid of assets on their balance sheet, thus increases its capital adequacy ratio. It is an important reason for the commercial banking to aggressively lend, knowing that it can remove the assets and default risk through the securitization. If we assume all mortgages are securitized in our model, then the issuance of mortgage-backed securities ( $\Delta MBS$ ) whose price  $p_{mbs}$  is derived directly from the amount of new mortgages created ( $\Delta M$ ).<sup>24</sup>  $FEE$  is the amount of administrative fees that SPVs pay when they buy mortgages from the commercial banking sector. In this way, while commercial banking sectors remove previously created loans from their balance sheet, it receives fees from the SPVs through the securitization process. SPVs sector derives its profit from the interest payments on mortgages ( $i_M \cdot M_{-1}^{SEC}$ ) minus the interest on MBSs ( $i_{MBS} \cdot MBS_{-1}^s$ ) and the fees paid to the commercial banking sector. Capital of the SPVs is determined by the previous period ( $K_{spv,-1}$ ) plus their profits ( $PS$ ). The supply and demand equilibrium in the MBSs market ( $MBS^s = MBS^d$ ) is given by the mechanism that is similar to suggestion of [Nikolaidi \(2010\)](#) according to whom the equilibrium mechanism exists in the equity market.

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<sup>24</sup>See [Eatwell et al. \(2008\)](#) for a consideration of the shadow banking system and its interaction with the housing market. In the model, it is assumed that all purchases of housing units are financed through mortgages and the change in the mortgage-backed securities is derived from the amount of new mortgages created by the commercial banking sector. However, their model is limited to the commercial banking sector and the SPV sector. There is no other financial institution such as broker-dealers on the demand side of these securities who purchase and use as collateral in the end.

### 2.6.6 MMMFs

$$PM = i_{REPO} \cdot REPO_{-1}^s \quad (2.51)$$

$$PM^U = s_{mmf} \cdot PM_{-1} \quad (2.52)$$

$$PM^D = PM - PM^U \quad (2.53)$$

$$K_{mmf} = K_{mmf-1} + PM^U \quad (2.54)$$

What is important about the MMMF sector is that the shares bought by rentier households defines their main source of fund.<sup>25</sup> Once shares have been issued to the rentier sector in exchange for deposits, the MMMF sector involves in repo market, representing the lender sight of the repo transactions. In so doing, they receive interest on (reverse) repo lending. Therefore, the profit of MMMF sector ( $PM$ ) is given by the interest received on its repo lending ( $i_{REPO} \cdot REPO_{-1}^s$ ). The MMMF sector distributes part of their profits to rentier households who hold exchanged their deposits for the shares ( $PM^D$ ). ( $PM^U$ ) says that the MMMFs retain a small part of their profits. ( $s_{mmf}$ ) denotes the retention ratio. The capital of MMMF sector is defined by the previous period, plus its undistributed profits of the current period.

### 2.6.7 Broker-Dealers

The amount of repos borrowed from the MMMFs arises from the need to finance the purchase of the MBSs from the SPVs.

$$COL_{bd,t} = \begin{cases} T - bills_{bd,-1}, & \text{if } t = 0 \\ MBS_{bd,-1}, & \text{if } t > 0 \end{cases}$$

$$\Delta REPO_{rd} = p_{mbs} \cdot \Delta MBS \cdot (1 - HAIRCUT) \quad (2.55)$$

$$REDOd = \min(REPOs, REPOrd) \quad (\text{REPO supply constrained by MMF}) \quad (2.56)$$

$$REPOed = REPOrd - REPOd \quad (\text{Excess demand in the REPO market}) \quad (2.57)$$

$$LEV_{bd} = \frac{\text{Total Assets}}{\text{Equity}} \quad (2.58)$$

<sup>25</sup>We assume that the shares issued by MMMFs have a stable price equal to 1\$ per share. See Nikolaidi (2015).



$$PBD = i_{MBS} \cdot MBS_{-1} - i_{REPO} \cdot REPO_{-1}^d \quad (2.59)$$

In Section 3 we have mentioned that how broker-dealers find new assets to invest in and acquire additional funds to finance the expansion of their balance sheet. We assume that the broker-dealer sector starts at time  $t_0$  with their own funds, their equity, whose counterpart is some government bonds (which they acquired as primary dealers). This starting point of the broker-dealer sector is important to explain how they obtain a deposit from the MMMF sector for the first time. Most importantly, due to impose of haircut on the repo transactions, the loan made by the MMMF sector is smaller than the value of the collateral. Furthermore, given that the other side of the repo transaction, that is MMMF sector invest in repo according to their portfolio allocation between ABCPs and REPOs, demand for repo by the broker-dealer sector cannot exceed the supply of repo by the MMMF sector. Therefore, we formulate, first, realized demand for repo loans by the broker-dealers ( $\Delta REPO_{rd}$ ). We define such mechanism<sup>26</sup> by which the constraint that may come from portfolio choice of the MMMF sector for the availability of repo loans ( $REPO_d$ ). In other words, demand for repo loans by the broker-dealer sector cannot exceed the supply of repo ( $REPO_s$ ) by the MMMF sector. Besides this, the excess demand may occur in the repo market which is given by ( $REPO_{ed}$ ). The profits of the broker-dealer sector derives from the interest rate on MBSs ( $i_{MBS} \cdot MBS_{-1}$ ), minus the interest it paid on the repo transactions ( $i_{REPO} \cdot REPO_{-1}^d$ ).

### 2.6.8 The government

$$\Delta GD = TB_{-1} + G + i_{TB} \cdot TB_{-1} - PC \quad (2.60)$$

$$\Delta TB = GD \quad (2.61)$$

$$G = G_{-1}(1 + g) \quad (2.62)$$

$$\overline{i_{TB}} = i_A \quad (2.63)$$

In our model government finances its expenditure by issuing Treasury bills ( $\Delta TB = GD$ ). Note that, the government expenditure is exogenous and grows at constant rate ( $g$ ). The change in bills issues by the government ( $\Delta TB$ ) is equal to the total amount of government expenditures ( $G$ ), the interest paid on the amount of Treasury bills from the previous period  $i_{TB} \cdot TB_{-1}$  minus the profits of the central bank ( $PC$ ). We assume that the interest rate on Treas-

<sup>26</sup>See, for example, [Botta et al. \(2019\)](#) for a similar mechanism that they formulate in their model when they define a market in which investment funds' holdings ("realized demand") of CDO cannot exceed the maximum amount of CDOs potentially producible by the SPV sector.

surely bills is set exogenously it is equal to the interest rate on central bank advances  $\overline{i_{TB}} = i_A$

### 2.6.9 The central bank

$$PC = i_{TB} \cdot TB_{cb-1} + i_A \cdot A_{cb-1} \quad (2.64)$$

$$TB_{cb} = TB - TB_r - TB_b \quad (2.65)$$

$$HPM = HPM_r + HPM_b \quad (2.66)$$

$$HPM = TB_{cb} + A \quad (2.67)$$

The central bank in our model holds Treasury bills ( $TB_{cb}$ ) as a residual purchaser from the government, accommodate demand for advances  $A_{cb}$  and provides the high-powered money  $HPM$  that rentier households ( $HPM_r$ ) and commercial banking sector ( $HPM_c$ ) demand. In so doing, central bank acts as the buffer for Treasury billy, in a way, buying the remaining Treasury bills the rentier households and commercial banking sector do not wish to hold ( $TB_{cb} = TB - TB_r - TB_b$ ). Following [Dos Santos and Zezza \(2004\)](#), the high-powered money ( $HPM^s$ ) is supplied to the economy by the central bank through channels: purchases of Treasury bills by the rentiers and the commercial banking sector, and when central bank grants advances to the commercial banks.

## 2.7 Results and Discussion

Given the complexity and largeness of our model, we now come to find a way of solving it for the simulation experiments. Considering its complexity, we limit our analysis to the key elements that the model can potentially explore for our research goals. For this reason, the simulation experiments will only focus on the mechanisms by which shadow banking system ability to create credit in the financial system.

Our aim is to show that there are two main channels through which shadow banks find their sources for credit creation. In doing so, we first reduced the model with respect to the larger model we presented in Section 4. The reduced form of the model includes all details on the two sources of credit within the shadow banking system depicted in Section 3.

Even though the number of sectors remain the same, we exclude the assets like ABCPs and thus lose the fact that the non-financial firms invest in commercial papers. The securitization of assets is limited only to the securitization of mortgages which become the source of SPV sector to produce MBSs and sell them in financial markets. To begin with, our model can be analyzed only through numerical simulations. We start with assigning a reasonable set of parameters for its values and decide the initial values of stocks. In what follows, we found a steady-state

solution to serve as the basis for our simulation experiments where we exogenously shock the model.

The goal of this section is to show the two ways by which credit is created within the financial system from the interaction between the commercial banking and shadow banking sectors, in line with the two sources of funds within the shadow bank system identified in Section 3. Therefore, we focus on two exogenous developments when attempting to simulate the model. The first exogenous shock that we consider is a change in the regulatory framework regarding ability of the commercial banking sector to securitize their assets. The second exogenous shock that we want to explore its effects is the role that credit rating agencies play in repo markets through their evaluation of the quality of private-label securities (MBSs). In what follows, the attention will be given to the interaction between securitization practices and repo market to explore the two channels of credit creation within the shadow banking system.

**1. The creation of securities from loans:** Both the commercial banking sector and the SPV sector are involved in the securitization process. The result of such practice leads to the commercial banking sector packaging a part of its assets and removing these assets from their balance sheets. As for SPV sector, these purchases of illiquid assets become the “raw materials<sup>27</sup>” (securitized mortgages) for the production and issuance of securities (MBSs). Two points are important to note when assets are securitized: (1) it increases the capital adequacy ratio (CAR) of commercial banks (more on that below) and (2) it enables commercial banks to be more available for the provision of new credit. [Botta et al. \(2015, p. 212\)](#) highlight these points: “securitization allows commercial banking sector to manage their balance sheet in a more flexible way, to gain margin of maneuver to further expand their own business and create more space for opening up new financial positions while still benefitting and profiting from previously created and sold assets.” With the help of the simulation experiments, we will explore these dynamics – namely, the consequences of securitization of existing assets for banks and for the financial system and the economy in general. In particular, the analysis will pay attention to a positive shock to the degree of securitization and its effects on the asset side of the commercial banking sector, and credit availability through capital adequacy ratio.

**2. Lending in REPO:** The second group of simulation experiments consider the credit creation by the provision of REPO loans from the MMMFs to the Broker-Dealer sector in exchange for securitized assets (MBSs) as collateral. The broker-dealer sector plays a central role in the repo market. The amount of repo loans that broker-dealer sector borrow from the MMMF sector arises from the need to finance the securities that it purchases from the SPV sector. Accordingly, on one hand they are involved in repo transactions with the MMMF sector and purchasing MBSs from the SPV on the other. By lending in REPO, the MMMF sector as a (cash) lender in the repo market obtains funds by issuing shares. Note that the shares bought by

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<sup>27</sup>See [Botta et al. \(2018\)](#)

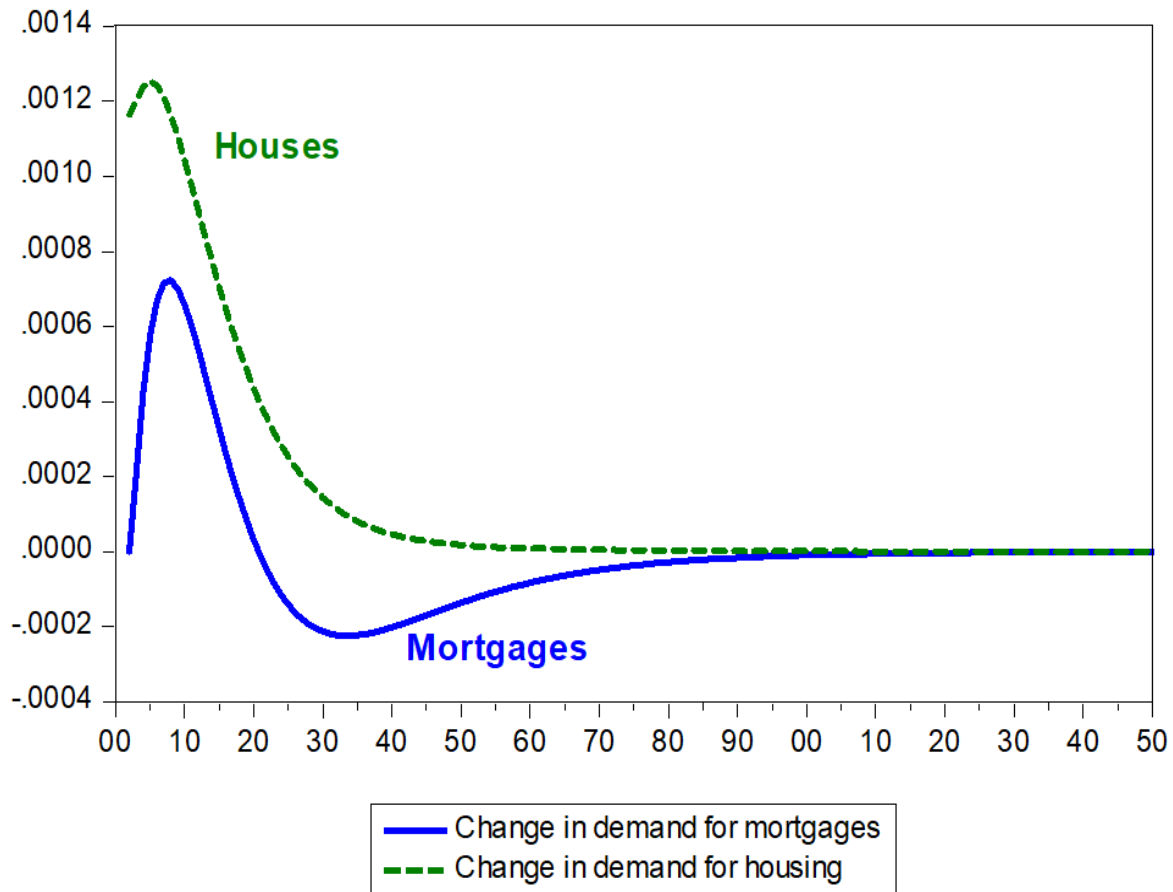


FIGURE 2.2: Evolution of mortgages and housing units, relative to their initial steady-state values, following a one-step permanent decrease of 50 points in the interest rate on mortgages

rentier household sector constitute the main source of fund of broker-dealer sector to invest in repo. It is this ability - issuing shares when rentier want to reallocate their portfolios (or when they prefer to exchange their deposits with shares of MMMFs) – that MMMFs obtain liquid deposits. The reason why MMMFs invest in the repo market by lending their deposits is because MMMFs perceive repos as profitable substitutes for their liquid deposits due to the guarantees provided by allegedly riskless MBSs used as collateral in repo contracts<sup>28</sup>. Given that MBSs as collateral plays a significant role in the repo market, the second group of experiment focuses on a positive shock on the price of MBSs ( $p_{mbs}$ ) to explore its effects on REPOs, MBSs and leverage of broker dealers.

### 2.7.1 Simulation experiment 1

Figure 2.2 presents the result of an exogenous shock to the interest rate on mortgages. With a positive shock on the interest rate on mortgages, we want to explore the effects of such exogenous shock on the demand of mortgages and houses in our artificial economy. The shock given in the first experiment is a result of a decrease in the interest rate on mortgages. The obvious

<sup>28</sup>See (Botta et al., 2015, p. 223) for the role MMMFs as a lender in the repo market

result is that the initial decrease in the interest rate on mortgages generates an increase in both demand of mortgages and of houses. This result (Figure 2.2) is not surprising given that the interest rate on mortgages is negatively correlated with both mortgage demand and housing demand in the behavioural equation of worker households. The implication of this first simulation is important for our next analysis where we want to explore the consequence of the worker households' access to credit to purchase houses. In other words, credit creation by the commercial banks through endogenous money creation is the starting point to explore credit creation within the shadow banking system. What emerges from the first step is that households demand for houses leads to demand for mortgages and this leads to the commercial banking sector creating new deposits by granting new mortgages to the worker households. Due to our concentration on the shadow banking sector and its role in the financial system, we do not attempt to provide the implications of housing demand for the house price and its dramatic effects on the total output of the economy in the short run. In fact, there is a vast literature, suggesting that the increasing mortgage demand and housing demand leads to a rise in the housing price with an increase in the supply of houses. As a result, the more supply of housing units by non-financial the higher output of the economy. For example, [Zeza \(2008\)](#) shows that a decrease in the interest rate on mortgages through monetary policy increases housing investment due to lower leverage and increase in the disposable income of workers as the cost of credit decreases on existing mortgages.

In addition to this result, he explores that the effects of mortgage demand and house demand by workers stimulate aggregate demand, accompanied with the demand for housing units will increase following both the increase in real income and the reduction in the debt burden. [Fontana and Godin \(2013\)](#) focus on the price of houses held by indebted households. In their simulation experiment, they present the effects of a positive shock to the (expected) price of houses, providing a result that increase in the price of houses decrease the leverage of worker households. They note that the leverage ratio of workers after some period following the positive shock stimulates worker households to demand more mortgages to purchase more houses, suggesting that it will increase their leverage again. However, this story in their results is linked to the short run analysis. They rightly emphasize this point where leverage of worker households will tend to lower in the long run because worker households will face higher prices of houses. Their results regarding leverage of households and price of houses are countercyclical, as in [Adrian and Shin \(2010b\)](#). A rise in the price of houses reflects a decline in the leverage of households.

### 2.7.2 Simulation experiment 2

With the well-known observations that existing literature already focused on the linkages between housing market and financial sector, we now come to our next simulation experiment to explore what happens after worker households has become increasingly indebted and

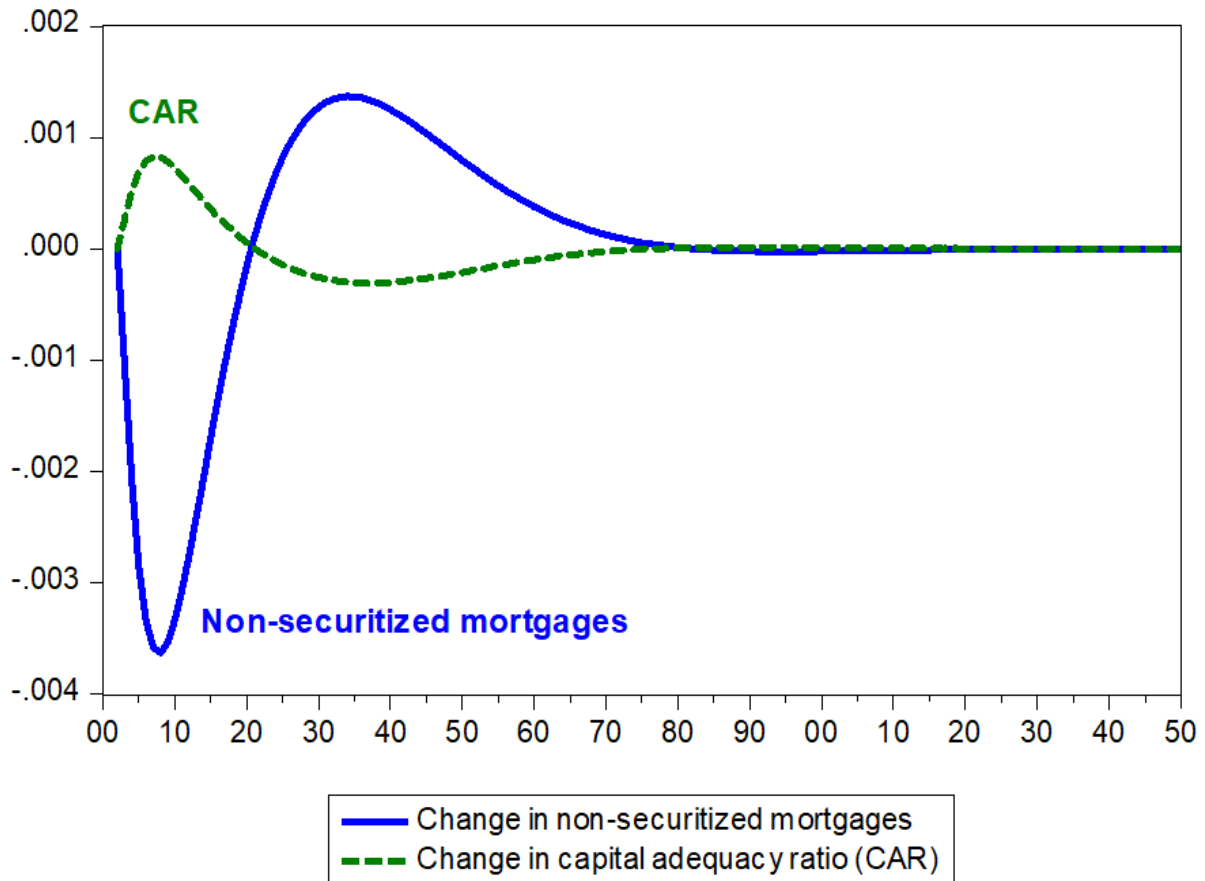


FIGURE 2.3: *Effect of a shock (securitization) on mortgages and capital adequacy ratio of banks*

commercial banks end up with new assets by granting new mortgages. The former transfers<sup>29</sup> its deposits to the rentier households in exchange for the asset, that is houses, while the latter involves in the securitization process by which commercial banks sell part of these previously originated assets, consequently downsizing the asset side of their balance sheet.

Figure 2.3 presents result of a positive shock to the degree of securitization and its effects on the capital adequacy ratio (CAR) of banks and on the asset side of the commercial banking sector. We have mentioned that the securitization process implies a practice wherein the commercial sector can get rid of their mortgages that they already issued on demand by worker households. The main actor in conducting this process of securitization in our model is the SPV sector who purchases mortgages and produces MBSs. Therefore, we shock the degree of securitization by increasing the parameter of securitized mortgages ( $z_{sec}$ ) to explore the evo-

<sup>29</sup>We do not explicitly show this mechanism by which worker households transfer their deposits to the rentier households. We are aware that this is such an important aspect to grasp the true dynamic of income distribution away from workers to rentiers, but we implicitly try to grasp such income redistribution by assuming that rentier households are the owner of the commercial banks and non-financial firms who produce houses and sell to the workers. Therefore, one may make inferences that the higher indebtedness of households through mortgages the higher redistribution of income that channels from worker household sector to the rentier household sector.

lution of the non-securitized mortgages held by commercial banking sector. Technically, we increased the securitization parameter ( $z_{sec}$ ) from 0.5 % to 0.9 %, meaning that the commercial banking sector securitize almost all of its mortgages previously issued to the worker households. Indeed, the consequence of this securitization of mortgages is to decrease the amount of mortgages that previously had to stay on their balance sheet. In short, the main effect of this shock is to reduce the balance sheet of commercial banking sector by selling their assets (in our model read as mortgages). Most importantly, it is the presence of securitization that enables commercial banking sector to aggressively grant mortgages given that they can remove those mortgages after granting them to the worker households.

The main idea behind the securitization that commercial banks are willing to involve is to find a way of increasing their capital adequacy ratio (CAR), among other things. The capital adequacy ratio is also known as capital-to-risk weighted ratio assets ratio. Banks operates under such rules to secure a minimum amount of capital relative to their assets. In the behavioural equations of banking sector, we define the CAR as the ratio of the bank's available capital to its assets. Such rules imposed on the banking sector targets the asset side of the banking sector. (Godley and Lavoie, 2007, ch. 11 p. 402) point out that loans to the private sector and individuals by commercial banks carry a 100% risk weight. For commercial banks, the way in which commercial banks find a maneuver or way out under such rules imposed by the regulatory framework or monetary authority is to move off their assets by securitizing their existing assets. To repeat, it is the idea of increasing their capital adequacy ratio that drives banks to securitize their assets<sup>30</sup>.

We formulate a rule in our model to capture the crucial role that securitization plays for commercial banks when they want to increase their capital adequacy ratio. The Figure 2 shows that the securitization practices, before anything else, decreases the assets of banking sector. Given that denominator of the capital adequacy ratio, that is, asset side of the banking sector decrease after a shock to increase the degree of securitization, the capital adequacy ratio of banks will increase.

The simulation experiment presented in Figure 2.3 explore these important facts to understand how the commercial banking sector finds a way to improve their capital adequacy ratio within a regulatory framework that imposes such rules. In short, a positive shock to the securitization which is the core business of the SPV sector in our model will decrease the assets (non-securitized mortgages) while increasing the capital adequacy ratio of the commercial banking sector. In the next experiment, we will explore the link between the importance of higher CAR for banks and credit availability when workers demand for mortgages.

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<sup>30</sup>We are aware that commercial banks earn fees every time they sell their assets to the SPV sector which we define this cost component of the SPV in the behavioural equations of the model, but we want to stress the main effect when commercial banks securitize their assets.

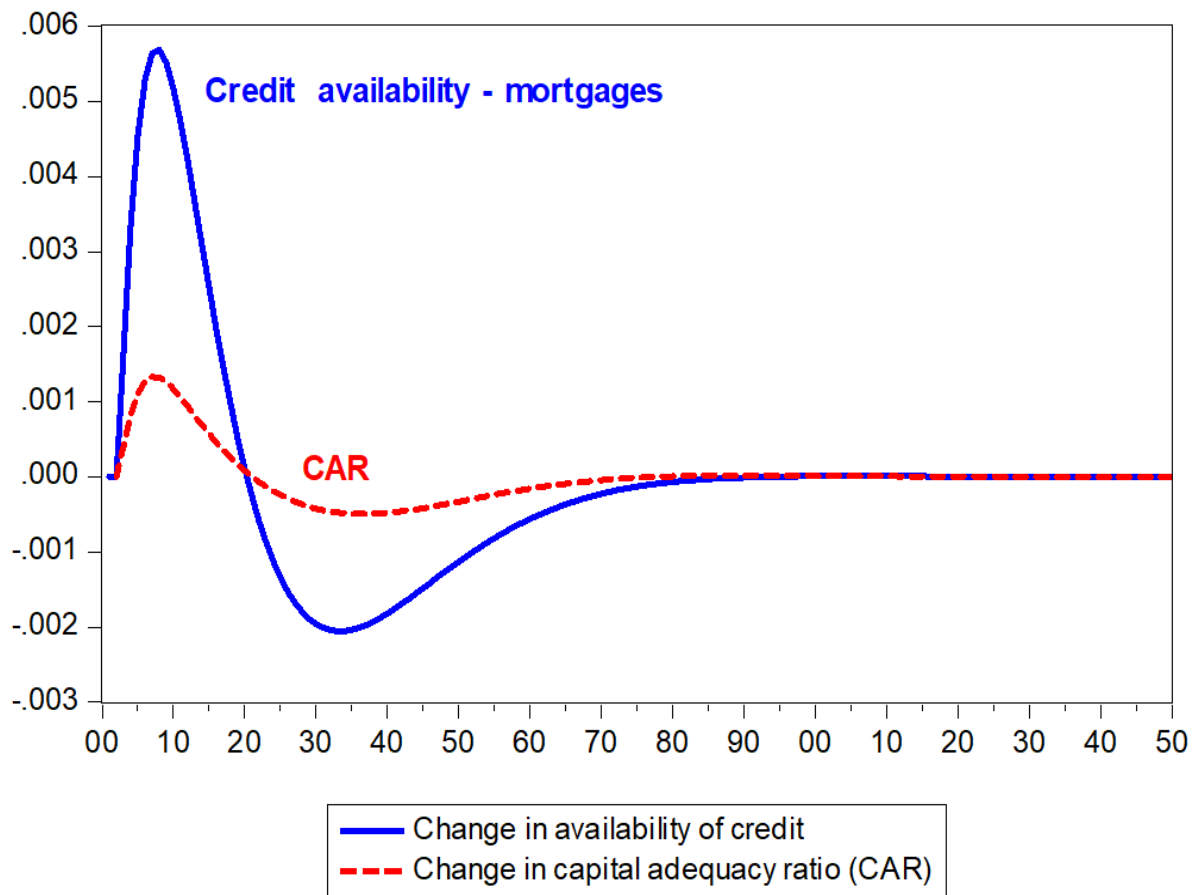


FIGURE 2.4: *Effect of a shock (securitization) on credit availability and capital adequacy ratio of banks*

### 2.7.3 Simulation experiment 3

Experiment 2 showed that the securitization decreases the assets held by the commercial banking sector while it increases the capital adequacy ratio of the banks. The key question now is: what is the implication of this securitization practices that enabled the banks to remove the assets on their balance sheets accompanied with a rise in the capital adequacy ratio?

The beauty lies in the fact that the condition of credit availability of the commercial banks. In the behavioural equation of the banks, we formulate new mortgages as a proportion ( $m_{ava}$ ) of the desired amount of mortgages demanded by worker household. Recall that  $m_{ava}$  is between zero and 1 ( $0 < 1 < m_{ava}$ ). To capture the role CAR plays in the availability of credit, we define an equation that formulates the degree of credit availability ( $m_{ava}$ ) as a positive function of the difference between lagged capital adequacy ratio ( $CAR_{-1}$ ) and normal capital adequacy ratio (NCAR). Experiment 3 presents the effects of a positive shock to the securitization on the availability of credit and capital adequacy ratio of banks. The main effects of the shock is to increase capital adequacy ratio combined with a rise in the availability of credit. In short, with securitization, commercial banking sector can remove their existing mortgages from the



assets side of their balance sheet to increase their capital adequacy ratio so that there is more credit available for the worker households' desire to buy new houses. [Nikolaidi \(2015\)](#) presents similar results when she shocks the degree of securitization in her model.

#### 2.7.4 Simulation experiment 4

In the previous experiments, we focused on the securitization practices and its expansionary role for the commercial banking sector and the housing market. Our fourth experiment describes what happens when the SPV sector issues MBSs and the broker-dealer needs to finance the MBSs in the repo market. It is our aim in this experiment to explore the creation of "fictitious" liquidity by the combination of securitization and the balance sheet expansion of broker-dealer that plays a significant role in the repo market. According to ([Adrian and Shin, 2010b](#)), the ultimate supply of securitized credit to the real economy is often channeled through broker-dealer balance sheets. In this way, broker-dealers "serve as a barometer of overall funding condition in a market-based financial system." ([Adrian and Shin, 2010b](#), p. 7).

Recall that the broker-dealer sector uses its securities as collateral for repo loans from the MMMF sector. Therefore, the interaction between the SPV sector and the broker-dealer sector is essential. The broker-dealer sector needs to obtain securities to use them as collateral when they interact with the MMMF sector for their deposits. Given that securities play a central role for the repo market, we exogenously shock the price of securities ( $p_{mbs}$ ) to explore its effects on the demand of MBS and of repo, and leverage ratio of the broker dealers (Figure 2.4). It is the result of such shock that we wish to analyze on the relationship between funding conditions and the resulting market prices of assets. This experiment will help us to tell more why the concept of liquidity is "fictitious" and elusive during the financial distress or when there is a decline in the price of securities.

Our aim, in particular, is to explore how the leverage and the balance sheet of broker-dealers are related. The simulation experiment shows that a rise in the price of securities leads to a rise (positive shock) in the demand for repo together with the demand for MBSs and thus, to an increase in the leverage ratio of broker-dealers. Note that the leverage of broker-dealer sector is the ratio of its total assets to its equity. It is important to emphasize that there is a strongly positive relationship between changes in total assets and changes in leverage of broker-dealers, suggesting that leverage is procyclical.

With such strong evidence, we can confirm that this is one of the most important characteristics of the broker-dealers that actively adjust their leverage through their balance sheet. In other words, leverage grows when balance sheets are growing and then contracts when balance sheets are contracting. Therefore, we consider such procyclical nature of leverage to be a consequence of active balance sheets by the broker-dealer sector who responds to changes in the price of MBSs. [Adrian and Shin \(2010b\)](#) provides empirical evidence to show the procyclical nature of leverage in the U.S financial system. Accordingly, the sample they focus on their

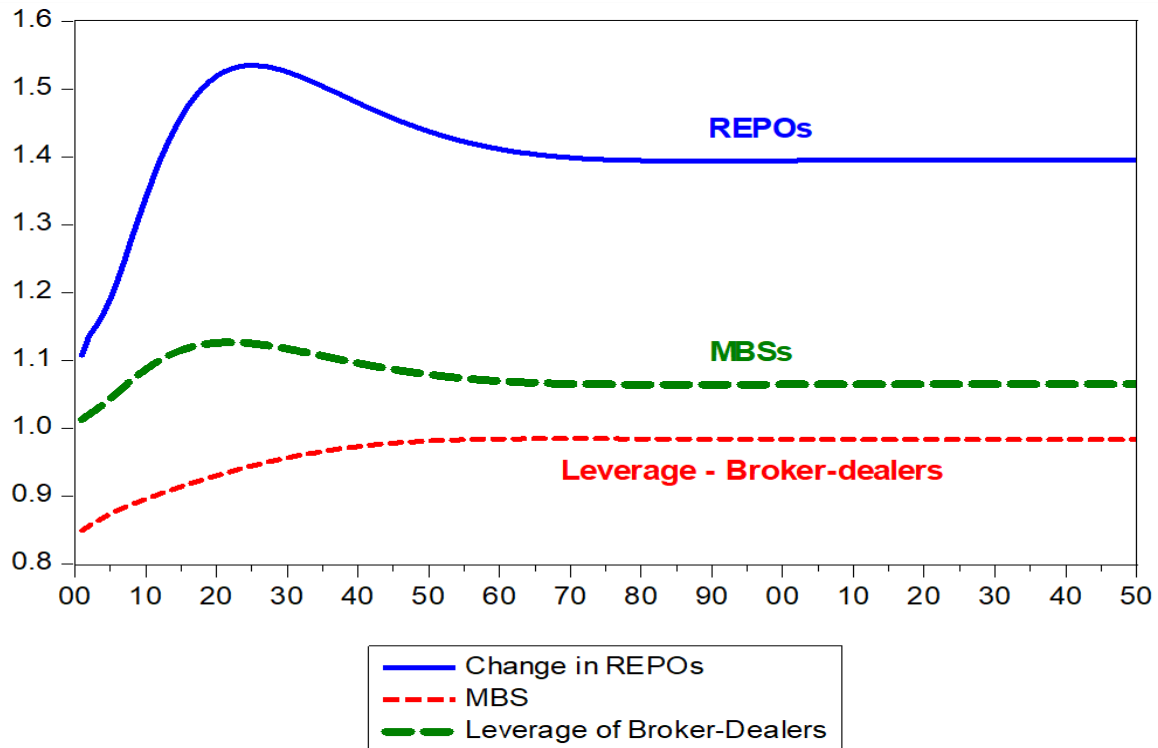


FIGURE 2.5: A shock to the price of MBS and its effects on the repo market and leverage of broker-dealers

investigation includes US investment banks - Lehman Brothers, Merrill Lynch, Morgan Stanley, Bear Stearns, Goldman Sachs and Citigroup Markets. See Appendix D in the appendix for the graphic illustration of their findings. They note that “in all cases, leverage is large when total assets are large—i.e., leverage is procyclical.” (Adrian and Shin, 2010a, p. 12)

This evidence suggests that, as we explore in our model, the broker-dealer sector with such privilege position can increase its leverage ratio when the price of MBSs is increasing. It is this procyclical nature of their leverage that “the margin of adjustment in the fluctuations of balance sheet is through repos.” (Adrian and Shin, 2010b, p. 428)

## 2.8 Conclusion

This paper developed an SFC model that includes complex financial markets and important components of the shadow banking sector, which enables us to explore the relationship between core commercial banks and shadow banks. Building a complete financial sector and its interaction with the real sectors within an SFC framework allowed us to shed light on the role that shadow banking plays in the origination of credit. In Section 3, we identified two channels through which shadow banks find sources of funds to involve in credit intermediation process. Accordingly, we described two different sources of funds in the shadow banking system. The first source of funds of the shadow banking relies on commercial banks. Shadow banks require

existing stock of loans previously made by commercial banks to obtain funds if they want to grant credit. We noted that while the funds made by commercial banks represent the first step of the credit creation, the agent (worker households) who obtains funds from the commercial bank needs to spend these funds so that shadow banks can enter the process of credit intermediation.

Contrary to the first channel of the shadow banking system, the sources of funds in the second channel does not rely on the first step in which commercial bank are the originators of funds. However, we showed that this does not mean that commercial banks do not play any role in the second channel. Commercial banks still play a crucial role in the entire shadow banking system. With the process of securitization, commercial banks involve in the business of packaging and reselling loans that are sold to the shadow banks, namely Special Purpose Vehicles (SPVs). In turn, SPVs act as intermediaries in arm-length relation between commercial banks and shadow banks such as Broker and Dealers. This is exactly the place where we delved into the important role of broker and dealers in the second channel of shadow banking. Brokers and dealers take advantage of this second source of funds to invest in new assets and acquire additional funds to finance the expansion of their balance sheets. We showed that a simple activity of granting a loan to worker households and funding these loans on balance sheets previously conducted by commercial banks can be divided into a long chain of activities that involve several institutions and structures. In this regard, the consequence of endogenous money - loans create deposits - and financialization allowed worker households to benefit from an increasing amount (then securitized) of mortgages.

In Section 4, we explained the motivation behind our modelling concept, that is based on PK-SFC framework (Godley and Lavoie, 2007). We argued that SFC models are powerful tools if one is interested in a complete picture of an economy in which the real economy is depicted with complex modern financial sectors. In Section 5, we have presented the specific properties of the model. In this, we split the household sector into workers and rentiers, where rentiers allocate their wealth according to rates of return on assets, while workers borrow from banks to finance their house purchases. Inclusion of the housing sector represented an important feature of our model to capture the role of mortgages for financing the investment in housing. Furthermore, we explicitly take into account several pieces of the shadow banking system to capture the role played by the most recent financial institutions (e.g. Special Purpose Vehicles, Broker-Dealers and Money Market Mutual Funds). In Section 7, we presented the behavioural equations of the system in which we define the interaction and the financial transactions between sectors. Finally, in Section 8, we presented the results that we obtained from our simulation experiments.

In attempting to simulate the model, we concentrated on two exogenous developments. The first exogenous shock that we focused on is a change in the regulatory framework regard-

ing ability of the commercial banking sector to securitize their assets. The second exogenous shock that we wanted to explore its effects is the role that credit rating agencies play in repo markets through their evaluation of the quality of private-label securities (MBSs).

With respect to the first exogenous shock to securitization, the model shows that an increase in the degree of securitization, a process through which mortgages are packed into securities (MBSs) leads to an increase in the capital adequacy ratio of commercial banks. In turn, we showed that higher capital adequacy ratio for commercial banks improves their credit availability conditions. In consequence, with securitization of mortgages, the shadow banking system, notably the SPV sector as the main actor in the securitization process, increased the elasticity of the commercial banking sector by relaxing capital requirements (CAR). As selling mortgages to the SPV sector, commercial banking sector act more aggressively to lend while the SPV sector obtains more assets to issue securities backed by mortgages.

With respect to the second exogenous shock, the model shows that an increase in the price of securities (MBSs) increases the net worth of the broker-dealer sector, which allows an increase in leverage. Most importantly, to benefit from the rise in the price of MBSs, the broker-dealer sector must find new assets to invest in and acquire additional funds to finance the expansion of their balance sheets. With such result, we confirm the pro-cyclical behaviour of the broker-dealer sector as in [Adrian and Shin \(2010a,b\)](#). Leverage is large when total assets are large. What is even more important here is that the margin of adjustment in the fluctuation of balance sheet of the broker-dealer sector is through collateralized borrowing transactions such as repo. In this way, changes in leverage of the broker-dealer sector are achieved through expansions and contractions in the collateralized borrowing.

# Appendix A

## A.1 Appendix: Literature Overview

Literature Overview

Authors	Year	Sectors	Assets	Housing	Securiti- zation	Repo Market	Financiali- zation of firms	Beh. Eq.	Sim. Exp.
Gennaro Zeza	2008	Top 5 percent - Households Top 95 percent - Households Firms Banks Central Banks	Pr. Capital Homes Cash Advances Bank deposits Loans to firms Mortgages Treasury Bills Equities	Yes	No	No	No	Yes	Yes
J. Eatwell, T. Moukil and L. Taylor	2008	Households Shadow Banking System Special Purpose Vehicles Banks Financial Sector Government RoW	Capital Real Estate Govt. Bonds Loans Mortgages HPM MBS Repos	Yes	Yes	Yes	No	Yes	No
Marc Pilkington	2008	Households Firms Banks Government Shadow Financial System	Bank deposits Bank loans SFS securities Loans Government Bills Capital Goods	No	No	No	No	No	No

*Literature Overview*

<b>Authors</b>	<b>Year</b>	<b>Sectors</b>	<b>Assets</b>	<b>Housing</b>	<b>Securiti- zation</b>	<b>Repo Market</b>	<b>Financiali- zation of firms</b>	<b>Beh. Eq.</b>	<b>Sim. Exp.</b>
Maria Nikolaidi	2015	Worker Households Investor Households Commercial banking sector Investment banking sector Special Purpose Vehicles Central bank Government Firms	Housing Inv. Capital HPM Loans Treasury bills Short-term deposits Long term deposits Advances	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
O. Fonatana and A. Godin	2013	Workers Capitalists Firms Commercial Banks Investment banks 1 investment bank 2	Capital Real Estate Deposits of banks Dep. of Inv. Banks Loans Equities Interbank Credit Mortgages Securities	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>

Literature Overview

Authors	Year	Sectors	Assets	Housing	Securiti- zation	Repo Market	Financiali- zation of firms	Beh. Eq.	Sim. Exp.
Maria Nikolaïdi	2015	Worker Households - type 1 Worker Households - type 2 Firms Commercial banks SPVs - Underwriters Institutional Investors Investor Households Government Central Bank	Houses Pr. Capital HPM Consumer loans Housing loans Firms' loans Treasury Bills MBSs Deposits Inst. Inv.' shares Firms' equities Advances	Yes	Yes	No	No	Yes	Yes
Paul J. Beckta	2015	Capitalist Household Worker household Firm Commercial bank Central bank Government	Cash Deposits Saving account Mortgages Loans Bills Houses Bank Capital	Yes	No	No	No	Yes	Yes



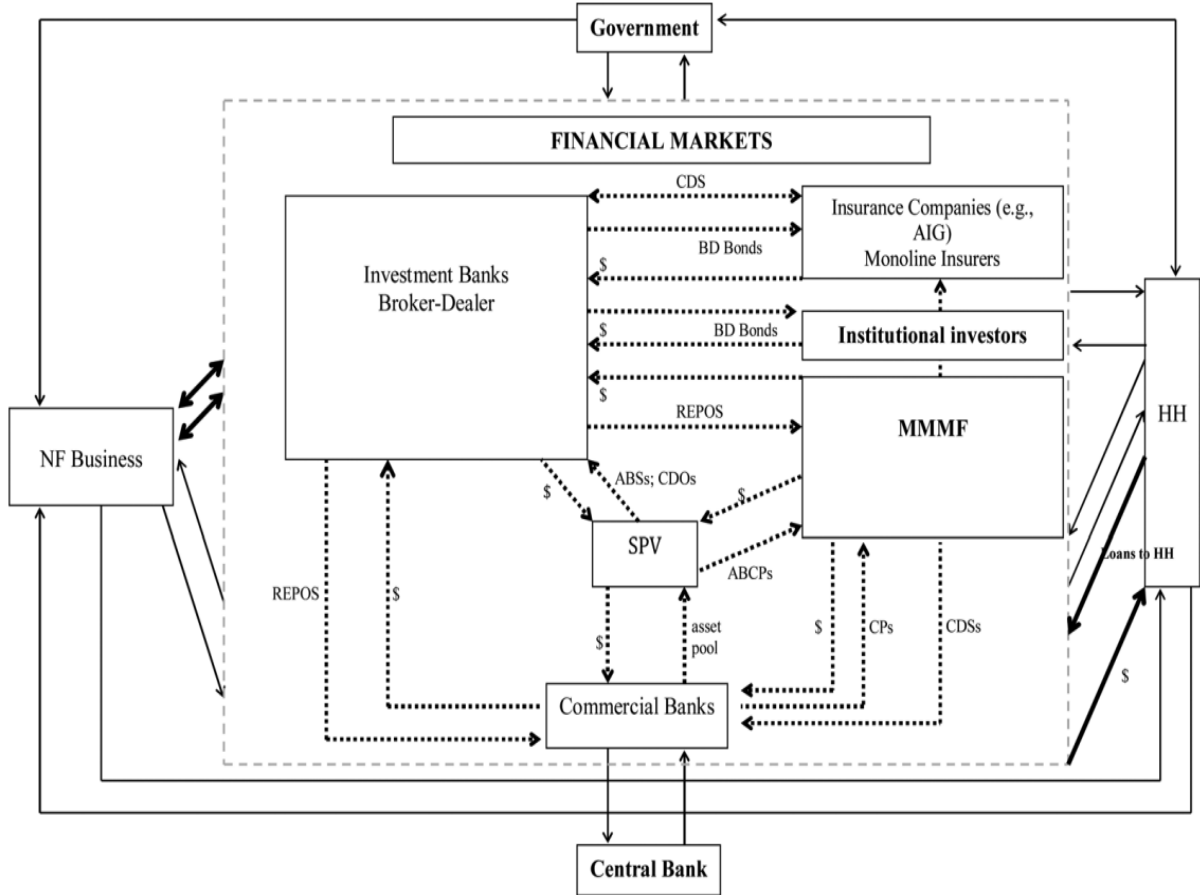
Literature Overview

Authors	Year	Sectors	Assets	Housing	Securiti- zation	Repo Market	Financiali- zation of firms	Beh. Eq.	Sim. Exp.
Shaotang Cao	2015	Households Firms Banks Investment Banks Central bank	Pr. Capital Homes Cash Advances Checking deposits Term deposits Loans Repos Mortgages MBSs	Yes	Yes	Yes	No	Yes	Yes
A. Botta, E. Caverzasi and D. Tori	2015	Household Rentier Firms Banks SPV MM.MF Inv. Fund Broker & Dealer Ins. Comp.	Real Capital Money Shares Longer shares ABS REPO CDS Houses Loans Mortgages	Yes	Yes	Yes	Yes	No	No
A. Botta, E. Caverzasi and D. Tori	2018	Workers Rentiers NF-firms Commercial banks Financial Firms Central bank	Capital Deposits Houses Cash Mortgages Loans CDO Repos, Equities	Yes	Yes	Yes	Yes	Yes	No

*Literature Overview*

<b>Authors</b>	<b>Year</b>	<b>Sectors</b>	<b>Assets</b>	<b>Housing</b>	<b>Securiti- zation</b>	<b>Repo Market</b>	<b>Financiali- zation of firms</b>	<b>Beh. Eq.</b>	<b>Sim. Exp.</b>
A. Botta, E. Caverzasi and A. Russo	2019	Households Banks Special Purpose Vehicles Investment Fund Firms Government	Deposits Capital Shares Bonds Loans Derivatives	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

**A.2 Appendix: An Extended Financialized Monetary Circuit** [Botta et al. \(2015\)](#)

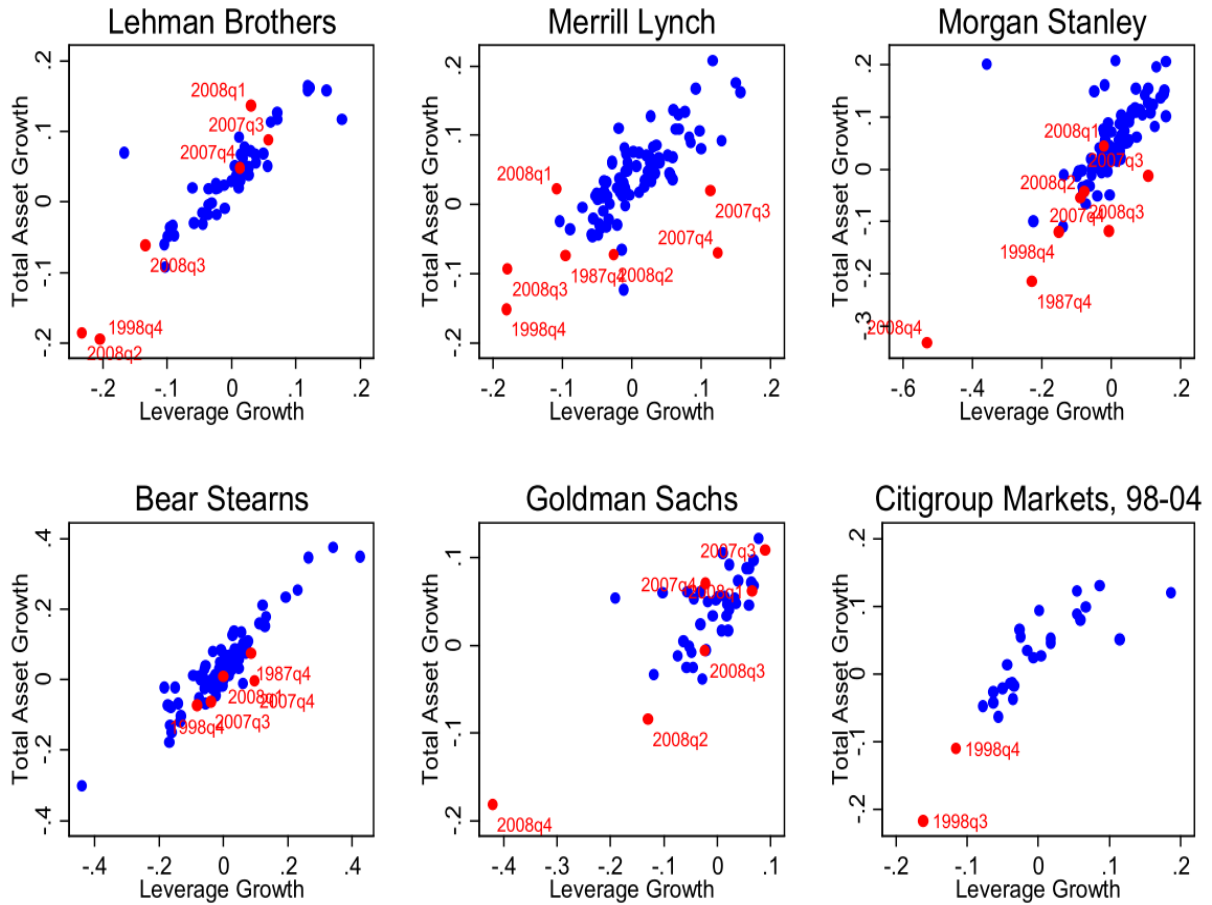


**A.3 Appendix: Transaction Flow Matrix**

### Transaction Flow Matrix

	Workers		Rentiers		NFFs		Banks		SPVs		MMMFs		Broker-Dealers		Govt.		CB		\
	CA	KA	CA	KA	CA	KA	CA	KA	CA	KA	CA	KA	CA	KA	CA	KA	CA	KA	
Real Side																			
Consumption	$-C_w$				$+C$														0
Wages	$+WB$				$-WB$														0
Taxes	$-T_w$			$-T_r$											$+T$				0
Investment					$+I$														0
Gov. Exp.					$+G$										$-G$				0
Financial Side																			
Int. on Dep.			$+i_D \cdot D_r$				$-i_D \cdot D_b$				$+i_D \cdot D_{mmmf}$				$\$+i_{\cdot}\{D\} \cdot D_{\cdot}\{bd\}$				0
Int. on Loans					$-i_L \cdot L_f$		$+i_L \cdot L_b$		$+(z)i_L \cdot L_b$										0
Int. on Mortg	$-i_M \cdot M_w$						$+i_M \cdot M_b$		$+(\omega)i_M \cdot M_b$										0
Int. on Bills			$+i_{TB} \cdot TB_r$													$-i_{TB} \cdot TB_{gov}$			0
Int. on MMMF			$+i_{SH} \cdot SH_r$										$-i_{SH} \cdot SH_{mmmf}$						0
Int. on ABS									$-i_{abs} \cdot ABS_{B+b}$				$+i_{abs} \cdot ABS_{bd}$						0
Int. on ABCP					$+i_{abcp} \cdot ABCP_f$				$-i_{abcp} \cdot ABCP_b$		$+i_{abcp} \cdot ABCP_{mmf}$								0
Int. on REPO											$+i_{repo} \cdot REPO_{mmmf}$		$-i_{repo} \cdot REPO_{bd}$						0
Fees							$+FEE$		$-FEE$										0
Bank Profits			$+PB^D$				$-PB^D$	$+PB^U$											0
NFF profits			$+PF^D$		$-PF$	$+PF^U$													0
NNF Equity					$+OF_f$														0
Bank Equity					$+OF_b$		$-OF_f$		$-OF_b$										0
CB Profits																$+PF_{cb}$	$-PF_{cb}$		0
Real Capital							$-\Delta K$												0
Total Saving	$-SAV_w$	$+SAV_w$	$-SAV_r$	$+SAV_r$	$-SAV_f$	$+SAV_f$	$-SAV_b$	$+SAV_b$	$-SAV_{spv}$	$+SAV_{spv}$	$-SAV_{mmmf}$	$+SAV_{mmmf}$	$-SAV_{bd}$	$+SAV_{bd}$	$-SAV_{gov}$	$+SAV_{gov}$	0	0	0
Changes in Stocks (Uses and Sources of Funds)																			
Deposits		$-\Delta D_w$		$-\Delta D_r$		$-\Delta D_f$		$+\Delta D_b$		$-\Delta D_{spv}$		$-\Delta D_{mmmf}$		$-\Delta D_{bd}$					0
Loans						$+\Delta L_f$		$-(1-z) \cdot \Delta L$		$+\Delta L^{sec}$									0
Mortgages		$+\Delta M_M$						$-(1-\omega) \cdot \Delta M$		$+\Delta M^{sec}$									0
Bills				$-\Delta TB_r$										$-\Delta TB_{bd}$		$+\Delta TB_{gov}$			0
MMMF Shares				$-\Delta SH_r$									$+\Delta SH_{mmmf}$						0
ABS										$-\Delta ABS_{spv}$				$-\Delta ABS_{bd}$					0
ABCP						$-\Delta ABCP_f$				$-\Delta ABCP_{spv}$									0
REPO												$-\Delta REPO_{mmmf}$		$+\Delta REPO_{bd}$					0
Houses		$-\Delta p \cdot H_w$		$-\Delta p \cdot H_r$															$-\Delta p \cdot H$
Real Capital						$+\Delta K$													0
Advances								$+\Delta A$											$-\Delta A$
Reserves								$-\Delta R$											$+\Delta R$
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$-\Delta p \cdot H$

### A.4 Leverage of broker-dealer and total assets from [Adrian and Shin \(2010b\)](#)





## Chapter 3

# REPO LENDING AND ITS IMPLICATIONS FOR MONETARY POLICY AND GOVERNMENT DEBT\*

### ABSTRACT

The focus of this chapter is twofold. First, it tackles the transformation of the money markets (the shift to repo markets) on the central bank monetary policy implementation as well as its implications for government debt issues. In this context, the financial systems around the world underwent an important transformation over the course of the 1980s, 1990s, and the 2000s. The crucial transition was the shift away from an unsecured core money market to a collateralized market, the repo market. Due to this shift, collateral supply has become an important factor in today's financial world. Furthermore, I focus on the central bank monetary policy implementation in an environment where the core money market operates on a collateralized segment. Secondly, it is important to connect government debt issues (collateral supply) for the central bank monetary policy implementation. I discuss that government issues debt to finance its expenditures and now this debt is used as collateral for the repo market. In what follows, a careful comparison of the pre-crisis monetary policy framework and post-crisis monetary policy is important to explore central bank operations in the financial system organised around collateral. It follows that monetary policy cannot be implemented without taking these changes into account. The final part of the chapter focuses consequences of using repo lending for market liquidity by separating repo in normal times and repo in times of crisis. I discuss that while it is true that repo can be a source of liquidity, it is essential to separate the monetary effect of the repo from the balance sheet effect of the repo. Despite the presence of collateral in repo markets, the contractual structure of such lending creates safety for the lenders –at the expense of the borrower – and the source of instability. What we try to emphasize is that the instability stems from a financial system that relies heavily on repo-type contracts. The problem with repo markets is that they provide liquidity in normal times, but this source of liquidity evaporates when prices are expected to fall. Accordingly, in times of stress, it is ever more costly to borrow, because the collateral that is being asked gets an ever lower value so that more good collateral is required in order to get a loan of a given amount. As there is more stress in the financial markets, borrowers, in order to keep their loans, are required to provide additional collateral. During these liquidity events, repo borrowers realize losses. That is the same contractual structure that empowers lenders also drains liquidity from the financial system. It follows that the growth of repo markets has had these effects because repo markets convert a simple decline in collateral prices into a liquidity event via the collateral calls and collateral sales that are integral to the operation of the repo.

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**Keywords:** Interbank market, Repo, Collateral, Shadow banking, Monetary policy, Government debt

### 3.1 Introduction

Since the Global Financial Crisis, two big macro phenomena have occurred in key parts of the developed world. First, governments have run big budget deficits, leading to a steep rise in government debt outstanding, and central banks have bought large quantities of government debt under the unconventional monetary policies (credit easing and QE operations). In response to the challenges of the COVID-19 pandemic, central banks have once again massively intervened in government bonds market to stabilise the international financial system. (See, for example, Gabor (2020), Sissoko (2020) Hauser (2020), BIS (2019a, 2019b). According to International Monetary Fund, central banks purchased on average around 75% of government debt issued in 2020.

In this chapter, I argue that central bank monetary policy implementation in 2008 and in 2020 differs from the way it implemented its monetary policy before the Crisis (of 2008). For example, since the Crisis, the federal funds market in the United States has stopped serving as an effective venue for implementing monetary policy. The starting point to proceed my analysis is to ask what has changed and what caused the central banks to change their monetary policy implementation? To address these questions, I examine the transformation of money markets over the past four decades and the implications of this transformation for the monetary policy implementation. The main development in the money market was the shift from interbank (unsecured) money markets to repo (secured) money markets during and in the aftermath of the Crisis that began in August 2007. In particular, the trust in banking system was broken and their trust in each other permanently damaged by the Crisis. The interbank market collapsed due mostly to Crisis and there has been a clear shift from an unsecured to a secured (repo) market. The question I ask then is: How did central banks adapt their policy framework to an evolving financial system? From the central bank perspective, monetary policy implementation changed with the recent financial crisis. The proper starting point is to analyze of these changes in operational procedures for understanding how central bank operation and monetary policy actually function during and after the financial crisis. Possible explanation for the main forces underlying the observed changes is to link between central bank and the rest of the financial system (banks and shadow banks). In the new segment of money markets (repo markets) banks wanted other banks to provide collateral against reserves. The repo market, where banks and shadow banks exchange short-term liquidity for high-quality liquid assets, has become an increasingly important component of the money markets. Therefore, the repo market became more important than the unsecured interbank market and most of trades between banks moved to the repo market.



The second part of this chapter discusses the role of government debt in the financial system. The question I address in the second part of this chapter is: Why did central bank's holding of government bonds increase rapidly since the global financial crisis? The fact that the core money market is the repo market, government debt is a money market phenomena because they increase collateral supply. This is important because in the traditional framework the fact that the increase in government debt is also an increase in collateral supply does not matter because the core money market is unsecured, and has nothing to do with the collateral supply (Sissoko, 2020). In this context, central bank purchases of government bond reflect the new role that government debt play in this collateral-intensive financial system that is organised around securities, derivatives, and wholesale money markets. Moreover, fiscal policy can have direct effects on the money markets if the core money market is operating on secured basis (Gabor 2020). The reason is that the increasing role of collateral in the new financial system. The government debt means supply of collateral and this creates not only settlement pressure as in the traditional fiscal policy analysis, but also generates a funding pressure on the money market.

The analysis proceeds with Section 2 presenting changes in monetary policy implementation during and after the financial crisis. Section 3 discusses the shift from interbank (unsecured) lending to repo (secured) lending. Section 4 presents a repo transaction and its structure. Section 5 introduces unconventional monetary policy tools and differs credit easing operations from quantitative easing. Section 6 discusses the role of government debt in the financial system. Section 7 looks at the consequences of using repo lending. Section 8 concludes.

### 3.2 Changes in Monetary Policy Implementation

With the recent financial crisis, monetary policy implementation changed. One of the consequences of the crisis is that the traditional interbank funding market has declined in importance relative to the secured money markets. As will be described below, observed developments in the interbank market were a decline in unsecured money market activity and growth of the secured market during and emerging from the financial crisis began in August 2007. This is the particular date when the financial crisis spilt over into the interbank money market and the markets experienced enormous stress during that time.

The first questions of this paper are, therefore, what has changed and what caused the interbank market to seize up? It is worth noting that the confidence crisis in the interbank market may explain why the reliance of banks and shadow banks shifted from unsecured to secured overnight lending in repo. Because the basis of banking ultimately is confidence and trust, when fear and panic replaced market euphoria, this resulted in non-traditional forms of bank runs among the banks themselves as the latter scrambled for liquidity during the worst of the financial crisis, especially after the collapse of Lehman Brothers in the United States in 2008. The interbank market completely seized up because of this loss of trust (Seccareccia, 2012,

p.289). This may not create a serious problem in the case of an individual bank. However, if all banks started to see loss of trust among each other then this may create a potential problem for the market not to be properly functioning. The point is that there is a possible reason to understand why banks and shadow banks decide to trade in the repo market when banks do not trust each other. Summing up this point, if the counterparty risks is too high then banks trade in the secured money market, in exchange for collateral. As discussed by [Seccareccia \(2012\)](#), banks became increasingly reluctant to lend liquidity to each other in the interbank funds market, due to higher perceived counterparty risk. [Lavoie \(2010, p. 8\)](#) describes the failure of Lehman brother on September 15, 2008: 'no counterparty was judged to be safe anymore'. As a result, turnover in the unsecured interbank market significantly decreased.

The proper starting point is to analyze these changes in operational procedures to understand how central bank operation and monetary policy actually function during and after the financial crisis. A possible explanation for the main forces underlying the observed changes is the link between the central bank and the rest of the financial system (banks and shadow banks). Therefore, the starting point is to describe the modern central bank's role in the national payment system, consistent with the post-Keynesian horizontalist view of money and interest rates.

As a central banker, Ulrich Bindseil defines the concept of an operational target of monetary policy, according to which a central bank sets the level of short-term money market interest rates that the central bank aims at in its day-to-day operations during the period until the next meeting of the central bank's decision-making body ([Bindseil, 2004b, p.7](#)). In this context, a central bank, for example, the Federal Reserve in the United States after each Federal Open Market Committee (FOMC) meeting sets an operational target of monetary policy –the fed funds target rate – and seeks to influence short-term money market rates by setting its policy rate. The short-term overnight interest rate can be considered the appropriate operational target and the operational target of monetary policy is an economic variable, which is under control of the central bank. The central bank uses monetary policy instruments to reach its operational target. For instance, standing facilities, open market operations, and reserve requirements (where applicable) are tools available to the central bank that can be used to reach its operational target. In effect, the main objective of the central bank is to keep the overnight market interest rate on target. Next, I will explain how the the Fed implemented its monetary policy before the Crisis and then I will delve into the changes in monetary policy during and after the crisis.

### **3.2.1 Corridor system: Pre-Crisis limited reserves framework**

Before the Crisis, the framework that the Fed conducted its monetary policy was a corridor system. The main feature of this system is that a central bank is operating under a limited-reserve regime in which reserve balances have to be managed by the central bank if the central bank wants to implement its monetary policy through short-term interest rate targeting. In such a

system, the interest rate on bank reserves or reserve balances at the central bank is equal to zero. Thus, there is no interest that central banks pay when (commercial) banks want to deposit their (excess) reserves at the central bank. For a central bank operating under corridor system, there is a necessary task to carefully monitor the level of reserves in the system as long as it wishes to see its expected interest rate (the overnight rate, for example the federal funds rate in the US) and the actual interest rate (the effective federal funds rate) do not diverge too much from each other. To achieve this, the central bank needs to correctly forecast changes in the demand for reserves and the factors outside the central bank's control such as government transactions. For example, if there is demand for central banks reserves (or reserve balances), this requires the central bank to supply exact amount of reserves that the banks look for. Likewise, it is the central bank's job to drain reserve balances of excess reserves that banks do not need at a certain time. The possibility of such movements in the reserve balances (either in need for reserves or get rid of their excess reserves) is the focus of any central bank that operates under the corridor system.

For post-Keynesians, the supply of money and the supply of high-powered money are demand-determined and what central banks can do in this endogenous money world is to target the short-term rate of interest. Endogenous supply of money and control of the short-term rate of interest are the two key points to understand pre-crisis central bank operational frameworks. In line with the post-Keynesian endogenous (or horizontalist) money view, it is the central bank that provides money at the target rate whenever the banking system demands central bank reserves. It should be clear that the central bank has a monopoly power in supplying money and essentially controls the short-term interest rate. What also needs to be emphasized here is that the central bank provides liquidity – central bank reserves – that is sufficient to meet the demand of the banking system at the targeted rate of interest. (Lavoie, 2019a, p.91) points out that the horizontalist view of central bank operational framework is such that “the supply of money could best be conceived as a horizontal line at the targeted rate of the central bank”. Considering money is demand-determined and that the short-term interest rate is under the control of the central bank, the provision of liquidity as a central bank operation is therefore essentially defensive. To get a better understanding of the defensive role of central banks, it is important to look at the day-to-day operations of central bank in the monetary system. In the overnight interbank market, banks need reserves in order to meet the demand by their clients to transfer their funds and fulfil reserve requirement (if applicable) or to respond to banknote demand. It is worth pointing out again that banks need reserves after granting loans and they do not need reserves in order to make loan in the first place, meaning that banks first create loans and then look for central bank reserves. This is the point to grasp the defensive role of central banks for stability in the overnight interbank market – central banks provide liquidity (reserves) for banks whenever they need reserves for their aforementioned needs. In addition to this, there are factors that are out of the control of central banks called autonomous

liquidity factors which affect the interbank market for reserves. Autonomous factors include government expenditure, taxes, changes in public's demand for currency, and foreign exchange reserves.

Lavoie (2019a) notes that autonomous liquidity factors are important for the working of the reserve market and could cause large fluctuations in the interbank market for reserves if the central bank does nothing. In other words, when the central bank does not act as defensive and does not meet the demand for reserves by banks in the overnight market, this will find a response in the money market, meaning that fluctuations in the overnight interest rates will be inevitable. Accordingly, two possible situations may occur in the overnight interbank market: liquidity surplus and liquidity deficit. Both cases have different effects on the overnight interest rate. In the case of liquidity surplus in the overnight interbank market in which there is no remuneration of bank reserves to deposit reserves at the central bank, the overnight rate could fall to zero. In contrast, in the case of liquidity deficit in the overnight interbank market, the overnight rate would have a sharp increase as the central bank does not take a position to provide liquidity. In short, the central bank plays a critical role with its defensive role to avoid these two possible situations and hence, daily fluctuations in the overnight interest rate that may occur in the interbank market for reserves. For these reasons, the central bank must pursue defensive operations, so as to counter-act, that is, "neutralize" the effects of the factors affecting the reserve market. (Lavoie, 2019a, p.95)

As can be seen from Figure 3.1, with a ceiling and floor established, the key advantage of a corridor system is that it limits fluctuations in the overnight policy rate. Consider, for example, when a bank needs liquidity (reserve) in the money market. The price that the bank will pay to cover its liquidity deficit position in the money market is the following: (1) the bank would have no reason to pay a rate higher than the lending rate (The discount window from the central bank) to borrow reserves in the overnight money market and (2) when a bank have liquidity surplus in the money market, it would have no reason to accept a rate lower than the deposit rate offered by the central bank (More on this point later). As pointed out by researchers from the Bank of England (BoE), Jackson and Sim (2013) argue: "such corridor system provided market overnight rates traded within the corridor created by the standing facilities, banks were incentivized to trade with each other, rather than with the Bank, to meet their reserve targets." As a result, without any change in the supply of reserves to the banking system, the central bank can tightly control the interest rate on overnight funds. Moreover, the Eurosystem standing facilities which serve as the deposit facility (acting as a floor) and the marginal lending facility (acting as a ceiling) also helped guiding the short-term market interest rate, which was usually set in the middle of the corridor (Grossmann-Wirth, 2019, p.338).

Lavoie (2015, p.10) argues that this goal is more easily achieved by the adoption of the "corridor system" in which banks can borrow or deposit reserves using central bank's standing facilities at interest rates fixed above and below the central bank policy rate, respectively. In

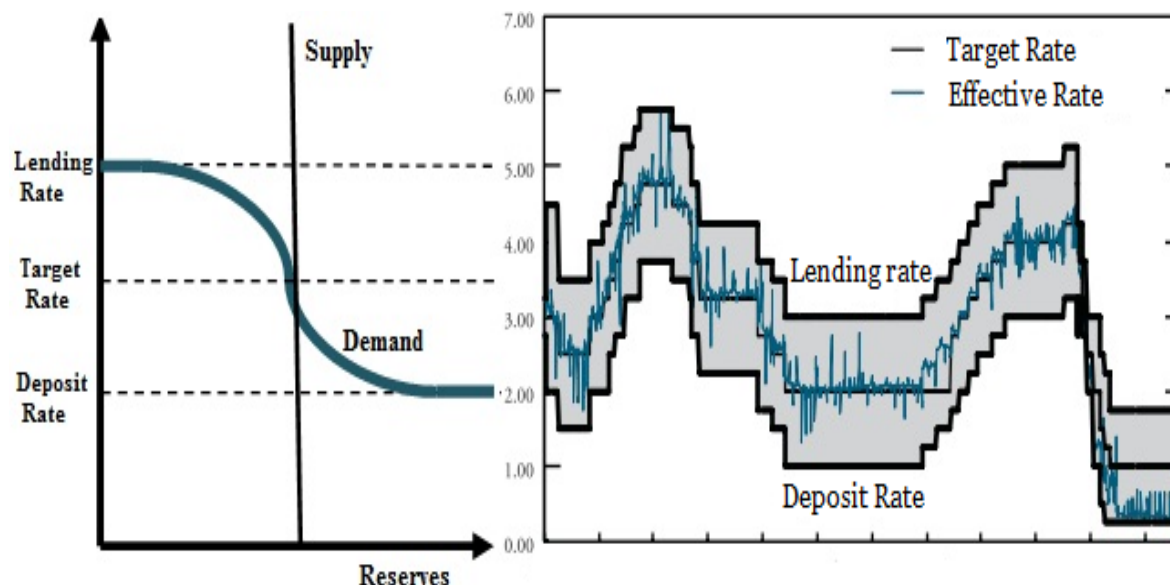
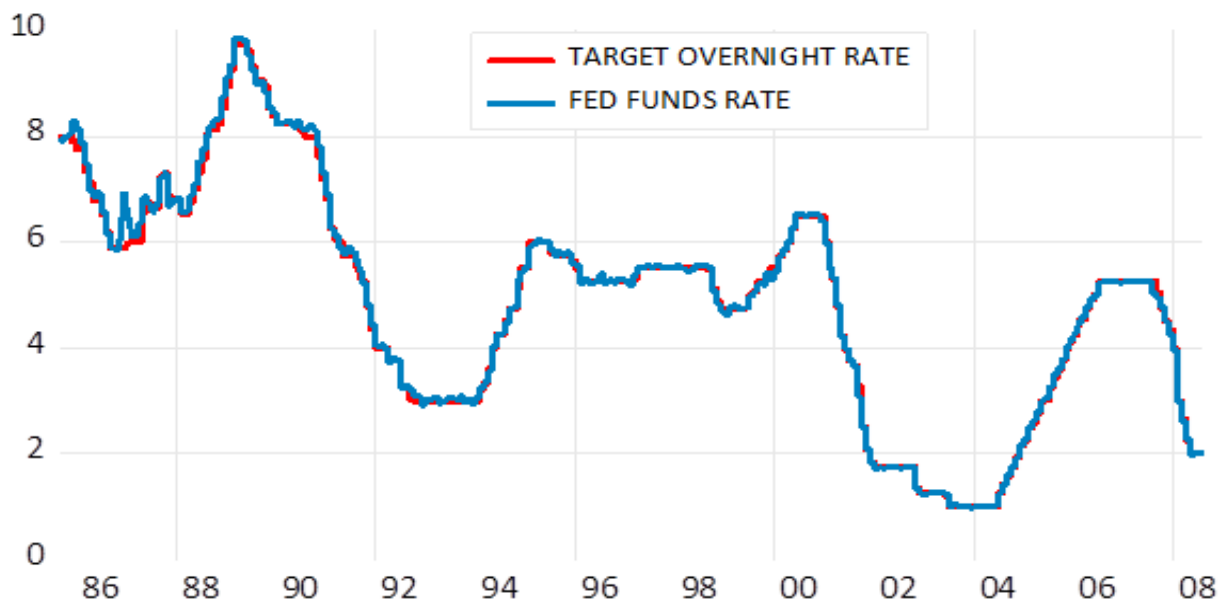


FIGURE 3.1: A stylized demand for reserves in a 'corridor system' with the target rate at the midpoint of the corridor

such a system, the interest rate targeted – the fed funds rate - by the Federal Reserve is set within the corridor established by the two interest rates defining the standing facilities of the central bank: the floor rate or deposit facility rate, which is the rate of interest paid on bank reserves at the central bank; and the ceiling rate, which is the rate of interest at which banks can borrow reserves from the central bank.

Figure 3.1 shows a stylized illustration of the demand for reserves in a corridor system. Let us consider the corridor rates before the crisis. Figure 3.1 is useful to understand the monetary policy implementation under the symmetric corridor system. Accordingly, the lending rate is the upper limit federal funds target range. Banks in the money markets (the federal funds market) have access to this facility if they are in the short of liquidity position and have the difficulty to obtain liquidity in the federal funds market. The deposit rate represents the lower limit federal funds target range. Assume that at a time, the lending rate was 5% and the deposit rate was 2% (we just assume that banks can park their reserves at the central bank and earn interest in this stylized corridor rates), the ceiling and the floor, respectively. In this case, banks could obtain reserves from the Fed at an interest rate of 5% and banks with excess reserves could deposit their reserves in the deposit facility at 2%. It should be clear that banks in the federal funds market were not willing to trade reserves at rates worse than those available from the central bank' standing facilities, whereby the fed funds target rate is set in the middle of the corridor as operational target of monetary policy. As [Cesaratto \(2020, p. 202\)](#)<sup>1</sup> argues that one does not have to be an economist to guess that the two banks will agree to an interest rate

<sup>1</sup>[Cesaratto \(2020\)](#) explains the corridor system in the case of European Central Bank and its corridor rates are different from the example I illustrate for the case of Federal Reserve



Board of Governors of the Federal Reserve System (US), Rate retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FEDFUNDS>

FIGURE 3.2: *Federal funds target overnight rate and effective federal funds rate*

around 3.5% precisely equal to the target rate targeted by the Fed. It is this rate that becomes the short-term interest rate that the Fed wanted to prevail on the federal funds market where the central bank exerts its influence. The whole idea of central banks was then to set this short-term interest rate for monetary policy implementation before the Crisis, influencing the economy through through this short-term interest rate occurred in the interbank market: 'this rate becomes the keystone of all the interest rates in the economy.' (Cesaratto, 2020, p. 202) .

The Fed was able to implement its monetary policy through short-term interest rate targeting. Indeed, this is exactly what happened until the financial crisis of 2007-08 when central banks in many countries successfully conducted their monetary policy under the symmetric corridor system. Figure 3.2 shows the relation between the federal funds target rate and the effective federal funds target rate, starting from 1990 to the 2007-08 financial crisis. This other rate - the (effective) fed funds rate - is important for the implementation of monetary policy because the effective federal funds rate (blue line) is the weighted average of all transactions among the banks in the interbank market (or the federal funds market). Basically the Fed sets a target rate (red line), and the effective fed funds rate is supposed to match the target rate (or reasonably close to the target rate. The importance of such close connection between the federal funds rate and target overnight rate implies that the first step of monetary policy transmission mechanism works, meaning that the Fed's monetary policy implementation through short-term overnight rate (target rate) function in the interbank market. At first glance, it is obvious that the Fed successfully implemented its monetary policy under the corridor system wherein the supply of reserves were limited.

My task for the next section is to explain how the Fed lost the control of the short-term overnight rate (fed funds rate) when the crisis erupted in 2007 and connect the difficulties when the Fed tried to implement its monetary policy through the standard corridor system during the crisis. As will be discussed below, in the end, the Fed needed to adopt that variant of the corridor system which is called Floor system.

### 3.2.2 Transition from the Symmetric 'Corridor' to a 'Floor' System

The global financial crisis erupted on August 9, 2007. This date is a pivotal moment because it is the day when mortgage crisis went global. To begin with, the mortgage crisis or housing bubble before 2007 was the result of transformation of the financial system that started from the development of Eurodollars and the shadow banking system. In this regard, it is important to pay attention to the Eurodollar and its transformation into the banking system which played an incredibly important role in the global financial crisis. To reiterate, at the beginning of this transformation, a significant amount of these Eurodollar products (ABCPs, repos, MMFs) was taking place in the shadows. Therefore, the term 'shadow' is appropriate to describe the activities which occur in such an unregulated banking system. The fact is shadow banking did not come out of nowhere. It did not just spring up in the 2000s. It must be clear that it was a process that had started back into the period when Eurodollar came into existence. Starting from the period 1960s to the 2000s, the banking system underwent a dramatic transformation. The transformation of the banking system from "originate and hold" (what it used to be) to "originate and distribute" (what it has become) played an important role for the shadow banking. The consequence of endogenous money creation by banks enabled shadow banking to expand their credit intermediation in the financial system. Specifically, the securitization process played a distinctive role in the whole story. Commercial banks and their ability to create money endogenously in the act of lending and then packing their assets and selling them in the financial markets through securitization enabled a rapid expansion of the shadow banking system. Moreover, the rise of securitization led for the potential growth in the repo market. In the repo market, the repo is essentially a collateralized loan. Collaterals became an important part of the financial system because collaterals became essential to obtain funding. Therefore, the rise of securitization and the need for collateral in the shadow banking system were crucial factors behind the mortgages and housing bubble before the global financial crisis. In such a system in which 'expansion for the sake of expansion' led ordinary households to take out mortgages for their housing investment. On the other hand, commercial banks were busy to package these mortgages and sell them to shadow banks through securitization. With securitization, these mortgages become complex financial products such as the Mortgage-Backed Securities (MBSs) and tradable instruments within the financial system. Before the financial crisis, many of these securities were perceived very safe with no risk. The investors who invested in these securities did not know or did not consider that these securities were pool of mortgages and a huge

part of the structure were illiquid mortgages. Needless to say, all these complex structures were used as collateral in the repo market. And the repo market is a global market in which not only investors in the United States were investing in these securities but also investors from outside the United States, especially European banks. However, this expansion for the sake of expansion was not endless.

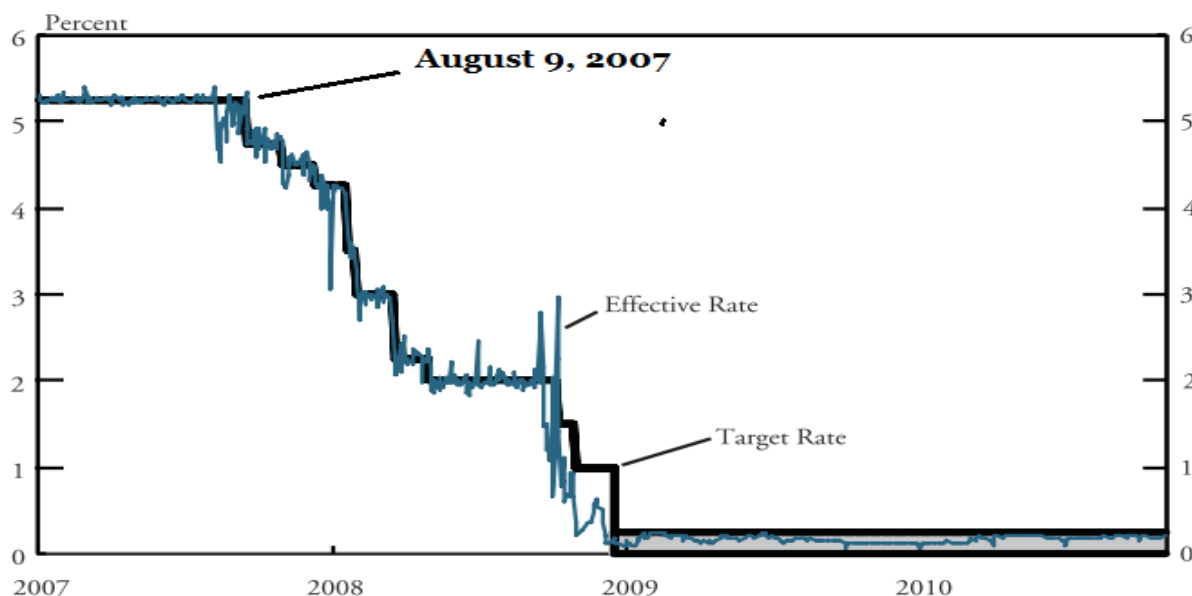
Starting in June 2004, the Federal Reserve tightened their monetary policy through the federal funds rate, which was supposed to transition into the rest of the credit system. The reason behind this is that the Fed understood that the housing sector just went off the rails after the rise of securitization and growth of repo market. We have previously noted that the system started with the Eurodollar and then found itself into the shadows. That is to say, the system evolved outside of the Federal Reserve. So, the Federal Reserve was not there during the evolution of the system, especially when shadow banking system was effectively replacing the Eurodollar. In the middle of the housing mania (in the mid 2000s), the Fed started to intervene by increasing the federal funds rate from 1% in June 2004 to 5.25% in June 2006. Note that the Fed changes the federal funds rate by 25 basis points. The Fed's intention was tightening so that an increase in the federal funds rate would influence the economic activity. While the Fed reduced (ease) the interest rate (the federal funds rate) to stimulate the economy in an expansionary sense, it raised (tightening) the interest rate to decrease the economic activity. All the way up, this rate reached 5.25% by the middle of 2006. Doing 17 rate hikes (each one of those was 25 basis points) was supposed to be a tremendous amount of tightening during this period. Ben Bernanke stated that the subprime market seemed likely to be contained<sup>2</sup>. It was this period that the housing bubble burst and inherent risks in the mortgage securities were revealed. August 9, 2007 was a trigger where everything started to freeze up. The collateral backing the ABCPs declined to value them because these investors realized their exposure to the subprime mortgages. Suddenly, asset-backed commercial paper (ABCP) which was one of the primary innovations of the shadow banking and the largest U.S. short-term debt instruments with more than 1.2 trillion outstanding, completely collapsed. Confidence crisis spread to banks, and they ceased to lend to each other. Therefore, in the interbank (the federal funds market), there was a breakdown of trust to lend each other liquidity (credit crunch). Banks also ceased to extend credit to households and firms in this period.

The subprime crisis that erupted in 2007 transmitted to the real economy due to the reduction of bank credit to households and firms. The conclusion of this analysis is that it was far beyond the ability of the Fed to control it on the way up because everything had been created decades before. There was also no response when the Fed started to increase the short-term interest rates in a recessionary sense to reduce the economic activity in the middle of 2000s. Figure 3.4 shows that on August 9, 2007, the Fed started to aggressively cut the federal funds

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<sup>2</sup>"At this juncture, however, the impact on the broader economy and financial markets of the problem in the subprime market seems likely to be contained." statement by Ben Bernanke before the pivotal moment that the crisis erupted on August 9, 2007.





Board of Governors of the Federal Reserve System (US), Rate retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/FEDFUNDS>

FIGURE 3.3: *The federal funds target Rate and the effective rate*

rate starting from 5.25% back to 1% in an attempt to stimulate the economy. However, the effective rate did not follow the federal funds target rate. This meant that the monetary transmission mechanism under the corridor system was not working because there was no response to the Fed's monetary policy.

There was a breakdown in the system (breakdown of interbank market), and it was working against the Federal Reserve monetary policy. According to Lavoie and Seccareccia (2012, p. 172), 'the standard monetary instrument of central bankers, based on Wicksellian rules, has reached its limits, making the central bank unable to pursue a more expansionary monetary policy.'

In the next section, I will address the shift from the standard corridor system to a floor system to explain why the configuration of central bank monetary policy implementation we described above – standard monetary policy implementation – was no longer sufficient in response to the Crisis and that many central banks responded to the Crisis by shifting from the conventional framework to an unconventional framework. In this regard, I will focus on answering the following question: what was the weakness of conventional tools that central banks had to depart from their standard way to implement monetary policy in response to disruption in the financial markets during the Crisis?

### 3.2.3 Floor System : Post-crisis ample-Reserves Framework

During the period of 2007-08, the federal funds market experienced stress due to a loss of confidence and trust. In turn, this led to higher volatility in the interbank market as banks became unwilling to lend reserves to other banks and increased the cost of borrowing. In response to

the financial crisis and in particular the stress in the interbank market, the traditional monetary policy framework was insufficient to ease funding conditions in the financial markets. For example, in the US, the Fed initially responded to the financial crisis with conventional tools such as cutting short-term interest rates to near zero. However, this traditional monetary policy framework has been complicated at the beginning of the financial crisis and the Fed began addressing monetary policy transmission issues, providing additional stimulus in conjunction with the decrease in short-term interest rates.

With these developments in response to the financial crisis, the central bank monetary policy implementation framework for setting short-term interest rate changed as the balance sheet grew to unprecedented size. In the US, the open market desk at New York Fed found it increasingly difficult to achieve the FOMC's target funds rate (Kahn, 2010). With a vast amount of excess reserves, the federal funds rate came under considerable downward pressure<sup>3</sup>. In short, during this period, the Federal Reserve Open Market Desk injected a huge amount of excess reserves and the effective federal funds rate fell below the target funds rate as a result. As a consequence of these excess reserves in the banking system and the difficulty to control the short-term interest rates in such environment, the Fed had to modify its approaches to control short-term rates.

Before explaining the impact of these excess reserves on the decline of the interbank money market, one could ask what banks can do with reserves. What do excess reserves mean for the economy? What is important to emphasize here is the role of (excess) reserves in the banking system. The point is that banks can only lend reserves to each other in the interbank market or other money markets. Fullwiler (2017, p.53) points out that the more fundamental issue is to consider when banks use reserves in the first place, rather than asking where or how banks obtain reserve balances. It is important to note that the excess liquidity remains with central banks because of the link between banks and their current accounts with central bank. That is, all these excess reserves are held in these accounts at central banks or in the deposit facility where banks receive interest for depositing their excess reserve at the central bank.

While an individual bank can lend its excess reserves thus reducing its reserves, the aggregate banking system cannot alter the quantity of reserves in the system. To understand the difference between an individual bank and the banking system as a whole in altering the total amount of reserves in the system, let us suppose that an individual bank transfers funds to another bank in the money market on behalf of its clients. From this transfer of funds, such lending of reserve balances can only shift reserve balances between banks and does not alter the aggregate quantity of reserves in circulation (Fullwiler, 2017, p.56). As a matter of double-entry accounting, the trade of reserves always ends up with another bank that has an account at the central bank. Therefore, it is clear that the banking system as a whole cannot alter the total

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<sup>3</sup>For example, the FOMC cut its target funds rate to 1 percent at the end of October 2000. The vast amount of excess reserves kept the funds rate trading persistently below its target (See in more detail the effects of excess reserves in response to the financial crisis during and its aftermath, (Kahn, 2010))

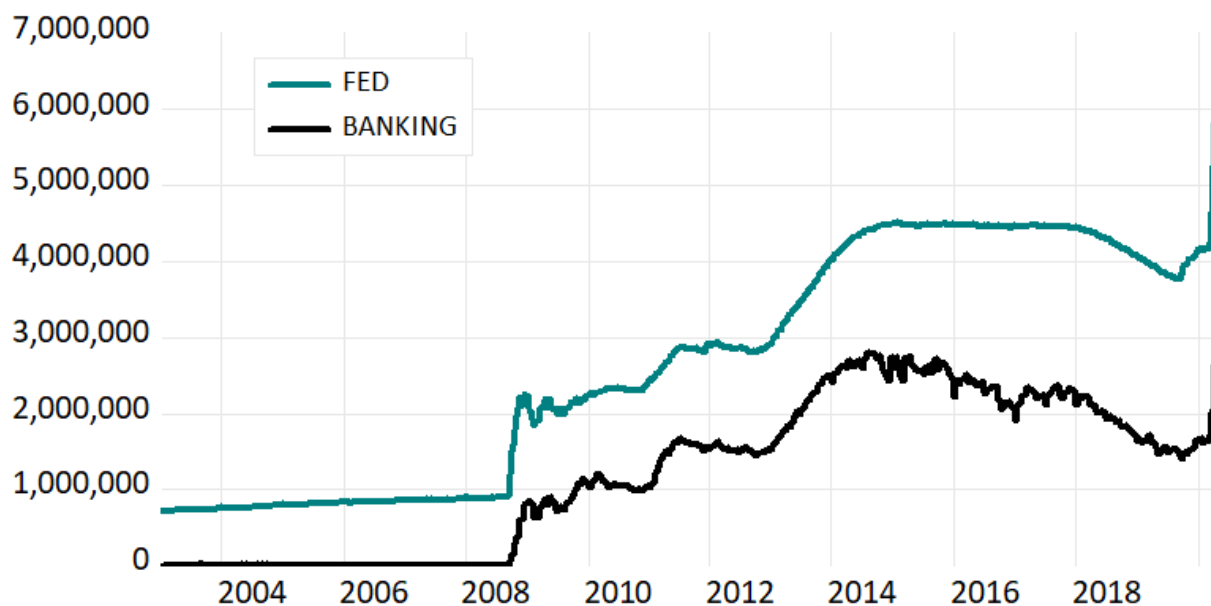


FIGURE 3.4: *Total Reserve Balances Maintained with Federal Reserve Banks*

quantity of reserve balances. Note, however, that changes in the aggregate quantity of reserve balances depend on changes in the central bank's balance sheet. For example, open-market operation, that is, changes in claims on governments or the outstanding quantity of central bank bills will lead to a change in central banks' balance sheet thus changing the aggregate quantity of reserve balances (Fullwiler, 2017, p.56).

In late 2008, the Fed switched from using a standard corridor operating system to using a modified corridor operating system, the so-called floor system<sup>4</sup>. With a floor system, the Fed sets the target federal funds rate equal to the deposit rate – interest on excess reserves. To understand how it works and differs from the standard corridor system, Figure 3.5 illustrates the floor system when the Fed first adopted it in late 2008<sup>5</sup>.

At first, the Fed introduced the first elements of the corridor system in mid-September 2008 as it began paying interest on reserves<sup>6</sup>. The issue with the corridor system, however, was that the supply of excess reserves would lead to a decline in the Fed funds rate below its target rate. In other words, without introducing this element – an interest rate floor by the corridor– the injection of huge amounts of excess reserves could push the policy rate well below its target.

<sup>4</sup>In fact, the Fed authorized to begin paying on reserve balances on October 1, 2011, but the disruption in the financial market during the financial crisis forced the Fed to adopt the floor system three years earlier. See the announcement by the Fed when it started to pay interest on excess reserves. <https://www.federalreserve.gov/monetarypolicy/20081006a.htm>

<sup>5</sup>Current version of the floor system includes one more administrative policy rate – Overnight Reverse Repurchase Agreement (ON RRP). The FOMC announced in 2014 that it intends to use an ON RRP facility to help control the Federal Funds rate. <https://www.federalreserve.gov/monetarypolicy/overnight-reverse-repurchase-agreements.htm>

<sup>6</sup>Note that, at that time, while the Federal Reserve has not formally adopted a corridor system, a number of central banks—including the Bank of Canada, Bank of England, Bank of Japan, European Central Bank (ECB), Norges Bank, Reserve Bank of Australia, Reserve Bank of New Zealand, and the Swedish Riksbank—have for some time operated under various versions of the corridor system.

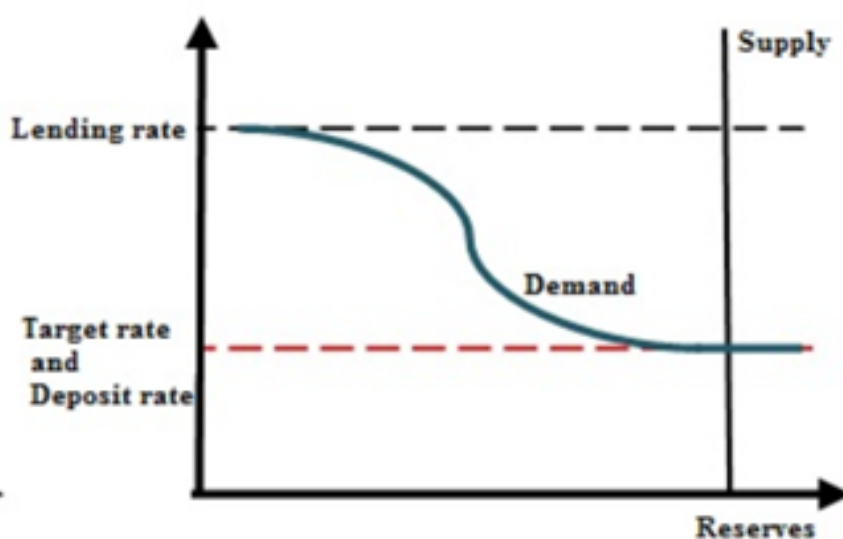


FIGURE 3.5: *The Floor System, with the Target Rate at the Bottom of the Corridor*

Therefore, the Fed adopted a floor system in November 2008 in which interest on reserves became the target rate for monetary policy. In the floor system, the bottom of the corridor becomes the target overnight interest rate where banks could deposit their excess reserves and receive interest on reserves. With the floor system, central banks were allowed to control interest rates while reserves typically exceeded the level required to meet the banking sector's demand for liquidity. Moreover, while a central bank with a floor system allows changing the provision of liquidity, a central bank has control over the policy rate. In a floor system as (Lavoie, 2019b, P.104) points out "there is a total disconnect between short-term interest rates and the amount of reserves."

Note also that the interest on reserves and its role in the US are related to the participants in the federal funds market. However, this introduction did not cover all participants in the money market and the Fed introduced another facility (overnight reverse repo, ONRRP). With this facility, other participants – nonbank institutions – in the money market were allowed to deposit their reserves and earn interest on reserves at the central bank<sup>7</sup>.

To understand how the central bank conducts its monetary policy through the floor system, we consider the Fed's implementation framework. We start with three segments of the demand curve shown in Figure 3.5<sup>8</sup> There are three segments in the floor system. The first segment is the top of the curve where the demand is flat, and this segment coincides with the Fed's discount rate or lending rate. Banks in the federal funds market have access to this facility provided by the Fed when they need reserves. Lending rate at the top of the corridor (or the Fed's discount

<sup>7</sup>In particular the so-called Government sponsored enterprises, and money market funds

<sup>8</sup>Such stylized model of the demand and supply of reserves under the floor system can be seen in Lavoie (2010, P.12)

window) ensures the banks that they can borrow reserves in the market with an interest rate lower than its lending rate. Importantly, the Fed sets such lending rate under the floor system to create a ceiling on market for reserves. Therefore, the first segment of the demand curve incorporates the ‘fact that banks in the market should not be willing to pay more for reserves in the market than the interest rate charged by the Federal reserve to bank for loans they can obtain through the Federal reserve lending rate’ (Ihrig and Wolla, 2020, p. 8).

Second, the middle of the demand curve represents the second segment where the demand curve is steeply downward-sloping. The curve implies that banks in the federal funds tend to hold the reserves when the cost of overnight decreases. The idea of such behavior in the federal funds arises from the opportunity cost of holding reserves. Banks in the federal funds see the decline in the opportunity cost of holding funds and it is this reaction that leads banks to start holding more reserves. Indeed, if necessary, having more reserves may help banks not to be caught short of funds.

Third, the third segment of this demand curve is the bottom of the curve which is the important segment for the main purpose of the floor system. In this segment, the demand curve is nearly flat and the supply intersects at supply curve. This flat portion of the curve at the bottom implies that the level of reserves in the banking system is significantly large and ‘as the quantity of reserves in the banking system increases, at some point, banks do not find much benefit from holding additional reserves other than the interest the fed pay on these balances’ (Ihrig and Wolla, 2020, p. 9).

What is most important to know about the floor system is that the Fed is able to implement a monetary policy through two different policies: interest rate policy and reserve policy, or liquidity policy. Therefore, the Fed can separate these two policies when it implements its monetary policy. With the floor system, the interest rate policy divorces from the reserve policy. In other words, the Fed can set an interest rate policy while it can provide an excessive amount of reserves. The level of reserves in the system that operates under such framework is significantly large because central banks can set the amount of excess reserves at whatever level that it desires (Lavoie, 2016, P. 184).

“In the floor system, the central bank injects a large amount of reserves to deliberately bring the actual overnight interest rate to the level of the floor rate”(Lavoie, 2010, P. 11). In the case of the Fed, the actual federal funds rate and the target federal funds rate must be equal because the floor rate is the target rate. Injecting a large amount of reserves can drop the federal funds rate to the floor rate, but not lower than the floor rate because banks with excess reserves in the federal funds market will deposit their excess reserves at the central bank rather than lend their reserves at a lower rate in the federal funds market. Therefore, the Fed does not actively need to monitor small movements in the level of reserves and there is no need of (daily) open market operation to adjust level of reserves in the system. Because the system has a large amount of reserves under the floor system, shifts in this level do not cause a significant impact

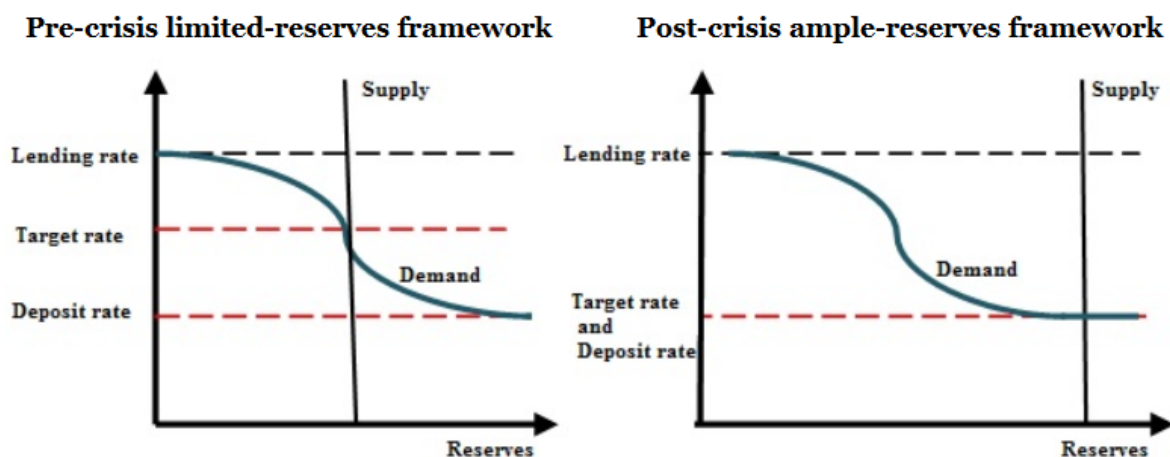


FIGURE 3.6: Graphical Comparison of pre-crisis limited and post-crisis ample-reserve frameworks

on the federal funds rate. According to Lavoie (2010), the main advantage of the floor system is that the central banks need not proceed to neutralizing operations under such framework. Effectively, the Fed implements its interest rate policy independently from reserve policy. This is why Borio and Disyatat (2009) call this new system “decoupling principle” pointing out the complete separation between interest rate policy and supply of reserves policy by the central bank.

To conclude this part, monetary policy changes in response to the financial crisis of 2007-08, the Fed and its provision of reserves initially led to the funds rate falling below its target rate. Later, the Fed introduced a floor system that helped anchor the Fed funds rate near the FOMC’s target rate. With the corridor, in particular the corridor floor, interest on reserves allows the Fed to inject a vast amount of reserves while separating interest policy and the policy of maintaining liquidity in the interbank market.

### 3.2.4 Comparison of the pre-crisis and post-crisis monetary policy framework

As Lavoie (2010, p. 7) points out, in the limited reserves framework which was before the financial crisis, ‘the rate of interest on deposits at the central bank, that is the interest rate on bank reserves at the central bank, is equal to zero.’ This is a key difference between two regimes. In the pre-crisis limited-reserve framework, what is striking is that the central bank (the Fed) is adopting a symmetric corridor system in which the target overnight rate is set right in the middle of the band (See left side in Figure 3.7). Put differently, the target overnight rate (the fed funds rate) takes place halfway between the lending rate (the primary credit rate) for credit facilities and the rate of interest on deposits at the central bank, which constitute the ceiling and the floor of the corridor (Lavoie, 2010, p. 10).

In the symmetric corridor system, until the financial crisis erupted in 2007-08, the Fed con-

ducted its operations, amongst other things, by supplying reserves on demand. In other words, reserves were available to the banking system when they needed. Therefore, supplying reserves on demand was a fundamental characteristic of the (symmetric) corridor system. The Fed was doing such a job to make sure that ‘the actual overnight rate ought to remain near the middle of the band and hence near the target rate.’ (Lavoie, 2010, p. 10). The symmetric corridor system was designed to allow the fed funds rate moving only between the ceiling and the floor rate. This has an important implication: if there are large fluctuations in the demand for reserves or in the supply of reserves, this is not going to be an important issue for the Fed because ‘the overnight interest rates will remain in the corridor and so cannot get away too much from the target federal funds rate’ (Lavoie, 2010, p. 10)). Such role of the Fed for monetary policy implementation, that is, supply of reserves must accommodate demand, enabled the actual overnight rate to remain near the middle of the corridor and thus around the target rate.

By contrast, in the post-crisis ample-reserve framework, the supply of reserves is ample, meaning that small fluctuation in this level of reserves do not create problems on the target overnight rate because the excess amount of reserves will keep the overnight rate (target rate) at the floor rate (deposits rate). For this reason, a central bank operating under ample-reserve regime does not need to actively monitor and adjust the supply of reserves with daily open market operations (Ihrig and Wolla, 2020, p. 13). An important feature of the ample-reserve framework is that the central bank sets the target interest rate equal to the deposit rate (See right side in Figure 3.7). In doing so, the central banks separate the amount of reserves from the overnight interest rate. “Thus, with a floor reserves, the central bank can keep control of the overnight rate whatever the amount of reserves is in the economy, provided the supply of reserves is much larger than the amount being demanded by banks at the target rate of interest.” (Lavoie, 2016, p. 184). Therefore, in the post-crisis ample reserves framework, changes in the target rate does not require a change in the supply of reserves. Borio and Disyatat (2009) put it ‘de-coupling principle’. In short, the main consequence of the transition from pre-crisis limited-reserves framework to post-crisis ample-reserves framework is that central banks with ample-reserves framework obtain a supply of reserve policy as well as interest rate policy to implement their monetary policy. The reason is that the level of reserves is completely disconnected from the overnight interest rate under ample-reserves framework.

It is interesting to note that two authors from the Federal Reserve call for a change in the current textbooks’ treatment of monetary policy implementation. Ihrig and Wolla (2020) examine several new textbooks published after new regime –ample reserves of monetary policy conducted since the aftermath of the global financial crisis of 2007-08 and recommend their authors to update their treatment of monetary policy implementation, pointing out that it is time that teaching materials are updated. “Further, rather than tying monetary policy implementation to the textbook content of money and banking and the money supply, we recommend

TABLE 3.1: *Comparison of the pre-crisis monetary policy framework and the post-crisis monetary policy framework*

	Pre-crisis limited-reserves Framework	Post-crisis ample-reserves Framework
Level of reserves is...	limited	ample
Target rate of interest is...	set in the middle of the bands: halfway between the lending rate and the rate of interest on deposits at the central bank.	Equal to the rate of interest on deposits (floor level) at the central bank
Supply of reserves	Accommodates demand	Exceeds demand
Fluctuation in the level of reserves have ...	Have a significant impact on the overnight interest rate	Have a minimal impact on the target rate because the excess amount of reserves keep the overnight rate at the floor level which is target overnight rate
Monetary policy is through ...	Interest-rate policy	Interest rate policy and reserve policy
Neutralizing operations ...	Are necessary because fluctuations have significant impact on the overnight interest rate	No need to proceed because there is large amount of reserves in the system and no need to forecast the demand for reserves
Reserve requirements are ...	Banks concern with reserve requirements (if applicable) and they pay attention to their level of reserves with respect to their reserve requirements	There is no need for compulsory reserves because there is a large amount of reserve in the banking system and most banks hold excess reserves
Policy tools are ...	Open-Market Operations (OMO) and Reserve Requirements	Interest On Excess Reserves (IOER) and Overnight Repo Facility (ON RRP)
Adopted System is ...	Symmetric corridor system	Floor System
Supply curve intersects ...	Supply intersects demand on the steep downward sloping part of the demand curve	Supply intersects demand on the flat part of the demand curve

focusing directly on the Fed's ability to use these tools to influence the federal funds rate and other market interest rates. These are demand-side tools that affect business investment and personal consumption decisions." (Ihrig and Wolla, 2020, p. 41).

To sum up: I can conclude that one of the most important consequences of the Global Financial Crisis was the breakdown of trust in the interbank market, where banks lend and borrow reserves. Interbank market (the federal funds market) is a market in which banks operate on unsecured segments that is reliant on the credibility, trust and confidence. Before the Crisis, banks operated in the interbank market without questioning these key elements of financial system. However, the crisis changed everything. A breakdown of trust induced banks to shift from interbank (unsecured) lending to secured (repo) lending. Next, I will explain this crucial transition from an unsecured core money market to a collateralized market, the repo market.

### 3.3 A shift away from unsecured (interbank) lending and towards secured (repo) lending

Overnight money markets are essential for the financial system and play an important role in the implementation of monetary policy as the target overnight rate of interest rate is often central banks' target rates. Key overnight money market can be divided in two markets: the market for unsecured (interbank) loans and the market for secured (repo) loans. While transactions in repo markets are collateralized the market for unsecured transactions is not collateralized.

It is important to emphasize that banks can only lend reserves to each other. The purpose of lending and borrowing reserves are twofold: payment settlement and meeting reserve requirements (if applicable). This point is important to get a better understanding the special role that played by banks in the payment system because bank deposits are part of the payment system (Lavoie, 2019a, p.111).

From this perspective, it is clear that banks first create deposits and then obtain reserves from the central bank. As Lavoie (2019a, p.111) points out, the causal arrow goes from loans to deposits to reserves. To get a better understanding of this mechanism, suppose a bank after granting credit needs a central bank reserve because it has a temporary shortage of reserves to settle its customer commitments. The bank can meet its reserve deficiency by borrowing reserves from another bank in the interbank market to make the payment on behalf of its cos-



tumer. This happens when households or business transfer their previously created deposits in the originating bank to another bank. The receiving bank has to accept a liability (a promise to pay) to the depositor for the final payment. Because the bank payment goes through the books of the central bank, or through the clearinghouse (for example in Canada) in which reserve balances issued by the central bank serve as means of settlement.

From the endogenous money view of banking and central bank operations perspective, in response to the demand for reserves the monetary authorities will supply any amount of reserves at the given target overnight interest rate (the fed funds rate). It should be noted that the reserve balances at the central bank are not there to constrain to create deposits. More precisely, reserve balances do not fund credit creation of banks. A study by Bundesbank (2019, p.60) reports that “banks need not maintain any liquidity buffers in the form central bank reserves over and above their reserve requirements if the redistribution of liquidity among banks is readily possible via money markets”. In this context, the primary objective of all central banks is to ensure the smooth functioning of their national payment systems (Fullwiler, 2017, p.60). It is in fact a duty of any central bank to guarantee the smooth functioning of the payment system (Rochon and Rossi, 2007, p.552). Overnight funding services, both secured and unsecured are the core of central banking and play a critical role for the implementation of monetary policy. For (Fullwiler, 2013, p.190), “a fundamental tenet of central banking is to defend the integrity of the payments system every day, every hour, every minute”.

Overnight markets underwent dramatic changes during the financial crisis of 2007-09, with interest rates rising to previously unseen levels and trading activity declining significantly in some market segments. Unsecured, interbank lending and lending secured with risky collateral were particularly affected. There has been a clear shift from interbank markets to repo markets since the financial crisis.

The unsecured (interbank) money market allows banks to lend central bank reserves to each other. The way banks borrow and lend to each other in the unsecured interbank money market are usually conducted by phone in the form of bilateral over-the-counter (OTC) credit agreements and also depends on ongoing business relations between borrowers and lenders. The transactions are usually overnight which means that the amount of loan that is borrowed is due on the very next day.

In interbank transactions, there is no need to transfer collateral in exchange for central bank reserves. In other words, borrowing in the interbank money market is uncollateralized. When a bank in a deficit position in the interbank money market - that bank has a shortage of reserves – it can get a sufficient amount of overnight loans from another bank which is in a surplus position without providing any collateral for this transaction. Therefore, in the interbank bank market, the transactions between banks are unsecured and the bank in surplus of liquidity (reserves) position can lend its surplus liquidity to a bank which is in short of liquidity. In such a transaction between the bank with surplus and the bank with deficit trade of reserves does

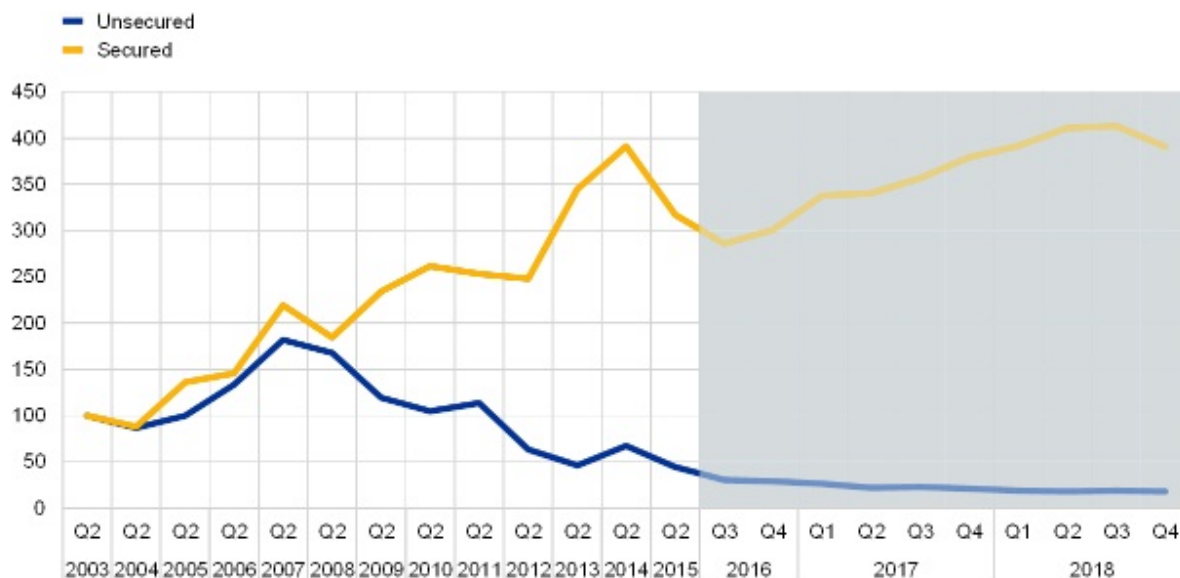


FIGURE 3.7: Turnover in unsecured and secured segments in euro area, Source: ECB, Money Market Statistical Reporting

not take any collateral to secure the bank with surplus of liquidity in the event of the recipient bank being unable to pay the amount of the loan. As will be noted below, this point is crucial to make a sharp difference between an interbank market and a secured (repo) money market in which borrowing is collateralized. Then, the main question of this section is: what does motivate banks to trade reserves with one another in the interbank money market given that borrowing is uncollateralized in this money market segment? As I have previously mentioned, confidence and trust are the key prerequisites for a credit (reserve) transaction to be traded between banks in the interbank market. As Lavoie (2013a, p. 226), “if a bank believes that it can be profitable by lending more or issuing more assets, it can always do so, as long as it maintains the trust of other banks and of investors.”

Money markets around the world have undergone substantial changes since the summer of 2007. From the standpoint of the study here, the most striking change has been the declining importance of the unsecured interbank money market and growth of secured (repo) market.

According to the Eurosystem, money market statistical reporting (MMSR), turnover in unsecured and secured segments in euro area have doubled their size until 2008. Starting in 2008, there is clear shift away from unsecured interbank lending and towards secured (collateralized) lending. Figure 3.8 shows that the total turnover in the money markets doubled between 2003 and 2018. However, the share of the unsecured transactions in total declined from about 45% in 2003 to 5% in 2018.

I think it is necessary to explore what factors do play an important role for the use of repo. This point that reported by the BIS (2019a, p.24) and the report shows since the start of Global Financial Crisis, trading volumes in unsecured interbank markets have declined in most ju-

risdictions, including the euro area, Japan and the United States. According to the report by the BIS (2019b, p.343), changes in regulation and increased risk aversion have disincentives for short-term funding and induced a broader shift from unsecured to secured markets. Similarly, ECB reported stylized facts that show there has been a clear shift from unsecured funding to secured funding transactions since the crisis (Coeuré, 2017). From the Bank of England, Jackson and Sim (2013) noted that during the height of the crisis, banks increasingly transacted with the Bank (in the case of England) rather than in the money market to manage their liquidity. Their conclusion is that money market activity, particularly in the unsecured interbank market, fell as a result of developments in the overnight money market.

In parallel to these points, several other factors may also have contributed to this decline in unsecured activity. An important factor that can explain the shift in money markets from secured to unsecured funding markets is the presence of shadow banking. At this point, Bindseil (2018, p.112) argues that post-crisis prudential and market regulations have made banks more resilient, but also led to growth of shadow banking and changes of market liquidity. Similarly, Coeure argues that "in the context of the ECB's operational framework in post-crisis times and that tighter financial regulation is both increasingly affecting the behaviour of supervised entities, and encouraging a parallel shift towards unregulated forms of finance' Coeuré (2016).

A combination of major changes in the regulatory framework (for example, the Liquidity Coverage Ratio), the increased aversion to risk post-crisis and a very high level of excess liquidity has had significant impact on the structure of short-term money markets in which central banks operate, a point made among others by (Grossmann-Wirth, 2019, p.346). It is also important to focus on the consequences of using repo lending. Therefore, in attempting to explain the operational developments in response to shift in money markets from unsecured to secured market, the aim is to explore the important ties between banks and shadow banks and how their reliance increasingly on the repo funding market rather than interbank funding market has repercussions for monetary policy implementation and discuss this aspect of the repo market that makes the financial markets more fragile.

### 3.4 Repo Transaction

A repo, or sale and repurchase agreement, is a short-term transaction (usually overnight) between two parties in which one party borrows cash from the other by pledging a financial security as collateral. In a repo transaction, the borrower (of cash) sells a security as collateral to the lender with a commitment to buy the security back later (often the day after) at the same price plus interest. The difference between the sale price and the repurchase price is the interest rate that the borrower pays the cash lender in the form of repo rate. Note also that the repo rate reflects the riskiness of the transaction, the quality of the collateral, the liquidity of the collateral, etc. Besides the repo rate, the borrower has to provide additional collateral which protects

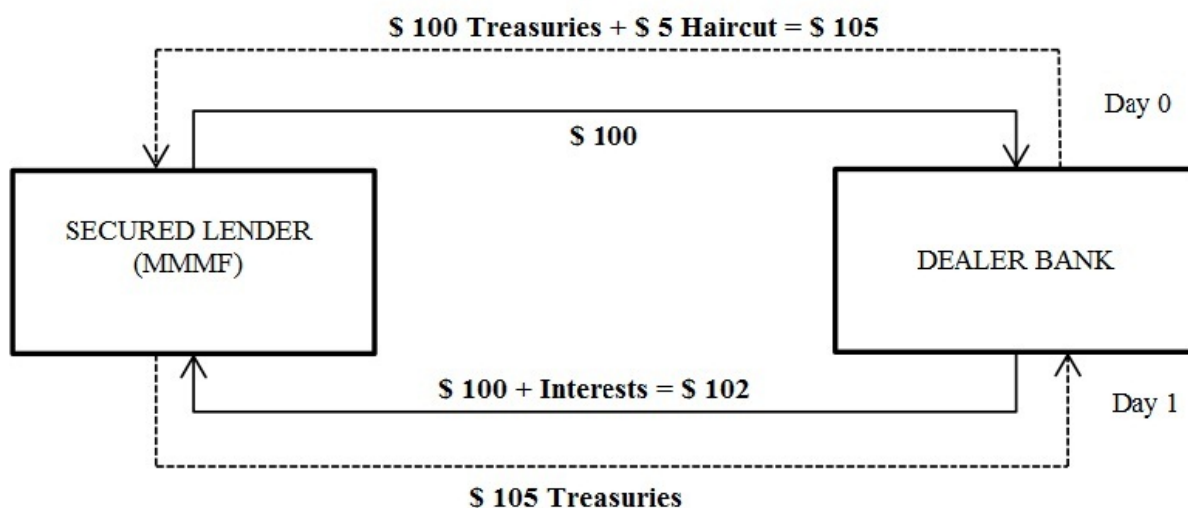


FIGURE 3.8: A Repo Transaction

lenders against fluctuations in the value of collateral. The spread between the market value of the transferred assets (collateral) and the purchase price is called the “haircut”. Conceptually, the repo is secured by collateral. What is important to emphasize here is that a repo is over-collateralized because there is a haircut on the notional amount of loan that the borrower typically has to post. (Sissoko, 2019, p. 7). In a repo transaction, the quality of securities used as collateral determines the haircut so that a lower-rated collateral bears higher haircuts. Repo transactions are usually marked-to-market daily in order to avoid the under-collateralisation arising from fluctuations in collateral value.

Consider the following example to better appreciate with a repo transaction. Imagine a dealer bank is the seller (provider of collateral) and a Money Market Mutual Fund (MMMF) represents a buyer (cash investor). The MMMF is looking for a safe place for its cash. On the other hand, the dealer bank is in need of cash to finance its inventory of securities. The transaction starts with the dealer bank that receives \$100 from the MMMFs by selling \$100 worth of Treasuries plus haircut to the cash provider on the first day. In turn, the dealer bank gets the use of cash through a repurchase agreement. Simultaneously, the selling of Treasuries to the MMMF in exchange of cash, the bank promises to repurchase the Treasuries at a future agreed date (day 1) at a given price (\$102), with the \$2 difference representing the interest on the principal amount of the loan – more specifically the repo rate. Thus, in this transaction, the Treasuries represent collateral as they are pledged as insurance for the promise to pay.

Besides, the MMMF gets legal title on the government Treasuries (collateral) received in exchange for the cash it lent to the dealer bank. As lender, the MMMF does not really care as much about the willingness of the bank to repurchase the Treasuries. In fact, if the bank defaults or does not repurchase the collateral, the MMMF will liquidate the collateral to recover most or all of its cash. Therefore, what really worries the MMMF is how much the price of Treasuries

used as collateral tends to move.

This last point is critical point to understand market liquidity in a world in which banks rely on repo markets. In other words, collateral plays a central role for the repo transactions. The concept of market liquidity captures the ability to buy and sell collateral without large price movements. (Gabor et al., 2021). In collateral-based financial systems, market liquidity matters. (more on that below).

At the end of the day, the cash lender (in our example MMMF) faces three possible scenarios. First, the dealer bank pays the cash \$100 plus the interest (\$2) and receives its \$105 worth securities (Treasuries) including haircut. This is how both parties reached a deal when they involve the repo transaction. Second, both parties agree to “roll over” the repo as repo transactions are usually short-term and they agree to refinance the positions. Third, in this scenario, the dealer bank defaults on transaction and does not repurchase the securities that were transferred to the MMMF. If the dealer bank at the end of the day does not pay back the \$102 loan, the MMMF has the right to keep the collateral. Next section starts with a brief outline of the ‘unconventional’ monetary policy implementation framework. I will address the question of what makes these new tools unconventional.

### 3.5 Unconventional monetary policy tools

In response to the global financial crisis, major central banks started to introduce the so-called unconventional monetary policies. For example, the Fed announced its new unconventional monetary policies such as lending facilities and large-scale asset purchase programmes but everyone else called it quantitative easing just as the Bank of Japan pursued. According to Bank for International settlements (BIS), central banks around the world needed such unconventional tools because their conventional instrument was based on interest rate targeting was not sufficient to mitigate the impact of global financial crisis: “Overall, the main message is that unconventional monetary policy tools (UMPTs) provided policymakers with additional policy space and flexibility, effectively addressing the GFC’s most pernicious consequences and helping central banks pursue the achievement of their mandates when conventional policy was constrained.” (BIS, 2019b, p. 1) According to BIS (2019b, p. 10)<sup>9</sup>, several central banks in advanced countries broadly pursued UMPTs to achieve two main objectives: (1) ‘addressing problems in the monetary policy transmission mechanism; and (2) providing additional monetary stimulus once policy rates could not be reduced further’. In addition to this, BIS, documents that, based on a survey of 23 central banks, a result of over the third of the 62 lending programmes introduced between 2007 and 2016 by the surveyed central banks were introduced during the first two years of the survey. “Central banks introduced new instruments and made changes to their monetary policy frameworks in order to address the challenges posed by the crisis and the eco-

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<sup>9</sup>examine unconventional monetary policy tools by classifying into four categories: negative interest rate policies, new central bank lending operations, asset purchase programmes, and forward guidance.

conomic environment that ensued. They implemented different combinations of unconventional monetary policy tools (UMPTs) and adapted their operations to the prevailing circumstances in their jurisdiction.” BIS (2019b, p. 6)

These new policies adopted by the major central banks (BoE, BoJ, ECB and Fed) increased the size and altered the composition of their balance sheets. For example, the Fed started to increase its balance sheet to an unprecedented size in 2008. This can be seen by looking at Figure 3.6, the balance sheet of the Fed and banks’ reserves in the US. Prior to 2008, there was not a significant amount of bank reserves in the system, and it was about \$1 billion that the interbank market and other money markets trading reserve to meet their needs. Importantly, the same markets functioned fine before the crisis without having multi-trillion bank reserves in the system. The expansion of balances at first occurred through the supply of reserves to the key credit markets and lending to financial institutions. The main purpose of these lending facilities was to alleviate the stress in the funding markets. In addition to these policies, central banks, particularly the Fed, began a large-scale asset purchase program to inject more liquidity<sup>10</sup>. These lending facilities and large-scale asset purchase programs financed the creation of bank reserves well more than reserve requirements, swelling the Federal Reserve’s balance sheet from roughly \$800 billion in 2007 to \$2.3 trillion at the end of 2009. In fact, this was the case for five central banks in the large advanced economies<sup>11</sup> (Kahn, 2010, p.10). According to the (BIS, 2019a), the aggregate size of the balance sheets of these central banks (Fed, BoE, SNB, BoJ, ECB) more than quadrupled, in stark contrast to more moderate growth in currency in circulation and GDP (BIS, 2019a, p.5)

Against this backdrop, a question needs to be addresses: What is the difference between the open-market operations (buying or lending against government debt securities held by banks) previously used by the central banks and these new lending facilities through unconventional monetary policies? The most important difference is that with new lending facilities, central banks increased the range of collateral to be accepted, broadened the set of institutions (shadow banks) that could participate in operations. According to the BIS (2019b, p. 8), ‘What was really different about unconventional policy were the combinations of monetary policy actions, the unprecedented scale of operations and the purposes for which many tools were used.’ To solidify this point, BIS (2019b, p. 19) documented:

“Some central banks also offered new facilities to swap less liquid assets against Treasury securities, to provide certain financial institutions with liquid assets that could then be used as collateral to obtain cash in private repo markets. The Fed’s TSLF, from March 2008, and the BoE’s Special Liquidity Scheme (SLS), from April

<sup>10</sup>At the beginning the Fed bought \$1.25 trillion of agency mortgage-backed securities and \$300 billion in longer-term Treasury securities. See the Federal Reserve Board web site: [https://www.federalreserve.gov/monetarypolicy/bst\\_crisisresponse.htm](https://www.federalreserve.gov/monetarypolicy/bst_crisisresponse.htm)

<sup>11</sup>(BIS, 2019a) reports many central banks including ECB, BoE and their monetary policy response during the financial crisis and its aftermath

2008, are two prominent examples.” BIS (2019b, p. 19)

It is also important to address the question of whether the Fed had the same aim as the Japanese experience of QE when it introduced QE in response to the global financial crisis. Bernanke (2009) tried to make a distinction between the Fed’s new policy frameworks – balance sheet expansion through QE – and the Japanese experience of QE. This is the reason Bernanke (2009) coined the term ‘credit easing’ to emphasize that the Fed did not want to go for the quantitative easing. Fiebigler and Lavoie argue this point and emphasize Bernanke’s effort to differentiate its approach from that of the Bank of Japan during 2001-06.

“In a credit-easing regime, policies are tied more closely to the asset side of the balance sheet than the liability side, and the effectiveness of policy support is measured by indicators of market functioning, such as interest rate spreads, volatility, and market liquidity. In particular, the Federal Reserve has not attempted to achieve a smooth growth path for the size of its balance sheet, a common feature of the quantitative-easing approach (Bernanke et al., 2009)” Fiebigler and Lavoie (2020, p.23)

From the standpoint study here, the distinction between credit easing and quantitative easing (QE) is important to understand different effects of these operations for the financial system. Therefore, next I will describe the differences between these two unconventional monetary policies adopted after the Crisis and argue their implications for balance sheet of the central bank.

### 3.5.1 Credit Easing

Based on a survey provided by 23 central banks, new lending and asset purchase programmes introduced from 2007 to 2009 were undertaken as “measures to address financial market strains, while a substantial majority of the programmes introduced in 2010 or later were introduced for reasons unrelated to financial market strains, reflecting a broad shift toward providing policy stimulus.” BIS (2019a, P. 5). What is important here is that BIS (2019a) suggests that central banks introduced new lending programmes or credit easing operations to respond to the crisis and then asset-purchase programmes or quantitative easing operation became a by-product of previous attempts to ease the stress in the financial markets, by continuing to conduct large-asset purchase programmes. “The later lending programmes often had larger and more persistent effects on the size of central bank balance sheets than earlier lending programmes did, reflecting the later programmes’ longer, often multi-year maturities. In aggregate, however, lending programmes had a smaller impact on the size of central bank balance sheets than the APPs.’ For BIS (2019a, P. 7), lending (credit-easing) programs did not have a big impact on the size of the balance sheet of central banks because the maturities were not so long. However, this finding by BIS (2019a) can be misleading since the report does not provide the

actual workings of the lending or credit easing operation at the beginning. In fact, these operations by central banks were neutralized, meaning that the central banks were able to offset the effects of purchase and that of sales and thus the balance sheet of these central banks remained constant or nearly equal the same size. However, with quantitative easing, as [BIS \(2019a\)](#) calls it asset-purchase programs, central banks were not able to offset the effects of these programs due to the unusual size of these operations rather than multi-year maturities.

The key point here is that central banks were selling their holding of Treasury bills to offset the effects of lending programs and that they were successful up until they run out of T-bills. This possibility of running of Treasury bills by central banks pointed out by [Keynes \(1930\)](#) according to whom 'For the success of open-market policy depends on the Central Bank always having in hand adequate ammunition in the shape of open-market securities available for sale'. [Lavoie \(2016, p. 179\)](#) quotes that passage from Keynes [Keynes \(1930, p. 259\)](#) and argues that 'Keynes was concerned by the possibility that the central bank may run out of Treasury bills that it can sell'.

There are two important points to know about credit easing. First, it differs from quantitative easing with respect to the mechanics of the balance sheet. It is important to say that credit easing and quantitative easing are not the same things and thus they have different effects. The second and main difference between credit easing and quantitative easing is: "Whereas quantitative easing targets the liability side of the balance sheet a central bank, credit easing - the only other tool left - targets the asset side" [Lavoie and Seccareccia \(2012, p. 179\)](#). Above all, what is important to know about credit easing is that it brings the central bank independence to the end. With credit easing operations, as will be shown later, central bank independence becomes an illusion. The important collaboration between governments and central banks to initiate credit easing operations is essential to understand the two works together and cannot be independent to each other. Therefore, one should understand that credit easing operations by the central banks require a close relationship with the governments and their role in monetary policy implementation.

According to [Lavoie and Seccareccia \(2012, p. 179\)](#), credit easing can be understood through two processes. First, credit easing operations do not necessarily involve the central bank and there is a role for the government to initiate credit easing operations. Indeed, the collaboration between the government and central bank is inevitable since the two work together. It is important to explain how this channel of the credit easing is conducted by the government. For example, [Lavoie and Seccareccia \(2012, p. 180\)](#) show that when the amount of gross debt of the Canadian government increases due to credit easing operation during the financial crisis. They note that this increase in government debt 'is totally unrelated to government deficits since the 2008-09 fiscal year showed a nearly balanced budget' [Lavoie and Seccareccia \(2012, p. 180\)](#). They perfectly show this collaboration between the government and the central bank when they study the monetary policy implementation by the Canadian government and the



Bank of Canada:

“Indeed, while the size of the balance sheet of the Bank of Canada moved up from \$53 billion in August 2008 to \$80 billion in March 2009, the total amount of Government of Canada securities outstanding jumped from \$402 billion to \$497 billion during the same time period. This increase in the amount of gross debt of the Canadian government is totally unrelated to government deficits, since the 2008–09 fiscal year showed a nearly balanced budget. Thus, all of this, or nearly all of this, occurred before the Canadian government started racking up large deficits as a result of the economic recession. The increase in the outstanding gross debt must therefore be (nearly) entirely attributed to the efforts of the Canadian government to conduct credit easing in collaboration with the Bank of Canada”

The increase in the outstanding gross debt by the government in times of crisis must be understood as an attempt to conduct credit easing in collaboration with the central bank. Following [Lavoie and Seccareccia \(2012\)](#) and their description of the credit easing according to which government role is essential to initiate credit easing, there is a second process that credit easing can be conducted directly by the central bank.

In this second process, the central bank can involve in credit easing by neutralizing the pure credit easing operations. In other words, the central bank involves conducting credit easing through repo operations. With the second process, the central bank stands ready to purchase the public or private assets such as long-term securities or less liquid private assets – the ABCP. Note that the second process of credit easing targets the asset side of the balance sheet of the central bank. It is pure because credit easing in the second process necessarily includes its neutralizing operations [Lavoie and Seccareccia \(2012\)](#). It is important to emphasize that such credit easing operations need to be neutralized. In other words, once the central bank involves in credit easing by purchasing public and private assets from the banks or the primary dealers through repo agreements, the central bank then offsets the temporary increase in assets associated with the repo agreements. For a central bank to offset such temporary increase in assets is to sell its holding of Treasury bills to banks or the primary dealers ([Lavoie and Seccareccia, 2012](#)). While the central bank conduct credit easing through repo operation which leads to an increase on the asset side of the balance sheet, the same central banks compensate this increase by selling the Treasury bills that it held on its assets of the balance sheet. Importantly, the central bank stands ready to sell its holdings of Treasury bills to the financial system, in particular the banks and the primary dealers, in exchange for their less liquid private assets such as mortgage-backed securities and asset-backed commercial papers. The central bank does such outright sales, aiming to prevent complete collapse in the price of such private assets. Therefore, one must understand such operations by the central bank changes only the composition of the balance sheet (asset side) of the banks rather than their quantitative level.

“During the first two weeks of October 2008, the Bank of Canada was selling the Treasury bills that it held on its own balance sheet. The increase of term PRAs on the asset side of the balance sheet of the Bank of Canada were thus being compensated by a fall of an almost exactly equal amount of Treasury bills also on the asset side. In other words, the central bank was exchanging advances to the private sector in lieu of advances to the public sector. Thus, in this case and during the period from July 2008 to mid- October 2008, the size of the balance sheet of the Bank of Canada did not change by much.” [Lavoie and Seccareccia \(2012, p. 182\)](#).

Because the central bank neutralizes the effects of such asset purchases by selling its Treasury bills, they can offset the temporary changes in assets associated with credit easing operations. Indeed, the central bank can neutralize such effects if they notice the holding of their Treasury bills is sufficient to purchase private market assets. This is how neutralization occurs whenever the central bank wants to offset the temporary increase in assets. After a while, however, there is an issue with pure credit easing operations.

We mentioned that in pure credit easing operations, central banks sell their holding of Treasury bills to the banks. Therefore, one can observe that central banks only swap doubtful assets for highly secure ones. At the beginning these swaps by the central bank to alleviate the stress in the financial market allow central banks to pursue credit easing without expanding the size of their balance sheet and thus the amount of free reserves ([Lavoie, 2016, p. 178](#)). The problem arises here when central banks run out of Treasury bills due to the unusual size of these swaps, that is, purchasing private assets from banks, selling to them Treasury bills in exchange. The possibility that central banks may run out of Treasury bills implies that central banks have difficulty to continue conducting pure credit easing operation that involves neutralizing operations. To solve this problem, the central banks need to ask their governments to issue new Treasury bills if they want to initiate credit easing operations on their own way. The consequence of this request of new Treasury bills from central bank and if the government agrees to issue new Treasury bills follow a different approach to conduct credit easing operations. On one hand, the government is not running any deficit but ready to issue new debt because the central bank ran out of Treasury bills. On the other hand, the balance sheet of central bank increases due to newly acquired Treasury bills. When central bank acquires Treasury bills newly issued by the government, the balance sheet of the central bank grows quickly since there is increase in the deposit account of the government at the central bank. This cooperation between government and central bank allows the central bank to continue selling these Treasury bills to the banks in return for their less-liquid assets. The impact of such monetary operation on the banks is certainly important. With credit easing operations conducted by the central bank, the banks get rid of their less-liquid assets on their balance sheet and thus transforming their balance sheets more liquid by obtaining safe government assets such as Treasury bills. In a period of crisis, banks need such safe assets and because they can easily use such Treasury bills as collateral to

obtain cash through repo operations. To summarize this process of credit easing, it is important to note that it essentially differs from quantitative easing as it targets the asset side of the balance sheet of the bank. By doing so, credit easing has impact on the composition of bank assets by transforming less-liquid into more-liquid bank assets through term repo operations.

### 3.5.2 Quantitative easing

We start with a definition of quantitative or QE. The term ‘quantitative easing’ is introduced for the first time when the Bank of Japan described its new framework of targeting the quantity of banking system reserves in March 2001. [Fiebiger and Lavoie \(2020, p. 22\)](#) point out that ‘Japan was the first nation to experiment with QE from 2001 to 2006.’ Despite the fact that there is vast literature on the success<sup>12</sup> of the Japanese experience with QE from 2001-06, with the advent of the financial crisis of 2008, quantitative easing became an international experience as central banks in major countries including the Federal Reserve in the United States (the Fed), European Central Bank (the ECB), Bank of England (The BoE), and the Bank of Canada conducted the so called-unconventional monetary policies via asset purchases: credit facilities and quantitative easing. For example, the ECB introduced the Securities Markets Programme in May 2010 at the start of the sovereign debt crisis, aiming to stabilize securities markets. Importantly, this program by the ECB differs from quantitative easing as the ECB were basically swapping less-liquid assets with more-liquid safe assets. In contrast, the Bank of England started to explicitly pursue quantitative easing, purchasing financial assets through the creation of central bank reserves. What makes a difference between the conduct of unconventional monetary policy between these two central banks is that, while the creation of central banks is sterilized in the former case, the purchase of financial assets in the latter case were unsterilized. Thus, the purchase were financed through an expansion of settlement balances. In this context, I will address the following questions in this section: Why did the central banks pursue QE? What are the transmission mechanisms of QE?

Passages below are taken from the BIS report on “Large central bank balance sheets and market functioning”. The report includes detailed summation of central banks’ balance sheets timeline procedures in response to the global financial crisis. More importantly, it documents the clear distinction between credit easing operation and quantitative easing policies. Reading these passages leads us to understand that QE was a by-product of credit easing operations they implemented at the beginning of the crisis and that it was a must process to continue conducting its operations post-crisis world.

“The lending and asset purchase programmes focused on addressing financial market strains, providing policy stimulus – particularly where conventional monetary policy became constrained by effective lower bounds – or a combination of

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<sup>12</sup>For example, [Fiebiger and Lavoie \(2020, p. 23\)](#) argues that the Japanese experience with quantitative easing during 2001-06 ‘has shown that inflation is not necessarily a monetary phenomenon.’

the two. In practice, the main motives for balance sheet expansion evolved over time, in response to changing market and macroeconomic conditions. According to survey responses provided by 23 central banks, almost all of the lending and asset purchase programmes introduced from 2007 to 2009 were undertaken as “measures to address financial market strains”, while a substantial majority of the programmes introduced in 2010 or later were introduced for reasons “unrelated to financial market strains”, reflecting a broad shift toward providing policy stimulus. (BIS, 2019a, p. 5)”

“Asset purchase programmes introduced after 2010 generally aimed to provide additional monetary policy stimulus to meet policy targets, as short-term interest rates reached their effective lower bound, rather than alleviate financial market strains.” (BIS, 2019a, p. 7)”

It is clear that the injection of excess liquidity through its quantitative easing operations was a process it had to continue after credit easing policies were adopted during the period of 2007-2009. Lavoie (2010, p. 16) points out that the “Fed did not go for quantitative easing. The creation of reserves was a by-product of the credit-easing policies, and its intent was not an expansion of the supply of reserves.” In another study, Lavoie and Fiebiger (2018) summarize the crucial difference between credit easing policies and quantitative easing policies:

“As a start, one should define quantitative easing. It is a monetary policy, the main purpose of which is to increase the balance sheet of the central bank and the size of the reserves held by commercial banks on the liability side of the central bank. There is some similarity to a policy of credit easing. The latter may or may not lead to an increase in the balance sheet of the central bank and in the amount of reserves, but if there is an increase it is a consequence of the policy being pursued and not its main goal. This is why the US Federal Reserve (the Fed) has always been reluctant to use the expression ‘quantitative easing’, as it has seen itself as trying to ease liquidity conditions in financial markets by modifying the composition of the asset side of its balance sheet. A pure credit easing policy would be one where there is no impact on the size of reserves, for instance when the central bank undertakes a swap, purchasing risky private assets and providing the financial markets with safe (public) assets.” (Lavoie and Fiebiger, 2018, p. 140)

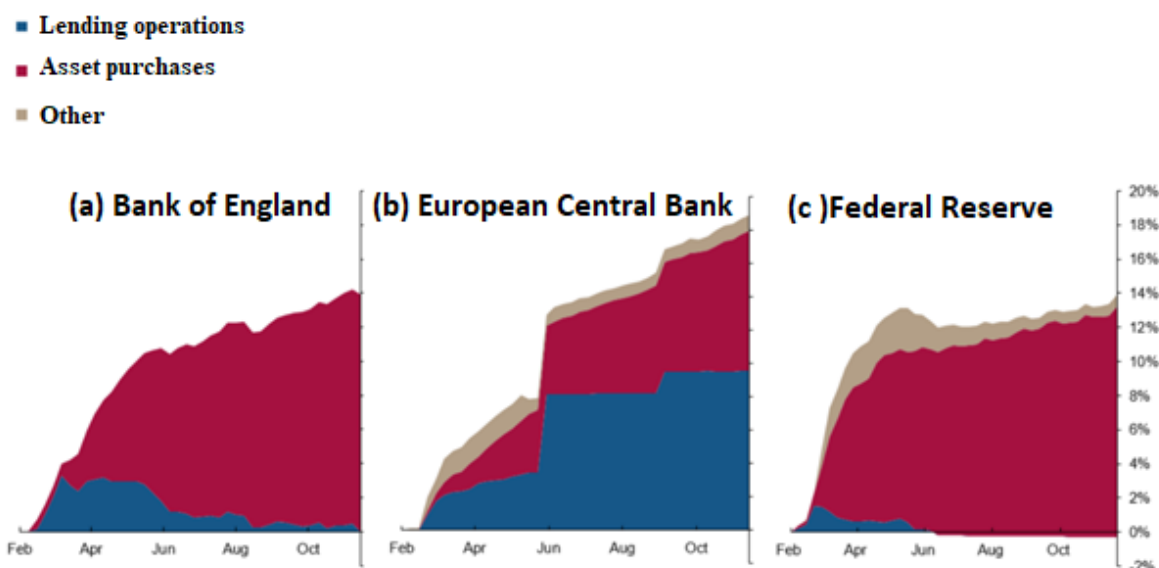
### 3.6 Role of government debt in the financial system

Since the financial crisis and Great Recession, two big macro phenomena have occurred in key parts of the developed world: (1) Governments have run big budget deficits, leading to a steep rise in government debt outstanding, and (2) central banks have bought large quantities of government debt under the unconventional monetary policies (credit easing and QE operations). According to International Monetary Fund, central banks purchased on average around 75%

of government debt issued 2020. In consistent with this empirical evidences, Hauser (2021, p. 8) notes that the huge asset purchase programmes in response to COVID-19 had a dramatic and immediate calming effect: 'getting in all the cracks of the liquidity shortage amongst non-banks, and taking duration risk off dealers' balance sheets.' Figure 3.10 shows that these large asset purchase programs by the central banks (the BoE, the ECB and the Fed). The main purpose of these large-scale interventions in the bond markets by these three central banks were aimed, in part and at least initially, at restoring market functioning. (Hauser, 2021, p. 10). To repeat, central banks with their interventions in bonds market is to restore market liquidity. Recall that market liquidity refers to the ability of bond-holders to buy and sell bonds without generating price volatility (Gabor et al., 2021, p. 19). As noted by Hauser , "three central banks resorted such large-scale interventions in bond markets to market functioning: "the Bank of England said it would complete its asset purchases 'as soon as is operationally possible, consistent with improved market functioning'. The Federal Reserve said it would 'purchase Treasury securities and agency mortgage-backed securities in the amounts needed to support smooth market functioning'. And the ECB framed its decisions in the context of severe strains in the financial markets' posing risks 'of the ECB's monetary policy transmission becoming significantly impaired". Hauser (2021, p. 8)

### 3.6.1 Shadow monetary financing

This section is heavily related to two works by Carolyn Sissoko (*The collateral supply effect on central bank policy*) and Daniela Gabor (*Revolution without revolutionaries: Interrogating the return of monetary financing*) on the relationship between government debt and monetary policy. The relevance of the work by Daniela Gabor (2020) for my study is that central bank purchases of government debt reflects a new understanding of macro-financial role of government debt in the financial system. According to Gabor et al. (2021), the traditional central bank purchases of government debt (the fiscal view of government bond) does not address the question of why central banks' holdings of government have increased rapidly since the global financial crisis. For this reason, the conventional view that central bank buying large amounts of government debt (in other words, monetary financing) when the government issues new debt to finance its expenditure does not reveal the idea of government debt in the new financial system. To begin with, I borrow the term 'shadow monetary financing' from Gabor et al. (2021) according to whom monetary financing is conducted to support market liquidity in government bond market. Moreover, she identifies two monetary financing regime. Accordingly, "the regime - subordinate regime - was predominant before the 1970s, in which central banks support governments by keeping borrowing cost. The shadow regime in which central banks buy government debt to anchor inflationary expectations and stabilise the inherent fragile market-based financial system, whereby government debts play a critical role." Gabor et al. (2021). Two immediate results from this analysis is that (1) such large-scale purchases of government



(a) Bank of England lending operations shown here: Indexed long-term repo, Contingent term repo facility, US dollar repo operations, Liquidity Facility in Euros, Term Funding Scheme and Term Funding Scheme with additional incentives for SMEs. Bank of England asset purchases shown here: Asset Purchase Facility and Covid Corporate Financing Facility.

(b) ECB lending operations: Lending to euro-area credit institutions related to monetary policy operations denominated in euro. ECB asset purchases: Securities held for monetary policy and other purposes.

(c) Federal Reserve lending operations: Repurchase agreements, Loans and Net portfolio holdings of TALF II LLC. Federal Reserve asset purchases: Securities held outright. Section of chart lying below the zero line from mid-2020 reflects a decline in repo outstanding relative to end-February

taken from Andrew Houser (2021) based on Bank of England, Bureau of Economic Analysis, European Central Bank, Eurostat, Federal Reserve Board, ONS and Bank calculations.

FIGURE 3.9: LOLR (lending operations) vs asset purchases (including MMLR), as % of 2019 GDP

bonds has nothing to do with government expenditure and (2) government debt in shadow financing regime connects monetary policy repo markets. For [Gabor et al. \(2021\)](#), we are in the shadow regime since the 2008 global financial crisis. Whereas the term ‘monetary financing’ is frequently used in the past, shadow monetary financing is relatively new to the literature. Recall that the breakdown of interbank market during the Crisis. I previously discussed that the repo market replaced interbank market. This shift from interbank market to repo markets has repercussions for monetary policy implementation and government debt issues. Sissoko (2020 p.14) argues that the core money is the repo market after examining the money market evolution over the course of 1990s and the 2000s and rightly connect her analysis to the collateral supply effect on central bank policy:

In the traditional framework the fact that the increase in government debt is also increase in collateral supply does not matter because the core money market is unsecured and functions independent of the collateral supply. The situation is very different where the core money market is collateralized, because the increase in collateral supply has its own monetary effect.

In an environment where funding on repo is the norm, fiscal policy cannot be separated from its effect on the money supply, because the issue of new debt (or in other words collateral supply) has become a money market phenomenon. ([Sissoko, 2020](#), p. 15)

From this perspective, in line with ([Sissoko, 2020](#)) analysis there is an important implications of this new transformation. There are two consequence of government debt issuance for the new financial system. First, as it is well known, the issuance of government debt creates settlement pressures in the money market and the central bank needs to offset the effects of debt issuance. Second, newly issued government debt means new collateral in the money market to take into account that ‘it generates on-going funding pressures in the money market *in addition to* the settlement pressures that arise when the debt is first issued” ([Sissoko, 2020](#), p. 15) emphasis added). To get a better understanding of this consequences, let us start with traditional fiscal view of monetary financing. Whenever the government (read the Treasury) spends (e.g. public-sector wages) it creates reserves in the banking system (or it creates a liquidity - high-powered money - in the interbank market). This fiscal view of government spending through an account with the central bank is monetary financing. An immediate result from such operation between the Treasury and the central bank implies that not only the central bank is the monopoly supplier of reserves to the banking system, but also the Treasury creates reserves when it spends. [Gabor et al. \(2021, p. 9\)](#) argues that when the Treasury spends, its deposit account at the central bank falls, and commercial bank reserves increase: “Then, sovereign bonds are not issued ‘finance’ spending but to destroy reserves created via fiscal operations that increase interbank market liquidity and thus lower interest rates there beyond the level desired by the central bank”

“Fiscal dominance means that central bank money creation is set by the pace of intervention in government bond markets, by increased reserves issued to the commercial banking system.” (Gabor et al., 2021, p. 13)

The traditional fiscal view of monetary financing requires central bank to offset settlement pressures for the debt. I have previously discussed that the central banks interest rate targeting (what is called conventional monetary policy) concerns with the daily central bank operations (or even hourly). It has to do with the transactions between the central bank and/or the government account at the central bank. For example, the central bank manages the exchange rate by buying or selling foreign currency or pay government expenditure (for instance, to pay civil servants). In addition to these transactions, the central bank manages to collect taxes. Whenever one of these transactions happen between the central bank and the government, there is an immediate impact on the amount of reserves available to the banking system. The central bank then ‘pursues defensive operation, in order to counteract the impact of the transactions going through the clearing house and involving the government, as central banks do their best to adjust the supply of reserves to the demand for reserves compensating for what is now called autonomous factors’ (Lavoie, 2010, p. 178). Next, I will focus on the fiscal view of monetary financing when government spends and focus on the clearing and settlement system.

To do so, following Lavoie (2013b) and his distinction between neo- and post-chartalist<sup>13</sup> description of how the government issues debt and finances its expenditures, using simple T-Accounts to present a relationship between the government, the central bank, and reserves. Note that I do not consolidate the government and the central bank into a single sector<sup>14</sup> to capture the mechanics of the clearing and settlement system. My aim is to show that government debt issue creates clearing and settlement pressures when the debt is first issued and then delve into the second consequence of government debt issuance, that is issuance of new debt creates on-going funding pressures in the money market.

### 3.6.2 Fiscal view monetary financing

Table 3.2 presents a simple way to understand how the government initially finances its expenditures by issuing Treasury bills to the central bank. I begin with the first row of the table to illustrate the fiscal view of monetary financing. Suppose the Treasury issues and sells securities. In this simple example, I assume that the central bank is the purchaser of these Treasury bills. For concreteness, suppose the Treasury bills are worth 100 monetary units (dollars). Newly issued Treasury bills are purchased by the central bank. In the second step, as can be seen on the second row of the Table, I assume that the government spends 100\$, for example, to pay

<sup>13</sup>This is a modern revival of the views of Knapp (1924), the originator of the state theory of money, and Keynes (1930), who both used the term ‘chartal’ in describing money.

<sup>14</sup>Lavoie (2013b) emphasizes the importance of the first step according to which many neo-chartalists often skip this first step because they prefer to consolidate the central bank and the federal government into one single entity, the state.



TABLE 3.2: *Neo-chartalist view of government deficit-spending*

Central Bank		Commercial Bank	
Asset	Liability	Asset	Liability
+100 T-bills	+100 Gov. Deposits		
+100 T-bills	+100 Deposits of banks	+100 Reserves	+100 Household Deposits
+19 T-bills	+9 Deposits of banks	+9 Reserves	+90 Household Deposits
	+10 Banknotes	+81 T-Bills	

wages of public sector (civil servants).

The second row of Table 3.2 shows that ‘the government’s account is a liability on the central bank’s balance sheet and the government spending necessarily credits reserve balances to the reserve account of recipients’ banks (Fullwiler, 2017, p. 61). This leads to a transfer of the government deposits in the central bank to the civil servants’ deposits in commercial banks. In other words, ‘the government transfers reserve balances between its own account at the central bank and correspondent bank accounts in the commercial banks’<sup>15</sup> (Fullwiler, 2017, p. 62). The mechanics of the clearing and settlement system lie precisely in the second step: “when the government pays its expenditures through its account at the central bank, settlement balances (reserves) are added to the clearing system” (Lavoie, 2013b, p. 11). As (Lavoie, 2013b, p. 11) explains, ‘these payments go through the clearing and settlement process, commercial banks acquire settlement balances at the clearing house. The third step of this illustration shows the central bank compensating operation that moves 100\$ of reserve balances away from the commercial banking sector. This is a necessary operation by the central bank since there is nothing that commercial banks in aggregate can do get rid of these extra 100\$ reserve balances. Following assumption that (Lavoie, 2013b) makes to illustrate the result of such a compensating operation, households hold 10\$ in the form cash, while keeping 90\$ in the form of bank deposits. Another assumption here is that commercial banks operate under 10 percent compulsory reserve requirements on deposits. It is clear that commercial banks are left with 90\$ reserve balances once households keep 10\$ in the form cash. Knowing that 10 percent of compulsory reserve requirements on deposits, the commercial banking sector is left with 81\$ excess reserves on their balance sheet. This last step shows how commercial banks get rid of these excess reserves, and thus replaced with 81\$ via open market operations.

To summarize, the Table 3.2 shows that the government can initially finance its expenditures by issuing securities (in our illustration we assume that this is short-term Treasury bills) and the central bank is ready to buy these securities whenever the government needs to spend. Another important implication for central bank and its operational target is that central bank sells securities to the private commercial banks to achieve the target rate of interest. It is this implication that central bank stops overnight interest rates from falling to the floor. Otherwise,

<sup>15</sup>Fullwiler (2017) explain that taxation debits commercial bank account. As Lavoie (2013b, p. 12) puts it ‘if the government levies taxes, these effects go in reverse gear’.

TABLE 3.3: *The Post-Chartalist view of government deficit-spending*

Central Bank		Commercial Bank	
Asset	Liability	Asset	Liability
		+100 T-bills	+100 Gov. Deposits
		+100 T-bills	+100 Household Deposits
+19 T-bills	+9 Deposits of banks	+9 Reserves	+90 Household Deposits
	+10 Banknotes	+81 T-Bills	

such government-deficit spending has a significant decreasing impact on the overnight rate since commercial banks end up with excess reserves and they are not able to lend to other banks in the interbank market.

In the previous process (Table 3.2), I have shown that the central bank is ready to purchase securities on the primary market whenever the government spends. Such a relationship between the government and the central bank is a starting point to understand how the government finances its expenditures in the first place. As (Lavoie, 2013b) asks, ‘what if this is not the case?’. In the second illustration I answer this question by showing a case in which the government would start spending process by issuing securities to be auctioned to the private sector. (Lavoie, 2013b, p. 12).

As seen from Table 3.3, I continue reproducing the same three steps of Table 3.2. However, in this case commercial banks purchase the newly issued securities (100\$) by the government. This time one can observe the government spending process starts with the relations between the Treasury and commercial banks as purchaser of government debt in the first place. The first relationship between the government and central bank does not come into the place. Indeed, this process describes the reality better and the existing institutional arrangements. For example, in Europe, central governments are not allowed to sell any of their newly issued securities to their national central banks or to central banks. Likewise, in the United States, Federal Reserve cannot directly purchase the securities from the Treasury since it is prohibited by law. (Lavoie, 2013b, p. 13) notes that either in Europe or in the United States, the post-chartalist view is a better representation for their institutional settings. After dealing with the security sale by the government in the first step, the same assumption that the government pays its civil servants goes for the second step. With this move, the government deposits to the commercial banks transfer to the households’ account at the commercial bank. As a result, the government balances at commercial banks are brought down to zero, while those of households rise by 100\$. This can be seen in the second row of Table 3.3. The same assumptions such as 10 percent of compulsory reserve requirements on deposits for commercial banks and households’ intention to transform 10\$ of their deposits into cash are also made for this case. It is clear that commercial banks need to acquire 19\$ of high-powered money to meet its reserve requirement and demand for cash by households. The third step shows that commercial banks sell 19\$ of their treasury bills to the central bank in return for cash. Therefore, commercial banks can meet their

compulsory reserve requirement ratio and meet the demand for cash by households. Note that the central bank provides all cash on demand when commercial banks look for reserves. In so doing, the central bank achieves its target overnight rate. The last step of Table 3.2 and Table 3.3 are the same since commercial banks are left with 81\$ of treasury bills and the central bank holds 19\$ of Treasury bills.

To summarize, I have shown how fiscal view of monetary financing works under the traditional monetary policy framework. The aim was to show that the focus of the traditional analysis was on the settlement pressures when the government issues debt. Specifically, the government debt issuance creates the settlement pressures in the money market and this become the central bank responsibility to offset the effects of government debt issuance. In the examples, I assumed that the government (the Treasury in the example) issues new debt and immediately spends the receipt. Therefore, there was no delay in between the issuance of debt and spending the receipt. If such delay occurs, this means that there are funds that remain at the government account which represents a withdrawal of deposits (and withdrawal reserves) from the banking system. In the traditional monetary framework, such settlement pressures are under the radar of the central bank. (Lavoie, 2013b, p. 11) points out this mechanism: ‘when the government pays for its expenditures through its account at the central bank, settlement balances (reserves) are added to the clearing system’. The example shows that the government issues debt and either public or central bank is ready to purchase its securities. What happens after the issue of government debt is that the government both receives money and spends it and hence deposits holdings of the public in aggregate are ultimately unchanged. Therefore, government debt issue creates clearing and settlement pressures when the debt is first issued. What central banks can do is to adjust the amount of reserves on their balance sheet (in the bank system) through defensive operations to ensure that the interest rate is in line with their policy rate. (Lavoie and Seccareccia, 2012, p. 177) summarize the fiscal view of monetary financing:

“In reality, central banks have to conduct defensive operations on a daily basis, and the amount of reserves left in the monetary system Eichner (1985). This is because whenever the central bank and government enter into financial transactions with the rest of the economy, a surplus or a deficit of settlement balances is created. The central bank thus need to neutralize the effects of these operations, as long as it wishes to achieve a given interest rate target”

As Sissoko (2020, p. 14), rightly points out, ‘any pressures on short-term interest rates are generated by the expenditure itself, not by pressures created in the short-term money markets.’ Sissoko (2020, p. 14) argues that traditional analysis is based on the relationship between government debt and interbank money markets where the collateral supply does not matter. The point is that the increase in government debt is also an increase in collateral supply does not matter in the traditional framework. However, my task is now to show that government issues debt to finance it expenditures and now (today’s repo market) this debt is used as collateral for

TABLE 3.4: *Shadow monetary financing*

Central Bank		Broker-dealer	
Asset	Liability	Asset	Liability
+19 T-bills	+9 Deposits of banks +10 Banknotes	+100 T-bills +100 T-bills +9 Reserves +81 T-Bills	+100 Gov. Deposits +100 Household Deposits +90 Household Deposits
Tri-party Repo Market			
Broker-dealer		MMMF	
Asset	Liability	Asset	Liability
+100 Deposit	+100 Repo	+100 Repo	+100 MMMF shares

the repo market. Therefore, next, I consider government debt issuance as supply of collateral and I focus on the implication of this government debt (as collateral) for monetary policy implementation. The idea of government debt issuance in an environment where the core money market is collateralized requires a careful analysis to explore the monetary effects of the collateral supply to the money markets because ‘it generates on-going funding pressures in the money market in addition to the settlement pressures that arise when the debt is first issued.’ (Sissoko, 2020, p. 14).

Recall that the traditional fiscal view of monetary financing in our examples where the government issues new debt and spend the receipt without having a delay between its issuance and its spending. Now, consider an environment in which the core money market is secured (repo market), not a traditional uncollateralized interbank market. Now the agent who purchases the government debt (because government finances its expenditure by issuing debt) obtains a collateral. Then, the agent (for example, a broker-dealer) funds this new debt on the tri-party repo market<sup>16</sup>. The main conclusion of this analysis for the agent – broker-dealer – is that it expanded both sides of its balance sheet. While the asset side of the agent increased because it obtained new government debt, the liability side also grew because it funded the new debt through repo. On the other side of the repo transaction, let us assume there is a money market mutual fund (who invests in repo). Therefore, the public both holds the repo as an asset on its balance sheet and gets the benefit of the government funds that are spent. (See Table 3.4). Sissoko (2020) points out this consequence of government debt issues for money markets and for monetary policy implementation:

“Because the market for repo loans sees an increase in demand due to the increase in collateral supply, the fact that the supply of reserves and of deposits is unchanged implies that this fiscal policy will put pressure on the repo interest rate as the demand for money market loans increases without a corresponding increase in the supply of funds on the money market. In short, fiscal policy can be expected to have a direct effect on quantity and price of the short-

<sup>16</sup>See, for example, see Sissoko (2020) for the role of JP Morgan in the tri-party repo market that played an incredibly important role in monetizing the assets that traded on the tri-party repo market.

term credit available in the repo market -even when the reserve position of the banking system does not change." [Sissoko \(2020, p. 15\)](#)

Like the traditional fiscal policy analysis and its relationship with the central bank monetary policy, in this example, there is no change in the deposit holdings of public in aggregate or in the level of reserves. However, things immediately changed in the repo market because of the increase in the government debt that is used as collateral. In other words, the market for collateralized loans sees an increase in demand after issuance of government debt (hence collateral). We can infer that fiscal policy in an environment where the money markets are operating on secured basis have significant effects (or pressure) on the repo interest rate due to an increase in demand for money market loans implied by the collateral supply via government debt issuance without a corresponding increase in the supply of funds on the money market [Sissoko \(2020, p. 15\)](#). Although when the level of reserves does not change after the issuance of government debt, it is most likely that fiscal policy in such environment has a lot of effects on the market condition of repo markets. To summarize, fiscal policy can have direct effects on the money markets if the core money market is operating on secured basis, This is because the monetary role of collateral in new environment. The government debt means supply of collateral and this creates not only settlement pressure as in the traditional fiscal policy analysis, but also generates a funding pressure on the money market. Our main conclusion is that this is an important difference from an environment in which the money market is unsecured and is not affected by government debt issues (or in other words, collateral supply). [Sissoko \(2020, p. 15\)](#) As suggests: "the government's fiscal stance creates pressures on the repo market and on the money markets more generally. And these pressures become the central bank's responsibility to resolve. At a minimum, new models of the money market need to be developed in order for the central bank to be able to do this effectively".

Another important important implication of the shift to repo-based money markets for monetary policy is related to long-term government debt since it represents an important component of collateral supply. The consequence of a rise in the long-term interest rates reflects dramatic effect on the value of the aggregate collateral and this mean some repercussions for monetary policy implementation. [Sissoko \(2020, p. 16\)](#) notes that an interest increase of 2% on long-term collateral generates a massive decline in the value of outstanding long-term debt. The main conclusion of this second implication connects connects monetary policy transmission mechanism to long-term interest rates and to asset prices. Given that short-term interest rate is the first step of transmission mechanism through which long-term interest rates are responsive to the the first step of monetary policy (short-term interest rate), the collateral supply effect becomes more important for the central bank monetary policy.

### 3.7 Consequences of using repo lending

As underlined above, repos are a collateralized loan and this type of lending has different effects on borrower and lender. For (Sissoko, 2019, p.10), because the safety provided to lenders is created by the contractual structure of a repo transaction, it is offset by a danger to borrowers. While use of collateral makes repo lending 'safe' debt for lenders, the presence of collateral in the repo transaction makes the opposite of what constitutes a 'safe' debt for a borrower. From the perspective of the lender (provider of cash), the repo is secured by collateral and this safety of using repo for lender has repercussions on borrowers when collateral value experiences fluctuations. If the collateral falls in price, the lender (provider of cash) may require additional collateral from borrower (provider of collateral) to compensate the fluctuations in collateral value. The first consequence of using repo funding from the perspective of borrowers is to provide the additional collateral in order to keep their loan. If the borrower is not able provide additional collateral that is being asked then the lender has the right to sell the collateral.

It is clear that in a repo transactions and its contractual structure that makes repo 'safe' for the lender at the expense of the repo borrower leads to instability in the repo market. (Hördahl and King, 2008) argue that the main risk in a repo transaction is the market risk which arises from fluctuation in asset prices. Therefore, their argument correctly points out that under-collateralization of the repo results from a decline in the price of securities used as collateral. Let us assume that there is a \$2 million loan of cash secured by a security - 110 per cent – as collateral. As seen from this contract, the repo is already over-collateralized (\$2.2 million). In normal times, the lender would receive the same amount of cash plus interest the day after (in the case of overnight repo) and transfer the same security to the borrower. This is the nature of the repo when things go in the right direction, meaning that the moment both lenders and borrowers reach a deal for a repo at the day of transaction and ending the day after without any fluctuations in the value of collateral. However, when the value of assets used as collateral becomes volatile things are no longer going to be in the right direction for the borrower. To understand the consequence of using repo funding for the borrower, imagine the value of asset used as collateral aforementioned falls below \$2.2 million. From the perspective of the lender, the previously received security used as collateral can no longer be pledged as collateral. As Gabor (2014) notes "the lender calculates the market value of collateral on a daily basis and makes margin calls due to declining value of securities used as collateral, requiring the cash borrower to post additional collateral." (Gabor, 2014, p.198)

In our example of repo contract after price volatility in collateral if the borrower is not able to meet additional securities in response to the collateral call then the collateral will be sold to pay off the loan with sales proceeds in excess of the \$2 million loan returned to the borrower. (Gabor, 2014) argues that this loss of liquidity in a market increases price volatility, the asset

used as collateral in that market becomes more expensive as collateral. Importantly, during the periods of market stress: a decline in price between the call and the sale of the collateral may mean that the lender does not obtain the value of the loan (Sissoko, 2019, p.3). “Because repo trades are predominately of a very short-term nature, and secured funding can create a false sense of security when collateral prices are in fact often procyclical excessive reliance on repo market funding may quickly turn into a source of instability for the financial system as a whole” (Coeuré, 2017).

### 3.8 Conclusion

In this chapter, I argued the transformation of money markets and its implications for monetary policy and government debt issues. My starting point to understand the transformation in the money markets coincided with the question of what happened to the financial system during and after the Global Financial Crisis of 2007-08.

In attempting to answer this question, I explore that the banking system underwent a dramatic transformation way before the Crisis erupted in 2007. The basic model that we had in our mind about traditional banking system and its “originate and hold” version was replaced with the version: “originate and distribute”. In the second version of banking system, I argued that there is an incredible role of the so-called shadow banking system and its reliance on the traditional banking system. The connection between traditional (commercial) banking and shadow banking reflected money market activities during this period. Traditionally, the interbank money markets allow commercial banks to lend central bank reserves to each other. More importantly, the interbank money market is the core money market in which the central bank implements its monetary policy through a short-term-interest rate (target rate). Another money market segment that was important for my analysis is the repo market, a market in which it is not constrained by the regulated commercial banks. This segment of money market was not new but the development of the shadow banking system and its reliance on the commercial banking system led this market to become an important segment of the money markets. The main difference of repo markets from interbank markets is that when banks or shadow banks lend each other there is no transfer of collateral in exchange for borrowing. In other words, borrowing in the interbank money market is uncollateralized and the key elements in this segment of money markets are trust and confidence. However, in the repo markets, collateral plays a crucial role in lending. Any agents who want to borrow in the repo markets needs to provide collateral in exchange for liquidity. Examining dramatic changes in the banking system and in the money markets enabled me to explain how the financial system underwent a dramatic transformation that led to the global financial crisis. I pointed out that the first effects of the financial crisis were on the breakdown of the interbank market. In this segment of the money markets, banks stopped lending each other because of the loss of trust and confidence. From the central bank perspective, the transmission mechanism of monetary policy was broken.

My first contribution was therefore, to explore the substantial changes that money markets have undergone since the financial crisis. From the standpoint of the study here, the unsecured (interbank) market collapsed due mostly to the financial crisis and there has been a clear shift from an unsecured to a secured (repo) market since the financial crisis. The repo market, where banks and shadow banks exchange short-term liquidity for high-quality liquid assets, has become an increasingly important component of the money markets. In other words, the repo market became more important than the unsecured interbank market. Due to this shift, collateral supply has become an important factor in money market dynamics. This transition from an unsecured core money market to a collateralized market has important implications for the central bank monetary policy implementation. To explore its implications for the central bank monetary policy, I argued that monetary policy implementation changed with the recent financial crisis. To address this part of the study, I presented the operational changes in conducting monetary policy by comparing the pre-crisis monetary policy framework with the post-crisis monetary policy framework. In the pre-crisis framework, the central banks (the Federal Reserve) conducted its monetary policy by setting positive short-term interest rate and this rate determined the cost of borrowing in the interbank market (the federal funds market in the United States). Determination of this short-term interest rate influences longer-term interest rates, which then affect the economic activity more generally. The main conclusion of this comparison in my analysis was that the central bank (the Federal Reserve) successfully implemented its monetary policy through short-term interest rate in the interbank under the corridor system wherein the supply of reserves was limited. However, since the crisis, the federal funds market has stopped serving as an effective venue for implementing monetary policy. The chapter points out that it was a feature of the crisis that unsecured interbank lending collapsed and was replaced by the kinds of repurchase agreements or repos that banks already used with shadow banks pre-crisis. Then I focused on answering the question: how did central banks adapt their policy to an evolving financial system defined as shadow banking? To answer this question, I continued examining the important transformation in the conduct of monetary policy during and after global financial crisis. My primarily contribution in this section was to explore the consequences of the transition from a corridor system to a floor system. In the former, I discussed that central banks operate through interest rate policy and they must adjust the supply of reserves to its demand as long as they want to achieve the target interest rate. In the floor system, the central bank implements its monetary policy while reserve policy is also possible. In contrast to the symmetric corridor rates (the lending rate, the target rate, and the deposit rate or the floor rate), the policy rate (target rate) is equal to the deposit rate (rate of interest on reserves) in the floor system. The feature of the floor system allows the central bank to set both a target interest rate and a target amount of reserves. In other words, the central bank can still set an interest rate policy while it can provide an excessive amount of reserves. I argued that the main advantage of the floor system is that the central bank does not have to



proceed to neutralizing operations for adjusting the level of reserves in the banking system.

In addition to this shift in the conduct of monetary policy, I showed that central banks in major advanced economies started to introduce the so-called unconventional monetary policies such as lending facilities and large-scale asset purchase programmes. Before delving into the details of unconventional tools, the importance of this section for my analysis is that I wanted address two big macro phenomena: (1) governments have run big budget deficits, leading to a steep rise in government debt outstanding after the Crisis; and, (2) central banks purchased large quantities of government debt under the unconventional monetary policies. In so doing, as a contribution, I add the role of government debt for the financial system and connect monetary policy under the unconventional tools to repo markets.

In examining unconventional tools, I argued that the distinction between credit easing and quantitative easing (QE) is important to understand the different effects of these operations on the financial system and on the balance sheet of the central bank. Then, I focused on answering the following question: what is the difference between the open-market operations (buying or lending against government debt held by banks) previously used by the central banks and these new lending facilities through unconventional monetary policies? To provide an answer to this question, my starting point was to connect monetary policy to repo markets where shadow banking plays a critical role. To begin with, the main purpose of these lending facilities was to alleviate the stress in the funding markets. The most important difference is that with new lending facilities, central banks increased the range of collateral to be accepted and broadened the set of institutions (including shadow banks) that could participate in operations. This is an important point to recall the shift to the repo markets or towards unregulated form of finance and its repercussion for monetary policy implementation. In the pre-crisis, funding liquidity was available to the banks in the interbank market through the central banks' liquidity with their role as "Lender of Last Resort". In the post-crisis, central banks expanded its backstop not only to the banks through interbank market but also started to intervene in government bond markets via large-scale asset purchase programmes. To repeat, these purchases aimed to ease private financing by backstopping government bond market liquidity with "Market-maker of Last Resort". The reason behind this intervention in the repo market, a market that critically supports the liquidity of the bond market, is that central bank connected repo markets to financial stability. With (shadow) monetary financing, central banks organised around collateral aim to preserve the stability of financial system which is heavily reliant on liquid government bonds. It follows that central banks recognised government debt issuance to be a money market phenomenon which needs to be managed actively. The conclusion of this central banks with their interventions in bonds market is to restore market liquidity. In my analysis, market liquidity referred to the ability of bond holders to buy and sell bonds without generating price volatility. Given that there is a shift to the repo markets and collateral plays a crucial role in such collateral-based financial systems, market liquidity matters. Furthermore, to get a better

understanding of central banks' increase holding of government bonds since the Crisis, it is important to consider government debt with a different perspective. Government debt is not what it used to be in the financial system. The shift to the repo markets and the essential role of collateral in the money markets brought in government debt as the cornerstone of the financial system. In the pre-crisis, shadow banking was a factory of collateral for the market liquidity and this was perceived safe with no risk up until the Crisis. In the post-crisis, the core money market was collateralized and government securities became important for the repo market since an increase in government debt (demand for safe) means an increase in collateral supply. From this perspective, the government became a collateral factory for the collateral-intensive financial system and government debt became a money market phenomenon. However, there are two consequences of government debt issuance for the financial system and central bank monetary policy operations. First, as it is well known, the issuance of government debt creates settlement pressures in the money market and the central bank needs to offset the effects of debt issuance. Second, newly issued government debt means new collateral in the money market that generates on-going funding pressures in the money market in addition to the settlement pressures that arise when the debt is first issued. The main conclusion is that this is an important difference from an environment in which the money market is unsecured and is not affected by government debt issues (or in other words, collateral supply).

Finally and most importantly, I argued that it is important to look at the consequence of using repo lending for market liquidity. Despite the presence of collateral in the repo lending, there is monetary consequences of collateral when the repo market experiences turmoil. During periods of market stress, the value of assets used as collateral becomes too volatile, requiring the cash borrower to post additional collateral through a margin call. If the borrower does not provide additional collateral in order to keep the loan, collateral is sold and that prices fall further. As a result, the liquidity evaporates when prices are expected to fall.

# Bibliography

- Acharya, V. V., Cooley, T. F., Richardson, M. P., Walter, I., of Business, N. Y. U. S. S., and Scholes, M. (2010). *Regulating Wall Street: The Dodd-Frank Act and the new architecture of global finance*, volume 608. Wiley Hoboken, NJ. 49
- Adrian, T. and Ashcraft, A. B. (2012). Shadow banking regulation. *Annu. Rev. Financ. Econ.*, 4(1):99–140. 41, 45, 49
- Adrian, T. and Shin, H. S. (2009). Money, liquidity, and monetary policy. *American Economic Review*, 99(2):600–605. 46, 59
- Adrian, T. and Shin, H. S. (2010a). The changing nature of financial intermediation and the financial crisis of 2007–2009. *Annu. Rev. Econ.*, 2(1):603–618. 59, 87, 89
- Adrian, T. and Shin, H. S. (2010b). Liquidity and leverage. *Journal of financial intermediation*, 19(3):418–437. iv, 49, 59, 60, 64, 82, 86, 87, 89, 98
- Adrian, T. and Shin, H. S. (2011). Financial intermediary balance sheet management. *Annu. Rev. Financ. Econ.*, 3(1):289–307. xv
- Awrey, D. (2017). Brother, can you spare a dollar: Designing an effective framework for foreign currency liquidity assistance. *Colum. Bus. L. Rev.*, page 934. 23
- Baba, N., McCauley, R. N., and Ramaswamy, S. (2009). Us dollar money market funds and non-us banks. *BIS Quarterly Review*, March. 21
- Backus, D., Brainard, W. C., Smith, G., and Tobin, J. (1980). A model of us financial and nonfinancial economic behavior. *Journal of Money, Credit and Banking*, 12(2):259–293. 53
- Bagehot, W. (1873). *Lombard Street: A description of the money market*. Scribner, Armstrong & Company. 6
- Battilossi, S. (2020). International money markets: Eurocurrencies. *Handbook of the History of Money and Currency*, pages 269–314. 19, 20, 21, 23, 30
- Bellofiore, R. and Garibaldi, F. (2020). Us growth, the housing market, and the distribution of income. *Annals of the Fondazione Luigi Einaudi*, Available at <https://www.>

## BIBLIOGRAPHY

- [annalsfondazioneiluigieinaudi.it/images/LIV/1/2020-1-013-bellofiore.pdf](https://annalsfondazioneiluigieinaudi.it/images/LIV/1/2020-1-013-bellofiore.pdf) or DOI: 10.26331/1109, 1:245–256. 46
- Bernanke, B. S. (2007). Before the joint economic committee, u.s. congress. *US Congress*, Available at <https://www.federalreserve.gov/newsevents/testimony/bernanke20070328a.htm>. 34
- Bernanke, B. S. (2009). The crisis and the policy response. *Stamp lecture, london School of economics, January*. 123
- Bernanke, B. S. et al. (2009). The federal reserve’s balance sheet: an update: a speech at the federal reserve board conference on key developments in monetary policy, washington, dc, october 8, 2009. Technical report. 123
- Bindseil, U. (2004a). *Monetary policy implementation: theory, past, and present*. Oxford: Oxford University Press. 14
- Bindseil, U. (2004b). The operational target of monetary policy and the rise and fall of reserve position doctrine. Technical report. 102
- Bindseil, U. (2018). What monetary policy operational framework after the crisis? *Revue française d’économie*, 33(3):105–126. 119
- BIS (2009). *Bis quarterly review*. 23
- BIS (2019a). Large central bank balance sheets and market functioning. Technical report, Bank for International Settlements, report by Logan, Lorie and Bindseil, Ulrich. 118, 122, 123, 124, 128
- BIS (2019b). *Unconventional monetary policy tools: a cross-country analysis*. Bank for International Settlements. 119, 121, 122, 123
- Borio, C. and Disyatat, P. (2009). Unconventional monetary policies: an appraisal. *BIS Working Papers*, 292. 114
- Botta, A., Caverzasi, E., Russo, A., Gallegati, M., and Stiglitz, J. E. (2019). Inequality and finance in a rent economy. *Journal of Economic Behavior & Organization*. 47, 48, 52, 78
- Botta, A., Caverzasi, E., and Tori, D. (2015). Financial–real-side interactions in an extended monetary circuit with shadow banking: Loving or dangerous hugs? *International Journal of Political Economy*, 44(3):196–227. iv, 27, 47, 48, 50, 52, 62, 65, 67, 80, 81, 96
- Botta, A., Caverzasi, E., and Tori, D. (2018). The macroeconomics of shadow banking. *Macroeconomic dynamics*, pages 1–30. 47, 52, 80

## BIBLIOGRAPHY

- Bougrine, H. (2020). The theory of money, interest and unemployment. In *Credit, Money and Crises in Post-Keynesian Economics*. Edward Elgar Publishing. ix, 12
- Bouguelli, R. (2019). Is shadow banking really akin to banking? a critical analysis in light of monetary theory. *Journal of Post Keynesian Economics*, 43(1):1–27. 27, 46, 50, 52
- Bundesbank (2019). Longer-term changes in the unsecured interbank money market. Technical report, Deutsche Bundesbank Monthly Report, September. 117
- Bundesbank, D. (2017). The role of banks, non-banks and the central bank in the money creation process. *Monthly Report*, 69(4):13–34. 13, 14
- Caverzasi, E., Botta, A., and Capelli, C. (2018). The endogeneity of money and the securitizing system. beyond shadow banking. 38, 40, 50
- Caverzasi, E., Botta, A., and Capelli, C. (2019). Shadow banking and the financial side of financialisation. *Cambridge Journal of Economics*, 43(4):1029–1051. 37, 47, 52
- Caverzasi, E. and Godin, A. (2014). Post-keynesian stock-flow-consistent modelling: a survey. *Cambridge Journal of Economics*, 39(1):157–187. 51, 53, 54, 55, 56
- Cesaratto, S. (2020). *Heterodox Challenges in Economics: Theoretical Issues and the Crisis of the Eurozone*. Springer Nature. 105, 106
- Cetorelli, N. and Peristiani, S. (2012). The role of banks in asset securitization. *Federal Reserve Bank of New York Economic Policy Review*, 18(2):47–64. 38
- Chick, V. (1992). The evolution of the banking system and the theory of saving, investment and interest. In *On money, method and Keynes*, pages 193–205. Springer. 4, 5, 6, 7
- Cipriani, M. and Gouny, J. (2015). The eurodollar market in the unite states, liberty street economics, federal reserve bank of new york, may 27, 2015. *Federal Reserve Bank of Richmond Richmond, Virginia*, Available at <https://libertystreeteconomics.newyorkfed.org/2015/05/the-eurodollar-market-in-the-united-states.html>. 18
- Claessens, M. S., Ratnovski, M. L., and Singh, M. M. (2012). Shadow banking: Economics and policy. 24, 40, 41, 49, 50
- Cœuré, B. (2016). The ecb’s operational framework in post-crisis times. In *Speech by Benoît Cœuré, Member of the Executive Board of the ECB, at the Federal Reserve Bank of Kansas City’s 40th Economic Policy Symposium, Jackson Hole*, volume 27. 119
- Cœuré, B. (2017). Asset purchases, financial regulation and repo market activity. In *Speech by Benoit Cœuré, Member of the Executive Board of the ECB, at the ERCC General Meeting, Brussels*, volume 14. 119, 139

## BIBLIOGRAPHY

- Cook, R. M. (1958). Speculations on the origins of coinage. *Historia*, (H. 3):257–262. 8
- Copeland, M. A. (1949). Social accounting for moneyflows. *The Accounting Review*, 24(3):254–264. 55
- De Cecco, M. (1987). Inflation and structural change in the euro-dollar market. In *Monetary theory and economic institutions*, pages 182–208. Springer. 19, 20
- Dos Santos, C. H. and Zezza, G. (2004). A post-keynesian stock-flow consistent macroeconomic growth model: preliminary results. 79
- Dufey, G. and Giddy, I. H. (1994). *The international money market*. New Jersey: Prentice Hall. 20
- Eatwell, J., Mouakil, T., and Taylor, L. (2008). Liquidity, leverage and the impact of sub-prime turbulence. *Centre for Financial Analysis and Policy, Judge Business School, University of Cambridge*. 71, 75, 76
- Eichner, A. S. (1985). *Toward a new economics: essays in post-Keynesian and institutionalist theory*. ME Sharpe. 135
- Fair, R. C. (1984). *Specification, estimation, and analysis of macroeconometric models*. Harvard University Press. 53
- Fiebiger, B. and Lavoie, M. (2020). Central bankers and the rationale for unconventional monetary policies: reasserting, renouncing or recasting monetarism? *Cambridge Journal of Economics*, 45(1):37–59. 123, 127
- Fontana, O. and Godin, A. (2013). Securitization, housing market and banking sector behavior in a stock-flow consistent model. Technical report, Economics Discussion Papers. 52, 75, 82
- Fowler, S. A. (2014). The monetary fifth column: the eurodollar threat to financial stability and economic sovereignty. *Vand. J. Transnat'l L.*, 47:825. 23
- Fratianni, M. (1972). *La liquidità internazionale*. Il Mulino. 23
- Friedman, M. (1971). The euro-dollar market: Some first principles. *Federal Reserve Bank of St. Louis Review*, (July 1971). 23
- Fullwiler, S. (2017). Modern central bank operations: the general principles. In L. P. Rochon S. Rossi (Eds.), *Advances in endogenous money analysis*, pages 50–87. 13, 14, 15, 110, 111, 117, 133
- Fullwiler, S. T. (2013). An endogenous money perspective on the post-crisis monetary policy debate. *Review of Keynesian Economics*, 1(2):171–194. 117
- Gabor, D. (2014). Learning from japan: the european central bank and the european sovereign debt crisis. *Review of political economy*, 26(2):190–209. 138

## BIBLIOGRAPHY

- Gabor, D. (2016). The (impossible) repo trinity: the political economy of repo markets. *Review of international political economy*, 23(6):967–1000. 24
- Gabor, D. et al. (2021). Revolution without revolutionaries: Interrogating the return of monetary financing. *Transformative Responses to the crisis, Finanzwende, Heinrich-Boll-Foundation*. 121, 129, 131, 132
- Gabor, D. and Vestergaard, J. (2016). Towards a theory of shadow money. *Institute for New Economic Thinking, INET Working Paper*. 24, 41
- Gibson, W. E. (1971). Eurodollars and us monetary policy. *Journal of Money, Credit and Banking*, 3(3):649–665. 18
- Godley, W. (1999). Money and credit in a keynesian model of income determination. *Cambridge journal of economics*, 23(4):393–411. 57
- Godley, W. and Cripps, F. (1983). *Macroeconomics*. Oxford University Press. 53
- Godley, W. and Lavoie, M. (2007). *Monetary economics: an integrated approach to credit, money, income, production and wealth*. Palgrave Macmillan. 47, 52, 53, 54, 56, 57, 58, 71, 75, 84
- Goodfriend, M. (1981). Eurodollars. *FRB Richmond Economic Review*, 67(3):12–18. 18
- Goodfriend, M. (1998). Eurodollars. *Federal Reserve Bank of Richmond Richmond, Virginia*, Available at [https://www.richmondfed.org/~media/richmondfedorg/publications/research/special\\_reports/instruments\\_of\\_the\\_money\\_market/pdf/chapter\\_05.pdf](https://www.richmondfed.org/~media/richmondfedorg/publications/research/special_reports/instruments_of_the_money_market/pdf/chapter_05.pdf). 18, 23, 29
- Goodhart, C. A. (1998). The two concepts of money: implications for the analysis of optimal currency areas. *European Journal of Political Economy*, 14(3):407–432. 8, 11
- Gorton, G. and Metrick, A. (2010). Regulating the shadow banking system [with comments and discussion]. *Brookings papers on economic activity*, pages 261–312. 37, 38
- Gorton, G. and Metrick, A. (2012). Securitized banking and the run on repo. *Journal of Financial economics*, 104(3):425–451. 24, 43, 46, 49, 50
- Grierson, P. (1977). *The origins of money*, london: University of london. 7, 8
- Grossmann-Wirth, V. (2019). What monetary policy operational frameworks in the new financial environment? a comparison of the us fed and the eurosystem perspectives, 2007–2019. *International Journal of Political Economy*, 48(4):336–352. 104, 119
- Hauser, A. (2021). From lender of last resort to market maker of last resort via the dash for cash: Why central banks need new tools for dealing with market dysfunction. *Speech at Thomson Reuters, London, United Kingdom, January, 7*. 129

## BIBLIOGRAPHY

- He, D. and McCauley, R. (2012). Eurodollar banking and currency internationalization. In *Investing in Asian Offshore Currency Markets*, pages 199–214. Springer. 21
- Helleiner, E. (1994). *States and the reemergence of global finance*. Cornell university press. 20
- Hördahl, P. and King, M. R. (2008). Developments in repo markets during the financial turmoil. *BIS Quarterly, December*. 138
- Hudson, M. (1992). Did the phoenicians introduce the idea of interest to greece and italy—and if so, when. *Greece Between East and West: 10th–8th Centuries BC*, pages 128–43. 8
- Hudson, M. (2004). The archaeology of money: debt versus barter theories of money’s origins. *Credit and State Theory of Money, in Wray.,* pages 99–127. 8, 9, 10
- Hudson, M. (2014). The real problem is that when most economists wring their hands about the financial system melting down, what they really mean is the top 1 percent losing the amazing amount of wealth they’ve doubled since 1979. *European Journal of Economics and Economic Policies: Intervention*, 11(1):1–9. 8
- Ihrig, J. and Wolla, S. (2020). Let’s close the gap: Revising teaching materials to reflect how the federal reserve implements monetary policy. Available at <https://www.federalreserve.gov/econres/feds/lets-close-the-gap-revising-teaching-materials-to-reflect-how-the-federal-reserve-implements-monetary-policy.htm>. 113, 115, 116
- Ingham, G. (2004). *The nature of money*. Polity Press, Cambridge. x, 8, 10, 12
- Jackson, C. and Sim, M. (2013). Recent developments in the sterling overnight money market. *Recent Developments in the Sterling Overnight Money Market (September 17, 2013)*. Bank of England Quarterly Bulletin, page Q3. 104
- John, C. (2018). Anatomy of a meltdown. *The New Yorker*, Available at <https://www.newyorker.com/magazine/2008/12/01/anatomy-of-a-meltdown>. 34
- Kacperczyk, M. and Schnabl, P. (2010). When safe proved risky: Commercial paper during the financial crisis of 2007–2009. *Journal of Economic Perspectives*, 24(1):29–50. 36
- Kahn, G. A. (2010). Monetary policy under a corridor operating framework. *Economic Review–Federal Reserve Bank of Kansas City*, page 5. 110, 122
- Kaldor, N. (1970). The new monetarism’lloyds bank review. 97(1-17). 4
- Karlick, J. R. (1977). *Some Questions and Brief Answers about the Eurodollar Market: A Staff Study Prepared for the Use of the Joint Economic Committee, Congress of the United States*. US Government Printing Office. 20



## BIBLIOGRAPHY

- Keynes, J. M. (1930). *Treatise on money: Volume 2, The Applied Theory of Money*. New York: Harcourt Brace and Company. 124, 132
- Keynes, J. M. (1971). *The Collected Writings of John Maynard Keynes*. Volume V. Donald Moggridge, ed. London, UK and Basingstoke, UK: The MacMillan Press, Ltd. 11
- Khalil, S. and Kinsella, S. (2015). Bad banks choking good banks: simulating balance sheet contagion. *European Journal of Economics and Economic Policies: Intervention*, 12(1):51–72. 46
- Kindleberger, C. P. (1970). *Power and money*. Springer. 20, 23
- Knapp, G. F. (1924). The state theory of money. 132
- Kregel, J. (2014). Regulating the financial system in a minskian perspective. *Financial Stability and Growth: Perspectives on Financial Regulation and New Developmentalism*, pages 127–142. 47, 50
- Lavoie, M. (1984). The endogenous flow of credit and the post keynesian theory of money. *Journal of Economic Issues*, 18(3):771–797. 4, 10, 12
- Lavoie, M. (1992). Foundations of post-keynesian economic analysis. *Books*. 4
- Lavoie, M. (1996). Monetary policy in an economy with endogenous credit money. In *Money in motion*, pages 532–545. Springer. 4, 7
- Lavoie, M. (2010). Changes in central bank procedures during the subprime crisis and their repercussions on monetary theory. *International Journal of Political Economy*, 39(3):3–23. 102, 112, 113, 114, 115, 128, 132
- Lavoie, M. (2012-2013a). Financialization, neo-liberalism, and securitization. *Journal of Post Keynesian Economics*, 35(2):215–233. 118
- Lavoie, M. (2013b). The monetary and fiscal nexus of neo-chartalism: a friendly critique. *Journal of Economic Issues*, 47(1):1–32. 132, 133, 134, 135
- Lavoie, M. (2014). *Post-Keynesian economics: new foundations*. Edward Elgar Publishing. 46, 50
- Lavoie, M. (2015). What post-keynesian economics has brought to an understanding of the global financial crisis. In *Progressive Economics Forum at the Annual Conference of the Canadian Economics Association, Toronto*. 104
- Lavoie, M. (2016). Rethinking monetary theory in light of keynes and the crisis. *Brazilian Keynesian Review*, 2(2):174–188. 113, 115, 124, 126
- Lavoie, M. (2019a). Advances in the post-keynesian analysis of money and finance. In *In P. Arestis M. Sawyer (Eds.), Frontiers of Heterodox Macroeconomics, International Papers in Political Economy*, pages 89–129. Palgrave, Macmillan. 13, 46, 47, 50, 103, 104, 116

## BIBLIOGRAPHY

- Lavoie, M. (2019b). A system with zero reserves and with clearing outside of the central bank: The canadian case. *Review of Political Economy*, 31(2):145–158. 112
- Lavoie, M. and Fiebiger, B. (2018). Unconventional monetary policies, with a focus on quantitative easing. *European Journal of Economics and Economic Policies: Intervention*, 15(2):139–146. 128
- Lavoie, M. and Seccareccia, M. (2012). Monetary policy in a period of financial chaos: The political economy of the bank of canada in extraordinary times. In *Monetary Policy and Central Banking*. Edward Elgar Publishing. 109, 124, 125, 126, 135
- Leimone, J. E. (1968). *The Euro-Dollar Market: An Element in Monetary Policy*. Federal Reserve Bank of Atlanta. 19
- Levi, M. D. (2009). *International finance 5th edition*. Routledge. 19
- McCauley, R. N. (2020). The global domain of the dollar: Eight questions. *Atlantic Economic Journal*, 48(4):421–429. 2
- McCauley, R. N. and McGuire, P. (2014). Non-us banks' claims on the federal reserve. xi, 18
- McCulley, P. et al. (2009). The shadow banking system and hyman minsky's economic journey. *Global central bank focus*, 12. 28, 36, 38
- McKinnon, R. I., McKinnon, R. I., McKinnon, R. I., and McKinnon, R. I. (1977). *The eurocurrency market*. International Finance Section, Department of Economics, Princeton University. 20
- McLeay, M., Radia, A., and Thomas, R. (2014). Money creation in the modern economy. *Bank of England Quarterly Bulletin*, page Q1. 13, 49
- Mehrling, P. (2011). *The new Lombard Street: How the Fed Became the dealer of last resort*. Princeton University Press. 24
- Mehrling, P. (2012). The inherent hierarchy of money. *Social Fairness and Economics: economic essays in the spirit of Duncan Foley*, 169:394. 24, 25, 50
- Michell, J. (2017). Do shadow banks create money; financialisation' and the monetary circuit. *Metroeconomica*, 68(2):354–377. 24, 25, 46, 50
- Minsky, H. P. (1957). Central banking and money market changes. *The Quarterly Journal of Economics*, 71(2):171–187. 4
- Minsky, H. P. (1982). *Can" it" happen again?: essays on instability and finance*. M.E. Sharpe. 46
- Minsky, H. P. (1986). Stabilizing an unstable economy. 10, 46

## BIBLIOGRAPHY

- Minsky, H. P. (1991). The endogeneity of money. In *Nicholas Kaldor and mainstream economics: Confrontation or Convergence?*, pages 207–220. New York: St. Martin's Press. 7
- Moore, B. J. (1988). *Horizontalists and verticalists: the macroeconomics of credit money*. Cambridge University Press. 4
- Moore, B. J. (1991). Marx, keynes, kalecki and kaldor on the rate of interest as a monetary phenomenon. In *Nicholas Kaldor and Mainstream Economics*, pages 225–242. London: Macmillan. 7
- Murau, S. (2017). *The political economy of private credit money accommodation*. PhD thesis, City, University of London. 24, 50
- Murau, S. (2018). Offshore dollar creation and the emergence of the post-2008 international monetary system. Technical report. 24, 50
- Murau, S., Rini, J., and Haas, A. (2020). The evolution of the offshore us-dollar system: past, present and four possible futures. *Journal of institutional economics*, 16(6):767–783. 21, 24, 25
- Nersisyan, Y. and Dantas, F. (2017). Rethinking liquidity creation: Banks, shadow banks and the elasticity of finance. *Journal of Post Keynesian Economics*, 40(3):279–299. 49, 50
- Nikiforos, M. and Zezza, G. (2017). Stock-flow consistent macroeconomic models: a survey. *Journal of Economic Surveys*, 31(5):1204–1239. 54, 55, 56, 57, 58
- Nikolaïdi, M. (2010). Securitization, household debt and financial instability in a stock-flow consistent model. In *14th Conference of the Research Network Macroeconomics and Macroeconomic Policies, Stabilising an Unequal Economy*. 52, 71, 72, 73, 75, 76
- Nikolaïdi, M. (2015). Securitisation, wage stagnation and financial fragility: a stock-flow consistent perspective. 47, 52, 71, 75, 86
- Noeth, B. J., Sengupta, R., et al. (2011). Is shadow banking really banking? *the Regional economist*, 10:8–13. 46
- Pigou, A. (1949). *The veil of money* macmillan, new york: St. 9
- Pozsar, Z. (2013). Institutional cash pools and the triffin dilemma of the us banking system. *Financial Markets, Institutions & Instruments*, 22(5):283–318. 24, 46, 49, 50
- Pozsar, Z. (2014). Shadow banking: The money view. Available at [www.financialresearch.gov/working-papers/files/OFRwp2014-04\\_Pozsar\\_ShadowBankingTheMoneyView.pdf](http://www.financialresearch.gov/working-papers/files/OFRwp2014-04_Pozsar_ShadowBankingTheMoneyView.pdf). 24, 40
- Pozsar, Z., Adrian, T., Ashcraft, A., and Boesky, H. (2010). Shadow banking. Available at <https://ssrn.com/abstract=1640545> or <http://dx.doi.org/10.2139/ssrn.1640545>. 49

## BIBLIOGRAPHY

- Prates, D. M. and Farhi, M. (2015). The shadow banking system and the new phase of the money manager capitalism. *Journal of Post Keynesian Economics*, 37(4):568–589. 38
- Reuters (2007). Bnp freezes \$2.2 bln of funds over subprime. *Reuters*, Available at <https://www.reuters.com/article/us-bnpparibas-subprime-funds-idUSWEB612920070809>. 35
- Ricks, M. (2010). Shadow banking and financial regulation. *Columbia Law and Economics Working Paper*, Ricks, Morgan, *Shadow Banking and Financial Regulation* (August 30, 2010). Available at SSRN: <https://ssrn.com/abstract=1571290> or <http://dx.doi.org/10.2139/ssrn.1571290>, (370). 49
- Ricks, M. (2016). *The money problem: rethinking financial regulation*. University of Chicago Press. 24, 50
- Robinson, J. (1956). *The accumulation of capital*. London: Macmillan. 4
- Rochon, L.-P. and Rossi, S. (2007). Central banking and post-keynesian economics. *Review of Political Economy*, 19(4):539–554. 117
- Rochon, L.-P. and Rossi, S. (2013). Endogenous money: the evolutionary versus revolutionary views. *Review of Keynesian Economics*, 1(2):210–229. 7
- Samuelson, P. A. (1998). *Economics. 16th ed.* The Mc Graw - Hill Companies. 10
- Sawyer, M. and Veronese Passarella, M. (2017). The monetary circuit in the age of financialisation: a stock-flow consistent model with a twofold banking sector. *Metroeconomica*, 68(2):321–353. 47
- Schenk, C. R. (1998). The origins of the eurodollar market in london: 1955–1963. *Explorations in economic history*, 35(2):221–238. 21
- Seccareccia, M. (2012). Financialization and the transformation of commercial banking: understanding the recent canadian experience before and during the international financial crisis. *Journal of Post Keynesian Economics*, 35(2):277–300. 101, 102
- Sheard, P. (2013). Repeat after me: Banks cannot and do not “lend out” reserves. *Economic Research of Standard and Poors*, August 13. 14, 15, 17
- Sissoko, C. (2019). Repurchase agreements and the (de) construction of financial markets. *Economy and society*, 48(3):315–341. xvi, 120, 138, 139
- Sissoko, C. (2020). The collateral supply effect on central bank policy. Available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3545546](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3545546). xv, 101, 131, 135, 136, 137

## BIBLIOGRAPHY

- Smithin, J. (2002). *What is money?* London: Routledge. 9
- Snider, J. and Townsend, E. (2018). Eurodollar university. Available at <https://www.macrovoices.com/aia/321-eurodollar-university-featuring-alhambra-partners-cio-jeffrey-snider>. 28, 30, 34
- Stein, J. C. (2010). Securitization, shadow banking & financial fragility. *Daedalus*, 139(4):41–51. 49
- Stigum, M. L. and Crescenzi, A. (2007). *Stigum's money market*, volume 4. McGraw-Hill New York. 18, 20, 23, 29
- Taylor, L. (2004). Exchange rate indeterminacy in portfolio balance, mundell–fleming and uncovered interest rate parity models. *Cambridge Journal of Economics*, 28(2):205–227. 55
- Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of money, credit and banking*, 1(1):15–29. 53, 57
- Turnovsky, S. J. (1977). *Macroeconomic analysis and stabilization policy*. CUP Archive. 53
- Unger, R. (2016). Traditional banks, shadow banks and the us credit boom: Credit origination versus financing. 26, 50, 51, 62, 63
- Wray, L. R. (1990). Money and credit in capitalist economies. *Books*. 3, 4, 9, 10, 12
- Wray, L. R. (2007). Endogenous money: Structuralist and horizontalist. 12
- Wray, L. R. (2012). Introduction to an alternative history of money. *Levy Economics Institute, working paper*, (717). 9, 11
- Zeza, F. (2018). Stock-flow consistent macroeconomic models: Theory, practice and applications. *Unpublished PhD Thesis, University of Siena*, URL: <http://phdeconomics.wp.unisi.it/thesis>. 53
- Zeza, G. (2008). Us growth, the housing market, and the distribution of income. *Journal of Post Keynesian Economics*, 30(3):375–401. 47, 52, 58, 66, 82
- Zeza, G. and Zeza, F. (2019). On the design of empirical stock–flow consistent models. *European Journal of Economics and Economic Policies: Intervention*, 16(1):134–158. 54