LIQUIDITY AND BANKING LIQUIDITY:
THEORETICAL OVERVIEW

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Abstract
The recent financial crisis of 2007-2008 highlighted the important role of liquidity in the banking system. Financial markets around the world have run out of liquidity and many financial institutions have gone bankrupt due to liquidity problems. Nevertheless, liquidity remains a very complex concept to define because of its polymorphic character. Only recently has the literature focused on defining the notion of liquidity and its different forms and the interactions that may exist between them. This paper aims to present a synthesis of reflections on banking liquidity. First, it discusses the different theoretical approaches to the concept and typology of the liquidity situation.
concept. Then, it presents the different liquidity risks. Finally, it discusses the main theoretical underpinnings of interactions between types of liquidity.

**Keywords:** Liquidity, Liquidity risks, banking liquidity, interactions.

**Résumé**

La récente crise financière de 2007-2008 a mis en exergue le rôle important de la liquidité dans le système bancaire. Les marchés financiers partout dans le monde ont connu un assèchement de liquidité et de nombreuses institutions financières ont fait faillite à cause des problèmes de liquidité. Néanmoins, la liquidité reste un concept très complexe à définir en raison de son caractère polymorphe. Ce n’est que récemment que la littérature s’est intéressée à la définition de la notion de la liquidité et ses différentes formes ainsi que les interactions qui peuvent exister entre-elles. Cet article a pour objectif de présenter une réflexion synthétique sur la problématique de la liquidité bancaire. D’abord, elle aborde les différentes approches théoriques de la notion et de la typologie du concept de liquidité. Ensuite, elle propose de présenter les différents risques de liquidité. Finalement, elle évoque les principaux fondements théoriques relatifs aux interactions entre les types de liquidité.

**Mots-clés :** liquidité, risques de liquidité, liquidité bancaire, interactions.
Introduction

In the aftermath of the 2007-2008 financial crisis that shook the world of economics and finance, theorists and practitioners recognized the crucial role of liquidity in all financial markets, including the banking market. Indeed, international banks like Northern Rock, Lehman Brothers and Bear Stearns were forced to liquidate their assets at reduced prices in order to meet their financing commitments, many of them have gone bankrupt, and others have been bailed out by their states because of their systemic dimension. Also, the loss of confidence between the banks led to a liquidity scarcity which subsequently liquidity shortage in the banking system. This shortage of liquidity in the interbank markets prompted central banks around the world to intervene in order to support their banking systems by injecting significant amounts of liquidity. In addition, this financial crisis has highlighted the failure of financial institutions' risk management systems and more specifically the underestimation of liquidity risk. On the other hand, it showed loopholes in the banking regulations. The Basel II regulation does not include a liquidity risk hedge, as regulatory capital is a measure primarily used to hedge credit risk, market risk and operational risk.

Only after the financial crisis did much theoretical and empirical work on the liquidity issue emerge. For a long time, the concept of "liquidity" was a very difficult notion to define because of its polymorphic nature. It is a concept "which is easier to recognize than to define"\(^1\). It is a term that has multiple meanings depending on the context in which it is used. These meanings, although distinct, are interconnected. Indeed, economists often associate the term liquidity with the availability of money or more specifically with the monetary actions and policies undertaken by the central bank. Traders on the other hand equate liquidity with the ability to buy and sell assets in financial markets. Nevertheless, none of these definitions can give an exact and complete meaning to the concept of liquidity.

Yet theorists and practitioners seem to agree that liquidity is considered as a necessary and important factor for the well-functioning of any market. Thus, this paper is intended to be conceptual and theoretical, and aims at first, to propose a state of the art on the notion of liquidity.

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and its different dimensions, namely, funding liquidity, market or assets liquidity and central bank liquidity. Next, the aim is to highlight the different liquidity risks as well as the interactions between its various existing risks in the literature, particularly the models of (Brunnermeier & Pedersen, 2009; Nikolaou, 2009).

1. Liquidity concept

Liquidity in the economic literature is the ability of an agent to trade wealth for goods and services or other assets (Nikolaou, 2009). Two essential elements can be found in this definition. Firstly, the notion of exchange of flows, that is to say that liquidity is a concept that can be understood in terms of flows as opposed to the notion of assets. Second, the "ability" of the agent to attain these flows. its inability will make it illiquid, and this capacity may be hampered by asymmetric information and inefficient markets.

What constitutes liquidity has mutated and evolved over time. The most common factor that has accompanied and characterized liquidity throughout its changes is the fact that good liquidity goes hand in hand with improving the quality of information on the value of traded goods. Barter, as a first form of exchange, was a very slow process and presented uncertainty to economic agents because prices were not transparent. The value of the goods traded depended on whether the seller offered what the buyer needed.

Over time, gold and silver coins began to replace barter, giving rise to the association of the notion of liquidity with money. The introduction of money into the economy as an intermediary of exchange increased economic efficiency. The currency offered a resolution of the problem of "double coincidence of needs" and thus reduced transaction costs (Mishkin, 2013). In this way, liquidity is associated with money since it is considered and accepted as the most liquid asset. Money does not have to be converted into something else to trade, on the contrary, it is the other assets that have to be turned into money.

According to (Benson, Faff, & Smith, 2015), they consider that the notion of liquidity can be apprehended in two distinct forms, namely the "macro" liquidity and the "micro" liquidity. On one hand, "macro" liquidity mainly indicates the level of liquidity in a financial market. On the other hand, "micro" liquidity refers to the ease with which an asset can be bought or sold, often
represented by the bid-ask spread. According to the authors, both forms of liquidity are necessary to ensure the normal functioning of the financial markets. Indeed, the latter require macro liquidity to ensure their growth, development and stability. A liquid market according to the "macro" approach is a market that provides an offer of securities able to meet the demand. In this sense, liquidity provides some insurance against market shocks. As for the "micro" approach, a liquid market is one that ensures a speed of execution of transactions with a negligible impact on the price. (Benson et al., 2015) equate "micro" liquidity with the classic definition of market liquidity. Indeed, for them, "micro" liquidity is apprehended in four dimensions namely cost, depth, immediacy and resiliency. Cost is the expense incurred when executing transactions. A market is said to be liquid when transaction costs are low. Depth indicates the ability of a market to absorb a shortage between supply and demand without significant price impact. Immediacy refers to the time between order submission and settlement. A resilient market refers to the ability of the latter to absorb a large number of transactions (large quantities of securities).

2. Liquidity and liquidity risk

The literature recognizes three main types of liquidity: central bank liquidity, funding liquidity and market liquidity.

2.1. Funding liquidity and funding liquidity risk

Banks provide funding liquidity, according to their intermediation activity, through financing illiquid assets (loans) by liquid resources (deposits). (Strahan, 2008) defines funding liquidity as the ability of a bank to raise short-term funds through liquidation of assets or a new loan.

In a broader perspective, the International Monetary Fund (2008) defined funding liquidity as the ability of a solvent financial institution to meet its deadlines on time. This definition focuses on the solvency of a financial institution.

Accordingly, (Drehmann & Nikolaou, 2013) define funding liquidity as the ability of a financial institution to meet its obligations as they fall due. As a result, a bank is illiquid when it is unable to meet its obligations on time. In this case, the bank is defaulting, shareholders and depositors will suffer losses.
According to the Basel Committee on Banking Supervision, funding liquidity refers to the ability of a bank to finance its increasing asset while meeting its obligations as they come due, with reasonable costs (BCBS, 2008). The definition of the Basel Committee's funding liquidity seems similar to the one proposed by Drehmann & Nikolaou, even though they find that the second part of the definition related to "reasonable costs" relates more to the funding liquidity risk, they add that this part is a bit ambiguous and requires further clarification.

From a practical point of view, funding liquidity is a concept related to the concept of flows that can be understood in terms of budget constraints. In other words, an entity is said to be liquid as long as its inflows exceed its outflows.

According to Drehmann & Nikolaou's definition, funding liquidity risk can be defined as the probability with which a bank, within a specific horizon, could become unable to meet its commitments according to their maturity. It is important to differentiate between funding liquidity and funding liquidity risk. Funding liquidity is a binary concept: A bank is either able to meet its obligations or not. As for the funding liquidity risk, it is related to the distribution of future results and can therefore take several different values. Funding liquidity is always associated with a particular point in time, while funding liquidity risk is always measured within a defined time horizon. The current funding liquidity risk of a bank remains dependent on its ability to meet its future obligations (future funding liquidity).

There is little evidence in the literature about the characteristics of funding liquidity risk. (Drehmann & Nikolaou, 2013) find that funding liquidity risk is similar to the market liquidity risk, in the sense that it is low and stable during the period when the financial markets are calm, however it may be subject to occasional peaks during disturbances. This conclusion is supported by (Matz & Neu, 2007) who consider liquidity risk as a consequence of other risks, because it increases following the increase of one or more other financial risks (market liquidity risk).

### 2.2. Market liquidity and market liquidity risk

The notion of market liquidity is not recent, it goes back to the time of the founding works of Keynes (Keynes, 1930, 1936) where he argues that the choice of economic agents (banks) for the preference of highly liquid assets is motivated by three factors namely the motive of transaction,
precaution and speculation. The first is the liquidity needs of banks to finance their operating cycles. The second is that banks prefer to hold cash buffers to guard against potential liquidity shocks. The third encourages banks to hold more cash to take advantage of market opportunities and make their portfolios profitable.

However, it was not until the late 1990s that a definition of market liquidity emerged. Numerous studies and academic studies define market liquidity as the ability to exchange an asset in the short term without generating high costs or having a considerable impact on its price. According to this definition, we assume that market liquidity is a multidimensional concept because it can be apprehended according to three essential determinants: tightness, depth and resiliency. The tightness measured by the bid-ask spread which corresponds to the difference between the bid and the ask price, a market is said to be tight when the price of the transactions does not diverge from the middle price of the bid-ask spread. The depth indicates the volume that can be executed immediately without a change in the price of the asset. In other words, it refers to the ability of the market to absorb large volumes without a significant impact on price. Resiliency determines the speed with which prices return to their equilibrium value as a result of a disruption situation (for example, an order of a very large size tends to vary the price).

(Dowd, 2005) defines market liquidity as the ability to execute an exchange of asset or liquidate positions with minimal cost, risk and inconvenience. Liquidity is a function of the market and therefore depends on several factors such as the number of investors in the market, the frequency and volume of transactions, the time needed to execute a transaction, the cost of transactions and the nature traded assets (some financial markets are considered more liquid than others, especially those that offer standardized financial products such as stock markets and the foreign exchange market).

As for market liquidity risk, it is the risk of not being able to liquidate an asset at the market price. In simple terms, it corresponds to losses incurred as a result of liquidation costs. There is liquidity risk when transaction generates lot of costs, transaction volumes are lower and transaction execution time is long. In the literature on the valuation of financial assets, market liquidity risk has always been understood in terms of cost or premium that affects the value of assets in a positive way (Bangia, A., Diebold, F.X., Schuermann, T, and Strougair, 1999;
Chordia, Sarkar, & Subrahmanyam, 2005). Indeed, the higher the market liquidity risk, the higher is the premium.

2.3. Central bank liquidity and central bank liquidity risk

This is the ability of the central bank to meet the demands of liquidity in the financial system. It is measured by the amount of money injected by the central bank into the economy. The central bank, within the framework of the monetary policies that it defines, has a discretionary power which confers on it the right to lend to the financial institutions the quantity of money which it considers adequate to the cost (rate of interest) which it defines while ensuring that there are no situations of excess and lack of liquidity in the financial system. In practice, the central bank determines its monetary policy through its strategy. To do so, it deploys its monetary policy instruments (open market operations) to act on liquidity in the money market so that the interest rate (TMP) is aligned with the key rate defined by the central bank.

The absence of the notion of liquidity risk related the central bank in the literature is due to its non-existence. Indeed, the central bank can never be illiquid because it still holds the monopoly of issuing bank notes and therefore the liquidity risk in this case is almost absent. It is important to underline that, as part of its role as a liquidity provider, the central bank may incur costs that are generated by, among other things, specific risks such as counterparty risk related to the value of the collateral or relative risks and monetary policy, However, these costs do not necessarily reflect a liquidity risk. In addition, these risks have no impact on the central bank's ability to provide liquidity.

3. The links and interactions between liquidity types

3.1. Nikolaou 2009 model

Given the links between the different actors in the financial markets, liquidity in its different types (central bank liquidity, funding and market) are linked and interconnected. (Nikolaou, 2009)highlights the different interactions between different types of liquidity by analyzing two scenarios. The first one concerns normal periods when the markets are calm and the liquidity risk
is at its lowest level. During these periods, a virtuous circle is created and established by the three types of liquidity, thus strengthening the stability of the financial system. The second scenario is turbulent periods when markets are turbulent and characterized by a very high level of liquidity risk. During these periods of turbulence, the link between the three types of liquidity remains very strong, however a vicious circle takes place thus generating a destabilization of the financial system.

3.1.1. The interactions of the types of liquidity in normal periods

In normal times, liquidity flows easily between the three types of liquidity, creating a virtuous circle that strengthens the stability of the financial system. The central bank, acting as a liquidity provider, responds to the demand for liquidity by covering the existing deficit in the financial system. These liquidity injections will allow banks to refinance through the various available channels (interbank market, asset market and deposits), which contribute to the redistribution of liquidity via the financing of agents who need it. In this way, each type of liquidity plays a specific role, which suggests that each type of liquidity is dependent on the other two types. Indeed, the role of each type of liquidity is unique in the financial system and depends heavily on the smooth functioning of other types of liquidity for the system to be liquid as a whole. In fact, the liquidity initially injected by the central bank will ultimately have to fund the agents that need it as long as the market liquidity is well redistributed and the funding liquidity is allocated efficiently and effectively. In addition, the funding liquidity depends on the availability of sources of funding liquidity. For example, a bank will always be liquid as long as it is able to obtain liquidity from the interbank market and the central bank to meet its financing needs.

Figure 1: Liquidity types in the financial system (Nikolaou 2009).
In normal times, all types of liquidity work perfectly, creating a virtuous circle in the economy and allowing the financial system as a whole to enjoy a good level of liquidity. In addition, liquidity will be able to flow easily through the system and banks will be able to use the least costing source of liquidity in the case where markets are efficient. In this first scenario, given the stability of the financial system and ensured, the systemic risk is very small and the likelihood of a (systemic) financial crisis is very low.

### 3.1.2. Types of interactions during periods of turbulence

As financial markets are characterized by the inefficiency and asymmetry of information which often lead to coordination failures between its various stakeholders (banks, depositors and market operators), the virtuous liquidity cycle described in the first scenario will yield his place to a vicious circle. This circle is characterized by a high level of liquidity risk; it produces a spiral of illiquidity that threatens the stability of the financial system as a whole. (Nikolaou, 2009) shows that liquidity risk is endogenous to the financial system, i.e., the virtuous circle created by liquidity in normal periods could become a vicious circle during periods of turbulence. The author also explains the interactions between the three types of liquidity (central bank, funding and market) and how they are affected by the liquidity risk. In times of turbulence, the link between the three types remains as strong as in normal periods. However, it plays the role as a liquidity risk propagating channel destabilizing, therefore, the entire financial system.

In his analysis, the author chose a situation in which a bank is exposed to a high risk of funding liquidity and shows how this situation could spread in the financial market through market liquidity risk and what is the role central bank liquidity in such a case.

#### 3.1.2.1. Propagation by the bank itself through funding liquidity risk

Funding liquidity risk is at the heart of the banking activity. Banks, through their intermediation business, transform liquid resources into illiquid assets (Diamond & Dybvig, 1986). In other
words, the main role of banks in the financial system is to provide liquidity through their intermediation activity. They engage with depositors to collect liquidity for the benefit of investors in the form of illiquid assets (credits). In this way, banks transform short maturities into long maturities in order to create liquidity for investor financing. However, this transformation of maturities could be a source of fragility for the bank (Diamond & Rajan, 2001).

Indeed, when there is a malfunctioning of the transformation activity, it creates a kind of destabilization through banks’ role as a provider of liquidity. The fragility of the bank exposes it to funding liquidity risk. Indeed, given the fragility inherent in its business, the inefficiency of the markets and the asymmetry of information between depositors demanding the liquidity of the bank could lead to bank runs, considered as the extreme form of funding liquidity risk. (Diamond & Dybvig, 1983) equate the phenomenon of bank runs as the situation where depositors believe that other depositors run on the bank, which forces them to liquidate their deposits before the maturity of the investment, thus causing an increased demand for liquidity that the bank would not be able to satisfy. In this case, even the most solvent banks will go bankrupt.

3.1.2.2. Propagation by asset market and the interbank market through market liquidity risk

- Through the interbank market

The funding liquidity risk for a single bank does not present a problem in itself for the regulatory authorities. The situation becomes alarming when the liquidity risk of the bank in question turns into a systemic risk through its transmission to other banks. Since banks are all connected and interconnected by a common market that is the interbank market, an individual bank failure due to excessive exposure to liquidity risk of funding could paralyze the functioning of the interbank market and create a weakening of the level of liquidity of the last. As a result, liquidity risk spreads to other banks, leading to a liquidity drain that could lead to a series of bankruptcies in the entire banking system. This spread is due to the fact that there is a strong interconnection between banks in the interbank market, and that the funding liquidity risk is strongly linked to market liquidity risk.
Indeed, an individual bank run of depositors (funding liquidity risk) induces a series of runs for other banks causing a banking panic. Moreover, the loss of confidence between the banks due mainly to asymmetric information (banks do not lend themselves to each other because of the fear of bankruptcy of the counterparty) causes an impediment of the interbank market which could eventually lead to liquidity drying up and hence, banks’ failures without central bank intervention.

- Through the asset market

Asset markets can be viewed as another channel for spreading funding liquidity risk and market liquidity risk. Indeed, when banks find it difficult to refinance via the interbank market because of the weakening of liquidity in the latter, they will be forced to move towards the asset markets to seek liquidity through the liquidation of assets at "discounted prices". In this case, banks are forced to restructure their portfolios of assets by favoring the most liquid assets and seeking buyers to get rid of the less liquid assets. In a context where the financial markets are incomplete, this liquidation has a negative impact on the price of the assets as the financial markets have only a limited capacity to absorb all the liquidation of the assets. This would lead to increasing asset price volatility and reduced participation by market participants due to uncertainty. As a result, asset prices fall below their core values, creating a liquidity drying-up in the asset market as a whole.

3.1.3. The spiral of funding liquidity risk and market liquidity risk

The interconnection between funding liquidity risk and market liquidity risk is not a one-way street. Both types of risk can impact each other to create a spiral of illiquidity in the market. This could happen in a regulated financial system where assets are valued at their mark-to-market prices. In this situation, falling asset prices are directly reflected in the balance sheet banks that are forced to restructure their portfolios (liquidating even more assets at discounted prices) to meet regulatory requirements, particularly with regard to solvency constraints (capital requirements). The losses incurred by the bank's liquidity risk exposure can be passed on to its creditors, which would in turn lead to interbank liquidity risk. In this sense, the interactions between funding liquidity risk and market liquidity risk can lead to a spiral of dreadful illiquidity.
In addition, securitization could also strengthen the link between market and funding liquidity risk and provide a channel for spreading both types of risk. Admittedly, securitization plays a fundamental role in the proper functioning of the bank's activity in the sense that it constitutes a source of financing and at the same time a tool for managing the funding liquidity risk through the transfer of credit risk out of their balance sheet. But on the other hand, securitization has significantly reduced the bank's traditional role of transforming liquidity. Indeed, in the current banking context, banks create assets through securitization and act as market makers to evaluatethem. As a result, they must develop some expertise in asset valuation (pricing models) while becoming increasingly dependent on other market institutions such as rating agencies. As a result, securitization has made banks more tied to market financing and, as a result, their ability to distribute loans is highly dependent on financial market conditions compared to the past, where banks were financed mainly by deposits. In this way, the link between funding liquidity and market liquidity has become narrower and the risks are transmitted more directly.

3.2. The model of Brunnermeier and Pedersen 2009

(Brunnermeier & Pedersen, 2009) have also developed a model that highlights the link between funding liquidity and market liquidity. According to the authors, traders provide market liquidity that depends on their ability to find financing i.e. capital and margin requirements. On the other hand, the funding of traders also depends on the market liquidity of the assets. They explain that in times of crisis, the link between funding liquidity and market liquidity is strengthened and remains very strong which can lead to liquidity spirals.

Trading activity requires equity. Traders (investment banks, hedge funds, etc.) can borrow liquidity from a counterparty to buy a security. The latter can be used as collateral with the lender to guarantee the operation. However, the trader cannot borrow the full price. Indeed, the difference between the price of the security and the value of the collateral, called the margin, must be financed by the trader's own financial resources (capital).

The model of (Brunnermeier & Pedersen, 2009) shows that the financing of trading activities is affected and at the same time affects the liquidity of the market in a deep way. When funding liquidity is low, it forces traders and makes them more reluctant to take positions, especially
when it comes to positions that require very high margins. This leads to a decline in market liquidity which in turn leads to the funding liquidity risk for the trader and consequently to an increase in margins. In a context of asymmetric information where market operators are not informed about the fundamental value of the assets traded and where asset volatility is at its highest level, the increase in margins may play a crucial role in destabilizing the financial market in the sense that it makes it possible to incite the agents to liquidate their positions in a sudden way which leads to the reinforcement of the illiquidity and the dryness of the market.

**Figure 2: Liquidity spirals (Brunnermeier and Pedersen 2009)**

In an illiquid market, margins increase which makes traders' financing difficult. These in turn bring less market liquidity. In this way (Figure 2), liquidity spirals are created and reinforced by the lack of funding liquidity and market liquidity. Liquidity spirals can be in two forms namely loss spirals and margin spirals. The spiral of loss occurs when the trader finds financing difficulties that pushes them to liquidate the securities at his disposal at bargain prices. In this case, it suffers losses and at the same time contributes to the reduction of market liquidity. As for the spiral of margins, it arises when traders face financing problems and they provide less market...
liquidity. In this situation, the margins increase which further intensifies the problem of financing for traders who are forced to reduce their trading activity.

4. Conclusion

The recent financial crisis of 2007-2008 has shown the importance of liquidity in the financial markets. One of the major elements that has played a central role in this crisis is the interaction between funding liquidity risk and market liquidity risk. Indeed, under normal market conditions market illiquidity is generally short-lived, especially for traders who, by providing additional funding liquidity, contribute to the restoration of the smooth functioning of the market (González-Páramo, 2008). On the other hand, in times of severe turbulence, liquidity transmission mechanisms are disrupted either by the asset market (market liquidity) or through the balance sheet of financial institutions (funding liquidity). This can lead to market dysfunction, creating risks of systemic imbalances.

The purpose of this paper is to shed light on a very difficult concept to understand and understand liquidity since it is a multidimensional notion that varies according to the context in which it is used. This work aims to initially propose a literature review of the different dimensions of liquidity, namely funding liquidity, market liquidity and central bank liquidity. Then, it detects the different liquidity risks while always referring to the literature. Finally, she proposes theories that have dealt with the interactions between liquidity risks, mainly two leading theories (Brunnermeier & Pedersen, 2009) and (Nikolaou, 2009).
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