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## **A Taxonomy of Liquidity**

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## **A Taxonomy of Liquidity**

The term “liquidity” covers many concepts, but is generally taken to refer to the ease of convertibility into money. The literature classifies this ease of convertibility as “market liquidity” to distinguish it from “funding liquidity” which represents the ease of obtaining funding. Many other forms of liquidity can be identified that do not receive their own specific classification. A more granular taxonomy that clarifies and distinguishes each form would permit greater analytical precision when investigating empirical evidence. This paper offers such a taxonomy.

Key words: market liquidity; funding liquidity; self-liquidating; price-protection

### **Introduction**

The terms “liquid” and “liquidity” cover many loosely defined concepts. Liquidity is most commonly identified with being “more certainly realisable at short notice without loss” (Keynes 1930, 67) or “the ability to convert an asset into money at short notice with minimum loss” (Rogers 2014, 5). Other equivalent terms such as “saleableness” (Menger 1892, 242), “shiftability”, “salability” (Mehrling 2011, 6) or “marketable” (Kiyotaki and Wright 1989, 935) are used to encompass the three dimensions: trading a significant amount at the asset’s fundamental price within a short time-frame. The fact that some assets are seemingly more marketable than others has led to the concept and empirical observation of a liquidity premium. According to Mehrling (2011, 50), “the extra yield on the long-term investment is a kind of ‘liquidity premium’ that compensates the long-term investor for the fact that he may have to take a loss if for some reason he needs to convert his investment into cash before maturity.”

The liquidity literature classifies the common, salability form of liquidity as “market liquidity” and distinguishes it from “funding liquidity”, which refers to the ability to refinance debts as they mature (Brunnermeier and Pedersen 2009). A third form, “technological liquidity”, arises when an investment in physical capital is reversible

(Brunnermeier, Eisenbach, and Sannikov 2013, 5). Yet, market liquidity and technological liquidity are both related to the ease with which an investment can be reversed if necessary, since marketable financial assets allow reversible commitments to otherwise illiquid and heterogeneous capital assets (Brown 2003). Market liquidity cannot apply to the economy as a whole in the same way that technological liquidity can. To a certain extent, market liquidity can mitigate technological illiquidity, although not for society as a whole.<sup>1</sup>

None of these concepts, however, covers the pure or perfect liquidity of money itself (Hayes 2018). Lozano (2015, 14, original emphasis) argues for a “universal definition” of liquidity “*as the nominal relationship between maturity and value.*” It is because there is no accepted taxonomy of liquidity in the existing literature that this paper examines liquidity’s ontological aspects to identify the elements of a taxonomy.

This paper uses the existing literature to isolate and clarify the forms of liquidity that can be used to construct a taxonomy of liquidity. These forms are presented in the following six sections. Section 0 provides a summary of the taxonomy and some concluding thoughts.

## **Market Liquidity**

Market liquidity, whereby “liquidity is the ease of trading a security” (Amihud, Mendelson, and Pedersen 2005, 270), naturally leads to a study of the microstructure of financial markets. In an idealized world of perfect market liquidity, all assets can be immediately bought or sold in any amount at their fundamental value. Deviations from this perfect market liquidity arise from “frictions” such as transaction fees and taxes, demand pressure, inventory risk, information asymmetries and search impediments. Each restriction adds costs to transactions and reduces the ease of trading, in other words:

illiquidity. The costs of illiquidity can have an impact on asset prices and expected returns “if investors require compensation for bearing them” (Amihud, Mendelson, and Pedersen 2005, 271; Pástor and Stambaugh 2003). Market liquidity costs are paid either in “shoe-leather” while searching or as income to securities dealers or market makers. For the market maker, the problem becomes one of inventory management:

...variations in demand pressure that cause variations in the market maker inventory change the prices at which he is willing to trade. These are short-term, transitory effects of inventory on prices, but the permanent effect on prices and expected return flows through the effect on trading costs. For example, in market systems with better capacity to absorb inventory shocks, the models would predict smaller illiquidity costs and consequently there would be smaller price discount due to illiquidity. (Amihud, Mendelson, and Pedersen 2005, 300)

Like used-car dealers, market makers provide inventory management services for profit and are an important part of the ontological landscape of liquidity, just as bankers are for money. Market makers can profitably provide a ready market for people wanting to buy and sell by means of a spread between buy and sell prices. “Dealers supply liquidity by absorbing temporary imbalances on their own balance sheets, and they charge for the service” (Mehrling 2013, 359).

In providing their service, market makers hold assets in inventory until they can be resold, and by having a judicious combination of long and short positions they can largely avoid overall market or systematic risk. Because dealers operate in the practical realm of finance and use relative values (Cochrane 2005, xiv), dealer-based liquidity is not founded on absolute value. Consequently, a “dealer has no need to assess the fundamental value of the security” (Mehrling 2013, 356). By applying matched-book or hedging techniques (Stigum 1990, 433) dealers can inoculate themselves from both systematic risk and the need to know absolute prices (Mehrling 2015). Instead, they rely

on the frequency of transactions and a stable relative-price structure. In the face of constant selling pressure, they must stand aside. The market makers themselves provide market liquidity and, as such, it is a property superimposed on the asset by a third party, not a fundamental or intrinsic characteristic of the asset itself. In a dramatic movement of market level market making ceases and all assets become illiquid until the new level of the market is established.

Inventory imbalances are resolved, not by adjusting the bid-offer spread, but by skewing bid and offer prices (Treynor 1987). When a market maker's inventory is too long, both the bid and offer prices are lowered relative to those displayed by other market makers. Conversely, when the inventory is too short, the relative prices displayed are raised. In this way, flow imbalances are shared between market makers. Market makers operate a smaller "inside" spread within the protective boundaries of the "outside" spread provided by "value-based investors" (Treynor 1987). "Dealers are thus valuable to transactors in a hurry, because they greatly reduce the spreads encountered by those transactors. By doing so, they also greatly improve the liquidity of the markets in which they deal" (Treynor 1987, 27). In addition to skewing their bid and offer prices, market makers rely on the outside spread to manage their inventory. At the limits of a dealer's inventory capacity, the market maker can deal with "the only other transactor in the market who is motivated by price—the value-based investor" (Treynor 1987, 27). The value-based investor acts as a "market-maker of last resort" (Treynor 1987, 28) or, equivalently, "dealer of last resort" (Mehrling 2011).

Trading itself incorporates information. If trading happens at a low frequency, then there will be more information between each trade and the market will be less continuous. Large orders result in discontinuous price jumps. "The ability to handle large amounts of stock in short periods of time without changing the price of the stock is not a

characteristic of a liquid market” (Black 1971, 31). The market maker should not resist large changes in price resulting from large orders, nor should he increase his spread, as this will make prices “sticky” (Black 1971, 32). If prices move with new information, they will be informationally “efficient” and exhibit randomness, meaning that profits cannot be earned from statistical knowledge of past transactions (Black 1971, 32; Fama 1970; Fama 1991). Therefore, large price movements in one direction, and not a series of small steps, are a sign of an efficient market. If market makers resist price moves, then those with special information will make money at the expense of those without.

Fischer Black gives the clearest set of criteria for market liquidity provided by an organized exchange:

...the market for a stock is liquid if the following conditions hold: (1) There are always bid and asked prices for the investor who wants to buy or sell small amounts of stock immediately. (2) The difference between the bid and asked prices (the spread) is always small. (3) An investor who is buying or selling a large amount of stock, in the absence of special information, can expect to do so over a long period of time at a price not very different, on average, from the current market price. (4) An investor can buy or sell a large block of stock immediately, but at a premium or discount that depends on the size of the block. The larger the block, the larger the premium or discount. (Black 1971, 30)

In a liquid market, small amounts should be tradable at any time, but it is unrealistic to expect to be able “to buy or sell large blocks of stock in short periods of time without moving the price of the stock very much” (Black 1971, 30; see also Kyle 1985). An organized exchange has low costs and bid-offer spreads, continuous trading or immediate execution, and easy access (Black 1971, 34). It does not display “price continuity or ‘stability’” (Black 1971, 35). An attempt to sell a large block of an individual security suggests the possession of private information affecting relative values and not a simple need to raise funds. If a genuine desire for cash is the motivation for

selling, then the investor should be happy to sell smaller amounts of any combination of the stocks in their portfolio. This observation alone demonstrates that discounts are inevitable for large parcels (Black 1971, 30).

An ideal market has at most one market maker, more than this is inefficient (Black 1971, 33). In practice, market making requires an established liquid point of convergence in the form of an asset that can be bought and sold to offset the risk of the other, less-liquid, assets held inventory. Thus, many market makers, operating by hedging against a common futures contract, emulate an ideal single market maker in the same way that the banking system aims to operate as one bank by means of an interbank money market.

Market makers can be conceived of as providing both a call and a put option to their customers. The customer has the right, but not the obligation, to buy at the ask price and the equivalent ability to sell at the bid price (Copeland and Galai 1983, 1464). Bid-ask spreads, and hence the cost of market liquidity, must increase with risk and volatility (Amihud 2002, 39) and observations of volatility and market liquidity for both bonds and stocks are highly correlated (Chordia, Sarkar, and Subrahmanyam 2005).

With market liquidity provided by an organized exchange the asset is “readily shiftable”, since, in general, a market price exists at all times, but nevertheless the gain or loss on sale is unpredictable (Sayers 1964, 178). The asset has the property of being convertible into money quickly but not necessarily without loss. The uncertainty concerning the proceeds of an asset sale associated solely with market liquidity excludes it from any idea of “perfect liquidity”, as with money itself; instead, it merely signifies a form of “shiftable” (Sayers 1964, 179). For this reason, Robinson (1951, 94) calls market liquidity the “convenience” of an asset and explicitly draws attention to the crucial difference between market liquidity, an asset’s underlying value, and the idealized concept of “perfect liquidity”.



For example, government bonds held to maturity have a known capital-value outcome, but this certainty of outcome comes at the cost of illiquidity. Convenience is a concept quite apart from variability in an asset's price and distinguishes it from "capital-uncertainty" and "income-uncertainty" (Robinson 1951, 94). Bills and bonds have the same level of convenience but are less convenient than money (or bank deposits) and are "good" in the sense that there is no credit risk (Robinson 1951, 95). Bills differ from bonds in that they have no capital-uncertainty, but they do have income-uncertainty.

In the practical realm, Kay (2015) finds that market liquidity might help in providing a continuously tradable price, otherwise known as "price discovery". He makes the point, however, that many long-term investors would be just as well served by an asset market that traded once per week. Instead, the attempt to offer perfect market liquidity in investment products affects the composition of the underlying assets and is ultimately counter to the interests of investors.

### **Funding Liquidity**

Funding liquidity represents the ease with which a borrower can obtain a loan or access money to repay an existing loan. Whereas market liquidity refers to conversion of assets into cash and is therefore associated with the asset side of the balance sheet, funding liquidity is the counterpart for the liability side of the balance sheet.<sup>2</sup> Funding liquidity represents the ability to access funds by issuing new liabilities, or the re-establishment of an existing liability.

Nevertheless, funding liquidity can be re-interpreted as a form of market liquidity. Conceptually, the borrower is "selling" an asset in the form of a new loan to replace an old one, or equivalently re-selling an old one, since "'borrowing' is selling an asset, the asset being money forward" (Radcliffe Committee 1959, 132). The difference is that for

market liquidity the asset being sold has only the risks associated with the asset itself, the nature of the seller of the asset is unimportant. For funding liquidity, by contrast, the risks for the purchaser predominantly relate to the credit-worthiness of the vendor. Otherwise, the risks involved—transaction costs and the expected interest rate payable—are simply the ones analyzed in relation to market liquidity. Since banks are the predominant providers of loans, they are essentially dealers in funding liquidity. In the presence of organized loan markets (overdrafts and pre-arranged lines of credit), where transaction costs are minimal, the interest rate applicable at the time that the loan is drawn is the predominant cause of uncertainty. Again, it is uncertainty of the future rate of interest at the time that the cash flow arises that is the fundamental element to be considered.

Dealers are the link between money markets and financial markets because security sale and repurchase agreements (“repo”) provide the funding for their market making. Funding liquidity and market liquidity are interdependent, both are mutually supporting (Adrian and Shin 2010). The ease of trading overall depends on the interplay between both market and funding liquidity. Because inventories are funded by repo, market liquidity is constrained by the dealer’s capacity for inventory, which in turn relies on funding liquidity. Brunnermeier and Pedersen (2009) and Mehrling (2010) emphasize the inherent roles of both market and funding liquidity in financial instability. The relationship between market liquidity, funding liquidity and risk suggests a “commonality in liquidity” because the “shadow cost of capital is a driving state variable” (Brunnermeier and Pedersen 2009, 2227).

The link between market liquidity and funding liquidity can be explained by changes in monetary policy (Chordia, Sarkar, and Subrahmanyam 2005). To see this, consider “maturity transformation”, where illiquid long-term debts are funded by short-term money-like debt. Maturity transformation blurs the distinction between money and

credit and moves the liquidity risk from the investor to the financial system. The banking system creates market liquidity by adopting funding liquidity risk. The interdependence between market and funding liquidity identified above comes about due to their being fundamentally the same thing—the ability to sell financial assets. They are provided by dealers and are not macroeconomic phenomena.

### **Trade Liquidity**

Considering a debtor's potential sources of finance reveals yet another form of liquidity. According to Minsky ([1986] 2008, 260) there are three sources of finance: “cash flows from operations, refinancing or rolling over debts, and selling assets or net borrowing.” The final two are covered by the aforementioned funding liquidity and market liquidity, respectively; the first is not. Furthermore, Minsky ([1986] 2008, 223) identifies three types of operational cash flow: income, balance sheet, and portfolio. Again, portfolio cash flow arising from the sale and purchase of assets is already represented by market liquidity. The process of production and sale yields cash flow, and hence liquidity (Rochon 1997, 287). We must introduce the category of trade liquidity, which is associated with the circular flow of funds, the dynamic process of income becoming expenditure, and the continual creation and destruction of credit money.

Income cash flows—wages and salaries, both public and private, the payments from one stage of production and trade to another, and gross profits after taxes of business—result from the process of production. Money, in effect, goes around an income circuit; the income circuit as here defined includes all the payments for partially finished products sold by one firm to another. (Minsky [1986] 2008, 223)

The process of production, especially in buoyant conditions, allows for a form of liquidity based on expectations of future trade. In boom conditions, “industry is likely to be confident of replenishing its liquidity out of future profits” (Radcliffe Committee 1959,

103). Trade liquidity is available “even when bank credit is being contracted, so long as business expectations remain sanguine” (Radcliffe Committee 1959, 103).

For consumption is just as effective in liquidating the short-term finance as saving is. There is no difference between the two. If the entrepreneur gets wind of ex-ante consumption in the mind of the consumer, he is not only just as safe to get liquid and pay off his bank in due course as where there is ex-ante saving, but indeed much safer—for there is no risk that the consumption, when it matures, will take the form of an enhanced desire for cash. (Keynes 1937, 667-668)

The second type of operational cash flow—balance sheet—is income generated by existing assets and “the rapidity with which the wealth embodied in them can become ‘liquid’, in the sense of producing output, the proceeds of which can be re-embodied if desired in quite a different form” (Keynes 1936, 240). For the purposes of liquidity, balance-sheet cash flow can be considered as trade liquidity.

Thus, the supply of liquidity, in its broadest sense, is not based on the number of liquid instruments in existence at any point in time. It must include some element of its potential supply. The relationship between liquidity, credit and money means that

...an individual’s power to purchase, which is the objective element behind demand in terms of *numéraire*, is not fully represented by the amount of the credit instruments that are actually used in “payment” or even, so we should add, by the deposits, overdrafts, etc. against which checks are drawn, but by the total amount that an individual could command if he wanted to, i.e. the amount that is actually at his disposal in some measurable form plus something that might be called *potential* credit, which defies measurement, yet is a factor in any situation. (Schumpeter 1954, 718, n. 5, original emphasis)

Because trade liquidity is based on the anticipation of spending arising from the proceeds of production, it is a socially constructed property of the system arising from the circular flow of income and expenditure.

## **Self-Liquidating Assets**

One form of cash flow in the balance-sheet category that requires its own distinction is the form of liquidity displayed by short-dated financial instruments. Short-term assets, such as bills of exchange, are “self-liquidating paper” (Sayers 1964, 183), since they are expected to produce cash flow in the near future. These assets are generally classified as “near-money” and have properties that are described as self-liquidating, since the “proceeds of a loan would be used to finance the acquisition of a specific stock of goods, and the sale of these goods—either with or without processing or transporting—was to yield the funds to repay the debt” (Minsky [1986] 2008, 229). Thus, it is a form of liquidity closely related to, but once removed from, trade liquidity, since the cash flow generated by the asset is supported by the proceeds of an anticipated income cash flow.

In the context of banking specifically, the term “liquidity” can be taken to mean the “ability to satisfy demands for cash in exchange for deposits”, for which a banker “must maintain an adequate degree of liquidity in his assets” (Sayers 1964, 177). For a bank, the perfectly liquid asset is cash, by which is meant either state or central bank money, but it is an “idle asset” since it generally earns no interest. To meet the requirement to satisfy depositors’ demands for cash, bank assets must be convertible into cash quickly and without loss. The latter requirement means that banks cannot rely on assets that only offer only market liquidity because of their capital-uncertainty. As we have seen, government bonds are often highly shiftable, but have capital-uncertainty unless held to maturity, thus rendering them effectively illiquid for the purposes of a bank. The capital-uncertainty associated with a fixed-term asset decreases as it approaches maturity. The Real Bills Doctrine recommends that banks hold self-liquidating assets (Mehrling 1996, 335-336; Mehrling 2011, 31). A bank with a portfolio consisting entirely of long-term assets will be reliant on market liquidity, in other words,

on shiftability to a market maker, and will be forced to secure term funding to match the illiquidity of its assets.

### **Aggregate Liquidity**

The taxonomy outlined so far is incomplete; the pure or perfect liquidity associated with money itself is left uncategorized. If liquidity can only be defined “in terms of exchangeability for money” then money cannot have “perfect liquidity”, for to do so “is to argue in a circle” (Hicks 1989, 42). Defining money as the most liquid commodity via its “exchangeability” is therefore tautological (Ingham 2004, 6). Going further, liquidity presents “both a tautology and a paradox” (Lozano 2015, 15), for both liquidity in its purest form and the realized value of an asset are represented by money. Liquidity cannot only be money, for then they could not be separate concepts, nor could non-monetary assets have the property of liquidity (Lozano 2015, 16).

Money has no natural place in a liquidity theory based simply on the ease of conversion to money (such as market liquidity), even if money is in some way defined to be perfectly liquidity or “*par excellence* ‘liquid’” (Keynes 1936, 234, original emphasis). Under the commodity view, money is the most saleable—and hence liquid—good where its acceptability derives from its liquidity, and its liquidity from its acceptability. For Chick (1983, 306), “the fact that argument is circular does not make it less true. The properties of money are self-reinforcing.” The liquidity of money itself is of a form that is not captured by mere salability, unless it refers to the conversion money into assets, the reverse of the process of salability. The liquidity of money is in a fundamentally different category from market liquidity.

Some degree of clarity is provided by the terms “inside” liquidity and “outside” liquidity, which are used to refer to liquidity provided by a cash reserve and liquidity

from sale of assets, respectively. Confusingly, these terms have been associated with funding and market liquidity (Bolton, Santos, and Scheinkman 2011, 266). Although it would be accurate to recognize outside liquidity as a form of market liquidity, holding a cash reserve cannot be justifiably viewed as a form of funding liquidity since no requirement for refinancing exists. Instead, including money in the framework requires a distinction between, on the one hand, “market microstructure or microeconomic liquidity” (Tirole 2008, 54), which focuses on bid-ask spreads and market liquidity, and, on the other hand, “aggregate or macroeconomic liquidity” (Tirole 2008, 55), which attaches to securities that maintain their value in an economic crisis.

The importance of a macroeconomic perspective is highlighted by the “paradox of liquidity”, in which the “the attempt of economic agents to become more liquid transforms previously liquid assets into not-so-liquid assets” (Lavoie 2014, 21). Market liquidity is subject to a fallacy of composition: the more people want market liquidity the more it disappears. More precisely, a desire for aggregate liquidity undermines the supply of market liquidity. Nesvetailova recognizes and expands on the illusion of market liquidity:

The first fallacy is the assumption that it is the market-making capacity of financial intermediaries to identify, price and trade new financial products that creates and distributes liquidity in the markets. Second is the view that general market trade and turnover are synonymous with market liquidity. The third and corresponding fallacy is the notion that market liquidity itself – when multiplied across many markets – ultimately is synonymous with the liquidity (and financial robustness) of the economic system as a whole. Altogether, this line of reasoning has been underpinned by the notion that financial innovation in its various forms ultimately enhances the liquidity of the financial system as a whole. (Nesvetailova 2010, 17)

The recognition that dealers can provide an overlay of market liquidity to assets only at a microeconomic level leaves the open question of what “liquidity” can mean at a

macroeconomic or aggregate level, and whether it can be measured. Thus, in the taxonomy of liquidity, aggregate or macroeconomic liquidity is an important classification. To extract the precise liquidity implications of the fallacy of composition, we should introduce yet another classification: aggregate liquidity. Two conditions appear to distinguish aggregate liquidity from market liquidity. First, aggregate liquidity does not require market-making agents for its provision and, second, it is available regardless of the prevailing economic conditions. The nature of agents that have the ability to provide macroeconomic liquidity compared with microeconomic liquidity leads to the idea of “public” and “private” liquidity, respectively (Holmström and Tirole 1998). This distinction suggests another paradox of liquidity: financial innovations that appear to increase the provision of private liquidity actually decrease the level of overall liquidity (Lavoie 2014, 21; Nesvetailova 2007, 78).

For Nesvetailova (2010, 8, original emphasis), aggregate “liquidity is a property of an *asset*”, not the state of the market overall. Any assumption otherwise is rejected as a fallacy:

At the level of financial institutions themselves, the axiom that financial innovation and engineering have the capacity to *liquefy* any type of asset – or, more accurately, debt – has resulted in the now mainstream notion of liquidity that is divorced from any attribute of assets *per se*. (Nesvetailova 2010, 16, original emphasis)

Some assets are more liquid, in the aggregate sense, than others. Furthermore, aggregate liquidity is “intimately related to the notion of money” (Nesvetailova 2010, 8).

Aggregate liquidity manifests itself only in a select set of assets:

“Aggregate or macroeconomic liquidity” understanding: according to this alternative definition, variants of which date back to Keynes and Hicks, an asset offers liquidity to the corporate world if it can be used by the latter as a cushion to address pressing needs. To be an effective cushion, though, the asset must not lose value in those very



circumstances in which the corporate sector does need money. In this respect, the on-the-run Treasury bond is rather distinct from the stock index or the hypothetical mortgage-backed portfolio in that it does not lose value in recessions, while the latter's value is likely to be reduced precisely in case of an industrial or financial recession. (Tirole 2008, 55)

The description given here, however, is insufficiently distinguished from a more standard measure of risk or volatility, especially in correlation with systematic risk. It is suggested here that on-the-run Treasuries<sup>3</sup> are more liquid in a macroeconomic sense because they are negatively correlated with overall market risk. In many ways, this definition leads us simply to the “risk-free” asset so prevalent in much of finance and macroeconomic theory. Aggregate liquidity should not be confused with asset-price uncertainty.

For Nesvetailova the definition of liquidity is “an asset’s capability over time of being realized in the form of funds available for immediate consumption or reinvestment – proximately in the form of money” (Nesvetailova 2010, 8). Her discussion frames the historical movement in the meaning of the term “liquidity” from a property of an asset, to a property of the market overall. It is clear from the context that Nesvetailova is implicitly referring to a process whereby the meaning of the term “liquidity” has transitioned from aggregate liquidity to market liquidity and is discussing the associated macroeconomic difficulties. The result is that “over the past few decades, analyses of finance in the macro-economy have assumed that liquidity is no longer primarily a property of assets, but rather an indicator of the general condition and vitality of a financial market” (Nesvetailova 2010, 11). The lack of a clear taxonomy of liquidity contributes to this confusion.

Similar confusion arises when Holmström and Tirole (1998, 2) focus on the demand for liquidity, where “liquidity refers to the availability of instruments (market and

nonmarket) that can be used to transfer wealth across periods.” These intertemporally liquid instruments are required to cover unexpected funding shortfalls. In their model, when risks are purely idiosyncratic, “private liquidity” is sufficient, but in the face of pure aggregate uncertainty, “public liquidity” must be provided. At an aggregate level, shiftability can only be awarded to assets by the ultimate market maker, the central bank (Sayers 1964, 181). Thus:

An institution that performs a lender-of-last-resort function guarantees that the terms of some contracts will be fulfilled, regardless of market conditions or the business situation of the particular debtor. Thus, a lender of last resort diminishes the risk of default of the assets it guarantees. Assets with low default risk are readily marketable—they are liquid. When the Federal Reserve extends the domain of instruments that it protects against default, it is increasing the effective quantity of liquid assets and thus of assets that have the properties of money in the community. (Minsky [1986] 2008, 47)

As we have seen, however, marketability is not risk free: the central bank does not necessarily remove price uncertainty. The ability to avoid price uncertainty is valuable and an important part of liquidity.

### **Price-Protection**

Ricks (2011) argues that money-market instruments function as “money”, where the key aspect of these “money-claims” is their short-term price stability. Although a precautionary motive (Keynes 1936, 170) describes why agents hold a stock of the medium of exchange, Ricks argues that the actual medium itself need not be held. Instead a very liquid equivalent will do—hence the existence of the money market and its highly liquid instruments. These instruments are more than just marketable, like equities or Treasury bonds: “Not only are they extremely liquid (i.e., convertible into the medium of exchange on very short notice and at practically no cost), but, like deposits, their value in

terms of money is almost always extremely stable” (Ricks 2011, p.92). Ricks calls this their “price-protection” feature, and it is more than just high credit quality.

Closely related to price-protection is the concept of “information insensitivity” (Cochrane 2014; Dang, Gorton and Holmström 2012), which refers to debt instruments of sufficient credit quality that almost full payoffs can be expected in all future states of nature, thereby removing the need for investors to uncover any private information about the underlying obligor. Not all money-claims can be used as a medium of exchange (Michell 2017), but their near perfect market liquidity is their distinguishing feature and inasmuch as the shadow banking was able to create these instruments then this appears to be a form of liquidity creation.

Using the concept of price-protection, Ricks (2011, 101) considers whether the Modigliani-Miller theorem applies to banks and other maturity-transformation firms (such as shadow banks) who finance themselves in the money market. The Modigliani-Miller theorem (Modigliani and Miller 1958) demonstrates the irrelevance of debt versus equity funding in determining a firm’s value. Money-claim financing, however, has a lower expected return because of the instrumental value of transaction-reserve assets, and the ability to create these instruments affects the value of the firm. The Modigliani-Miller theorem rests on the assumption that investors can re-create the financing arrangements of the firm themselves and hence adjust it to their preference. This is not possible with money-market funding. Thus:

On closer examination, this analysis does not actually contradict the Modigliani-Miller theorem. That theorem rests on explicit assumptions, one of which is that the firm’s suppliers of funds are able to finance themselves on the same terms as the firm. And this condition cannot hold true in the case of maturity-transformation firms. The market will not fund just any economic agent with money-claims; the “moneyness” of a money-claim depends on its price-protection, which requires exceptionally high credit quality. For this reason, maturity-transformation firms

invariably invest the vast majority of their assets in credit instruments—that is, in senior claims on other economic agents. As a logical matter, not every economic agent can limit its assets to senior claims on other economic agents. (Nor should they want to!) Thus, very few savers seeking to store transaction reserves are able to issue low-yield money-claims themselves. Otherwise it would happen all the time. (Ricks 2011, 102)

This insight points the way to one potential limit to liquidity creation: the availability of senior claims on other economic agents. For Ricks this reliance on senior claims is a modern version of the money-multiplier. “Functionally speaking, all of these firms are engaged in the activity of fractional-reserve banking (or money creation), whether they are called ‘banks’ or not” (Ricks 2011, 97). Thus, for Ricks at least, the shadow banking edifice of liquidity is built on foundations that are not unlimited.

The concept of price-protection has a broader application. Assets that maintain price stability in the unit of account provide a reserve of liquidity. Through the maintenance of convertibility, bank liabilities are one such example. Price-protection can also take the form of guarantee or risk transfer:

In the private market, the amount of cash you can get for an asset depends on that asset’s current market value. By buying a guarantee of the market value of your assets, in effect you are guaranteeing your access to cash as needed; if no one else will give you cash for them, the guarantor will. (Mehrling et al. 2013, 7-8)

The hierarchy of money can then be extended to include the liquidity-storage capability inherent in price-protected money-claims (Pozsar 2014). These money-claims come in four forms depending on the “type of assets backing them and the type of backstops supporting them” (Pozsar 2015, 4). First are public money-claims such as central bank reserves and government bills. Second, we have private-public money-claims in the form of government-insured bank deposits. Third, repurchase agreements backed by government securities are public-private money-claims, where private

promises to pay are backed by public assets. Finally, there are purely private money-claims not supported in any way by a public assets or backstops. The result is what Pozsar (2014, 2015) calls the “Money Matrix” (see Table 1). As noted above, many of these “money” forms cannot be used as a medium of exchange, so they are more appropriately classified as forms of liquidity. The instance of assets with a price-protection feature, but which lack monetary characteristics, in that they cannot be used to settle debts, is an important phenomenon in the taxonomy of liquidity.

[Table 1 near here]

## **Conclusion**

Market liquidity—the ability to sell assets quickly without undue loss—is the most common form of liquidity in the literature. Funding liquidity, which is the ability to access funds to repay an existing loan, enters the literature as a complement to market liquidity in studies of the microstructure of dealers and market makers. That market and funding liquidity are liable to a fallacy of composition is recognized by categorizing them as privately provided outside liquidity, in that the liquidity provided is not intrinsic to the asset in question.

Market and funding liquidity refer to the conversion of assets into monetary or pure liquid form. The former captures the idea of salability or marketability of an asset, the latter the ability to acquire liquidity to postpone payments of existing debts. Each aligns with the necessity that, when a payment is due, offsetting credits must be available with which to make the payment. If there are insufficient credits then the agent must acquire them and may need to appeal to market or funding liquidity.

Two other options are available: either to rely on credits arriving into one’s possession; or have on hand a ready store of credits that are due at that moment, that is:

money. Thus, market making provides transactional liquidity associated with portfolio flows, and can be distinguished from liquidity arising from income-producing activities and liquidity flows from short-dated or self-liquidating assets. Inside liquidity, in the form of cash balances, is provided by assets with a price-protection feature that provide an overarching stability in the unit of account. Otherwise-safe assets such as government bonds are convenient in that they are readily shiftable but cannot provide capital certainty.

[Table 2 near here]

What appears is a hierarchy of liquidity from price-protected money-claims, through trade liquidity, self-liquidating assets, funding liquidity, to market liquidity. The spectrum falls between the inside and the outside categories of pure cash and the reliance on the sale of assets. Other categories that must be considered are the public and private provision, and the availability in the face of aggregate and idiosyncratic disruptions.

Table 2 provides a summary of the liquidity forms and spectrum thus identified.

This paper goes a long way towards clarifying the confusion surrounding the concept of liquidity. A taxonomy is offered that attempts to clarify and distinguish the varying forms of liquidity so that future theoretical and empirical analysis can be conducted with greater precision.

## Notes

1. Non-specialist equipment with many applications is the sort of physical equipment that could be classified as technologically liquid. For instance, in economic models containing a single consumption good, such as corn, whereby saving and investment are indistinguishable, “investment” can be reversed by consuming more corn. Technological liquidity is not related to conversion into money and will not be considered in this study.
2. For Tirole (2011, 288, n. 3), however, the correspondence of market and funding liquidity with opposing sides of the balance sheet is not so clear-cut. The counter-example given is the securitization of a bank’s loan portfolio coupled with liquidity support, but it actually shows the combination and the interaction of market and funding liquidity rather than a

refutation of their boundaries. The balance-sheet correspondence is a useful working definition.

3. The on-the-run bond is the one most recently sold into the market by the US Treasury and is the one most actively traded. Off-the-run bonds are held as core portfolio positions by insurance and investment funds and are traded much less frequently.
4. Except possibly for those assets that are part of the central bank's open-market operations.

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Table 1 – The “Money Matrix”

	Public Backstop	Private Backstop
Public Assets	Central bank reserves, treasury bills	Government bond repos
Private Assets	Insured bank deposits	Non-government bond repos, uninsured bank deposits

(Adapted from Pozsar 2014, 2015)

Table 2 – Forms of Liquidity Supply

Liquidity	Inside/Outside	Private/Public	Supplier	Example
Purely Public	Inside & Price-Protected	Public	Government	Central bank reserves and state money
Private-Public	Inside & Price-Protected	Hybrid	Banks	Insured bank deposits
Public-Private	Inside & Price-Protected	Hybrid	Money market dealers	Government bond-backed repos
Purely Private	Inside & Price-Protected	Private	Money market funds and banks	Uninsured deposits
Self-Liquidating	Outside	Either	Production	Bills of exchange
Trade	Outside	Private	Consumption	Sales of goods and services
Funding	Outside	Private	Banks	Borrowing
Market	Outside	Private <sup>4</sup>	Dealers	Sales of assets