Market liquidity and the role of public policy

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1. Introduction

Much attention has been devoted in the recent period, in both private and public circles, to the question of market liquidity. There are a number of circumstantial reasons for this heightened interest. One is the recognition that market liquidity cannot be taken absolutely for granted, even in normal times or in the deepest and most liquid segments of the financial system. The deterioration, admittedly limited, of liquidity in the US Treasury bond market, in a context of reduction of the public debt, is an example at hand. Another factor of interest stems from the behaviour of liquidity during and especially after financial market crises. Widespread market commentary that liquidity in a broad cross section of the financial system has never fully recovered to the levels prevailing before the financial crisis of autumn 1998 has raised a number of questions, not all fully answered as yet, as to the dynamics of market liquidity. The private benefits of secondary market liquidity for issuers of public debt have equally attracted a large amount of attention, especially in the context of the more competitive environment created in Europe by the introduction of the euro. Finally, many questions have been raised by the development of alternative trading systems and the effect they may have on market liquidity.

The interest in understanding the nature, the role and the dynamic of market liquidity also has deeper roots. The trend towards a larger role of markets in financing economic activity, as well as the prevailing use of market-based instruments for the implementation of monetary policy, suggest that market liquidity may be increasingly relevant to public policymakers in general, and central banks in particular.

This paper is intended as one among many contributions to the broad-based investigation of the multiple facets of market liquidity. Its focus is on the role of market liquidity from a public policy point of view, and on the various types of public policies aimed, directly or indirectly, at enhancing market liquidity. This version of the paper constitutes a starting point rather than an outcome of the investigation of this issue, and was prepared for the Autumn Meeting of Central Bank Economists hosted by the Bank for International Settlements in October 2001.[2]

The following section of the paper proposes a simple conceptual framework to approach the issue of market liquidity, according to which market liquidity is defined as the output of financial intermediation. Section 3 raises the question of the public benefits provided by market liquidity, and to what extent the existence of such benefits justifies an active involvement of public authorities in fostering the provision of liquidity. The fourth section describes a number of actual policies through which public authorities have actively supported the provision of market liquidity over the years. Section 5 concludes.

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[2] The paper strongly benefited from extensive discussions with S Grittini and V Brousseau at the ECB as well as from substantial comments by F Papadia (ECB) and B Cohen (BIS). The views expressed by the author remain his own, however, and cannot be attributed to the ECB or to the BIS.

2. A simple conceptual framework for the analysis of market liquidity

2.1 Definition of market liquidity

Market liquidity is a notion that everybody seems to understand intuitively, but that is considerably more difficult to translate into a universally accepted definition. One reason for this is that market liquidity covers not one, but several concepts, more or less tightly linked. Muranaga and Shimizu (1999) provide a survey of different interpretations of market liquidity and quote in particular the definition offered by Black in 1971, according to which:

"A liquid market is a market in which a bid-ask price is always quoted, its spread is small enough and small trades can be immediately executed with minimal effect on price."

The definition proposed by Muranaga and Shimizu is close to that of Black and is also the definition retained, inter alia, by the study group on market liquidity established by the Committee on the Global Financial System in December 1997.[3] This definition reads as follows:

"A liquid market is a market where a large volume of trades can be immediately executed with minimum effect on prices."

These definitions call for a number of remarks. Firstly, while it is clear that a market may be more or less liquid, it is much less clear that two markets can always be ranked in terms of their degree of liquidity. According to the definitions proposed here, liquidity has several dimensions, the most traditionally presented being tightness and depth.[4] Whereas tightness refers to the ability of the market to match supply and demand at a low cost, depth refers to the size of transactions that a market can absorb without any noticeable impact on prices.

As long as these two dimensions are positively correlated, as is traditionally assumed, they should not create significant problems in interpreting the degree of liquidity of a market. The assumption of a positive correlation between tightness and depth has, however, recently been challenged by market participants. In the context of the foreign exchange market, in particular, a number of active dealers have reported that the increased tightness of the market brought about by the development of electronic brokerage systems has been accompanied by a reduction in the depth of the same market.

These statements may deserve to be substantiated by conclusive research.[5] They illustrate, however, the difficulty of fully encompassing the notion of market liquidity in one single quantitative indicator, be it the bid-ask spread, turnover or any of the other indicators often used as proxies for liquidity. This also suggests that liquidity may change qualitatively, in a way that makes it difficult to conclude that it has improved or deteriorated altogether. This would be the case, for instance, if a market had become tighter but at the same time shallower, as suggested above.

Another remark relates to the question of what would be an infinitely liquid market. Extrapolating from the definition proposed above, one may infer that an infinitely liquid market would be a market where it is possible to immediately execute a transaction of any volume at zero cost and without any impact on prices. One may, however, question whether a market where the preferences of participants, reflected in their transactions, have no effect whatsoever on price would still be an efficient market, or indeed a market at all.

It follows from this that a perfectly liquid market may not be a market where any transaction can be executed without any impact on prices, but one where the price impact of a transaction is not out of

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[3] In December 1997, the CGFS established a study group of central bank researchers, under the chairmanship of the Bank of Japan, to study the determinants and dynamics of market liquidity. The conclusions of the group were published by the CGFS in May 1999 under the title *Market liquidity: research findings and selected policy implications*.

[4] Kyle (1985) provides another review of the definition of market liquidity and describes it as including "tightness (the cost of turning around a position over a short period of time), depth (the size of an order flow innovation required to change prices a given amount) and resiliency (the speed with which prices recover from a random, uninformative shock)".

[5] Muranaga and Shimizu (1999) provide an example of such research. They provide a theoretical model that leads to the conclusion that, under certain assumptions, an increase in depth comes with a deterioration of tightness and vice versa.

proportion to its information content. Incidentally, the common use of the phrase "deep *and* liquid markets" suggests that the notion of depth and that of liquidity overlap, but do not entirely coincide.

A similar definition of market liquidity is that a market is liquid if uncertainty as to the execution price of a transaction is low. This does not necessarily imply that the execution price is identical to the mid-price prevailing in the market at the time of the transaction, but rather that the deviation between the two is predictable. In practice, this is likely to be associated with low and stable bid-ask spreads, as well as with significant depth.

It is noteworthy that all definitions of market liquidity implicitly or explicitly (as in the case of Black's definition) assume it is always possible to execute transactions immediately. This suggests that market liquidity encompasses two elements, one of which is discrete, and the other continuous:

A market is only truly liquid insofar as it is always possible to execute a transaction.

The less the execution price of a transaction deviates from the mid-price prevailing at the time of the transaction, the more liquid is the market.

The first condition, in particular, is of key importance. It is not enough that turnover is high for a market to qualify as liquid. A market must be able to absorb any (reasonable) flow such that, whenever a participant decides to enter into a transaction, there exists another participant or group of participants ready to act as counterparty, albeit possibly at the cost of a variation of the price.

2.2 Market liquidity defined as the output of financial intermediation

Based on the definitions proposed in the previous section, one may elaborate a simple conceptual framework for the analysis of market liquidity. This relies in particular on the conclusion that the notion of liquidity is closely connected to the possibility of executing a transaction at any time.

According to this simple framework, liquidity is the output of financial intermediation on the secondary market. Financial assets, such as bonds for instance, are not produced by dealers. They are produced by the issuers (ie the debtor or the originator of the asset) and ultimately purchased by investors. What dealers produce is the ability for investors to buy or sell assets at any point during their lifetime. In other words, dealers produce liquidity and the end users of the market purchase it.

This framework may appear so obvious that its presentation is completely superfluous. Yet it provides a good basis for the analysis of liquidity. In particular, it allows us to introduce the concept of the production cost of liquidity, and to link the various factors traditionally described as having a bearing on liquidity to the technology used by dealers for its production.

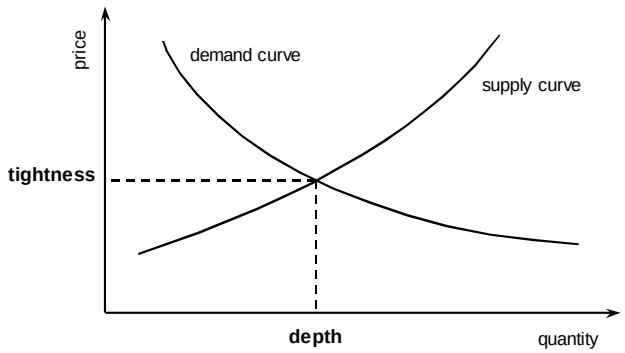
This simple framework can be further described as follows. A unit of liquidity is defined as the ability to execute a transaction for a value of, say, €1, in a given market, with no impact or only a negligible impact on price. The more units of liquidity are produced, the deeper the market is.

The price of liquidity is the price that end users are willing to pay to ensure that they can execute a transaction.[6] The cost of production of liquidity is the amount of capital that a dealer requires, given technology, to guarantee that he can quote two-way prices at a given time. Under this framework a simple demand curve, as well as a supply curve, for liquidity can be defined. The degree of liquidity in a market, whether approached from the point of view of tightness or depth, is defined by the intersection of the two curves, as illustrated in the chart below.

[6] This price is not exactly equal to the transaction cost, because there are other means through which end users may be willing to pay for liquidity. The yield that investors forgo in return for holding more liquid assets is one example.

Chart 1

Equilibrium of liquidity supply and demand



This representation of a supply and a demand curve can be used either at the scale of the market as a whole, or at the scale of each individual transaction. This paper generally adopts the first approach. However, adapting the same concept to each individual transaction would possibly allow us to better encompass elements such as returns to scale in the production of liquidity.[7]

2.3. Dealers' capital input and absorption capacity of the market

The framework proposed here allows analysis of the various factors having a bearing on market liquidity, such as market or product design, through their contribution to the technology used to produce liquidity. Before engaging in this discussion, it should be underlined that the main and essential input in this production process is capital. No market can be truly liquid unless a sufficient amount of capital is devoted to its functioning by participants.

The reason for this is that liquidity, as defined earlier, depends on the fact that, whenever a participant decides to enter into a transaction, there is another participant willing to act as counterparty. The first agent is the consumer of liquidity, the second is the producer, or provider. The provider, by agreeing to enter into a financial transaction, agrees, by definition, to be exposed to a financial risk. His ability to enter into a transaction therefore depends on his capital base, and the more liquidity he provides, the more capital, all things equal, he has to consume (ie immobilise) for that purpose.

The notion of capital consumed can be interpreted in several ways, all of which are encompassed in the rest of this paper. For instance, it can be interpreted in the sense of providing coverage for risk limits in derivatives transactions and other margined positions. It can also be interpreted in the sense of inventory management: just as entering into a derivatives position increases the dealer's risk exposure and consumes some of his capital, entering into a cash transaction either consumes some of his inventory (in the case of a sale of an asset) or consumes some of his funding capacity (in the case of a purchase).

Another point worth underlining here is that liquidity suppliers need not be "professional" market-makers. They may be end users of the market, such as relative value traders for instance, as long as they are willing to enter into transactions at the request of other participants. From this point of view, liquidity may be produced as a by-product of another activity (arbitrage for instance). Users of liquidity may also under certain circumstances become producers of liquidity (and vice versa).

To illustrate the link between the capital committed to a market and its shock absorption capacity, take a market, say a foreign exchange market, with a very large number of end users and a certain number

[7] The - very basic - underlying idea here is that the higher the degree of liquidity in the market, the less additional capital would be required to produce a marginal unit of liquidity, and therefore the lower the average cost of production of each unit would be as the overall amount grows. One may further refine this - still extremely basic - model to propose that expectations that a market is liquid are a factor of production of liquidity. Self-fulfilling expectation mechanisms, whereby if market participants expect a market to be liquid, it is likely to become liquid, could be analysed in this context.

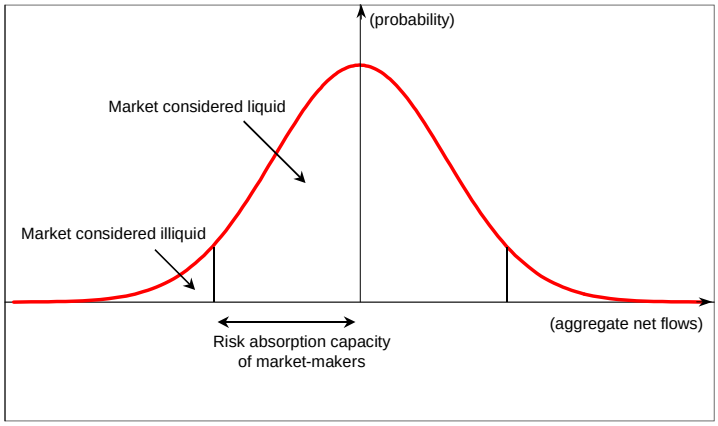
of market-makers. The role of the market-makers in this model is to act as counterparty to any transaction initiated by an end user. It is clear that, since this activity implies that the market-makers are willing to take a risk, their ability to do so will be constrained by their overall risk limits. Market-makers can therefore play their role only to the extent that the aggregate flows from all end users at one point in time do not exceed the aggregate risk limit of all the market-makers,[8] or, for practical purposes, their capital base.

The end users may be corporate treasurers or institutional asset managers, all of whom have to conduct daily foreign exchange business related to their core activities. For the purpose of illustration, it is assumed that these end users conduct their transactions passively, ie without taking directional views on the level of the exchange rate, and independently of whatever transactions are carried out by other participants in the market. By means of simplification, it is assumed that all these agents have a flat probability of buying or selling at any moment in time any amount of euros, up to €1 billion. In such circumstances, the aggregate net flows resulting from the passive activity of all these individual agents would follow a normal distribution, with an average of 0 and a standard deviation of €500 million.

As long as net flows do not exceed the risk limit of the market-makers, no problem would arise, and the market would be considered liquid. Should, however, the aggregate net flows from end users exceed the risk absorption capacity of market-makers, the latter would no longer be able to play their role. There would be end users willing to enter into a transaction but unable to find a counterparty. To the extent that liquidity is defined by the ability to execute a transaction on request, the market would effectively become illiquid.

Chart 2

Representation of the probability of endogenous "jamming" of the market



The probability of such a situation, under the assumptions used here, is admittedly low. For instance, the probability of the aggregate net flows exceeding €2.5 billion at any time would here be only 0.0006%. However, the probability of these aggregate flows exceeding €1.25 billion, half the previous amount, rises to 1.2%.

The illustrative amount highlighted and the assumptions used here are of course unimportant. The important points can be summarised as follows. Firstly, however small, there always exists a probability of a market "jamming" at any time. Secondly, all things equal, this probability rises considerably if and when the absorption capacity of the market is reduced, even moderately. Thirdly, this absorption capacity is a direct reflection of the amount of capital committed to the market by liquidity providers.

[8] In this model, the number of market-makers is irrelevant. It could just as well be assumed that there is only one large market-maker.

The model used here is of course simplistic. For one thing, it ignores entirely the complementary role of dealer capital and price adjustments in rectifying imbalance. If the strain on capital from an increase in purchases (or sales) is too high, the price will have to rise (or fall) until the imbalance is eliminated. The underlying concept is, however, unchanged. The fact that price adjustments allow the elimination of imbalances implies that there are participants in the market who are willing to enter into a transaction if the price deviates from its perceived equilibrium value. In a way, it can be said that these participants are willing to provide liquidity by taking a position, at a certain cost, which is the difference between the price initially prevailing (equilibrium value) and the one at which they are ready to trade.

Another qualification is that the amount of capital necessary to ensure the liquidity of a market may not necessarily increase as the number of end users increases. In fact, providing there exists a sufficient diversity of behaviours among end users, the required amount of capital may be largely independent of the overall turnover of the market. The scenario presented above is one such example, where it is the average size of transactions, rather than their number, that determines the capital requirement of a liquid market.

The discussion on the necessity for a certain amount of capital to be devoted to trading activities for a market to be liquid is, however, central in some of the ongoing developments in several markets. A first observation in this regard is that dealers will only commit capital to liquidity provision if this activity is profitable. In fact, it is probably not sufficient that liquidity provision is profitable per se. It needs to be at least as profitable - when adjusted for risk - as other lines of business of the financial institutions involved.[9] It has often been suggested that a reduction in transaction margins has been accompanied by a reduction in the profitability of liquidity provision, and accordingly by a withdrawal of capital from these activities. The result would be a lower capacity of main markets to absorb shocks.

The *71st Annual Report* of the BIS, for instance, underlines that "there are currently no more than 20 global players in foreign exchange markets" that can provide two-way prices on a wide range of currency pairs. This is probably a generous estimate, if it refers to the ability of dealers to quote prices even under volatile market conditions. In addition, individual dealers have often reported that, especially after the financial crisis of autumn 1998, they had very significantly downsized their risk limits, ie equally their risk absorption capacity.

Indeed, dealers have sometimes reported an increased frequency of micro-stress episodes, or "gaps", defined as situations when a random flow occurring in the market exceeds the risk absorption capacity of market-makers at that time. As market-makers are unable to absorb the transaction, its execution is contingent on finding an "external" source of liquidity. This would explain sudden rises or falls in prices that only stop at levels where contingent orders had been placed by customers ex ante,[10] as it is these orders that act as external sources of liquidity. Anecdotal reports of an increased frequency of gaps may, however, need to be better substantiated by facts.[11]

There are, by contrast, also good indications that the risk-adjusted return on capital of trading firms remains healthy, at least for some market segments. A study published by McKinsey in the summer of 2001 suggests that a number of banks "are realising a return on equity of well over 20% from making markets for traditional cash equities".

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[9] Alternatively, dealers may commit capital to the supply of liquidity if there is synergy with other business lines, say brokerage, bond/equity syndication, M&A consultancy, etc. This would imply that liquidity is vulnerable to prospective return in these other businesses (see also D'Souza and Lai (2001) for an excellent analysis of this problem).

[10] Contingent orders are instructions from customers to dealers to execute on their behalf a certain transaction if and when market prices reach a certain level.

[11] See Chaboud and Weinberg (2001) for a particularly useful analysis of very short-term volatility in the foreign exchange market that sheds light on this particular question.

2.4 Technology and the liquidity production process

A considerable amount of work has already been done to identify the various determinants of market liquidity, and it is not the purpose of this paper to add to these efforts. Rather, this section briefly recalls some of the well known factors that have a bearing on liquidity, and suggests that they can be interpreted as contributing to improving the productivity of the production of liquidity, ie reducing the amount of capital consumed per unit of liquidity produced.

The five headings below are directly extracted from the note entitled *How should we design deep and liquid markets? The case of government securities*, published by the CGFS in October 1999. Other factors, not covered under these headings, that have a bearing on liquidity can also be interpreted through the angle of their contribution to "technology".

(a) Competitive market structure

The idea that it is important that dominant market players can be challenged by new entrants is not directly related to productivity, but rather to the desirability that liquidity services are priced to customers at their marginal cost. Indirectly, this also means that, all things equal, productivity improvements in the production process directly translate into an increase in liquidity.

(b) Level of fragmentation of the market

A common finding of studies on market liquidity is that it benefits from a high substitutability of instruments, or from a high outstanding amount of fungible assets. This is typically the case for government bonds, for instance, where large benchmark issues tend to be more liquid. The same argument underpins the idea that the liquidity of government bonds is likely to increase across the curve if these bonds can be stripped, and if similar coupons issued from the stripping of different bonds are fully fungible.

An interpretation of this finding is that the easier it is for a liquidity producer to hedge his position, the less capital he will consume when agreeing to enter into a transaction at the request of an end user. This ability to hedge one's position rapidly and effectively may depend on the availability of assets in the market where liquidity is produced, on the number of potential counterparties in this market, etc. It may also depend on how easy it is to hedge one's risk through another - related - market. In this context, liquidity in one market may be used as input for the production of liquidity in another market segment, which allows saving on capital. One example of that is the case of strips mentioned above.

Another example is the role of highly liquid futures markets to generate liquidity for the cash market, not only for bonds deliverable against the futures contract, but also for the rest of the yield curve. If a dealer can properly and rapidly hedge any bond through a linear combination of positions in a small number of highly liquid instruments, he will be more likely to enter into transactions on any of these bonds, for the same consumption of capital.

(c) Transaction costs

Another standard finding of studies on market liquidity is that transaction costs tend to be negatively correlated with liquidity. The simple interpretation under the model proposed here is that the cost of liquidity provision, which includes transaction costs, must ultimately be entirely charged by producers to the consumers. Accordingly, transaction costs, and in particular transaction taxes, raise the price of liquidity for end users and therefore, all things equal, reduce consumption.

(d) The role of infrastructure

The role of infrastructure in the production cost of liquidity would deserve a study of its own. This heading encompasses at least two issues, the in-house infrastructure of the liquidity producers and the market infrastructure itself.

The execution of a transaction requires a full range of operations, from front-end order capture to back office clearing and settlement. Each of these steps has a cost, and this cost has ultimately to be charged by the liquidity producer to the consumers. Wherever technological improvement allows the cost of these operations to be reduced, it also allows more units of liquidity to be produced per unit of capital. Economies of scale are typically possible in this field. The McKinsey study quoted earlier

suggests that emerging technologies will allow only a small number of institutions to increase dramatically the number of transactions they can process while lowering their costs and increasing their profitability.

Another aspect of infrastructure is the "public" part of market infrastructure, such as payment and settlement systems. The soundness and efficiency of this part of the infrastructure are plainly crucial to the risk associated with any transaction, and hence its cost in terms of capital.

(e) Behaviour and diversity of market participants

The CGFS note upon which this section draws concluded that "heterogeneity of market participants in terms of transaction needs, risk assessments and investment horizons enhances market liquidity". Once again, this can be interpreted as the fact that the more diverse end users are, the more likely that flows received by liquidity producers will offset each other instead of adding to each other, ie that a lower amount of capital is necessary to execute a larger volume of transactions.

2.5 The volatility of production cost and the insurance function of market-makers

To conclude this section, a few questions may be raised as to the difference between true and apparent liquidity and the consequences of volatility in the cost of production of liquidity. It has often been heard, over the past few years, that liquidity has changed in nature, insofar as it is very good in normal conditions but tends to evaporate rapidly whenever market conditions become slightly unstable. This is the pattern known under the name of "fair weather liquidity". Once again, these comments may need to be substantiated by facts. There have been, even in the very recent past, numerous occasions where exogenous shocks to the financial system or an increase in market volatility do not seem to have markedly affected market liquidity in a negative way in the main markets.

The notion of fair weather liquidity nonetheless deserves a few remarks, or at least questions. Under the analytical model presented in this paper, it seems reasonable that the production cost of liquidity can be highly volatile, and closely correlated to asset price volatility itself. An important part of the production cost of liquidity includes the consumption of capital generated by the financial risk incurred by a liquidity producer between the execution of a transaction with an end user and the execution of an offsetting transaction with another participant. The more volatile the market, the more costly this risk is to bear.

The consequence of this is that, if liquidity is priced at each moment on the basis of its current production cost, the consumption of liquidity will be extremely volatile. Fair weather liquidity may therefore, to a certain extent, be the consequence of an efficient pricing of liquidity.

The question that arises is whether the service that consumers are willing to pay for is not the ability to execute a transaction at a specific moment, but rather the ability to execute a transaction at any moment. In that case, the price they will be willing to pay for liquidity will not be based on its current production cost, but rather on an average production cost, taking into account future potential volatility. If part of the service sold by liquidity providers is to ensure a constant price of liquidity over a certain period, they will charge a price higher than the production cost during "normal" periods and lower than that during "stress" times. Thus, the production and consumption of liquidity will be smoothed, and market-makers will effectively play a role of insurance with respect to the degree of liquidity of the market.

Adding this intertemporal dimension to the question of liquidity immediately raises a number of questions with respect to the existence of contractual arrangements between producers and consumers of liquidity. In particular, the possibility of free-riding behaviour raises the question of coordination problems between the producers and consumers of liquidity and this, in turn, leads to the question of the justification, or lack thereof, for intervention by the public authorities in the field of market liquidity. The following section touches upon some facets of this question.

3. The public benefits of market liquidity

One of the commonly accepted benefits of market liquidity is that it provides a number of positive externalities, both within the financial system and from the financial system towards the rest of the economy. A liquid foreign exchange market, for instance, may facilitate international trade, and therefore equally the process of industrial specialisation based on comparative advantages. The same assessment, as regards the benefits of liquid government bond markets, is expressed in the following terms in the international capital markets report published by the IMF in August 2001:

"Partly because of their unique characteristics, especially their minimal credit risk, government securities and the deep, liquid markets in which they are traded have come to play important, if not critical, roles in facilitating aspects of private finance. In particular, they have facilitated the pricing and management of financial risks associated with private financial contracts."

The existence of positive externalities does not necessarily justify an involvement of the public authorities in the provision or distribution of market liquidity. To the extent that there exist market failures that prevent all the social benefits that these externalities can provide from being extracted, a public involvement may, however, be justified in certain conditions. In other words, the primary justification of an involvement of the public authorities would be to ensure that the external costs and benefits of liquidity are properly priced by the private sector, not to supply liquidity per se.

The trend towards an increased role of markets in financing economic activity may also suggest that market liquidity, or at least liquidity in some key segments of the financial system, is assuming increasingly global relevance. Two of the merits of market-based financing are that it facilitates the pricing of financial services and that it allows providers of capital as well as borrowers to manage their assets and liabilities more flexibly. Both these aspects relate to the concept of liquidity.

Another possible argument for involvement of the public authorities in the field of market liquidity is the role it plays in allowing them to implement their policies in the first place, or in improving the conditions in which these policies are implemented. Monetary policy is one example, since it is now predominantly implemented through market-based instruments in developed economies. In addition, the transmission process of monetary policy might benefit from the linkages between markets, efficient price discovery, etc that market liquidity brings about, or to which it contributes.

Some of these arguments are discussed in the following paragraphs.

3.1 Private benefits of liquidity for fiscal policymakers

Paradoxically, a first public benefit of market liquidity may be the private benefits it entails for the issuers of public debt. To the extent that assets are liquid, investors may be - and in practice are - willing to pay a premium for holding these assets. A direct externality of market liquidity is that it lowers the funding cost for the issuers of such assets.

Traditionally, government securities have tended to be highly liquid (at least relative to private assets) and therefore to benefit from a significant premium. This high degree of liquidity derives from a combination of factors, such as the relatively large outstanding amount of fungible securities, the existence of a well developed market infrastructure, including associated repo and futures markets, etc. The investor base of government securities markets also tends to be fairly wide and well diversified, in particular because the minimal credit risk associated with these assets makes them valuable for a multitude of purposes.[12] All these factors contribute to lowering the production cost of liquidity in government securities markets.

While the lower funding cost of the government is in itself a private benefit, it may be interpreted as a public benefit because of the nature of the issuer. A lower funding cost increases in principle the

[12] The minimal credit risk of government bonds qualifies them as an appropriate benchmark for valuation - and to a certain extent hedging - of the credit risk of other issuers. It also qualifies government bonds as highly desirable collateral for cash management operations in the secured money market (repo). Low or inexistent credit risk and long maturities may also be crucial in enhancing demand for government bonds from these investors, who may have a very low preference for the present or even possibly a preference for the future, such as retired persons, or the pension funds that manage their assets.

effectiveness of fiscal policy, as it increases the amount of current government investment for a given amount of future liabilities. To the extent that fiscal spending aims by definition at achieving public benefits, the liquidity of government bond markets is indirectly a matter of public interest.

3.2 Benefits of liquidity associated with the implementation of monetary policy

Another type of public benefit originating from a proprietary source relates to the role of market liquidity in allowing an efficient and effective implementation of monetary policy. This has also gained importance with the generalisation of market-based instruments for that purpose. There are two ways in which market liquidity may be crucial to the implementation of monetary policy.

The first relates to the market in which the central bank executes its operations. This market, or market segment, must be deep enough to absorb the operations of the central bank. Alternatively, the central bank can (and in practice does) choose the market in which it intervenes on the basis of whether it is deep and liquid enough to absorb whichever size of transactions the central bank may need to execute.

As an illustration, the operational framework of the Eurosystem includes the establishment of a "sui generis" market, where central bank credit is provided against adequate collateral, according to conditions defined by the central bank. This specific feature partly reflects the fact that the large size of the open market operations of the Eurosystem would have made it difficult to implement them in any specific existing market segment. By contrast, the Federal Reserve System executes its operations more directly in the interbank repo market. The decision to split these operations between three segments of the repo market (those for Treasury securities, agency securities and mortgage-backed securities) also reflects the difficulty that would have arisen if repos had continued to be conducted in one single market segment, in a context of reduction in the availability of collateral. A third example, possibly even more explicit, is provided in the Annual Report for 2001 of the Reserve Bank of Australia, in which the rationale for the increased use of currency swaps, in addition to the standard domestic repos, for monetary policy operations is presented as follows: "The usefulness of foreign exchange swaps for domestic market operations reflects the fact that the foreign exchange market is very deep and liquid."

The second way in which market liquidity may be crucial to the implementation of monetary policy relates to the market in which central bank money is redistributed within the entire banking system, typically the unsecured money market. Insofar as the redistribution of central bank money and the equalisation of its price across the jurisdiction of the central bank is the first step in the whole transmission process of monetary policy impulses, the public benefits provided by the liquidity of this market are fairly obvious.

In principle, the liquidity of the unsecured money market is rarely a serious matter for concern. One rare case where it could have been was the introduction of the euro. The unprecedented need to integrate 10[13] national money markets into one had led to some ex ante uncertainty as to the degree of liquidity of the single unsecured money market at the beginning of Stage Three of monetary union. This concern was addressed in two ways. Firstly, the Eurosystem set up its own infrastructure for cross-border payments between banks across the euro area (TARGET). Secondly, during the first three weeks of January 1999, the ECB set the width of the corridor between its two standing facilities, which effectively determine boundaries for the fluctuation of the overnight rate, to a mere 50 basis points. The purpose of this measure was to facilitate the adaptation of credit institutions to the new operational framework and to avoid insufficient market liquidity in the unsecured money market resulting in excessive differences in pricing of central money across the euro area. In practice the single market effectively integrated within days of the introduction of the euro, and its very high depth and liquidity from the start has allayed all concerns.

[13] Eleven countries adopted the euro on 1 January 1999, but two of them, Belgium and Luxembourg, had already participated in a currency union since 1922 and accordingly already had a single money market between them.

3.3 Other public benefits of market liquidity

The two types of benefits of market liquidity discussed in the previous two sections are probably small in comparison with the much broader benefits it brings about to the economy at large, if only by improving the efficiency of the allocation of resources, or through its contribution to financial stability. There is little discussion over the merits of market liquidity in this context, as underlined by the CGFS in October 1999 in the following terms:

"There seems to be a growing consensus that deep and liquid financial markets, especially government securities markets, are needed to ensure a robust and efficient financial system."

Market liquidity may not qualify as a pure public good per se.[14] The strong positive externalities that it induces, from one segment of the financial system to others, and from the financial system towards the rest of the economy, may, however, be a sufficient justification for policies aiming at enhancing market liquidity. This would be the case in particular if these externalities cannot be properly charged by liquidity producers to all those who benefit from them, so that all the social benefits that can be derived from its existence cannot be reaped through market forces alone.

Alleviating the negative effects of market failures of this type is, almost by definition, the role of public policy. In the specific field of the efficient functioning of the financial system, of which liquidity is a core component, some central banks have a mandate expressed only in very general terms, while some others have a much more explicitly defined mandate. One of the clearer examples is provided by the Bank of England, which, as a core purpose, is mandated to "seek to ensure the effectiveness of the UK's financial services". This is further defined in the following terms:

"The Bank wants a financial system that offers opportunities for firms of all sizes to have access to capital on terms that give adequate protection to investors, and which enhances the international competitive position of the City of London and other UK financial centres. It aims to achieve these goals through its expertise in the market place; by acting as a catalyst to collective action where market forces alone are deficient; by supporting the development of a financial infrastructure that furthers these goals (...)."

By contrast, the mandate of the Federal Reserve System does not make explicit reference to the effectiveness of the financial system as a (even a subsidiary) policy objective. The Eurosystem is perhaps in something of an intermediate position, insofar as its constitution explicitly places the actions of the central bank in the context of the principles of an open market economy with free competition and efficient allocation of resources. In addition, without prejudice to its primary objective of price stability, the Eurosystem is mandated to support the general economic policies of the European Community, inter alia "to promote economic and social progress". Insofar as insufficient liquidity were deemed likely to result in a loss of economic welfare, there is a case to say that most public authorities would find in their mandate justification for policies aiming at relieving this insufficiency.

There are numerous examples of the efforts of the public authorities to enhance market liquidity, and some are presented in Section 4 of this paper. In practical terms, however, it is noteworthy that many policies implemented by the public authorities to enhance market liquidity, in particular in the field of government securities markets, seem to have originated in direct private interests rather than from the recognition of its public value. This is perhaps particularly evident in the euro area, given the restructuring of many government bond markets in the context of the more competitive environment brought about by the introduction of the euro. Against this background, the importance of a deep and liquid secondary market to lower (or to maintain at low levels) the cost of funding of governments on the primary market has been presented as the main rationale for reforms in product design in particular. The acceleration of reforms immediately ahead of or after the introduction of the euro may, however, raise the question of why they had not been initiated before. One answer may be that the

[14] Market liquidity may or may not be excludable, depending on whether the public community considered is that of market participants alone or the entire jurisdiction of a country. But it is even less likely that market liquidity is non-rival, insofar as it relates to the absorption capacity of a market. In the context of the simple framework proposed in the first section of this paper, if an end user enters into a transaction with a liquidity producer, he "consumes" a certain amount of the capital allocated to the market by that producer. This therefore reduces the ability of another end user to initiate another transaction in the same direction with the same producer. Accordingly, the consumption of liquidity by one end user reduces the potential consumption of liquidity by another.

existence of a more or less captive source of domestic funding at the time limited the private benefits - for the issuer - of a higher degree of liquidity of government bonds. It may also mean that the public benefits this liquidity entails had not been fully recognised, despite the example of countries such as the United States, where the benefits of liquid government bond markets had been evidenced for many years.

The trend towards the creation of more or less autonomous government agencies responsible for the management of the public debt, with clearly defined mandates, may also be interpreted as a reflection of the pre-eminence of the private approach to market liquidity. As an example, the Swedish National Debt Office has a statutory objective to minimise the direct cost of funding of the government. It is not entitled to incur any cost (including presumably an opportunity cost) for the explicit purpose of generating positive externalities from the government bond market to the rest of the economy. The same applies to a large extent to many treasuries, which admit that their decisions, with respect in particular to product design and/or infrastructure, answer essentially to proprietary motives.

Under such an approach, it might not be possible to create assets that provide benefits by, for instance, completing financial markets,[15] unless these assets provide a clear and immediate funding cost reduction for the government.

The focus on the private interests of the government does not mean that the optimal level of liquidity is not generated, in particular as the same good tends to provide both private and public benefits. In addition, a reflection on the desirability of public policies aiming at enhancing liquidity needs to start with an assessment of which are the key segments of the financial system, where liquidity generates the most significant externalities. For instance, it is likely that the existence of at least one liquid interest rate market is desirable for the purpose of facilitating the valuation of other assets, for the management of financial risk associated with these other assets, for cash management purposes, etc. It is by no means certain that it must be the government bond market that fulfils this role. To the extent that market forces alone do not bring about the desired level of liquidity in at least one market segment, however, public policymakers may need to become involved. In practice, they have in many cases, through a multitude of different actions. These form the subject of the next section.

4. A taxonomy of public policies aiming at enhancing market liquidity

Just as the various determinants of market liquidity could presumably be interpreted in the light of the simple analytical framework presented in Section 2 of this paper, the various policies aiming at enhancing market liquidity can probably be interpreted with the same framework. In the following paragraphs, three types of policies are identified. Firstly, there can be policies whereby public authorities directly produce a certain amount of market liquidity. Secondly, there are policies whereby the authorities subsidise the production of liquidity by a selected number of private providers. Thirdly, there are policies whereby the authorities contribute to a technological improvement available to all producers, which effectively lowers production costs.

4.1 Direct production of market liquidity by public authorities

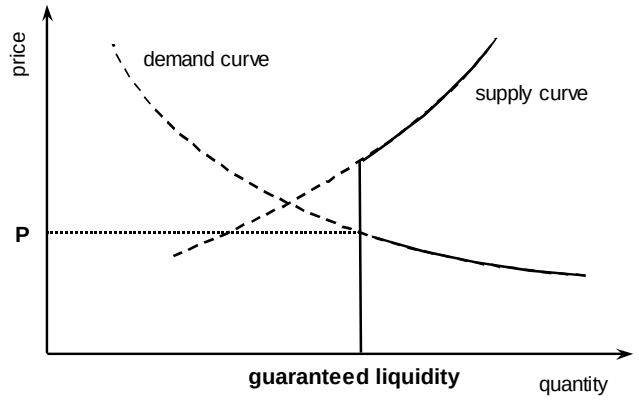
A first type of policy by which public authorities can influence the degree of liquidity of a market is if they themselves produce liquidity. This implies that the authorities are willing to enter into a transaction (and to take the associated financial risk) on request by end users. Such a policy would amount to setting a floor to the amount of liquidity in a particular market, even when the production cost of liquidity for private producers is too high and liquidity should accordingly dry up. In essence, such a policy would qualify the authorities as a market-maker of last resort.

Using the small analytical model proposed in Section 2 of this paper, one can graphically represent the situation with the following chart.

[15] Inflation-linked bonds, for instance, could possibly be considered as such an asset. The possibility of stripping government bonds probably also qualifies in this category.

Chart 3

Production by the public authorities of a guaranteed amount of market liquidity



If the authorities wish to ensure that the degree of liquidity of the market is at least equal to a guaranteed amount, they should be able to provide liquidity at a maximum cost equal to *p* on the chart, ie the price for which demand will be equal to the desired amount. In that case, to the extent that the cost of production of the same amount of liquidity would exceed the price charged to end users, the difference between the two would have to be subsidised by public funds. Such a policy would only make sense if the externalities created by the existence of a guaranteed amount of liquidity exceed this subsidy.

A possible justification for such a policy would be if a particular market took on systemic importance in the public authorities' jurisdiction, so that a total dislocation of that market could have massive repercussions on the whole financial system and economy. In that case, a role of market-maker of last resort could *in theory* be likened to the traditional role of central banks as lenders of last resort in the event of a run on banks.

In practice, such types of situations or policies are of course very rare, but there are some examples which conform more or less precisely to this situation.

A related example may be the situation of exchange rate arrangements, such as the ERM and ERM II, which imply potentially unlimited interventions of the central banks at the margin. In a way, these policies imply that central banks produce unlimited (or quasi-unlimited) amounts of market liquidity at the margin. Of course, the purpose of such currency arrangements has very little to do with liquidity provision per se.

More to the point, several national treasuries conduct trading activity on their own government debt, notably so as to ensure that retail investors are guaranteed the possibility to buy or sell government bonds at all times and at "fair" prices. The Fonds des Rentes established by the Belgian Treasury is one example at hand. This activity constitutes, in its own way, a guaranteed (if limited) liquidity-providing service.

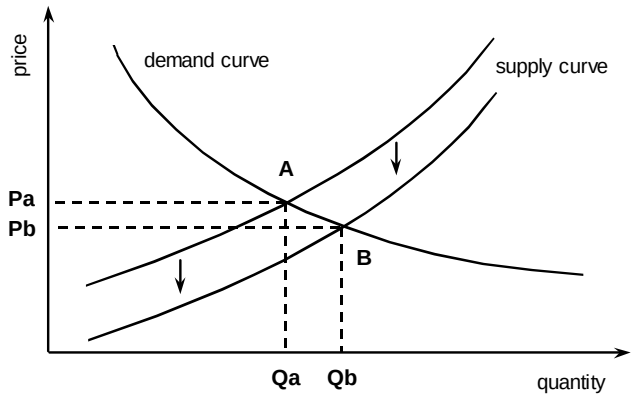
Many treasuries have also created special facilities to give market participants the possibility to borrow, or purchase outright, government securities in short supply, with a view to alleviating price volatility or preventing market manipulation. Insofar as these policies imply that the authorities are willing to enter into such a transaction more or less on request, they are similar in essence to guaranteeing a certain amount of liquidity in the repo market. The IMF, in its international capital reports for 2001, suggested that such a policy could be applied with benefits to the segment of German government bonds deliverable against the bund and bobl futures contracts. The justification for advocating such a policy is that squeezes in the government securities markets reduce the efficiency of the bond, derivatives and repo markets and, in turn, of all the markets in which these instruments are used for the purpose of valuation, hedging, etc.

4.2 Public subsidies to the production of liquidity

Another type of public policy that can enhance liquidity consists in subsidising the provision of liquidity by private producers. Once again, this can be illustrated graphically as indicated in the chart below.

Chart 4

Public subsidies to the production of liquidity



In this case, the public subsidy lowers the net production cost per unit of liquidity, and therefore, all things equal, is likely to both reduce its price for end users and increase the amount produced and consumed. To the extent that the social benefits exceed the cost of the subsidy for the public authorities, this policy would be justified.

The one example of such a type of policy that springs to mind is the primary dealership or official market-maker status established in many countries for a variety of markets, ranging from foreign exchange to government securities, inter alia. Market-making arrangements typically function as subsidies because the market-makers, as a group, normally benefit from an oligopolistic rent. This rent can take several forms. Commonly, primary dealers have privileged access to the primary market (hence their name). In Spain, for instance, they also have access to a “second round” of bidding in government-held auctions, which takes place after competitive bidding has been closed. Primary dealers also typically hold a monopoly over the activity of stripping government bonds. Official market-makers may also be the only counterparties the official sector uses for its commercial transactions, for central bank operations or for other purposes.

The counterpart to this rent is the obligation to quote two-way prices, with maximum bid-ask spreads, to end users. In other words, the production of liquidity is subsidised.

It may be underlined here that subsidies to the production of liquidity may not necessarily originate from the public sector. They may also originate from the private sector, if the issuer of the assets traded in the market is in a position to impose a solution to what is essentially a coordination problem. In the case of government securities, the end users are willing to pay for the liquidity of the assets by giving up a yield premium, which is therefore “earned” by the government. By surrendering this income to the market-makers in the form of a rent, the government only completes the market for liquidity. Insofar as the rent paid by the government to market-makers is lower than the income it received from investors, a coordination problem within the three groups has been solved and this need not affect the rest of the community. A similar solution applies when, for instance, private issuers enter into a contract with the lead managers of a bond issue, whereby the banks agree to make a market for these issues.

Subsidies take on a fully public character when the subsidy required by the producers to make a market exceeds the private benefits earned by the issuer through a yield premium. In that case, the decision to subsidise market liquidity may still be justified if there are sufficient externalities to be earned from the existence of liquidity, outside the group of direct end users, market-makers and issuer.

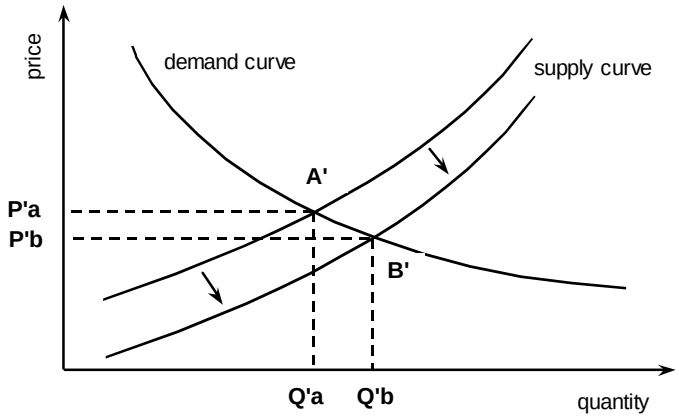
4.3 Contribution to technology

The third, and probably the most frequent policy by which authorities can enhance the production of liquidity is by contributing to improvements in production technology. Productivity improvements lead to a lowering of the production cost of liquidity (always in terms of the amount of capital immobilised by this production) and therefore allow more liquidity to be produced at a lower price. By reference to the model used throughout this paper, this situation is fairly similar to the previous one. It results in a downward translation of the supply curve, which leads to a presumably more favourable equilibrium. There are, however, two differences between this type of policy and direct subsidies. Firstly, while subsidies tend to be restricted to a limited number of liquidity producers, improved technology in principle benefits all producers. Secondly, while subsidies must be paid in each period, technological improvements may require an initial investment but thereafter yield permanent benefits.

One example of a contribution to technology that lowers the production cost of liquidity is product design. It is generally agreed that the concentration of issuance in a few large benchmarks well distributed along the maturity spectrum tends to enhance the liquidity of government bonds. In that case again, not only governments but all issuers may be able to promote liquidity by providing dealers with assets for which it is relatively easier and cheaper to produce liquidity. Jumbo Pfandbrief issuance and US agency benchmark programmes fall into that category.

Chart 5

Effects of technological improvement on liquidity



To the extent that the larger the free-float of a type of assets, the cheaper it is to produce liquidity, another way in which authorities may contribute to enhancing liquidity is by avoiding reducing this free-float in the context of their own operations. This applies in particular to monetary policy operations and is summed up by the statement by the Reserve Bank of Australia that, had it not changed its operating procedures, it “would now be holding about 40% of the combined total of securities issued by the Commonwealth and State governments. Clearly, this would not be a viable situation as the market would have great difficulty functioning in such circumstances”.

Market design can also contribute to a more capital-efficient technology. The introduction of, in particular, electronic trading platforms, in some cases combined with market-making requirements for participants, is generally understood to have positively contributed to market liquidity. The electronic inter-dealer market(s) MTS and the electronic interbank money market MID created in Italy in 1988 and 1990 respectively both contributed to enhancing market liquidity and efficiency. Public authorities fostered these initiatives in both cases. In a broadly similar manner, national treasuries have been instrumental in the establishment of other national MTS markets across Europe, eg in Belgium.

More generally, one can interpret the five recommendations issued by the CGFS for the design of deep and liquid markets as measures aimed at improving the productivity of liquidity production by reducing the amount of capital this production requires. These recommendations apply to government bond markets, but the underlying principles may apply to all markets.

The first of these recommendations refers to the desirability of an appropriate distribution of issues along the maturity spectrum and to the establishment of large benchmarks, as discussed above. The second refers to the desirability of minimising the liquidity-impairing effect of taxes (discussed also in Section 2.4). The third refers to the desirability of transparency of information regarding issuance and trading, with due attention to the anonymity of market participants. The fourth refers to the benefits of safety and standardisation in trading and settlement practices, ie to the capital-saving benefits of lower operational risks. Finally, the fifth recommendation refers to the desirability of developing repo, futures and option markets related to government securities markets, all of which enlarge the options offered to a liquidity provider to hedge his positions, and hence lower his risk per transaction.

While in principle technology improvement does not require public intervention, it might arguably be useful or necessary in some situations. This would be true in particular when technological improvement itself is a public good within the community of dealers, ie when in particular it is non-excludable (the fact that it is non-rival is taken for granted). In such cases, there may be disincentives for one market participant to develop (at a cost) a technology that will benefit all of his competitors. That would typically be a situation that could require action defined by the Bank of England as “acting as a catalyst for collective actions when market forces alone are deficient”.

Another case for public involvement refers to the situation where the improvement in technology is by definition a privilege of the authority, such as the avoidance of transaction taxes, sound supervision of financial institutions and the oversight of payment systems, etc.

5. Conclusion

This paper was initiated as a discussion paper and therefore is intended more to raise questions than to provide answers. A few conclusions may, however, be proposed.

Firstly, there is a wealth of examples of public policies aiming directly or indirectly at enhancing liquidity in key segments of the financial markets. While some of these policies do have the proprietary interests of the government or the central bank in mind, many aim at achieving more global social benefits.

Secondly, if market liquidity entails significant positive externalities across the financial system at large and, through it, to the entire economy, such policies are not only justified, but may even be necessary.

Thirdly, the question of the desirability or otherwise of such policies is likely to gain importance along with the share of market-based financing in the economy, especially for those economies which tend to be lagging in this process. This includes emerging economies, but also some large developed economies, such as the euro area.

Fourthly, the appropriateness of policies aiming at enhancing liquidity should be assessed on the basis of a comprehensive cost-benefit analysis for the public sector. This implies in particular the identification of those markets in which market liquidity provides the strongest externalities.

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