

### III. Special feature: Market liquidity and stress: selected issues and policy implications

Since turbulence engulfed financial markets in mature economies in autumn 1998, market liquidity has attracted increasing attention on the part of market participants, central banks and regulatory and supervisory authorities. In particular, perceptions of a persistent reduction in market liquidity in a number of segments of global financial markets have raised questions about their potential vulnerability to financial disturbances.

The purpose of this note is to explore some of the issues raised by these developments. The first section defines two closely related notions of liquidity, namely market and cash liquidity. The second explains the reasons for the growing interest in market liquidity. The third draws some lessons about the determinants of market liquidity from past episodes of market turmoil. It argues that for a proper understanding of liquidity under severe stress, the interaction of basic order imbalances with cash liquidity constraints and counterparty risk needs to be explained. Leverage and risk management play a key role. It also suggests that some factors that may contribute to liquidity in normal times can actually make it more vulnerable under stress. The final section considers some policy implications.

#### What is market liquidity?

Much like systemic risk, *market liquidity* is more easily recognised than defined. A working definition is that a market is liquid if transactions can take place rapidly and with little impact on price. So defined, market liquidity has several dimensions.<sup>20</sup> *Tightness* refers to the difference between buy and sell prices, for example the bid-ask spread in a quote-driven market. *Depth* relates to the size of the transactions that can be absorbed without affecting prices. *Immediacy* denotes the speed with which orders can be executed, and *resiliency* the ease with which prices return to “normal” after temporary order imbalances.<sup>21</sup>

The notion of market liquidity is closely related to that of *cash* or *funding liquidity*. Cash liquidity can be defined as the ability to realise (“cash in”) value, either via the sale of an asset or access to external funding.<sup>22</sup> This is what underpins an institution’s capacity to meet its contractual obligations. In modern financial markets, funding liquidity is best thought of as including command not only over cash and deposits, but also over other instruments that can be used to meet margin calls and hence, effectively, settle transactions, most commonly government securities.

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<sup>20</sup> See CGFS (1999a) and BIS (forthcoming).

<sup>21</sup> There may be a trade-off between these various dimensions. For instance, greater competition among institutions providing market-making services can improve tightness (for example by narrowing the bid-ask spreads). However, by reducing the profitability of the activity, this can lead to a withdrawal of capital from it and to a deterioration in market depth, unless offset by other factors.

<sup>22</sup> The loose and general notion of “liquidity” is closely related to cash liquidity. Often, market commentators make statements such as “ample liquidity is boosting asset prices”. One way of interpreting this is that market participants have sizeable liquid funds to invest, either because the share of particularly liquid assets (eg money and money substitutes) in their portfolios is high or because they can obtain ample and cheap external finance, especially in the form of credit.

The relationship between market and cash liquidity is a multifaceted one. Some of the links are obvious. For instance, selling an asset in a market or unwinding a profitable position is one way of raising cash. Others, however, are less apparent. In particular, it will be argued below that access to external funding can underpin market liquidity and that the mechanisms that lead to the disappearance of cash liquidity under stress can be similar to those that lead to the evaporation of market liquidity.

### Why do we care (increasingly) about market liquidity?

There are two reasons why market liquidity has been attracting increasing attention on the part of market participants, central banks and regulatory and supervisory authorities. The first relates to the long-run development of the financial system, the second to more recent events.

A salient characteristic of the evolution of financial systems since at least the 1970s has been the rapid growth of financial markets. It is only natural that market liquidity should have gained in importance, as a factor underpinning the smooth functioning of the financial system and conditioning the daily activities of economic agents, including pricing, trading and risk management.

Central banks, for instance, have shown a growing interest in market liquidity from the perspective of their responsibility for both monetary and financial stability. As regards monetary stability, the shift towards market-oriented operating procedures<sup>23</sup> and the greater use of asset prices as a guide for policy have put a premium on market liquidity. For example, the reliability of estimates of market participants' expectations about inflation as derived from yield curves depends crucially on the liquidity of the underlying market.<sup>24</sup> As regards financial stability, central banks and supervisory authorities have made growing use of asset prices in the monitoring of vulnerabilities in the financial system, as they contain information about market participants' assessment and pricing of risks. The validity of this information in turn underpins market discipline, an aspect that has received increasing attention in recent policies.<sup>25</sup> Above all, as financial institutions have come to depend more and more on markets for their risk management, *robust market liquidity under stress* has become critical and, in turn, increasingly influenced by risk management practices. The dislocations generated by the evaporation of liquidity in some key fixed income and foreign exchange markets in autumn 1998 are a clear illustration of the heightened significance of market liquidity for financial stability.<sup>26</sup>

In fact, the Asian crisis in 1997, and especially the turbulence in mature markets in autumn 1998, represented a watershed in market liquidity conditions in several segments of global financial markets. To the surprise of many observers and market participants alike, these episodes of financial distress heralded a protracted period of diminished market liquidity. While many markets have recovered since then, questions remain about the scope, causes and possible implications of these developments. In particular, lingering doubts have been voiced about the resilience and robustness of market liquidity in the current environment.

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<sup>23</sup> In particular, technical liquidity management operations, which are not intended to convey signals about the stance of policy, rely on liquid markets that allow transactions to take place without affecting the underlying price. In the case of the Federal Reserve, for instance, all market operations are of this kind, as the key policy signal is represented by announcements of the target federal funds (overnight) rate. See Borio (1997) for an elaboration on the link.

<sup>24</sup> See, for instance, BIS (1998a).

<sup>25</sup> Notably, market discipline has become Pillar 3 of the new capital adequacy proposals. See BCBS (1999a).

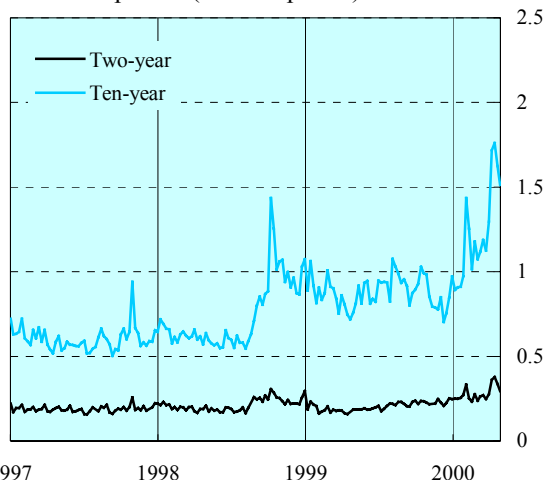
<sup>26</sup> The growing interest in market liquidity on the part of central banks is reflected in several recent publications of the Committee on the Global Financial System (formerly known as the Euro-currency Standing Committee), the standing committee of senior central bank officials that has among its tasks that of examining the functioning of markets. These publications include a report that explores the determinants of liquidity in government bond markets (CGFS (1999a)), a set of guidelines for the establishment of deep and liquid government bond markets, with particular reference to emerging market countries (CGFS (1999b)), and a report that investigates the dynamics of the evaporation of liquidity during the market turbulence in 1998 (CGFS (1999c)).

Given the difficulties in measuring market liquidity, its evolution is hard to document. In spring 1999, surveys of market participants pointed to perceptions of a widespread reduction in market liquidity in several markets relative to the pre-turbulence period. This was especially true for fixed income and foreign exchange instruments, both with respect to tightness and depth. A variety of measures suggest that the decline in tightness and depth since 1997-98 has been most marked and persistent in the US government bond market (Graph III.1). Markets for dollar fixed income instruments from emerging economies also appear to have been lastingly affected, though to a lesser extent (Graph III.1).<sup>27</sup> This also appears to apply at least in part to foreign exchange markets. According to market sources, forex turnover declined markedly in autumn 1998, when the broad financial market turmoil was

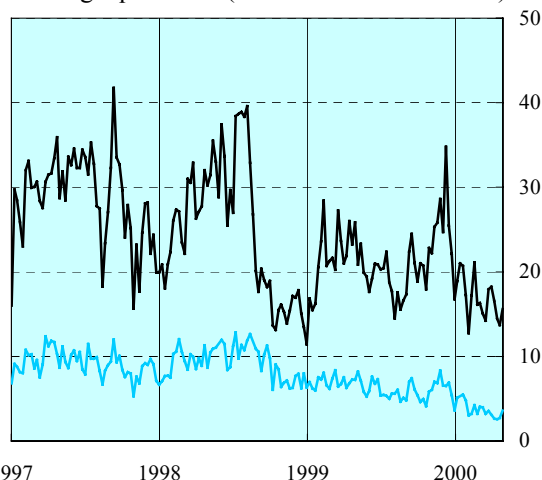
Graph III.1  
Indicators of market liquidity in bond markets

US Treasury securities

Bid-ask spreads (in basis points)

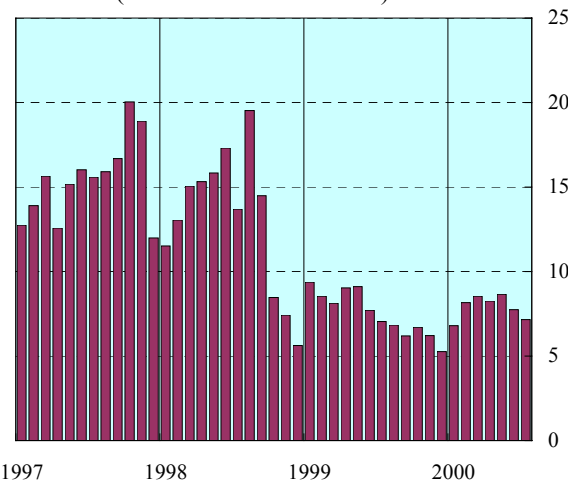


Average quote size (in millions of US dollars)

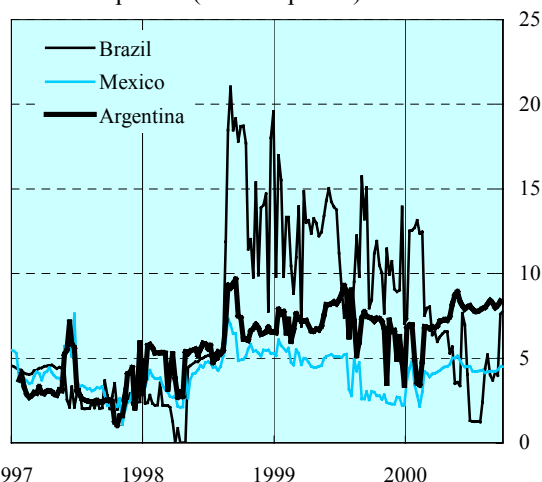


Dollar-denominated emerging market bonds

Turnover (in billions of US dollars)<sup>1</sup>



Bid-ask spreads (in basis points)<sup>2</sup>



<sup>1</sup> Daily average turnover of 25 most traded bonds in one month. <sup>2</sup> Of most actively traded bonds; weekly averages.

Sources: Federal Reserve Bank of New York; Fleming (2000), based on data from GovPX; Bloomberg; Euroclear.

<sup>27</sup> Some local currency fixed income markets, however, are more liquid than ever, as a result of the steps taken to develop them.

accompanied by a global reduction in liquidity. The decline was particularly pronounced in emerging markets, as described in more detail in the box “Forex trading volumes, volatility and spreads in emerging market countries”, on pages 49-51. In the months that followed, global forex turnover appeared to have recovered but to levels well below those reached in 1998. Measures of tightness too seem to have recovered since then, as suggested by a normalisation of spreads in emerging market countries.<sup>28</sup>

These indicators, however, are not forward-looking. Their message, therefore, has failed to dispel the perception that the depth of markets, particularly under stress, may be less robust than in the past.

Several reasons can be put forward for the perceived decline in market liquidity. Some of these are in part related to the recent episodes of market turbulence, which have arguably played a catalytic or reinforcing role. Others reflect independent structural developments.

Severe dislocations leave a legacy of reduced liquidity in the market segments affected. Scars take time to heal, especially if market-makers experience severe losses and doubts arise about the profitability of trading strategies, or validity of hedging practices, that were directly or indirectly providing liquidity to the market in normal conditions. There is, for instance, evidence of a protracted reduction in market liquidity in some segments of equity markets following the crash of 1987.<sup>29</sup>

These ingredients were again evident in the recent episodes of market turbulence. In Asian and, subsequently, US markets, institutions providing liquidity services came under strain as a result of the financial turbulence. Strategies that had proved consistently profitable suddenly generated huge losses, as exemplified by foreign currency carry trades and relative value arbitrage transactions. The turmoil accelerated the exit from the industry of market players who had been contributing to a perception of liquidity by taking the other side of trades in the tranquil market conditions that preceded the turbulence, such as some macro and relative value arbitrage funds. The winding-down of Long-Term Capital Management is just the most salient example, as some large macro funds have since voluntarily exited.<sup>30</sup> Hedging operations in government bond markets were thrown out of kilter as the spread between government and corporate securities defied previous historical relationships, encouraging a shift away from government securities towards swaps for hedging purposes. Reportedly, the turbulence was a factor inducing several institutions to strengthen risk management and reassess the risk/reward trade-off associated with market-making, apparently leading to a reduction in the amount of capital devoted to this activity. This response may have been reinforced by the trend towards global consolidation among market players. Apart from limiting the need to execute trades in the market, this trend is encouraging cutbacks in position and credit limits.

As elaborated further in the special feature “Size and liquidity of government bond markets”, on pages 52-58, in the US government bond market the announced debt repayment programme has been a major contributor to the persistence of the reduction in market liquidity. After some transition difficulties, part of that liquidity migrated to swaps markets, whose role as benchmarks for pricing and as hedging vehicles has increased.

Finally, and more speculatively, questions have been raised about the impact of the proliferation of electronic trading platforms. One concern is that this may lead to an excessive fragmentation of market

<sup>28</sup> There is also some evidence that the price impact of trades associated with transactions by non-residents in equity markets has failed to recover to pre-turbulence levels in several emerging market countries (Persaud (2000a)).

<sup>29</sup> See, for instance, BIS (1988) and International Stock Exchange (1988). The imbalance between demand for and supply of market liquidity cannot be detected in direct measures of market depth and tightness but may be seen indirectly in the relative yield on securities. Thus, when the imbalance is especially high, the premium on liquidity increases, so that the return required on less liquid securities rises in comparison with that on their more liquid counterparts. This pattern is typical of flights to safety.

<sup>30</sup> See the special feature “Hedge funds” on pages 61-71.

liquidity.<sup>31</sup> Another, more controversial, concern is that the shift towards auction-based trading mechanisms that has accompanied the spread of electronic platforms might reduce market depth.<sup>32</sup>

While the potential factors affecting market liquidity can easily be listed, it is fair to say that we lack a good understanding of their relative importance or, indeed, of the scope and implications of the processes at work. This lack of understanding and the greater awareness of the ease with which liquidity can evaporate even in highly developed financial markets, not least on the part of official authorities and risk managers, have no doubt contributed to a lingering sense of unease.

### **What determines market liquidity under stress?**

Against this background, attempting to draw some lessons about the determinants of market liquidity from past episodes of market turbulence becomes all the more important. What follows highlights four propositions and selected implications.

The *first lesson* is that the relative significance of the factors that determine liquidity under normal conditions and under stress can differ substantially. In particular, under severe stress counterparty risks and liquidity constraints can be of first-order importance, whereas they are not generally binding otherwise.<sup>33</sup> There are at least three reasons for this.

First, while sometimes overlooked, the process of trading can generate large, albeit in some cases short-lived, credit exposures, which make the willingness to transact a function of counterparty risk. Credit exposures are generated in the settlement process. In this case, they arise from the lack of synchronisation between the payment and delivery legs of transactions, for both securities and foreign exchange (eg, so-called Herstatt risk), from the financing needed to meet delivery-versus-payment trades, and, to a lesser extent, from the lags between trading and settlement dates.<sup>34</sup> In addition, counterparty risk is inherent in derivatives transactions, where the size of the exposure can be very sensitive to the change in market prices. As risk management tools, derivatives originally targeted market risk. A neglected consequence, however, was the creation of credit exposures associated with the trades that have a positive market value vis-à-vis counterparties. The pyramiding of transactions often needed to take or hedge positions adds to these credit risks. Finally, external funding is common to finance positions and inventories, for example through repos.

Second, the exposures and risk profiles arising from trading can be just as opaque as those of traditional loan portfolios, and possibly even more so. Opaqueness is associated with complex trading strategies and the speed with which information can become stale.

Finally, the functioning of securities and derivatives markets relies fundamentally on the availability of cash liquidity. At bottom, settlement can be seen as a mechanism through which economic agents limit or eliminate counterparty risk. Trading generates enormous settlement volumes that need to be financed; for each seller, there is a buyer. And even instruments designed to limit average settlement

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<sup>31</sup> Greenspan (2000), for instance, discusses these concerns with respect to equity markets. Levitt (2000) considers the reasons for, and obstacles to, intermarket linkages.

<sup>32</sup> A common view is that quote-driven markets, where market-makers stand ready to buy and sell at posted prices, can be more liquid than order-driven markets, where no such specialised tasks are performed. There is, however, no clear evidence that this is indeed the case under stress (see below). Moreover, liquidity in quote-driven markets depends critically on the continued viability and soundness of the market-makers themselves, which may raise particular concerns in those market segments where concentration in the market-making business is very high.

<sup>33</sup> The bulk of the academic literature, by contrast, deals mainly with questions of asymmetric information, where some traders are assumed to know more about the value of the asset traded than others, or concerning pre-trade and post-trade information, since liquidity under stress is not their focus. For excellent reviews, see O'Hara (1995) and Lyons (forthcoming). More recently, some attention has started to be paid to net wealth and liquidity constraints; see for example Kyle and Xiong (2000).

<sup>34</sup> See, for instance, Borio and Van den Bergh (1993).

volumes can generate highly variable cash needs, which balloon at times of stress as prices change sharply. For instance, to the extent that they do not require repayment of principal, futures or interest rate swap contracts reduce the settlement and counterparty risks compared with the cash transactions that would replicate the same payoffs. But the daily marked-to-market margining and settlement of these contracts mean that the corresponding demands on cash flows rise,<sup>35</sup> possibly non-linearly, as market prices move.

As a corollary, a market can stop functioning, or seize up, in ways that are similar to how a financial institution can fail to meet its obligations when starved of cash: concerns about the creditworthiness of counterparties<sup>36</sup> and the influence of liquidity constraints underlie both processes. The *willingness* to trade is undermined by doubts about the capacity of counterparties to settle the transactions. The *ability* to trade can be heavily curtailed by the lack of the external funding needed to engage in trades and honour margin calls. Moreover, cash and market liquidity tend to reinforce each other. An inability to raise external funding can force the generalised liquidation of profitable positions, while rapidly changing prices can result in surging funding needs. The interaction between concerns about counterparty risk and liquidity constraints was highly apparent in the market turbulence of autumn 1998, but had also been a factor in previous episodes of severe stress, such as the failure of Drexel Burnham Lambert and the 1987 stock market crash.<sup>37</sup>

The bottom line is that the distinction between markets and institutions is sometimes overemphasised. In particular, the conventional wisdom that the growth of markets for tradable instruments significantly reduces the risk of funding liquidity crises should be questioned. Modern financial markets rely on access to funding liquidity, while trading counterparty risks together with mark-to-market practices and margining can make funding needs highly variable and vulnerable to crises of confidence. Moreover, the process of the evaporation of liquidity under stress has certain self-fulfilling aspects to it. Concerns about prospective lack of liquidity or large pending orders can exacerbate order imbalances. For all of these reasons, one could say that markets, just as institutions, can be subject to runs.

The *second lesson* is that the arrangements for dealing with counterparty risk in the various market segments can play a major role in determining market liquidity under stress. All else being equal, markets with centralised counterparties can be more robust as long as the soundness of the central counterparty is ensured.<sup>38</sup> The corresponding risk mitigation and sharing mechanisms as well as greater transparency are factors that facilitate trading under stress. There is, in fact, a well documented tendency for exchange-based derivatives markets, where participants tend to lay off their residual risks, to act as a kind of market liquidity provider of last resort for OTC markets.<sup>39</sup> Experiences during autumn 1998 or at the time of the bond market crash in 1994 are no exception. Arguably, these market

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<sup>35</sup> In this case, cash should be interpreted broadly to include any asset that can be used to meet margin calls.

<sup>36</sup> And, via trading links, concerns about the creditworthiness of the counterparties of counterparties, etc.

<sup>37</sup> See CGFS (1999c) and BIS (1988) and (1994). In particular, the CGFS report characterises the market turbulence in 1998 as a “global margin call”. Beyond obvious similarities, the episodes exhibited a number of differences. For example, compared with the 1998 market turbulence, during 1987 deleveraging was arguably less significant and the source of order imbalances had more to do with positive feedback trading strategies such as portfolio insurance; see also CGFS (1999d) and Gennotte and Leland (1990). Likewise, the disruptive interaction of markedly different sets of trading, regulatory and institutional arrangements was more prominent in 1987. These differences can exacerbate large and sudden intermarket trading flows, distort price and quantity signals and make it harder to distinguish liquidity from solvency problems; see, notably, Presidential Task Force (1988).

<sup>38</sup> This need not be the case, as illustrated by concerns about the soundness of the Options Clearing Corporation at the time of the 1987 stock market crash. See, for example, Securities and Exchange Commission (1988) and Bernanke (1990).

<sup>39</sup> For an examination of clearing and settlement arrangements in OTC and exchange-based derivatives markets, see CPSS (1998a) and CPSS (1997).

characteristics are more relevant than others, such as the distinction between quote-driven and order-driven markets, which often appear to attract more attention.<sup>40</sup>

The *third lesson* is that the dynamics of market liquidity depend crucially on the performance of risk management systems. Market participants, and especially market-makers, need to make sure that they operate with sufficient cushions in terms of capital and liquidity so as not to be forced into the liquidation of positions and distress selling that would exacerbate market strains. Likewise, they should have sufficient information about their counterparties so as to be able to take informed decisions about the risks they wish to incur. And risk management strategies that assume *ex ante* the existence of liquid markets in which to hedge and lay off risks lead to pressure on those markets and reduced market liquidity precisely when it is most needed.<sup>41</sup>

A corollary is that financial institutions that structurally provide liquidity to the economy in normal times may not necessarily be the best suited to supply market liquidity under stress. The reason is that they would tend to finance their market-making activity through leveraged positions and short-term funding. All else being equal, this would imply a greater sensitivity of their net wealth and funding positions to changes in market prices. In turn, this would naturally result in shorter investment horizons under stress. This puts a premium on proper risk management to overcome the possible comparative disadvantage of their funding and liability structures.<sup>42</sup> From this perspective, the balance sheet structure of pension funds or insurance companies may make it easier for them to provide liquidity in periods of strain than it would be for banks and, in particular, securities firms. Conversely, risk management processes of institutional investors that do not exploit their potentially longer investment horizon can unnecessarily add to strains on market liquidity. An obvious example was the widespread use of portfolio insurance strategies in the run-up to the 1987 stock market crash.<sup>43</sup>

The *fourth lesson* is that episodes of severe strain on market liquidity are often preceded by extended periods in which, at least with hindsight, balance sheets become overextended through the accumulation of leverage, that is, risk exposure relative to capital. In other words, one needs wood to make a fire, and the intensity and life span of the fire depend on the amount of wood available. In 1997, for instance, the wood was represented in particular by carry trades in Asian currencies, in 1998 by the proliferation of relative value and credit risk arbitrage strategies, and in 1994 by yield curve plays.<sup>44</sup>

The implication is that, in the run-up to the financial strains, markets may appear *artificially liquid*. The success of (leveraged) trading strategies generates profits, adds to market-making capacity and lulls participants into a false sense of security. Liquidity may be perceived as highest precisely when it is most vulnerable.

Seen from this perspective, the current situation can give rise to contrasting assessments. The glass can be seen as half full. Market liquidity could justifiably be regarded as having been artificially high before the market turbulence and as having returned to more realistic levels after a traditional overshooting. This view would stress the benefits deriving from more sober assessments of risk/reward trade-offs and improved risk management practices. Remaining difficulties in certain

<sup>40</sup> For instance, the OECD (1991) concluded that it was difficult to judge which of the two types of market had performed more effectively during the 1987 stock market crash.

<sup>41</sup> For an interesting theoretical analysis of aspects of this problem, see Morris and Shin (2000). Thus, under stress the supply of liquidity is reduced precisely as the demand rises sharply. The change in the pricing of liquidity is also reflected in the increase in the spread between the less liquid securities and the most liquid ones, a situation that can persist for some time. See BIS (2000) and the special feature "Size and liquidity of government bond markets", on pages 52-58.

<sup>42</sup> However, normal access to central bank funding, both intraday and for longer maturities, can be a compensating factor.

<sup>43</sup> Albeit less damaging, increasingly popular trading practices, such as indexing, can also restrict the number of contrarians in markets.

<sup>44</sup> For 1997, see BIS (1998b); for 1998, see CGFS (1999b), BIS (1999) and IMF (1999); for 1994, see Borio and McCauley (1996), BIS (1995) and IMF (1995).

market segments, such as US government bonds, would be viewed as purely instrument-specific. The glass, however, can also be seen as half empty. Such an assessment would probably place more emphasis not on the specifics of market liquidity, but on remaining sources of potential systemic disturbances to global financial markets. It would also stress the risk of unpredictable responses in asset prices as market participants adjust to a world in which, for the foreseeable future, the traditional roles of US government bonds as benchmarks and a safe haven are diminished.<sup>45</sup>

### What can be done to promote robust market liquidity?

As the foregoing analysis makes clear, lack of market liquidity under stress is generally a symptom of problems that originate elsewhere. Prices in a market where order imbalances develop will need to adjust, that is precisely their function. Beyond seeking to ensure that the market allows willing buyers and sellers to transact,<sup>46</sup> the more critical issue is why and how the order imbalances develop in the first place. Market liquidity is only in part a property associated with market arrangements, such as market-making procedures or trading platforms. Market-makers, for instance, cannot be expected to stand in the way of the juggernaut. Ultimately, it rests on the way participants perceive and respond to risks and returns. And the *illusion of permanent market liquidity* is probably the most insidious threat to liquidity itself. Markets are *expected* to be liquid, loans are *known* not to be.

Some of the prerequisites for liquid markets in general are well understood. For example, in its guidelines for the development of deep and liquid government bond markets the BIS Committee on the Global Financial System lists the following factors: a competitive market structure, low fragmentation, minimisation of transaction costs, heterogeneity of market participants and a sound infrastructure.<sup>47</sup> But if the focus is robust liquidity under stress, some of these factors are arguably relatively more important (see below). Moreover, policies would need to address the root causes of order imbalances and the propagation of disturbances. Clearly, any policy that addresses financial instability would be relevant. What follows, however, focuses on a limited set, more closely related to market liquidity proper. Policies can be directed either to individual market participants or to markets generally and their infrastructure.<sup>48</sup> Each of these is taken in turn.

Policies aimed at individual financial institutions take two forms. The first is encouraging better risk management. The second is promoting the dissemination of better information about risk profiles.

Better risk management means practices that address and recognise the interaction between the different types of risk (market, credit and liquidity risk) and are tailored to the kind of activity performed. Measurement and management of counterparty risk are crucial. It also requires a keen awareness of the fact that actions that may appear reasonable from the perspective of individual institutions may actually worsen market outcomes. Following mechanistic defensive responses at times of stress is a case in point. For instance, the mechanical application of dynamic hedging, value-at-risk limits or equivalent stop-loss strategies could easily reinforce market movements, especially if the original design of these tools fails to incorporate the possibility that liquidity is variable and to a large extent endogenous. This can be a serious problem, but one which is very difficult to solve. Encouraging more forward-looking measures of risk may be part of the answer. Stress testing is one

<sup>45</sup> See the special feature “Size and liquidity of government bond markets”, on pages 52-58, and, for the safe haven role, Wojnilower (2000).

<sup>46</sup> Even this is not self-evident, given the long-standing debate that surrounds the desirability of circuit breakers, such as temporary trading halts.

<sup>47</sup> See CGFS (1999b) for further discussion of more concrete policy recommendations stemming from these general factors. See also APEC (1999). In addition, the special feature “Size and liquidity of government bond markets”, on pages 52-58, elaborates further on the policies that can be implemented to promote liquid government bond markets.

<sup>48</sup> Given the close linkages between firm behaviour and market liquidity, however, this categorisation is admittedly somewhat arbitrary.



such example, especially if informed by measures of market vulnerabilities (see below). Operating with greater *safety cushions* relative to the limits, which institutions can afford to run down at times of turmoil, is another. At a minimum, these cushions would provide breathing space to examine not only the risks, but also the potential rewards of taking a contrarian position. Partly under official prodding, the experience of 1998 has spurred a significant improvement in risk management philosophies and practices.<sup>49</sup> But it is widely recognised that further progress is called for.

Promoting the dissemination of better information about risk profiles involves strengthening standards of disclosure. Obviously, disclosure is not a panacea. Limitations in the use of information are arguably more serious than those in its availability. And difficult questions need to be addressed, including proprietary concerns, the feasibility of supplying information that is both meaningful and digestible, and the balance between comparability and relevance. Even so, providing timely information about risk profiles is a necessary condition for the proper measurement of risk and the exercise of market discipline.<sup>50</sup> Several initiatives are under way in this area.<sup>51</sup>

Policies directed to markets per se can be classified into two categories: those that pertain to market infrastructures and those that deal with the development of information about incipient market vulnerabilities.

Strengthening the market infrastructure is vital to ensure that the markets continue to function effectively under stress. The 1987 market crash, for instance, spurred a series of measures aimed at improving trading capacity and order execution.<sup>52</sup> More generally, upgrading clearing and settlement arrangements plays a key role, as it allows better management of counterparty risk and can dampen the propagation of disturbances. Efforts to promote the implementation of delivery-versus-payment or payment-versus-payment mechanisms, contract netting and cross-margining, to reduce settlement lags and to improve the legal underpinning of contracts are obvious examples. In recent years, considerable progress has been made in this area.<sup>53</sup>

In contrast, developing information about incipient market vulnerabilities is substantially harder and very much in its infancy.<sup>54</sup> By analogy with the provision of information about the risk profiles of individual institutions, its function would be to allow participants to assess the sources of strains that

<sup>49</sup> See, in particular, the efforts made by the private sector, as described in CRMPG (1999), the Basel Committee document on highly leveraged institutions (1999b) and the one evaluating the progress made since the original recommendations (2000). The special feature “Hedge funds”, on pages 61-71, discusses the management of counterparty risk vis-à-vis hedge funds and the various official efforts in this area in more detail.

<sup>50</sup> In addition to the efforts being made in national jurisdictions and by international regulatory bodies, work is being taken forward by a joint group that brings together representatives of the Committee on the Global Financial System, the Basel Committee on Banking Supervision, the International Organization of Securities Commissions and the International Association of Insurance Supervisors.

<sup>51</sup> It has long been recognised that, in certain circumstances, disclosure may actually be destabilising. This was the conventional wisdom regarding financial distress at banks, but the point has recently been made with respect to market crises too (eg Persaud (2000b)). Rather than an argument against disclosure per se, this can best be regarded as one in favour of *early* and *frequent* disclosure, so as to strengthen prevention and avoid discontinuities in the flow of information.

<sup>52</sup> See, for example, Lindsey and Pecora (1998).

<sup>53</sup> See BIS (1994) for an overview and CPSS (1998b) on progress in addressing foreign exchange transactions. A joint CPSS-IOSCO Task Force is in the process of developing recommendations for the design, operation and oversight of securities settlement systems, covering both individual systems and the cross-border linkages between them. For a description of cross-border securities settlement systems, see CPSS (1995).

<sup>54</sup> A related issue is the provision of information about the motivation behind trades. In particular, on the basis of the 1987 stock market crash experience, it has been argued that disclosing information about the volume of trading strategies insensitive to fundamental value, such as portfolio insurance, could alleviate the intensity of price movements and, by implication, strains on market liquidity. The reason is that traders would not erroneously infer from the selling pressure that views about the true or correct value of the asset have changed and would thus be more willing to accommodate the pressure. For the theoretical underpinnings of this argument, see, for instance, Gennotte and Leland (1990).

arise from the *commonality* of exposures and their *interaction*. This would inevitably be based on some form of aggregation of risk information about individual institutions. But exactly what information this should be or, indeed, whether the development of useful aggregate information is feasible are still very much open questions.<sup>55</sup>

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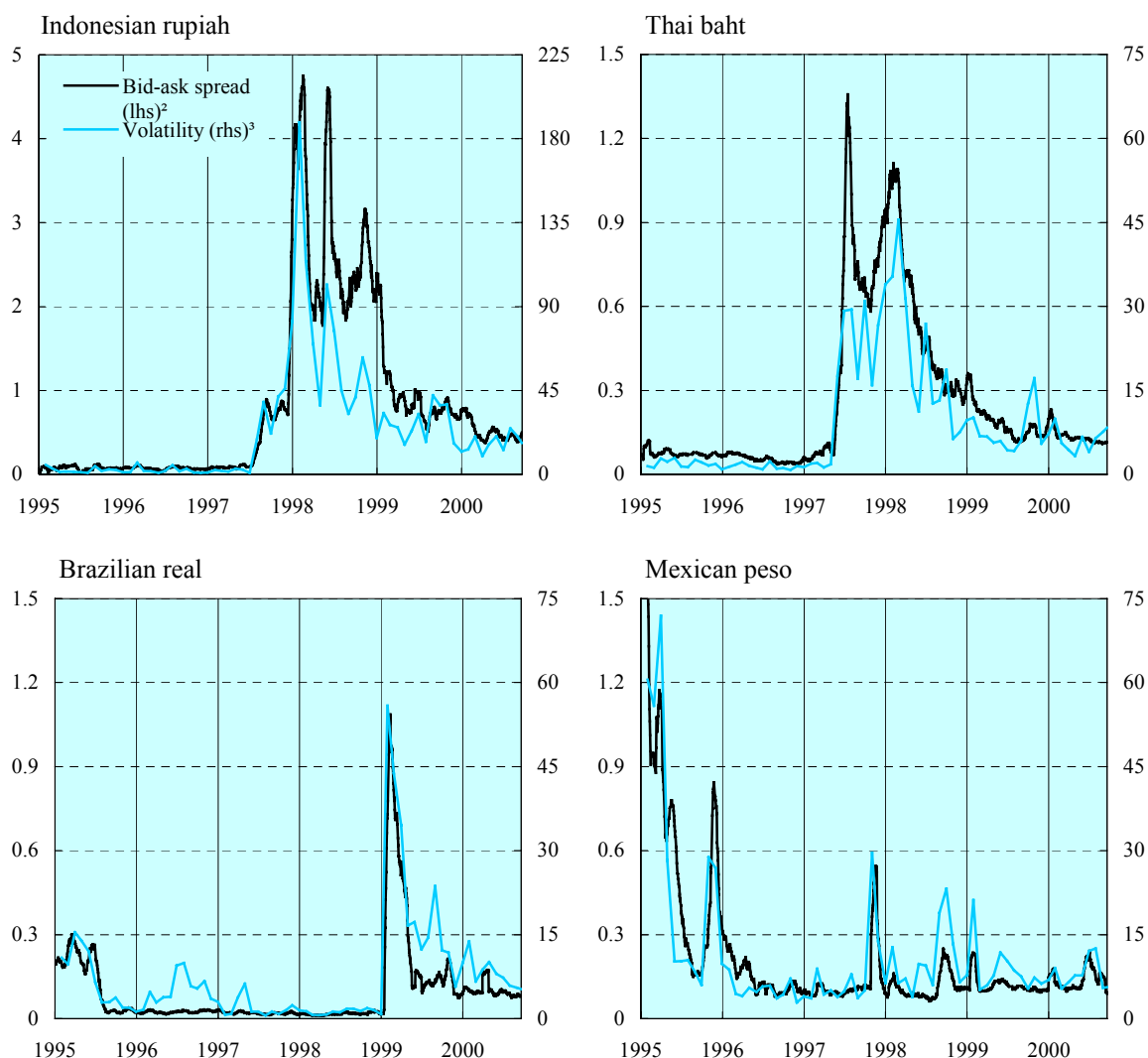
## Forex trading volumes, volatility and spreads in emerging market countries

Gabriele Galati<sup>①</sup>

Market participants and central banks are increasingly focusing on monitoring the current conditions of financial market liquidity and trying to assess how it is likely to evolve in the near future. This note describes how liquidity in the foreign exchange markets of emerging market countries has changed over the past five years. It examines: bid-ask spreads, which measure tightness; trading volumes, which can be viewed as being related to depth; and volatility, which is generally considered to be a measure of risk.

Graph A shows the behaviour of bid-ask spreads and historical exchange rate volatility for the dollar/baht, dollar/rupiah, dollar/real and dollar/Mexican peso exchange rates since 1995.<sup>②</sup> Graph B reports the historical

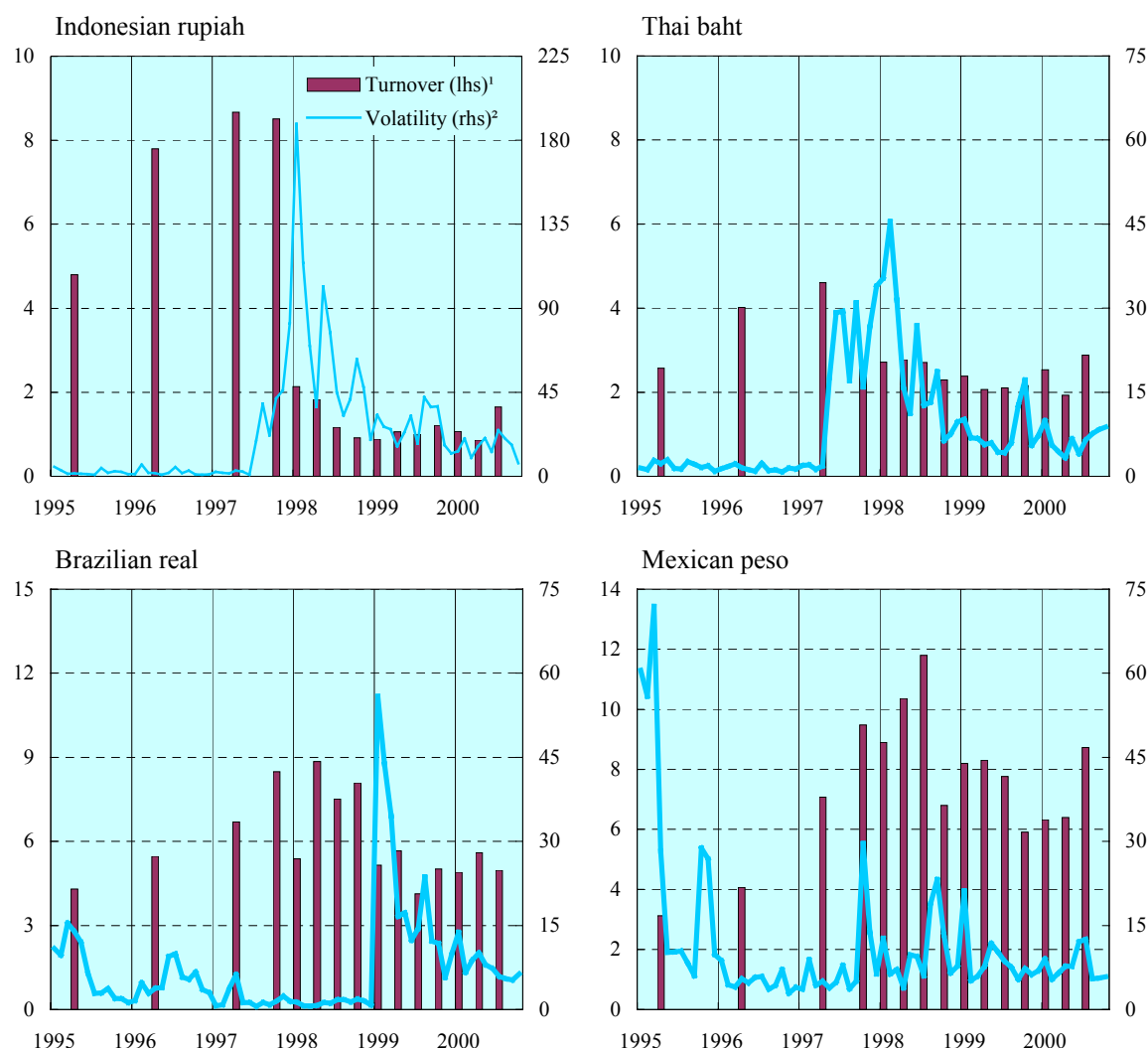
### A. Volatility and bid-ask spreads in selected foreign exchange markets<sup>1</sup>



<sup>1</sup> Against the US dollar. <sup>2</sup> Percentage deviation from the midrate. <sup>3</sup> One-month annualised standard deviation of daily percentage changes.

Sources: Datastream; Reuters America.

<sup>①</sup> Angelika Donaubauber provided excellent research assistance. <sup>②</sup> Dollar exchange rates are defined in terms of units of domestic currency per dollar. The quality of data on bid-ask spreads (which are taken from DRI) has been questioned for higher frequencies, but much less so for lower frequencies. Moreover, it is likely that the incidence of measurement error is less important for data from emerging markets, since they are highly volatile. <sup>③</sup> A fairly active offshore market for dollar/rupiah and dollar/baht exchange rates existed in Singapore in the mid-1990s but dried up following the Asian crisis. Local trading volumes therefore underestimate total turnover until 1997 but are fairly representative thereafter.

**B. Trading volumes and volatility in selected foreign exchange markets**

<sup>1</sup> Estimates of local turnover in the domestic currency as reported by the respective central banks, net of double-counting, per trading day in the month shown (in billions of US dollars) except: for Brazil and Mexico, including other currencies; for Indonesia, on a gross basis and, for 1995 and 1996, annual averages; for Thailand, 1995 second half and 1996 annual averages. <sup>2</sup> One-month annualised standard deviation of daily percentage changes in the exchange rate against the US dollar.

Sources: Central banks; Datastream; BIS calculations.

volatility of these exchange rates together with their turnover in local forex markets.<sup>③</sup> The table presents some summary statistics.

The graphs reveal some interesting characteristics of forex markets in emerging market countries. First, bid-ask spreads and volatility have moved closely together, as the microstructure theory on inventory risk predicts. For the exchange rates under investigation, the correlation coefficient of spreads and volatility ranges between 0.76 and 0.87. According to this theory, a rise in exchange rate volatility increases price risk and hence the cost of maintaining open positions. To compensate for this higher cost, traders demand wider spreads. Second, on average over the past five years turnover has been negatively correlated with volatility and spreads. The correlation coefficient of volumes and volatility lies between  $-0.20$  and  $-0.40$  for the baht, rupiah and peso and is  $-0.82$  for the real. The coefficient for volumes and spreads is around  $-0.50$ . This result appears to be driven by the incidence of periods of turbulence. Third, the interaction between volatility, volumes and spreads can be characterised by three distinct sets of conditions in forex markets.<sup>④</sup>

<sup>④</sup> The similarity between the panels on Mexican forex markets and Graph III.1 on Latin American bond markets (p 40) suggests that this characterisation may also hold for bond markets.

Conditions of normal market liquidity can be identified by relatively low volatility, low spreads and high turnover. Related research shows that given this set of conditions a rise in volatility is typically associated with an increase in (unexpected) trading volumes (Galati (2000)). These conditions existed in the dollar/rupiah and dollar/baht markets in 1995 and 1996, in the dollar/real market until mid-1998 and in the dollar/peso market from mid-1996 to mid-1998. In these markets, turnover actually followed a rising trend in the mid-1990s, as commercial banks tried to compensate for the anticipated loss of revenue from European forex trading by shifting resources to emerging markets. International investors appeared to profit in particular from the stability of Asian exchange rates combined with relatively high domestic interest rates.

During periods of turbulence, liquidity dried up, as suggested by sharp rises in volatility and a marked widening of spreads (to up to four times their values in normal times). Trading volumes rose before the crises but dropped dramatically when volatility reached its height. These features could be observed during the 1997 Asian crisis, the period of global financial market turmoil in autumn 1998 and the speculative attack on the real in January 1999.<sup>⑤</sup>

Market liquidity appeared to be low during the periods following crises. This is indicated by declining volatility and narrowing spreads, which stabilised above pre-crisis levels. It is also suggested by trading volumes stable at below pre-crisis levels. One noteworthy feature that is evident from the graphs is that spreads narrowed fairly quickly, while it took quite some time before trading volumes picked up, reflecting a gradual return of investors to these markets.

The behaviour of the markets described in this note is to a large extent characteristic of emerging market countries, and these countries account for only a minor share of total forex turnover.<sup>⑥</sup> Nevertheless, there are some important parallels with global forex market conditions. Total forex trading appeared to have declined markedly in autumn 1998, concomitant with the general reduction of liquidity that affected financial markets. Market sources suggest that trading volumes, and hence, arguably, depth, rebounded several months later, but are currently still significantly below the levels reached in early 1998. While market commentary indicates that since autumn 1998 tightness has generally improved somewhat, it is difficult to gauge how it has evolved in different market segments.

Historical averages, 1995-2000			
	Volatility	Spreads	Turnover
Mexican peso	11.41	0.11	7.55
Real	7.40	0.05	6.01
Rupiah	23.60	0.36	2.90
Baht	9.10	0.13	2.69
<i>Memorandum item:</i> <i>Yen/dollar</i>	<i>12.09</i>	<i>0.10</i>	<i>10.92(*)</i>

Note: During the period under review, the four currencies followed different official exchange rate regimes. The peso floated independently throughout the period. The real moved within an adjustable band until it was floated in January 1999. The baht was pegged to a basket of currencies before being floated in July 1997. The rupiah followed a managed float against a basket of currencies of major trading partners until it was floated in summer 1997. Historical volatilities are computed with daily data over rolling windows of 20 business days. Average daily turnover, in billions of US dollars. (\*) Traded on the Tokyo interbank market. In April 1998, average daily *global* turnover for yen/dollar transactions amounted to \$267 billion. Total forex turnover in April 1998 was \$1,500 billion.

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<sup>⑤</sup> They are also visible for the tail of the 1994-95 Mexican crisis. <sup>⑥</sup> In April 1998, it amounted to less than 3% of total forex market turnover (BIS (1999)).