# Measuring liquidity under stress

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In my contribution to the panel, I want to focus on how to measure liquidity under stress. Since financial markets seem to behave quite differently in periods of stress than under normal conditions, measures of liquidity that tend to work well most of the time may no longer be meaningful in turbulent markets.

In line with much of the literature, I define market liquidity as the "ease" with which a security can be traded. The word "ease" can be substituted by the word "cost". The cost of trading includes commissions, fees and taxes as well as the bid-ask spread, the price impact of a trade, and the cost caused by prices movements if a trade cannot be executed at once or when it is split up into a sequence of smaller transactions. In normal times, the cost of trading is particular relevant for those investors who try to make a profit by trading on small movements in prices and, consequently, turn over positions relatively quickly. For such agents, even small differences in the cost of a transaction can make or break a trading strategy. Investors with longer time horizons shouldn't really worry about market liquidity.

In periods of stress, the relative importance of the individual factors determining market liquidity changes. Prices become much more volatile than they are normally, and a strong desire on part of the traders to close undesired positions seems to dominate all other motivations for trading. From conversations with practitioners, I have the impression that costs arising from the price impact of trades or the inability to close positions quickly when prices are moving against them tend to eclipse the bid-ask spread and administrative costs. As a consequence, any measure for liquidity under stress should meet two requirements:

1. it should reflect the costs of closing large positions quickly; and
2. it should be available at a relatively high frequency as even relatively brief bouts of illiquidity may impose heavy costs on market participants if prices are volatile.

In order to illustrate the issues involved, I consider the liquidity of 10 year German government bonds market during two episodes of stress. The first took place in the aftermath of the Russian debt moratorium on 17 August, and the second during the sharp revaluation of the yen vis-à-vis the US dollar on 8 and 9 October of the same year.[1] As you will find out, the microstructure of the German bond market is broadly similar to that of foreign exchange markets, so the discussion should have some relevance beyond the particular market segment considered.

Although German government bonds are listed, the role of exchanges is negligible, with the bulk of trading taking place over the counter. This is especially true for the inter-dealer market, where trading takes place either directly between banks or through inter-dealer brokers (Freimakler). These act as intermediaries, but have no obligation to provide firm quotes. More recently, a sizeable proportion of inter-dealer trading has shifted to the electronic trading systems Euro-MTS, but electronig trading did not exist in 1998. The OTC market seems to be altogether rather opaque. Participants observe quotes but do not receive timely information on other traders' past transactions beyond anecdotal evidence. The only comprehensive data set is maintained by the German securities regulator, which receives information on every single transaction in Germany, regardless of whether or not it takes place on an exchange. However, this data is not published on a regular basis - not even in aggregated form - although it has been available for research purposes.

After this brief excursion into the microstructure of the German government bond market, let me turn to our main topic. A measure for liquidity that is often used by practitioners is trading volume. As a macroeconomist raised on representative agent models, where markets can be liquid without any trades actually taking place, I initially found this surprising. Market liquidity is only one, and not necessarily the most important, factor affecting trading activity. For example, if traders have sufficiently large hedging needs, then they may trade even if market liquidity is relatively low. What volume does tell us, however, is whether trading was possible at all.

[1] The analysis is based on Upper (2000).

Turnover in the German government bond market was particularly high just after the Russian debt moratorium, with a high average size of trade. Both turnover and the average trade size declined throughout September, and remained relatively - but not unusually - low on 8 and 9 October. Should we conclude that the market was very liquid during the first episode but not during the second? Not necessarily. Perhaps market participants had much stronger hedging needs after the Russian moratorium than during the events in the forex market.

A measure for liquidity that is easily available at any frequency and is directly linked to the cost of trading is the *quoted* bid-ask spread. However, since there is no commitment to market making in the OTC market for Bundesanleihen, quoted spreads are merely indicative, ie agents do not have to honour the prices they promise. While this should not matter in normal times, it is a problem in periods of stress. Traders told me that in the aftermath of the Russian moratorium, some traders simply did not bother to answer the phone. In addition, quoted spreads apply to transactions up to a specified amount only, which, furthermore, may vary over time. Eg if market participants cut this amount in periods of stress, then this would leave the quoted spread unchanged, even though market depth would fall.

One way out is to compute *effective* spreads from transactions data.[2] Unlike quoted spreads, effective spreads refer to the *average* transaction and therefore capture at least some of the cost of closing large positions. Unfortunately, this comes at a cost. Effective spreads have to be estimated, which introduces noise and reduces the frequency at which they are available. For the four German government bonds of our sample, the highest frequency which could be computed was one day.

Figure 2 shows the effective bid-ask spreads computed with Roll's (1984) measure. While this measure has important shortcomings[3], it is easy to estimate and does require a direction of trade indicator (which I have not been able to construct). I find that effective bid-ask spreads rose from values of less than one basis point during the first, tranquil, half of the year to 2-2½ basis points during the second half of August. This clearly indicates a *reduction* in market liquidity, in contrast to the *increase* suggested by the turnover series. Effective spreads gradually declined until the beginning of October, but soared to to around 4 basis points on 8 and 9 October.

How can we interpret the apparently contradictory findings of the activity series and the bid-ask spreads? First of all, the two measures should be viewed in conjunction. The increase in spreads after the Russian moratorium looks less menacing if we bear in mind that the market has been able to handle a considerably higher volume as well as larger trade sizes than under normal conditions. In early October, in contrast, there was no surge in volume which could explain at least part of the widening of the bid-ask spreads, which therefore looks much more threatening.

Let me conclude by restating the two requirements that a measure for liquidity under stress should meet. Firstly, it should reflect the cost of closing large positions within a short period of time. Secondly, it should be available at high frequencies. Neither trading volume nor the effective bid-ask spread considered completely satisfy both requirements on their own. Taken together, however, we do get a fair picture of a market that seems to have been rather effective in handling a high degree of activity in August but became rather illiquid in October.

The ascent of electronic trading should - in principle - open up new sources of high quality data, which would permit us to compute more elaborate measures of liquidity. It is crucial, though, that central banks actually get access to this data. The experience in this respect has so far not been very encouraging.

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[2] For a survey of different ways to compute effective spreads refer to Huang & Stoll (1997).

[3] In particular, the Roll-measure is biased downwards in the presence of asymmetric information or inventory effects. Since such effects are more likely to occur in times of stress when price volatility adds to inventory risk and there may be more scope for private information, the Roll measure probably underestimates any stress-related reduction of market liquidity.

**References**

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