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The Market Impact - Liquidity Measure in Electronic Securities Trading

Liquidity and transaction costs: Two important criteria of market quality

In the discussion about the relative advantages of securities markets, two factors are regularly the focus of attention: liquidity and transaction costs. In the framework of portfolio restructuring, liquidity is by far the most important decision-making criterion for investors (Schiereck [1995]) and is regarded as the central quality characteristic in securities markets. At the macro-level, liquid capital markets are essential for the efficiency of capital allocation in modern economies and lead to low cost of capital for issuers. At the micro-level, a liquid market enables access to a large number of trading interests and thus ensures that investors can carry out their transactions at any time.

In order to maximize the net return on an investment in securities, it is especially important for investors to be able to execute their buy and sell transactions at the lowest possible transaction costs. Therefore, the anticipated transaction costs should ideally be included as a decision-making criterion when deciding on a specific investment, i.e. stock picking, so that securities can be compared and/or benchmarked in terms of the anticipated net return.

Although the importance of liquid markets and low transaction costs is undisputed, there is neither a uniform understanding of the term liquidity, nor an operational model for the integrative analysis of liquidity and transaction costs.

With this motivation in mind, Deutsche Börse AG has set out to structure the discussion of liquidity and put it on a more objective footing. The goal is to identify a measure of liquidity based on transaction-cost analysis that quantifies liquidity in a single figure. To do this, the so-called Market Impact is being introduced as the Xetra Liquidity Measure. This figure rates the liquidity of the traded instruments on the basis of a uniform methodology and provides investors with a tool for the objective assessment of the trading costs. On this basis, the liquidity of individual securities as well as whole marketplaces can be analyzed in a comparable and transparent manner.

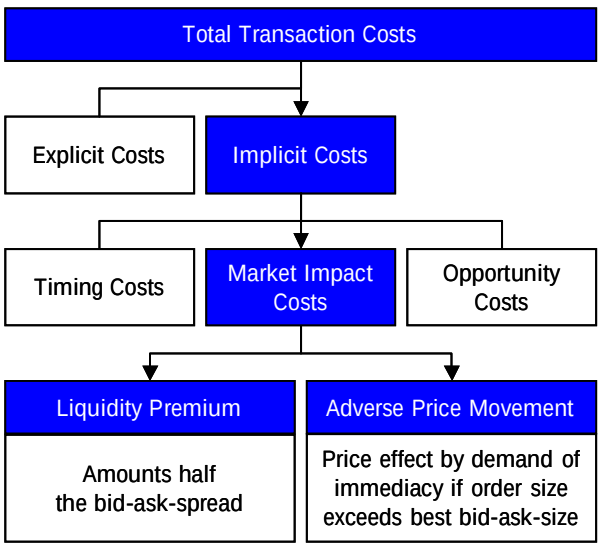
The liquidity factor: Dimensions and approximations

The term liquidity takes in four dimensions, which are reflected in the Xetra order book: market breadth, market depth, immediacy in execution and the market resiliency (Hasbrouck & Schwartz [1988] or Roll [1984]). In order to assess liquidity, often approximation factors oriented to the transaction frequency and/or turnover are used. In this context, ratios such as transaction frequency (number of transactions executed within a certain span of time), unit volume (number of units traded in a given security within a certain span of time), transaction volume (value of all transactions within a certain span of time) or also the relative transaction volume (ratio of transaction volume to free float of the respective security) are applied - for a comparative analysis of various liquidity measures, see Brunner [1996]. On the one hand, however, these factors are oriented to the past, and on the other, they reflect the activity, but not necessarily the liquidity in a given security. Consequently, these indicative figures, e.g. the unit volume or transaction volume, can be significantly distorted by a small number of very large transactions or – as in the case of transaction frequency – by a large number of very small transactions. Therefore, an objective figure for the measurement of liquidity should be derived from its direct benefit for the market participants: High liquidity enables market participants to achieve a desired portfolio structure at low costs. The direct benefit of liquid markets for the investor derives from the minimization of performance loss resulting from opening and closing a position (round trip). The lower these costs are, the higher the liquidity rating of the respective security or in the aggregate of the market segment and/or market.

The concept of transaction costs: Explicit versus implicit components

The term transaction costs (synonym: trading costs) consists of two main components: explicit and implicit transaction costs, see Figure 1. Explicit transaction costs are incurred with the order-processing and trade settlement by brokers, banks and exchanges. They take the form of fees, commissions or taxes and are directly charged to the market participant.

Fig. 1:
Individual components of transaction costs



In reality, securities markets do not obey the theoretical construct of perfect capital markets, i.e. it is not possible to buy or sell arbitrary quantities of securities at any time at their current theoretical market price. The difference between the buy and/or sell price that is actually achieved and the theoretical market price reflects the trading costs in imperfect markets and is referred to as implicit transaction costs. Implicit transaction costs depend on the order-book situation at the time of order execution. They are not stated or itemized as such for the market participant and therefore are hardly recognizable

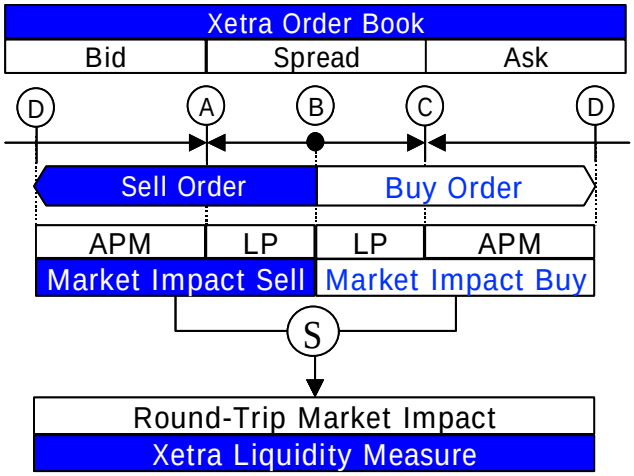
for the investor. For this reason, the comparison of securities markets on and off the exchange is often based exclusively on the first main component, the explicit transaction costs, and fails to consider the implicit transaction costs. Yet, these costs are many times higher than the explicit transaction costs.

In securities trading, liquidity and implicit transaction costs are closely related. They represent two sides of a coin: The more liquid a marketplace, the lower the implicit transaction costs. The Xetra Liquidity Measure takes advantage of this interrelation: It uses the directly observable and measurable cost component Market Impact to assess the unobservable liquidity in securities trading.

The Xetra Liquidity Measure: Integration of liquidity and transaction costs

The Market Impact is a measure of the costs of the immediate demand for liquidity. It consists of the sum of the liquidity premium (LP) and the adverse price movement (APM), see Figure 2.

Fig. 2:
Basic concept of the Xetra Liquidity Measure



The liquidity premium equals half of the bid-ask spread representing the minimum costs of liquidity consumption. It is measured from the difference between the middle of the bid-ask spread (midpoint B) and the current best ask limit (point C) for a buy order (B-to-C) or, as the case may be, the current best bid limit (point A) for a sell order (A-to-B). The midpoint in the proposed model serves as the benchmark for the theoretical market value in the proposed model.

The liquidity premium, however, represents only one dimension of liquidity. It reflects the market breadth and is useful as a reasonable figure to measure the trading costs of retail orders. For larger, institutional orders, however, it is oversimplified. In this case, liquidity and, consequently, the resulting trading costs have to be considered in more differentiated terms. The market depth has to be included if the order volume in demand exceeds the quoted volume at the best bid or ask limit. These orders are executed against several limits on the respectively other side of the order book, and with every additional execution, the average execution price for the order deteriorates. The trading costs for the investor then increase additionally by the difference between the respective best bid or ask quote and the resulting average execution price (C-to-D for a buy order and/or A-to-D for a sell order).

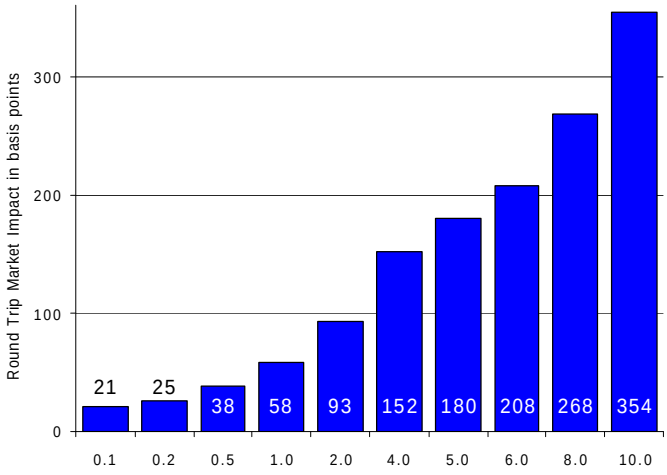
Market Impact costs are paid by investors who demand liquidity and are collected by investors who supply liquidity via limit orders. The provision of liquidity is thus rewarded and every transaction on a securities market leads to a redistribution of the Market Impact costs

from investors demanding liquidity to investors supplying liquidity. This redistribution, however, distorts the allocation efficiency in securities trading, because it can prevent the transformation of a given portfolio structure into a desired portfolio structure.

The Xetra Liquidity Measure condenses the Market Impact information into one single figure. The measure is the sum of the Market Impact on the bid and ask side of the Xetra order book in basis points for a given euro transaction volume. It describes the performance loss due to liquidity costs that are incurred by the liquidity-demanding investor by opening and closing a position. The lower these costs are, the higher the liquidity rating of the respective security or in aggregate of the market segment and/or market. At the same time, the above-mentioned explicit transaction costs have to be left aside, because these components are independent of the currently given market situation at the time of order execution. The Market Impact as a liquidity measure methodologically covers three of the four liquidity dimensions. The fourth dimension is assessed through the change in measuring results over the course of time.

Empirical results from the Xetra order book

Fig. 3:
The Xetra Liquidity Measure for Deutsche Telekom



(Source: Deutsche Börse AG, October 2001)

Figure 3 shows the Xetra Liquidity Measure for Deutsche Telekom in October 2001. The round-trip in the Xetra order book, for example, results in relative liquidity costs of 21 basis points on a mean average for the month (one basis point is equivalent to 0.01%), corresponding to 210 euros for an order size of 100,000 euros. The Xetra Liquidity Measure is a monotone rising function depending on order size. The state of the function is an expression of the basis costs of the demand for liquidity in the form of the liquidity premium. The slope corresponds to the marginal costs of the liquidity consumption in the form of the adverse price movement. Time series, such as the intraday distribution, for example, or a breakdown of the Xetra Liquidity Measure into its components, enable detailed insights into the dynamics and depth of liquidity.

The Xetra Liquidity Measure permits the comparison of securities according to their trading costs. Figure 4 shows the position of Deutsche Telekom within the DAX trading segment as a whole, for an order size of 0.1 million Euro.

Fig. 4: Heat Map of the Liquidity in 18 DAX instruments

€-Volume	MUV2	EOA	ALV	DBK	BAS	SIE	DTE	DCX	SAP	RWE	BAY	VOW	SCH	HVM	BMW	LHA	HEN3	FME
0.1 mn	12	13	14	15	16	20	21	21	22	26	27	27	27	29	32	33	38	42
0.2 mn	14	16	16	18	21	25	25	28	29	33	38	38	40	40	45	43	56	56
0.5 mn	20	25	24	28	35	43	38	48	49	54	72	76	81	74	86	75	115	116
1.0 mn	31	41	37	45	59	76	58	84	83	91	131	146	163	138	176	135	200	250
2.0 mn	55	78	63	85	123	143	93	157	148	160	235	292	334	359	474	322	344	390

Highly Liquid [0;50]	Liquid (50; 200]	Less Liquid (>200)

(Source: Deutsche Börse AG, all results in basis points, October 2001)

The most liquid instrument for this period was Münchner Rückversicherung (Munich Re) with liquidity costs of 12 basis points for the round trip with an order volume of 0.1 million euros. Deutsche Telekom ranks 7th, between Siemens and DaimlerChrysler. The color scheme in Figure 4 illustrates a conceivable segmentation of the instruments by liquidity in the form of a Heat Map. Highly liquid trading in the range from zero to 50 basis points, for example, is marked green.

Possible applications of the Xetra Liquidity Measure

The integrative perspective of transaction costs and liquidity makes the Xetra Liquidity Measure a powerful analysis tool for various types of applications. It provides decision-making support in the selection of securities, in order execution as well as in the choice of a preferred trading venue based on cost considerations. The liquidity measure can also make a contribution to the definition of investment directives for managed fund accounts.

- Decision support for securities selection

With the help of the Xetra Liquidity Measure, the expected net return on an investment can be calculated ex ante by adjusting the expected performance of the investment (difference between selling and buying price) to include the explicit transaction costs and the round-trip trading costs. This provides for a relative comparability of alternative investments on the basis of their net returns. Particularly in matters of portfolio structuring, e.g. in the selection between securities with the same correlations and comparable diversification effects, or in the selection of alternative securities in a sector/industry, including the trading costs can provide important decision support.

- Transparency in order execution

Liquidity is a dynamic phenomenon. The order book liquidity that is currently available changes continuously with every transaction and/or order placement. An open and transparent order book allows the investor to assess the market impact for every transaction by considering the current order book breadth and depth. However, whether or not a transaction is advisable at a given time, i.e. exhibits relatively low transaction costs, cannot be determined solely on the basis of the current order book situation.

As a benchmark, the Xetra Liquidity Measure enhances the transparency in order execution in two respects. Prior to order execution, it provides valuable indications for the assessment of the current liquidity relative to the average historical liquidity, and thus for the timing of order placements. After order execution, the Xetra Liquidity Measure enables an objective view of the broker service by distinguishing simple versus complex transactions. This distinction as well as the objective presentation of order execution quality is carried out relative to the basis liquidity provided in the electronic order book.

- Decision support on the preferred trading venue

In recent years, international securities' trading has undergone a distinct trend in favor of using electronic open limit order books. The model of the Xetra Liquidity Measure can be applied directly to these markets and allows an international comparison of the empirical order book liquidity.

Figure 5: International comparison of liquidity for Nokia

01.02.02	Nokia Round Trip MI	
Volume (€)	EN Paris	DB Xetra
10,000	16.8 bp	14.6 bp
25,000	17.4 bp	15.2 bp
50,000	17.9 bp	16.2 bp
100,000	18.1 bp	18.0 bp
150,000	18.9 bp	19.5 bp
200,000	21.5 bp	21.0 bp
250,000	24.4 bp	22.5 bp

(Source: Deutsche Börse AG, all results in basispoints)

Figure 5 shows this comparison between the two stock-exchange centers Euronext Paris and Xetra, in the case of Nokia as an example. Both in Paris and on Xetra, trading in Nokia is highly liquid, as the comparison of order sizes shows with the results from Figure 4. Overall, trading on Xetra proves to be slightly more advantageous for the investor due to the lower liquidity costs. With the exception of the order size with 150,000 euros, the liquidity costs on Xetra are lower for all volume categories compared with Euronext Paris. One of the main reasons for this is the narrower spread at the top of the order book and thus a lower liquidity premium on Xetra.

Taking into account the brokerage commissions, which often diverge between domestic and foreign transactions, and the additional settlement costs for a foreign transaction, the total trading costs for cross-border transactions can be determined on this basis and weighed against a transaction in the domestic market.

- Application for the development of investment directives

In the framework of investment directives for mutual funds, the investment in liquid securities and/or blue chips is often prescribed (Matthes & Klein, 2000). The Xetra Liquidity Measure supports the understandability and transparency of such investment directives by providing investors as well as fund managers with an objective, unambiguous and verifiable criterion for liquidity.

The Xetra Liquidity Measure as a benchmark in securities trading

With mounting competitive intensity, benchmarks are becoming increasingly important in securities trading, which put terms that are often used but are so far not very specifics, such as liquidity, into an operational form. In this way, the Xetra Liquidity Measure is making a contribution and enables the marketplace operator as well as intermediaries and investors to provide the foundation for the development of a concept that will serve as the standard in securities trading.

Deutsche Börse AG is using the Xetra Liquidity Measure internally to determine the trading parameters on Xetra as well as in the assessment of steps to improve market structure. The Xetra Liquidity Measure is computed continuously and available since July 2002.

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