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Volume, liquidity, and liquidity risk ☆

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Abstract

Many classes of microstructure models, as well as intuition, suggest that it should be easier to trade when markets are more active. In the data, however, volume and liquidity seem unrelated over time. This paper offers an explanation for this fact based on a simple frictionless model in which liquidity reflects the average risk-bearing capacity of the economy and volume reflects the changing contribution of individuals to that average. Volume and liquidity are unrelated in the model, but volume is positively related to the variance of liquidity, or liquidity *risk*. Empirical evidence from the U.S. government bond and stock markets supports this new prediction.

JEL classification: D91; E21; E44; E52; G12

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1. Introduction

Recent empirical studies of liquidity dynamics have turned up a surprising negative result: higher volume does not necessarily lead to more liquid markets. In annual vector autoregressions using the Dow Jones 30 industrial stocks, Jones (2002) finds no significant effect of changes in turnover on changes in bid-ask spreads. Using monthly aggregate stock market data, Fujimoto (2004) finds mostly insignificant impulse responses to turnover shocks for several liquidity measures. Evans and Lyons (2002) and Galati (2000) find no association between liquidity and level of activity on the foreign exchange market, while Danielsson and Payne (2002) find a *negative* relationship. Similar negative findings are reported in Foster and Viswanathan (1993) and Lee, Mucklow, and Ready (1993) for individual stocks.[1] In the U.S. Treasury market, Fleming (2003) finds that neither trading volume nor trading frequency are consistently correlated with price impact or bid-ask spreads.

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[1]A positive association between trading activity and volume is sometimes observed. There are common time-of-day and day-of-week effects in spreads or depth and volume. See Chordia, Roll, and Subrahmanyam and Barclay and Hendershott (2004), for example. Lipson and Mortal (2007) find that bidder firms experience increases in volume and liquidity following takeovers.

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These results seem to challenge the basic intuition that it ought to be easier to trade in more active markets. This intuition certainly seems to find support cross-sectionally. Larger, more active markets are usually more liquid. Indeed, this was the original finding of Demsetz (1968), which is sometimes viewed as the starting point of the field of market microstructure. More frequently traded stocks have lower bid-ask spreads.

To Demsetz, the result was an unsurprising consequence of competitive intermediation: higher transaction demand leads to more profit for dealers and hence cheaper provision of liquidity services. Further, lower costs should naturally elicit more trade, as in any other product market. Underlying this view, of course, is the conception of liquidity as the output of a sector with access to a particular intermediation technology.

However, the same conclusion applies for different reasons in some classical models of asymmetric information. In Kyle (1985), equilibrium in the game between informed traders and liquidity suppliers requires that informed demand (and hence volume) scales with uninformed demand, while illiquidity (Kyle's lambda) is inversely proportional to the scale of uninformed demand because more noise makes total order flow less informative. Hence more volume means higher liquidity. This is a comparative static result. However, the logic is borne out in dynamic extensions such as Admati and Pfleiderer (1988) and Foster and Viswanathan (1990). Again, when uninformed traders are allowed to respond to variations in liquidity, the relationship is strengthened.[2]

Finally, a third trading paradigm, search models, also implies that more active markets are more liquid. When there is more search activity for whatever reason, then liquidity—measured by the opportunity cost of the searching time—will be shorter, almost by definition (see Lippman and McCall, 1986).

The lack of a *dynamic* relationship between liquidity and volume thus seems to pose something of a challenge, both to intuition and to several classes of model. The consistency of the non-finding across several types of asset, market structure, and frequency suggests that there is indeed something to explain here. Moreover, all the empirical studies cited above control for things such as returns and volatility. So it is not the case, for example, that liquidity fails to rise with volume because volume rises with uncertainty.

Understanding liquidity dynamics is important for a number of reasons. Since liquidity directly determines the feasibility and costs of dynamic trading strategies, any investor or institution that needs to implement such a strategy must quantify the liquidity risk involved. Because investors care about it, studying the consequences of liquidity risk has become a central topic in asset pricing (see Pástor and Stambaugh, 2003; Acharya and Pedersen, 2004). Finally, liquidity risk is important from a policy perspective because of the danger posed by large drops in liquidity, which may lead to price distortions, disruptions in risk transfer, and possibly inefficient liquidation of real investments.

Perhaps especially for this latter reason, a crucial aspect of our understanding of liquidity dynamics is pinning down the role played by intermediaries or "liquidity providers." It is here that the empirical volume–liquidity results are directly relevant. By falsifying a basic intuition, they seem to call into question the view of liquidity as a service output provided by a segmented sector. This view underlies much policy analysis of market fragility, which regards the capital constraints of intermediaries as the key determinant of liquidity risk.

An alternative view, in which intermediaries play no role, models liquidity as the average willingness of the market as a whole (or a representative agent) to accommodate trade at prevailing prices (Pagano, 1989). This willingness may fluctuate as the underlying state of the economy changes. In general, agents are more flexible and asset prices respond less to trade demand when a marginal perturbation to their portfolios has a low impact on their intertemporal marginal rate of substitution (discount rates). Johnson (2006) develops the calculation of this liquidity in representative agent economies and illustrates its endogenous dynamics in several examples. By definition, however, there is no trade in representative agent economies, meaning that the examples in that paper can shed no light on the connection between volume and liquidity.

This paper extends Johnson (2006) by computing the equilibrium price-response measure of liquidity in a simple multi-agent economy with trade. The derivation explicitly connects the (shadow) illiquidity characterizing a representative agent's demand curve for shares with the actual trade impact costs that

[2]Not all asymmetric information models support this intuition. In Spiegel and Subrahmanyam (1992), uninformed volume raises volatility, which hurts liquidity. In Easley and O'Hara (1992), informed traders have no timing or quantity choice, so higher volume necessarily means more information risk, which lowers liquidity.