The Empirical Analysis of Liquidity

Craig W. Holden
Kelley School of Business
Indiana University, USA
cholden@indiana.edu

Stacey Jacobsen
Cox School of Business
Southern Methodist University, USA
staceyj@cox.smu.edu

Avanidhar Subrahmanyam
Andersen School of Management,
University of California, Los Angeles, USA
subra@anderson.ucla.edu

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Kelley School of Business
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Stacey Jacobsen
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staceyj@cox.smu.edu

Avanidhar Subrahmanyam
Andersen School of Management,
University of California, Los Angeles, USA
subra@anderson.ucla.edu

Contents

Abstract

We provide a synthesis of the empirical evidence on market liquidity. The liquidity measurement literature has established standard measures of liquidity that apply to broad categories of market microstructure data. Specialized measures of liquidity have been developed to deal with data limitations in specific markets, to provide proxies from daily data, and to assess institutional trading programs. The general liquidity literature has established local cross-sectional patterns, global cross-sectional patterns, and time-series patterns. Commonality in liquidity is prevalent. Certain exchange designs enhance market liquidity: a limit order book for high volume markets, a hybrid exchange for low volume markets, and multiple competing exchanges. Automatic execution increases speed, but increases spreads. A tick size reduction yields a large improvement in liquidity. Providing ex-post transparency to an otherwise opaque market dramatically improves liquidity. Opening up the limit order book improves liquidity. Regulatory reforms that increase the number of competitive alternatives, move toward linking them up, and level the playing field between exchanges improves liquidity. High-frequency traders trade in both a passive, liquidity-supplying manner and an aggressive, liquidity-demanding manner. Their overall impact improves both liquidity and price efficiency, but concerns remain regarding occasional trading glitches, order anticipation strategies, and latency arbitrage at the expense of slow traders. The liquidity and corporate finance literature provides abundant evidence that liquidity is beneficial in many corporate settings: liquidity increases the power of governance via exit, reduces the cost of governance via intervention, facilitates the entrance of informed traders who produce valuable information about the firm, enhances the effectiveness of equity-based compensation to managers, reduces the cost of equity financing, mitigates trading frictions investors encounter when trading in the market to recreate a preferred payout policy, and lowers the immediate transaction costs and subsequent liquidity costs for firms conducting large share repurchases. Further, the influence goes both ways. There is evidence that firms influence their own liquidity through a broad range of corporate decisions including internal governance standards, equity

issuance form and pricing, share repurchases, acquisition targets, and disclosure timeliness and quality. The literature on liquidity and asset pricing demonstrates that both average liquidity cost and liquidity risk are priced, liquidity enhances market efficiency, and liquidity strengthens the arbitrage linkage between related markets. We conclude with directions for future research.

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1

Introduction

This literature survey reviews the empirical analysis of liquidity. We start with an overview of how liquidity is measured and specialized issues in liquidity measurement. Next, we review what is known about cross-sectional and time-series patterns in liquidity, commonality in liquidity, the impact of exchange design, the impact of exogenous policy shifts (such as the reductions in the minimum tick size and changes in transparency of trade reporting) on liquidity, and the impact of high-frequency traders on liquidity. We then review how liquidity relates to the corporate finance literature, including to governance, executive compensation, capital structure, and payout policy. We next review how liquidity influences the asset pricing literature, including return differentials due to average liquidity cost, liquidity premia for systematic liquidity risks, the impact of liquidity on market efficiency, and the impact of liquidity on the law of one price. Finally, we discuss open questions and opportunities for future research.

What is *market liquidity*? A simple definition is the ability to trade a significant quantity of a security at a low cost in a short time.[1] Thus, liquidity is a multi-dimensional concept encompassing quantity, cost, and time dimensions. We discuss liquidity measures of each dimension separately and in combination.

The modern theory of market microstructure formulates the trading process as an interaction between liquidity suppliers and liquidity demanders. *Liquidity suppliers* offer to buy a particular security (e.g., stock, bond, option, futures, currency, etc.) at a *bid* price or sell it at an *offer* price. Then *liquidity demanders* agree to buy the security at the offer price or sell it at the bid price and a trade is born. Liquidity matters because it represents the cost, quantity, and time of a trade to the liquidity demander. Equivalently, it represents the profit, quantity, and time of a trade to the liquidity supplier.

In a *pure limit order book exchange*,[2] each trader can decide moment-by-moment if they want to supply liquidity by submitting a non-marketable limit order[3] to replenish the limit order book or demand liquidity by submitting a market order or a marketable limit order[4] to deplete the limit order book. In a *pure dealer exchange*, dealers supply liquidity by quoting bid and offer prices and other traders demand liquidity by submitting a market buy (sell) order to trade at the current offer (bid) price. In a *hybrid exchange*, both non-marketable limit orders and dealers supply liquidity and other traders demand liquidity. In a *search market*, a liquidity demander seeks potential liquidity

[1] Market liquidity is also called the *transactional* liquidity of a securities market. Market liquidity is different concept than the *funding* liquidity of market makers or the *cash flow* liquidity of a bank.

[2] For simplicity, we use the word exchange to refer to any type of trading venue.

[3] A limit order is an offer to buy or sell a specified quantity at a specified limit price. A non-marketable limit order is a limit buy (sell) order with a limit price below the current offer price (above the current bid price). It cannot execute immediately and must wait on the limit order book for a counterparty to trade with.

[4] A market order is a request to buy or sell a specified quantity at currently available price(s). It will execute in full immediately. A marketable limit order is a limit buy (sell) order with a limit price greater than or equal to the current offer price (less than or equal to the current bid price). It will execute immediately up to (down to) and including the limit price.

suppliers, who offer to buy or sell at a particular price, then decides whether to trade at the quoted price.

Twenty-first century trading has been transformed and continues to change. Electronic trading has almost entirely replaced floor-based trading on a global basis and across all asset classes [Jain, 2005, Johnson, 2010]. Algorithmic trading increasingly dominates manual trading on a global basis and across all asset classes [Johnson, 2010, Boehmer et al., 2014]. Trading has become much faster and continues to accelerate [Angel et al., 2011]. In its ever evolving form, trading still comes down to the interaction between liquidity suppliers ("makers") and liquidity demanders ("takers").

We find that the liquidity measurement literature has established standard measures of liquidity that apply to broad categories of market microstructure data. Specialized measures of liquidity have been developed to deal with data limitations in specific markets (e.g., futures, U.S. corporate bonds, U.S. equity), to provide proxies from daily data, and to assess institutional trading programs.

We find that the liquidity literature has established local cross-sectional patterns (liquidity is positively related to dollar volume and price level and negatively related to volatility and size), global cross-sectional patterns (liquidity is positively related to judicial efficiency, accounting standards, and political stability) and time-series patterns (liquidity exhibits seasonality, declines during crisis periods, and varies around macroeconomic announcements). Commonality in liquidity[5] is prevalent. Certain exchange designs enhance market liquidity: limit order book for high volume markets, hybrid for low volume markets, and multiple competing exchanges. Automatic execution increases speed, but increases spreads. A tick size reduction yields a large improvement in liquidity as measured by average trade-weighted effective spread. These benefits are concentrated in small trades, but large trades are typically not harmed even net of the reduction in depth. Institutional traders have adapted their trading strategies to smaller tick sizes. Adding ex-post transparency to an otherwise opaque

[5]Commonality in liquidity is a common component in liquidity variation across securities markets.

market dramatically improves liquidity. Adding ex-ante limit order book transparency to relatively transparent market causes a more modest improvement in liquidity. Regulatory reforms that increase the number of competitive alternatives, move toward linking them up, and level the playing field between exchanges have improved liquidity on both the cost and speed dimensions. High-frequency traders trade in both a passive, liquidity-supplying manner and an aggressive, liquidity-demanding manner. Their overall impact improves both liquidity and price efficiency, but concerns remain regarding occasional trading glitches, order anticipation strategies, and latency arbitrage at the expensive of slow traders.

We find that the literature on liquidity and corporate finance provides abundant evidence that liquidity is beneficial in many settings: liquidity increases the power of governance via "exit," reduces the cost of governance via intervention, facilitates the entrance of informed traders who produce valuable information about the firm, enhances the effectiveness of equity-based compensation to managers, reduces the cost of equity financing, mitigates trading frictions investors encounter when trading in the market to recreate a preferred payout policy, and lowers the immediate transaction costs and subsequent liquidity costs for firms conducting large share repurchases. Further, the influence goes both ways. There is evidence that firms influence their own liquidity through a broad range of corporate decisions including internal governance standards, equity issuance form and pricing, share repurchases, acquisition targets, and disclosure timeliness and quality. Overall, equity market liquidity can lead to firm value gains via both increases to the cash flows of the firm and decreases in the discount rate.

We find that the literature on liquidity and asset pricing demonstrates that both average liquidity cost and liquidity risk are priced, liquidity enhances market efficiency, and liquidity strengthens the arbitrage linkage between related markets.

This review is organized as follows. In Section 2, we consider the approaches taken to measure liquidity. Section 3 considers cross-sectional and time-series patterns in liquidity, commonality in liquidity, the impact of exchange design, the impact of exogenous policy shifts

(such as the reductions in the minimum tick size and changes in transparency on trade reporting requirements) on liquidity, and the impact of high-frequency traders. Section 4 analyzes the relation between liquidity and corporate financial decisions. Section 5 explores the impact of liquidity on asset pricing, and Section 6 concludes with directions for future research.

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