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Market liquidity in the financial crisis: The role of liquidity commonality and flight-to-quality

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ABSTRACT

We examine the dynamics and the drivers of market liquidity during the financial crisis, using a unique volume-weighted spread measure. According to the literature we find that market liquidity is impaired when stock markets decline, implying a positive relation between market and liquidity risk. Moreover, this relationship is the stronger the deeper one digs into the order book. Even more interestingly, this paper sheds further light on so far puzzling features of market liquidity: liquidity commonality and flight-to-quality. We show that liquidity commonality varies over time, increases during market downturns, peaks at major crisis events and becomes weaker the deeper we look into the limit order book. Consistent with recent theoretical models that argue for a spiral effect between the financial sector's funding liquidity and an asset's market liquidity, we find that funding liquidity tightness induces an increase in liquidity commonality which then leads to market-wide liquidity dry-ups. Therefore our findings corroborate the view that market liquidity can be a driving force for financial contagion. Finally, we show that there is a positive relationship between credit risk and liquidity risk, i.e., there is a spread between liquidity costs of high and low credit quality stocks, and that in times of increased market uncertainty the impact of credit risk on liquidity risk intensifies. This corroborates the existence of a flight-to-quality or flight-to-liquidity phenomenon also on the stock markets.

1. Introduction

The drying-up of market liquidity during the financial crisis is a well-documented phenomenon held, at least partially, responsible for the financial contagion experienced during that crisis. Brunnermeier and Pedersen (2009) provide an explanation for the occurrence of such liquidity spirals by linking an asset's market liquidity, i.e. the ease with which it is traded, with traders' funding liquidity, i.e. the ease with which they can obtain funding. They point out that market declines negatively affect a trader's assets, thereby increasing the probability of margin calls. This might coerce the trader to partially liquidate her portfolio putting additional price pressure on the assets. A self-enforcing liquidity spiral is likely to occur. Moreover, in such a context also other puzzling facts, like liquidity commonality across securities and the flight-to-quality or flight-to-liquidity phenomenon, can be explained.

By using a unique data set on stock market liquidity this paper aims to shed further light on these puzzling features of market liquidity. Actually, the existing literature on market liquidity in times of crises which in most cases focuses on the bid-ask spread to measure liquidity costs. We are able to extend the literature in this respect because we have access to a unique volume-weighted spread liquidity measure called XLM (Xetra liquidity measure). The data is provided by Deutsche Börse. It is a liquidity measure that measures the order-size-dependent liquidity costs of a roundtrip. Hachmeister (2007) provides theoretical background on this measure and Stange and Kaserer (2011) scrutinize its empirical properties for the German stock market. A similar measure called cost of round trip trade (CRT), which aggregates the status of the limit order book at any moment in time for a specific transaction size, was introduced by Irvine et al. (2000). Also Barclay et al. (1999), Coppejans et al. (2002), Giot and Grammig (2005), and Rösch (2012) used similar liquidity measures in a different context. The use of this order-size-dependent volume-weighted spread measure enables us to scrutinize whether specific liquidity effects hold for the whole depth of the limit order book.

On the basis of these unique data-set we aim to make a contribution to the existing market liquidity literature in several ways. First of all we investigate and try to better understand the role of market liquidity during periods of financial distress. Not surprisingly we show that market liquidity evaporates when it is most needed, i.e. in market downturns and times of crises, worryingly

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Nomenclature

DAX®	Deutscher Aktiendindex (30 largest German stocks)
MDAX®	Mid-Cap Index (50 largest stocks below DAX)
SDAX®	Small-Cap Index (50 largest stocks below MDAX)
TecDAX®	Tec-Index (30 largest technology stocks below DAX)

implying that there is a positive relationship between market risk and liquidity risk and that investors are struck by both risks at the same time. Moreover, this effect is more pronounced the deeper one digs into the limit order book, i.e. the larger traded positions are, and the less liquid stocks are, i.e. the smaller the respective companies are.

Secondly, we extend the existing literature on liquidity commonality (e.g., Chordia et al. (2000), Hasbrouck and Seppi (2001), Huberman and Halka (2001), and Brockman and Chung (2002)) by examining the dynamics and causes of it in the periods of market distress. In accordance with the literature we show that liquidity commonality significantly varies over time, increases during market downturns and peaks at major crisis events. However, because of our unique data set we can scrutinize the liquidity commonality dynamics over the whole order book depth. Interestingly, it turns out that liquidity commonality becomes weaker the deeper we look into the limit order book. As far as the drivers of liquidity commonality are concerned, our results corroborate the theoretical predictions proposed in the paper of Brunnermeier and Pedersen (2009). In fact, by using different measures of funding liquidity tightness we find evidence that by making the traders' funding situation more restrictive an increase in liquidity commonality is induced, which then leads to market-wide liquidity dry-ups. Therefore we are able to corroborate the view that market liquidity by amplifying financial market procyclicality can be a driving force for the transmission of shocks and financial contagion.

Third, we explore the phenomenon called flight-to-quality, which is also known as flight-to-liquidity. This basically states that liquidity costs are positively correlated with credit risk and that investors tend to shift their portfolio towards less risky and more liquid assets in stressed market scenarios (Beber et al., 2009). The flight-to-quality theory, to the best of our knowledge, was never tested before for stock markets and therefore we want to close this gap. In line with the existing research on the flight-to-quality phenomenon, we show that there is a positive relationship between credit risk and liquidity risk, i.e., there is a spread between liquidity costs of high and low credit quality stocks, and that in times of increased market uncertainty the impact of credit risk on liquidity risk intensifies. This corroborates the idea that in times of crisis investors become increasingly risk avers and have a preference for more liquid instruments. We are therefore able to show that the flight-to-quality or flight-to-liquidity phenomenon also exists in the stock market.

To sum up, by using a sophisticated liquidity measure we are able to analyze liquidity dynamics and drivers over the whole depth of the limit order book. In this way our research helps to better understand the impact of stock market liquidity in crisis scenarios and therefore sheds further light on the characteristics of market liquidity risk. This should be helpful for institutional investors, exchange officials, financial regulators, and risk management practitioners.

The remainder of this paper is organized as follows. In Section 2, we give an overview on the literature and present our research hypotheses. Section 3 gives some background on the Xetra market structure and introduces our dataset. In Section 4 we discuss our empirical results and provide some robustness tests that support our findings. Conclusions follow in Section 5.

2. Literature review and research hypotheses

2.1. Liquidity in times of crisis

Amihud et al. (1990) were among the first to show that market liquidity can be a driving force for market declines. They argue that the stock market crash of 1987 can be at least partially explained by an across the board revision of investor's expectations about stock market liquidity. As market liquidity is priced in the stock market (e.g., Amihud and Mendelson (1986)), a drop in investor's expectation about this liquidity will lead to a decline of the stock prices.

In more recent research market declines are seen as a driver for illiquidity. In fact, Chordia et al. (2001) detect that market liquidity is affected by market returns in a sample of NYSE stocks from 1988 to 1992. They discover that bid-ask spreads respond asymmetrically to market returns as they significantly increase in down markets and only marginally decrease in up markets. Liu (2006), by using several different liquidity measures, shows that market liquidity in the US stock market is impaired following large economic and financial events such as the 1972–1974 recession, the 1987 crash, the Asian financial crisis in 1997, the 1998 Russian default, the collapse of the LTCM hedge fund in 1998, the early 2000 burst of the high-tech bubble and the terrorist attacks on September 11, 2001. Analyzing 23 emerging markets over the period 1993–2000, Lesmond (2005) descriptively shows that bid-ask spreads as well as several other liquidity measures sharply increase during the Asian and Russian crisis. Yeyati et al. (2008) also focusing on emerging markets and using a sample of 52 stocks from seven different countries over the period April 1994–June 2004 demonstrate that crisis periods[1] are associated with higher liquidity costs and an initial increase in trading activity, which reverses at a later stage of the crisis. Hameed et al. (2010) also find that there is a negative relationship between market returns and changes in the proportional bid-ask spreads. They provide strong evidence that market declines cause market illiquidity, as on average, the spread increases by 2.8 (6.2) basis points in their sample of NYSE ordinary stocks from January 1988 to December 2003 after a large[2] market decline. Also Naes et al. (2011), by taking a more general view on the relation of business cycles and market liquidity, show that stock market liquidity tends to dry up during economic downturns, using an US sample that covers NYSE common shares from 1947 to 2008 and a Norwegian sample from the Oslo Stock Exchange covering the period from 1980 to 2008.

All these findings lead to our first hypothesis:

[1] They define a crisis as period that begins when the stock market index starts declining for at least five consecutive weeks reaching a total loss in market value of more than 25% and ends after the index kept rising for at least four consecutive weeks.

[2] They define a large market decline as a drop of the weekly market return below more than 1.5 standard deviations of its mean.