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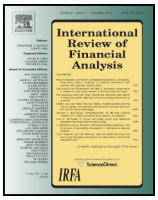

The asset pricing effects of UK market liquidity shocks: Evidence from tick data

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ABSTRACT

Using tick data covering a 12 year period including much of the recent financial crisis we provide an unprecedented examination of the relationship between liquidity and stock returns in the UK market. Previous research on liquidity using high frequency data omits the recent financial crisis and is focused on the US, which has a different market structure to the UK. We first construct several microstructure liquidity measures for FTSE All Share stocks, demonstrating that tick data reveal patterns in intra-day liquidity not observable with lower frequency daily data. Our asymptotic principal component analysis captures commonality in liquidity across stocks to construct systematic market liquidity factors. We find that cross-sectional differences in returns exist across portfolios sorted by liquidity risk. These are strongly robust to market, size and value risk. The inclusion of a momentum factor partially explains some of the liquidity premia but they remain statistically significant. However, during the crisis period a long liquidity risk strategy experiences significantly negative alphas.

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1. Introduction

One of the striking features of the recent financial crisis was the abrupt drop in aggregate liquidity across global financial markets. This drop in liquidity is a market failure that led to a large increase in trading costs through wider spreads and greater price impact. The financial crisis has heightened awareness among investors of the importance of considering liquidity (Brunnermeier, 2008; Longstaff, 2010). In this paper we make three key contributions to the literature on liquidity and stock returns. We are the first paper to examine the pricing of liquidity risk in stock returns in the UK market. Second, we employ a high frequency intra-day data set unprecedented in depth for a UK study. Finally, as we specify a sample period which incorporates this crisis incidence of market illiquidity, our paper provides much needed additional evidence on the role of liquidity in asset pricing.

Trading on the UK stock market is quite different to the US, where prior research on high frequency data has focused. In the UK all trading takes place on the London Stock Exchange (LSE) whereas in the US stocks trade primarily on two main exchanges, the Nasdaq and NYSE. On the LSE trading is a mix of order book driven (SETS) and a hybrid quote/order book driven system (SETSmm), whereas in the US trading on Nasdaq is order book driven and the NYSE has a hybrid system. The differing market structure of UK and US exchanges leads to differences in liquidity characteristics (Huang & Stoll, 2001). By providing evidence on the pricing of liquidity in the UK market we are able to assess whether these differences in market structure and liquidity characteristics affect conclusions on the relation between liquidity and stock returns as documented in the predominantly US literature.

Using an extensive data set of over 1.2 billion tick and best price observations covering the period January 1997 to February 2009 we are able to construct several microstructure stock liquidity measures for the UK for the first time. Our tick data enable the calculation of liquidity measures, some of which cannot be calculated using lower frequency, even daily, data. Others can be estimated with daily data but we find such estimates risk biasing results.[1] We construct time series of seven liquidity measures for each of the FTSE All Share constituent stocks over our sample period. We examine a large number of measures as different aspects of liquidity risk may not all be captured by one measure. For each liquidity measure we use asymptotic principal component analysis to capture commonality in liquidity across stocks in order to develop a systematic market liquidity factor. We also develop a systematic market liquidity factor across all seven measures combined which draws on the commonality in liquidity across assets as well as the

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[1] For example, taking the quoted spread liquidity measure which can be calculated using high frequency tick data or lower frequency daily closing prices, we demonstrate that the quoted spread varies considerably throughout the day, falling steadily over the course of the morning and flattening out in the afternoon. Calculating this measure using daily closing prices could give a false impression of liquidity.

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commonality across liquidity measures. We construct liquidity risk mimicking portfolios based on stocks' sensitivity to shocks to our systematic market liquidity factors. We examine several related questions: Is there a return premium for UK market or systematic liquidity risk? If so, is this return premium compensation specifically for the stock's systematic liquidity risk or the liquidity characteristics of the stock generally? What is the degree of commonality across liquidity measures among UK stocks? Are liquidity shocks persistent?

Briefly, we find that liquidity risk confers a significant premium in normal market conditions. There is evidence that the liquidity risk premium is related to momentum, consistent with Sadka (2006), but is unrelated to market, size and value risk. However, our new evidence around the recent financial crisis indicates that liquidity risk sensitive portfolios suffered significant abnormal negative returns during the period, highlighting the skewed nature of the pricing of liquidity risk.

The paper is organised as follows: Section 2 provides a brief discussion of the theory and empirical methods of the surrounding literature. Section 3 describes the extensive data set used. Section 4 outlines the methodology for estimating the liquidity measures from the data while Section 5 presents the methodology and results of tests for the cross sectional pricing of liquidity risk. Section 6 concludes.

2. Theory and empirical methods

The traditional domain of market microstructure research is the individual security with liquidity studied as an idiosyncratic phenomenon. Models of this type include the inventory based models of Stoll (1978) and the information based models of Kyle (1985). US based studies indicate that liquidity exhibits systematic variations (Chordia, Roll, & Subrahmanyam, 2000; Huberman & Halka, 2001; Korajczyk & Sadka, 2008). However, commonality in liquidity across stocks is not peculiar to the NYSE's idiosyncratic market structure, it has also been detected in order only markets. For example, Brockman and Chung (2002) analyse commonality in liquidity on the Hong Kong stock exchange which has no central market makers and find evidence of commonality. It has also been found across multiple markets (Brockman, Chung, & Perignon, 2009; Zhang, Cai, & Cheung, 2009). Karolyi, Lee, and Van Dijk (2012) suggest that commonality is driven by demand side factors more than funding liquidity drivers. Specifically, the authors find that global market liquidity is not primarily driven by financiers increasing margin requirement in times of crisis but rather investors themselves influencing liquidity based on sentiment, information acquisition incentives and correlated trading activity.

A separate vein of microstructure research indicates that static illiquidity, namely the property of a stock being persistently more or less liquid over time, is cross sectionally priced as a characteristic (Amihud & Mendelson, 1986). Certain theoretical models question this hypothesis. Constantinides (1986) argues that investors will adjust their trading frequency to offset any trading costs over multiple periods. Single period models which study the pricing of liquidity as a characteristic fail to take account of the empirically observed time variation in liquidity. Acharya and Pedersen (2005) develop an overlapping generations (OLG) model of liquidity risk and argue that liquidity risk may be split up into (i) sensitivity of individual asset's return to market liquidity, (ii) sensitivity of individual asset's liquidity to market liquidity and (iii) sensitivity of individual asset's liquidity to market return.

Also using tick data for the US, Korajczyk and Sadka (2008) is a comprehensive analysis of liquidity and liquidity pricing. The authors construct several liquidity measures and examine the commonality in liquidity across assets as well as the commonality across liquidity measures. The paper uses asymptotic principal component analysis to incorporate the commonality across assets into a systematic market liquidity factor for each liquidity measure while also developing a systematic market liquidity factor based on all liquidity measures jointly. The study finds in particular that systematic market liquidity based on this joint measure is priced as a factor and that high minus low liquidity risk portfolios generate a statistically significant positive alpha by CAPM and Fama and French (1996) specifications.

To our knowledge there is little research on systematic liquidity in the UK stock market. Galariotis and Giouvris (2007) report strong commonality among FTSE 100 stocks. Lu and Hwang (2007) study the pricing of illiquidity as a characteristic and report the surprising finding that illiquid stocks significantly underperform liquid stocks. Our paper adds to this literature by examining the pricing of systematic market liquidity risk employing a large and long intra-day data set, examining several new measures of liquidity and including much of the financial crisis period.

3. Data

The UK tick data and best price data analysed here were purchased from the LSE information products' division and cover the period from January 1997 to February 2009. The tick file contains all trades of which the LSE has a record. The data for each trade includes the trade time, publication time, price at which the trade occurs, the number of shares, the currency of the trade, the tradable instrument code (TIC) and SEDOL of the stock, the market segment and sector through which the trade was routed as well as the trade type. In total, the files contain 792,995,147 trades prior to any filtering. The best price files contain the best bid and ask prices available on the LSE for all stocks for the same time period. This includes the TIC, SEDOL, country of register, currency of the trade and time stamp of best price. The files contain 1,956,681,874 best prices prior to any filtering.

We apply a number of filters to the data prior to our analysis. All trades and quotes that occur outside the Mandatory Quote Period (SEAQ)/continuous auction (SETS) are removed (i.e., only trades between 08:00:00 and 16:30:00 are included).[2] Opening auctions are removed as their liquidity dynamics may be different from continuous auction trades. Cancelled trades are removed. We estimate liquidity in a given month only if the stock was a constituent of the FTSE All Share that month.[3] The data are cross-referenced with the London Share Price Database (LSPD) Archive file, SEDOL master file and returns file used in the construction of benchmark portfolios in our multi-factor performance models. The LSPD Archive file records when a given stock was a constituent of the FTSE All Share. We cross reference the data sets by comparing SEDOL numbers.[4] Best prices that only fill one side of the order book (i.e., where there is a best bid but no corresponding ask price) are removed. Trades that occur in any currency other than GBP are removed. A small number of unrealistically large quoted spreads are removed on data quality grounds: for stocks with a price greater than £50 spreads > 10% are removed while for stocks with prices

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[2] The data file covers trades of all the LSE's systems. The Stock Exchange Automated Quotation (SEAQ) system is a dealer centred system with dealers registered in a number of stocks. Dealers have an obligation to post firm bid and offer prices throughout the Mandatory Quotation Period (MQP) from 08:00:00 to 16:30:00. These bid and offer prices have to be honoured for at least the Normal Market Size (NMS) of a stock, defined as 2.5% of the average daily volume. The Stock Exchange Electronic Trading Service (SETS) system was set up in 1997 for the most liquid stocks on the exchange, namely FTSE100 stocks. This system is an order driven system where market participants have the choice between the traditional SEAQ style trade with dealers and an electronic order book that matches off setting orders. The inclusion of a stock in SETS removed the obligation of dealers to provide quotes and trades with dealers had to be negotiated. In September 1999, 47 mid cap stocks that were included in the FTSE 250 were transferred to SETS. In 2003 more stocks were added to a hybrid SETSmm where dealers still have an obligation to provide firm quotes in their registered stocks but investors have the option of using the electronic order book.

[3] The FTSE All Share Index is the aggregation of the FTSE 100, FTSE 250 and FTSE Small Cap indices comprising between 600 and 1000 stocks on the LSE historically. We are satisfied that this is sufficiently broad based and includes stocks most relevant to investors.

[4] To control for the fact that the SEDOL numbers of certain stocks have changed multiple times over the sample period we use the LSPD's SEDOL Master File.

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