Stock Market Liquidity and Macro-Liquidity Shocks: Evidence from the 2007-2009 Financial Crisis

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Abstract

We develop an empirical framework that links micro-liquidity, macro-liquidity and stock prices. We provide evidence of a strong link between macro-liquidity shocks and the returns of UK stock portfolios constructed on the basis of micro-liquidity measures between 1999-2012. Specifically, macro-liquidity shocks, which are extracted on the meeting days of the Bank of England Monetary Policy Committee (MPC) relative to market expectations embedded in 3-month LIBOR futures prices, are transmitted in a differential manner to the cross-section of liquidity-sorted portfolios, with liquid stocks playing the most active role. We also find that there is a significant increase in shares' trading activity and a rather small increase in their trading cost on MPC meeting days. Finally, our results emphatically document that *during* the recent financial crisis the shocks-returns relationship has reversed its sign. Interest rate cuts *during* the crisis were perceived by market participants as a signal of deteriorating economic prospects and reinforced "flight to safety" trading.

Keywords: Liquidity Shocks; Monetary Policy; Market Micro-Structure; Stock Returns.

JEL Classification: G12; E43; E44; E51; E52

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1. Introduction

The recent global financial crisis has highlighted the importance of liquidity for the well-functioning of financial markets. It is now well understood that a decline or, worse, evaporation of liquidity may cause large falls in asset prices that are not justified by their fundamentals. It may also cause the initialization of a downward spiral in asset prices, amplified by fire sales and deleveraging to meet margin calls and higher haircuts (see Brunnermeier, 2009, and Gorton and Metrick, 2010). Such feedback mechanisms can eventually pose a major threat to the stability of the financial system (Pedersen, 2009).

Liquidity plays a crucial role both at the macro level and at the micro level. Macro-liquidity refers to the money supply provision by central banks and the availability of funds for financial markets' participants, such as financial intermediaries. Micro-liquidity refers to the trading conditions of individual assets, namely the cost, speed, volume and price impact of transforming cash into financial assets and vice versa (Chordia, Sarkar and Subrahmanyam, 2005). The aim of this study is to examine the potential link between liquidity at a macro and a micro-level by evaluating the response of liquidity-sorted stock portfolios' returns to macro-liquidity shocks extracted on the Bank of England (BoE) Monetary Policy Committee's (MPC) meeting days.

Central banks possess a set of monetary policy tools for managing macro-liquidity. The policy rate they determine is considered to be the benchmark for the term structure of interest rates. This is particularly true for the short-end of the yield curve (Kuttner, 2001). Moreover, the terms of liquidity provision to financial intermediaries affect to a great extent the broad money supply in the economy. Crucially for the focus of our study, the pivotal role of intermediaries in the modern financial system also implies that macro-liquidity shocks induced by changes in the monetary policy stance of central banks can be transmitted through the entire intermediation chain, eventually affecting investors in the marketplace.[1]

Most obviously, the interbank market is crucially affected by monetary policy decisions. These are reflected in LIBOR fluctuations that influence the flow of funds among major intermediaries and determine the value of their proprietary portfolio of assets and agreements as well as the borrowing ability of dealers. As a result, these intermediaries may have to rebalance their own portfolios and modify their risk exposure and degree of leverage to meet regulatory requirements and remain solvent (see e.g. Adrian and Shin, 2010b). At the same time, intermediaries pass on to their institutional or individual clients these new terms of funds' exchange by modifying their lending standards as well as their margin requirements or call rates. This, in turn, may cause major shifts in the composition of these clients' portfolios and the trading conditions for the corresponding financial assets.[2] In sum, a shift in the quantity of available funds and the price of liquidity at the macro-level can be spread along the intermediation chain, reaching investors and traders by altering their funding conditions and investment decisions.

In addition to macro-liquidity, micro-liquidity is widely considered as an important source of market frictions that can have first-order effects on investment decisions and asset prices (see Amihud and Mendelson, 1980, 1986a, 1986b). Most importantly, micro-liquidity can be regarded as a risk factor leading to substantial risk premia in the cross-section of stock returns (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005). Motivated by this evidence, we argue that macro-liquidity shocks, to the extent that they affect liquidity conditions in the stock market, may also have a differential impact on the cross-section of

[1] Adrian and Shin (2010a) provide a detailed description of the long intermediation chain characterizing a modern financial system and the transmission of liquidity shocks across its links. See also Garcia (1989) for an account of the monetary policy tools for liquidity provision to financial intermediaries.
[2] See Brunnermeier and Pedersen (2009) for a model of the interaction between the availability of funds for traders and microstructure liquidity. Fortune (2000) explains the mechanics of margin lending and demonstrates the close relationship between the broker call money rate and the Fed Funds rate.

liquidity-sorted portfolios' returns. Stocks with different microstructure characteristics, and hence different exposure to micro-liquidity risk, may be differently affected by a common macro-liquidity shock.

A number of recent studies for the US find that expansionary macro-liquidity shocks improve micro-liquidity conditions, especially during periods of financial distress (see e.g. Chordia et al., 2005, Goyenko and Ukhov, 2009, Jensen and Moorman, 2010).[3] Nyborg and Ostberg (2010) analyse the process through which banks attempt to recover liquidity when they face tighter funding conditions. In line with "liquidity pull-back" trading, they find that increased tightening in the interbank market is associated with greater trading activity in highly liquid stocks relative to less liquid ones.[4] Our study is also related to the well-established strand of the literature that examines the impact of monetary policy shocks on stock returns (see e.g. Thorbecke, 1997, and Bernanke and Kuttner, 2005).[5]

In analyzing the link between macro-liquidity shocks and stock prices, our study also accounts for the potential impact of the recent global financial crisis, which was associated with evaporating liquidity (Nagel, 2012). We follow Bernanke and Kuttner (2005) and adopt an event study methodology along with interest futures' based measures of macro-liquidity shocks in order to assess the impact of macro-liquidity on the returns of stock portfolios that have been formed on the basis of micro-liquidity measures.[6] UK macro-liquidity shocks are extracted on the meeting days of the BoE's MPC relative to market expectations embedded in

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[3] See also Fernandez-Amador et al. (2013) for evidence suggesting that expansionary monetary policy by the European Central Bank increases stock market liquidity in three Eurozone markets (France, Germany and Italy).

[4] Nyborg and Ostberg's (2010) empirical approach is based upon identifying the highest and lowest funding illiquidity days in every month of their sample (based upon the LIBOR-OIS spread and the TED spread) and examining the patterns in the corresponding trading activity in more liquid versus less liquid stocks.

[5] These studies use various empirical approaches, ranging from vector autoregressive models to event studies, and find that US stocks react positively to expansionary monetary policy shocks, with a stronger reaction identified for small and value stocks (see e.g. Kontonikas and Kostakis, 2013, Maio, 2013). Wongswan (2009) and Hausman and Wongswan (2011) investigate the impact of US monetary policy on international stock markets. Previous studies on the relationship between monetary policy and stock returns in the UK include Bredin et al. (2007) and Gregoriou et al. (2009).

[6] Bernanke and Kuttner (2005) use the methodology suggested by Kuttner (2001) to extract a measure of interest rate shocks from futures contracts written on the Fed funds rate. This approach has become quite popular in the literature because these futures contracts naturally embed market participants' interest rates expectations; thus, one-day changes in their prices cleanly isolate the unexpected rate changes.

3-month LIBOR futures prices. We focus on LIBOR futures prices because there are no futures market instruments that track the BoE's policy rate (the two week repo rate) in the UK. The 3-month LIBOR futures contract traded on LIFFE is one of the instruments used by BoE to gauge market expectations regarding future interest rates (Brooke, Cooper and Scholtes, 2000, Joyce, Relleen and Sorensen, 2008). Since these futures contracts are actually written on LIBOR, which affects the cost and the supply of funds in financial markets, we argue that the changes of their prices on MPC meetings can be more broadly considered as macro-liquidity shocks initiated by the central bank actions (or inactions) rather than being narrowly defined as monetary policy shocks.

By examining the cross-section of liquidity-sorted portfolios, rather than broad stock market or sectoral indices, our approach can shed more light on the link between macro- and micro-liquidity. Specifically, we utilise the universe of stocks listed on the London Stock Exchange (LSE) during the period 1999-2012 and construct portfolios by sorting them according to their Return-to-Volume price impact ratio. This is the most commonly used liquidity measure, originally suggested by Amihud (2002). To account for the cross-sectional size bias induced by this measure, we also utilize the recently introduced Return-to-Turnover Rate price impact ratio (see Florackis et al., 2011), which is free of size bias.[7]

Thus, we contribute to the existing literature by: (i) estimating the response of UK liquidity-sorted stock portfolios' returns to macro-liquidity shocks extracted on the BoE MPC meeting days; (ii) accounting for the effect of the 2007-2009 financial crisis; (iii) testing whether this return response differs across the portfolios containing the most and the least liquid stocks; (iv) examining whether such a potentially different response can be attributed

[7] Despite the considerable attention that micro-liquidity has attracted in prior literature, it remains an elusive concept (Amihud, 2002, Pastor and Stambaugh, 2003). This feature has led to the emergence of a vast literature proposing a series of measures capturing the four dimensions of liquidity (trading cost, quantity, speed and price impact).

to changes in stocks' trading activity or trading cost conditions induced by these macro-liquidity shocks; and (v) utilising also a micro-liquidity measure that is immune to size bias.

Previewing our empirical results, we highlight the following main findings. First, the relationship between macro-liquidity shocks and liquidity-sorted portfolio returns is subject to an important structural break *during* the recent financial crisis; failing to account for this break, one would erroneously conclude that macro-liquidity shocks have no effect on returns. Interest rate cuts *during* the crisis not only failed to boost stock prices at MPC meeting days, but they actually led liquid stocks to lower prices because these were perceived by stock market participants as bad news, signals by the BoE of a worsening economic outlook. Second, and related to the previous point, interest rate cuts *during* the crisis reinforced "flight to safety" trading away from declining stocks and towards government bonds. Third, our results indicate that macro-liquidity shocks are transmitted to the cross-section of liquidity-sorted portfolios albeit in a differential manner between the most liquid and the most illiquid portfolios. Interestingly, the effect is much more statistically and economically significant for the most liquid portfolios. Fourth, there is a significant increase in shares' trading activity and a rather small increase in their trading cost on MPC meeting days. The increase in trading activity is more pronounced for the most illiquid shares, while there is no significant cross-sectional difference in the trading cost effect.

Our study is structured as follows. Section 2 describes the datasets and discusses various methodological issues. Section 3 examines the impact of macro-liquidity shocks on liquidity-sorted stock portfolios, while Section 4 assesses stock market liquidity conditions, on MPC meeting days. Section 5 contains a series of robustness tests. Section 6 concludes.

2. Data and Methodology

In line with the methodology suggested by Kuttner (2001), we use data from interest rate futures to extract macro-liquidity shocks on BoE's MPC meeting days.[8] For the UK, however, there are no futures market instruments that track the BoE's policy rate (the 2-week repo rate). The closest substitute is the short sterling futures contract that settles on the 3-month British Bankers' Association (BBA) London Interbank Offer Rate (LIBOR).[9] This is one of the instruments used by BoE to gauge market expectations regarding future interest rates and is widely used to hedge against and speculate on interest rate movements (Brooke et al., 2000, Bredin et al., 2007, Joyce et al. 2008). Since this futures contract is written on the LIBOR, we argue that the changes of their prices on MPC meetings days can be more broadly considered as macro-liquidity shocks initiated by the central bank actions (or inactions) rather than being narrowly defined as monetary policy shocks. This is especially true because the LIBOR is not necessarily equal to the BoE's policy rate; their spread, equivalent to the LIBOR-OIS spread in the US, is actually time-varying and conveys significant information for the interbank market conditions in periods of liquidity draughts (Gorton and Metrick, 2010, 2012).

The *unanticipated* interest rate change (macro-liquidity shock), Δi_d^u, is defined as the change in the implied 3-month LIBOR rate on the MPC meeting day, *d*, relative to the previous day, *d-1,* i.e.:

$$\Delta i_d^u = f_{m,d} - f_{m,d-1} \tag{1}$$

where $f_{m,d}$ is the implied interest rate, 100 minus the LIFFE futures contract price, extracted by the corresponding contract with delivery month *m* nearest to the MPC meeting day *d*.[10]

[8] The list of meetings and decisions is available at http://www.bankofengland.co.uk/monetarypolicy.

[9] The settlement price is 100 minus the BBA LIBOR that prevails at 11:00 on the last trading day (third Wednesday of the delivery month) rounded to three decimal places. Contracts are standardised and traded between members of the London International Financial Futures and Options Exchange (LIFFE).

[10] No adjustment is necessary for the number of days remaining in the month as in the US studies, because unlike the futures on the Fed funds rate whose settlement is based on the *average* Fed funds rate of the last

The sample period under investigation is June 1999-December 2012, yielding a total of 164 MPC meetings, and the source of LIBOR futures prices is Thomson DataStream.[11] Moreover, we define the *anticipated* change in interest rate, Δi_d^e, as the actual change in the 3-month rate minus the *unanticipated* change:

$$\Delta i_d^e = \Delta i_d - \Delta i_d^u \tag{2}$$

Descriptive statistics for the unexpected and expected LIBOR changes on MPC meeting days are provided in Panel A of Table 1, along with the corresponding statistics for the 5-year and 10-year UK Government bond yield changes, which are also sourced from Thomson DataStream. The average unexpected interest rate change is close to zero, ranging from a minimum of -39 basis points (bps) to a maximum of 23 bps. Figure 1 plots the actual along with the unexpected change in LIBOR on MPC meeting days. It indicates significant interest rate volatility during the financial crisis, especially following the Lehman Brothers' collapse in September 2008.

[Table 1 about here]

[Figure 1 about here]

For the construction of liquidity-sorted portfolios, we consider an initial sample that consists of all common stocks listed on the LSE for the period from May 1999 to December 2012. Our analysis covers both presently listed shares and shares that were de-listed at some point during the sample period, and hence our dataset is free of any potential survivorship bias. We minimize the impact of outliers by excluding firms with a market value less than £5 million. Finally, following conventional practice in UK stock market studies (see e.g.

month in the futures' life, in the UK the settlement of the 3-month LIBOR futures is based on the corresponding LIBOR of the last trading day.

[11] We start our event study analysis from June 1999 because LIBOR futures contracts did not settle on a monthly basis before that date; only contracts with quarterly delivery existed. The lack of correspondence in frequencies between the event (MPC monthly meetings) and the instrument's settlement may lead to biased estimates of the shock before June 1999.

Fletcher and Kihanda, 2005), we exclude unit trusts, investment trusts and ADRs. We obtain data from Thomson DataStream and construct, on a daily basis for each stock, a series of micro-liquidity measures, namely bid-ask spread, turnover rate, trading volume, Return-to-Volume and Return-to-Turnover Rate price impact ratios, which capture different dimensions of liquidity (i.e. trading cost, trading quantity, trading speed and price-impact). We define *bid-ask spread* as the difference between the ask price quoted (PA) and the bid price offered (PB) at the close of the market. *Turnover Rate* is the ratio of number of shares traded on a day to the number of outstanding shares. *Trading Volume* is measured as the total value (in pounds) of all shares traded on a particular day. *Return-to-Volume* (RtoV) represents the price impact ratio for each share and it is calculated as the average ratio of the absolute daily return to the corresponding pound trading volume, using 60 trading days prior to the MPC meeting day *d* in month *m*. To eliminate the impact of very thinly traded stocks, we require a non-zero trading volume for at least 45 out of the 60 trading days. Formally, this price impact ratio is given by:

$$RtoV_i = \frac{1}{D_i} \sum_{d=1}^{D_i} \frac{|R_{id}|}{V_{id}} \qquad (3)$$

where R_{id} and V_{id} are, respectively, the return and monetary trading volume of stock *i* on day *d* and D_i is the number of non-zero trading days for stock *i*. Finally, the *Return-to-Turnover Rate* (RtoTR) is an alternative price impact ratio recently proposed by Florackis et al. (2011) and it is calculated as the average ratio of the absolute daily return to the corresponding turnover rate, again using 60 trading days prior to the MPC meeting. This price impact ratio is given by:

$$RtoTR_i = \frac{1}{D_i} \sum_{d=1}^{D_i} \frac{|R_{id}|}{TR_{id}} \qquad (4)$$

where TR_{id} is the Turnover Rate of stock i at day d, while D_i and R_{id} are as previously defined.

The use of *RtoTR* is motivated by the potential cross-sectional size bias that Amihud's *RtoV* ratio encompasses. In particular, since the trading volume that appears in the denominator of this ratio is highly correlated with stocks' market value, ranking stocks according to *RtoV* is almost identical to ranking them according to their capitalization (see Florackis et al., 2011, for a more detailed analysis). On the other hand, *RtoTR* is not expected to exhibit a size pattern, because turnover rates are not strongly correlated with market values.

Our final dataset comprises of an average of 780 shares in each month. Using alternatively RtoV and RtoTR, we sort listed firms on the trading day prior to each MPC meeting day d in month m and we construct quintile portfolios (P1 to P5). In this way, we utilize the latest available information regarding shares' liquidity characteristics and at the same time we ensure that these were also available to investors in real time. Portfolio 1 (P1) contains the most liquid shares while Portfolio 5 (P5) contains the most illiquid shares. Since we are interested in the portfolios' return response due to a macro-liquidity shock on the MPC meeting days, we calculate (daily) portfolio returns on each MPC meeting day. Our benchmark results use equally-weighted portfolio returns, but for robustness we also calculate value-weighted returns. Panels B and C of Table 1 provide descriptive statistics for the daily returns of portfolios sorted on the basis of RtoV and RtoTR, respectively.

In our study we also examine the impact of macro-liquidity shocks on stock market liquidity conditions. To this end, we investigate whether trading activity, as measured by trading volume and turnover rate, and trading cost, as measured by bid-ask spread, for the shares in each of the previously described liquidity-sorted portfolios are affected on the MPC meeting day. To isolate the effect of the macro-liquidity shock on the MPC meeting day, we follow Nyborg and Ostberg (2010) by normalizing each share's trading activity or cost measure extracted on that day with its corresponding average value in the 5 prior trading days. For example, the normalized trading volume for share *i* on MPC meeting day *d* is given by the following expression:

$$\text{Normalized Volume}_{i,d} = \frac{\text{Volume}_{i,d}}{\sum_{j=d-k}^{d-1} \left(\text{Volume}_{i,j} / k \right)} \tag{5}$$

where k=5 in our benchmark results. Equipped with these normalized measures, we calculate the average portfolio normalized trading volume, turnover rate and bid-ask spread for each liquidity-sorted portfolio and each MPC meeting day in our sample.

3. Response of stock returns to macro-liquidity shocks

The starting point of our analysis is to examine the relationship between expected and unexpected interest rate changes and the returns of liquidity-sorted portfolios on BoE's MPC meetings. The benchmark model employed by Bernanke and Kuttner (2005) is given by:

$$r_{p,d} = \alpha + \beta^{u} \Delta i_{d}^{u} + \beta^{e} \Delta i_{d}^{e} + \varepsilon_{d} \tag{6}$$

where $r_{p,d}$ is the daily return of the RtoV- or RtoTR-sorted portfolio *p* on the MPC meeting day *d*.

Using this benchmark specification, we find in unreported results that neither anticipated nor unanticipated interest rate changes have a significant impact on liquidity-sorted portfolio returns on MPC meeting days. Moreover, the explanatory power of these regressions is almost negligible. These results for the full sample period June 1999- December 2012 are in sharp contrast to the evidence documented in prior studies on the inverse returns-shocks relationship (see e.g. Bernanke and Kuttner, 2005 for the US and Bredin et al., 2007 for the UK market). An inspection of portfolio returns during the crisis period and the preliminary evidence provided by Gregoriou et al. (2009) for the UK market motivates us to examine whether structural instability lies behind this puzzling finding.

In particular, the common perception and finding of previous studies that share prices rise due to a larger than expected decrease in interest rates was not confirmed during the recent financial crisis period. As a characteristic example, while the unexpected interest rate decrease on the MPC meeting of 6th November 2008 was an astonishing 40 bps, relative to market expectations implied by the 3-month LIBOR futures price, the FTSE All Share index plummeted by 5.53% on that day.[12] Similarly, the most liquid portfolio (P1) constructed on the basis of RtoV (RtoTR) yielded a negative return of -4.90% (-3.97%) on the same day. Moreover, the unexpected interest rate decrease of 10 bps on the meeting of 8th October 2008 was associated with a FTSE All Share drop of 4.98%, while the corresponding return for the most liquid portfolio on the basis of RtoV (RtoTR) was -3.97% (-3.14%). This puzzling phenomenon has attracted considerable attention in the financial press; a plausible interpretation is that surprising the market during the crisis by reducing rates more than expected was perceived as a signal for an even bleaker economic outlook by the central bank. Furthermore, conventional monetary policy becomes ineffective close to the zero lower bound and the reduction of interest rates to historically low levels may have been seen as a sign of the desperation of the central banks.[13]. Hence, interest rate cuts at the peak of the financial crisis instead of boosting stock returns, as previously thought, actually signalled bad news to the investment community and led stock prices to lower levels. On the other hand,

[12] It is worth noting that the magnitude of this unanticipated decrease is so big because the market was actually expecting an increase in LIBOR on that meeting day. Moreover, the BoE cut its policy rate by a historical record of 150 bps. Hence, it is an even more intriguing fact that the stock market collapsed in the face of the largest unexpected interest rate cut in record.

[13] Buttonwood also utilizes this line of argumentation in “Another paradox of thrift”, The Economist, 18th September 2010.

rising interest rates could have been regarded as good news, indicating the end of the crisis period.[14]

In order to formally test for structural change in the relationship between liquidity-sorted portfolio returns and macro-liquidity shocks during the financial crisis, we introduce a crisis period dummy variable that spans late 2007 to early 2009.[15] Specifically, the start of the financial crisis is dated to August 2007 when major doubts about global financial stability emerged and the first major central bank interventions in response to increasing interbank market pressures took place, shortly followed by the bank run at Northern Rock in September 2007. The end of the most intense period of the crisis is dated to early March 2009 when the stock market reached its lowest level and subsequently started to recover. The 2007 - 2009 dating scheme is also consistent with previous analyses of the recent financial crisis (see e.g. Brunnermeier, 2009, and Kontonikas et al., 2013). The crisis dummy variable is interacted with the explanatory variables of the benchmark specification in (6), leading to the following regression model:

$$r_{p,d} = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \varepsilon_d \qquad (7)$$

where $DCrisis$ stands for the crisis period dummy variable that takes the value 1 from August 2007 to March 2009 and 0 otherwise.

For estimation, we first use ordinary least squares where *t*-values are calculated using Newey-West (1987) standard errors. For robustness purposes, and in order to account for outliers, we also follow Basistha and Kurov (2008), Kurov (2010) and Kontonikas et al. (2013), employing the MM weighted least squares procedure introduced by Yohai (1987), which yields estimates that are robust to the presence of outliers. Table 2 (Table 3) reports the least squares (robust) estimates for RtoV- and RtoTR-sorted equally-weighted portfolio

[14] See, for example, "Why rising rates is good news", Financial Times, 14th December 2010.
[15] For robustness, in Section 5.1 we alternatively use a narrower definition of the financial crisis period.

returns in Panels A and B, respectively. We also report least square estimates from model (7) using value-weighted, instead of equally-weighted, portfolio returns (see Table 4).

[Tables 2, 3 and 4 about here]

The results reported in these three tables lead to the following set of conclusions. Starting with the results covering the period *outside* the financial crisis, we recover the inverse relationship between interest rate shocks and stock returns. This inverse relationship is both economically and statistically significant, especially for the portfolios containing the most liquid stocks. To illustrate the economic significance of the relationship, the estimated β_1^u coefficients in Table 3 (robust estimates) indicate that, outside the crisis period, an unexpected interest rate decrease of 25 bps would be associated with a positive daily return of 1.66% (1.17%) for the most liquid quintile portfolio (P1) constructed on the basis of RtoV (RtoTR) price impact ratio. On the other hand, the economic and statistical significance of this inverse relationship is much lower for the least liquid portfolio (P5), especially when RtoV is used as a sorting criterion. This finding highlights that at MPC meeting days macro-liquidity shocks are transmitted in a differential manner to stocks with different micro-liquidity characteristics.

To further examine the link between the performance of liquidity-sorted stock portfolios and macro-liquidity shocks, we formally test whether the most liquid - least liquid differential response is also statistically significant. This is true when least squares estimates are used (see Table 2). Under robust estimates (Table 3), the differential is also statistically significant when RtoV is used as a sorting criterion, but not when RtoTR is employed instead. A potential interpretation for the differential response is that an expansive macro-liquidity shock led to improved stock market liquidity conditions, rendering the liquid stocks even closer substitutes to other highly liquid instruments, and hence the corresponding liquidity premium required by investors to withhold them was reduced, boosting their prices. The opposite process would take place in a contractionary macro-liquidity shock. On the other hand, the micro-liquidity conditions of the most illiquid shares were largely unaffected by either expansionary or contractionary shocks, rendering their prices unresponsive. We formally test this explanation in Section 4. An alternative explanation for this differential response is that investors revise the premia they require relative to other highly liquid asset classes (e.g. government bonds and commercial paper) only for the most liquid shares; this process does not involve the most illiquid shares because their liquidity characteristics classify them as a separate asset class.

The second conclusion we derive from the results presented in Tables 2 to 4 is that both expected and unexpected interest rate changes can help explain the daily returns of the liquidity-sorted portfolios on BoE MPC meetings once we adjust for the crisis effect. Though daily returns are quite noisy by nature, macro-liquidity shocks exhibit a very high explanatory power. The adjusted R^2 of the model can be even higher than 20% for the most liquid portfolios and for both liquidity proxies used to construct them when we use robust regressions (see Table 3). On the other hand, the explanatory power of the model for the portfolios containing the least liquid shares is rather low, showing again that these shares' returns are rather unresponsive to the shocks. Overall, these findings highlight the fundamental importance of macro-liquidity, confirming that such shocks are directly transmitted to share prices via the channels we described in Section 1, albeit in a differential manner between liquid and illiquid shares.

Finally, the economic and statistical significance of the expected interest rate change coefficients contradicts the conjecture that this information would have been already incorporated into stock prices. Similar evidence has been also reported in the seminal study of Bernanke and Kuttner (2005) for the US market (see Table II, p. 1226) and in Gregoriou et al. (2009) for the UK market. This finding is at odds with representative agent asset pricing models in a frictionless environment, which would imply a reaction only to interest rate surprises. The explanation we put forward for this finding is that investors actually react to the total change in LIBOR rather than its unexpected component only. To formally test this conjecture, we utilize the following regression model:

$$r_{p,d} = \alpha + \beta_1 (1 - D_d^{Crisis}) \Delta i_d + \beta_2 D_d^{Crisis} \Delta i_d + \varepsilon_d \tag{8}$$

where Δi_d is the total change in LIBOR on MPC meeting day *d*. Confirming our conjecture, unreported regression results show that the return response coefficients to total LIBOR changes are economically and statistically significant for the liquid portfolios (P1 and P2) as well as for the spread between the most and the least liquid portfolios (P1-P5), both during and outside the financial crisis period.[16]

In terms of the results *during* the crisis period, we emphatically document that the interest rate changes - returns relationship reversed its sign during that period. In particularly, β_2^u and β_2^e estimates indicate that it turned into a positive relationship that is statistically as well as economically highly significant, for both unexpected expected and expected rate changes, respectively. In other words, an unexpected (or expected) decrease in the 3-month LIBOR led to a negative portfolio return response *during* the crisis, while it would have yielded a positive return *outside* the crisis period. The magnitude of the return responses is also noteworthy; for the portfolios containing liquid shares, the positive response to the shock during the crisis was at least twice greater than the negative response (in absolute value) documented excluding the crisis. On the other hand, the corresponding response for the portfolio P5 containing the least liquid shares was much lower, but still positive during the crisis period. In fact, the differential response between the most and the least liquid portfolio (P1-P5) during the crisis period was economically and statistically significant for both

[16] These results are readily available upon request.

liquidity proxies, for both econometric methodologies and for both equally- and value-weighted returns, as shown in Tables 2 to 4.

A possible explanation for the reversal of the shocks-returns relationship during the crisis period is that a decrease in interest rates on BoE MPC meeting days was signalling worsening prospects for the financial system and the macroeconomy; hence investors fled the stock market liquidating their positions to hoard cash or cash-like instruments, reduce their risk exposure and meet margin calls. The "flight to safety" or "flight to liquidity" mechanism, according to which investors rebalance their portfolios towards less risky and more liquid assets during times of economic and financial distress, is well-studied in the previous literature (see e.g. Longstaff, 2004, Chordia et al., 2005, Goyenko and Ukhov, 2009). Indeed, following the collapse of Lehman Brothers in September 2008, risk aversion peaked and equities experienced major losses while the price of "safe haven" assets increased.[17] To formally test whether interest rate shocks during the financial crisis reinforced "flight to safety" trading, we regress the daily changes in the 5-year and 10-year UK government bond yield on MPC meetings ($\Delta yield$) on the expected and unexpected interest rate changes:

$$\Delta yield_d = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \varepsilon_d \quad (9)$$

The corresponding regression results that are reported in Table 5 validate this argument. While the effect of unexpected rate changes on the 5-year UK government bond yield is small and statistically insignificant *outside* the crisis, there is a positive relationship that is highly economically and statistically significant *during* the crisis. In other words, an unexpected interest cut during the crisis period was accompanied by a fall in the 5-year UK government bond yield, caused by investors fleeing the stock market and investing in

[17] For example, while the FTSE 100 stock index declined by 50% between August 2007 and March 2009, the 5-year UK government yield fell from 5.25% to 2.41% over the same period.

government bonds, which were considered a “safe haven” at the time. Similar is the evidence from the 10-year UK government bond yield.

[Table 5 about here]

Finally, the significantly differential return response between the portfolios containing the most and the least liquid shares that we previously documented *during* the crisis period is also consistent with “flight to safety” trading. The rebalancing of investors’ portfolios during the crisis period was mainly accomplished by selling off their most liquid shareholdings, because these were easier to liquidate relative to the least liquid shares (consistent with the conjecture of Brunnermeier, 2009, and the evidence provided by Anand et al., 2010) and at the same time they ceased to be regarded as close substitutes to cash-like instruments such as fixed income securities. Therefore, the required premia for the most liquid shares were increased, and hence their prices were much more heavily penalized relative to the least liquid shares that were already penalized with a high premium required by investors to hold them.

4. Effects on stock market liquidity

The results in the previous section indicate that the macro-liquidity shocks on MPC meetings days are transmitted to the cross-section of liquidity-sorted portfolio returns in a differential way. In this section we examine how these shocks affect the trading activity and trading costs of these portfolios, testing also whether there is a differential effect between liquid versus illiquid shares.

4.1 Trading activity

In this section we examine the trading activity of RtoV- and RtoTR-sorted portfolios on MPC meeting days. We proxy trading activity using shares’ trading volume and, alternatively, turnover rate. To isolate the effect of the macro-liquidity shock on the MPC meeting day only, we follow Nyborg and Ostberg (2010) by normalizing each share's trading volume and turnover rate extracted on that day with its corresponding average value in the 5 prior trading days, as in equation (5). This normalization adjusts for the different levels of trading activity that each share exhibits prior to the MPC meeting and may be irrelevant to the effect of the specific macro-liquidity shock. In this way, we can also compare the relative effect on trading activity between liquid and illiquid shares, as classified on the basis of the two price impact ratios we utilize in this study. Values of the normalized measure above (below) 1 indicate that the trading activity on the MPC meeting day was higher (lower) than the prior average trading activity. We have also examined alternative short windows for the normalization; the results, which are readily available upon request, are qualitatively similar to the ones presented here.

Table 6 presents the average normalized trading volumes for RtoV-sorted (Panel A) and RtoTR-sorted (Panel B) portfolios, while Table 7 presents the corresponding average normalized turnover rates. In addition to reporting these averages for all MPC meetings in our sample period, we separately report them for meetings with a negative $\left(\Delta i^u < 0\right)$, positive $\left(\Delta i^u > 0\right)$ or no $\left(\Delta i^u = 0\right)$ unexpected interest rate change occurred. In this way, we can also examine whether the direction of the interest rate shock on the MPC meeting day affects shares' trading activity. Finally, we also report the corresponding averages excluding the meetings that took place during the financial crisis period, i.e. from August 2007 to March 2009, to examine whether there was any particular crisis effect.

[Tables 6 and 7 about here]

The results reported in Tables 6 and 7 lead to the following conclusions. First, trading activity considerably increases on MPC meeting days for the entire cross-section of liquidity-sorted portfolios. This is true for both proxies of trading activity. In particular, the reported values show that, in almost every case we examined, there is an increase of at least 15% relative to the average trading activity observed in the 5 prior trading days. Unreported *t*-tests show that this increase is also statistically significant at the 1% level or lower. Second, the observed increase in the trading activity remains remarkably robust across the different categories of MPC meetings. It does not depend on the sign of the interest rate shock and it cannot be attributed to the crisis period. This finding highlights that the MPC meeting is an important date for investors' calendar and that the informational content of MPC decisions is very important, leading to a significant increase in trading activity on this day. Third, the normalized trading activity of the least liquid shares, as classified by their price impact ratios prior to the meeting, increases much more relative to the trading activity of the most liquid shares. The differential trading activity normalized increase between the most and the least liquid portfolios (P1-P5) can be even higher than 20% and it is highly significant. This finding highlights that investors trade the least liquid shares on MPC meetings much more actively relative to the prior days. Therefore, the finding of the previous section that the returns response of the least liquid shares to macro-liquidity shocks is rather mundane cannot be attributed to thin trading of these stocks; quite the opposite is true on MPC meetings. Thus, it appears that higher trading in least liquid shares on MPC meeting days does not exhibit an overall direction that is as consistent as in the case of most liquid shares, and therefore does not lead to strongly positive or negative returns. Concluding, the differential response between the most and the least liquid shares' returns to the common macro-liquidity shocks that we documented in Tables 2 to 4 is not due to a differential impact on their micro-liquidity conditions.

4.2 Trading cost

In Table 8 we report the average normalized bid-ask spread for RtoV-sorted (Panel A) and RtoTR-sorted (Panel B) portfolios on MPC meeting days. The normalization is performed using each share's average bid-ask spread in the 5 trading days prior to the meeting. As with trading activity, we report the average bid-ask spreads for all meetings taking place in our sample period, for different signs of the interest rate shocks as well as excluding the meetings that took place during the crisis period.

[Table 8 about here]

The results reported in Table 8 lead to the following conclusions. First, there is a small increase in shares' bid-ask spreads on MPC meetings relative to the prior trading days. This increase is in the order of 5% and it is observed across all liquidity-sorted portfolios. Second, this small increase in the normalized bid-ask spreads remains intact when we separately examine MPC meetings associated with a positive, negative or no unanticipated interest rate change. This is an interesting and counterintuitive finding since, for example, trading costs are not reduced even when expansive macro-liquidity shocks (i.e. unexpected interest rate cuts) occur. Possibly, this result shows that bid-ask spreads widen relatively to the prior days because of the arrival of new information related to MPC decisions and the corresponding price discovery process that accompanies the considerably increased trading activity we previously documented. Third, this relative increase in the bid-ask spreads is similar across the liquidity-sorted portfolios. The differential relative increase between the most liquid and the most illiquid portfolios (P1-P5) is neither economically nor statistically significantly different from zero.

5. Robustness checks

5.1 Alternative definition of the crisis period

The introduction of the slope dummy variable for the recent crisis period in model (6) has played a crucial role for our analysis. As a result, it is legitimate to ask how an alternative definition of the crisis period may affect the reported results. For robustness purposes, we use September 2008, when Lehman Brothers collapsed, as an alternative starting point of the crisis. Thus, the slope dummy variable $DCrisis$ now takes the value of 1 during the period September 2008 - March 2009 and 0 otherwise. Using the resulting narrower crisis period definition that essentially captures the most intense phase of the recent financial crisis, we re-estimate model (7).

The estimation results, shown on Table 9, are very similar to the ones obtained using the benchmark definition of the crisis period. The inverse shocks-returns relationship excluding the crisis is economically and statistically significant. Most importantly, we also confirm the reversal in the sign of this relationship during the crisis period. The economic as well as the statistical significance of the positive response of returns to interest rate shocks remains intact and robust to the narrower definition of the crisis period. Examining the return responses across liquidity-sorted portfolio, our findings are very robust to the alternative characterization of the crisis period. In particular, the most liquid portfolios' returns react more negatively than the most illiquid portfolios' returns to interest rate shocks *before* and *after* the crisis period. Moreover, *during* the crisis period, the most liquid portfolios' returns react far more positively to these shocks relative to the most illiquid portfolios' returns.

[Table 9 about here]

5.2 Additional control variables

Our analysis has focused on the response of liquidity-sorted daily portfolios' returns to macro-liquidity shocks. Despite the use of an event study methodology, arguably other factors may be driving our results. To take into account potentially omitted variables that may affect UK daily stock returns, we estimate the following augmented regression model:

$$r_{p,d} = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \gamma ' X_d + \varepsilon_d \qquad (10)$$

where X_d represents the vector of additional explanatory variables. Following Bredin et al. (2007), we consider as additional control variables the daily change in the log sterling pound/ US dollar exchange rate, the daily change in the log sterling pound/ Euro exchange rate as well as the return on the US market as proxied by the daily change in the log S&P 500 index.[18]

Table 10 contains the response coefficients estimated from model (9). Panel A presents the results for the RtoV-sorted portfolios' returns, while Panel B shows the corresponding results for the RtoTR-sorted portfolios' returns. We can confirm the robustness of our benchmark results, even in the presence of additional explanatory variables. There is a differential response to interest rate shocks between the most liquid and the most illiquid portfolios' returns. This differential response is particularly significant, both statistically and economically, *during* the crisis period. More specifically, most liquid portfolios' returns exhibited a highly positive reaction to macro-liquidity shocks *during* the crisis, while most illiquid portfolios' returns remained largely unaffected.

[Table 10 about here]

5.3 Alternative definition of macro-liquidity shocks

This study has utilized macro-liquidity shocks defined relative to market expectations embedded in the traded futures contract written on the 3-month LIBOR. A series of previous US-based studies have utilized the changes in the LIBOR-OIS spread as a measure of interbank market funding conditions, with increases in the spread indicating macro-liquidity

[18] Given the time lag between the US and the UK market close, we follow common practice in the literature and use the lagged S&P 500 daily return.

deterioration.[19] Therefore, in this subsection we seek to examine the response of the micro-liquidity sorted portfolios' returns to changes in this alternative proxy of macro-liquidity conditions. For the UK market, we define the equivalent spread as the difference between the 3-month LIBOR (*L*) and the BoE Base rate (*B*). An increase in the LIBOR-BoE rate spread on an MPC meeting day implies an adverse macro-liquidity shock, in the sense that funding conditions for financial intermediaries and market participants deteriorate, either through an increase in the cost of funds or through a reduction in their supply. The model we estimate is given by:

$$r_{p,d} = \alpha + \beta^{spread} \Delta(LIBOR - BoE\ rate)_d + \varepsilon_d \qquad (11)$$

where $\Delta(LIBOR - BoE\ rate)_d$ stands for the change in the spread on meeting day *d* over the previous trading day *d-1*.

An important feature of the LIBOR-BoE rate spread is that it becomes very active mainly since the onset of the financial crisis in late 2007 (see Figure 2). As a result, we do not need to introduce a crisis period slope dummy variable in model (10). This effect is inherently taken into account by the behaviour of the spread. Furthermore, we do not decompose between anticipated and unanticipated components of this spread change (see also Nyborg and Ostberg, 2010).

Table 11 presents the estimated response coefficients from model (10). Panel A (Panel B) contains the results for the RtoV (RtoTR)-sorted portfolios' returns. Overall, the results show again a significantly different response between the most liquid and the most illiquid portfolios' returns. In particular, we find that the returns of the most liquid portfolios exhibit a significantly negative response to innovations in the LIBOR-Base rate spread. Moreover, this variable possesses very strong explanatory power with respect to liquid portfolios'

[19] The LIBOR-OIS spread is widely accepted as "a barometer of fears of bank insolvency" in the words of Alan Greenspan (see Thornton, 2009, and Gorton and Metrick, 2012, for an analysis of its features).

returns. Regarding the most illiquid portfolios' returns, they are significantly less affected by innovations in this spread.

[Table 11 about here]

5.4 Response of 2- and 3-day window returns to macro-liquidity shocks

Our analysis has focused on the contemporaneous effect of macro-liquidity shocks on liquidity-sorted portfolio returns. However, it is interesting to examine whether it takes illiquid stocks longer to respond to these interest rate shocks.[20] To this end, we compute 2- and 3-day portfolio returns and estimate their corresponding response coefficients. In particular, we firstly utilize the following regression model:

$$r_{p,[d,d+1]} = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \varepsilon_d \qquad (12)$$

where $r_{p,[d,d+1]}$ stands for the cumulative 2-day portfolio return, calculated at the end of the next trading day after the MPC meeting day *d*. To examine an even longer window, we also utilize the following regression model:

$$r_{p,[d,d+2]} = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \varepsilon_d \qquad (13)$$

where $r_{p,[d,d+2]}$ stands for the cumulative 3-day portfolio return, calculated at the end of 2 trading days after the MPC meeting day *d*.

We run these regressions for both RtoV- and RtoTR-sorted portfolios. The results are reported in Tables 12 and 13 for the 2-day and 3-day window returns, respectively. Overall, these results point to the following conclusions. Firstly, outside the crisis period, the most illiquid portfolio returns do not significantly respond to macro-liquidity shocks extracted on MPC meetings even when we compute these returns over 2- or 3-day windows. To the contrary, the magnitude of the (insignificant) response coefficients is further reduced as we

[20] We would like to thank an anonymous referee for suggesting this robustness check.

increase the length of the window from two to three days. The same is true for the explanatory power of the models. Secondly, even for the most liquid portfolios the magnitude and the significance of their return response is diminished when we compute these returns over 2- or 3-day windows. These results imply that the impact of macro-liquidity shocks on the most liquid portfolios' returns is predominantly contemporaneous, without exhibiting any significant lag effects. Finally, the corresponding return response coefficients during the crisis period remain large and significant for some of the examined portfolios when we compute them over a 2-day window, but they are eventually diminished when a 3-day window is used. In other words, the contemporaneous effect of macro-liquidity shocks on liquidity-sorted portfolio returns is so large during the crisis period (recall Tables 2-4), that it takes 2 trading days after the MPC meeting to become insignificant.

[Tables 12 and 13 about here]

6. Conclusions

The 2007-2009 global financial meltdown has brought macro- and micro-liquidity to the center stage of analysis for asset prices' fluctuations and the stability of the financial system. This study examines the transmission of shocks that affect the funding liquidity conditions of market participants and financial intermediaries to stock market returns. In particular, we examine the potential link between macro-liquidity shocks and the returns of portfolios sorted on the basis of the shares' micro-liquidity. In the process of doing so, we also account for the impact of the recent financial crisis. Shocks are extracted relative to market expectations embedded in LIBOR futures prices on BoE MPC's meeting days. Furthermore, we evaluate the underlying micro-liquidity conditions during those days.

There are four important conclusions from our empirical analysis. First, the relationship between macro-liquidity shocks and liquidity-sorted portfolio returns has changed significantly, by reversing its sign, *during* the recent financial crisis. Specifically, as nominal interest rates moved towards the zero lower bound, expansionary rate surprises led to lower prices for liquid stocks since investors perceived them as bad news for future economic prospects. Second, seen in this light, interest rate cuts *during* the crisis reinforced a rebalancing of portfolios away from stocks and towards "safe haven" assets such as government bonds. Third, the impact of macro-liquidity shocks is much more statistically and economically significant for the portfolio returns of most liquid stocks. Fourth, on MPC meeting days stocks' trading activity increases significantly, especially for the most illiquid shares. Trading cost also increases but not strongly, and without exhibiting significant cross-sectional differences.

These empirical findings have several important implications for policy makers and market participants. The conventional wisdom that reducing interest rates can boost stock prices in the short-run does not necessarily hold during a severe crisis period. To the contrary, under such conditions, interest rate cuts may be perceived by investors as a message that macroeconomic prospects are even worse than previously thought. This signalling effect may actually exacerbate the impact of adverse market conditions, eventually leading investors to flee the stock market, initializing a downward price spiral and posing a serious threat to the stability of the financial system.

However, our findings do not imply that it was a mistake for the BoE to lower interest rates during the crisis period. These dramatic cuts were a justified response to the unprecedented magnitude of the crisis, ultimately leading to the adoption of several rounds of quantitative easing (QE). Our findings also imply that the transmission of these macro-liquidity shocks may affect differentially stocks with different micro-liquidity conditions. Therefore, dissecting the cross-section of stock returns can prove quite useful for portfolio selection and diversification due to their differential exposure to liquidity risk. This differential risk exposure may lead to differential premia and less correlated price movements. Concluding, as Blinder (2012) recently noted, the reduction of policy rates to levels close to the zero lower bound and the implementation of QE by BoE calls for a detailed investigation of the impact of unconventional monetary policies on the returns of liquidity-sorted portfolios; this topic is left for future research.

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Table 1: Descriptive statistics

Panel A: Interest rate changes					
	Mean	*Median*	*Max*	*Min*	*St. Dev.*
Expected rate change	-0.4 bps	0 bps	26 bps	-40 bps	6 bps
Unexpected rate change	-0.1 bps	0 bps	23 bps	-39 bps	7 bps
5-year bond yield change	-0.7 bps	-1 bps	15 bps	-18 bps	6 bps
10-year bond yield change	-0.3 bps	-1 bps	17 bps	-10 bps	6 bps
Panel B: RtoV-sorted portfolios					
Portfolio	*Mean*	*Median*	*Max*	*Min*	*St. Dev.*
P1 (most liquid)	-0.10%	-0.03%	5.52%	-4.90%	1.32%
P2	0.01%	0.06%	5.26%	-4.23%	1.28%
P3	0.05%	0.15%	2.64%	-4.28%	0.90%
P4	0.06%	0.16%	2.13%	-4.30%	0.80%
P5 (most illiquid)	0.12%	0.26%	3.51%	-4.31%	0.96%
Panel C: RtoTR-sorted portfolios					
Portfolio	*Mean*	*Median*	*Max*	*Min*	*St. Dev.*
P1 (most liquid)	-0.03%	0.07%	5.35%	-4.49%	1.20%
P2	-0.01%	0.08%	4.51%	-4.58%	1.21%
P3	0.08%	0.17%	3.26%	-4.58%	1.02%
P4	0.06%	0.18%	2.60%	-3.74%	0.85%
P5 (most illiquid)	0.04%	0.09%	2.32%	-4.28%	0.87%

Notes: This Table presents descriptive statistics for liquidity-sorted portfolios' daily returns on Bank of England's (BoE) Monetary Policy Committee (MPC) meeting days. The analysis covers the period from June 1999 to December 2012 (164 MPC meetings). Panel A reports statistics for the expected and unexpected 3-month LIBOR changes, relative to expectations implied from LIBOR futures prices, as well as for the 5-year and 10-year UK government bond yield changes. Bps denotes basis points Panel B reports the statistics for equally-weighted quintile portfolios constructed on the basis of LSE-listed shares' Return-to-Volume (RtoV) price impact ratios calculated over the 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while Portfolio P5 contains the most illiquid shares. Panel B reports the corresponding statistics for portfolios constructed on the basis of shares' Return-to-Turnover Rate (RtoTR) price impact ratios calculated in the same way.

Table 2: Response of liquidity-sorted equally-weighted portfolio returns to rate changes- Least squares

Panel A: RtoV-sorted portfolios					
Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
P1 (most liquid)	-6.47**	-4.91*	19.58***	14.16***	8.82%
	(-2.08)	(-1.72)	(7.05)	(3.07)	
P2	-5.64**	-2.39	15.26***	10.40**	6.16%
	(-2.10)	(-0.95)	(5.25)	(2.27)	
P3	-2.39	-0.88	10.94***	6.27*	6.55%
	(-1.22)	(-0.45)	(5.31)	(1.94)	
P4	-2.22	-1.14	4.53*	0.85	2.25%
	(-1.35)	(-0.58)	(1.86)	(0.22)	
P5 (most illiquid)	-1.68	-0.33	3.08	0.65	-0.76%
	(-0.70)	(-0.13)	(1.05)	(0.16)	
P1-P5 spread	-4.79**	-4.58***	16.50***	13.52***	10.35%
	(-2.51)	(-3.19)	(7.06)	(4.77)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-5.26*	-2.31	16.09***	11.65***	7.34%
	(-1.80)	(-0.89)	(7.31)	(3.22)	
P2	-5.34**	-3.18	16.97***	11.77**	7.98%
	(-2.07)	(-1.25)	(5.63)	(2.41)	
P3	-2.87	-2.22	12.33***	5.88	8.05%
	(-1.44)	(-1.07)	(4.68)	(1.34)	
P4	-2.50	-1.09	7.36***	4.49	2.29%
	(-1.26)	(-0.54)	(3.30)	(1.47)	
P5 (most illiquid)	-2.43	-0.85	0.64	-1.45	-0.57%
	(-1.12)	(-0.33)	(0.25)	(-0.37)	
P1-P5 spread	-2.83*	-1.46	15.45***	13.10***	13.39%
	(-1.74)	(-1.15)	(9.09)	(7.01)	

Notes: This Table presents the estimates from least squares regressions of liquidity-sorted equally-weighted portfolio returns ($r_{p,d}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \,.$$

D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 3: Response of liquidity-sorted equally-weighted portfolio returns to rate changes- Robust estimates

Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-6.65***	-6.85***	20.88***	16.86***	21.18%
	(-2.75)	(-3.06)	(5.98)	(4.76)	
P2	-4.76**	-4.05**	16.40***	12.77***	15.86%
	(-2.15)	(-1.97)	(5.13)	(3.86)	
P3	-3.62***	-3.28**	13.46***	10.45***	25.34%
	(-2.61)	(-2.55)	(6.85)	(5.22)	
P4	-3.45***	-3.11***	7.82***	6.46***	15.09%
	(-2.89)	(-2.80)	(4.65)	(3.68)	
P5 (most illiquid)	-3.58**	-2.77*	5.97**	5.64**	3.98%
	(-2.12)	(-1.75)	(2.44)	(2.30)	
P1-P5 spread	-4.24***	-5.60**	17.07***	13.53***	18.63%
	(-2.94)	(-2.06)	(5.53)	(4.39)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-4.66**	-4.00**	17.47***	14.29***	19.65%
	(-2.27)	(-2.10)	(5.99)	(4.80)	
P2	-5.02**	-4.80**	18.94***	15.50***	22.79%
	(-2.44)	(-2.49)	(6.49)	(5.18)	
P3	-4.06***	-4.47***	14.50***	9.68***	28.33%
	(-2.70)	(-3.22)	(6.65)	(4.37)	
P4	-4.16***	-3.40***	9.74***	8.58***	15.12%
	(-2.93)	(-2.59)	(4.83)	(4.19)	
P5 (most illiquid)	-4.11***	-3.57**	3.51	3.61	3.71%
	(-2.63)	(-2.44)	(1.61)	(1.62)	
P1-P5 spread	-1.97	-1.80	16.18***	13.33***	20.98%
	(-1.18)	(-1.17)	(6.64)	(5.45)	

Notes: This Table presents the estimates from robust regressions of liquidity-sorted equally-weighted portfolio returns ($r_{p,d}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \,.$$

D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. The MM weighted least squares estimation procedure of Yohai (1987), which is robust to the presence of outliers, is employed. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio, calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 4: Response of liquidity-sorted value-weighted portfolio returns to rate changes- Robust estimates

Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-8.19***	-8.05***	20.89***	15.27***	24.77%
	(-3.51)	(-3.78)	(6.03)	(4.43)	
P2	-5.39**	-4.78**	15.42***	11.69***	14.39%
	(-2.32)	(-2.18)	(4.70)	(3.46)	
P3	-3.24*	-2.76*	13.01***	9.27***	18.24%
	(-1.91)	(-1.72)	(5.52)	(3.83)	
P4	-4.06***	-3.31**	6.23***	6.12***	8.17%
	(-2.85)	(-2.44)	(3.12)	(2.94)	
P5 (most illiquid)	-3.51**	-2.48*	3.76	3.86	2.18%
	(-2.17)	(-1.65)	(1.61)	(1.63)	
P1-P5 spread	-6.12***	-7.63***	19.63***	13.46***	22.68%
	(-2.59)	(-3.52)	(5.68)	(3.92)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-7.43***	-6.90***	22.19***	18.40***	24.01%
	(-3.26)	(-3.30)	(6.45)	(5.46)	
P2	-6.31**	-7.02***	20.21***	13.70***	19.41%
	(-2.35)	(-2.84)	(5.25)	(3.50)	
P3	-6.75**	-8.14***	7.38*	1.02	10.32%
	(-2.48)	(-3.14)	(1.81)	(0.24)	
P4	-4.85*	-5.12**	9.90***	6.89*	5.31%
	(-1.85)	(-2.12)	(2.68)	(1.87)	
P5 (most illiquid)	-1.96	-0.85	11.04***	6.51	4.02%
	(-0.64)	(-0.26)	(2.63)	(1.57)	
P1-P5 spread	-2.46	-0.79	9.45**	7.87**	2.11%
	(-0.88)	(-0.29)	(2.46)	(2.03)	

Notes: This Table presents the estimates from robust regressions of liquidity-sorted value-weighted portfolio returns ($r_{p,d}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \,.$$

D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. The MM weighted least squares estimation procedure of Yohai (1987), which is robust to the presence of outliers, is employed. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio, calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 5: Response of 5-year and 10-year UK bond yield changes to rate changes- Least squares

	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
5-year bond yield change	0.13 (0.84)	-0.26* (-1.87)	0.59*** (3.87)	0.43** (2.05)	13.93%
10-year bond yield change	-0.03 (-0.18)	-0.23* (-1.71)	0.55*** (2.72)	0.52* (1.83)	4.60%

Notes: This Table presents the estimates from least squares regressions of 5-year and 10-year UK government bond yield changes ($\Delta yield$) on rate on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$\Delta yield_d = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \,.$$

$\Delta yield_d$ stands for the change in the government bond yield on meeting day *d* over the previous trading day *d-1*. D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. In parentheses we show *t* statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 6: Average normalized trading volume of liquidity-sorted portfolios on MPC meeting days

	P1 (liquid)	P2	P3	P4	P5 (illiquid)	P1-P5
Panel A: RtoV-sorted portfolios						
All meetings (N=164)	1.15	1.24	1.35	1.39	1.34	-0.19***
Meetings with $\Delta i^u<0$ (N=74)	1.15	1.25	1.36	1.39	1.33	-0.18***
Meetings with $\Delta i^u>0$ (N=62)	1.16	1.23	1.34	1.40	1.37	-0.21***
Meetings with $\Delta i^u=0$ (N=28)	1.15	1.21	1.34	1.35	1.33	-0.18***
Excluding crisis (N=144)	1.15	1.25	1.36	1.40	1.34	-0.19***
Excluding crisis and $\Delta i^u<0$ (N=69)	1.14	1.25	1.37	1.40	1.31	-0.17***
Excluding crisis and $\Delta i^u>0$ (N=48)	1.16	1.26	1.37	1.43	1.38	-0.22***
Excluding crisis and $\Delta i^u=0$ (N=27)	1.15	1.22	1.35	1.35	1.32	-0.18***
Panel B: RtoTR-sorted portfolios						
All meetings (N=164)	1.19	1.22	1.30	1.39	1.37	-0.18***
Meetings with $\Delta i^u<0$ (N=74)	1.20	1.22	1.29	1.40	1.36	-0.16***
Meetings with $\Delta i^u>0$ (N=62)	1.19	1.22	1.31	1.39	1.39	-0.20***
Meetings with $\Delta i^u=0$ (N=28)	1.17	1.24	1.26	1.32	1.37	-0.20***
Excluding crisis (N=144)	1.20	1.23	1.30	1.40	1.37	-0.18***
Excluding crisis and $\Delta i^u<0$ (N=69)	1.20	1.22	1.30	1.40	1.35	-0.15***
Excluding crisis and $\Delta i^u>0$ (N=48)	1.20	1.24	1.33	1.43	1.41	-0.21***
Excluding crisis and $\Delta i^u=0$ (N=27)	1.18	1.25	1.28	1.32	1.37	-0.19***

Notes: This Table shows the average normalized trading volume of liquidity-sorted portfolios on BoE MPC meeting days during the period June 1999- December 2012. The trading volume of each share on MPC meeting day *d* is normalized using its average trading volume in the 5 prior trading days. The average portfolio normalized trading volume is calculated for all MPC meetings in our sample period as well as, separately, for the meetings that a negative ($\Delta i^u<0$), positive ($\Delta i^{u>0}$) or no ($\Delta i^u=0$) unexpected interest rate change occurred relative to expectations embedded in 3-month LIBOR futures prices. The corresponding averages are also calculated excluding the meetings that took place during the financial crisis period, i.e. from August 2007 to March 2009. To construct liquidity portfolios, shares listed on LSE are sorted on the basis of their Return-to-Volume (RtoV, Panel A) and Return-to-Turnover Rate (RtoTR, Panel B) price impact ratios and are assigned to quintile portfolios. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The difference in the average normalized trading volume between the most liquid and the most illiquid portfolios (P1-P5) is also reported and its statistical significance is indicated. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 7: Average normalized turnover rate of liquidity-sorted portfolios on MPC meeting days

	P1 (liquid)	P2	P3	P4	P5 (illiquid)	P1-P5
Panel A: RtoV-sorted portfolios						
All meetings (N=164)	1.15	1.22	1.34	1.38	1.33	-0.19***
Meetings with Δi^u <0 (N=74)	1.14	1.23	1.35	1.38	1.32	-0.17***
Meetings with Δi^u >0 (N=62)	1.15	1.22	1.34	1.39	1.35	-0.20***
Meetings with Δi^u =0 (N=28)	1.14	1.20	1.33	1.34	1.32	-0.19***
Excluding crisis (N=144)	1.14	1.23	1.36	1.39	1.33	-0.18***
Excluding crisis and Δi^u <0 (N=69)	1.14	1.23	1.36	1.39	1.30	-0.16***
Excluding crisis and Δi^u >0 (N=48)	1.15	1.25	1.36	1.42	1.37	-0.21***
Excluding crisis and Δi^u =0 (N=27)	1.14	1.21	1.34	1.34	1.32	-0.18***
Panel B: RtoTR-sorted portfolios						
All meetings (N=164)	1.17	1.21	1.29	1.38	1.37	-0.20***
Meetings with Δi^u <0 (N=74)	1.18	1.21	1.29	1.40	1.36	-0.18***
Meetings with Δi^u >0 (N=62)	1.17	1.21	1.31	1.39	1.39	-0.22***
Meetings with Δi^u =0 (N=28)	1.16	1.23	1.26	1.32	1.37	-0.21***
Excluding crisis (N=144)	1.17	1.22	1.30	1.39	1.37	-0.20***
Excluding crisis and Δi^u <0 (N=69)	1.17	1.21	1.29	1.40	1.35	-0.17***
Excluding crisis and Δi^u >0 (N=48)	1.17	1.23	1.32	1.42	1.41	-0.23***
Excluding crisis and Δi^u =0 (N=27)	1.16	1.23	1.27	1.32	1.36	-0.20***

Notes: This Table shows the average normalized turnover rate of liquidity-sorted portfolios on BoE MPC meeting days during the period June 1999- December 2012. The turnover rate of each share on MPC meeting day *d* is normalized using its average turnover rate in the 5 prior trading days. The average portfolio normalized turnover rate is calculated for all MPC meetings in our sample period as well as, separately, for the meetings that a negative (Δi^u<0), positive ($\Delta i^{u>0}$) or no (Δi^u=0) unexpected interest rate change occurred relative to expectations embedded in 3-month LIBOR futures prices. The corresponding averages are also calculated excluding the meetings that took place during the financial crisis period, i.e. from August 2007 to March 2009. To construct liquidity portfolios, shares listed on LSE are sorted on the basis of their Return-to-Volume (RtoV, Panel A) and Return-to-Turnover Rate (RtoTR, Panel B) price impact ratios and are assigned to quintile portfolios. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The difference in the average normalized turnover rate between the most liquid and the most illiquid portfolios (P1-P5) is also reported and its statistical significance is indicated. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 8: Average normalized bid-ask spread of liquidity-sorted portfolios on MPC meeting days

	P1 (liquid)	P2	P3	P4	P5 (illiquid)	P1-P5
Panel A: RtoV-sorted portfolios						
All meetings (N=164)	1.05	1.07	1.06	1.04	1.04	0.01
Meetings with $\Delta i^u<0$ (N=74)	1.05	1.09	1.07	1.04	1.05	0.01
Meetings with $\Delta i^u>0$ (N=62)	1.04	1.05	1.05	1.04	1.03	0.01
Meetings with $\Delta i^u=0$ (N=28)	1.07	1.06	1.05	1.04	1.03	0.03
Excluding crisis (N=144)	1.05	1.07	1.06	1.04	1.04	0.02
Excluding crisis and $\Delta i^u<0$ (N=69)	1.06	1.09	1.07	1.04	1.05	0.01
Excluding crisis and $\Delta i^u>0$ (N=48)	1.04	1.05	1.05	1.03	1.02	0.02
Excluding crisis and $\Delta i^u=0$ (N=27)	1.07	1.06	1.05	1.04	1.04	0.03
Panel B: RtoTR-sorted portfolios						
All meetings (N=164)	1.06	1.06	1.05	1.04	1.05	0.00
Meetings with $\Delta i^u<0$ (N=74)	1.06	1.08	1.06	1.05	1.06	0.00
Meetings with $\Delta i^u>0$ (N=62)	1.05	1.04	1.04	1.04	1.05	0.00
Meetings with $\Delta i^u=0$ (N=28)	1.06	1.07	1.04	1.04	1.04	0.02
Excluding crisis (N=144)	1.06	1.06	1.05	1.04	1.05	0.01
Excluding crisis and $\Delta i^u<0$ (N=69)	1.06	1.07	1.06	1.05	1.05	0.01
Excluding crisis and $\Delta i^u>0$ (N=48)	1.05	1.04	1.03	1.03	1.03	0.01
Excluding crisis and $\Delta i^u=0$ (N=27)	1.07	1.07	1.04	1.04	1.05	0.02

Notes: This Table shows the average normalized bid-ask spread of liquidity-sorted portfolios on BoE MPC meeting days during the period June 1999- December 2012. The bid-ask spread of each share on MPC meeting day *d* is normalized using its average bid-ask spread in the 5 prior trading days. The average portfolio normalized bid-ask spread is calculated for all MPC meetings in our sample period as well as, separately, for the meetings that a negative ($\Delta i^u<0$), positive ($\Delta i^{u>0}$) or no ($\Delta i^u=0$) unexpected interest rate change occurred relative to expectations embedded in 3-month LIBOR futures prices. The corresponding averages are also calculated excluding the meetings that took place during the financial crisis period, i.e. from August 2007 to March 2009. To construct liquidity portfolios, shares listed on LSE are sorted on the basis of their Return-to-Volume (RtoV, Panel A) and Return-to-Turnover Rate (RtoTR, Panel B) price impact ratios and are assigned to quintile portfolios. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The difference in the average normalized bid-ask spread between the most liquid and the most illiquid portfolios (P1-P5) is also reported and its statistical significance is indicated. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 9: Response of liquidity-sorted equally-weighted portfolio returns to rate changes using a narrower crisis period definition

Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-5.55*	-3.86	19.10**	13.22**	7.77%
	(-1.75)	(-1.28)	(2.45)	(2.45)	
P2	-5.06*	-1.69	14.87***	9.12*	6.21%
	(-1.87)	(-0.65)	(4.65)	(1.83)	
P3	-2.31	-0.69	11.28***	5.85	7.63%
	(-1.20)	(-0.38)	(4.25)	(1.42)	
P4	-2.13	-0.93	4.18	-0.36	3.38%
	(-1.31)	(-0.50)	(1.36)	(-0.07)	
P5 (most illiquid)	-1.72	-0.61	3.54	1.00	-0.79%
	(-0.76)	(-0.26)	(0.98)	(0.20)	
P1-P5 spread	-3.83*	-3.26*	15.56***	12.21***	7.87%
	(-1.94)	(-1.81)	(7.17)	(4.90)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-4.57	-1.67	15.82***	10.95***	6.72%
	(-1.57)	(-0.64)	(6.32)	(2.66)	
P2	-4.72*	-2.39	16.71***	10.74*	7.76%
	(-1.80)	(-0.90)	(4.61)	(1.86)	
P3	-2.68	-1.98	12.55***	5.28	8.87%
	(-1.38)	(-1.01)	(3.66)	(0.95)	
P4	-2.30	-0.83	7.30***	3.91	2.61%
	(-1.18)	(-0.43)	(2.76)	(1.07)	
P5 (most illiquid)	-2.49	-0.93	0.61	-2.05	-0.11%
	(-1.19)	(-0.39)	(0.18)	(-0.41)	
P1-P5 spread	-2.07	-0.74	15.21***	13.00***	11.25%
	(-1.23)	(-0.55)	(8.11)	(5.85)	

Notes: This Table presents the estimates from least squares regressions of liquidity-sorted equally-weighted portfolio returns ($r_{p,d}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \,.$$

In this case, D^{Crisis} is consistent with a narrower definition of the crisis and takes the value 1 on MPC meetings from September 2008 to March 2009 and 0 otherwise. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show t statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 10: Response of liquidity-sorted equally-weighted portfolio returns to rate changes using additional control variables

Portfolio	$\Delta i^u (1-D^{Crisis})$	$\Delta i^e (1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-9.59**	-5.92**	12.35***	11.96***	20.66%
	(-2.08)	(-2.22)	(3.10)	(2.69)	
P2	-8.80***	-3.47	7.21*	8.24*	22.45%
	(-2.92)	(-1.54)	(1.81)	(1.80)	
P3	-4.61**	-1.68	4.90*	4.94*	26.60%
	(-2.38)	(-1.08)	(1.93)	(1.79)	
P4	-4.13***	-1.84	-0.50	0.04	23.64%
	(-2.62)	(-1.16)	(-0.17)	(0.01)	
P5 (most illiquid)	-4.06*	-1.15	-2.71	-0.55	17.46%
	(-1.86)	(-0.53)	(-0.85)	(-0.17)	
P1-P5 spread	-5.52**	-4.77***	15.07***	12.51***	10.54%
	(-2.40)	(-3.18)	(5.88)	(5.88)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-8.24***	-3.26	9.35***	9.49***	19.98%
	(-2.57)	(-1.33)	(2.85)	(2.70)	
P2	-8.33***	-4.21*	9.22**	9.85**	25.36%
	(-2.93)	(-1.86)	(2.24)	(2.16)	
P3	-5.62***	-3.19*	5.27	4.26	29.85%
	(-2.92)	(-1.89)	(1.59)	(1.11)	
P4	-4.50**	-1.78	2.46	3.45	18.30%
	(-2.40)	(-1.07)	(0.95)	(1.33)	
P5 (most illiquid)	-4.50**	-1.62	-5.05	-2.42	21.23%
	(-2.23)	(-0.76)	(-1.69)*	(-0.73)	
P1-P5 spread	-3.73**	-1.64	14.40***	11.91***	15.94%
	(-1.97)	(-1.27)	(7.74)	(6.12)	

Notes: This Table presents the estimates from least squares regressions of liquidity-sorted equally-weighted portfolio returns ($r_{p,d}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta_1^u (1 - D_d^{Crisis}) \Delta i_d^u + \beta_2^u D_d^{Crisis} \Delta i_d^u + \beta_1^e (1 - D_d^{Crisis}) \Delta i_d^e + \beta_2^e D_d^{Crisis} \Delta i_d^e + \gamma' X_d + \varepsilon_d \, .$$

X_d represents the vector of additional explanatory variables including the daily change in the log sterling pound/ US dollar exchange rate, the daily change in the log sterling pound/ Euro exchange rate as well as the lagged return on the US market, as proxied by the daily change in the log S&P 500 index. D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 11: Response of liquidity-sorted equally-weighted portfolio returns to changes in the LIBOR-BoE base rate spread

Portfolio	*Δ(LIBOR-BoE rate)*	R^2 adj.
Panel A: RtoV-sorted portfolios		
P1 (most liquid)	-2.13***	7.53%
	(-3.04)	
P2	-1.47**	3.57%
	(-2.15)	
P3	-1.26**	5.52%
	(-2.33)	
P4	-0.93**	3.61%
	(-2.12)	
P5 (most illiquid)	-0.90***	2.16%
	(-2.75)	
P1-P5 spread	-1.22**	4.18%
	(-2.47)	
Panel B: RtoTR-sorted portfolios		
P1 (most liquid)	-1.68***	5.61%
	(-2.85)	
P2	-1.83**	6.59%
	(-2.50)	
P3	-1.61***	7.24%
	(-2.64)	
P4	-0.81**	2.26%
	(-2.04)	
P5 (most illiquid)	-0.75**	1.68%
	(-2.11)	
P1-P5 spread	-0.93**	3.80%
	(-2.34)	

Notes: This Table presents the estimates from least squares regressions of liquidity-sorted equally-weighted portfolio returns ($r_{p,d}$) on the change in the spread between the 3-month LIBOR (L) and the BoE Base rate (B) on BoE MPC meeting days during the period June 1999-December 2012 (164 MPC meetings), according to the model below:

$$r_{p,d} = \alpha + \beta^{spread} \Delta(LIBOR - BoE\ rate)_d + \varepsilon_d \,.$$

$\Delta(LIBOR\text{-}BoE\ rate)_d$ stands for the change in the spread on meeting day d over the previous trading day d-1. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show t statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 12: Response of 2-day cumulative portfolio returns to rate changes

Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-6.15	-6.12	18.75***	18.41***	2.78%
	(-1.56)	(-1.63)	(3.88)	(2.99)	
P2	-6.59*	-5.45	18.87***	18.19***	2.81%
	(-1.82)	(-1.36)	(4.11)	(3.15)	
P3	-3.92	-3.24	19.14***	17.45***	4.05%
	(-1.18)	(-0.97)	(5.47)	(4.10)	
P4	-3.20	-2.26	7.35**	6.64*	-0.79%
	(-1.03)	(-0.60)	(2.30)	(1.65)	
P5 (most illiquid)	-1.71	-2.12	4.86	4.94	-1.99%
	(-0.45)	(-0.48)	(1.43)	(1.07)	
P1-P5 spread	-4.44*	-4.00**	13.89***	13.47***	2.44%
	(-1.94)	(-2.00)	(7.53)	(5.58)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-6.27*	-4.13	15.08***	15.80***	2.12%
	(-1.83)	(-1.24)	(3.49)	(2.88)	
P2	-5.93	-5.69	22.08***	20.27***	4.62%
	(-1.62)	(-1.49)	(5.15)	(3.83)	
P3	-3.24	-3.24	14.56***	12.94**	0.99%
	(-1.03)	(-0.92)	(2.89)	(2.03)	
P4	-3.34	-3.26	9.90***	9.44**	-0.12%
	(-0.97)	(-0.88)	(3.56)	(2.50)	
P5 (most illiquid)	-2.82	-2.87	7.35**	7.21*	-1.19%
	(-0.71)	(-0.61)	(2.31)	(1.86)	
P1-P5 spread	-3.45	-1.26	7.73***	8.59**	1.02%
	(-1.62)	(-0.59)	(2.63)	(2.56)	

Notes: This Table presents the estimates from least squares regressions of 2-day liquidity-sorted equally-weighted cumulative portfolio returns ($r_{p,[d,d+1]}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,[d,d+1]} = \alpha + \beta_1^u(1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e(1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d \, .$$

D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 13: Response of 3-day cumulative portfolio returns to rate changes

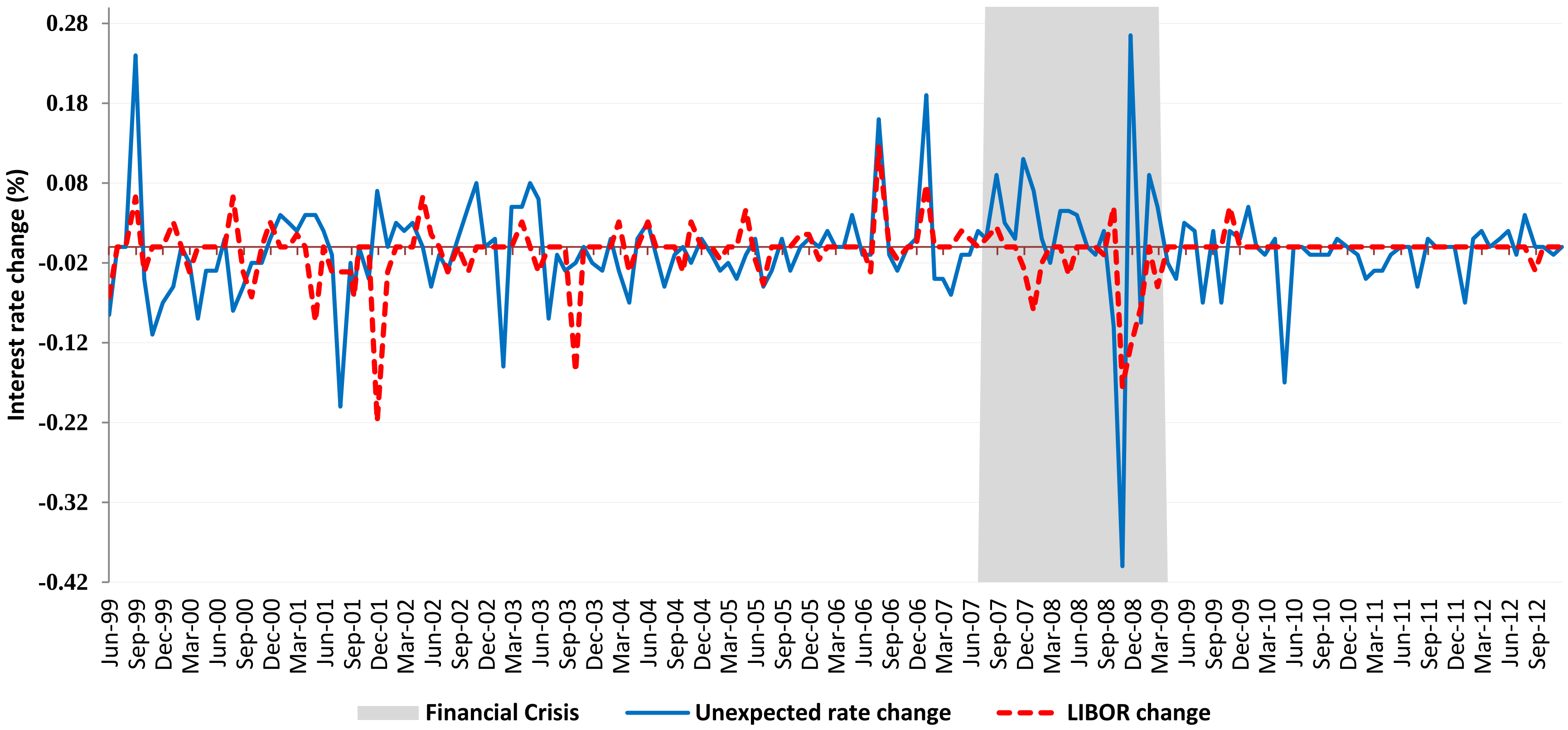
Portfolio	$\Delta i^u(1-D^{Crisis})$	$\Delta i^e(1-D^{Crisis})$	$\Delta i^u D^{Crisis}$	$\Delta i^e D^{Crisis}$	R^2 adj.
Panel A: RtoV-sorted portfolios					
P1 (most liquid)	-1.81	0.10	3.35	-6.70	0.61%
	(-0.29)	(0.02)	(0.39)	(-0.59)	
P2	-4.41	-2.65	4.36	-3.84	-0.28%
	(-0.78)	(-0.45)	(0.56)	(-0.39)	
P3	-2.00	-1.93	4.19	-4.82	0.72%
	(-0.34)	(-0.35)	(0.62)	(-0.54)	
P4	-1.10	0.12	-4.85	-8.38	-1.33%
	(-0.20)	(0.02)	(-0.80)	(-1.02)	
P5 (most illiquid)	1.19	0.24	-3.36	-6.77	-1.91%
	(0.18)	(0.04)	(-0.48)	(-0.69)	
P1-P5 spread	-3.00	-0.14	6.71**	0.07	0.62%
	(-0.85)	(-0.05)	(2.40)	(0.02)	
Panel B: RtoTR-sorted portfolios					
P1 (most liquid)	-3.53	-0.72	3.64	-4.56	0.13%
	(-0.64)	(-0.14)	(0.50)	(-0.49)	
P2	-3.79	-1.73	5.92	-2.25	-0.13%
	(-0.65)	(-0.30)	(0.73)	(-0.22)	
P3	-0.82	-0.75	0.12	-8.35	0.15%
	(-0.15)	(-0.14)	(0.01)	(-0.74)	
P4	-0.44	-0.18	-3.11	-9.16	-0.58%
	(-0.07)	(-0.03)	(-0.53)	(-1.07)	
P5 (most illiquid)	0.42	-0.76	-2.87	-6.20	-1.87%
	(0.06)	(-0.10)	(-0.45)	(-0.70)	
P1-P5 spread	-3.95	0.04	6.51	1.64	1.49%
	(-1.13)	(0.01)	(1.63)	(0.43)	

Notes: This Table presents the estimates from least squares regressions of 3-day cumulative liquidity-sorted equally-weighted portfolio returns ($r_{p,[d,d+2]}$) on expected (Δi^e) and unexpected (Δi^u) 3-month LIBOR changes on BoE MPC meeting days during the period June 1999- December 2012 (164 MPC meetings), according to the model below:

$$r_{p,[d,d+2]} = \alpha + \beta_1^u (1-D_d^{Crisis})\Delta i_d^u + \beta_2^u D_d^{Crisis}\Delta i_d^u + \beta_1^e (1-D_d^{Crisis})\Delta i_d^e + \beta_2^e D_d^{Crisis}\Delta i_d^e + \varepsilon_d .$$

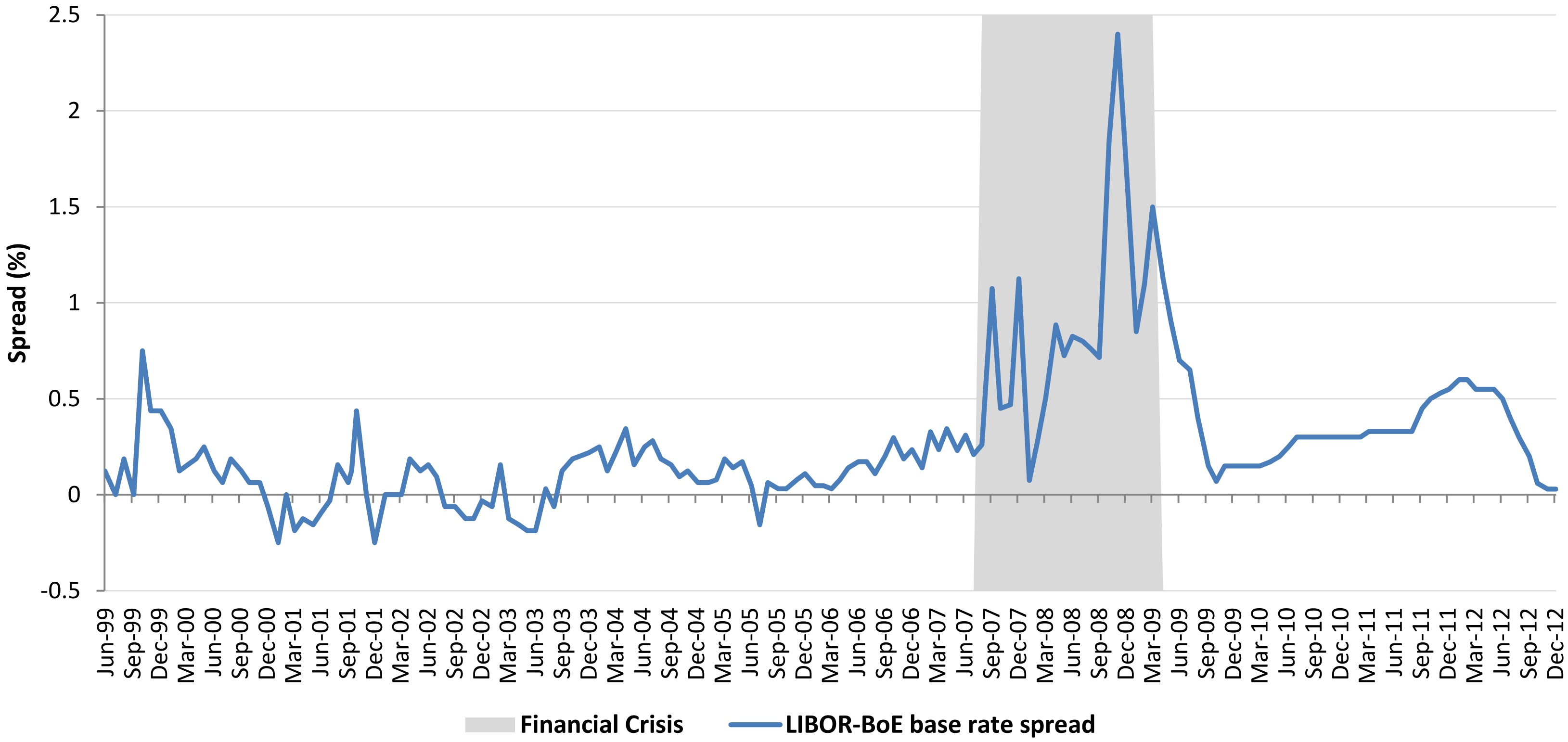
D^{Crisis} takes the value 1 on MPC meetings from August 2007 to March 2009 and 0 otherwise. Firms listed on LSE are classified into quintile portfolios on the basis of their Return-to-Volume (RtoV, Panel A) or Return-to-Turnover Rate (RtoTR, Panel B) price impact ratio calculated using 60 trading days prior to the MPC meeting. Portfolio P1 contains the most liquid shares, while P5 contains the most illiquid shares. The corresponding estimates for the spread return between the most liquid and the most illiquid portfolios (P1-P5) are also reported. In parentheses we show *t* statistics for the estimated coefficients using Newey-West standard errors. ***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Figure 1: Changes in LIBOR and unexpected interest rate changes



Notes: This Figure presents the daily changes in 3-month LIBOR as well as the corresponding unexpected interest rate changes, relative to expectations embedded in 3-month LIBOR futures prices, on BoE MPC meeting days during the period June 1999-December 2012 (164 MPC meetings).

Figure 2: LIBOR-BoE base rate spread



Notes: This Figure presents the LIBOR-BoE base rate spread, on BoE MPC meeting days during the period June 1999-December 2012 (164 MPC meetings).