Common Determinants of Bond and Stock Market Liquidity: The Impact of Financial Crises, Monetary Policy, and Mutual Fund Flows

Tarun Chordia
Goizueta Business School, Emory University
Tarun_Chordia@bus.emory.edu

Asani Sarkar
Federal Reserve Bank of New York
Asani.Sarkar@ny.frb.org

Avanidhar Subrahmanyam
The Anderson School, University of California at Los Angeles
subra@anderson.ucla.edu

December 11, 2001

We thank Michael Brennan, Arturo Estrella, Michael Fleming, Eric Hughson, Stavros Peristiani, Raghu Rajan, and René Stulz for helpful comments and/or for encouraging us to explore these issues. We also thank Michael Emmet for excellent research assistance. The views here are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors are the authors' alone.

Common Determinants of Bond and Stock Market Liquidity: The Impact of Financial Crises, Monetary Policy, and Mutual Fund Flows

Abstract

We study common determinants of daily bid-ask spreads and trading volume for the bond and stock markets over the 1991-98 period. We find that spread changes in one market are affected by lagged spread and volume changes in both markets. Further, spread and volume changes are predictable to a considerable degree using lagged market returns, lagged interest rates, lagged spreads, and lagged volume. During periods of financial crisis, stock and bond spreads and volume are more volatile and become more highly correlated; moreover, at these times, money supply positively affects financial market liquidity, albeit with a lag of two weeks. During normal times, increases in mutual fund flows enhance stock market liquidity and trading volume, but during financial crises, U.S. government bond funds see higher inflows, resulting in increased bond market liquidity. Overall, this study deepens our understanding of the dynamics of liquidity in financial markets and suggests how asset allocation strategies might be designed to reduce trading costs.

A number of important theorems in finance rely on the ability of investors to trade any amount of a security without affecting the price. However, there exist several frictions,[1] such as trading costs, short sale restrictions, circuit breakers, etc., that impact price formation. The influence of market imperfections on security pricing has long been recognized. Liquidity, in particular, has attracted a lot of attention from traders, regulators, exchange officials as well as academics.

Liquidity, a fundamental concept in finance, can be defined as the ability to buy or sell large quantities of an asset quickly and at low cost. Equilibrium asset pricing models do not consider trading and thus ignore the time and cost of transforming cash into financial assets or vice versa. Recent financial crises, however, suggest that, at times, market conditions can be severe and liquidity can decline or even disappear.[2] Such liquidity shocks are a potential channel through which asset prices are influenced by liquidity. Amihud and Mendelson (1986) and Jacoby, Fowler, and Gottesman (2000) provide theoretical arguments to show how liquidity impacts financial market prices.[3]

Until recently, studies on liquidity were focused principally on its cross-sectional determinants, and were restricted to equity markets (e.g., Benston and Hagerman, 1974, and Stoll, 1978). As more data has become available, recent work has shifted focus on studying time-series properties of liquidity in equity markets as well as in fixed-income markets. Hasbrouck and Seppi (2001), Huberman and Halka (2001), and Chordia, Roll and Subrahmanyam (2000) document commonality in equity market liquidity by showing that spreads and depths of individual stocks co-move with market- and industry-wide liquidity. Chordia, Roll, and Subrahmanyam (2001) study daily aggregate equity market spreads, depths and trading activity over an extended period to document weekly regularities in liquidity and the influence of market returns, volatility and interest rates on liquidity. Fleming (1997, 2001), and Brandt, Edelen, and Kavajecz (2001) study liquidity in the US government bond market while Fleming and Remolona (1997, 1999), Balducci,

[1] See Stoll (2000).
[2] "…One after another, LTCM's partners, calling in from Tokyo and London, reported that their markets had dried up. There were no buyers, no sellers. It was all but impossible to maneuver out of large trading bets." --- *Wall Street Journal*, November 16, 1998.

Elton and Green (2001), and Green (2001) analyze returns, spreads, and trading volume in bond markets around economic announcements.

So far the literature on stock and bond liquidities has developed in separate strands. In this paper, we jointly study the time-series of liquidity in stock and bond markets. Stocks and bonds are important for resource allocation, as they are the main vehicles by which funds are raised for long-term investments by firms and governments. Since liquidity has been shown to be related to asset returns and, in turn, costs of capital, analyzing how stock and bond liquidities move and co-move over time is important for enhancing the efficacy of resource allocation.

Further motivation for our study derives from the observation that, in practice, a number of asset allocation strategies shift wealth between stock and bond markets.[4] The question naturally arises as to the optimal way of executing these strategies so as to minimize trading costs. In particular, it is of interest to consider whether timing these allocations or sequencing them in a particular way can reduce trading costs associated with these strategies. Our consideration of the joint time-series of stock and bond market liquidity sheds light on this issue, and also on other specific research questions that have not yet been addressed in the literature:

- What is the extent of co-movement between stock and bond liquidity and how does the nature of this co-movement change during financial crises?
- Are there spillover effects from bond liquidity to stock liquidity or vice versa?
- What are the common determinants of time-series variations in bond and stock liquidity and trading activity?
- Is financial market liquidity predictable using publicly available information? If so, what variables help forecast future stock and bond market liquidity?
- Does pumping up the money supply (especially during financial crises) improve liquidity in stock and bond markets?

---

[3] See also Brennan and Subrahmanyam (1996) and Brennan, Chordia and Subrahmanyam (1998).

- What happens to money flows in and out of stock and bond mutual funds during financial crises and how does this impact stock and bond market liquidity?

Our goal in this paper is to address these questions by considering the joint time-series of bond and stock market liquidity over a fairly long time-period of over 1700 trading days.

Our results indicate that percentage bond spreads and volume are lower than percentage stock spreads and volume, but are also more volatile. But the time series properties of stock and bond liquidity are remarkably similar. For example, there are weekly regularities in both bond and stock liquidity. Further, an increase in volume in one market is associated with decreased volume in the other market after a lag of one to three days.

Previously documented autocorrelation in liquidity changes[5] suggests an examination of the practical and scientific issue of whether future liquidity is predictable from publicly available information. Results from forecasting regressions indicate that bond and stock spreads and volume are highly predictable. Lagged market returns, lagged interest rates, the lagged bid-ask spread and lagged volume are all predictors of the bid-ask spread and volume changes in both markets. In particular, liquidity in one market is a strong predictor of liquidity in the other market. For example, an increase in the past volume in stock markets predicts decreased current volume in the bond markets. Further, spread changes in the bond market lead spread changes in the stock market. The latter result indicates that if asset allocation strategies are to be executed slowly over time for price impact reasons, then, during periods of enhanced liquidity in the bond market, they should be executed first in that market followed by the corresponding stock market trades.

Markets behave differently during periods of financial crises. We consider the Asian crisis in 1997 and the Russian default crisis in 1998. Our results suggest greater market uncertainty during crisis periods, leading to increased volatility in stock and bond

---

[4] See, for example, Amman and Zimmerman (2001) and Fox (1999) for practical considerations, and Barberis (2000) or Xia (2001) for more academic standpoints.

[5] See, for example, Chordia et al. (2001).

liquidity, and greater trading activity by investors. Also, the correlation between stock and bond spread and volume changes increases dramatically during crises relative to normal times, and linkages between stock and bond market liquidity are significantly stronger in crisis periods.

An avowed role of the Federal Reserve System is to provide liquidity to financial markets during periods of turbulence (Greenspan, 1999). Such actions are claimed to have enhanced liquidity during prominent periods of stock market stress (Garcia, 1989). Using weekly data on money supply (M1), we examine the causative relation between monetary policy and financial market liquidity. We also examine how monthly money flows in and out of stock and bond funds affect liquidity during financial crises as well as in normal periods. We show that increases in money supply are generally unrelated to liquidity in normal times, but increase stock and bond market liquidity in crisis periods with a lag of 2 weeks. Further, increases in mutual fund flows enhance stock market liquidity and trading volume in normal times. During periods of crises, there is a decrease in fund flows to equity funds and an increase in fund flows to government bond funds, suggesting that the "flight to quality" during these periods leads to an increase in bond market liquidity.

The rest of the paper is organized as follows. Section I describes the data. Section II presents summary statistics; Section III performs daily regressions, whereas Section IV conducts a pure prediction exercise. Section V analyzes liquidity around periods of financial crises: namely the Asian and the Russian crises. Section VI presents the results of weekly and monthly regressions that use money supply and mutual fund flows. Section VII concludes.

I. Data

Bond and stock liquidity data were obtained for the period June 17, 1991 to December 31 1998. The sample period reflects the availability of tick-by-tick government bond data, obtained from GovPX, Inc., which covers trading activity among primary dealers in the interdealer broker market. The stock data sources are the Institute for the Study of Securities Markets (ISSM) and the New York Stock Exchange TAQ (trades and automated quotations). The ISSM data cover 1991-1992 inclusive while the TAQ data are for 1993-1998. We use only NYSE stocks to avoid any possibility of the results being influenced by differences in trading protocols between NYSE and Nasdaq.

A. Measures of Bond Liquidity

GovPX, Inc. consolidates data from the primary brokers and transmits the data in real-time to subscribers through on-line vendors. The service reports the best bid and offer quotes, the associated quote sizes, the price and amount (in million dollars) of each trade, and whether the trade is buyer or seller-initiated. The time of each trade is also reported to the second.[6] We use trading data for the 10-year, on-the-run Treasury note. Although on-the-run securities are a small fraction of Treasury securities, they account for 71% of activity in the interdealer market (Fabozzi and Fleming, 2000). We choose the 10-year note for two reasons. First, it is among the most actively traded fixed-income securities. Second, GovPX data is representative of the overall market for 10-year notes during our sample period. For other long-term Treasury notes (such as the 30-year Treasury note), the GovPX data captures a smaller and variable fraction of aggregate bond market activity since a major broker, Cantor Fitzgerald/eSpeed, does not report its data.[7]

The bond liquidity measures are based on data from New York trading hours (7:30 AM to 5:00 PM Eastern Time). We construct the following measures of bond liquidity:
PQSPRB: the daily average proportional quoted bid-ask spread, calculated as the difference between the best bid and best quote for the trade divided by the mid-point of the quote (in %). Only quotes that are matched with trades are retained in the sample. The trade price is matched with the most recently available quote record on the same day.

[6] Fleming (2001) provides a detailed account of the format of GovPX data.
[7] Boni and Leach (2001) documents the share of GovPX in the aggregate bond market volume.

PESPRB: the daily average proportional effective spread, i.e., the difference between the execution price and the mid-point of the prevailing bid-ask quote, divided by the mid-point of the quote (in %).

VOLB: the daily dollar volume (the nominal value of the bond contracts).

To obtain reliable estimates of the bid-ask spread and volume, the following filters are used:

1. Bid or offer quotes with a zero value are deleted.
2. Trade prices that deviate more than 20 percent from par value ($100) are deleted. These prices are grossly out of line with surrounding trade prices, and are most likely to be reporting errors.
3. A quoted or effective bid-ask spread that is negative or more than 50 cents per trade (a multiple of about 12 to 15 times the sample average) is deleted.
4. Trades with proportional effective spreads in the upper five percentile of its distribution for a particular calendar year are deleted. These trades are clearly outliers, since their proportional effective spreads are several times greater than its standard deviation, and also far exceed the maximum proportional quoted spread for the calendar year.

B. Stock Liquidity Data

Stocks are included or excluded during a calendar year depending on the following criteria:

- To be included, a stock had to be present at the beginning and at the end of the year in both the CRSP and the intraday databases.
- If the firm changed exchanges from Nasdaq to NYSE during the year (no firms switched from the NYSE to the Nasdaq during our sample period), it was dropped from the sample for that year.
- Because their trading characteristics might differ from ordinary equities, assets in the following categories were also expunged: certificates, ADRs, shares of beneficial interest, units, companies incorporated outside the U.S., Americus Trust components, closed-end funds, preferred stocks and REITs.

- To avoid the influence of unduly high-priced stocks, if the price at any month-end during the year was greater than $999, the stock was deleted from the sample for the year.

Intraday data were purged for one of the following reasons: trades out of sequence, trades recorded before the open or after the closing time, and trades with special settlement conditions (because they might be subject to distinct liquidity considerations). Our preliminary investigation revealed that auto-quotes (passive quotes by secondary market dealers) were eliminated in the ISSM database but not in TAQ. This caused the quoted spread to be artificially inflated in TAQ. Since there is no reliable way to filter out auto-quotes in TAQ, only BBO (best bid or offer)-eligible primary market (NYSE) quotes are used. Quotes established before the opening of the market or after the close were discarded. Negative bid-ask spread quotations, transaction prices, and quoted depths were discarded. Following Lee and Ready (1991), any quote less than five seconds prior to the trade is ignored and the first one at least five seconds prior to the trade is retained.

For each stock we define the following variables:

PQSPRS: the daily average proportional quoted spread, i.e., the quoted spread divided by the mid-point of the quote (in %).

PESPRS: the daily average proportional effective spread, i.e., the difference between the execution price and the mid-point of the prevailing bid-ask quote, divided by the mid-point of the quote (in %).

VOLS: Total trading volume (in $).

Our initial scanning of the intraday data revealed a number of anomalous records that appeared to be keypunching errors. We thus applied filters to the transaction data by deleting records that satisfied the following conditions:

1. Quoted spread>$5
2. Effective spread /Quoted spread >$4.0
3. Proportional effective spread / Proportional quoted spread > 4.0
4. Quoted spread/Mid-point of bid-ask quote > 0.4

These filters removed fewer than 0.02% of all stock transaction records. The above variables are averaged across the day to obtain stock liquidity measures for each day. Days for which stock return data was not available from CRSP were dropped from the sample. The daily dollar trading volume is obtained from CRSP. The daily spread measures are first averaged within the day for each stock, then averaged equal-weighted across stocks to obtain the aggregate market liquidity measures that we use in this study (for convenience we use the same variable names for the aggregate liquidity and volume measures).

II. Summary statistics

Table 1 presents the levels of proportional quoted and effective spreads and dollar trading volumes for stocks and bonds. The percentage spreads for bonds are lower than that for stocks. The average proportional quoted and effective spreads are 0.032% and 0.03%, respectively for bonds, but 1.3% and 0.9%, respectively, for stocks. The daily average bond trading volume is about $3.6 billion whereas the equally weighted average trading volume *per stock* is $8.3 million.[8] The median bid-ask spread measures are almost the same as the means suggesting little skewness in the daily distribution of the bid-ask spreads.

Figures 1 through 3 plot the daily levels of bond quoted and effective spreads and bond trading volume. The results show that bond spreads have remained fairly level over our sample period. In contrast, Chordia et al. (CRS) (2001) demonstrate that stock spreads generally declined through the 1990's. Figure 3 demonstrates that bond volume has steadily increased over the sample period; CRS show that the same is true for stock market volume.

Table 2 documents the daily absolute percentage changes in proportional quoted and effective spreads and dollar trading volumes for stocks and bonds (the "D" prefix to

[8] The number of traded stocks varies slightly over time, hence stock volume is reported on a per stock basis.

variables denotes a percentage change). Bond spreads and dollar trading volume are much more volatile than stock spreads and stock volume. For example, the average absolute percentage change for bond quoted spreads is about 11.2%, while it is only about 2% per day for stock quoted spreads. Similarly, the daily absolute change in stock dollar trading volume is about 13%, but the corresponding change in the bond trading volume is about 34% per day. The high variability of trading volume in the bond market is consistent with anecdotal evidence that secondary bond trading is highly sensitive to day-of-the-week effects (for example, lower trading on Fridays and before holidays) as well as to exogenous events such as Treasury auctions and macroeconomic news announcements.

Table 3 documents that the correlation structure within each market is quite similar. For example, the correlation between daily percentage changes in quoted and effective spreads is 68% for bonds and 67% for stocks; the correlation between the quoted spread and volume is -12% for bonds and -6% for stocks. The correlation between stock and bond market liquidity measures is low, however. For instance, the correlation between daily percentage changes in stock and bond quoted spreads is only about 13%. The correlation in effective stock and bond spread changes is only 8%. But there is a 27% correlation between stock and bond volume changes. In general, the univariate correlation in liquidity across the two types of security markets is fairly low, thus raising the issue of whether the underlying determinants of liquidity in the two markets are similar or not. This is the question we address in the next section.

III. Vector Auto-Regression Analysis

Consider the following bivariate Vector-Auto Regression (VAR):

$$X_t = \sum_{j=1}^{K} a_{1j} X_{t-j} + \sum_{j=1}^{K} b_{1j} Y_{t-j} + \sum_{j=0}^{M} c_{1j} Z_{t-j} + e_t \,, \tag{1}$$

$$Y_t = \sum_{j=1}^{K} a_{2j} X_{t-j} + \sum_{j=1}^{K} b_{2j} Y_{t-j} + \sum_{j=0}^{M} c_{2j} Z_{t-j} + u_t \,, \tag{2}$$

where X_t (Y_t) represents the bond (stock) liquidity variables such as quoted spreads, effective spreads and trading volume and Z_t represents other variables (to be presented shortly) than may impact liquidity. Note that the regressors include the lagged values of the dependent variables as well as concurrent and lagged values of other variables.[9] The VAR framework allows us to analyze the impact of bond liquidity on stock liquidity and vice versa. We now provide a discussion of the regressors, Z_t, which are as follows: [10]

Mkt+S: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise.
Mkt-S: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise.
Mkt+B: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise.
Mkt-B: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise.
Short rate: the daily first difference in the Federal Funds rate.
Term spread: the daily change in the difference between the yield on a constant maturity 10-year Treasury note and the Federal Funds rate.
Quality Spread: the daily change in the difference between the yield on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond.
Holiday: a dummy variable that equals one if a trading day satisfies the following conditions. (1) Independence day, Veterans' Day, Christmas or New Year's Day falls on a Friday, then the preceding Thursday, (2) a holiday falls on a weekend or on a Monday then the following Tuesday, (3) a holiday falls on a weekday then the preceding and the following days. Otherwise the dummy variable is zero.
Monday-Thursday: equals one if the trading day is Monday, Tuesday, Wednesday, or Thursday, and zero otherwise.

[9] In the next section, we will look at the predictability of liquidity and will thus use only the lagged values of the regressors.
[10] The regressors draw on Chordia et al. (2001).

GDP: dummy variable that equals one on the day of the GDP announcement and zero otherwise.
GDP12: dummy variable that equals one on two days prior to the GDP announcement and zero otherwise.
Emp, Emp12, CPI, and CPI12: corresponding dummy variables for employment and CPI announcements respectively.

In brief, the rationale for including these variables is as follows. The inventory paradigm (Stoll, 1978) suggests that liquidity depends on dealer financing costs and on inventory risks. Hence, interest rate levels and yield spreads are plausible candidates for determinants of liquidity. Market return performance is another plausible determinant. Recent price moves in either market could trigger changes in investor expectations while also prompting changes in optimal portfolio compositions resulting in order imbalances, and, in turn, changes in liquidity. In addition, the direction of market movements could trigger asymmetric effects on liquidity. For example, sharp price declines could induce relatively more pronounced changes in liquidity to the extent that market makers find it more difficult to adjust inventory in falling markets than in rising markets.

Trading activity and, in turn, liquidity, may also be influenced by the opportunity cost of devoting time to trading decisions, which could vary across days of the week. To investigate such regularities, we include indicator variables for days of the week as well as for days preceding and following holiday closures. Further, to capture portfolio rebalancing around major public information releases, we include dummy variables for macroeconomic announcements about GDP, the employment rate, and the Consumer Price Index. Separate dummies are provided for the day of the announcement and for the two days preceding the announcement.

The dependent variables in our regressions are daily changes in stock and bond proportional quoted and effective spreads, and dollar trading volume.[11] We include five lagged values of the dependent variable for stocks as well as for bonds, i.e., K=5. These

[11] Our results are qualitatively similar when we use the quoted and effective spread levels, rather than the proportional spreads.

lags are included based on the autocorrelation structure for spread changes documented in earlier research (viz., Chordia, et al., 2001). We include lags of bond spreads in the stock spread regression and vice versa because portfolio reallocations from bonds to stocks or vice versa could take time and, further, the speed with which information is incorporated into stock and bond prices could be different. Hence evidence of impending changes in liquidity in one market could be discernible in the other market.

Since the regressors are common across the two equations, the VAR can be efficiently estimated by running OLS on each equation separately. In order to correct for heteroskedasticity and serial correlation, we use the Generalized Method of Moments with the Newey-West correction. The regression results are presented in Table 4.

Panels A and B of the table indicate that the stock and bond quoted and effective spreads generally increase when contemporaneous bond and stock markets are down. Further, bond spreads are down Monday through Wednesday, whereas stock spreads are down Tuesday through Thursday relative to other days of the week.

Consistent with previous research (Fleming and Remolona, 1999), bond spreads increase on days of CPI and Employment announcements. In addition, bond spreads decrease over the two days leading up to the Employment announcements. Bond liquidity does not respond to the GDP announcement.[12] The stock effective spread increases over the two days leading up to the CPI announcement, but otherwise, controlling for the effects of the othe regressors including lagged bond and stock spreads, stock spread changes are not significantly related to the macroeconomic announcements.

Bond and stock quoted and effective spread changes are negatively serially correlated. All five lags of the bond quoted spread changes and the first four lags of the bond effective spread and the stock spread changes are negative and significant. In addition,

[12] This is probably due to the fact that, as Fleming and Remolona (1999) document, the increase in the bid-ask spread is limited to a 10-minute window surrounding the announcement. Since the magnitude of the spread increase from a GDP announcement is much smaller than that from CPI and Employment

the lagged bond trading volume is positively related to bond quoted spread changes. An increase in the past bond trading volume results in an increase in the current bond quoted spread. Also, the spread change in each market is weakly related to the lagged spread change and the lagged volume change in the other market. For example, the bond quoted spread change is positively related to the second lag of the stock quoted spread change, and the stock quoted and effective spread change is positively correlated with the fifth lag of the bond volume change. This suggests a spillover effect of liquidity from the bond market to the stock market and vice versa, suggesting that imbalances caused by portfolio reallocations in one market may predict liquidity changes in the other. The explanatory power (adjusted-R^2) of the regression with bond and stock spread changes as the dependent variable is quite impressive, ranging from 27% for the stock effective spread to 49% for the bond quoted spread. Further, the effects also are economically significant. For example, a 1% drop in the stock market, ceteris paribus, causes an extra change in the proportional bond quoted spreads of about +6%. As another example, a ceteris paribus 1% drop in the lagged stock quoted spread leads to an extra -0.2% change in the current bond quoted spread.

The volume regressions in Panel C indicate that stock and bond volumes increase when bond markets are up. Further, bond volume changes are negatively related to volume changes in the stock market. Interestingly, while stock volume changes exhibit negative autocorrelation, bond volume changes do not. Finally, both stock and bond trading volumes are higher on Employment announcement days.

The above results document that liquidity in the stock and bond markets are codetermined: returns, bid-ask spreads, and volume in one market affect the bid-ask spread and volume in the other market. However, stock market liquidity appears to be more responsive to changes in bond market liquidity, rather than the other way around. For example, the stock quoted and effective spread changes are correlated with bond spread and volume changes, but the bond quoted spread change is uncorrelated with stock

---

announcements (Fleming and Remolona, 1997), these effects may not be statistically discernible with daily data.

volume changes and the bond effective spread change is uncorrelated with the stock spread changes. Perhaps, reallocations following new public information about stock and bond returns are executed in the bond markets first, since the latter markets are dominated by large institutions who are better able to execute orders in a timely manner.

IV. Prediction

The regressions in Table 4 used contemporaneous and lagged quantities to investigate the time-series determinants of stock and bond liquidity. However, a related issue is whether liquidity is forecastable. Autocorrelation in the time series of liquidity changes suggests that one may be able to predict liquidity using publicly available variables. Such a prediction exercise has valuable scientific and practical implications both in helping us better understand the time-series behavior of liquidity, and in helping fund managers design cheaper trading strategies.

Motivated by the above observations, we conduct a pure prediction exercise in Table 5. Specifically, we examine whether daily changes in the bond and stock liquidity and volume can be predicted by lags of the explanatory variables used in Table 4.

The results indicate that, for both stock and bond quoted and effective spreads, past increases in the own spread predict decreases in current spreads. Also, an increase in the lagged bond volume generally predicts an increase in the current bond quoted spread. Most interestingly, liquidity in one market strongly predicts the bid-ask spread in the other market. For stock quoted and effective spreads, past increases in spreads in the bond market predict increased current spreads at short lags and decreased current spreads at longer lags; for bond quoted spreads, past increases in the stock spread increases the current spread, but the effect is weaker. As pointed out previously, these results are consistent with cross-market portfolio reallocations occurring first in the institution-dominated bond market. Considering the effect of past returns, for both stock and bonds, decreases in past own-market returns result in higher current spreads. The predictive ability of our bid-ask spread regressions is quite high, with an adjusted R-square of around 25% for both stocks and bonds.

Turning to the volume regressions, the noteworthy result is that past increases in the own-market volume predicts decreased current volume for both stocks and bonds. In addition, past increases in the stock volume predict an increase in the current bond volume. Past increases in the own and other market returns generally predict increased current volume for both stocks and bonds, suggesting that these markets exert cross-influences on trading activity. Finally, past increases in the term spread imply increased stock and bond market volumes, implying that loosening of credit terms increases trading activity. The predictive regression has reasonable explanatory power for stocks (adjusted R-square 12%) and for bonds (adjusted R-square 10%).

In summary, stock and bond market bid-ask spreads are surprisingly predictable. Lagged market returns, lagged interest rates, lagged bid-ask spreads and lagged volume are all predictors of spread and volume changes. A noteworthy result is that liquidity changes in one market are a predictor of liquidity changes in the other market.

V. Crisis periods

Several recent articles have suggested that financial crises affect liquidity.[13] For Treasury bonds, Fleming (2001) finds that price impacts and quoted bid-ask spreads are higher during crisis periods. Thus, it is plausible that the time-series properties of bond and stock liquidity are different during periods of crises as compared to normal circumstances. We identified two crisis periods in our sample - the Asian financial crisis (October 1 to December 31 1997) and the Russian default crisis (July 6 to December 31, 1998). The dates for the Asian crisis are from Choe, Kho, and Stulz (1997) and those for the Russian default crisis are from the Bank of International Settlements.[14]

[13] See, for example, Greenspan, 1999, and "Finance and Economics: Alan Greenspan's miracle cure," *Economist*, October 24, 1998, pp.75-76.
[14] "A Review of Financial Market Events in Autumn 1998", CGFS Reports No. 12, October 1999, available at http://www.bis.org/publ/cgfspubl.htm.

Table 6 shows that, both stock and bond trading volumes were higher in the crisis periods relative to the normal period, but stock market spreads were actually lower in the crisis period relative to the non-crisis period, whereas bond quoted spreads were higher. All changes are statistically significant at the five-percent level or below. The crises appear to have had an ambiguous effect on bond market liquidity, increased volumes in both markets, and increased stock market liquidity. These conclusions should be interpreted with caution, however, because they may be influenced by secular increases in liquidity. Specifically, since both crisis periods occur at the end of our sample period, the spread result may simply reflect a secular decline in the bid-ask spread in the 1990s.[15] In any case, these are univariate results. We will provide a more detailed analysis of the impact of the crises in Table 9.

Table 7 presents the summary statistics associated with daily absolute percentage changes in bond and stock spreads and trading volume for the normal and crisis periods. The quoted and effective bid-ask spread for stocks and bonds are more volatile during the crisis periods relative to normal times, and this increase is statistically significant at the five percent level or below. Changes in the volatility of the stock and bond market trading volume are not significantly different for crisis and normal periods. The results are consistent with increased uncertainty in the stock and bond markets during the crisis periods, leading to sharp swings in the bid-ask spread and increased stock and bond trading by investors.

Table 8 presents the correlation matrix for daily percentage changes in the variables of Table 6, separately for the crisis and non-crisis periods. Fisher's Z transformation is used to test whether the correlation is significantly different between normal and crisis periods. The table shows that the correlation between bond and stock quoted and effective spread changes is significantly higher during crises. For example, the correlation in the bond and stock quoted spread jumps from 10% to 28% during crisis periods, and the

[15] Evidence of such a decline is presented in Chordia et al. (2001) for stock markets. On June 24, 1997, there was a decrease in the tick size from 1/8 to 1/16 on the NYSE. This was the first time in the 200-year history of the NYSE that such a decrease in the tick size occurred.

correlation in the effective spread increases from 5% to 21% during crisis periods. The correlation between changes in stock and bond volume increases from 27% to 53% during crisis periods. Further, correlations between quoted and effective spread changes within each market increase significantly during the crisis periods. Finally, correlations between trading volume and spreads increase in both markets during crises. Since the effects of the crises on bond and stock liquidity work in opposite directions, this exemplifies the point that volume increases, if due to extreme order imbalances, do not necessarily enhance liquidity.[16]

We redo the regressions of Table 4 after including a dummy variable that equals one for the two crisis periods (and zero otherwise) and additional interaction terms of the crisis dummy with the explanatory variables. These results are reported in Table 9 (for brevity, only the coefficients of the crisis dummy and the interaction variables are reported). The correlation structure of stock and bond spreads is significantly different in crisis times. In particular, there is evidence of positive autocorrelation in bid-ask spread changes for stocks, whereas the autocorrelation is negative in normal periods. This suggests that changes in liquidity in the stock market tend to persist during crisis periods, unlike normal times. Further, for both stocks and bonds, there is an increase in the correlation between changes in own-market spreads and spread changes in the other market. For example, while changes in the effective bond spreads and effective stock spreads are not significantly related in normal times, the 2nd lag of effective stock spread changes is significant in explaining effective bond spread changes during crisis periods. This suggests stronger linkages between liquidity in the two markets during crises. Also, declining stock markets have a greater impact on bond market bid-ask spread changes and stock volume during a crisis. Finally, whereas the quality spread does not affect bond spread changes in normal times, it has a positive impact on bond spread changes during crises. This suggests that the flight to quality bond issues during crises causes high order imbalances in the Treasury bond market, leading to decreased liquidity.

[16] See Chordia et al. (2002) for a discussion of market order imbalance and liquidity.

VI. Weekly and Monthly Regressions, With Money Supply and Mutual Fund Flows

While several studies have informally discussed the notion that the Federal Reserve steps in to enhance financial market liquidity by loosening credit constraints during periods of market turbulence,[17] to date there has been no empirical study on the impact of changes in monetary policy on aggregate liquidity in financial markets. Furthermore, it has been conjectured that money flows in and out of mutual funds may have an important impact on financial market liquidity, especially during periods of financial turbulence (see, for example, Edelen, 1999), but this issue also remains to be explored. These are the issues to which we now turn.

Since it takes time for the effects of a loosening or tightening of monetary policy to filter through the economy, the effect of money supply fluctuations on liquidity may only be discernible at cycles longer than a day. In addition, to the best of our knowledge, data on money supply are not available at intervals shorter than a week, while data on fund flows are not available at intervals shorter than a month during our sample period. We thus use weekly M1 money supply data from the Federal Reserve Board[18] and monthly equity and government bond net flows from the Investment Company Institute for our analysis in this section.

Table 10 shows the percent changes in these variables during normal and crisis periods. The mean %DM1, the weekly percent change in M1, is about 0.06% in normal times and 0.09% during crisis periods, although the increase is not statistically significant. The mean %DEFLOW, the monthly percent change in the equity mutual fund net flows, is 13% in normal times and -14% in crisis periods. Again, however, the change is not statistically significant. The mean %DBFLOW, the monthly percent change in the

[17] See Garcia (1989), and "Monetary Policy Report to Congress," *Federal Reserve Bulletin*, March 1995, pp. 219-243.

[18] Of the three definitions of money supply (M1, M2 and M3), the M1 money supply is the narrowest. It includes the most liquid financial instruments and so is the most appropriate money supply variable for explaining changes in market liquidity. M1 consists of (1) currency outside the US Treasury, Federal

government bond mutual fund net flows, increases dramatically from -17% in normal times to 256% in crisis periods, a statistically significant change. This decrease in cash inflows to equity funds combined with the increase in cash inflows to government bond funds illustrates the "flight to quality" during periods of crises that is often alluded to by financial market commentators.

A. Weekly Regressions With Money Supply

We re-estimate the regression model of Table 4 using weekly data and include the contemporary value plus two lags of %DM1 as additional explanatory variables. We average the bid-ask spread, volume and interest rates over the week and then compute weekly changes. Since this is weekly data, only one lag of the stock and bond liquidity variables is used. The day-of-the-week and holiday dummies are no longer well-defined, and they are omitted as well.

The results for the weekly regressions are in Table 11. We find that the money supply variable is generally not significant during normal periods for the stock and bond liquidity regressions. The only exception is the stock volume, where the first lag of the money supply is significant and positive, indicating that an increase in the money supply has a positive impact on stock volume changes after a week. But the coefficient on the money supply variable is significant and negative during crisis periods for stock quoted and effective spread changes and for the bond quoted spread change. Bond and stock quoted spread changes are negatively related to money supply after a lag of 2 weeks. The effects of money supply are economically significant; for example, a 1% increase in money supply causes an extra decrease in stock quoted spreads of more than 4.5%.

For variables other than the money supply, the results are qualitatively similar to the earlier ones, and the adjusted R-square compares favorably with those for the daily regressions. For example, in the quoted stock spread regression, the coefficient on the

---

Reserve Banks, and the vaults of depository institutions; (2) travelers checks of nonbank issuers; (3)

stock returns is negative and the adjusted R-square is 37%, compared to 29% with the daily regressions.

B. Monthly Regressions With Mutual Fund Flows

We re-estimate the regression model of Table 4 using monthly data and include one lag of %DEFLOW and %DBFLOW as additional explanatory variables. We do not use the contemporary mutual fund net flow since returns and, perhaps, liquidity endogenously determine the fund flows. We average the bid-ask spread, volume and interest rates over the month and then compute monthly changes. In addition to the lagged %DEFLOW and the lagged %DBFLOW, we include the four market return factors, changes in the short rate and terms interacting these seven explanatory variables with the crisis dummy.

The results for the monthly regressions are in Table 12. For bond quoted and effective spreads, we find that the %DBFLOW variable is significant and negative during the crisis period; in the normal period, %DBLOW is not significant. For the stock quoted spread, the %DEFLOW variable is significant and negative during normal periods; during crises, %DEFLOW is negative but not significant. Thus, an inflow into equity funds in the past month has a negative impact on stock quoted spread changes in normal periods.

For the bond volume, increases in the past equity flow in normal times and increases in the bond flow during crisis periods have positive impacts on current bond volume changes. Surprisingly, increases in the past bond flow has a negative impact on current bond volume changes and, further, increases in the past *bond* flow has a negative impact on current *equity* volume changes in normal times. A likely explanation for these results is that, in normal times, there is net outflow from bond funds (Table 10) as the stock market was generally rising. Thus, an increase in the *past* bond flow is more likely to be associated, in the *current* month, with bond outflows and decreased bond volume, along with increased stock volume.

---

demand deposits at commercial banks; and (4) other checkable deposits.

Finally, we see that during crisis periods, there is an inverse relationship between bond fund flows and spread changes. Based on the evidence in Table 10, we can conclude that large inflows of wealth into bond funds associated with "flight to quality" during crises have a positive impact on changes in bond market liquidity.

VII. Conclusion

We examine common determinants of stock and bond liquidity over the period 1991 through 1998, and also examine the impact of financial crises, monetary policy, and mutual fund flows on financial market liquidity. The analysis helps us enhance our understanding of the dynamic behavior of liquidity, and also sheds useful light on how dynamic asset allocation strategies can be designed to reduce trading costs. Our principal findings are as follows:

- We find that liquidities in stock and bond markets are codetermined: returns, bid-ask spreads, and volume in one market affect the bid-ask spread and volume in the other market. The results generally are consistent with asset allocation strategies being conducted simultaneously in both stock and bond markets. For example, declines in the bond market induce are positively associated with stock spread changes after controlling for the contemporaneous stock market return. Also, there are strong weekly regularities in both bid-ask spread series; specifically, stock and bond spreads generally decrease mid-week and increase on Fridays relative to other days of the week.
- Stock and bond market bid-ask spreads can be forecasted to a remarkable degree using publicly available variables. Lagged market returns, lagged interest rates, the lagged bid-ask spread and lagged volume are strong predictors of the bid-ask spread and volume changes in both markets. A notable result is that bond spreads lead stock spreads. This result is consistent with order imbalances due to portfolio reallocations being reflected first in the institution-dominated bond markets, followed by stock markets. The result also indicates that asset allocation strategies in periods of enhanced liquidity should be executed first in the bond market. In general, our analysis helps provide an understanding of how practitioners can use public

information to forecast periods of enhanced liquidity and thereby design strategies to reduce trading costs.

- The time-series properties of bond and stock liquidity are different during crises as compared to normal circumstances. Levels of stock and bond volume, spread volatility, and the correlation between stock and bond liquidity are all significantly higher during crises. The results are consistent with increased investor uncertainty leading to frequent and correlated portfolio reallocations during financial crises.
- Monetary policy affects financial market liquidity during crises. To be precise, while in normal periods the money supply (M1) is generally not significant in explaining the bid-ask spread, during crises an increase in the money supply has a negative impact on changes in stock and bond spreads with a lag of up to two weeks. The effect is particularly pronounced for stock market liquidity. The results support the notion that increases in money supply loosen credit constraints faced by investors and dealers, which has a beneficial effect on financial market liquidity.
- Lagged money flows into stock mutual funds have a positive effect on stock market liquidity changes, as measured by changes in stock bid-ask spreads, during normal periods. During crises, this effect is not significant. However, there is an inverse relation between lagged bond fund flows and bond spread changes during crises, and the results indicate a net inflow into government bond funds (a flight to quality) in turbulent periods, that eventually has a beneficial effect on liquidity in the bond markets.

Our work suggests a fertile research agenda for theorists. Little theoretical work has been done on time-series movements in liquidity, and there is no theory on linking movements in liquidity across equity and fixed-income markets. A model of market equilibrium with endogenous trading across stock and bond markets would seem to be desirable. Further, the theoretical link between monetary policy, fund flows, and stock and bond market liquidity also represents a research issue that has largely remained unexplored. We hope our work serves to stimulate research in these areas.

References

Amihud, Yakov, and Haim Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223-249.

Amann, M., and H. Zimmermann, 2001, Tracking error and tactical asset allocation, *Financial Analysts Journal* 57, 32-43 (March/April).

Balducci, P., E. J. Elton, and T. C. Green, 2001, Economic News and Bond Prices: Evidence from U.S. Treasury Market, forthcoming, *Journal of Financial and Quantitative Analysis.*

Barberis, N., 2000, Investing for the long run when returns are predictable, *Journal of Finance* 55, 225-264.

Benston, G., and R. Hagerman, 1974, Determinants of bid-asked spreads in the over-the-counter market, *Journal of Financial Economics* 1, 353-364.

Boni, L., and J.C. Leach, 2001, Supply contractions and Trading Protocol: An examination of recent changes in the U.S. Treasury Market, Working Paper, University of New Mexico.

Brandt, M., R. Edelen, and K. Kavajecz, 2001, Liquidity in the U.S. treasury market: Asymmetric information, inventory, and supply shifts, working paper, University of Pennsylvania.

Brennan, M., and A. Subrahmanyam, 1996, Market microstructure and asset pricing: On the compensation for illiquidity in stock returns, *Journal of Financial Economics* 41, 441-464.

Brennan, M., T. Chordia, and A. Subrahmanyam, 1998, Alternative factor specifications, security characteristics, and the cross-section of expected stock returns, *Journal of Financial Economics* 49, 345-373.

Choe, H., B. Kho, and R. Stulz, 1999, Do foreign investors destabilize stock markets? The Korean experience in 1997, *Journal of Financial Economics* 54, 227-264.

Chordia, T., R. Roll, and A. Subrahmanyam, 2000, Commonality in liquidity, *Journal of Financial Economics* 56, 3-28.

Chordia, T., R. Roll, and A. Subrahmanyam, 2001, Market liquidity and trading activity, *Journal of Finance* 56, 501-530.

Chordia, T., R. Roll, and A. Subrahmanyam, 2002, Order imbalance, liquidity, and market returns, forthcoming, *Journal of Financial Economics*.

Edelen, R., 1999, Investor flows and the assessed performance of open-end mutual funds, *Journal of Financial Economics* 53, 439-466.

Fabozzi, F., and M. Fleming, 2000, U.S. treasury and agency securities, in F. Fabozzi, ed**.,** *The Handbook of Fixed Income Securities* (6th ed.) McGraw Hill, New York, NY.

Fleming, M., 2001, Measuring Treasury market liquidity, *Staff Reports* No. 33, The Federal Reserve Bank of New York.

Fleming, M., 2000, Financial market implications of the federal debt paydown, *Brookings Papers on Economic Activity*, 2, 221-252.

Fleming, M., and E. Remolona, 1997, What moves the bond market? *Economic Policy Review*, Vol. 3, No. 4, December 1997, 31-50.

Fleming, M., and E. Remolona, 1999, Price formation and liquidity in the U.S. Treasury market: The response to public information, *Journal of Finance* 54, 1901-1915.

Fox, S., 1999, Assessing TAA manager performance, *Journal of Portfolio Management* 26, 40-49.

Gallant, A., P. Rossi, and G. Tauchen, 1992, Stock prices and volume, *Review of Financial Studies* 5, 199-242.

Garcia, G., 1989, The lender of last resort in the wake of the crash, *American Economic Review* 79, 151-155.

Green, C., 2001, Economic news and the impact of trading on bond prices, working paper, Emory University.

Greenspan, A., 1999, Risk, liquidity, and the economic outlook, *Business Economics* 34, 20-24.

Harris, L., and E. Gurel, 1986, Price and volume effects associated with changes in the S&P 500 list: New evidence for the existence of price pressures, *Journal of Finance* 41, 815-829.

Hasbrouck, J., and D. Seppi, 2001, Common factors in prices, order flows and liquidity, *Journal of Financial Economics* 59, 383-411.

Hiemstra, C., and J. Jones, 1994, Testing for linear and nonlinear Granger causality in the stock price-volume relation, *Journal of Finance* 49, 1639-1664.

Ho, T., and H. Stoll, 1983, The dynamics of dealer markets under competition, *Journal of Finance* 38, 1053-1074.

Huberman, G., and D. Halka, 2001, Systematic liquidity, working paper, Columbia University.

Jacoby, G., D. Fowler, and A. Gottesman, 2000, The capital asset pricing model and the liquidity effect: A theoretical approach, *Journal of Financial Markets* 3, 69-81.

Jones, C., G. Kaul, and M. Lipson, 1994, Transactions, volume, and volatility, *Review of Financial Studies* 7, 631-651.

Judge, G., W. Griffiths, R. Hill, H. Lütkepohl, and T. Lee, 1985, *The Theory and Practice of Econometrics*, (New York: Wiley).

Karpoff, J., 1987, The relation between price changes and trading volume: A survey, *Journal of Financial and Quantitative Analysis* 22, 109-125.

Kyle, A., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315-1335.

Lo A., and J. Wang, 2000, Trading volume: definitions, data analysis, and implications of portfolio theory, *Review of Financial Studies* 13, 257-300.

Spiegel, M., and A. Subrahmanyam, 1995, On intraday risk premia, *Journal of Finance* 50, 319-339.

Stoll, H., 1978, The pricing of security dealer services: An empirical study of NASDAQ stocks, *Journal of Finance* 33, 1153-1172.

Stoll, H., 2000, Presidential address: Friction, *Journal of Finance* 55, 1479-1514.

Xia, Y., 2001, Learning about predictability: The effects of parameter uncertainty on dynamic asset allocation, *Journal of Finance* 56, 205-246.

Table 1: Levels of stock and bond market liquidity (Number of observations: 1887)
Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively.

	PQSPRB	PESPRB	VOLB ($million)	PQSPRS	PESPRS	VOLS ($million)
Mean	0.0316	0.0301	3568.0500	1.31	0.90	8.2859
Std	0.0062	0.0077	1408.6400	0.34	0.23	3.8410
Median	0.0305	0.0299	3517.0000	1.29	0.89	6.8772

Table 2: Daily absolute percentage changes in stock and bond market liquidity (Number of observations: 1887) The table presents summary statistics for daily absolute percentage changes in stock and bond liquidity. Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change.

	|DPQSPRB|	|DPESPRB|	|DVOLB|	|DPQSPRS|	|DPESPRS|	|DVOLS|
Mean	11.1648	12.1406	33.8613	2.0098	2.4948	13.2668
Std	10.9032	12.3476	107.5600	1.9011	2.3013	17.7214
Median	8.6148	8.8605	22.9439	1.5177	2.0040	9.5736

Table 3: Correlations in stock and bond market liquidity changes (Number of observations: 1887) The table presents the correlation matrix for the time series of market-wide liquidity and trading activity. Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change.

	DPQSPRB	DPESPRB	DVOLB	DPQSPRS	DPESPRS	DVOLS
DPQSPRB	1.0000					
DPESPRB	0.6803	1.0000				
DVOLB	-0.1146	-0.0267	1.0000			
DPQSPRS	0.1269	0.0937	-0.0641	1.0000		
DPESPRS	0.1221	0.0757	-0.0382	0.6660	1.0000	
DVOLS	-0.0232	0.0467	0.2662	-0.0603	0.0740	1.0000

Table 4: Time-series regressions for stock and bond liquidity Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change. Mkt+s: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise, Mkt-s: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise, Mkt+B: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise, Mkt-B: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise. Short rate: the daily first difference in the Federal Funds rate. Term spread: the daily change in the difference between the yield on a constant maturity 10-year Treasury note and the Federal Funds rate. Quality Spread: the daily change in the difference between the yield on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond. Holiday: a dummy variable that equals one if a trading day satisfies the following conditions, (1) if Independence day, Veterans' Day, Christmas or New Year's Day falls on a Friday, then the preceding Thursday, (2) if any holiday falls on a weekend or on a Monday then the following Tuesday, (3) if any holiday falls on a weekday then the preceding and the following days, and zero otherwise. Monday-Thursday: equals one if the trading day is Monday, Tuesday, Wednesday, or Thursday, and zero otherwise. GDP: dummy variable that equals one on the day of the GDP announcement and zero otherwise. GDP12: dummy variable that equals one on two days prior to the GDP announcement and zero otherwise. Emp, Emp12, CPI, CPI12: dummy variables for employment and CPI announcements respectively. The definition of the dummy variables is the same as for GDP announcements. Lags of PQSPRS are included in the quoted spread regressions and lags of PESPRS are used in the effective spread regressions. Estimation is done using the Generalized Method of Moments (GMM) procedure with the Newey-West Correction.

Table 4 (continued)

Panel A: Quoted Spreads

	DPQSPRB Coefficient	t-statistic	DPQSPRS Coefficient	t-statistic
Intercept	3.2545	3.53	0.2428	1.11
Mkt+b	-0.2456	-0.06	-2.0819	-1.89
Mkt-b	-28.7573	-6.38	-2.7406	-2.55
Mkt+s	3.2815	2.67	-0.8036	-2.78
Mkt-s	-6.0686	-4.80	-2.2888	-10.11
Short rate	-0.4405	-2.09	-0.0935	-1.78
Term spread	-0.4522	-2.14	-0.0986	-1.89
Quality spread	-0.0317	-0.21	-0.0151	-0.42
Holiday	0.4220	0.29	-0.2479	-0.68
Mon	-11.6040	-11.18	-0.2307	-1.06
Tu	-8.2620	-7.53	-0.9599	-3.66
Wed	-6.2483	-5.81	-0.3518	-1.55
Thu	-3.9918	-4.04	-0.4838	-2.08
Gdp	2.5592	1.22	-0.0413	-0.10
gdp12	-0.5019	-0.46	-0.0497	-0.18
Cpi	2.5574	2.14	-0.0957	-0.39
cpi12	0.4822	0.63	0.2661	1.63
Emp	10.5422	6.59	0.3224	1.07
Emp12	-3.5775	-4.22	-0.1599	-0.84
DPQSPRB: lag 1	-0.5234	-12.23	0.0088	1.49
lag 2	-0.3678	-11.01	-0.0030	-0.58
lag 3	-0.2520	-8.06	-0.0071	-1.30
lag 4	-0.1625	-5.97	-0.0060	-1.13
lag 5	-0.0431	-1.96	-0.0088	-2.06
DVOLB: lag 1	0.0076	3.55	0.0000	0.00
lag 2	0.0034	1.76	0.0000	-0.01
lag 3	0.0088	5.07	-0.0004	-0.95
lag 4	-0.0030	-1.81	0.0004	0.90
lag 5	0.0057	4.19	0.0006	3.29
DPQSPRS: lag 1	0.1934	1.70	-0.3785	-11.03
lag 2	0.2240	2.04	-0.2371	-7.62
lag 3	0.1823	1.46	-0.1115	-3.20
lag 4	0.0732	0.61	-0.0688	-2.60
lag 5	-0.0313	-0.29	0.0067	0.25
DVOLS: lag 1	-0.0032	-0.21	0.0029	1.19
lag 2	-0.0010	-0.09	0.0016	0.52
lag 3	-0.0210	-1.46	-0.0029	-0.81
lag 4	-0.0052	-0.40	-0.0034	-1.14
lag 5	-0.0082	-0.81	-0.0033	-1.12
Adjusted R^2	0.4891		0.2849	

Table 4 (continued)

Panel B: Effective Spreads

	DPESPRB Coefficient	t-statistic	DPESPRS Coefficient	t-statistic
Intercept	1.7066	1.46	0.3310	1.36
Mkt+b	8.4876	1.36	-3.3003	-2.41
Mkt-b	-20.8519	-3.74	-3.5659	-2.73
Mkt+s	3.1233	2.04	-0.7878	-2.31
Mkt-s	-6.2921	-4.86	-2.5924	-9.97
Short rate	-0.0868	-0.30	-0.1427	-2.20
Term spread	-0.0815	-0.28	-0.1469	-2.30
Quality spread	0.0956	0.51	0.0120	0.28
Holiday	-1.8140	-1.02	-0.2771	-0.63
Mon	-9.4111	-7.25	-0.1926	-0.73
Tu	-5.6479	-4.45	-0.7504	-2.43
Wed	-2.7960	-2.08	-0.6693	-2.49
Thu	-0.9027	-0.70	-0.7100	-2.78
Gdp	1.9379	0.92	0.3087	0.60
Gdp12	-0.4314	-0.38	0.4799	1.36
Cpi	2.3755	1.59	0.3895	1.15
Cpi12	0.8195	0.89	0.4515	2.18
Emp	14.1481	5.44	-0.0575	-0.16
Emp12	-4.4409	-4.49	-0.0816	-0.33
DPESPRB: lag 1	-0.4922	-19.00	0.0123	2.00
lag 2	-0.3095	-10.69	-0.0035	-0.64
lag 3	-0.2162	-6.28	-0.0078	-1.38
lag 4	-0.0898	-2.72	-0.0036	-0.74
lag 5	-0.0115	-0.46	-0.0034	-0.68
DVOLB: lag 1	0.0005	0.42	-0.0004	-1.07
lag 2	0.0012	0.87	-0.0009	-2.36
lag 3	-0.0020	-1.26	-0.0005	-0.93
lag 4	-0.0029	-1.36	0.0000	0.03
lag 5	0.0008	0.86	0.0009	2.15
DPESPRS: lag 1	0.1098	1.02	-0.4306	-11.30
lag 2	0.1773	1.65	-0.1996	-5.63
lag 3	0.0676	0.54	-0.1556	-4.60
lag 4	0.0368	0.33	-0.0550	-1.92
lag 5	-0.1894	-1.71	0.0027	0.11
DVOLS: lag 1	-0.0051	-0.25	0.0005	0.13
lag 2	-0.0210	-1.33	-0.0013	-0.28
lag 3	-0.0201	-0.90	-0.0037	-0.73
lag 4	-0.0525	-2.48	-0.0044	-1.05
lag 5	-0.0170	-0.98	-0.0042	-1.15
Adjusted R^2	0.3799		0.2699	

Table 4 (continued)

Panel C: Trading Volume

	DVOLB Coefficient	t-statistic	DVOLS Coefficient	t-statistic
Intercept	-18.4410	-5.24	-9.0774	-7.53
Mkt+b	48.6853	2.72	14.8324	2.03
Mkt-b	-19.4087	-0.95	-2.3845	-0.30
Mkt+s	-5.7628	-1.67	4.2612	3.14
Mkt-s	0.3878	0.10	-6.7928	-4.63
Short rate	-0.2963	-0.32	-0.1240	-0.32
Term spread	-0.4733	-0.51	-0.1647	-0.44
Quality spread	-1.8731	-1.78	-0.3845	-1.38
Holiday	47.2144	0.97	-8.2206	-2.17
Mon	-4.3740	-0.92	3.1723	1.34
Tu	66.6748	6.16	18.5339	12.10
Wed	21.5751	4.88	12.3647	8.52
Thu	21.6087	5.09	6.4430	4.74
Gdp	-0.2063	-0.02	0.5493	0.21
Gdp12	5.0432	0.52	6.7574	1.20
Cpi	6.8457	1.17	2.2642	1.63
Cpi12	-5.0627	-0.99	1.3860	1.14
Emp	19.0232	4.42	4.2118	2.02
Emp12	1.6056	0.59	2.9890	1.62
DVOLB: lag 1	-0.0372	-1.47	0.0018	0.61
lag 2	-0.0146	-0.85	0.0011	0.65
lag 3	0.0130	0.84	0.0088	1.89
lag 4	-0.0024	-0.20	-0.0034	-1.19
lag 5	0.0083	0.77	0.0042	1.33
DVOLS: lag 1	-0.3029	-2.32	-0.3300	-8.46
lag 2	-0.0677	-0.66	-0.1798	-4.75
lag 3	-0.0309	-0.36	-0.1005	-3.76
lag 4	-0.0231	-0.28	-0.0618	-2.00
lag 5	-0.0570	-1.03	-0.0440	-2.32
Adjusted R^2	0.0623		0.2133	

Table 5: Time-series predictive regressions for stock and bond liquidity Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change. Mkt+s: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise, Mkt-s: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise, Mkt+B: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise. Mkt-B: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise. Short rate: the daily first difference in the Federal Funds rate. Term spread: the daily change in the difference between the yield on a constant maturity 10-year Treasury note and the Federal Funds rate. Quality Spread: the daily change in the difference between the yield on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond. Holiday: a dummy variable that equals one if a trading day satisfies the following conditions, (1) if Independence day, Veterans' Day, Christmas or New Year's Day falls on a Friday, then the preceding Thursday, (2) if any holiday falls on a weekend or on a Monday then the following Tuesday, (3) if any holiday falls on a weekday then the preceding and the following days, and zero otherwise. Monday-Thursday: equals one if the trading day is Monday, Tuesday, Wednesday, or Thursday, and zero otherwise. GDP: dummy variable that equals one on the day of the GDP announcement and zero otherwise. GDP12: dummy variable that equals one on two days prior to the GDP announcement and zero otherwise. Emp, Emp12, CPI, CPI12: dummy variables for employment and CPI announcements respectively. The definition of the dummy variables is the same as for GDP announcements. Lags of PQSPRS are included in the quoted spread regressions and lags of PESPRS are used in the effective spread regressions. Estimation is done using the Generalized Method of Moments (GMM) procedure with the Newey-West Correction.

Table 5 (continued)

Panel A: Quoted Spreads

	DPQSPRB Coefficient	t-statistic	DPQSPRS Coefficient	t-statistic
Intercept	1.9010	2.42	0.3104	2.28
Mkt+b: lag 1	-13.4244	-2.38	-0.9966	-1.09
lag 2	-4.9658	-1.06	-1.4428	-1.73
Mkt-b: lag 1	-19.8235	-3.72	-0.3425	-0.34
lag 2	-2.6276	-0.50	-0.7277	-0.86
Mkt+s: lag 1	1.0653	0.83	-1.0350	-4.39
lag 2	-1.3531	-1.01	-0.7119	-2.83
Mkt-s: lag 1	-3.2380	-2.51	-1.8397	-5.31
lag 2	-0.2489	-0.21	-0.6526	-2.89
short rate: lag 1	-0.6473	-2.49	-0.0288	-0.58
lag 2	-0.1015	-0.42	-0.0603	-1.47
term spread: lag 1	-0.6567	-2.53	-0.0275	-0.56
lag 2	-0.1189	-0.49	-0.0592	-1.45
quality spread: lag 1	-0.0136	-0.07	0.0344	0.96
lag 2	0.1879	1.11	-0.0287	-0.93
DPQSPRB: lag 1	-0.6140	-21.91	0.0138	2.18
lag 2	-0.4663	-15.36	-0.0028	-0.42
lag 3	-0.3677	-11.59	-0.0139	-2.39
lag 4	-0.2292	-6.88	-0.0158	-3.07
lag 5	-0.0066	-0.27	-0.0156	-3.46
DVOLB: lag 1	0.0019	0.24	-0.0023	-1.67
lag 2	0.0071	2.80	0.0001	0.14
lag 3	0.0118	5.46	0.0000	0.01
lag 4	-0.0082	-2.88	0.0006	1.66
lag 5	0.0054	2.71	0.0004	1.07
DPQSPRS: lag 1	0.0493	0.35	-0.5588	-14.90
lag 2	0.1555	1.07	-0.3397	-8.73
lag 3	0.1460	1.04	-0.1589	-4.94
lag 4	0.2860	1.99	-0.1049	-3.70
lag 5	-0.0281	-0.23	-0.0160	-0.61
DVOLS: lag 1	0.0154	0.91	-0.0005	-0.17
lag 2	0.0294	1.93	0.0012	0.35
lag 3	0.0097	0.56	0.0005	0.14
lag 4	-0.0088	-0.50	-0.0021	-0.64
lag 5	-0.0415	-3.49	-0.0066	-2.23
Adjusted R^2	0.2639		0.2464	

Table 5 (continued)

Panel B: Effective Spreads

	DPESPRB Coefficient	t-statistic	DPESPRS Coefficient	t-statistic
Intercept	3.1684	3.81	0.4415	2.75
Mkt+b: lag 1	-10.1666	-1.62	-0.8729	-0.76
lag 2	3.6721	0.60	-1.7423	-1.74
Mkt-b: lag 1	-16.7974	-2.72	-0.6576	-0.54
lag 2	7.6739	1.23	-1.6794	-1.61
Mkt+s: lag 1	-0.3083	-0.21	-1.5087	-4.77
lag 2	-1.7765	-1.10	-0.6274	-2.25
Mkt-s: lag 1	-3.8364	-2.69	-1.7895	-4.03
lag 2	0.4299	0.31	-0.4045	-1.38
short rate: lag 1	-0.5518	-1.85	-0.0680	-1.14
lag 2	0.3613	1.21	-0.0944	-1.87
term spread: lag 1	-0.5802	-1.95	-0.0668	-1.12
lag 2	0.3185	1.07	-0.0942	-1.87
quality spread: lag 1	-0.0545	-0.29	0.0029	0.07
lag 2	0.3595	1.88	-0.0047	-0.12
DPESPRB: lag 1	-0.5306	-18.01	0.0145	2.36
lag 2	-0.3443	-11.09	-0.0004	-0.06
lag 3	-0.2778	-7.42	-0.0084	-1.59
lag 4	-0.1268	-3.33	-0.0105	-1.92
lag 5	0.0189	0.66	-0.0115	-2.43
DVOLB: lag 1	-0.0007	-0.08	-0.0040	-2.02
lag 2	0.0023	1.34	-0.0012	-2.67
lag 3	0.0003	0.15	-0.0004	-0.91
lag 4	-0.0068	-1.84	0.0004	1.23
lag 5	0.0004	0.38	0.0007	1.18
DPESPRS: lag 1	-0.1332	-1.04	-0.5459	-14.46
lag 2	0.1005	0.71	-0.2600	-6.42
lag 3	0.0250	0.18	-0.1990	-6.05
lag 4	0.1857	1.50	-0.0888	-2.94
lag 5	-0.1916	-1.68	0.0069	0.27
DVOLS: lag 1	0.0128	0.57	-0.0015	-0.37
lag 2	0.0135	0.74	-0.0012	-0.27
lag 3	0.0067	0.31	0.0002	0.03
lag 4	-0.0590	-2.15	-0.0022	-0.52
lag 5	-0.0473	-2.70	-0.0066	-1.79
Adjusted R^2	0.2365		0.2317	

Table 5 (continued)

Panel C: Trading Volume

	DVOLB Coefficient	t-statistic	DVOLS Coefficient	t-statistic
Intercept	14.3185	6.66	5.0187	4.83
Mkt+b: lag 1	-22.1804	-1.39	13.4215	1.75
lag 2	21.8979	1.68	14.8935	2.38
Mkt-b: lag 1	29.8243	1.75	30.7648	3.71
lag 2	41.8997	2.62	12.2517	1.68
Mkt+s: lag 1	0.3567	0.07	1.0840	0.59
lag 2	11.4942	3.13	-0.3625	-0.21
Mkt-s: lag 1	-4.9486	-2.05	-3.9358	-3.23
lag 2	4.8389	1.88	3.5458	3.57
short rate: lag 1	0.5266	0.64	1.1601	2.98
lag 2	1.9017	2.44	0.6645	1.99
term spread: lag 1	0.3473	0.42	1.0966	2.81
lag 2	1.8029	2.32	0.5976	1.80
quality spread: lag 1	0.9586	1.65	0.4242	1.70
lag 2	0.3687	0.59	0.0640	0.26
DVOLB: lag 1	-0.2353	-7.45	0.0174	1.42
lag 2	-0.0176	-1.15	-0.0026	-1.32
lag 3	-0.0090	-1.64	0.0044	1.58
lag 4	0.0008	0.21	-0.0008	-0.45
lag 5	0.0255	1.49	0.0085	1.57
DVOLS: lag 1	-0.0058	-0.08	-0.3494	-8.59
lag 2	-0.2099	-2.77	-0.2167	-5.17
lag 3	-0.2097	-3.41	-0.1454	-4.68
lag 4	-0.0533	-0.92	-0.0511	-1.87
lag 5	0.0573	1.03	0.0100	0.48
Adjusted R^2	0.1036		0.1242	

Table 6: Levels of stock and bond market liquidity during crises and non-crisis periods Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). A Ú indicates that the difference in the means between the normal and crisis periods is significant at the 5% level below according to a *t* test.

Panel A: Non-crisis (normal) period (Number of observations: 1702)

	PQSPRB	PESPRB	VOLB	PQSPRS	PESPRS	VOLS
Mean	0.0312	0.0306	3482.6900	0.0135	0.0093	7.5530
Std	0.0054	0.0073	1363.7300	0.0033	0.0023	3.1737
Median	0.0304	0.0303	3411.5000	0.0132	0.0090	6.4798

Panel B: Crisis period (Oct. 1-Dec 31, 1997, and July 6 to Dec. 31, 1998)
(Number of observations: 185)

	PQSPRB	PESPRB	VOLB	PQSPRS	PESPRS	VOLS
Mean	0.0354Ú	0.0253Ú	4353.3500Ú	0.0097Ú	0.0068Ú	15.0167Ú
Std	0.0104	0.0098	1568.0200	0.0015	0.0010	2.7428
Median	0.0323	0.0241	4305.0000	0.0096	0.0068	14.9146

Table 7: Daily Absolute percentage changes in stock and bond market liquidity during crises and non-crisis periods Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). A Ú indicates that the difference in the means between the normal and crisis periods is significant at the 5% level below according to a *t* test.

Panel A: Non-crisis (normal) period (Number of observations: 1702)

	|DPQSPRB|	|DPESPRB|	|DVOLB|	|DPQSPRS|	|DPESPRS|	|DVOLS|
Mean	10.9985	11.5889	34.4578	1.9000	2.4291	13.0581
Std	10.7537	11.8396	112.8590	1.7123	2.1425	16.4977
Median	8.5690	8.5143	22.9779	1.4701	2.0028	9.6295

Panel B: Crisis period (Oct. 1-Dec 31, 1997, and July 6 to Dec. 31, 1998)
(Number of observations: 185)

	|DPQSPRB|	|DPESPRB|	|DVOLB|	|DPQSPRS|	|DPESPRS|	|DVOLS|
Mean	12.694[Ú]	17.2135[Ú]	28.3772	3.0169[Ú]	3.0973[Ú]	15.1827
Std	12.1176	15.4317	28.3940	2.9658	3.3807	26.4172
Median	9.7047	13.0045	22.4147	2.2928	2.0202	9.1111

Table 8: Correlations in stock and bond market liquidity changes during crisis and non-crisis periods The table presents the correlation matrix for the time series of market-wide liquidity and trading activity. Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). A Ú indicates that the difference in the correlation between the normal and crisis periods is significant at the 5% level or below according to Fisher’s Z statistic.

Panel A: Non-crisis (normal) period (Number of observations: 1702)

	DPQSPRB	DPESPRB	DVOLB	DPQSPRS	DPESPRS	DVOLS
DPQSPRB	1.0000					
DPESPRB	0.6531	1.0000				
DVOLB	-0.1210	-0.0313	1.0000			
DPQSPRS	0.0974	0.0613	-0.0652	1.0000		
DPESPRS	0.1024	0.0449	-0.0411	0.6084	1.0000	
DVOLS	-0.0212	0.0604	0.2692	-0.0776	0.0528	1.0000

Panel B: Crisis period (Oct. 1-Dec 31, 1997, and July 6 to Dec. 31, 1998)
(Number of observations: 185)

	DPQSPRB	DPESPRB	DVOLB	DPQSPRS	DPESPRS	DVOLS
DPQSPRB	1.0000					
DPESPRB	0.8505Ú	1.0000				
DVOLB	-0.0450	0.0449	1.0000			
DPQSPRS	0.2758Ú	0.2182Ú	-0.1226	1.0000		
DPESPRS	0.2338	0.2133Ú	-0.0099	0.8980Ú	1.0000	
DVOLS	-0.0371	-0.0189	0.5258Ú	0.0016	0.1653	1.0000

Table 9: Time-series regressions for stock and bond liquidity for crisis and non-crisis periods Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a daily percentage change. Mkt+s: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise, Mkt-s: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise, Mkt+b: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise. Mkt-b: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise. Short rate: the daily first difference in the Federal Funds rate. Term spread: the daily change in the difference between the yield on a constant maturity 10-year Treasury note and the Federal Funds rate. Quality Spread: the daily change in the difference between the yield on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). The variable "crisis" takes on the value 1 if the date falls within each of these crisis periods, and is zero otherwise. Coefficients on the variables in Table 4 are not reported for brevity. Lags of PQSPRS are included in the quoted spread regressions and lags of PESPRS are used in the effective spread regressions. Estimation is done using the Generalized Method of Moments (GMM) procedure with the Newey-West Correction.

Panel A: Crisis period regressions for quoted spreads

	DPQSPRB Coefficient	t-statistic	DPQSPRS Coefficient	t-statistic
crisis	-1.1745	-0.75	0.1652	0.43
Mkt+b*crisis	-11.5042	-1.25	-4.3019	-1.67
Mkt-b*crisis	-7.5089	-0.50	-2.1859	-0.72
Mkt+s*crisis	-0.4204	-0.16	0.3619	0.55
Mkt-s*crisis	-3.5006	-1.53	0.0752	0.15
short rate*crisis	0.5462	0.99	-0.0822	-0.50
term spread*crisis	0.6395	1.14	-0.0799	-0.49
quality spread*crisis	0.7643	1.96	-0.0384	-0.24
DPQSPRB *crisis: lag 1	0.0516	0.80	0.0448	2.00
lag 2	-0.0314	-0.43	-0.0095	-0.60
DVOLB*crisis: lag 1	0.0022	0.10	0.0009	0.12
lag 2	0.0363	1.43	0.0099	1.26
DPQSPRS *crisis: lag 1	0.1755	0.62	0.1972	2.64
lag 2	0.5282	2.30	-0.0379	-0.53
DVOLS*crisis: lag 1	-0.0118	-0.41	0.0009	0.12
lag 2	0.0310	1.01	-0.0014	-0.19
Adjusted R^2	0.5013		0.3063	

Table 9 (continued)

Panel B: Crisis period regressions for effective spreads

	DPESPRB Coefficient	t-statistic	DPESPRS Coefficient	t-statistic
Crisis	-1.3739	-0.68	-0.1754	-0.43
Mkt+b*crisis	-21.4193	-1.47	0.6153	0.20
Mkt-b*crisis	-25.8917	-1.44	-1.6288	-0.47
Mkt+s*crisis	2.1189	0.57	0.2776	0.40
Mkt-s*crisis	-4.8558	-2.13	0.0555	0.10
short rate*crisis	0.0608	0.08	0.0827	0.48
term spread*crisis	0.2054	0.27	0.0684	0.40
quality spread*crisis	1.0567	1.91	-0.0369	-0.22
DPESPRB*crisis: lag 1	0.0719	1.02	0.0061	0.44
lag 2	-0.0538	-0.84	-0.0175	-1.20
DVOLB*crisis: lag 1	0.0091	0.25	0.0007	0.09
lag 2	0.0778	2.10	0.0071	0.69
DPESPRS*crisis: lag 1	0.2518	0.79	0.2732	2.87
lag 2	0.7445	2.68	-0.0453	-0.59
DVOLS*crisis: lag 1	0.0246	0.48	0.0076	0.86
lag 2	-0.0521	-1.09	0.0047	0.63
Adjusted R^2	0.4003		0.2825	

Panel C: Crisis period regressions for trading volume

	DVOLB Coefficient	t-statistic	DVOLS Coefficient	t-statistic
crisis	-6.4409	-0.58	4.3897	1.71
Mkt+b*crisis	-7.3716	-0.22	3.7462	0.22
Mkt-b*crisis	21.8276	0.45	-4.7771	-0.23
Mkt+s*crisis	4.8116	0.63	-5.2575	-1.53
Mkt-s*crisis	-1.8134	-0.19	10.9690	4.03
short rate*crisis	0.7165	0.31	-0.2698	-0.28
term spread*crisis	0.5377	0.24	-0.5661	-0.58
quality spread*crisis	0.6945	0.36	-0.3429	-0.45
DVOLB*crisis: lag 1	-0.1476	-2.12	0.1085	1.67
lag 2	-0.1962	-2.01	0.0296	0.46
DVOLS*crisis: lag 1	0.2296	1.18	-0.0951	-2.15
lag 2	0.1229	1.02	-0.0607	-1.32
Adjusted R^2	0.0571		0.2262	

Table 10: Changes in money supply and mutual fund flow changes during crisis and non-crisis periods The table presents percent changes in the weekly M1 money supply levels (%DM1), monthly equity mutual fund net flows (%DEFLOW) and monthly government bond mutual fund net flows (%DBLOW) during crisis and non-crisis periods. Weekly M1 money supply figures are from the Federal Reserve Board and monthly mutual fund data are from the Investment Company Institute. The sample period spans the period June 17, 1991 to December 31, 1998. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). A Ú indicates that the difference in the correlation between the normal and crisis periods is significant at the 5% level or below according to Fisher's Z statistic.

Panel A: Non-crisis (normal) period (Number of observations: 354 weeks for %DM1 and 82 months for %DEFLOW and %DBFLOW)

	%DM1	%DEFLOW	%DBFLOW
Mean	0.0607	13.0703	-16.8270
Std	0.3292	56.2080	222.8740
Median	0.0774	4.1308	-3.4869

Panel B: Crisis period (Oct. 1-Dec 31, 1997, and July 6 to Dec. 31, 1998)
(Number of observations: 40 weeks for %DM1 and 9 months for %DEFLOW and %DBFLOW)

	%DM1	%DEFLOW	%DBFLOW
Mean	0.0923	-14.2207	256.6100 Ú
Std	0.5149	131.2060	683.5000
Median	0.1122	-12.7883	-21.1541

Table 11 Weekly regressions - The impact of money supply on financial market liquidity Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a weekly percentage change. Mkt+s: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise, Mkt-s: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise, Mkt+b: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise. Mkt-b: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise. Short rate: the daily first difference in the Federal Funds rate. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). The variable "crisis" takes on the value 1 if the date falls within each of these crisis periods, and is zero otherwise. The variable %DM1 measures percent changes in the weekly M1 money supply levels as reported by the Federal Reserve Board. Since this variable is available only on a weekly frequency, weekly averages are used in these regressions. Lags of PQSPRS are included in the quoted spread regressions and lags of PESPRS are used in the effective spread regressions. Estimation is done using the Generalized Method of Moments (GMM) procedure with the Newey-West Correction.

Table 11, continued

Panel A: Quoted Spreads

	DPQSPRB Coefficient	t-statistic	DPQSPRS Coefficient	t-statistic
Intercept	-1.4245	-1.59	0.4459	1.78
Mkt+b	-1.3245	-0.18	2.8978	1.24
Mkt-b	-24.9429	-3.33	1.0705	0.71
Mkt+s	2.7310	0.87	-5.1878	-5.83
Mkt-s	-4.0605	-1.14	-3.5725	-2.30
short rate	0.1108	1.27	0.0424	2.46
term spread	0.0932	1.10	0.0378	2.51
quality spread	0.0691	0.36	0.0158	0.40
Lag of DPQSPRB	-0.2962	-6.86	-0.0190	-1.08
Lag of DVOLB	0.0088	0.56	0.0041	0.58
Lag of DPQSPRS	0.1116	0.66	0.0321	0.49
Lag of DVOLS	0.0128	0.28	0.0023	0.15
%DM1: lag 0	-1.7154	-1.44	-0.3774	-0.79
Lag 1	0.4854	0.39	0.0534	0.14
Lag 2	1.5564	1.20	0.5654	1.64
Russian or Asian crisis	-5.6822	-2.05	-0.1426	-0.16
Mkt+b*crisis	29.6493	1.31	9.7213	1.05
Mkt-b*crisis	-83.1314	-3.45	-19.6700	-2.80
Mkt+s*crisis	-7.4429	-0.77	0.0791	0.04
Mkt-s*crisis	-4.4705	-0.61	0.6116	0.27
short rate*crisis	-1.2330	-2.74	-0.3605	-2.56
term spread*crisis	-1.0715	-2.61	-0.3468	-2.71
quality spread*crisis	-0.6594	-1.40	-0.2661	-1.58
Lag of DPQSPRB*crisis	0.0922	0.64	0.0190	0.40
Lag of DVOLB*crisis	-0.1072	-1.09	0.0007	0.02
Lag of DPQSPRS*crisis	0.7220	1.53	0.0870	0.56
Lag of DVOLS*crisis	-0.2454	-1.53	-0.0719	-1.15
%DM1*crisis: lag 0	-7.9789	-1.34	-3.8810	-1.53
lag 1	-3.8206	-0.70	-3.2174	-1.67
lag 2	-10.2208	-2.10	-4.6414	-2.50
Adjusted R^2	0.2686		0.3727	

Table 11 (continued)

Panel B: Effective Spreads

	DPESPRB Coefficient	t-statistic	DPESPRS Coefficient	t-statistic
Intercept	-1.0631	-0.98	0.7753	2.38
Mkt+b	6.5476	0.64	0.7356	0.24
Mkt-b	-29.2133	-3.10	1.8976	1.00
Mkt+s	0.7047	0.19	-6.0785	-4.76
Mkt-s	4.7986	1.03	-2.8804	-1.43
short rate	0.2104	1.98	0.0151	0.68
term spread	0.1301	1.28	0.0167	0.93
quality spread	0.0209	0.11	0.0177	0.36
Lag of DPESPRDB	-0.2472	-4.18	-0.0126	-0.86
Lag of DVOLB	0.0166	0.87	0.0064	0.83
Lag of DPESPRDS	0.0610	0.35	-0.0094	-0.15
Lag of DVOLS	-0.0177	-0.37	-0.0146	-0.72
%DM1: lag 0	-2.4858	-1.62	-0.4261	-0.83
lag 1	-0.2138	-0.14	0.1138	0.23
lag 2	-0.0772	-0.05	0.7685	1.61
Russian or Asian crisis	-7.6035	-2.12	-0.6554	-0.65
Mkt+b*crisis	36.3864	1.07	10.0691	1.02
Mkt-b*crisis	-126.1490	-3.95	-25.1902	-3.44
Mkt+s*crisis	-7.6711	-0.62	2.0742	0.85
Mkt-s*crisis	-13.7875	-1.72	-0.3091	-0.12
Short rate*crisis	-1.4609	-2.16	-0.4574	-3.00
term spread*crisis	-1.2276	-2.01	-0.4483	-3.20
quality spread*crisis	-0.4565	-0.69	-0.3805	-2.12
Lag of DPESPRB*crisis	0.0124	0.09	0.0037	0.10
Lag of DVOLB*crisis	-0.2071	-1.68	0.0034	0.08
Lag of DPESPRS*crisis	0.8554	1.89	0.1799	1.39
Lag of DVOLS*crisis	-0.2438	-1.15	-0.0927	-1.49
%DM1*crisis: lag 0	-12.6051	-1.53	-5.3513	-1.91
lag 1	-6.9554	-1.10	-4.3338	-2.09
lag 2	-9.4909	-1.60	-6.5046	-3.51
Adjusted R^2	0.3615		0.3094	

Table 11 (continued)

Panel C: Trading Volume

	DVOLB Coefficient	t-statistic	DVOLS Coefficient	t-statistic
Intercept	-4.9957	-1.21	-3.2159	-2.10
Mkt+b	38.8355	1.07	8.1653	0.71
Mkt-b	-42.1116	-1.52	-1.8308	-0.16
Mkt+s	33.0171	2.21	17.4386	2.75
Mkt-s	-17.1447	-0.82	-21.0822	-3.61
short rate	0.1550	0.47	0.1172	1.03
term spread	-0.0417	-0.15	0.0588	0.57
quality spread	0.6461	0.82	0.1881	0.75
Lag of DVOLB	-0.1208	-1.72	0.0362	1.53
Lag of DVOLS	-0.2569	-1.00	-0.3816	-5.42
%DM1: lag 0	3.1221	0.63	0.0078	0.00
lag 1	3.0927	0.52	4.9656	2.34
lag 2	-11.1471	-1.64	-2.2583	-1.08
Russian or Asian crisis	3.8104	0.47	0.2226	0.05
Mkt+b*crisis	-41.5521	-0.83	-2.6972	-0.11
Mkt-b*crisis	84.4086	1.94	-8.4231	-0.29
Mkt+s*crisis	-37.3794	-1.86	-19.1198	-2.13
Mkt-s*crisis	13.7582	0.61	8.8854	1.08
short rate*crisis	1.0029	1.28	-0.0303	-0.06
term spread*crisis	0.9778	1.47	-0.1072	-0.22
quality spread*crisis	1.1770	1.02	-0.0070	-0.01
Lag of DVOLB*crisis	-0.1100	-0.50	-0.0570	-0.43
Lag of DVOLS*crisis	0.5011	1.59	-0.0800	-0.57
%DM1*crisis: lag 0	-1.7455	-0.18	-0.5510	-0.07
lag 1	-3.1771	-0.42	-8.9214	-1.58
lag 2	10.1022	0.94	5.3852	1.07
Adjusted R^2	0.0681		0.1977	

Table 12 Monthly regressions - The impact of mutual fund flows on financial market liquidity Bond liquidity estimates are based on the daily mean of the best bid and ask offer quotes by dealers on the 10-year Treasury note, as reported in the GovPX data set. The stock liquidity series are constructed by first averaging all transactions for each individual stock on a given trading day and then cross-sectionally averaging all individual stock daily means that satisfy the data filters described in the text. The sample period spans the period June 17, 1991 to December 31, 1998. PQSPR stands for proportional quoted spread, PESPR for proportional effective spread, and VOL for volume. The suffixes B and S refer to bond and stock variables, respectively, and the prefix "D" denotes a monthly percentage change. Mkt+s: the concurrent daily CRSP value-weighted index return if it is positive and zero otherwise, Mkt-s: the concurrent daily CRSP value-weighted index return if it is negative and zero otherwise, Mkt+b: the concurrent Lehman Brothers' aggregate bond index return if positive and zero otherwise. Mkt-b: the concurrent Lehman Brothers' aggregate bond index return if negative and zero otherwise. Short rate: the daily first difference in the Federal Funds rate. The two crisis periods are the Asian crisis (October 1 to December 31 1997), and the Russian default crisis (July 6 to December 31, 1998). The variable "crisis" takes on the value 1 if the date falls within each of these crisis periods, and is zero otherwise. The variable %DEFLOW (%DBFLOW) measures percent changes in the monthly equity (government bond) mutual fund net flows as reported by the the Investment Company Institute. Since these variables are available only on a monthly frequency, monthly averages are used in these regressions. Lags of PQSPRS are included in the quoted spread regressions and lags of PESPRS are used in the effective spread regressions. Estimation is done using the Generalized Method of Moments (GMM) procedure with the Newey-West Correction.

Panel A: Monthly regressions: Quoted Spreads

	DPQSPRB Coefficient	t-statistic	DPQSPRS Coefficient	t-statistic
Intercept	-3.6926	-1.60	3.7931	3.59
Mkt+b	33.5847	1.01	-17.3115	-0.82
Mkt-b	-105.3490	-3.49	14.3813	1.44
Mkt+s	0.0916	0.01	-25.1613	-5.68
Mkt-s	-11.0939	-0.78	-8.4727	-0.90
short rate	-0.0093	-0.13	-0.0487	-2.23
Lag of %DEFLOW	0.0195	1.18	-0.0178	-1.99
Lag of %DBFLOW	-0.0023	-1.61	-0.0007	-1.34
Russian or Asian crisis	-5.3628	-1.65	4.9962	2.24
Mkt+b*crisis	1059.6650	4.54	-75.1633	-0.40
Mkt-b*crisis	-2649.3000	-2.39	1696.6820	1.89
Mkt+s*crisis	-226.0110	-4.53	41.7050	1.05
Mkt-s*crisis	139.9647	3.74	-5.0571	-0.17
short rate*crisis	0.2532	0.35	-1.2600	-2.17
Lag of %DEFLOW*crisis	0.0303	1.02	-0.0315	-1.43
Lag of %DBFLOW*crisis	-0.0500	-2.55	-0.0037	-0.23
Adjusted R^2	0.3259		0.6068	

Panel B: Monthly regressions: Effective Spreads

	DPESPRB Coefficient	t-statistic	DPESPRS Coefficient	t-statistic
Intercept	-4.8013	-1.71	4.6514	3.47
Mkt+b	14.6954	0.35	-21.9538	-0.81
Mkt-b	-83.1217	-2.94	19.2821	1.49
Mkt+s	8.4798	0.96	-28.3655	-4.68
Mkt-s	-24.8328	-1.24	-3.8734	-0.41
short rate	-0.01433	-0.22	-0.0546	-1.89
Lag of %DEFLOW	0.0273	1.79	-0.0179	-1.60
Lag of %DBFLOW	0.0014	0.43	0.0009	1.32
Russian or Asian crisis	-5.9155	-1.39	3.3747	1.28
Mkt+b*crisis	1008.1960	3.42	-108.2110	-0.51
Mkt-b*crisis	-1518.3000	-1.08	1810.8800	1.77
Mkt+s*crisis	-205.9830	-3.30	50.7142	1.12
Mkt-s*crisis	132.3693	2.82	-22.0794	-0.68
Short rate*crisis	-0.7690	-0.84	-13.8664	-2.10
Lag of %DEFLOW*crisis	0.0159	0.44	-0.0306	-1.20
Lag of %DBFLOW*crisis	-0.0432	-1.77	0.0057	0.32
Adjusted R^2	0.2653		0.5191	

Panel C: Monthly regressions: Trading Volume

	DVOLB Coefficient	t-statistic	DVOLS Coefficient	t-statistic
Intercept	-10.6767	-2.24	-4.6664	-1.74
Mkt+b	156.0717	2.19	37.8730	1.10
Mkt-b	-29.6806	-0.54	2.6319	0.09
Mkt+s	45.8604	2.21	30.1369	2.84
Mkt-s	-32.5715	-0.99	-25.9479	-1.07
short rate	0.1121	0.80	-0.0561	-0.85
Lag of %DEFLOW	0.0886	2.16	0.0408	1.87
Lag of %DBFLOW	-0.0124	-4.77	-0.0058	-3.59
Russian or Asian crisis	-13.8788	-2.91	-7.4458	-1.73
Mkt+b*crisis	579.4235	6.49	997.6517	3.02
Mkt-b*crisis	-2604.3500	-10.01	-4378.4300	-2.78
Mkt+s*crisis	-147.4840	-6.18	-239.6670	-3.41
Mkt-s*crisis	40.6192	1.19	139.2806	2.54
short rate*crisis	1.5544	7.26	2.3998	2.35
Lag of %DEFLOW*crisis	-0.0448	-1.08	0.0664	1.60
Lag of %DBFLOW*crisis	0.0245	4.60	-0.0383	-1.39
Adjusted R^2	0.1693		0.1202	