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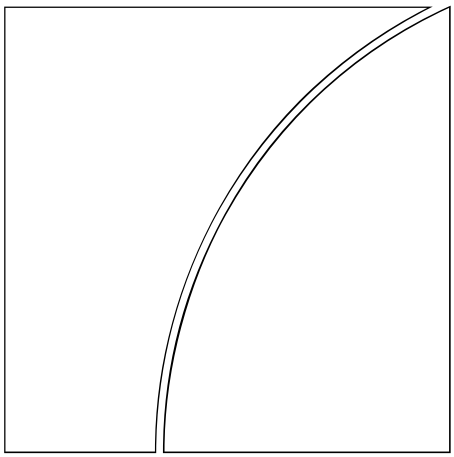

BIS Working Papers

No 99

The interbank market during a crisis

by Craig Furfine

Monetary and Economic Department

June 2001

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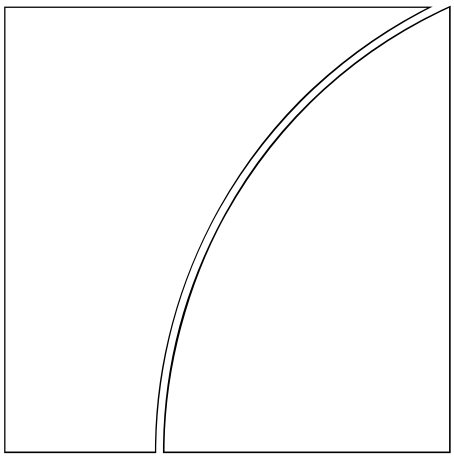

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The interbank market during a crisis

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Abstract

The autumn of 1998 provides a setting in which to test the performance of the interbank market during a potential financial crisis. This period witnessed Russia's effective default on its sovereign bonds and the near collapse of the hedge fund Long-Term Capital Management. Despite these negative shocks to bank capital and increased uncertainty in financial markets more generally, the federal funds market still effectively channeled liquidity to those institutions in need at rates consistent with Federal Reserve intentions. Further, risk premiums on overnight lending were largely unaffected and lending volumes increased, suggesting that the federal funds market performed well during this period.

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1. Introduction[1]

Interbank markets play at least two crucial roles in modern financial systems. First and foremost, it is in such markets that central banks actively intervene to guide their policy interest rates. Second, well functioning interbank markets effectively channel liquidity from institutions with a surplus of funds to those in need, allowing for more efficient financial intermediation. Thus, policymakers have an interest in having a financial system with a well functioning and robust interbank market, that is, one in which the central bank can achieve its desired rate of interest and one that allows institutions to efficiently trade liquidity.

This paper examines whether the federal funds market was sufficiently robust to achieve both of these policy objectives during the autumn of 1998.[2] This period witnessed two major disruptions in financial markets. First, on 17 August, Russia effectively defaulted on its sovereign debt. Shortly thereafter, on 23 September, a private sector rescue of the hedge fund Long-Term Capital Management (LTCM) was facilitated by the Federal Reserve. Thus, the autumn of 1998 offers the most recent opportunity to examine the behaviour of financial markets in a period where banks were conceivably exposed to large losses. Further, this period is also one where there was a large flight to both quality and liquidity.[3] It is precisely in such an environment that one might expect interbank markets not to function normally. That is, institutions might be expected to prefer the safety and liquidity of US government bills and bonds to the potentially risky investment of lending, especially unsecured, to another financial institution that may have been severely and adversely affected by the ongoing financial turmoil.

Although the events of late 1998 may not have been as severe as earlier US banking troubles, they suggest that the crisis was perceived by policymakers to be quite severe. First, there was the extraordinary central bank facilitation of the resolution of a non-bank institution. Second, the period witnessed three cuts in the Fed's target funds rate, including a rare instance of a cut between FOMC meetings. These events suggest that, at the time, the central bank itself was convinced that a significant risk of market breakdown existed.

Thus, the autumn of 1998 is a useful period to examine the federal funds market. To do so, we use unique data that identify all individual federal funds transactions made during 1998. From these data, the paper presents four main empirical results. First, the Federal Reserve was able to implement its desired interest rate policy. Interbank interest rates, in general, did not stray far from their intended level, although there is evidence of rate overshooting during July and August. Interest rate variability was largely unaffected as the crisis events materialised, although variability rose markedly following the Fed's inter-meeting interest rate cut on 15 October. Second, aggregate volume in the federal funds market was actually higher during the second half of 1998 than during the first. Volume was especially high shortly after the resolution of LTCM. Third, credit spreads in the interbank market did not behave in a way consistent with financial uncertainty. Spreads paid by institutions were often narrower during the crisis period. Finally, the interbank market seemingly allowed individual institutions to achieve their desired level of liquidity. Banks generally borrowed at least as much during the crisis period as before, although there is evidence that borrowing increased by more at safer institutions.

These findings suggest that the US federal funds market was robust to serious disruption and continued to allocate liquidity well during the financial crisis of 1998. Concerns that this market would fail as institutions sought safer investments during a period of greater uncertainty therefore seem to be at odds with events. The remainder of the paper is organised as follows. Section 2 reviews the literature that discusses the potential for interbank market failure. Section 3 describes the data used in this paper. Section 4 presents the evidence on the ability of the Federal Reserve to implement its desired monetary policy. Section 5 provides evidence on aggregate volume in the federal funds

[1] The author would like to thank his colleagues at the BIS for many helpful comments. Also, without the monumental efforts of Josh Weisbrod in assembling the data, this project would not have been possible. The views expressed are those of the author and do not necessarily reflect the views of the BIS.

[2] For a good discussion of the events surrounding the autumn of 1998, see Committee on the Global Financial System (1999).

[3] Corporate bond spreads over government securities widened dramatically, as did the "off-the-run/on-the-run" spread in government bonds. See Bank for International Settlements (1999).

market. Section 6 examines how federal funds transactions were priced. Section 7 examines the quantities borrowed by individual banks. Section 8 concludes.

2. Related literature

A well functioning interbank market will deliver the desired allocation of bank reserves within the banking system at the rate decided upon by the central bank. Goodfriend and King (1988) strongly support the view that the federal funds market most likely achieves this outcome. Kaufman (1991) and Schwartz (1992) draw further conclusions from the Goodfriend and King argument. In particular, these authors argue that if the market refrains from lending to a certain institution, and this abstention ultimately causes that institution's failure, then the failure is an efficient market outcome. Implicit in these authors' arguments is the assertion that market participants are the most well informed parties to judge the solvency of a liquidity-starved institution.

One might argue, however, that a well informed central bank might be better informed than individual market participants, and thus an interbank market might fail simply because the market lacked some necessary information. Examining this question, preliminary research has found that in many circumstances supervisors and markets are often complementary sources of information regarding bank health (Peek et al (1999), DeYoung et al (1998), Berger et al (1998)). The conclusions of these papers provide evidence that the Federal Reserve does have relevant knowledge regarding the health of a banking institution that is not known, or at least not right away, by market participants.

Even if markets and policymakers are equally well informed regarding the health of any particular institution, recent literature suggests that the interbank market can still fail at times of financial crisis. For instance, Flannery (1996) develops a model whereby during a financial crisis a lending bank becomes more uncertain about the creditworthiness of its counterparties. In Flannery's model, only a fraction of the banks wishing to borrow are insolvent, yet neither potential lenders nor the central bank can identify the insolvent from the merely illiquid. Since an individual bank is assumed to be unable to broadly diversify its interbank lending portfolio across many illiquid counterparties, it chooses instead to refrain from interbank lending. In another theoretical paper, Freixas et al (1999) develop a model whereby a bank can choose not to lend in interbank markets when it has doubts about its own inability to borrow in the future. In this way, the broad failure of the interbank market can be seen as a standard coordination failure.

Thus, there are a number of reasons why, in a financial crisis, an interbank market can fail to efficiently allocate credit. The economic relevance of these theories depends on the likelihood that interbank markets actually fail in practice. For this reason, we explore the performance of the federal funds market during the latter part of 1998.

3. Data

The data used in this paper come from the unsecured overnight federal funds market. Aggregate data on this market are constructed from individual transactions that were identified as follows. By definition, federal funds transactions are settled (ie the money is delivered and repaid) using Fedwire, the large-value transfer system owned and operated by the Federal Reserve. Thus, to begin a search for individual interbank loan transactions, data on every payment transferred across Fedwire during 1998 were collected.[4] Each payment identifies, among other items, the sending and receiving bank and the amount, in dollars and cents. Consistent with the discussion in Stigum (1990), we consider only Fedwire payments that were at least USD 1 million and ended in five zeros (seven including cents) to be possible federal funds loans being delivered. For each of these possible deliveries, the following day's payments were searched for a payment between the same two banks in the opposite direction in an amount that could reasonably be construed as the initial payment plus interest. Interest

[4] Repo transactions between banks are catalogued in a different system and therefore are not included in this sample.

rates were allowed to fall between 50 basis points below the minimum and 50 basis points above the maximum rates witnessed by the federal funds brokers surveyed each day by the Fed.

Pairs of payments on adjoining business days satisfying these search criteria were identified as a federal funds transaction. For example, if the Fedwire transaction data contain a payment from bank A to bank B for USD 10 million on Tuesday and also a payment from bank B to bank A for USD 10,001,527.78 on Wednesday, then this was identified as a federal funds loan of USD 10 million from bank A to bank B on Tuesday at an interest rate of 5.50%.[5] This process identified 781,675 transactions over the 252 business days.[6] Based on the information contained in the underlying Fedwire payments, each transaction specifies the borrowing bank, the lending bank, the time of the delivery and return of the funds, the amount of the loan, and (implicitly) the interest rate charged. From these data, one can construct aggregate measures of the federal funds market as well as detailed information regarding an individual institution's participation in the market each day.

Given the underlying sample of federal funds transactions, one can immediately question whether the autumn of 1998 was an unusual period for the market as a whole. To be precise, in the analysis that follows, the period between 1 July and 31 December will be compared to the more normal times of the first half of 1998. More precisely, five subperiods during the second half of 1998 will be examined to search for any deviations in federal funds market characteristics during these subperiods relative to more stable times. Table 1 defines the subperiods. The definitions of the subperiods allow for the possibility that different events, eg the Russian default, the LTCM recapitalisation, and the Fed's interest rate cuts, may have a differential impact on the federal funds market.[7]

4. The implementation of monetary policy

The two upper lines in Figure 1 plot the volume-weighted average interest rate in the federal funds market and the Fed's target rate.[8] As is evident in the figure, the average interest rate in the market broadly tracked its desired level. To explore this more formally, we report in the first column of Table 2 the results from a linear regression of the difference between the average and target federal funds rate on five dummy variables indicating the five crisis subperiods described in Table 1. As is shown, none of the coefficients on the dummy variables are statistically significant, suggesting that interest rates in the market were, on average, not different from their desired level. However, Figure 1 also indicates the presence of strong calendar-related and other high-frequency movements in average rates. As documented in Hamilton (1996) and Furfine (2000), daily federal funds rates are systematically related to weekends, holidays, reserve maintenance periods, and other calendar events. Thus, it is possible that the failure to find a statistically significant difference between average interest rates across time periods is an artifact of the additional volatility caused by calendar-related factors.

To control for this possibility, a second regression analysis is performed. First, average interest rates are regressed on a set of calendar-related variables on the sample covering only the first half of 1998. Then, predicted values from this regression are used to calculate actual and predicted residuals for the entire 1998 period. These residuals were then regressed on the same five dummy variables as before. These coefficient estimates are given in the second column of Table 2. As indicated, interbank interest rates were, on average, higher than one would have expected by 5-6 basis points during the months of July and August. No statistically significant difference in interest rates was found during the later parts of the year.

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[5] Federal funds transactions are quoted on a discount yield basis.

[6] By design, this search approach only identifies overnight transactions. However, according to a Federal Reserve Bank of New York (1987) survey, overnight transactions account for 96% of the funds market.

[7] The results that follow are robust to various changes in the definition of the crisis period.

[8] The average rate will, on most days, be very close to the effective federal funds rate reported by the Federal Reserve. The differences between the data here and the data reported by the Fed are attributable to the different transactions being sampled. The published series reflect only the 40% of federal funds volume brokered by the brokers surveyed each day by the Fed, whereas we report here data on all transactions settled using Fedwire.

The bottom line in Figure 1 shows the intraday standard deviation of transaction interest rates during 1998. This measures the volume-weighted variability of interbank transaction interest rates. Intraday variability can be caused by large differences in the risk of different market participants, but is often caused by uncertainty regarding the level of reserve demand on a given day and the related uncertainty regarding the Fed's ability to achieve its desired level of interest rates. Thus, it is common for days with average rates far from target to have higher than average intraday variability. The most notably volatile days are associated with calendar-related effects related to the Martin Luther King Day weekend, the end of the second quarter, and the end of the year. To analyse the intraday variability more carefully, we run two regressions analogous to those before. However, the dependent variables in these regressions are the intraday variability and the residuals from the first-stage variability prediction regression, respectively. Focusing on the fourth column of Table 2, the results indicate that intraday variability was not statistically different from what could be expected for the period up until the Fed's inter-meeting cut. The last subperiod of 1998 was characterised by a notable increase of 10 basis points in intraday variability.

5. Aggregate volume in the federal funds market

The light solid line in Figure 2 reports the total volume of borrowing in the overnight federal funds market during 1998. As is suggested by the figure, the volume of the federal funds market was generally higher during the second half of the year than the first. The first column of Table 3 verifies this by regressing the log of gross market value on the five subperiod dummy variables. All five of the coefficients are statistically significant and positive, confirming that the market was larger in the second half of the year, particularly after the rescue of LTCM. This subperiod witnessed market volume around 20% higher than in the earlier part of the year.

As was the case for average interest rates, however, there are strong calendar-related factors that influence market volume. In fact, perhaps the most notable observations in Figure 2 are the significant declines in market volume associated with Good Friday and the 4 July weekend. Therefore, the second column reports the coefficients on a residual regression analogous to what was described in Section 4. The only change made was to include a time trend in the prediction regression to account for the observation that the size of the overall federal funds market was growing during the first half of 1998. As indicated in the second column of Table 3, controlling for predictable movements in overall market volume changes the overall impression of the crisis period. In particular, overall market volume in July and August is estimated to be 3% below what might have otherwise been expected. Further, the 27% increase in market volume following the LTCM rescue is estimated to be only 12% higher than what might have been expected. Finally, volume at the end of the year is 4% higher than expected. Thus, controlling for predictable movements in market volume suggests that the second part of 1998, with the exception of the days after the LTCM rescue, was not much different in an economic sense from what would have been predicted from the market's volume during the first half of 1998.

The behaviour of aggregate volume during the latter part of 1998 may not truly reflect a measure of the market's reallocation of reserves. This is because large participants serve the market as dealers by both borrowing and lending. Thus, the increase in aggregate volume may reflect an increase in the activities of dealer banks responding to a perception that dealing in relatively uncertain times may present higher profit opportunities. Higher aggregate volume might therefore only represent a higher amount of intermediated funds trading as opposed to true reallocation of reserves. The dotted line in Figure 2 graphs the overall volume of net borrowing in the federal funds market. That is, for banks that both borrow and lend, only the net amount borrowed for any given day was included.[9] Comparing the two lines in Figure 2 suggests two conclusions. First, dealer trading in federal funds accounts for roughly 40% of the market's overall volume. Second, the apparent increase in volume during the crisis period of 1998 remains after the elimination of the buying and simultaneous selling of dealer banks. As confirmation of this, the final two columns of Table 3 report regression results using net volume and the net volume residuals as the dependent variables, respectively. The results are virtually identical to those using total funds volume.

[9] Banks that were net sellers of funds were treated as zeros. Otherwise, the sum net position would be zero by construction.

Finally, the behaviour of aggregate federal funds volume, either gross or net, may reflect changes to the level of banking system reserves. As the dark line in Figure 2 indicates, however, total banking system reserves changed relatively little throughout the year, despite three cuts to the target federal funds rate in the latter part of the year.

6. The pricing of federal funds transactions

In this section, we take a systematic look at the rates paid by individual banks to borrow funds in 1998. In particular, we explore whether riskier banks, during the crisis period, paid a higher price for borrowed funds. The risk of an institution in this market can be inferred from the rates paid by a bank for overnight funds relative to what the market is paying. The risk premium paid by a given institution on a given day is defined to be the difference between a bank's actual volume-weighted average rate paid for the funds it borrows and that day's overall weighted average rate. That is, premiums are taken relative to market rates and not the target rate to reflect the fact that all banks are subject to systematic changes in the daily federal funds rate. Then, we define the variable Risk as the average of each bank's risk premium during the first half of 1998.[10]

To isolate potential differences in pricing behaviour for institutions with different presence in the market, the sample was divided into three groups that represent different typical levels of market presence. The first group consisted of observations from banks that borrowed in the funds market with less than the median frequency during the first half of 1998. Banks in this category borrowed on less than 30 of the 125 business days between January and June. The second category contained observations for banks that borrowed with more than the median frequency but less than the 75th percentile. Specifically, banks in the middle category borrowed on between 31 and 106 days. The final category contained the most active borrowers in the market, ie those that borrowed on at least 107 of the 125 business days during the first half of 1998. For each category of institution, we regress a bank's daily interest rate premium on the five subperiod dummy variables and on the interaction of these five dummy variables and the borrowing institution's risk. The coefficients from these three regressions are given in Table 4.

The first row in Table 4 indicates that institutions that borrow less frequently in the funds market pay higher interest rates. On average, during the first half of 1998, the institutions that participated the least pay nearly 16 basis points over the average funds rate to borrow funds. More active participants tended to pay over 7 basis points over the average funds rate whereas the most active participants typically paid 0.5 basis points below the average funds rate. The coefficients on the time period dummy variables suggest that during the latter half of the year, the difference between the credit spreads paid by the most active and least active participants declined. To the extent that a crisis period would increase the uncertainty related to infrequent market participants more than other institutions, this result is something of a puzzle.

One might have expected the crisis to have heightened institutions' sensitivities to risk and that this increased sensitivity might have led to higher risk premiums much in the same way that other credit spreads were rising during this time period. The coefficients on the interaction between the Risk variable and the crisis subperiods, however, suggest that in the federal funds market risk premiums actually declined for the least active set of market participants. Recall that as defined, a coefficient estimate of 1.00 would mean that each additional basis point an institution paid to borrow funds during the first half of 1998 would correlate with one additional basis point paid during the crisis. The estimates for the least active market participants indicate that an institution with a given level of risk, as proxied by the premium paid during the first half of the year, actually paid premiums approximately half the size during the crisis period. Although the coefficient estimates for the two more active sets of market participants are occasionally statistically different from 1.00, they are not economically much different from 1.00. Overall, then, the federal funds market did not witness a widening of credit spreads during the latter part of 1998.

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[10] Although differences in risk may be the most important factor in determining interest rates paid for unsecured funds, other factors such as bank size and counterparty relationships may also be important. See Furfine (2001) for an analysis of many factors that determine the interest rate of an individual federal funds transaction.

7. The borrowing of federal funds by individual banks in 1998

In this section, we replicate the analysis of Section 6 but focus on the level of borrowing undertaken by individual institutions rather than on the interest rates paid. To do so, we rerun the same regressions as those that lay behind Table 4 but replace the dependent variable by a measure of each bank's gross borrowing. It is not possible to use the actual level of a bank's borrowing as the dependent variable in a regression analysis due to the dramatic differences in borrowing levels across institutions. To control for this, we scale an institution's daily borrowing level by both its mean level and its typical variation, where each bank's mean level and standard deviation of borrowing are calculated using data from only the first half of 1998. More precisely, we create a modified borrowing measure equal to the difference between a bank's actual level and its mean level during the first half of 1998 divided by the standard deviation of its borrowing level calculated over the first half of 1998. Thus, the dependent variable measures the number of standard deviations that a given bank's borrowing is away from its January-June 1998 level. The results of this analysis are given in Table 5.[11]

The time period dummies in Table 5 indicate that individual banks borrowed more in the federal funds market during the second half of 1998 than they did during the first half. For all categories of institutions, there was a notable increase in the borrowing level in the period after the rescue of LTCM. The final rows of Table 5 suggest that there was a notable shift in the pattern of borrowing during the second half of 1998. For the most active borrowers, there was a negative relationship between borrowing levels and borrower risk. That is, riskier active institutions borrowed less during the crisis subperiods. This negative relationship was also found in all three subsamples following the inter-meeting rate cut.

8. Summary and conclusions

The evidence in this paper suggests that the federal funds market did not suffer any obvious problems during the autumn of 1998. Although there was some mild evidence that average interest rates tended to be above their target, the Federal Reserve was able to achieve interbank interest rates roughly equal to its policy rate. Strains and uncertainty in the interbank market may have been reflected by a notable increase in intraday rate variability following the Fed's inter-meeting rate cut. Aggregate volume in the federal funds market was actually higher during the second half of 1998 than during the first, although much of this increase was predictable from calendar-related factors. After controlling for such factors, the size of the funds market was, during most of the latter half of 1998, not much different in an economic sense from what could have been predicted. Looking more closely at individual bank behaviour does not provide much evidence of market strain either. For many institutions, credit spreads tended to narrow. Finally, individual institutions borrowed more than would have been predicted during the crisis period, although this increase in borrowing was most pronounced at safer banks.

[11] Unlike the analysis described in Table 4, the regressions that lay behind Table 5 account for the potential calendar-related influences on individual bank borrowing levels. That is, a two-stage process was performed where the reported coefficients were derived from a regression of residuals from a prediction regression of individual bank borrowing. For robustness, the analysis was performed without this step, and unlike the findings in Tables 2 and 3, the results were virtually identical to those reported in Table 5. This is because individual banks have very different calendar-related patterns to their borrowing. Because the credit spreads were expressed as a difference from the market rate and the market rate contains the calendar-related element, this step was unnecessary in Table 4.

Figure 1

Average interbank interest rates and rate variability

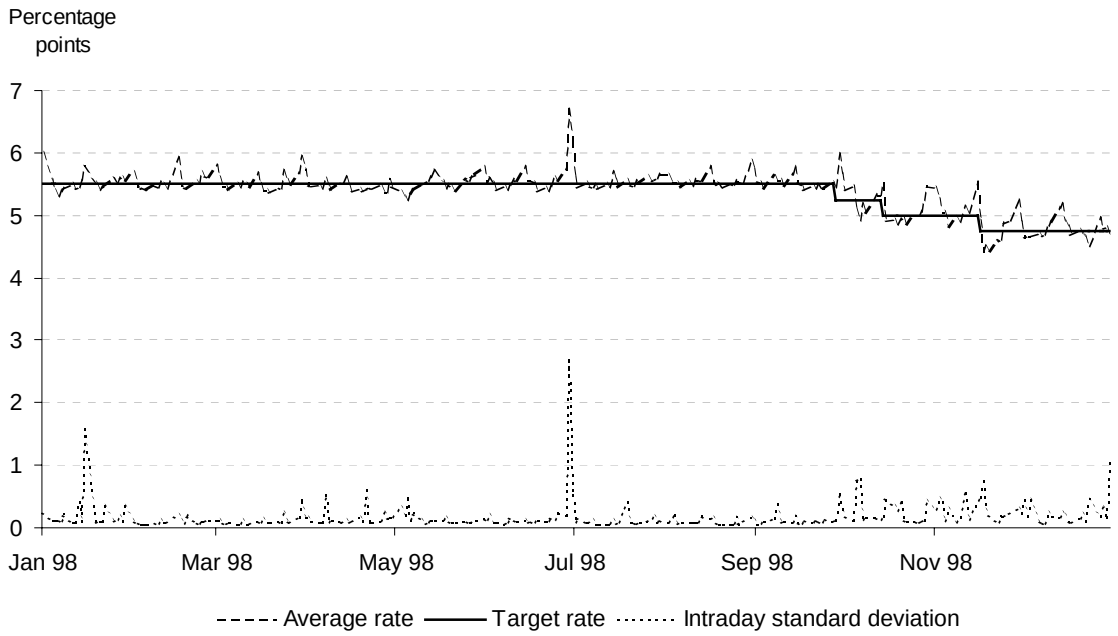

Figure 2

Volume of federal funds transactions

(in billions)

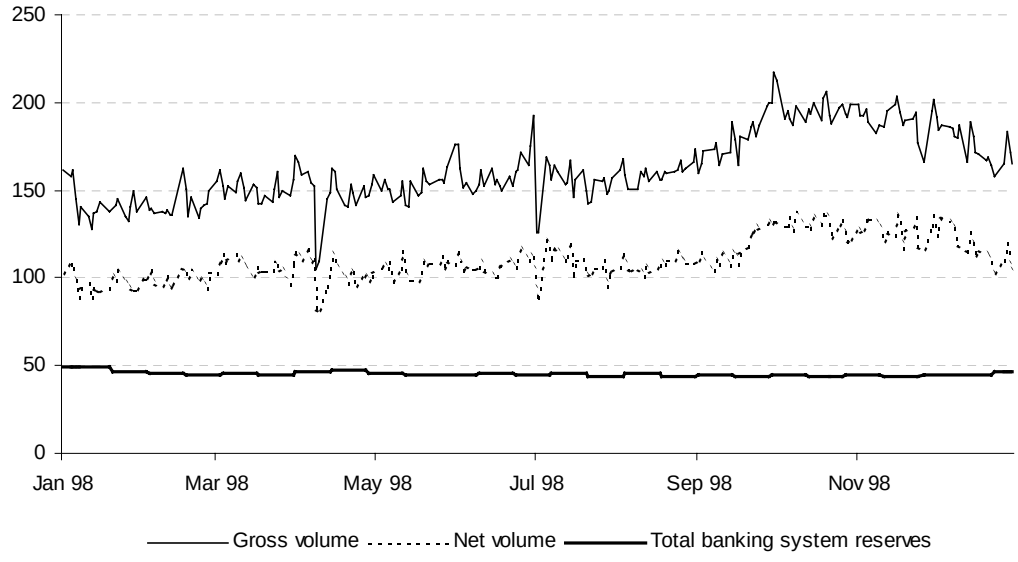

Table 1

Definitions of crisis subperiods

1 July-16 August	Period before the Russian default.
17 August-September 1	From the Russian default to the news of troubles at LTCM.
2 September-23 September	The days leading up to the LTCM recapitalisation.
24 September-15 October	After the LTCM recapitalisation until the Fed's inter-meeting rate cut.
16 October-31 December	After the Fed's inter-meeting rate cut.

Table 2

Weighted average interest rates in the federal funds market

(relative to non-crisis times, in basis points)

	Dependent variable			
	Actual average spread over target	**Unpredictable part of average spread over target**	**Actual intraday variability**	**Unpredictable part of intraday variability**
1 July-16 August	2.88 (2.77)	4.96 (1.59)[2]	– 4.28 (3.00)	– 0.82 (2.40)
17 August-1 September	5.73 (4.04)	5.98 (1.90)[2]	– 5.79 (2.78)[1]	– 1.21 (2.90)
2 September-23 September	0.63 (2.88)	1.98 (2.09)	– 4.55 (3.12)	– 5.60 (4.11)
24 September-15 October	7.35 (7.37)	1.78 (4.94)	9.19 (6.37)	0.69 (9.41)
16 October-31 December	1.12 (3.17)	0.47 (2.70)	9.64 (3.61)[2]	10.56 (2.59)[2]
Observations	252	252	252	252

Note: Standard errors in parentheses.

[1] Significant at 5% level. [2] Significant at 1% level.

Table 3

Aggregate volume of the federal funds market

(relative to non-crisis times, in percentage points)

	Dependent variable			
	Actual log of total gross volume	**Unpredictable part of log of total gross volume**	**Actual log of total net volume**	**Unpredictable part of log of total net volume**
1 July-16 August	4.06 (1.52)[2]	– 4.41 (1.15)[2]	3.30 (1.36)[1]	– 3.55 (1.27)[2]
17 August-1 September	8.43 (1.07)[2]	– 3.15 (0.90)[2]	6.09 (0.86)[2]	– 2.59 (0.93)[2]
2 September-23 September	15.92 (1.50)[2]	3.55 (1.13)[2]	9.34 (1.47)[2]	– 0.48 (1.30)
24 September-15 October	27.25 (1.38)[2]	12.41 (1.02)[2]	23.90 (0.79)[2]	12.30 (0.98)[2]
16 October-31 December	22.14 (1.16)[2]	4.03 (1.35)[2]	18.40 (1.21)[2]	4.48 (1.29)[2]
Observations	252	252	252	252

Note: Standard errors in parentheses.

[1] Significant at 5% level. [2] Significant at 1% level.

Table 4

Credit spreads in the federal funds market

(relative to non-crisis times, in basis points)

	Estimation sample		
	Least active participants	**Medium active participants**	**Most active participants**
Constant	15.9399 (1.3417)[2]	7.2095 (0.2496)[2]	– 0.5015 (0.1193)[2]
Time period dummy variables			
1 July-16 August	– 11.3466 (2.1015)[2]	– 7.8779 (0.7183)[2]	– 0.8212 (0.1961)[2]
17 August-1 September	– 11.2978 (1.7762)[2]	– 8.0616 (0.4700)[2]	0.2778 (0.2194)
2 September-23 September	– 9.0423 (2.0623)[2]	– 5.2874 (0.5760)[2]	2.5271 (0.2290)[2]
24 September-15 October	– 5.6645 (3.0075)	– 1.1672 (1.5976)	4.5534 (0.5539)[2]
16 October-31 December	– 2.5639 (1.9261)	3.3822 (0.8023)[2]	7.8702 (0.3063)[2]
Risk premiums during different time periods			
(1 July-16 August)**Risk*	0.4719 (0.0407)[2]	0.8079 (0.0577)[2]	0.9289 (0.0287)[2]
(17 August-1 September)**Risk*	0.4364 (0.0682)[2]	0.9644 (0.0351)[2]	0.8729 (0.0424)[2]
(2 September-23 September)**Risk*	0.3645 (0.0978)[2]	0.8928 (0.0665)[2]	0.8839 (0.0483)[2]
(24 September-15 October)**Risk*	0.3710 (0.0521)[2]	0.9587 (0.1358)[2]	1.1664 (0.0801)[2]
(16 October-31 December)**Risk*	0.6146 (0.0514)[2]	0.8517 (0.0643)[2]	0.9921 (0.0481)[2]
Observations	4,195	14,837	37,984

Note: Standard errors in parentheses.

[1] Significant at 5% level. [2] Significant at 1% level.

Table 5

Unpredictable borrowing levels in the federal funds market

(relative to non-crisis times, in standard deviations)

	Estimation sample		
	Least active participants	**Medium active participants**	**Most active participants**
Constant[3]	0.0000 (0.0650)	0.0000 (0.0123)	0.0000 (0.0068)
Time period dummy variables			
1 July-16 August	1.4793 (0.4486)[2]	0.0878 (0.0411)[1]	0.0440 (0.0187)[1]
17 August-1 September	1.2173 (0.3142)[2]	0.1530 (0.0758)[1]	0.1617 (0.0320)[2]
2 September-23 September	5.5249 (0.7168)[2]	0.1582 (0.0604)[2]	0.2501 (0.0334)[2]
24 September-15 October	8.4245 (1.0377)[2]	0.5096 (0.0899)[2]	0.5070 (0.0412)[2]
16 October-31 December	9.4516 (0.6640)[2]	0.9415 (0.0748)[2]	0.5390 (0.0264)[2]
Risk premiums during different time periods			
(1 July-16 August)**Risk*	– 0.0055 (0.0037)	0.0145 (0.0028)[2]	– 0.0064 (0.0021)[2]
(17 August-1 September)**Risk*	– 0.0123 (0.0035)[2]	0.0084 (0.0064)	– 0.0167 (0.0049)[2]
(2 September-23 September)**Risk*	– 0.0153 (0.0116)	0.0042 (0.0036)	– 0.0363 (0.0052)[2]
(24 September-15 October)**Risk*	0.0063 (0.0180)	0.0008 (0.0044)	– 0.0180 (0.0053)[2]
(16 October-31 December)**Risk*	– 0.0359 (0.0116)[2]	– 0.0053 (0.0027)[1]	– 0.0332 (0.0048)[2]
Observations	4,192	14,837	37,984

Note: Standard errors in parentheses.

[1] Significant at 5% level. [2] Significant at 1% level. [3] Because the dependent variable is a residual from a regression that covers the first half of the year and the regression includes a complete set of dummies for the remainder of the year, the constant term in the regression should, by construction, be equal to zero.

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