

A Black Swan in the Money Market



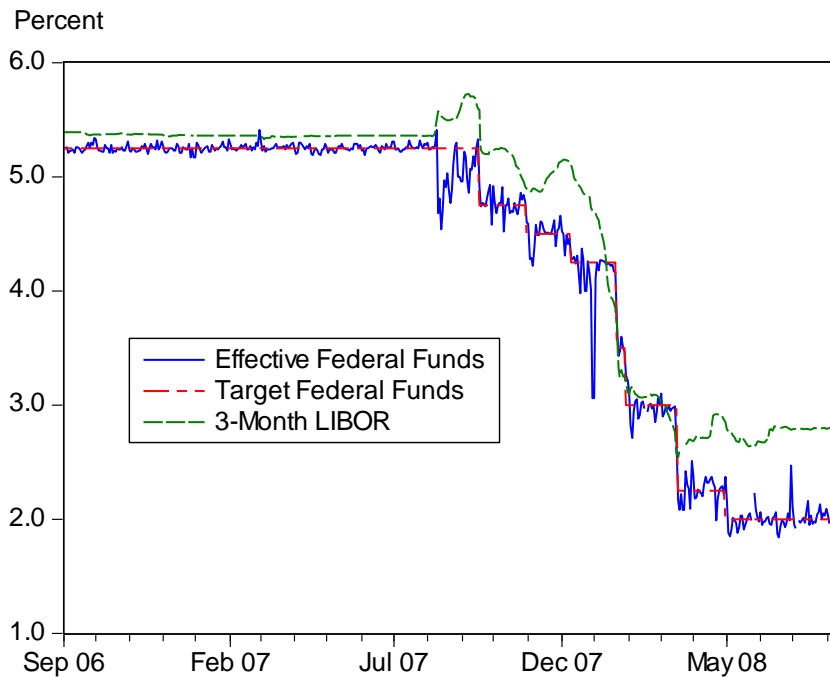
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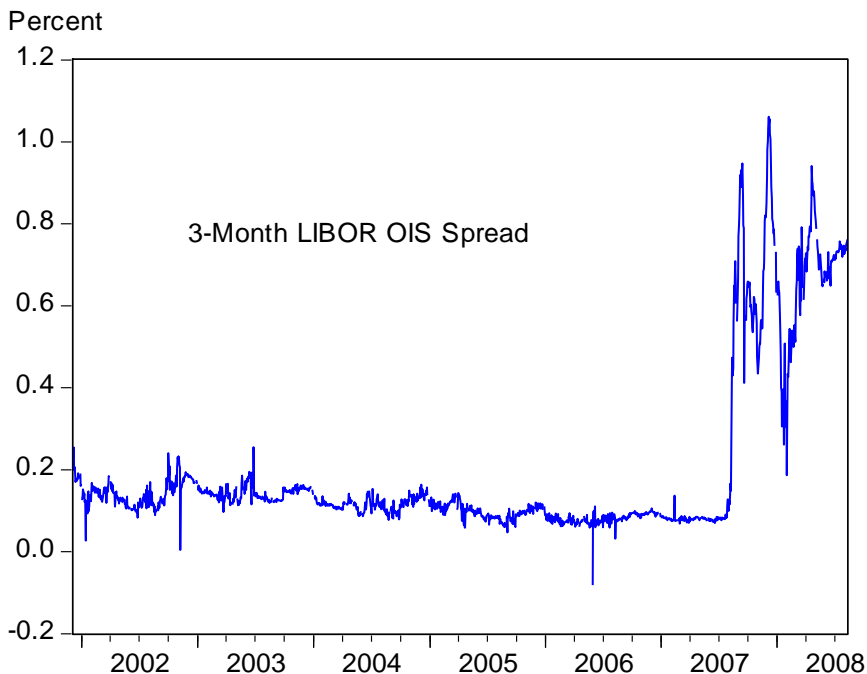
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Turmoil in Money Markets



- On August 9, 2007, money markets lurched into turmoil, with overnight rates swinging away from the Fed's target rate and longer-term money market rates rising sharply.

A Black Swan in the Money Market



- In first half of 2007, spreads on 3-month inter-bank loans (relative to OIS) averaged 8 bp. with a SD of 1 bp.
- Beginning on August 9, 2007 spreads shot up.
- In the year since then, the 3-month Libor-OIS spread has averaged 67 bp., with a SD of 17 bp.

Libor: London inter-bank offer rate.

OIS: Overnight indexed swap (proxy for average expected overnight rate)

Aim of Paper

- Analyze and measure the roles of counterparty risk and liquidity risk in term inter-bank lending rates during the past year.
 - Evaluate effects of Term Auction Facility (TAF) on term lending spreads.
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Arbitrage-Free Pricing

- Absent risk and transaction costs, arbitrage implies that rates on term inter-bank loans should equal the OIS rate.

- Example:

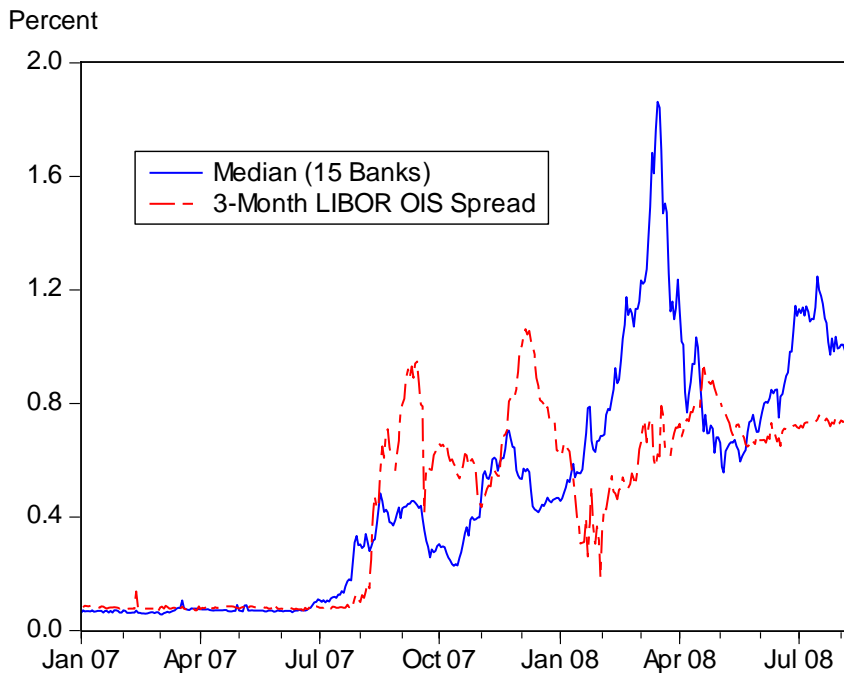
Bank A loans Bank B \$1 million for one month.

Bank A funds this loan by borrowing \$1 million each day from overnight fed funds market.

Bank A hedges interest rate risk by entering in a overnight index swap, agreeing to pay the counterparty the difference between the contracted fixed rate and the average overnight fed funds rate over the next month.

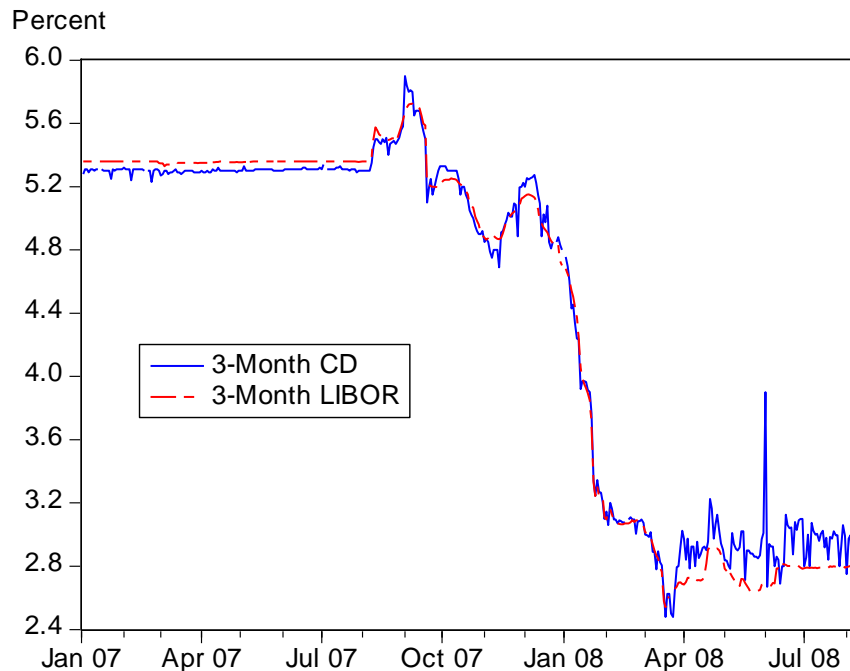
- In the past, arbitrage has kept the spread between Libor and OIS rate below 10 basis points.
 - Today, the spread is 80 basis points. What aren't banks taking advantage of this opportunity?
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Counterparty or Liquidity Risk?



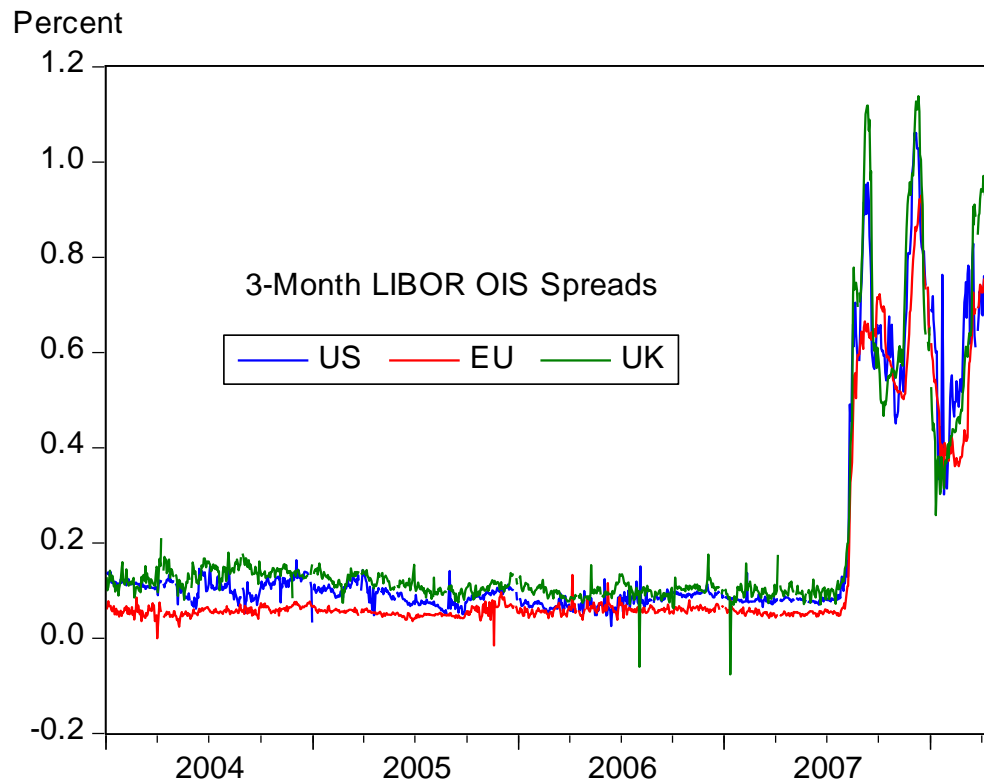
- Counterparty risk: late or non-payment of principal and/or interest.
 - Liquidity risk: funds may be needed soon and hard to obtain elsewhere.
 - Liquidity risk implies that banks are passing up otherwise profitable opportunities to "preserve balance sheet."
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CD-OIS Spreads Show Same Pattern as Libor-OIS



- CDs are a major supply of bank funding from outside banking sector and less affected by liquidity problems.
 - CDs, term federal funds, and Eurodollars show same pattern as Libor.
 - Libor has tended to be below other term rates since March 2008, causing some to question the accuracy of Libor.
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Money Market Turmoil in Europe

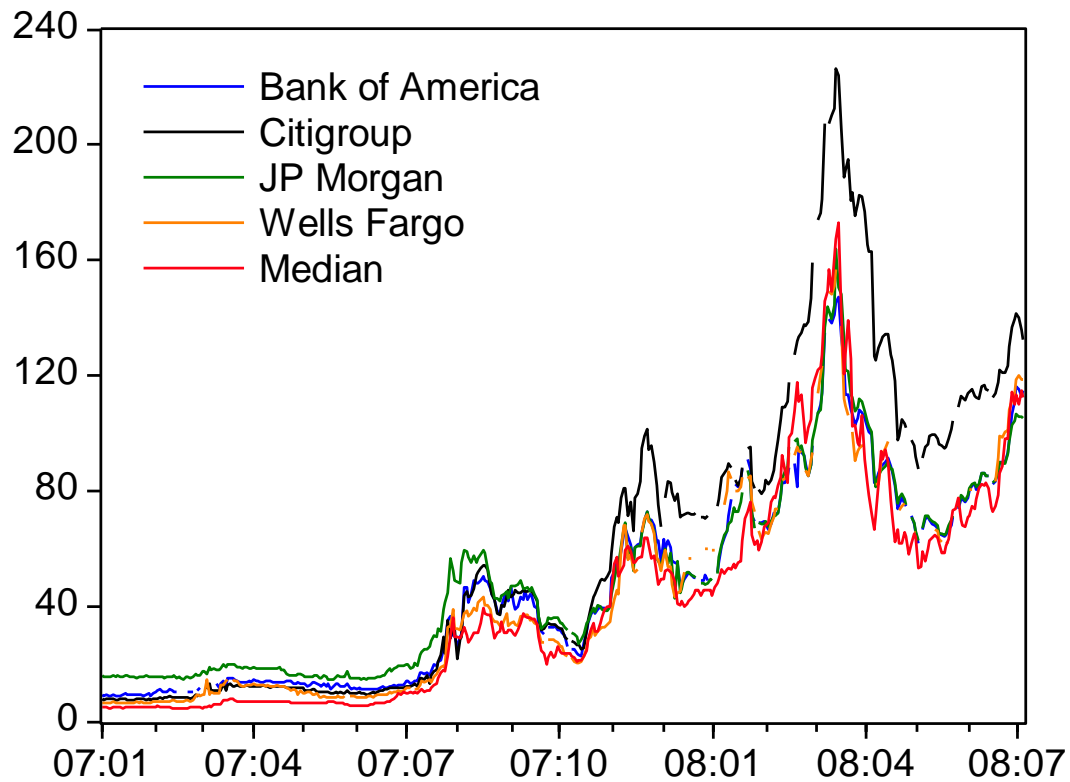


EU: Euro Libor and OIS; UK: Pound Sterling Libor and OIS.

Indicators of Counterparty Risk

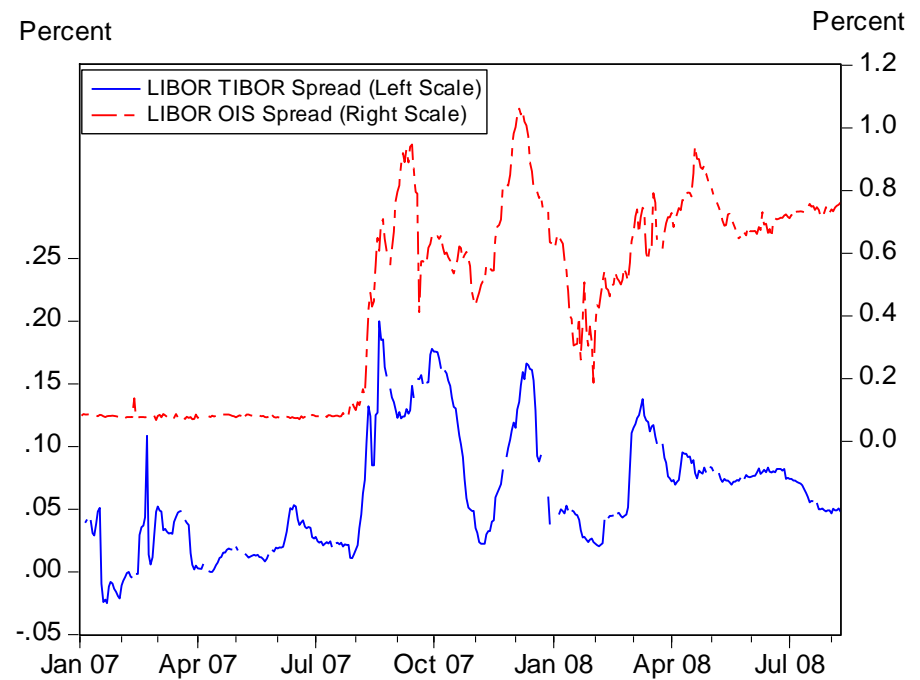
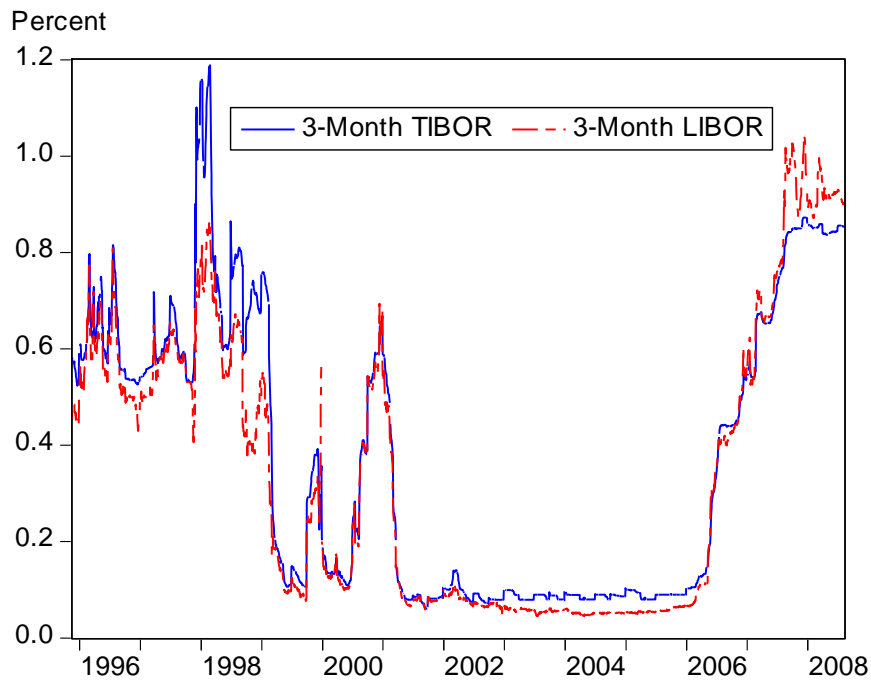
- Credit Default Swap (CDS) rates
 - Libor-Tibor spreads
 - Libor-Repo spreads
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Five-Year Credit Default Swaps Major U.S. Banks



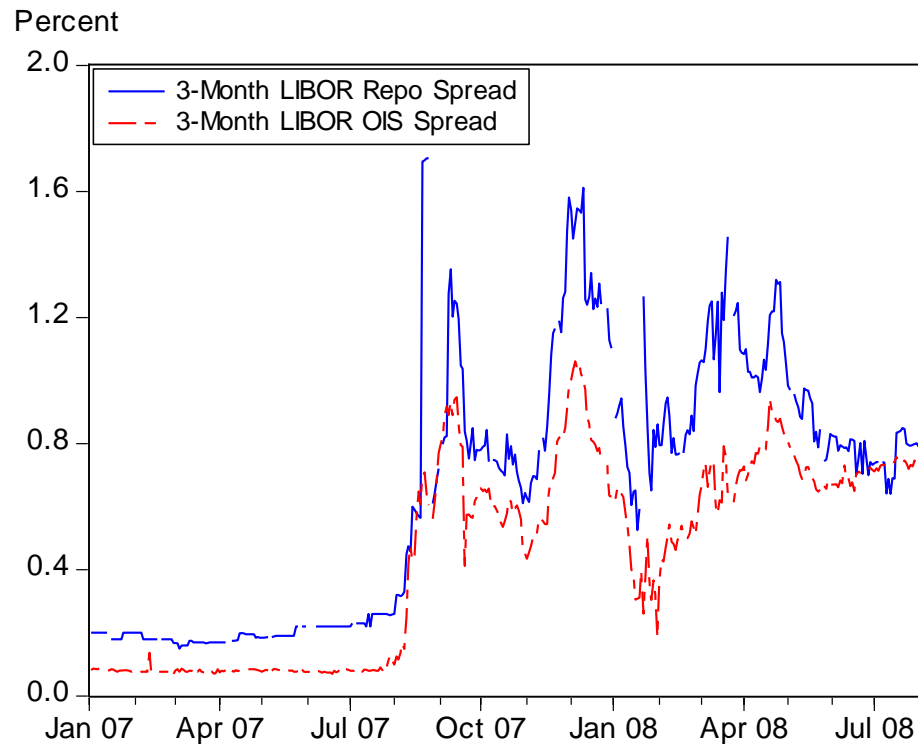
Strong co-movement in CDS rates across major commercial banks.

Yen Libor vs. Tibor

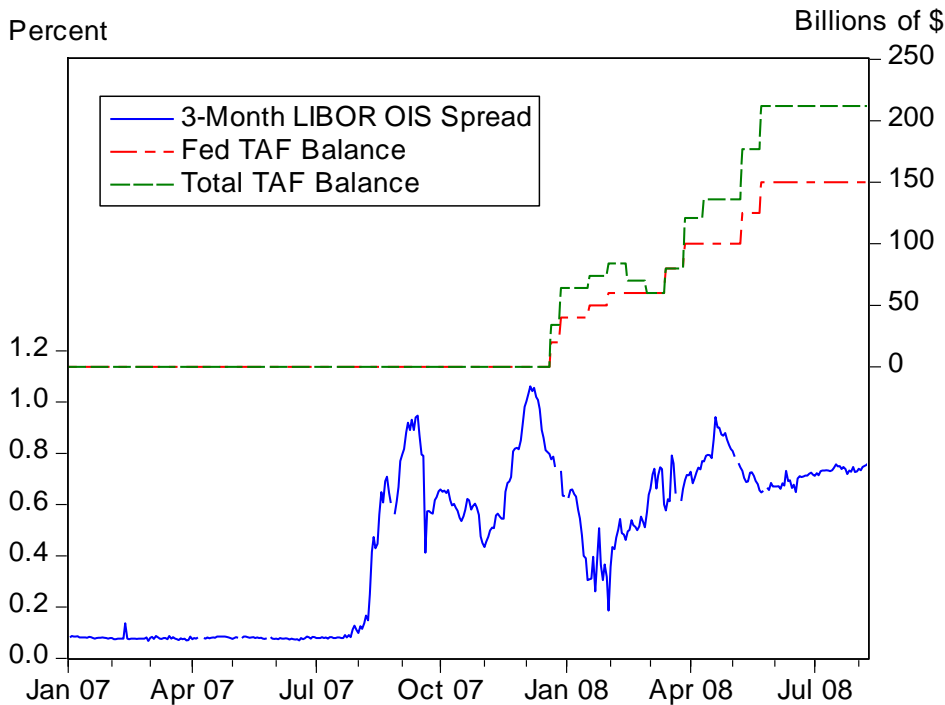


Tibor: Survey of Tokyo banks (4 of 16 in Libor survey).

Libor-Repo Spread as Credit Risk: Unsecured vs. Secured Lending

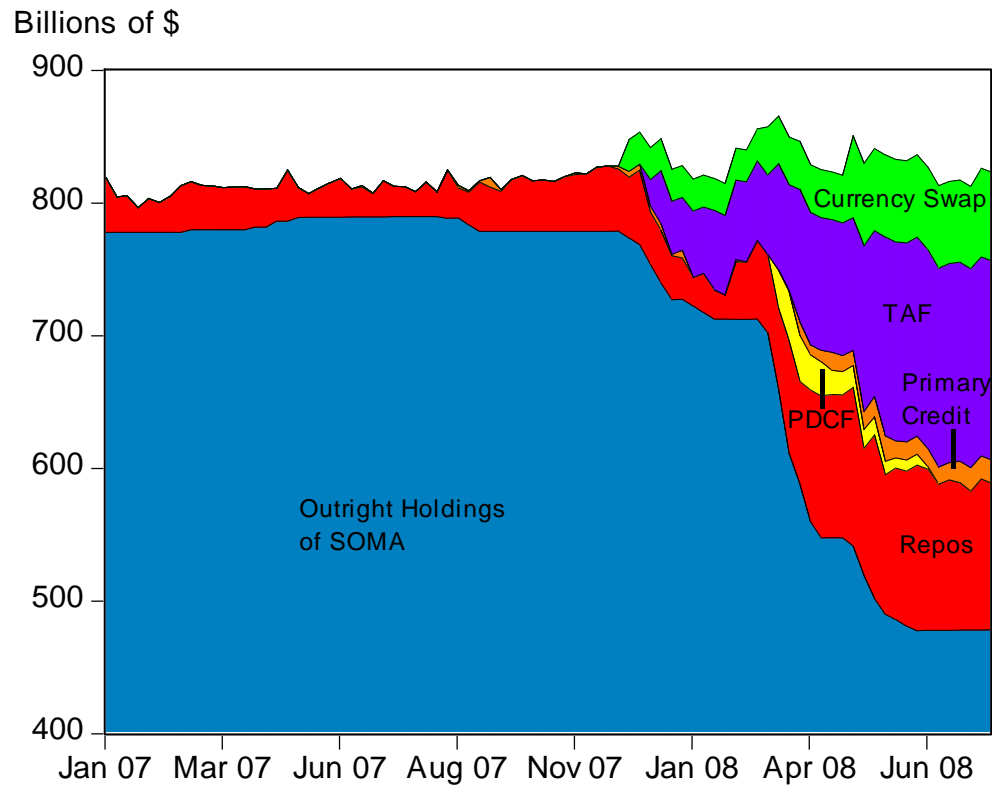


Liquidity Measures: Term Auction Facility (TAF)



- Goal: restore functioning of term inter-bank lending market, in part by reducing stigma associated with discount window borrowing.
- Begun in Dec. 2007, expanded several times.
- 28-day collateralized (discount window) loans.
- Rate set in single-price auction (every 2 weeks).
- Synchronized with dollar loans from ECB and SNB.

TAF Affects Composition, Not Size of Fed's Balance Sheet



Econometric Evidence: 3-month Libor-OIS Spreads

- We examine effects of our three market-based measures of counterparty risk and the TAF on bank term spreads.
- Theory is silent on timing of TAF effects on spreads, so we consider alternative specifications.
- First specification:

$$\begin{aligned} \text{Libor-OIS} = & c \\ & + a * \text{RISK MEASURE} \\ & + \sum_{i=1}^5 b_i * \text{TAF AUCTION DUMMY}(t-i) \end{aligned}$$

Econometric Evidence: Libor-OIS Spreads (similar results for CD & Term FF rates)

	(1)	(2)	(3)
Median CDS	0.56 (0.07)		
Libor-Tibor		4.58 (0.45)	
Libor-Repo			0.70 (0.04)
TAF Auction (sum of coefs)	-0.09 (0.27)	0.93 (0.18)	0.07 (0.15)
Adj. R ²	0.52	0.59	0.85

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

AR(1) Specification: Libor-OIS Spread (similar results for CD & term FF rates)

	(1)	(2)	(3)
Median CDS	0.15 (0.08)		
Libor-Tibor		0.53 (0.26)	
Libor-Repo			0.08 (0.04)
TAF Auction (sum of coefs)	-0.06 (0.05)	-0.08 (0.06)	-0.13 (0.05)
Adj. R ²	0.98	0.99	0.98

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

Econometric Evidence

- Based on three measures of term lending spreads:
- Estimated effects of all three measures of counterparty risk have the right sign and are in most cases statistically significant.
- Estimated effect of TAF ranges between -29 basis points and +145 basis points; negative estimated TAF effect is statistically insignificant in only 1 case (-13 basis points).

Robustness Analysis: Alternative Specifications

- Post Dec-11 TAF dummy variable (Wu)
 - Include lagged lending spread and alternative TAF dates (McAndrews, Sarkar, and Wang)
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Alternative Specification (Wu 2008)

Post Dec-11 TAF Dummy Variable

□ Test whether Libor-OIS spreads are lower since announcement of TAF than before, after controlling for CDS spread.

□ Assumes TAF permanently affects spread.

□ Specification:

$$\text{Libor-OIS} = c + a * \text{CDS} + b * \text{TAF_DUMMY}$$

$$\text{TAF_DUMMY} = 1 \text{ after Dec. 11}$$

OLS Regression with TAF Dummy: Libor-OIS Spreads (similar results for other spreads)

	(1)	(2)	(3)
Median CDS	0.58 (0.15)		
Libor-Tibor		4.26 (0.41)	
Libor-Repo			0.66 (0.04)
TAF Dummy	-0.03 (0.11)	0.29 (0.04)	0.06 (0.04)
Adj. R ²	0.52	0.74	0.85

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

AR(1) Regression with TAF Dummy: 3-month Libor-OIS Spreads

	(1)	(2)	(3)
Median CDS	0.15 (0.08)		
Libor-Tibor		0.55 (0.26)	
Libor-Repo			0.08 (0.04)
TAF Dummy	-0.08 (0.01)	-0.08 (0.00)	-0.05 (0.02)
Adj. R ²	0.98	0.99	0.98

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

AR(1) Regression with TAF Dummy: 3-month CD-OIS Spreads

	(1)	(2)	(3)
Median CDS	0.54 (0.15)		
Libor-Tibor		1.21 (0.44)	
Libor-Repo			0.16 (0.12)
TAF Dummy	0.04 (0.07)	0.14 (0.15)	0.14 (0.14)
Adj. R ²	0.92	0.91	0.91

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

Econometric Evidence: Post Dec-11 TAF Dummy Variable

- ❑ Based on three measures of term lending spreads:
 - ❑ Estimated effects of all three measures of counterparty risk have the right sign and are in most cases statistically significant.
 - ❑ Estimated effect of TAF ranges from -8 basis points to +44 basis points; negative estimated TAF effect is statistically significant in only 3 cases.
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Alternative Specification based on McAndrews-Sarkar-Wang (2008)

- Test whether Libor-OIS spreads change following TAF “events” (announcements, auctions), after controlling for contemporaneous change in CDS spread.
 - Assumes TAF events have lasting effects on spreads (through lags of spread in equation).
 - Specification:
$$\text{Libor-OIS} = c + a * \text{Lag}(\text{Libor-OIS}) + b * \Delta \text{CDS} + d * \text{TAF_EVENT_DUMMY}$$
-

Results with Announcement Effects and Lagged Spreads

	Libor-OIS	Term Fed Funds-OIS	CD-OIS
Change in Median CDS	0.18 (0.07)	0.12 (0.08)	0.43 (0.17)
TAF announcements	-0.05 (0.02)	-0.02 (0.02)	0.02 (0.04)
TAF Operations	-0.02 (0.01)	-0.02 (0.01)	-0.03 (0.03)
Adj. R ²	0.98	0.98	0.92

Sample: 1/1/2007 – 8/8/2008. Newey-West HAC standard errors in parentheses.

Results with Announcement Effects and Lagged Spreads

- TAF announcements and operations have statistically significant effects on Libor-OIS spreads in MSW specification.

 - But, these findings are sensitive to choices of lending spread and TAF operations dummy:
 - Estimated effects of TAF announcements is insignificant using Term Fed Funds and CD spreads.
 - Estimated effect of TAF operations is insignificant if TAF settlement dates are included in TAF operations dummy.
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Reconciling Results

- The evidence of significant effects of TAF announcements and operations on term lending spreads based on specification with lagged spread appears to contradict evidence from specification with post-Dec. 11 TAF dummy, which indicates that spreads are NOT much lower after the introduction of the TAF.
 - Evidently, on days without TAF announcements or operations, spreads tend to rise, offsetting beneficial effects of TAF announcements and operations.
 - These results are consistent with our first model, which implies that TAF effects on spreads are short-lived.
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Conclusion

- Risk measures are economically and statistically significant predictors of term lending spreads. This is a robust finding.
 - We do not find similarly robust evidence of an economically and statistically significant effect of the TAF on spreads.
 - Counterparty risk appears to be the predominant source of the extraordinary sustained rise in term lending spreads over the past year.
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