

Overcoming Borrowing Stigma: The Design of Lending-of-Last-Resort Policies

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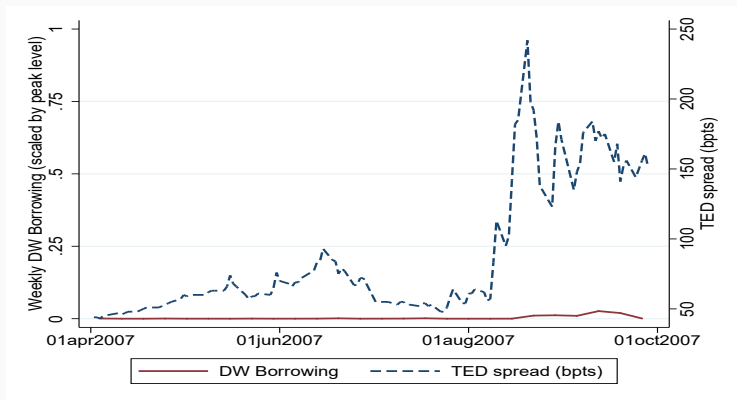
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How to provide liquidity to banks during episodes of financial turmoil to minimize their losses?

- In theory: lender of the last resort (Bagehot, 1873; Diamond and Dybvig, 1983).
- In (normal) practice: discount window since Fed's founding in 1913.
- In (special) practice: DW was less effective during the financial crisis.

Discount Window in Summer 2007

Summer 2007: liquidity shortage in the interbank market, but banks were reluctant to borrow from DW



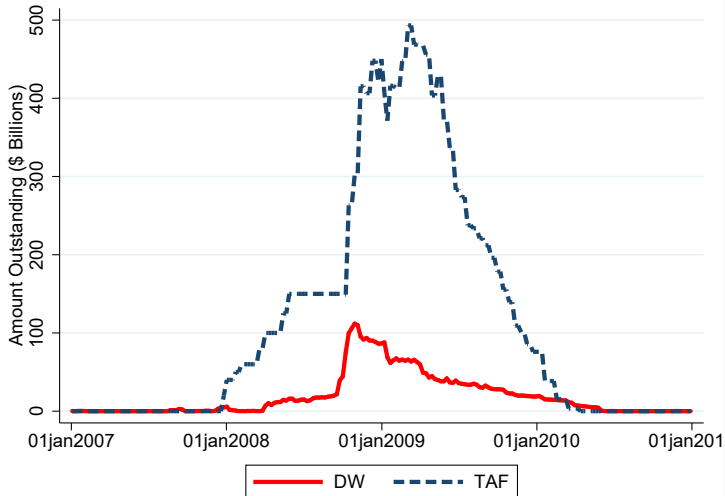
Largely ineffective initial policy responses: Reducing discount rate;
Extending loan maturity; Expanding acceptable collaterals;
Encouraging/forcing big banks to borrow.

Term Auction Facility, December 2007–February 2010

- In response to the lack of discount window borrowing, Fed created the **Term Auction Facility** (TAF) in December 2007.
- TAF ran an auction every two weeks between December 2007 and March 2010 to lend collateralized loans to banks.
 - Monday: Banks phoned their local Fed regional banks to submit their interest rate and loan amount and post collaterals.
 - Tuesday: Fed secretly informed the winners and publicly announced the stop-out rate, determined by the highest losing bid (or the reserve price if the auction was under-subscribed).
 - Thursday: Fed released the funds to the banks.
- Every Monday, each regional Fed published total lending from last week; banks may be inferred from these summaries or other channels.

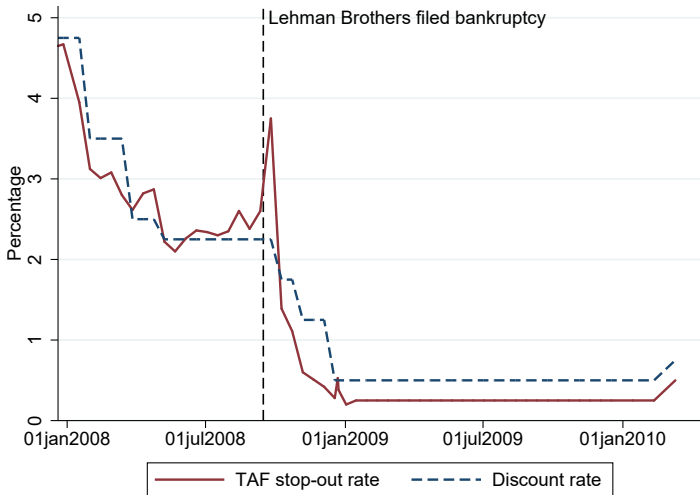
Q1. Why was TAF able to provide more liquidity?

Term Auction Facility introduced in December 2007: identical requirements on participants' eligibility, collaterals, and maturity.



Q2: Why were banks willing to pay more in TAF?

Banks were willing to bid more than the concurrent discount rate; in 21 of 60 auctions, the stop-out rate exceeded the concurrent discount rate.



Theoretically, we provide a model to explain the motivating questions

- Banks with heterogeneous liquidity needs.
- DW is immediately available, but TAF delays fund release.
- Endogenous stigma associated with each facility: Weaker banks use DW and stronger banks use TAF.

Empirically, DW banks, compared to TAF banks,

- were riskier (higher leverage, lower capital ratio, ...)
- had higher CDS spreads
- were more likely to fail subsequently

Theoretical Analysis

Model

- n banks with heterogeneous types $\theta \in [0, 1]$ distributed by F .
- Each bank realizes a return R , but encounters a liquidity shock.
- Bank θ collapses with probability $1 - \theta$ after a liquidity shock.
- Each bank can borrow from DW or TAF before the liquidity shock.

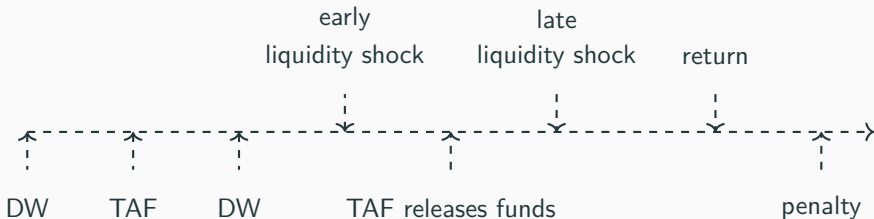


Figure 1: Timeline of the model

Discount Window and Term Auction Facility

- A bank can borrow from the discount window at (gross) discount rate r_D , and gets

$$(1 - \theta)R - r_D - k_D,$$

where k_D is the (endogenous) stigma cost associated with DW.

- A winning bank in auction can borrow at (gross) stop-out rate s , and gets

$$\delta(1 - \theta)R - s - k_A,$$

where $1 - \delta$ is the probability that a bank encounters a liquidity shock before the funds were released, and k_A is the (endogenous) stigma cost associated with TAF.

- Stigma cost of borrowing from a facility is negatively related to the average bank quality in the facility:

$$k_\omega = K - \kappa \int \theta dG_\omega(\theta), \quad \omega \in \{D, A\}.$$

Discount Window

A bank borrows from the discount window if and only if

$$(1 - \theta)R - r_D - k_D \geq 0 \Leftrightarrow \theta \leq \theta_D \equiv 1 - (r_D + k_D)/R.$$

Bank $\theta \leq \theta_D$ bids β such that

$$\delta(1 - \theta)R - \beta - k_A = (1 - \theta)R - r_D - k_D$$

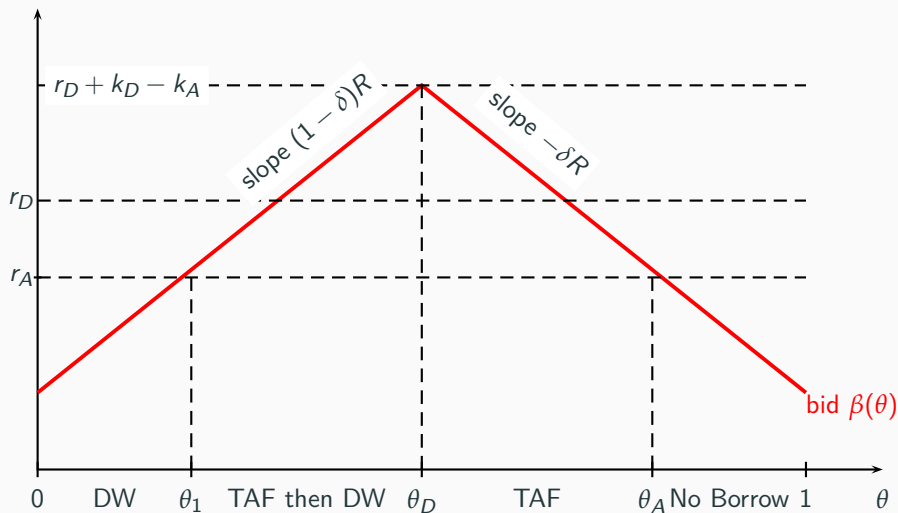
$$\Leftrightarrow \beta(\theta) = (1 - \delta)(\theta - 1)R + r_D + k_D - k_A.$$

Bank $\theta > \theta_D$ bids β such that

$$\delta(1 - \theta)R - \beta - k_A = 0$$

$$\Leftrightarrow \beta(\theta) = \delta(1 - \theta)R - k_A.$$

Bidding and Facility Choice



Empirical Analysis

Data

- Lawsuit by Bloomberg against Fed Board under FOIA
- Daily borrowing amount from DW and TAF
- Aug 1, 2007 to Apr 30, 2010 (TAF: Dec 2017 to Feb 2010)

	N	Mean	Max	Min	10 th	50 th	90 th
Borrowers	407						
Foreign Banks	92						
Both DW and TAF	260						
# of DW Events		12	242	0	0	2	35
# of TAF Events		5	28	0	0	3	13
DW Amt (MM)		1,529	190,155	0	0	20	1,809
TAF Amt (MM)		3,174	100,167	0	0	58	7,250

- Key observation: highly skewed borrowing behavior

1. Proxies for Unobserved Financial Conditions

135 BHCs having borrowed from either DW or TAF account for 42.2% of DW and 81.8% of TAF borrowing

$$\frac{DW_{it}}{DW_{it} + TAF_{it}} = \alpha + \beta \cdot \text{Fin Cond}_{it} + \Gamma \cdot [\text{Size}_{it}, \text{ROA}_{it}] + Q_t + \varepsilon_{it}$$

	T1RWA	Lev	%Liquid Asset	Priv. MBS/Asset	Unused Com/Asset	S.T. whole/Asset
Fin Cond	-2.008* (1.155)	2.094* (1.129)	0.244 (0.287)	1.714** (0.676)	0.111 (0.434)	0.011 (0.366)
Observations	578	578	578	381	556	578
Adjusted R^2	0.121	0.123	0.113	0.162	0.120	0.112

1. Capital ratio: Tier-1 Capital/Risk-Weighted Assets
2. Capital ratio: Book Leverage
3. Asset liquidity: Liquid Assets/Total Assets
4. Asset liquidity: Private MBS/Total Assets
5. Funding stability: Unused commitments/total assets
6. Funding stability: Short-Term Wholesale Funding/Assets

2. CDS Spreads

- Match Bloomberg data with CDS spreads in Markit
- 70 banks account for 24.8% of DW and 79.4% of TAF borrowing.

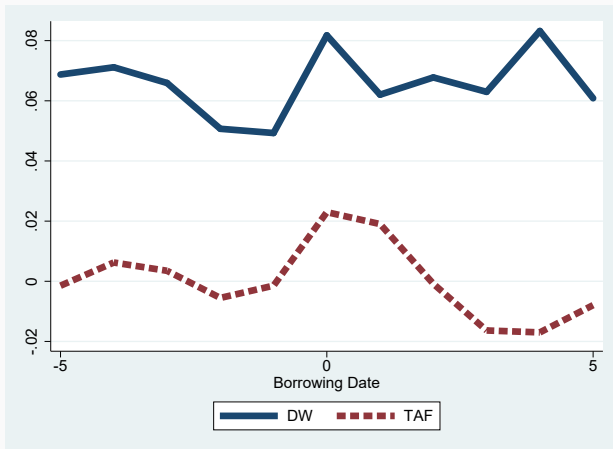


Figure 2: CDS Spreads around Borrowing Events

3. Bank Failure

We manually matched banks to subsequent failures events by name

- Actual bank failure: Lehman
- Nationalization: AIG
- Acquisition: Merrill Lynch

	Fail this quarter	Fail during Crisis
$\frac{DW}{DW+TAF}$	0.007* (0.004)	0.125** (0.050)
Constant	0.003 (0.002)	0.050*** (0.019)
Observations	1586	364
Adjusted R^2	0.001	0.020

4. Diff in Diff

Background: in early October 2008, leaders from the G7 countries met and established a plan of action that aimed to stabilize financial markets, restore the flow of credit, and support global economic growth.

- Credit guarantee programs were established subsequently.
- Allow domestic institutions to issue debt that would be backed by a guarantee from the government in exchange for a guarantee fee.

DID: Canada v.s. U.S.

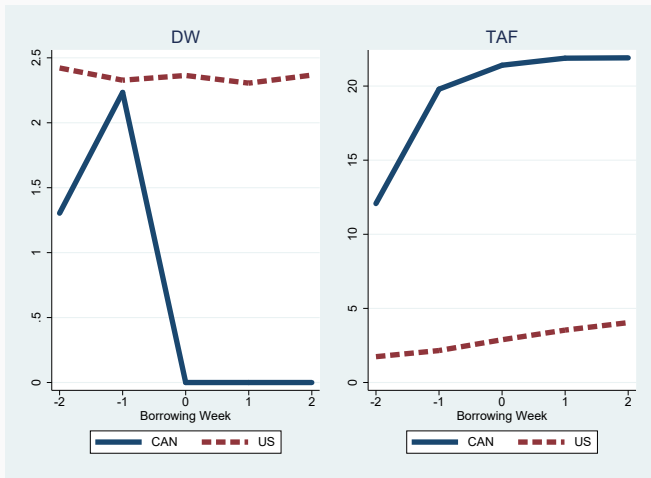


Figure 3: Logarithm of Borrowing Amount within two weeks

DID: Germany v.s. U.S.

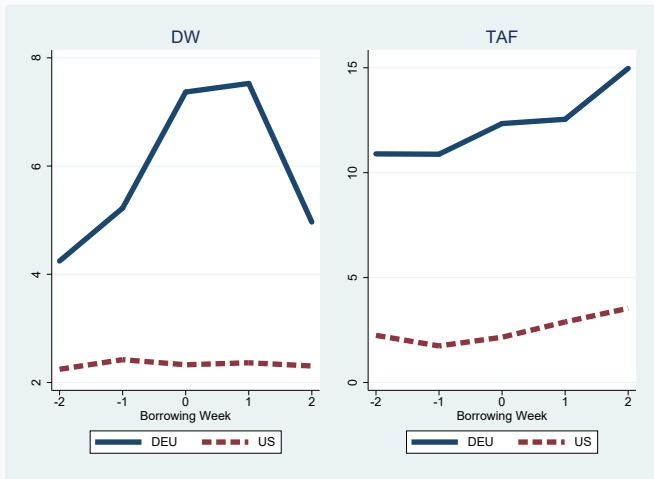


Figure 4: Logarithm of Borrowing Amount within two weeks

DID: France v.s. U.S.

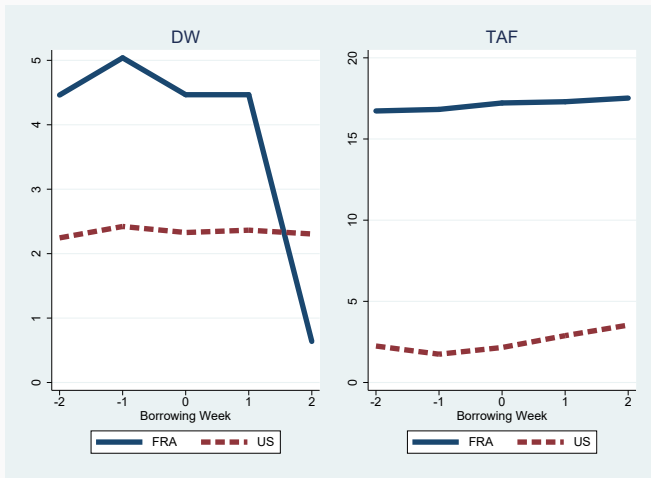


Figure 5: Logarithm of Borrowing Amount within two weeks

Conclusion

“Stigmatized” Lender of the Last Resort

- Theory: endogenous participation and stigma
- Evidence: DW banks were weaker than TAF banks
 - Financial conditions measured by observables and unobservables

THANK YOU!