Deposit Market Competition During the Great Financial Crisis

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Motivation

- Despite its critical relevance, few empirical papers examine deposit market competition during financial crises.

- Excessive competition during a crisis
  - Detrimental effects on financial stability
  - Impediment to the effectiveness of monetary and prudential policies

- Mixed perspectives in the literature regarding competition for deposits during crises
  1. Lower competition:
     - thanks to the flow of funds into the banking sector during crises due to the safety and liquidity offered by (insured) deposits (Gatev & Strahan 2006, Gatev et al. 2009)
  2. Higher competition:
     - Liquidity shortage during severe banking crises may require aggressive competition for deposits as banks seek to secure liquidity (Acharya and Mora 2015)
     - Potential spillover effects from distressed banks (Egan et al. 2017, Martin et al. 2018), as well as competition stemming from strong banks

This Paper

- Investigate competition in the U.S. deposit market during the Great Financial Crisis (GFC) of 2007-2009
  - Focus on the behavior of branches in local markets (counties)
  - Introduce a novel measure of competition: the responsiveness of deposit rates to competitors' rates.
  - Compare between normal times and the crisis period.

- Main Research Questions:
  1. Was there increased competition during the GFC?
  2. Did the behavior vary based on bank characteristics (capital, size) and local market structure? (omit in this presentation)
  3. Were banks that actively bid for deposits successful in attracting more during the crisis?

Related Literature

- Behavior of depositors and banks during crises: Kashyap et al. (2002), Gatev and Strahan (2006), Achrya and Mora (2015), Martin et al. (2018), Egal et al. (2017)
- Deposit pricing behavior of banks: Craig and Dinger (2014), Diebold and Sharpe (1990), Drechsler et al. (2017, 2021), Driscoll and Judson(2013), Hannan and Berger (1991), Neumark and Sharpe (1992), Yankov (2023)
- Measures of banking competition: HHI (Akins et al. 2016, Boyd et al. 2010), Lerner index (Anginer et al. 2014, Berger et al. 2009, Calderon and Schaeck 2016), H-Statistic (Claessens and Laeven 2004, Schaeck et al. 2009), Regulatory induced measures (Jiang et al. 2016)

Anecdotal Supporting Evidence from Business Media


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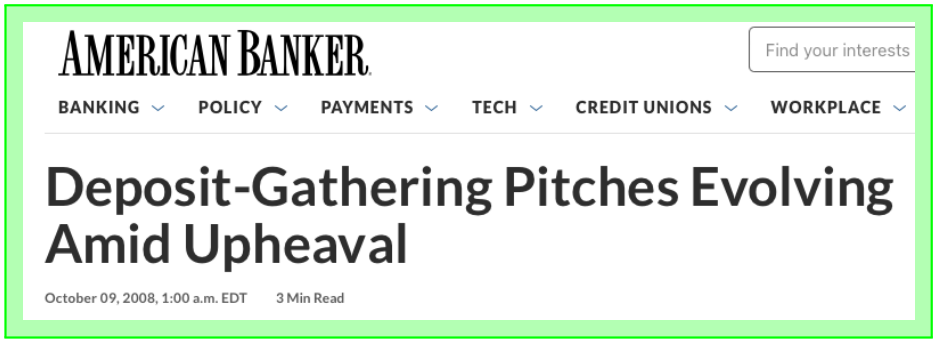
Why Rate Cuts Aren't Helping on Deposit Side

December 05, 2007, 2:00 a.m. EST 6 Min Read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October 09, 2008, 1:00 a.m. EDT 3 Min Read

"...the Federal Reserve has cut the federal rate twice in recent months, but deposit pricing has not followed suit."

"The competitive environment has been fairly severe, ... seven of the 10 largest U.S. banking companies ... increased rates in the 3rd quarter [2007]..."

(American banker, Dec. 5, 2007)

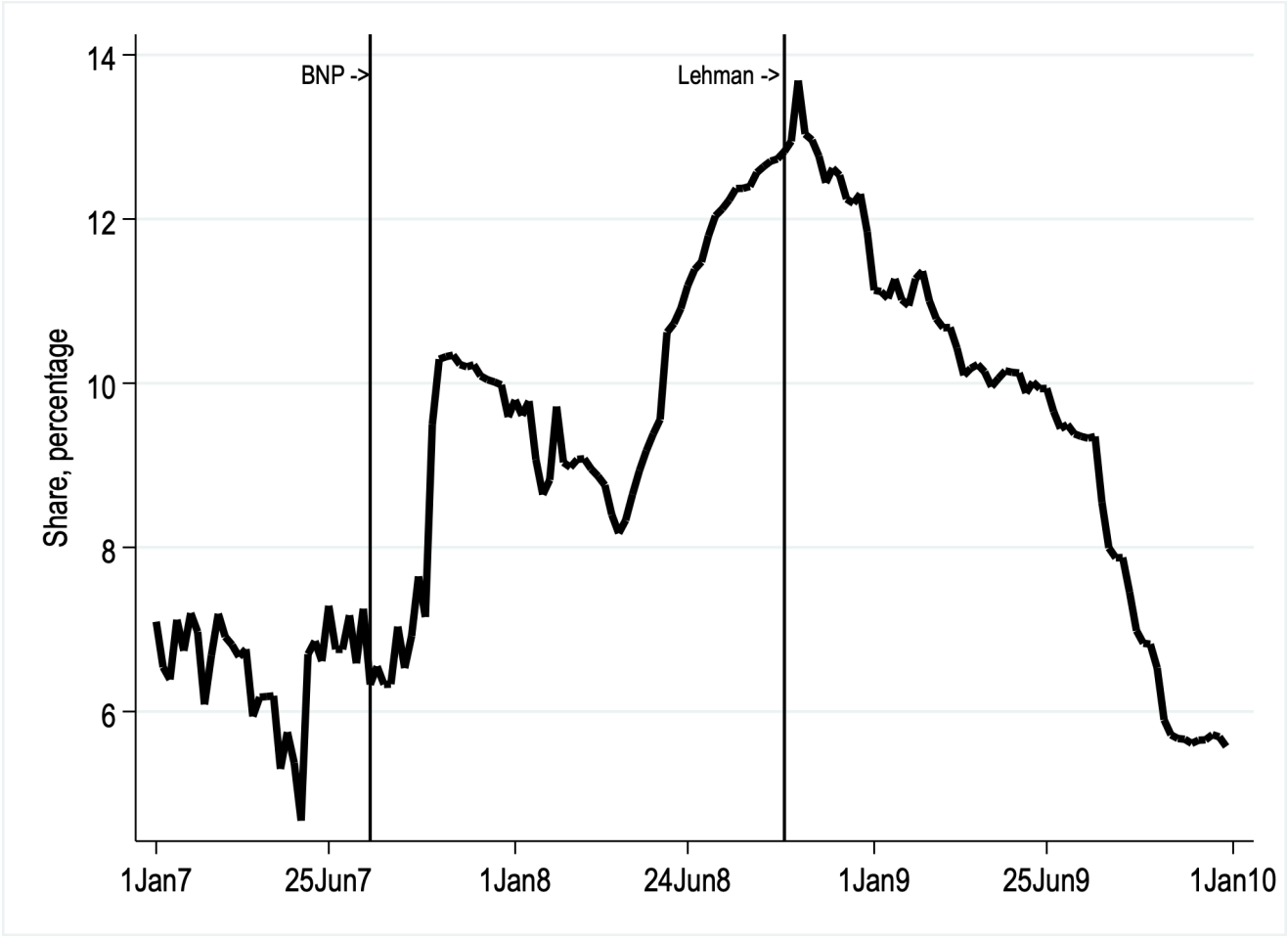
"[The banks] with solid financials are stepping up their efforts to exploit the opportunity created as weaker rivals exit the market. ... many bankers are tailoring promotions ..."

"Depsoits are still king... these days...[we doesn't] expect any material changes in deposit promotions."

(American banker, Oct. 9, 2008)

Aggregate Level Evidence 1

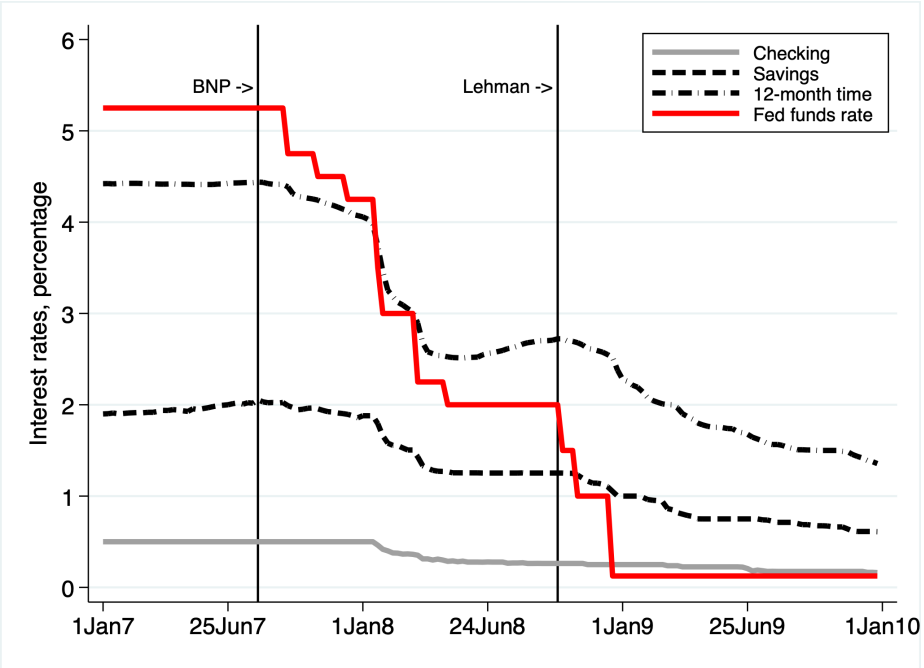
Share of promotional products in time deposits (weekly)



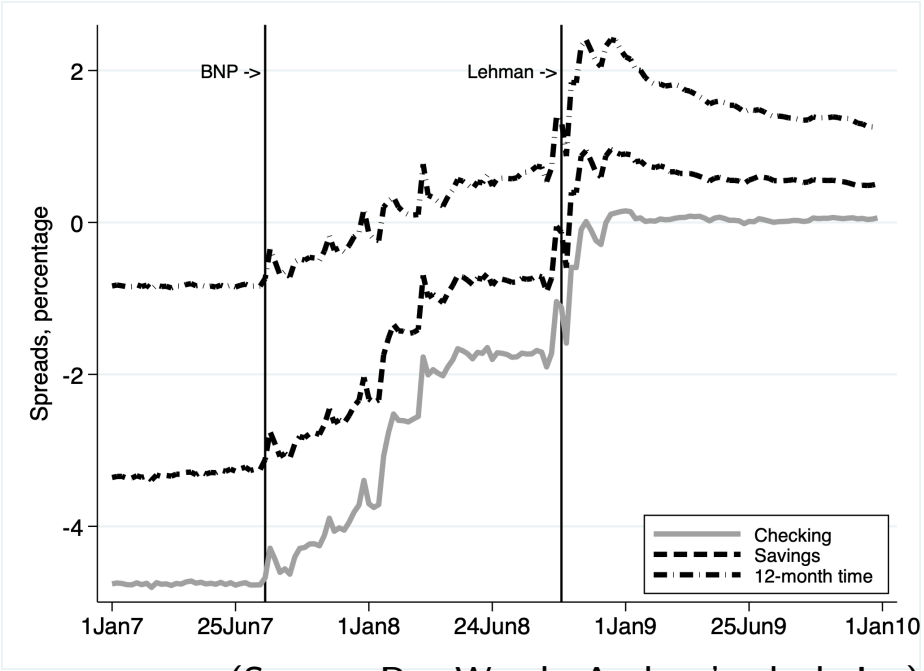
(Source: Rate Watch, Authors' calculation)

Aggregate Level Evidence 2

Deposit Rates (Weekly)



Deposit Spreads (Weekly)



(Source: RateWatch, Authors' calculation)

- Deposit rates decreased at a slower pace compared to the FFR. Even time deposit rate increased temporarily.
- Deposit spreads (= deposit rate - FFR), a measure of deposit funding cost, increased throughout most of the crisis period.

Data

- Period: 2004-2012 - covering 3 additional years before and after the crisis.
- Survey on deposit rates - RateWatch
  - Branch-level deposit rates in the US (weekly) -> compute quarterly averages.
  - The most common retail deposit products: interest-bearing checking deposits, saving deposits (MMDA), and small time deposits ($10K CD for 7 maturities, 3M to 60M)
  - Focus on the rate setter branches
- Summary of deposits (SoD) - FDIC
  - Information on branches (annual): location, deposits, parent bank, and BHC.
- Call reports data - FED Chicago, WRDS
  - Bank characteristics (quarterly): TA, Capital, Deposits composition
- FRED Economic Data - FED Saint Louis
  - Federal Funds Rates (target, effective)

Measure of Competition

- Branch's strategic variable: deposit spread (r_{it})

$$r_{it} = \text{deposit rate}\,(R_{it}) - \text{Fed Funds effective rate}\,(FFER_{it})$$

  - the cost of deposit funding relative to funding through (interbank) market.

- Degree of competition: "deposit spread pass-through"
  - A branch's responsiveness to competitors' changes in deposit spread in the local market.

- Deposit rate of branch i's competitors (R_{-it}) : distance-deposit weighted average of the deposit rates set by competitor branches in the local market (county).

$$R_{-it} = \sum_{c=1}^{C} \frac{\left(D_{ct}^{i}/d_{c}^{i}\right)}{\sum_{c=1}^{C}\left(D_{ct}^{i}/d_{c}^{i}\right)} R_{ct}$$

  - D_{ct}^{i}: Deposits held in branch i's competitor c;
  - d_{c}^{i}: Physical distance to competitor c;
  - R_{ct}: Deposit rate of branch c at time t.

Identification

- Isolate the impact of changes in competitors' spreads on deposit spreads while controlling for other factors

1. Omitted variables, such as lending opportunities, liquidity needs specific to banks and time.
   - Exploit within-bank variation of branches' pricing behavior in diverse local markets by controlling for Bank × Time fixed effects. (Drechsler et al. 2017, 2021, Jiménez et al. 2012, 2014, Peydrò et al. 2021).
2. Monetary policy: change in Fed funds target rate
   - Stickiness of deposit rate, with (relative) upward stickiness and downward flexibility (Driscoll & Judson 2013; Drechsler et al. 2017).
   - An inverse relationship between FFR and deposit spread.
   - Less change in deposit spread (in absolute terms) when FFR falls compared to when it increases.
3. Other controls:
   - State × Time fixed effect (Local economic shocks, state-level regulatory changes)
   - Branch, County, Quarter (seasonality)

Baseline Empirical Model

$$\Delta r_{it} = \beta \Delta r_{-it} + \beta^* \Delta r_{-it} \times Crisis_t + \rho \Delta FF_t + \rho^* \Delta FF_t \times Crisis_t + \alpha_{b(it)} + \sigma_{s(it)} + \text{other controls} + \varepsilon_{it}$$

- Δr_{it} (Δr_{-it}): Deposit spread change of branch i (i's competitors) at time t.
- ΔFF_t: Change in Fed funds target rate at time t.
- $Crisis_t$: *Crisis1* (2007q3 - 08q2) & *Crisis2* (2008q3 - 09q2) (Acharya & Mora, 2015)
- Standard errors are clustered at the county level.

- β: Deposit spread pass-through in normal times.
- $\beta + \beta^*$: Deposit spread pass-through during the crisis.
- Higher competition during the GFC: we expect $\beta^* > 0$ (with $\beta + \beta^* > 0$).

Summary Statistics

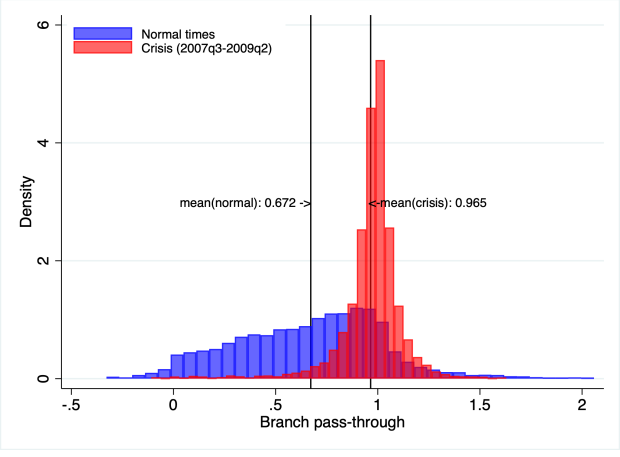
	Sample by sub-period				Full sample
	Before (04q1-07q2)	Crisis 1 (07q3-08q2)	Crisis 2 (08q3-09q2)	After (09q3-12q4)	
△ deposit spread of selected rates (quarterly change in %)					
Checking	-0.31	0.76	0.42	-0.01	0.01
	(0.23)	(0.47)	(0.57)	(0.06)	(0.45)
Savings	-0.24	0.61	0.34	-0.04	0.00
	(0.29)	(0.52)	(0.62)	(0.09)	(0.43)
12-month time	-0.11	0.36	0.26	-0.09	-0.01
	(0.26)	(0.42)	(0.76)	(0.12)	(0.38)
△ FFTR	0.33	-0.79	-0.49	0.00	-0.02
	(0.22)	(0.48)	(0.45)	(0.00)	(0.45)
Branch deposits (mill. $)	137.07	158.85	184.36	242.35	186.31
	(888.7)	(1,143)	(1,624)	(2,514)	(1,800)
Branch deposit growth (annual change in %)	6.17	4.86	7.16	3.12	4.96
	(23.63)	(27.64)	(29.15)	(27.38)	(26.36)
County-HHI	0.24	0.23	0.23	0.22	0.23
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Obs. (branch × quarter)	98,751	27,929	27,993	101,440	256,113

Notes. Mean and standard deviation in parentheses.

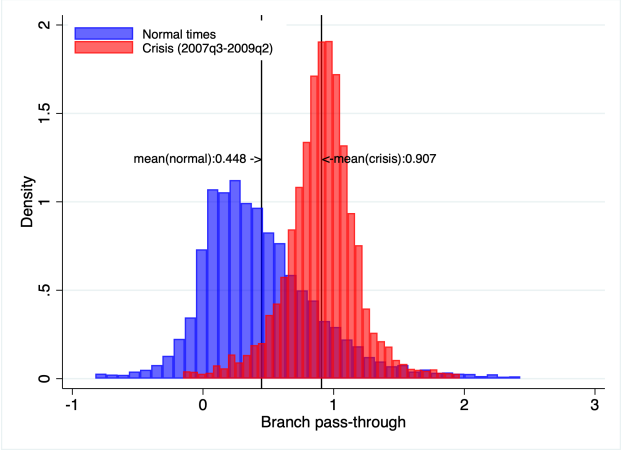
Deposit Spread Pass-Through at the Branch Level

Estimated by regression for each branch using the equation:

$$\Delta r_{it} = \beta_i \Delta r_{-it} + \beta_i^* \Delta r_{-it} \times Crisis_t + \rho_i \Delta FF_t + \rho_i^* \Delta FF_t \times Crisis_t + \varepsilon_{it}$$



Checking



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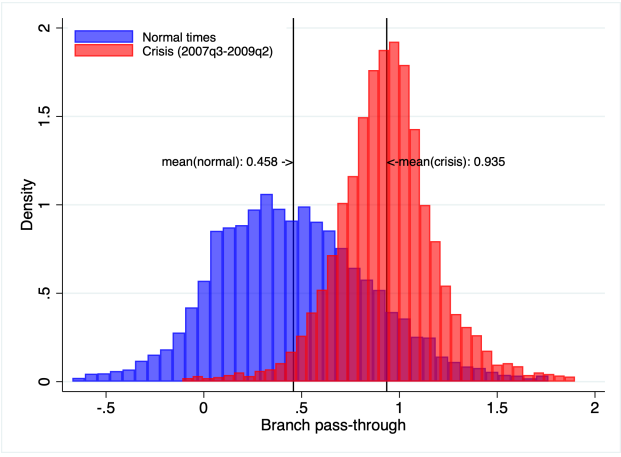

12-month time

Reaction during the GFC compared to normal times:

- Branches were more sensitive (by 30-48 bps).
- Overbidding (pass-through higher than 1): 12.7% -> 50% on average
- Reaction was less dispersed: more responses irrespective of branch characteristics

$\Longrightarrow$ More intensive competition during the GFC

Within-Bank Estimation with Baseline Model

	Δ Spread					
	Checking	Savings	3M time	12M time	36M time	60M time
Δ Spread_competitors	0.187***	0.079***	0.131***	0.182***	0.225***	0.226***
	(0.016)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Δ Spread_comp × Crisis1	0.702***	0.589***	0.609***	0.614***	0.522***	0.453***
	(0.015)	(0.017)	(0.013)	(0.013)	(0.017)	(0.018)
Δ Spread_comp × Crisis2	0.729***	0.716***	0.649***	0.578***	0.515***	0.458***
	(0.017)	(0.015)	(0.010)	(0.010)	(0.012)	(0.013)
Δ FFTR	-0.700***	-0.691***	-0.510***	-0.393***	-0.487***	-0.538***
	(0.014)	(0.009)	(0.008)	(0.007)	(0.007)	(0.008)
Δ FFTR × Crisis1	0.632***	0.531***	0.461***	0.415***	0.494***	0.548***
	(0.014)	(0.014)	(0.010)	(0.009)	(0.011)	(0.014)
Δ FFTR × Crisis2	0.660***	0.591***	0.418***	0.270***	0.381***	0.436***
	(0.014)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
Observations	206,311	202,976	193,667	213,620	190,109	160,606
R^2 within	0.798	0.455	0.420	0.426	0.383	0.324

Notes. Bank-time, state-time, county, branch, year, and quarter fixed effects are included.

- Pass-through increased in both phases of the crisis (by 45-73 bps):
  A 100bps increase in competitors' spread led to a 67-92 bps increase during the crisis, compared to only 8-23 bps in normal times.
  ⇒ Increased competition during the crisis, and even after Lehman's collapse.

Competition and Deposit Growth

1. Did intensive competition have an impact on deposit growth?
   - Estimate the contribution of an increase in deposit spreads to the growth of deposits:

$$\begin{aligned}\Delta log\left(dep\right)_{it} =& \beta \Delta r_{it-1} + \beta^{*} \Delta r_{it-1} \times Crisis_{t} + \rho \Delta FF_{t} \times HHI_{i} + \rho^{*} \Delta FF_{t} \times HHI_{i} \times Crisis_{t} \\ &+ \gamma \Delta \#Branch_{b(i)t} + \gamma^{*} \Delta \#Branch_{b(i)t} \times Crisis_{t} + \text{other controls} + \varepsilon_{it}\end{aligned}$$

   - The estimation results reflects the average effect across the entire sample.
   - There may be variations in deposit distribution among banks in response to changes in deposit spreads.

2. Did capital play a role in competition during the crisis?
   - Run a regression of the above model, adding a triple interaction term ($\Delta \text{Spread}_{t-1} \times$ Crisis $\times$ Capital)

	Δlog Deposits		
	(1)	(2)	(3)
ΔSpread$_{t-1}$	3.665***	3.160***	3.611***
	(0.457)	(0.502)	(0.458)
ΔSpread$_{t-1}\times$ Crisis1	-3.675***	-5.088**	-3.442***
	(1.060)	(2.182)	(1.002)
ΔSpread$_{t-1}\times$ Crisis2	-3.483***	-5.378***	-3.662***
	(0.957)	(1.066)	(0.953)
ΔSpread$_{t-1}\times$ Capital		0.038**	0.133
		(0.019)	(0.482)
ΔSpread$_{t-1}\times$ Crisis1 $\times$ Capital		0.131	-0.744
		(0.183)	(4.575)
ΔSpread$_{t-1}\times$ Crisis2 $\times$ Capital		0.165***	3.944***
		(0.043)	(1.083)
Observations	35,865	35,865	35,865
R^2 within	0.006	0.009	0.007

Notes. The coefficients of all other variables are omitted.

- The positive relationship vanishes during the GFC, then reemerges after the Lehman bankruptcy but remains weak: -0.01% (Crisis1), 0.18% (Crisis2) for a 100bps increase.
- Despite intense competition, an increase in deposit spreads did not lead to a significant rise in deposits during the crisis, especially before the Lehman bankruptcy.

Capital: (2) Book capital ratio / (3) Dummy =1 (top decile bank in capital ratio)

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R^2 within	0.006	0.009	0.007

Notes. The coefficients of all other variables are omitted.

- The impact of higher capital is highly significant both economically and statistically but only during the GFC following the Lehman bankruptcy.
- Despite intensive competition across the entire banking sector, only well-capitalized banks were successful in attracting deposits.

Robustness checks

- Alternative local market definition: 50km radius instead of by county
- Alternative model: Spatial Autoregressive Model (SAR)
- Alternative reference rates: Treasury rates for time deposits instead of Federal funds rate
- Alternative frequency : monthly instead of quarterly
- Our findings remain robust.

Takeaways

- We analyze competition in the U.S. deposit markets during the GFC using a novel competition measure.
- Banks reacted more strongly to competitor rate changes during the crisis.
  - Indicating heightened competition compared to normal times.
- Intense competition persisted even after a significant deposit inflow into the banking sector (after 2008q3).
  - suggesting it was not solely driven to safeguard liquidity.
- Increases in deposit spreads led to higher deposit growth during the crisis exclusively for well-capitalized banks after the Lehman collapse and government intervention.
  - Uneven benefits from the inflow of deposits.

Characteristics of Banks and Local Market

- Did changes in pass-through during the GFC vary based on the characteristics of banks and local market?
  - Run a regression with a triple interaction term (Δ spread $\times$ Crisis $\times$ Characteristic)

$$\begin{aligned}\Delta r_{it} =& \beta \Delta r_{-it} + \beta^{\circ} \Delta r_{-it} \times IA_{it} + \beta^{*} \Delta r_{-it} \times Crisis_t + \beta^{**} \Delta r_{-it} \times Crisis_t \times IA_{it} \\ &+ \rho \Delta FF_t + \rho^{\circ} \Delta FF_t \times IA_{it} + \rho^{*} \Delta FF_t \times Crisis_t + \rho^{**} \Delta FF_t \times Crisis_t \times IA_{it} \\ &+ \alpha_{b(it)} + \sigma_{s(it)} + \text{other controls} + \varepsilon_{it}\end{aligned}$$

1. Bank capital:
   - Importance of bank capital for bank stability, in particular during periods of market stress/crises. (Berger & Bouwman 2013, Demirguc-Kunt et al. 2013)
   - Poorly capitalized banks would be more likely to face deposit withdrawals during the crises. Did they react more to competitors' actions ?
2. Bank size:
   - Funding sources and branch networks are less diversified for small banks than for large banks.
   - Small banks rely more on local market deposits, making their reactions potentially more sensitive.
3. Local market structure

Banks' Behavior Based on Capital Ratio

Capital: Book capital ratio of the parent bank (average of pre-crisis period)

	Δ Spread					
	Checking	Savings	3M time	12M time	36M time	60M time
Δ Spread_comp × Capital	-0.003	0.002	0.001	0.000	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Δ Spread_comp × Crisis1 × Capital	0.001	0.001	-0.002	-0.002	-0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Δ Spread_comp × Crisis2 × Capital	0.002	-0.003*	-0.002	-0.001	-0.001	-0.003*
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Observations	184,047	179,858	170,148	189,247	166,496	137,758
R^2 within	0.794	0.466	0.435	0.445	0.405	0.343

Notes. The coefficients of other variables are omitted.

- No evidence supporting more aggressive behavior of poorly capitalized banks.
- Regardless of solvency, banks engaged in aggressive competition during the GFC.

Banks' Behavior Based on Size

Small == 1 if parent bank's TA<median

	Δ Spread					
	Checking	Savings	3M time	12M time	36M time	60M time
Δ Spread_comp × Small	0.062**	0.060***	0.059***	0.070***	0.014	-0.020
	(0.027)	(0.016)	(0.015)	(0.014)	(0.012)	(0.013)
Δ Spread_comp × Crisis1 × Small	-0.027	0.054**	0.034	0.069***	0.168***	0.199***
	(0.028)	(0.027)	(0.022)	(0.021)	(0.021)	(0.025)
Δ Spread_comp × Crisis2 × Small	-0.032	0.012	-0.038**	-0.021	0.038**	0.060***
	(0.029)	(0.021)	(0.019)	(0.017)	(0.018)	(0.021)
Observations	206,311	202,976	193,667	213,620	190,109	160,606
R^2 within	0.798	0.457	0.421	0.429	0.388	0.328

Notes. The coefficients of other variables are omitted.

- Small banks exhibit a stronger response, particularly in time deposits with longer maturities, during the crisis.
- Possible explanations:
  - Less competitive edge of small banks in checking deposits bundled with payment services.
  - Time deposits: relatively expensive but price-driven in terms of competition.
  - Longer-term maturities allow for locking in deposits until maturity, providing a stable funding source.

Impact of Local Market Structure

HHI: County-level HHI

	Δ Spread					
	Checking	Savings	3M time	12M time	24M time	48M time
Δ Spread_comp × HHI	-0.043	0.156**	0.253***	0.178***	0.041	0.046
	(0.105)	(0.071)	(0.085)	(0.067)	(0.065)	(0.075)
Δ Spread_comp × Crisis1 × HHI	-0.061	-0.111	-0.346***	-0.353***	-0.267**	-0.294**
	(0.118)	(0.141)	(0.106)	(0.096)	(0.118)	(0.148)
Δ Spread_comp × Crisis2 × HHI	0.013	-0.291***	-0.245***	-0.198***	-0.117	-0.181**
	(0.108)	(0.086)	(0.093)	(0.071)	(0.074)	(0.088)
Observations	206,311	202,976	193,667	213,620	202,139	160,626
R^2 within	0.798	0.455	0.420	0.427	0.402	0.346

Notes. The coefficients of all other variables are omitted.

- In counties with high HHI (indicating low concentration), the response to changes in competitors' spread is lower, especially for time deposits.

Asymmetric Response to Changes in Competitors' Spread

- Response may not be symmetric.
  - When there is a more intensive competition, banks would tend to react more sensitively to a rise in competitors' spread than to a fall.
  - Run regression adding a dummy ($Rise_{-it} == 1$ if $\Delta r_{-it} > 0$)

$$\Delta r_{it} = \beta \Delta r_{-it} + \beta^{*} \Delta r_{-it} \times Crisis_t + \beta^{\circ} \Delta r_{-it} \times Rise_{-it} + \beta^{**} \Delta r_{-it} \times Crisis_t \times Rise_{-it} + \alpha_{b(it)} + \sigma_{s(it)} + \text{Controls} + \varepsilon_{it}$$

		INTCK2.5K	MM25K	12MCD10K
$\Delta spread_c > 0$	Normal times ($\beta + \beta^{\circ}$)	6.9	-1.7	-1.2
	Crisis1 ($\beta + \beta^{\circ} + \beta_1^{\star} + + \beta_1^{\star\star}$)	90.5	71.1	69.9
	Crisis2 ($\beta + \beta^{\circ} + \beta_2^{\star} + + \beta_2^{\star\star}$)	98.5	79.4	52.3
$\Delta spread_c \leq 0$	Normal times (β)	28.9	15.6	22.3
	Crisis1 ($\beta + \beta_1^{\star}$)	-28.4	-23.9	16.4
	Crisis2 ($\beta + \beta_2^{\star}$)	6.2	12.8	39.8

- Response to $\Uparrow$ competitors' spread: significantly stronger during the crisis than in normal times.
- Response to $\Downarrow$ competitors' spread: smaller during the crisis, and even negative (*i.e.*, $\Uparrow$ spread to $\Downarrow$ in competitors' spread) for checking and saving deposits during Crisis1.
- Suggest more aggressive bidding during the crisis.