Wishful Thinking or Effective Threat?

Tightening Bank Resolution Regimes and Bank Risk-Taking

Magdalena Ignatowska, Goethe University Frankfurt (Germany)
Josef Korte, Goethe University Frankfurt (Germany)

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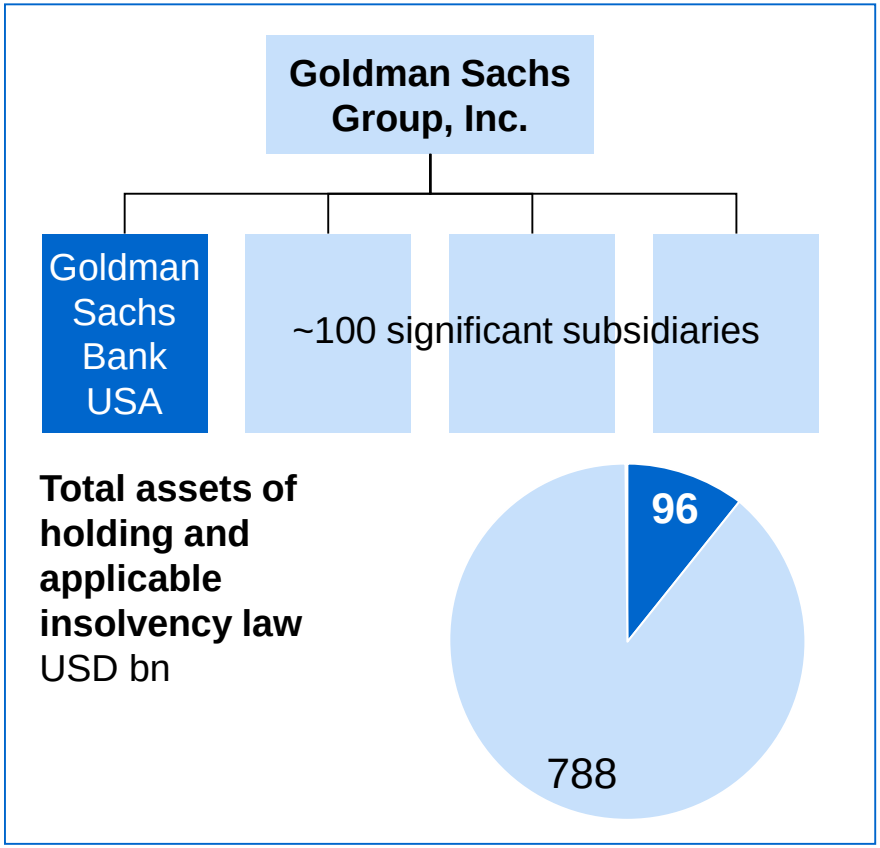
- **Motivation, theoretical model and key hypotheses**
- Identification strategy and model
- Results and policy implications

Motivation – The example of Goldman Sachs

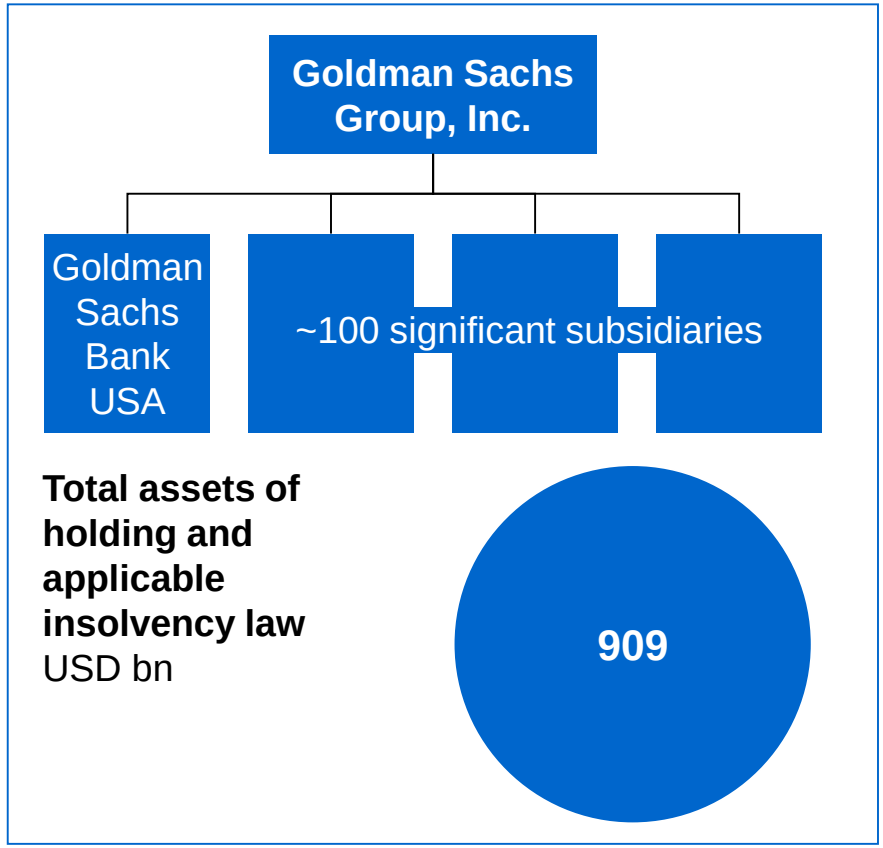
Bank insolvency regime applicable

Bank insolvency regime not applicable (quasi non-resolvable)

Before Dodd-Frank (30.06.2010)



After Dodd-Frank (30.09.2010)



Does this influence bank risk-taking? We think: It does!

?!

A theory of bank closure – DeYoung/Kowalik/Reidhill (2012)[1] offer a model that predicts improving resolution technology to change bank risk-taking

Model (DeYoung/Kowalik/Reidhill (2012))

- Closing or bailing out a bank can be modeled as a **trade-off between liquidity and discipline**
  - Option 1: **Resolution**
    - Pro: Increase discipline, prevent moral hazard
    - Con: Limits to resolution technology (e.g. slow process, legal limits) create illiquidity
  - Option 2: **Bailout**
    - Pro: Preserve liquidity
    - Con: Decrease discipline, create moral hazard
- **Time discount rate** of regulator important in finding an optimal solution, since
  - **Liquidity** effects are **short**-run
  - **Moral hazard** effects **long**-run

→ **Improvements in resolution technology change level of trade-off**

(Testable) predictions

- **Improvements in resolution technologies likely to change banks' behavior towards more discipline**
  - Less likely to pursue **complex** business strategies
  - Less likely to take **excessive risks**
- Increasing **political will** (i.e. decreasing time discount rate, less time inconsistency) makes application of the resolution authority **more credible** and hence **increases its effect** on bank behavior

If both conditions are given, a tightening in bank resolution regimes should decrease risk-taking of affected banks

1 Journal of Financial Stability, forthcoming

We exploit the following hypotheses to test the effect of a change in bank resolution regimes

		Verified in empirical tests
Main hypothesis	We assume that **affected banks** alter their behavior towards **less risk-taking and safer business models** after a change in bank resolution regimes becomes effective.	
Extension I	If the application of the new resolution regime is **not credible due to bank-specific characteristics** (i.e. systemic importance and size), we expect to find a **lower or even no effect on the respective banks' risk-taking** after the change in bank resolution regimes.	
Extension II	If the political and legislative procedures around the introduction of the change in bank resolution regimes **provide opportunities for gambling**, we expect to see an **increase in risk-taking of affected banks** after announcement and before enactment of the change.	

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An application to changes in the U.S. bank resolution regime – The Orderly Liquidation Authority (OLA) as the treatment

	BEFORE Dodd-Frank	AFTER Dodd-Frank
Issue 1: Appropriate insolvency regimes	**No unified resolution regime for financial institutions**[1] ▪ FDIA with **bank-specific administrative resolution** procedure for all **insured depository institutions** (Literature: most appropriate, frequently utilized) ▪ All **other financial institutions** (e.g. bank or financial holding companies) only covered by **default corporate insolvency law** (Literature: Less appropriate) → **No appropriate resolution technology for bank/financial holding companies (BHCs), making bailout the only choice**	**Orderly Liquidation Authority** (DFA, title II) ▪ Extends special resolution regime to financial institutions previously uncovered by bank-specific resolution law ▪ OLA resolution technically similar to FDIA-procedure, effectively covering any financial firm → **Legal empowerment to resolve BHCs**
Issue 2: Sufficient resolution funds	**Limited resources of Deposit Insurance Fund** (record high of USD 52 bn in 2008, ~1/10 of Bank of America's deposits) → **Financial limit to resolve large institutions**	Set up of new Orderly Liquidation Fund with ex post risk-based assessments → **Financial empowerment**

The Orderly Liquidation Authority is a significant legal and financial empowerment of the regulator and hence a technological improvement to the U.S. resolution regime

1 See Bliss/Kaufman (2006) and Marin/Vlahu (2011) for detailed descriptions and comparison of the different regimes

Treatment and control group defined based on share of total non-FDIA-regulated BHC assets

FDIA-regulated/resolvable before OLA

	Treatment group	Control group
Definition	BHCs (and their banks) with **high share of non-FDIA-regulated assets** are particularly affected by the change in resolution regime	BHCs (and their banks) with **low share of non-FDIA-regulated assets** are less affected, as FDIA resolution regime was effective before for most of its assets
Identification	**More than 30% of total BHC assets** were **not regulated by FDIA** before OLA *resp.* less than 70% of total BHC assets were resolvable previously	**Less than 10% of total BHC assets** were **not regulated by FDIA** before OLA *resp.* more than 90% of total BHC assets were resolvable previously
Obs. level	*Note: BHC was not resolvable before*	*Note: BHC was not resolvable before*
BHC level	BHC (treat)	BHC (control)
Bank level	Bank (treat); Other; Other; Other	Bank (cont.); Bank (cont.); Bank (cont.); Other

We test our hypotheses for different levels of aggregation: BHC and bank level

Model and data – The baseline regression framework

Potential data sources given in italics

$$\text{Risk taking}_{i,t} = \alpha + \beta_1 * \text{AFTER}_t + \beta_2 * \text{AFFECTED}_i + \beta_3 * (\text{AFTER}_t \text{x} \text{AFFECTED}_i) + \text{FE} + X_{i,t} + \varepsilon_{i,t}$$

- **Bank/BHC-level model** (*Call reports for all banks, FRY9C reports for all BHCs*)
  - Bank z-score
  - RoA volatility
  - Asset risk (RWA/assets)
  - Business model risk (e.g. risky securities ratio, trading assets ratio, NII/II ratio)
- **Market-data model** *(Datastream)*
  - Volatility of (weekly) stock returns
- **Loan-level model** (*Home Mortgage Disclosure Act registry*)
  - Loan-income-ratio
  - Application approval indicator per risk range

Dummy variable

- 0 = before introduction of OLA
- 1 = after introduction of OLA

- **Dummy variable**
  - 0 = non-affected bank (or BHC), part of a BHC with less than 10% non-FDIA-regulated assets
  - 1 = affected bank (or BHC), part of a BHC with more than 30% non-FDIA-regulated assets
- **Continuous alternative: FDIA-regulated share**

Interaction (Dif-in-Dif identification)

Fixed effects (bank and time/ bank and regional)

Control variables

- For **bank-level** models:
  - (Time-varying) bank controls, i.e. size, capitalization, profitability, liquidity, state support (TARP)
- For **loan-level** models:
  - (Time-varying) bank controls
  - Loan characteristics
  - Demographic controls
  - Economic conditions, esp. housing market

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Results – Bank/BHC level risk measures (accounting data)

Panel A: Dummy variable (treatment and control group definition)

	(1)	(2)	(3)	(4)	(5)	(6)
Level	**Bank level**			**BHC-level**		
Dep. variable	**Z-score**	**σ RoA**	**Asset risk**	**Z-score**	**σ RoA**	**Asset risk**
Affected bank	0.131**	0.0459	0.0142			
	(0.0559)	(0.0285)	(0.00903)			
Affected BHC				-0.991***	-0.0649	-0.195
				(0.253)	(0.148)	(0.141)
Affected bank x after OLA	0.476***	-0.181***	-0.0220***			
	(0.0410)	(0.0277)	(0.00536)			
Affected BHC x after OLA				0.545***	-0.504***	-0.0131**
				(0.0730)	(0.153)	(0.00645)
Constant	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	55,811	55,894	56,140	17,726	17,995	5,560
R-squared	0.813	0.810	0.889	0.858	0.717	0.894

Highly significant decline in overall risk between pre- and post-treatment for affected banks as compared to non-affected banks at **both the level of individual banks** as well as on the **level of BHCs**

Results – Market risk measure (stock return data)

	(1)	(2)	(3)
Level	BHC level		
Model	Univariate	Multivariate	
Dep. variable	σ Stock	σ Stock	σ Stock
Affected BHC	-0.00118	0.00154	
	(0.00687)	(0.0328)	
Unregulated share (BHC-level)			0.0293
			(0.0278)
Affected BHC x after OLA	-0.0419***	-0.0314***	
	(0.00813)	(0.00927)	
Unregulated share x after OLA			-0.0569***
			(0.0146)
Affected BHC x after placebo			
Unregulated share x after placebo			
Constant	YES	YES	YES
Controls	NO	YES	YES
Bank FE	NO	YES	YES
Time FE	NO	YES	YES
Observations	1,728	1,632	5,466
R-squared	0.020	0.690	0.635

- **Highly significant decline in stock return volatility** between pre- and post-treatment for affected BHCs as compared to non-affected BHCs

Results – Bank business model and investment choices (accounting data)

	(1)	(2)	(3)	(4)	(5)	(6)
Level	Bank level					
Dep. variable	Trading assets ratio	Low risk securities ratio	High risk securities ratio	CRECD loan ratio	Deposit funding ratio	NII ratio
Affected bank	0.00101	-0.0171	0.0404***	-0.00354	-0.0109	-0.000635
	(0.00318)	(0.0225)	(0.0151)	(0.00862)	(0.00720)	(0.00647)
Affected bank x after OLA	-0.00605***	0.0584***	-0.0377***	-0.0108***	0.0307***	-0.00927**
	(0.00136)	(0.0118)	(0.00926)	(0.00312)	(0.00610)	(0.00447)
Constant	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	56,140	54,000	44,050	55,384	56,137	53,737
R-squared	0.776	0.778	0.784	0.961	0.907	0.921

Decrease in risky activities and investment choices for the affected banks after the introduction of the OLA, when using several indicators for bank business model and investment choices as dependent variables

Results – Risk-taking in new business decisions (mortgage loan data)

Panel A: Newly originated loans from all banks in sample

	(1)	(2)	(3)
Level	Loan level		
Sample	All originated loans	Sold loans	Unsold loans
Dep. variable		Loan-to-income ratio	
Affected bank	-0.685***	-0.170	-0.701***
	(0.0767)	(0.135)	(0.0984)
After OLA	0.00146	-0.0581***	0.0458***
	(0.00367)	(0.00506)	(0.00554)
Affected bank x after OLA	-0.0691***	-0.0352***	-0.0459***
	(0.00477)	(0.00603)	(0.00918)
Constant	YES	YES	YES
Bank controls	YES	YES	YES
Loan controls	YES	YES	YES
Demogr. controls	YES	YES	YES
Economic controls	YES	YES	YES
Bank FE	YES	YES	YES
Tract FE	YES	YES	YES
Observations	1,366,242	913,178	453,064
R-squared	0.324	0.219	0.367

Affected banks significantly decrease loan-to-income ratios of new mortgage loans after the introduction of OLA for **both sold and unsold**[1] **loans**

1 We define unsold loans as loans that have not been sold in same calendar year

Extension – Is the OLA a credible threat for all banks?

	(1)	(2)	(3)
Level	Bank level		
Dep. variable	Z-score	σ RoA	Asset risk
Secular effects			
Affected bank	0.160**	0.0392	0.00534
	(0.0655)	(0.0319)	(0.00938)
Total assets	-0.0393	0.0221**	-0.00964***
	(0.0306)	(0.107)	(0.00321)
2nd level interactions			
Affected bank x after OLA	0.508***	-0.203***	-0.0241***
	(0.0422)	(0.0281)	(0.00552)
Total assets x after OLA	0.274***	-0.0587***	-0.00371*
	(0.0348)	(0.009)	(0.00191)
Affected bank x total assets	0.0626**	-0.0239**	0.00891***
	(0.0302)	(0.0105)	(0.0032)
Moderated Dif-in-Dif			
Affected bank x after OLA x total assets	-0.275***	0.0592***	0.00386**
	(0.0347)	(0.00899)	(0.00191)
Constant	YES	YES	YES
Controls	YES	YES	YES
Bank FE	YES	YES	YES
Time FE	YES	YES	YES
Observations	55,811	55,894	56,140
R-squared	0.807	0.805	0.888

- **Bank size moderates credibility of the resolution threat**: **Coefficients on triple interaction term** (affected bank x after OLA x total assets) show that **risk measures are increasing with total assets** for affected banks after the introduction of OLA
- Coefficient on difference-in-difference term (affected bank x after OLA) **supports robustness of earlier findings**

We find affected banks to significantly decrease risk-taking after OLA introduction; effect does not hold for systemically most important banks

		Verified in empirical tests
Main hypothesis	We assume that **affected banks** alter their behavior towards **less risk-taking and safer business models** after a change in bank resolution regimes becomes effective.	✓
Extension I	If the application of the new resolution regime is **not credible due to bank-specific characteristics** (i.e. systemic importance and size), we expect to find a **lower or even no effect on the respective banks' risk-taking** after the change in bank resolution regimes.	✓
Extension II	If the political and legislative procedures around the introduction of the change in bank resolution regimes **provide opportunities for gambling**, we expect to see an **increase in risk-taking of affected banks** after announcement and before enactment of the change.	?

Current reforms of bank regulation should take into account three fundamental features of an effective bank resolution regime

1 A bank resolution regime that takes into **account the special role of financial institutions** and is **financially sufficiently endowed** is essential to avoid major interruptions in liquidity provision and (particularly) to create a **credible resolution threat** for financial institutions in order to discipline them ex ante

2 **Comprehensive coverage** of financial institutions as a whole - that goes beyond the scope of deposit-taking entities only - will **avoid incentives to shift risks** into non-resolvable entities

3 **Implementation speed is crucial**: When the regulator succeeds in implementing the resolution threat quickly after its announcement, excessive **gambling** behavior in the lag time before enactment **can be prevented**

BACKUP

Motivation and research question – Are changes in the resolution regime effective in altering risk-taking behavior?

Context and objective

Regulatory changes to bank resolution regimes in an effort to **influence bank behavior**, e.g.

- US: Dodd-Frank Act (2010), particularly Orderly Liquidation Authority
- Other countries: Germany, UK

Opinions

"*Expanding resolution authority to cover new systemically significant institutions is one of the lynchpins of financial regulatory reform […] At the same time, banking* ***regulators have failed****, every time they have been given more resolution authority,* ***to exercise*** *that authority when it is needed.*"

David Zaring

"*The* ***most important provision*** *[of the Dodd-Frank Act] is the* ***resolution authority*** *under which federal regulators can seize any financial company […] This is an* ***improvement on the status quo****.*"

The Economist (July 3, 2010)

Main question

Does it work?

- Do bank resolution technologies **influence bank behavior?**
- More specifically: Does an extension of the resolution regime have a **disciplining effect** on banks?

?

Literature overview – Resolution of banks and risk-taking incentives

Bailout guarantees

- **Increase moral hazard incentives** (Bagehot (1873))
  - Creditors anticipate loss protection in case of bank failure and have little incentives to monitor the bank (or to adjust risk premiums)
- **Decrease incentives for excessive risk-taking** (Keeley (1990))
  - Banks fear losing charter values from bailout guarantees (i.e. lower funding cost)

→ **Empirical evidence rather in favor of increase in bank risk-taking** (e.g. Black and Hazelwood (2012), Duchin and Sosyura (2012) and Dam and Koetter (2012))

Resolution threat

- **Decreases excessive risk-taking incentives ex ante if credible** (DeYoung et al. (2012))
- Theoretical models predict **certain caveats**
  - Effect on risk-taking depends on bank's capital base and the regulator's closure rule (i.e. specifying closure at a certain capital level) (Davies and McManus (1991))
  - Time-inconsistency problem makes regulator's credible commitment difficult (Mailath and Mester (1994))
- **Increases ex post incentives for prudent risk behavior of surviving banks**
  - Acquisition of failed banks enhances charter values of surviving banks (i.e. greater market concentration) (Perotti and Suarez (2002))
- '**Gambling for resurrection**' due to loss in charter values (Murdock et al. (2000))
  - Withdrawal of (implicit) bailout guarantee can decrease charter values (i.e. higher funding costs)

→ **Currently no empirical evidence so far** to the best of our knowledge

Overview of literature (1/2)

How regulation drives bank risk-taking

- **DeYoung/Reidhill/Kowalik (2011):** Bank resolution model as tradeoff between market discipline and market liquidity, equilibrium determined by available resolution technology and discount rate
- **Black/Hazelwood (2011):** Risk of commercial loan origination changed for TARP-recipients, depending on size, strong indications for moral hazard
- **Dam/Koetter (2012):** Bailout expectations lead to additional risk taking (evidence for moral hazard)
- **Duchin/Sosyura (2012):** After bailout, banks approve riskier loans and hold riskier portfolios, but in same asset classes, so no effect on capital ratios, but increased volatility and default risk
- **Brei/Gadanecz (2012):** Banks that were bailed-out did not reduce the risk of new syndicated lending significantly more than non-rescued banks
- **Fischer/Hainz/Rocholl/Steffen (2011) and Gropp/Gründl/Gürtler (2011):** Removal of gov't guarantee changes bank risk taking, moral hazard effects associated with public guarantees
- **Gonzales (2005):** Regulatory restrictions increase risk-taking by reducing charter values, deposit insurance decrease risk taking by increasing charter value
- **Gropp/Hakenes/Schnabel (2011):** Perceived government guarantees to some banks increase risk-taking of competitor banks that are less protected
- **Fahlenbach/Prilmeier/Stulz (2011):** Large US banks in trouble during previous financial crises were same banks in trouble during recent crisis (were never closed, but bailed out several times
- **Acharya/Yorulmazer (2007) and Mailath/Mester (1994):** Time-inconsistency of bank closure can create moral hazard
- **Brown/Dinc (2005) and Imai (2009):** Political economy/capture explains closure or forbearance, providing explanation for moral hazard on the side of the regulator

Overview of the literature (2/2)

Incentives and advantages for large banks generated by too-big-to-fail (TBTF) guarantees	▪ **Hetzel (1991):** TBTF policies led to increased risk-taking behavior of banks and produced systemic instability ▪ **Angbazo/Saunders (1996):** TBTF raises profitability by lowering funding costs ▪ **O'Hara/Shaw (1990):** U.S. Regulator's TBTF announcement in 1984 raised banks' stock prices, especially for weak TBTF-banks ▪ **Baker/McArthur (2009)**: TBTF policies increase the funding cost gap between smaller banks and TBTF banks ▪ **Davies/Tracey (2012):** Large banks do not exhibit scale economies, apparent scale economies for large banks might be driven by lower funding costs due to TBTF market expectations ▪ **Brewer/Jagtiani (2011):** Banks are willing to pay an premium for mergers that would make them large enough to be considered TBTF and bank market values increase
US bank bankruptcy law/Dodd-Frank Act tech-nicalities	▪ **Economic and legal analysis:** Acharya et al (2010); Barr (2011); Bliss/Kaufman (2007); Bliss/Kaufman (2011); Broome (2011); Edwards (2011); Fitzpatrick/Greenlee/Thomson (2011); Kroener (2010); Marinc/Vlahu (2011); Masera (2010); Scott (2012); Taylor (2010); Zaring (2011) ▪ **Legal provisions:** Dodd Frank Act (12 USC 5301 seq.); Federal Deposit Insurance Act and FDIC Improvement Act (12 USD 1811-1835); US Federal Bankruptcy Code (11 USC, 101-1338)
Empirical impact of Dodd-Frank Act	▪ **Gao/Liao/Wang (2011):** Large banks experienced negative abnormal stock returns and positive abnormal bond returns in response to events surrounding the passage of the DFA and had lower idiosyncratic risk and systemic risk in the period after DFA's passage compared to the pre-period suggesting that the DFA reduces large banks' risk-taking

Our identification strategy applies the theory of bank resolution to changes in the US resolution regime – The Orderly Liquidation Authority (OLA)

Identification strategy:
Use quasi-natural experiment setup
in a difference-in-difference methodology

Requirement 1: Treatment effect

Is the OLA an improvement in resolution technology?

- OLA extends special resolution regime to financial institutions previously uncovered by bank-specific resolution law (legal improvement)
- Set up of new Orderly Liquidation Fund (financial improvement)

Requirement 2: Treatment and control group

Were financial institutions differentially affected?

- Affected banks: BHCs (and their banks) with high share of (previously) non-FDIA-regulated assets are mostly affected by the change in resolution regime (treatment group)
- Non-affected banks as control group

Requirement 3: Timing of treatment

Can clear pre- and post-treatment periods be distinguished?

- Part of reform package suggested by the Obama Administration in June 2009 → pre-treatment
- Effective through enactment of Dodd-Frank Act in July 2010 → post-treatment

Overview of bank-level risk taking measures (dependent variable)

BACKUP

Variable	Definition	Source	Examples for applications
Distance to default / Z-score	(avg ROA + avg CAR)/SD(ROA)	CR	Boyd et al, 1993 and 2009; Laeven/Levine, 2009; Gropp et al, 2011; Kaserer et al; 2011; Konishi/Yasuda, 2004; Dam/Koetter, 2012; Duchin/Sosyura, 2012
Earnings volatility	Standard deviation of RoA (net operating income/avg assets) over previous X quarters	CR	Laeven/Levine, 2009; Duchin/Sosyura, 2012; Gropp et al., 2011; Dam/Koetter, 2012
Asset risk	RWA/total assets	CR	Berger/Bouwman, 2011; De Nicolo et al, 2010; Gropp/Hakenes/Schnabel, 2009
Trading asset ratio	Assets held in trading accounts / total assets	CR	Dam/Koetter, 2012
Low risk securities ratio	Securities of U.S. government agencies and subdivisions / total securities	CR	Dam/Koetter, 2012
High risk securities ratio	(Equity securities + asset-backed securities + trading accounts) / total securities	CR	Dam/Koetter, 2012
CRECD-ratio	(Commercial real estate loans (CRE) + construction and development loans (CD)) / total loans	CR	DeYoung, 2013
Deposit funding ratio	Deposits / total assets	CR	Dam/Koetter, 2012
Non-interest income ratio	NII / total income (averaged)	CR	Brunnermeier et al, 2011; Demirgüc-Kunt/ Huizinga, 2010; De Jonghe, 2010; DeYoung/Roland, 2001
Stock return volatility	Standard deviation of weekly stock returns using total return index	DS	Laeven/Levine, 2009

Does it really make a difference? Some indicative evidence (1/2)

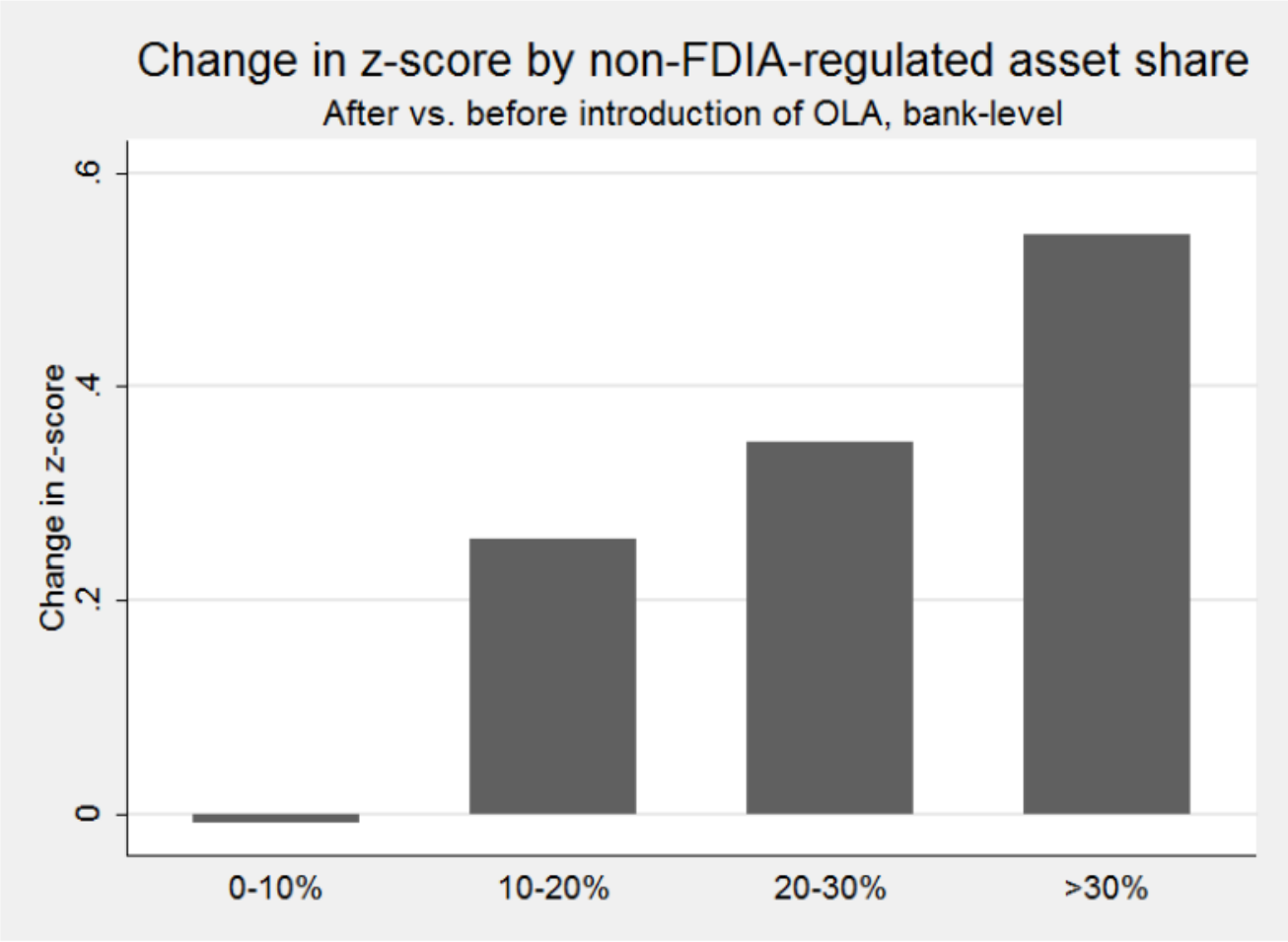

Figure 1: **Change in z-score by non-FDIA-regulated asset share**

Rough first indication: **Higher non-FDIA-regulated shares** in banks' assets correspond to higher increases of the z-score, i.e. **lower overall bank risk**, after the introduction of the OLA

Does it really make a difference? Some indicative evidence

Lower risk

Higher risk

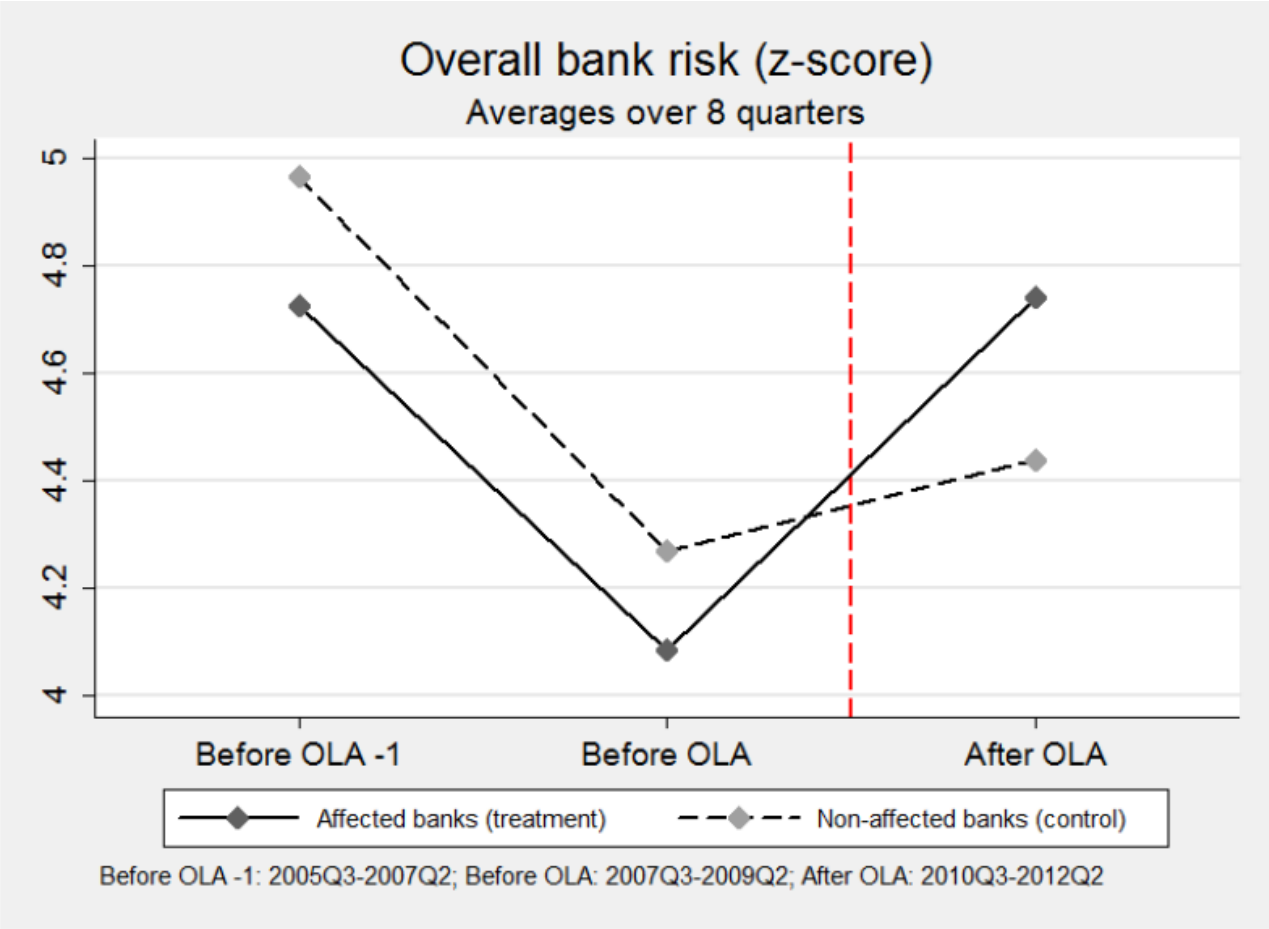

Figure 2: **Bank risk-taking before and after OLA**

Average bank risk for affected and non-affected bank exhibits a **parallel development in the absence of treatment**, but **affected banks decrease risk much stronger after treatment**

Does it really make a difference? Some indicative evidence (2/2)

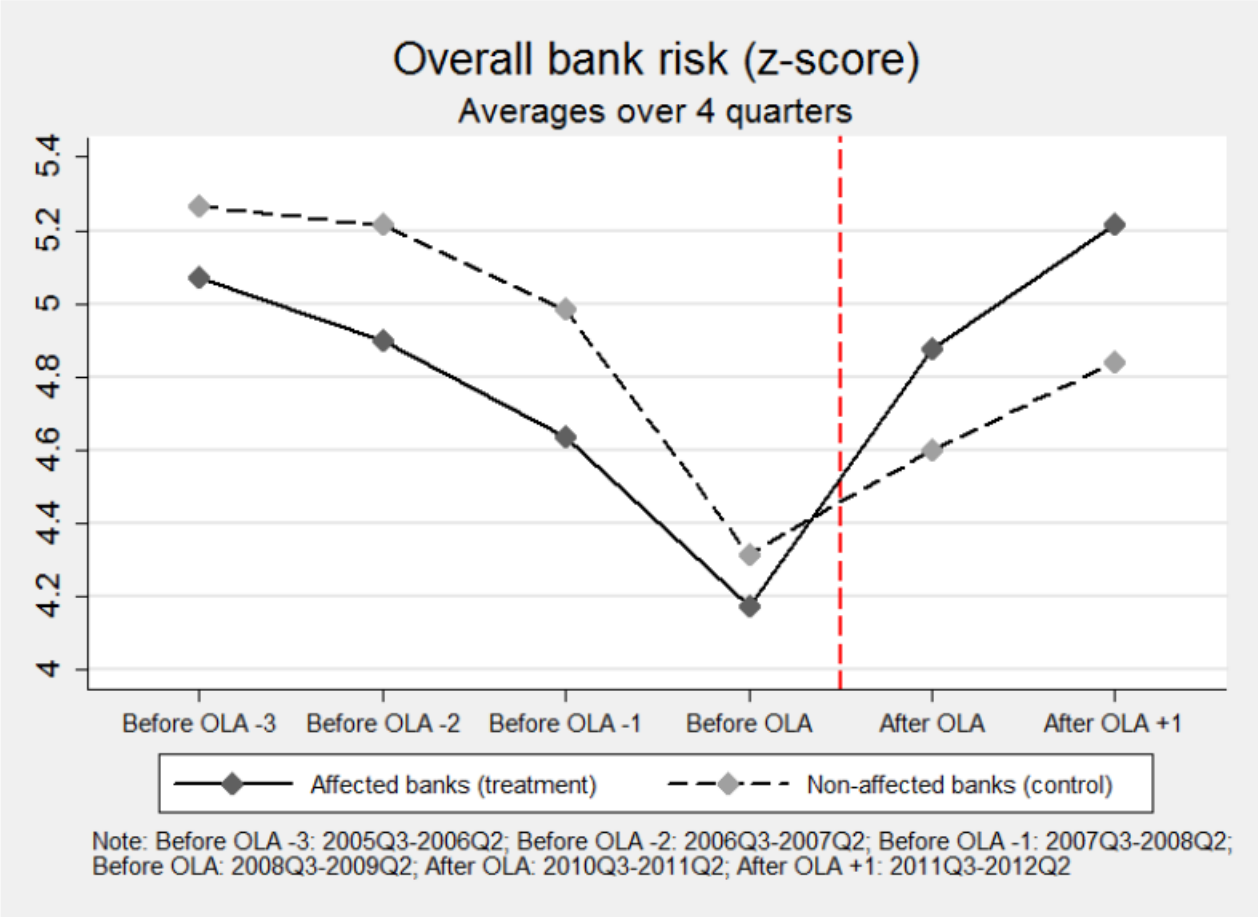

Figure 3: **Bank risk-taking before and after OLA**

Risk-measure over shorter periods: **Parallel development before treatment**, stronger **decrease of risk for affected banks** immediately after treatment, then **again parallel trend**

Summary statistics (1/3)

Panel A: BHC sample

Variable group and name	Source	Mean	SD	Min	Max	N
Dependent variables (risk and business model)						
Bank z-score	BHC	4.57	(1.27)	-2.76	11.96	46043
σ RoA	BHC	19.09	(54.99)	0	2709	77613
Asset risk (RWA/assets)	BHC	73.08	(11.98)	0	126.2	15395
Trading assets ratio	BHC	0.33	(2.29)	0	42.75	14663
Low risk securities ratio	BHC	0.21	(2.91)	0	100	15547
High risk securities ratio	BHC	2.46	(9.37)	0	97.81	8797
CRECD loans ratio	BHC	0.48	(1.64)	0	31.32	15642
Deposit funding ratio	BHC	67.66	(13.41)	0	99.81	14663
Non-interest income ratio	BHC	23.56	(14.29)	0.03	99.53	16679
Explanatory variables						
BHC non-FDIA-regulated share	BHC, SDI	12.23	(9)	0	100	46569
Affected bank dummy (treatment)	BHC, SDI	0.05	(0.22)	0	1	19467
After OLA dummy		0.49	(0.5)	0	1	86038
Additional bank- and quarter-varying control variables						
Total assets (in USD mn)	BHC	5040.52	(72044.57)	0	2358266	49112
Capital ratio	BHC	10.04	(6.55)	-57	100	47410
Earnings (RoA)	BHC	0.1	(0.84)	-41.95	81.82	47359
Liqudity ratio	BHC	6.57	(6.61)	0.02	97.12	44375
CPP recipient bank-quarter	TR	0.03	(0.18)	0	1	86038

Summary statistics (2/3)

Panel B: Bank sample

Variable group and name	Source	Mean	SD	Min	Max	N
Dependent variables (risk and business model)						
Bank z-score	SDI	4.44	(1.17)	-9.46	8.83	126104
σ RoA	SDI	25.58	(50.23)	0	2014.1	126427
Asset risk (RWA/assets)	SDI	67.67	(14.72)	0	231.97	127022
Trading assets ratio	SDI	0.07	(1.11)	0	77.17	126936
Low risk securities ratio	SDI	71.36	(26.25)	0	100	123346
High risk securities ratio	SDI	1.86	(9.17)	0	100	112917
CRECD loans ratio	SDI	32.89	(20.88)	0	112.5	126209
Deposit funding ratio	SDI	69.29	(11.45)	0	98.66	126785
Non-interest income ratio	SDI	16.41	(12.65)	0	99.95	122973
Explanatory variables						
BHC non-FDIA-regulated share	BHC, SDI	7.68	(9.18)	0	100	89547
Affected BHC dummy (treatment)	BHC, SDI	0.03	(0.16)	0	1	56464
After OLA dummy		0.47	(0.5)	0	1	127170
Additional bank- and quarter-varying control variables						
Total assets (in USD mn)	SDI	1703319.62	(31321571.09)	66	1842568960	127170
Capital ratio	SDI	11.72	(7.37)	-13.52	100	126788
Earnings (RoA)	SDI	0.11	(1.02)	-28.38	93.5	126788
Liqudity ratio	SDI	7.31	(7.93)	0	100	126936
CPP recipient bank-quarter	TR	0.03	(0.17)	0	1	127170

Summary statistics (3/3)

Panel C: Loan application sample

Variable group and name	Source	Mean	SD	Min	Max	N
Dependent variables						
Loan-Income-Ratio (loan appl.)	HMDA	2.04	(1.37)	0	7.22	4145701
Loan-Income-Ratio (orig. loans)	HMDA	2.15	(1.29)	0	7.22	3106212
Loan-Income-Ratio (sold loans)	HMDA	2.5	(1.13)	0.01	7.22	2021819
Loan-Income-Ratio (unsold loans)	HMDA	1.5	(1.31)	0	7.22	1084393
Approval indicator	HMDA	0.75	(0.43)	0	1	4329647
Explanatory variables						
BHC non-regulated share (continuous)	BHC, SDI	0.23	(0.21)	0	1	4089198
BHC non-regulated share (dummy)	BHC, SDI	0.42	(0.49)	0	1	1876201
After OLA (2011/2009)		0.46	(0.5)	0	1	4329647
Additional bank control variables						
Total assets (in USD mn)	SDI	401968.92	(564608.08)	18.13	1788146.13	4329291
Capital ratio	SDI	10.19	(2.6)	-1.01	40.2	4329224
Earnings (RoA)	SDI	0.12	(0.32)	-6.08	2.36	4329224
Liqudity ratio	SDI	5.69	(3.93)	0	77.74	4328745
CPP recipient bank	TR	0.57	(0.49)	0	1	4329647
Additional loan, demographic and economic control variables						
Government-guaranteed/-insured loan	HMDA	0.3	(0.46)	0	1	4329647
Sold loan (orig. loans)	HMDA	0.63	(0.48)	0	1	3242987
Total population in tract	HMDA	5487.1	(2676.24)	1	36146	4280501
Minority population in tract	HMDA	23.97	(25.29)	0.23	100	4280395
Median family income (in USD)	HMDA	65698.53	(14446.18)	16100	111900	4280666
House price index level in MSA	FHFA	183.56	(28.94)	110	338.02	4228877
House price index appreciation in MSA	FHFA	-3.67	(3.72)	-19.49	9.21	4228877

Results – Univariate difference-in-difference estimates

Panel A: Bank level

	(1)	(2)	(3)=(2)-(1)	(4)	(5)	(6)=(5)-(4)	(7)=(3)-(6)
	Affected banks			Non-affected banks			
	Before	After		Before	After		
Dep. variable	OLA	OLA	Dif	OLA	OLA	Dif	Dif-in-Dif
Z-score	4.086	4.741	0.655***	4.270	4.440	0.170***	0.485***
			(0.0608)			(0.0108)	(0.0668)
σ RoA	0.521	0.234	-0.287***	0.321	0.252	-0.0697***	-0.218***
			(0.0349)			(0.00503)	(0.0312)
Asset risk	0.694	0.631	-0.0618***	0.681	0.630	-0.0517***	-0.0101
			(0.0014)			(0.00132)	(0.00822)

Panel B: BHC-level

	(1)	(2)	(3)=(2)-(1)	(4)	(5)	(6)=(5)-(4)	(7)=(3)-(6)
	Affected banks			Non-affected banks			
	Before	After		Before	After		
Dep. variable	OLA	OLA	Dif	OLA	OLA	Dif	Dif-in-Dif
Z-score	4.051	4.554	0.503***	4.17	4.37	0.196***	0.307***
			(0.0896)			(0.0202)	(0.0986)
σ RoA	1.119	0.409	-0.71***	0.214	0.193	-0.0212***	-0.689***
			(0.196)			(0.00477)	(0.0475)
Asset risk	0.697	0.632	-0.0644***	0.762	0.682	-0.0801***	0.0157
			(0.0159)			(0.00292)	(0.0109)

- Significant decrease in all risk measures between the pre- and the post-treatment periods (not necessarily driven by change in regulation)
- **Dif-in-dif estimates** for both **Z-score and σ RoA** show **significantly larger decline** in risk-taking between pre- and post-treatment for treatment group as compared to control group.
- Less conclusive **dif-in-dif estimate** for **asset risk**

Results – Multivariate difference-in-difference results (2/2)

Panel B: Continuous variable (unregulated share in %)

	(1)	(2)	(3)	(4)	(5)	(6)
Level	Bank level			BHC-level		
Dep. variable	Z-score	σ RoA	Asset risk	Z-score	σ RoA	Asset risk
Unregulated share (parent BHC-level)	0.390***	0.0151	0.0675***			
	(0.0673)	(0.0277)	(0.00948)			
Unregulated share (BHC-level)				-0.869***	0.162	-0.110
				(0.244)	(0.202)	(0.0775)
Unregulated share x after OLA	0.772***	-0.133***	-0.0635***			
	(0.0537)	(0.0276)	(0.00690)			
Unregulated share x after OLA				1.766***	-1.316***	-0.0338*
				(0.155)	(0.391)	(0.0199)
Constant	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	88,710	88,795	89,194	43,050	43,338	14,221
R-squared	0.786	0.797	0.885	0.809	0.743	0.877

Robust results when **replacing the treatment dummy with the actual share of assets not subject to FDIA resolution** (continuous variable)

Results – Placebo tests

	(1)	(2)	(3)	(4)	(5)	(6)
Level	Bank level			BHC-level		
Dep. variable	Z-score	σ RoA	Asset risk	Z-score	σ RoA	Asset risk
Affected bank	0.160**	-0.0706	-0.00704			
	(0.0639)	(0.0468)	(0.00900)			
Affected BHC				-1.084***	0.382**	0.0586**
				(0.242)	(0.169)	(0.0237)
Affected bank x after placebo	-0.0177	0.106***	0.00590			
	(0.0367)	(0.0214)	(0.00362)			
Affected BHC x after placebo				0.0699	0.172	0.000800
				(0.0804)	(0.131)	(0.00473)
Constant	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	62,757	62,792	63,122	20,017	20,075	7,740
R-squared	0.755	0.819	0.901	0.787	0.774	0.933

No significant difference-in-difference effect for Z-score and asset risk (neither in the bank nor in the BHC panel) **between the pre-placebo** period (Q3 2005 to Q2 2007) **and the pre-treatment period**

Results – Risk-taking in new mortgage loan business (2/2)

Panel B: Newly originated loans from banks with share of synthetic loans <30%

	(1)	(2)	(3)
Level	Loan level		
Sample	All originated loans	Sold loans	Unsold loans
Dep. variable		Loan-to-income ratio	
Affected bank	-0.698***	-0.194	-0.747***
	(0.0824)	(0.136)	(0.110)
After OLA	-0.0193***	-0.0624***	0.00752
	(0.00514)	(0.00732)	(0.00769)
Affected bank x after OLA	-0.0470***	-0.0192	-0.0406***
	(0.00817)	(0.0118)	(0.0128)
Constant	YES	YES	YES
Bank controls	YES	YES	YES
Loan controls	YES	YES	YES
Demogr. controls	YES	YES	YES
Economic controls	YES	YES	YES
Bank FE	YES	YES	YES
Tract FE	YES	YES	YES
Observations	830,560	532,525	298,035
R-squared	0.350	0.229	0.387

Robust results for unsold loans when **controlling for banks that retain loans on balance sheet but securitize them** (synthetic loan share[1] larger than 30%)

1 We define synthetic loan share as the ratio of mortgage loans securitized but with servicing retained to total mortgage loan portfolio and calculate if from the bank level data

Results – Risk and approval of new mortgage loan business

Panel A: Approval rate of loan applications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Level	Loan level							
		Loan applications within loan-to-income ratio range						
Sample	All appl.	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	>3.0
Dep. variable	Application approval indicator							
Affected bank	0.102***	0.0270	0.0901	0.157**	-0.0146	0.147*	0.172**	0.155*
	(0.0221)	(0.0532)	(0.0647)	(0.0640)	(0.0614)	(0.0872)	(0.0819)	(0.0936)
After OLA	-0.0043***	-0.0233***	-0.0117***	-0.00251	0.00423	-0.00275	-0.00112	0.00294
	(0.00103)	(0.00345)	(0.00358)	(0.00317)	(0.00266)	(0.00254)	(0.00272)	(0.00218)
Affected bank x after OLA	-0.0465***	-0.00640	-0.0167***	-0.0529***	-0.0630***	-0.0599***	-0.0540***	-0.0563***
	(0.00127)	(0.00491)	(0.00481)	(0.00406)	(0.00336)	(0.00319)	(0.00339)	(0.00253)
Constant	YES	YES	YES	YES	YES	YES	YES	YES
Bank controls	YES	YES	YES	YES	YES	YES	YES	YES
Loan controls	YES	YES	YES	YES	YES	YES	YES	YES
Demogr. controls	YES	YES	YES	YES	YES	YES	YES	YES
Econ. controls	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Tract FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,839,672	193,601	164,310	189,605	242,163	257,310	234,283	491,291
R-squared	0.443	0.425	0.446	0.469	0.493	0.514	0.539	0.581

No significant decrease in probability of loan approval by affected banks after the introduction of OLA for **safest risk range**, while **significant decrease for all remaining risk ranges**, when accounting for potential **loan demand effects**

Results – Risk and demand for new mortgage loan business

Panel B: Total number of loan applications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Level	Loan level							
		Loan applications within loan-to-income ratio range						
Sample	All appl.	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	>3.0
Dep. variable		Log of total number of loan applications per bank, year, and range						
Affected bank	-0.196	0.605	-0.216	-0.420*	-0.230	0.101	-0.825***	-0.814**
	(0.180)	(0.410)	(0.278)	(0.242)	(0.299)	(0.313)	(0.242)	(0.341)
After OLA	-0.171***	-0.222***	-0.166***	-0.119***	-0.214***	-0.188***	-0.237***	-0.305***
	(0.0153)	(0.0269)	(0.0238)	(0.0247)	(0.0256)	(0.0253)	(0.0272)	(0.0297)
Affected bank x after OLA	-0.127	-0.229	-0.211	-0.198	-0.119	-0.109	-0.185	-0.0855
	(0.122)	(0.166)	(0.133)	(0.149)	(0.178)	(0.214)	(0.238)	(0.202)
Constant	YES	YES	YES	YES	YES	YES	YES	YES
Bank controls	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	33,762	4,510	4,492	4,338	4,225	4,060	3,791	4,261
R-squared	0.015	0.085	0.078	0.072	0.097	0.104	0.108	0.157

No systematic differences in loan demand across risk ranges between affected and non-affected banks after introduction of OLA when employing **the total number of loan applications per bank, year, and risk range as dependent variable**

Extension – How do "too-big-to-not-rescue" banks react to the introduction on the OLA?

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	**Part of U.S.-GSIFI**			**Asset size USD 50+ billion**		
Dep. variable	**Z-score**	**σ RoA**	**Asset risk**	**Z-score**	**σ RoA**	**Asset risk**
Unregulated share (parent BHC-level)	2.466***	-1.816*	0.721***	1.133***	-0.892***	0.111*
	(0.948)	(0.988)	(0.160)	(0.367)	(0.238)	(0.0579)
Unregulated share x after OLA	-1.415**	0.0800	0.262***	-0.815*	0.0992	0.0795*
	(0.696)	(0.295)	(0.0643)	(0.475)	(0.147)	(0.0455)
Constant	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Observations	485	485	492	452	452	454
R-squared	0.824	0.665	0.925	0.863	0.847	0.907

Resolution threat is not credible for TBTF-banks: **Affected, systemically important** banks do **not reduce their risk-taking** after the introduction of the OLA, but **might even increase it**

Extension – Gambling after announcement/before implementation?

Panel A: Benchmark tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Level	Bank level						
Periods	4-quarter periods				2-quarter periods		
Dep. variable	Z-score	Trading assets ratio	Low risk securities ratio	High risk securities ratio	Trading assets ratio	Low risk securities ratio	High risk securities ratio
Affected bank	0.0889	0.00313***	-0.0240	0.0591**	0.00315	-0.0253	0.125**
	(0.128)	(0.00115)	(0.0403)	(0.0278)	(0.00273)	(0.0886)	(0.0514)
Affected bank x after OLA	0.252***	-0.00568***	0.0542***	-0.0482***	-0.00390*	0.0517***	-0.0515***
	(0.0600)	(0.00202)	(0.0145)	(0.0129)	(0.00202)	(0.0170)	(0.0148)
Constant	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Observations	28,393	28,579	27,513	21,860	14,597	14,045	11,221
R-squared	0.801	0.749	0.850	0.838	0.801	0.892	0.883

Panel B: Gambling tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Level	Bank level						
Periods	4-quarter periods				2-quarter periods		
Dep. variable	Z-score	Trading assets ratio	Low risk securities ratio	High risk securities ratio	Trading assets ratio	Low risk securities ratio	High risk securities ratio
Affected bank	0.0882	-0.000280	-0.0225	0.0131	-0.00269	-0.0493	0.0269**
	(0.133)	(0.00162)	(0.0271)	(0.0206)	(0.00430)	(0.0328)	(0.0119)
Affected bank x after announcement	-0.00361	0.00285	0.0242**	-0.0275**	0.00607	0.00546	-0.0204**
	(0.0553)	(0.00241)	(0.0113)	(0.0113)	(0.00414)	(0.00977)	(0.00961)
Constant	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Observations	29,276	29,472	28,363	22,581	14,653	14,101	11,217
R-squared	0.822	0.804	0.900	0.869	0.830	0.951	0.933

- **Gambling might occur after announcement of OLA** if the changes in regulation reduce affected banks' charter value
- **Tested** with 4- and 2-quarter periods before/ after OLA and **before/ after announcement of OLA,** i.e. between the proposal of the OLA and its actual enactment
- **Benchmark effects are robust** and similar to previous findings, i.e. **less risk-taking by affected banks after OLA**
- **No indication for gambling:** If at all, **affected banks take less** - not more - **risk in the intermediate period**

We conduct a vast number of robustness checks

		Robust
Dependent variables	▪ **Alternative measures** for overall bank risk (accounting data as well as market data) and risk choices in business model/investment decisions, both on the bank level and on the micro-level of business decisions	✓
Definition of cutoffs	▪ **Alternative regulated asset share cutoffs** for treatment dummy variable and **share of non-FDIA-regulated assets** as explanatory continuous variable ▪ **Alternative quarterly computations** for the treatment period and the pre- and post-treatment periods	✓
Endogeneity concerns	▪ **Bank and time fixed effects** for regressions using **bank level dataset** ▪ **Bank and regional fixed effects** for regressions using **loan level dataset** as well as set of time-varying control variables ▪ Alternative specifications **including and excluding controls and fixed effects**	✓
Model speci-fications	▪ **Probit and logit models** as alternative specifications to test the application approval indicator (binary variable)	✓
Autocor-relation	▪ **Correct standard errors for possible autocorrelation at the bank level** (as suggested by Wooldridge (2010)) as panel dataset with repeated cross sections of banks and several periods of data before and after the treatment can be prone to autocorrelation problems (Bertrand et al. (2004))	✓
Sample selection	▪ **Correct for outliers** (winsorize the variables in bank level dataset at 1% highest and lowest percentile, trim loan-to-income ratio observations at 99.5% percentile) ▪ **Control for consistency of key explanatory variables** (exclude banks that change treatment status of within our observation period) ▪ **Test different levels of aggregation** (BHC and bank level)	✓