Financial Intermediation and the Macroeconomy

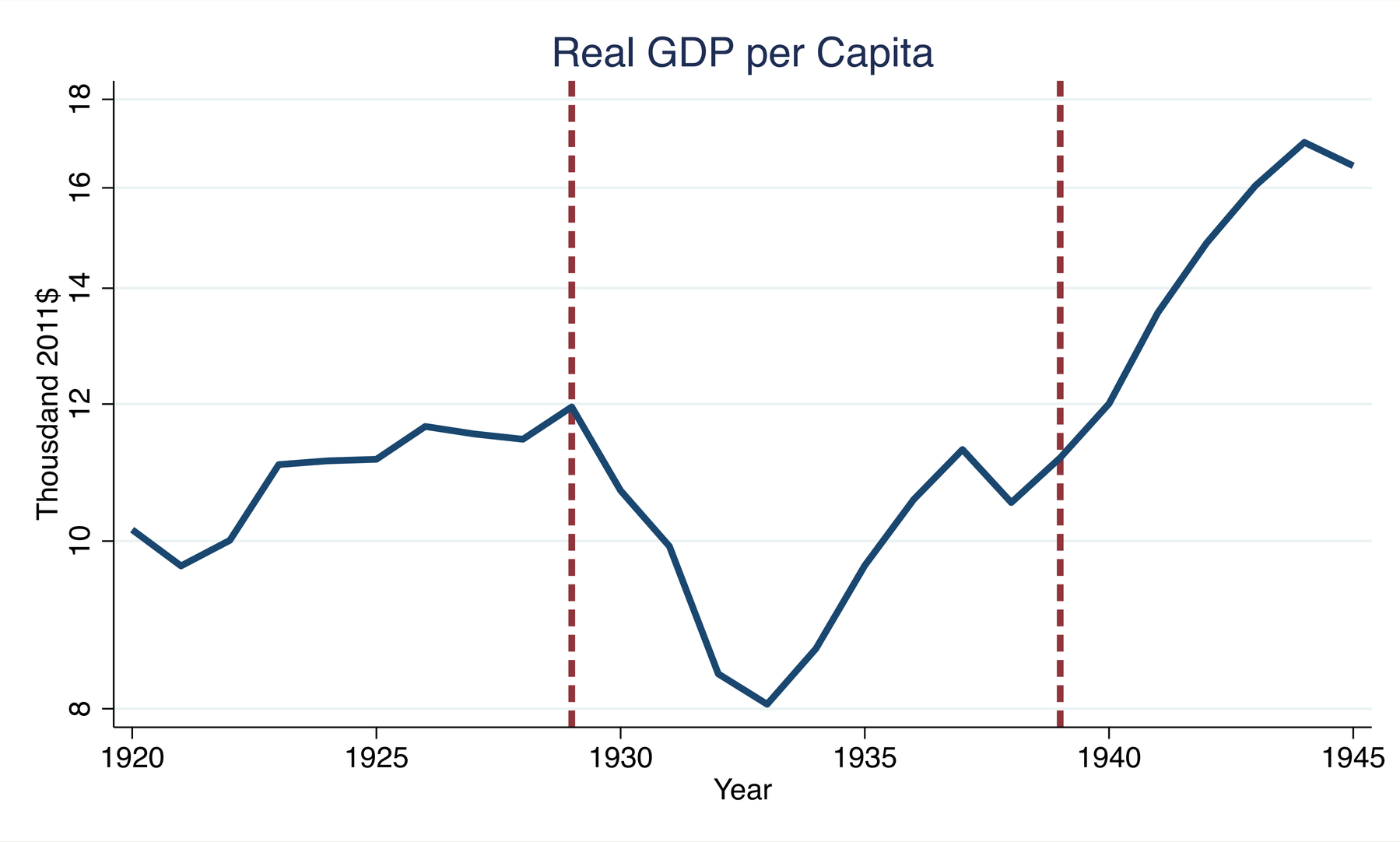
704B Macroeconomic Theory II
Lecture 8

Masao Fukui

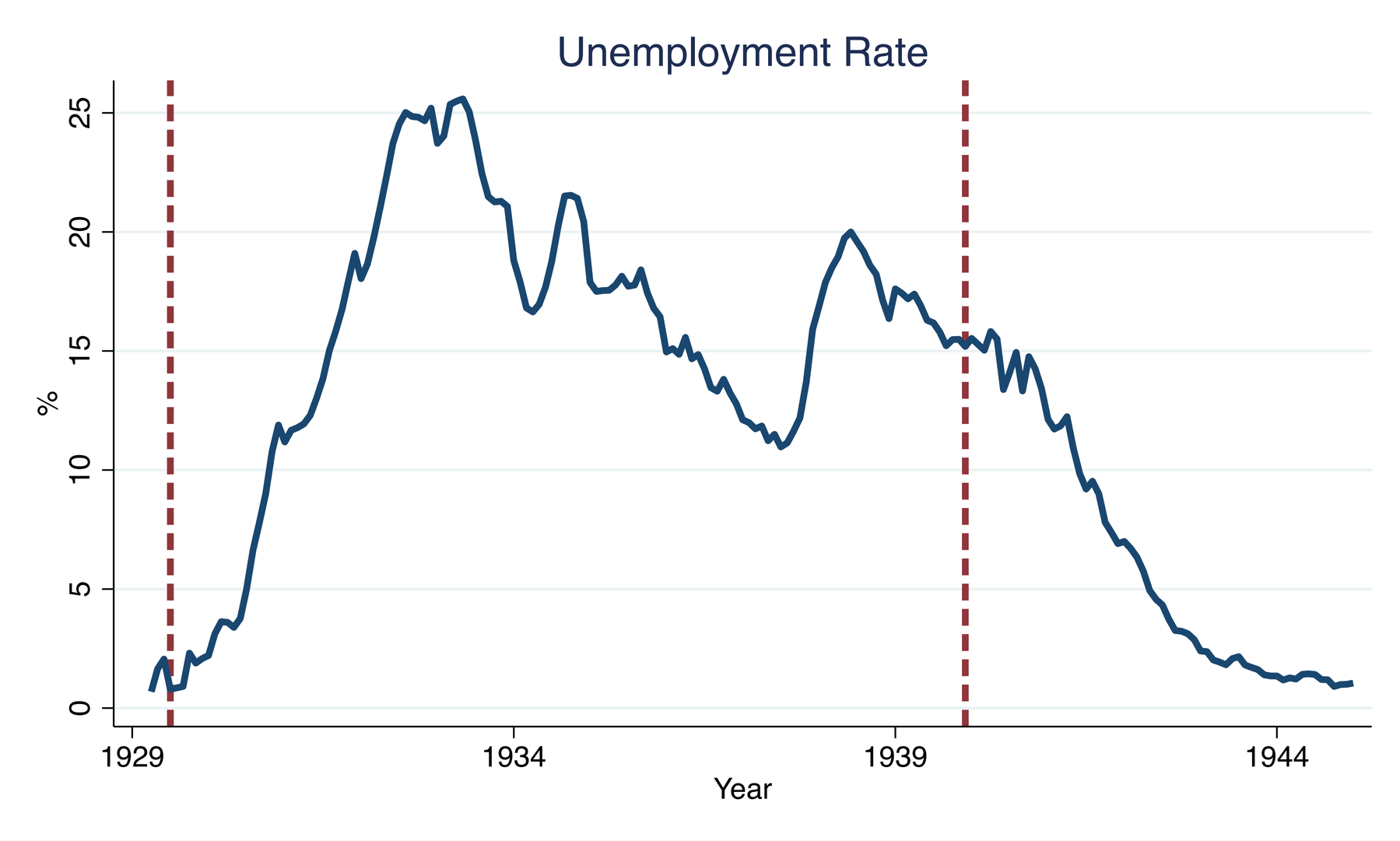
The Great Depression (1929-1939)

How Great Depression Started...

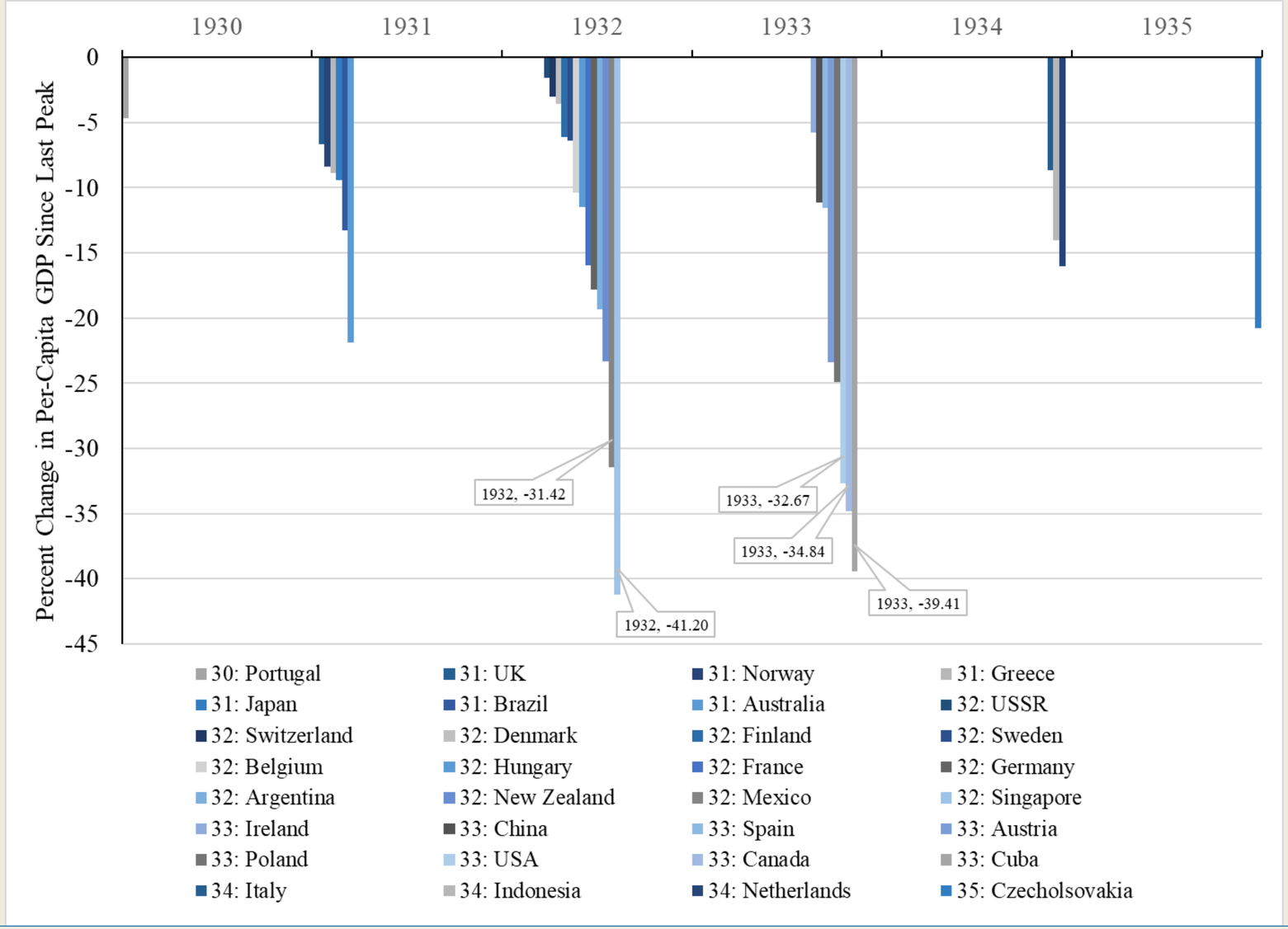
30% Drop in GDP



20p.p. Increase in Unemployment Rate



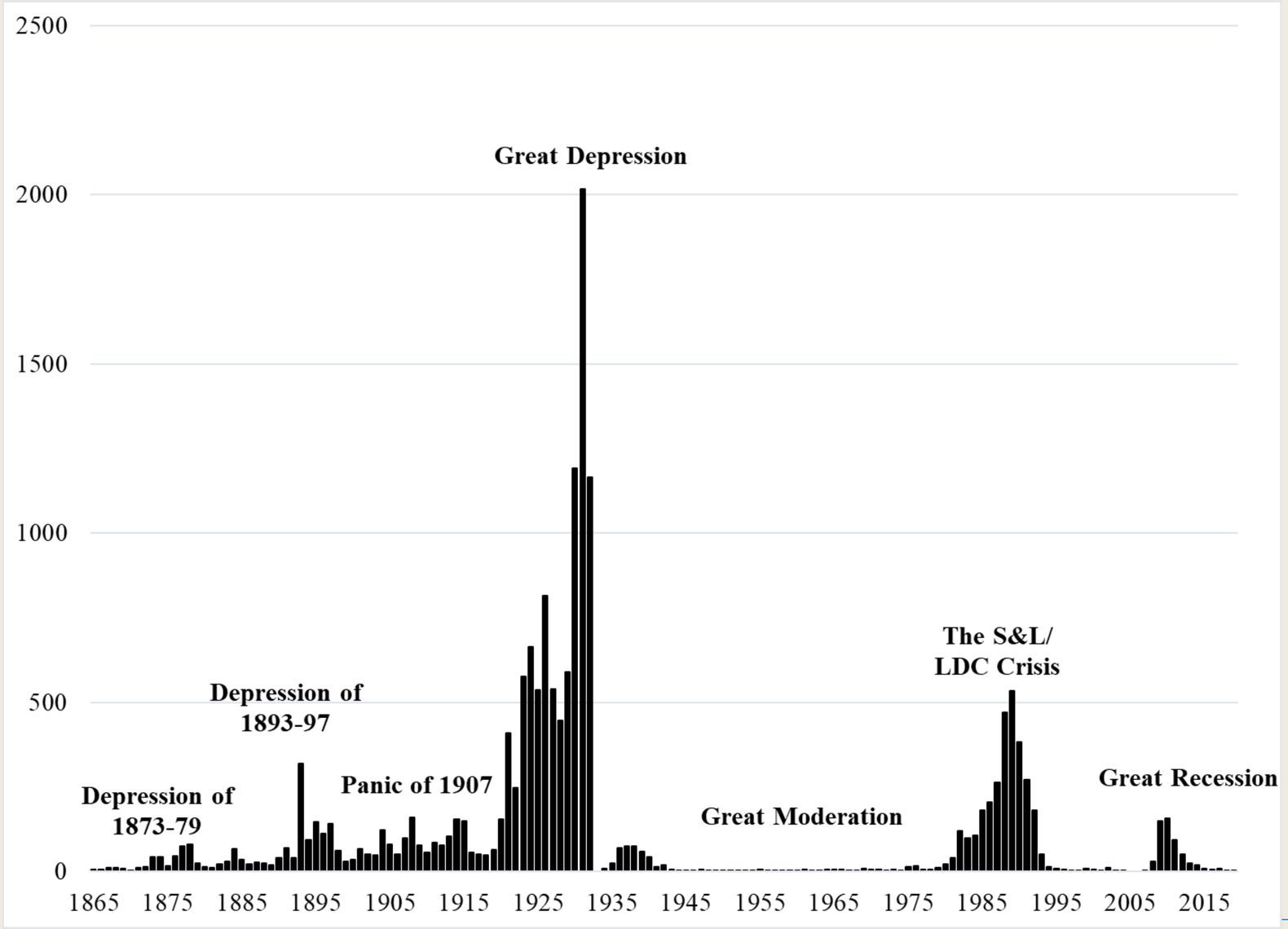
Turned into Global Crisis



…But Spurred Macroeconomics Research

- The quest to understand the Great Depression spurred macroeconomics research
  - to understand its roots, its depth, and its duration
- Keynseain macroeconomics grew out of the Great Depression
  - Keynes (1936): “drops in aggregate demand” cause recessions
- But what was so special about the Great Depression?

Number of Bank Failures



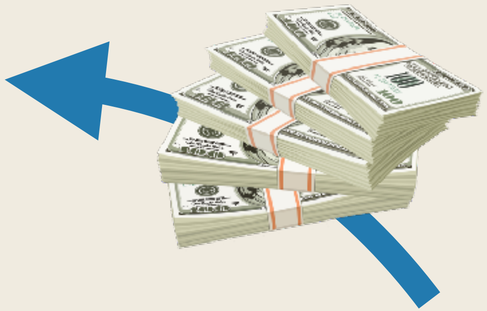
- Nearly half of banks failed

What Do Banks Do?

Investor

Banks

Loans	Deposit
	Net Worth



Saver

Cause or Consequence?

- Two views on bank failures:
  1. Bank failures are a ***consequence*** of the Great Depression
  2. Bank failures are the ***cause*** of the Great Depression

- The first view was dominant after the Great Depression

- In his 1983 paper, Bernanke brought a new perspective and argued for 2
  - His argument was based on time-series regression
  - At most suggestive given the current empirical standards

Bernanke (1983)

(3) $$Y_t = \underset{(9.86)}{.613}\ Y_{t-1} - \underset{(-2.63)}{.159}\ Y_{t-2} + \underset{(2.92)}{.332}\ (M-M^e)_t + \underset{(0.99)}{.113}\ (M-M^e)_{t-1} + \underset{(0.96)}{.110}\ (M-M^e)_{t-2}$$

$$+ \underset{(1.38)}{.156}\ (M-M^e)_{t-3} - \underset{(-4.24)}{.869E-04}\ DBANKS_t - \underset{(-1.93)}{.406E-04}\ DBANKS_{t-1}$$

$$- \underset{(-1.95)}{.258E-03}\ DFAILS_t - \underset{(-2.47)}{.325E-03}\ DFAILS_{t-1}$$

$s.e. = .0249 \quad D.W. = 1.99$ Sample: 1/21–12/41

(4) $$Y_t = \underset{(9.76)}{.615}\ Y_{t-1} - \underset{(-2.13)}{.131}\ Y_{t-2} + \underset{(3.99)}{.455}\ (P-P^e)_t + \underset{(1.97)}{.231}\ (P-P^e)_{t-1} - \underset{(-0.03)}{.004}\ (P-P^e)_{t-2}$$

$$+ \underset{(0.22)}{.024}\ (P-P^e)_{t-3} - \underset{(-4.03)}{.799E-04}\ DBANKS_t - \underset{(-1.66)}{.337E-04}\ DBANKS_{t-1}$$

$$- \underset{(-1.52)}{.202E-03}\ DFAILS_t - \underset{(-1.83)}{.242E-03}\ DFAILS_{t-1}$$

$s.e. = .0246 \quad D.W. = 1.98$ Sample: 1/21–2/41

Notes: Y_t = rate of growth of industrial production (*Federal Reserve Bulletin*), relative to exponential trend.
$(M-M^e)_t$ = rate of growth of $M1$, nominal and seasonally adjusted (Friedman and Schwartz, Table 4-1), less predicted rate of growth.
$(P-P^e)_t$ = rate of growth of wholesale price index (*Federal Reserve Bulletin*), less predicted rate of growth.
$DBANKS_t$ = first difference of deposits of failing banks (deflated by wholesale price index).
$DFAILS_t$ = first difference of liabilities of failing businesses (deflated by wholesale price index).
Data are monthly; *t*-statistics are shown in parentheses.

The Great Recession (2007-2009)

Sub-Prime Loans

High-risk Borrowers

- High-risk borrowers want to buy a house
- Too risky to lend

Banks

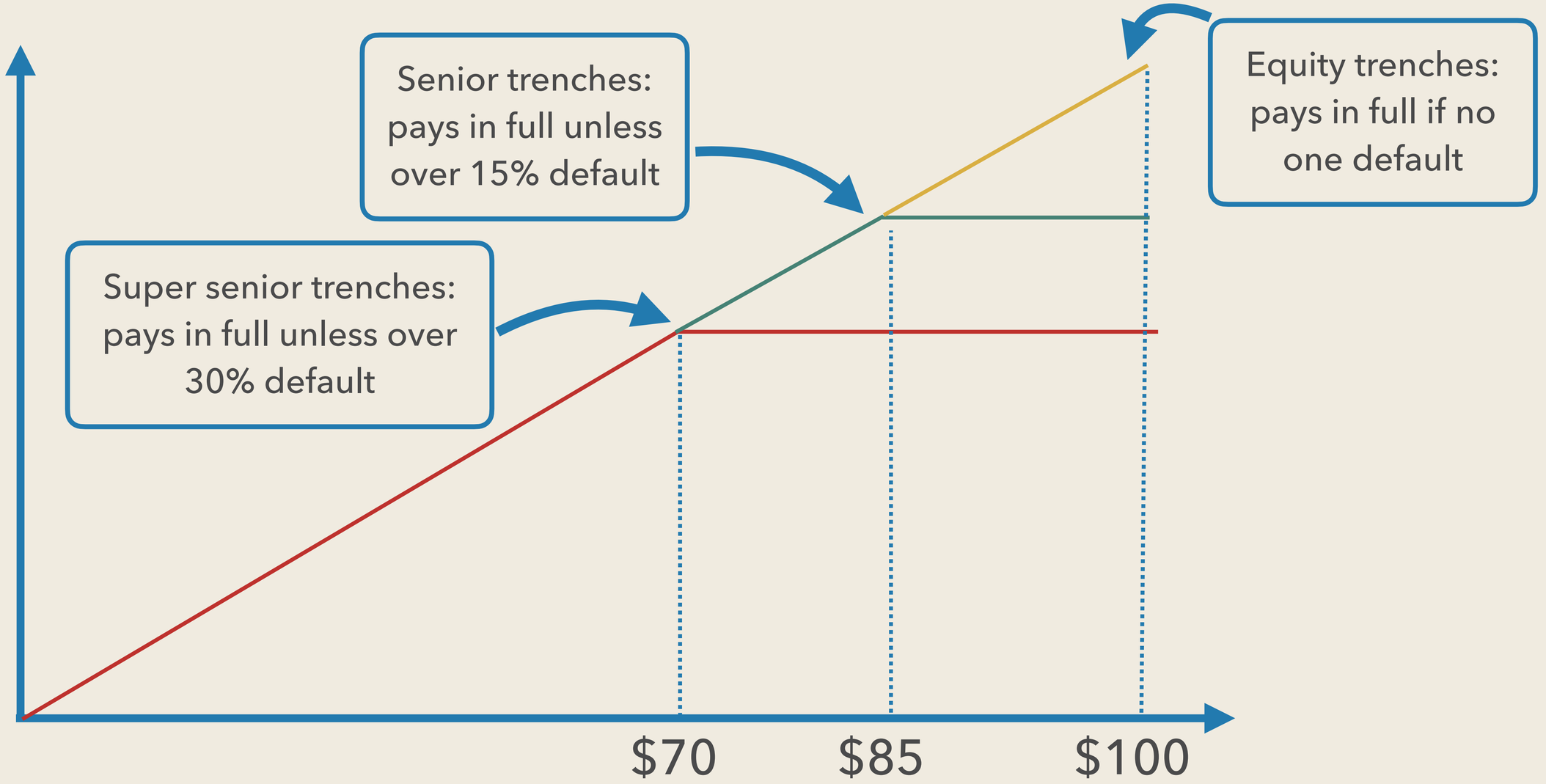
Loans	Deposit
	Net Worth

Saver

Securitization

- Financial innovation in 2000s seemed to allow banks to offload risks
- A typical example is collateralized debt obligations (CDOs)
- Two steps:
  1. Pool underlying securities (mortgages, corporate loans, etc)
  2. Sell claims to parts of the cash flows on the pool (“trenches”)
- Example:
  - Consider loans with a promise to pay $100 without default but $0 when default
  - Construct equally weighted portfolios of many such bonds
  - Cut into “trenches” by seniority

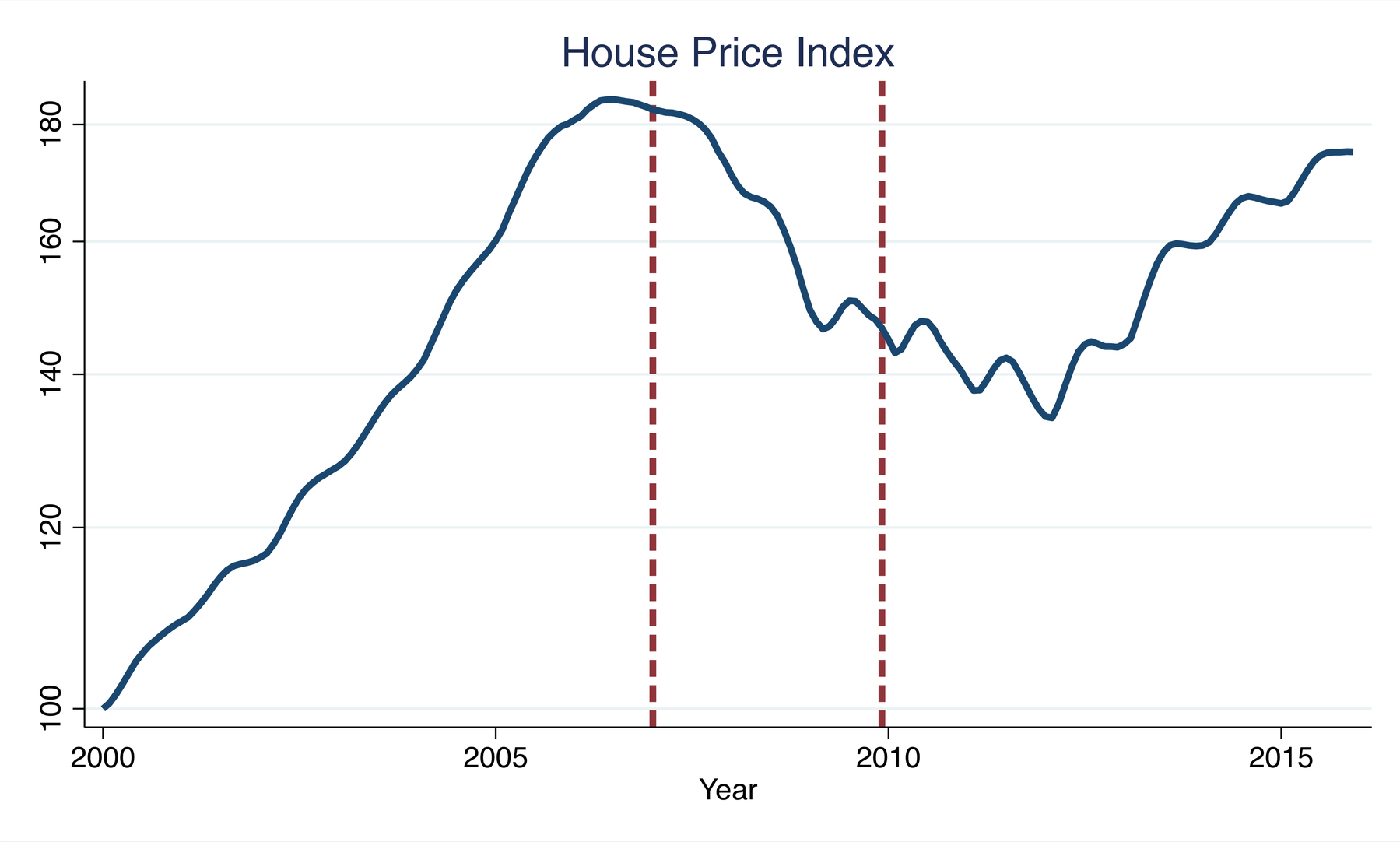
Structure of CDO



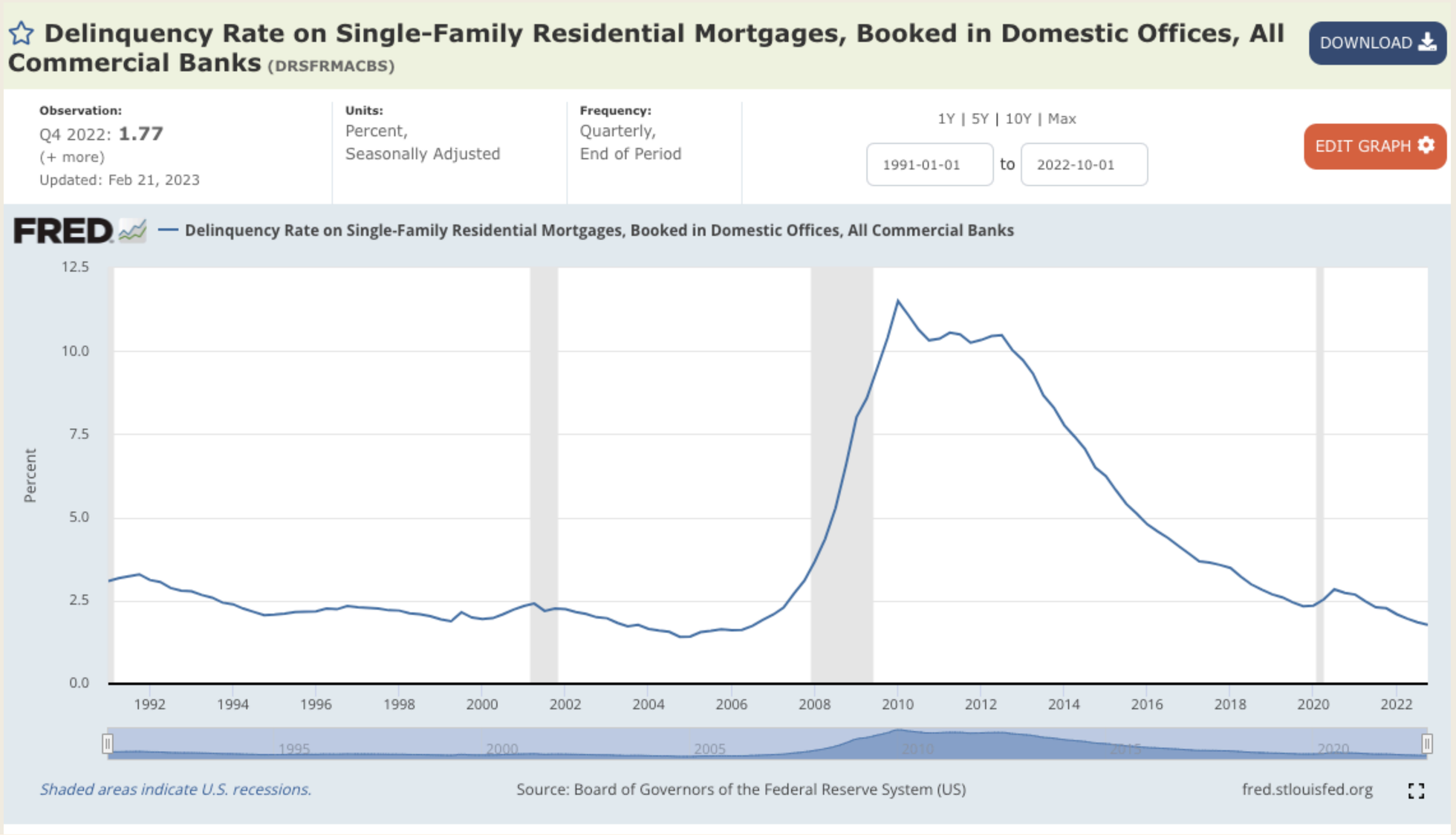
“Originate and Distribute”

- CDO created a seemingly “safe asset” though none of the loans is safe
  - Historical mortgage default rates were low
  - Past downturns in housing prices were primarily regional phenomena
- Credit rating agencies rated “super senior trenches” as AAA
- Banks hold “super senior trenches” and sell the remainings to hedge funds
- Happy ending?

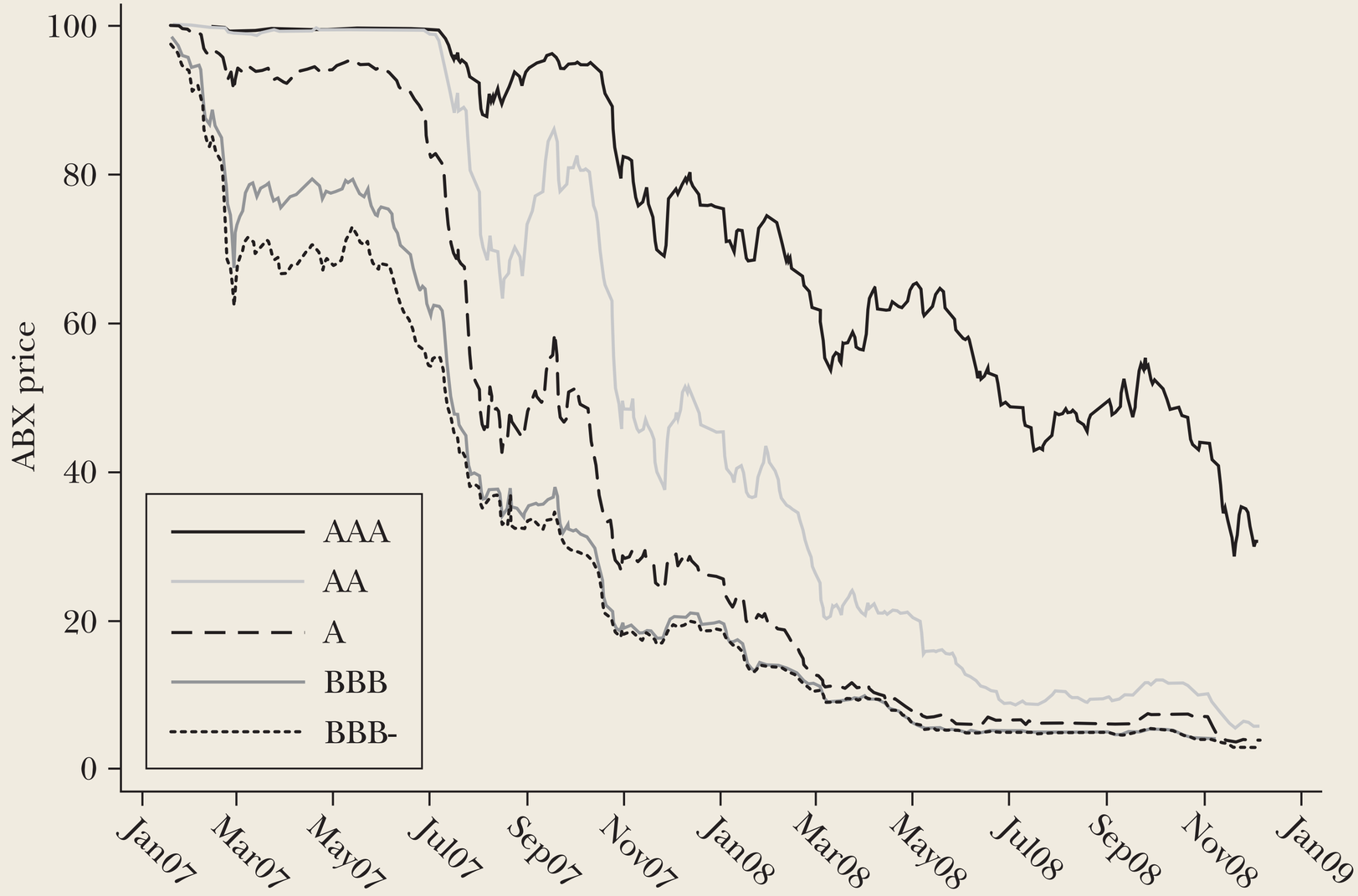
House Price Started to Decline…



Mortgage Default Rates Spiked Up



Mortgage Credit Default Swap Indices



Then Banks Failed

THE WALL STREET JOURNAL.

DOWJONES

MONDAY, SEPTEMBER 15, 2008 · VOL. CCLII NO. 64

★★★★ $2.00

Last week: DJIA 11421.99 ▲201.03 1.8% NASDAQ 2261.27 ▲0.2% NIKKEI 12214.76 unch. DJ STOXX 50 2858.68 ▲3.8% 10-YR TREASURY ▼20/32, yield 3.730% OIL $101.18 ▼$5.05 EURO $1.4217 YEN 107.87

LEHMAN BROTHERS

▼94.4% YEAR-TO-DATE

Friday's close: $3.65

Merrill Lynch

▼68.2% YEAR-TO-DATE

Friday's close: $17.05

AIG

▼79.2% YEAR-TO-DATE

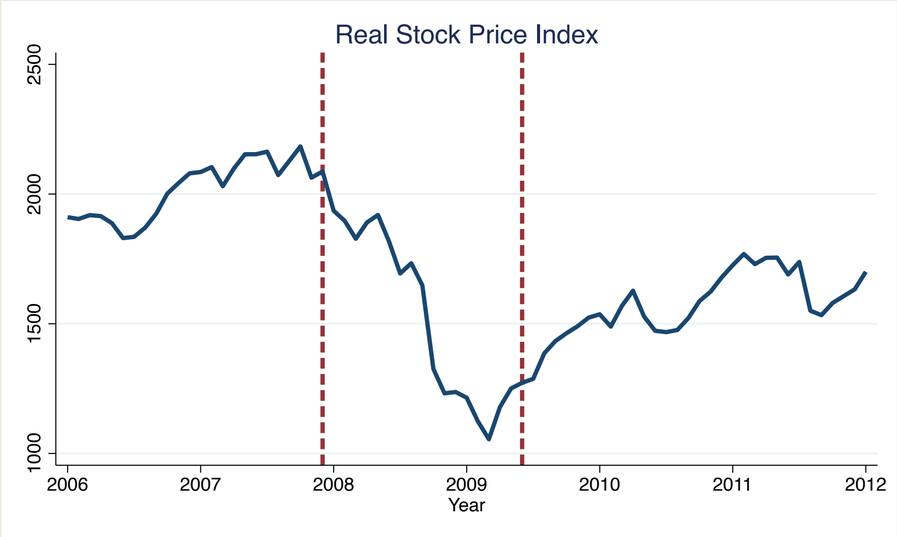
Friday's close: $12.14

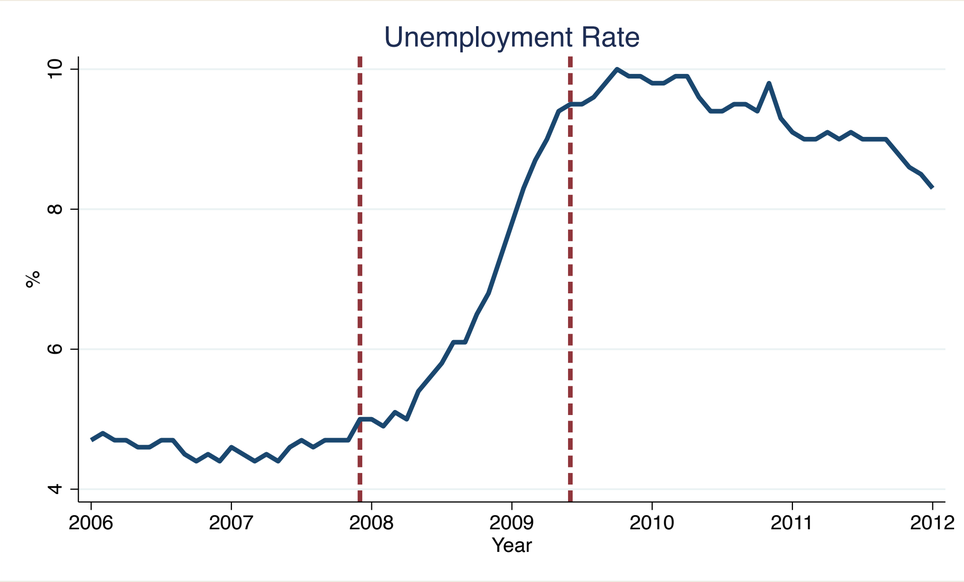
Source: WSJ Market Data Group

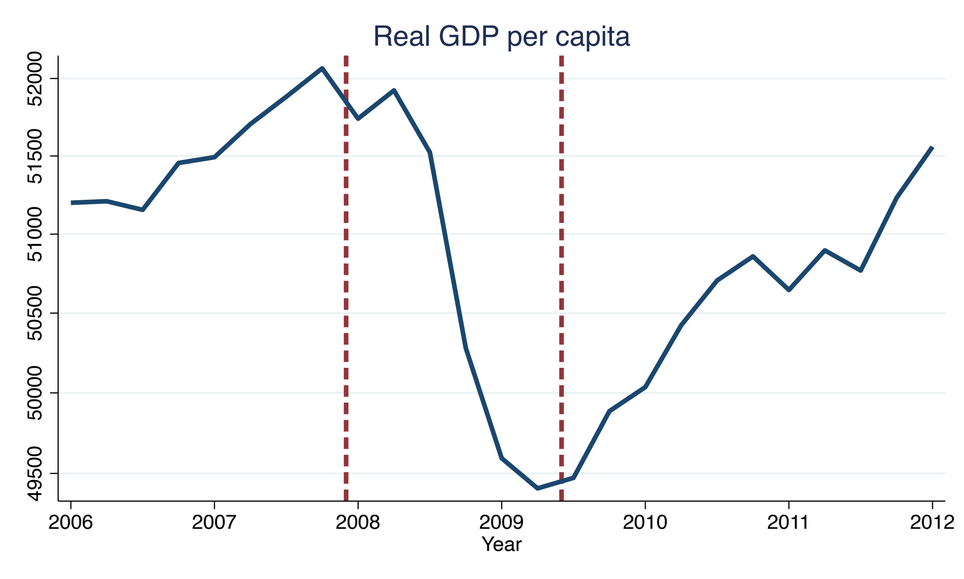
Crisis on Wall Street as Lehman Totters, Merrill Is Sold, AIG Seeks to Raise Cash

Fed Will Expand Its Lending Arsenal in a Bid to Calm Markets; Moves Cap a Momentous Weekend for American Finance

History Repeats Itself







Does the health of banks on Wall Street affect economic outcomes on Main Street?

– Firm-level Evidene (Chodorow-Reich, 2014)

Revisit Bernanke (1983)

- Bernanke (1983) ran

$$\Delta Y_t = \alpha + \beta \times \Delta(\text{Bank Health})_t + \gamma' \mathbf{X}_t + \epsilon_t$$

  - β can be hardly interpreted as the causal effect of bank health on Y
  - Many factors affect both bank health and Y, i.e., $\mathbb{E}[(\text{Bank Health})_t \times \epsilon_t] \neq 0$

- Chodorow-Reich (2014) revisits Bernanke (1983) with micro data

$$\Delta Y_i = \beta \times \Delta(\text{Bank Health})_i + \gamma' \mathbf{X}_i + \epsilon_i$$

  - Y_i: outcome at firm i
  - (Bank Haalth)$_i$: health of banks that firm i had a relationship with
  - No use of time-series variation
  - In the context of 2008-09 crisis

Key Idea

- Firm 1 & 2 had pre-existing relationship with Credit Suisse & U.S. Bankcorp, respectively
- Credit Suisse suffered large losses from MBS, while U.S. Bankcorp didn't
- Ask: How did firm 1 perform during 2008-09 **relative to firm 2**?
- **Identifying assumption**: firm 1 and 2 behaved similarly without Credit-Suisse suffering … conditional on controls

Empirical Implementation

$$\Delta Y_i = \beta \times \Delta(\text{Bank Health})_i + \gamma' \mathbf{X}_i + \epsilon_i$$

- Syndicated loan market ($\geq 50\,\%$ of commercial and industrial lending in the US)
- Lender-borrower relationship data from Dealscan database
- Firm-level employment data from BLS LBD
- Bank health is measured as the total lending to firms other than i

Lender's Health ↓ ⇒ Less Loan

$$\text{Prob(obtain new loan)}_i = \alpha_t + \beta \times \Delta(\text{Bank Health})_{it} + \gamma' \mathbf{X}_{it} + \epsilon_{it}$$

THE EFFECT OF BANK HEALTH ON THE LIKELIHOOD OF OBTAINING A LOAN

	(1)	(2)	(3)	(4)	(5)	(6)
	Firm obtains a new loan or positive modification					
	Probit		$\Delta\tilde{L}_{i,s}$ instrumented using			
			Lehman exposure	ABX exposure	Bank statement items	All
Explanatory variables						
%Δ loans to other firms ($\Delta\tilde{L}_{i,s}$)	2.19**	2.00**	3.65**	2.33*	2.28**	2.32**
	(0.79)	(0.53)	(1.28)	(1.12)	(0.64)	(0.63)
2-digit SIC, state, loan year FE	No	Yes	Yes	Yes	Yes	Yes
Bond access/public/private FE	No	Yes	Yes	Yes	Yes	Yes
Additional Dealscan controls	No	Yes	Yes	Yes	Yes	Yes
First stage *F*-statistic			14.0	8.2	18.2	19.8
J-statistic *p*-value			.	.	.	0.206
$E[borrow]$	0.134	0.134	0.134	0.134	0.134	0.134
$E[\widehat{borrow}:\Delta\tilde{L}_{p90} - \Delta\tilde{L}_{p10}]$	0.052	0.048	0.087	0.055	0.054	0.055
Lead lender 1 clusters	43	43	43	40	43	40
Lead lender 2 clusters	43	43	43	40	43	40
Observations	4,391	4,391	4,391	4,354	4,391	4,354

- One std. reduction in lender's health

  → 2 p.p. reduction in the probability of accessing a new loan (20% reduction)

Lender's Health ↓ ⇒ Lower Employment

THE EFFECT OF LENDER CREDIT SUPPLY ON EMPLOYMENT

	(1)	(2)	(3)	(4)	(5)	(6)
	Employment growth rate 2008:3–2009:3					
	OLS		$\Delta\tilde{L}_{i,s}$ instrumented using			
			Lehman exposure	ABX exposure	Bank statement items	All
Explanatory variables						
%Δ loans to other firms ($\Delta\tilde{L}_{i,s}$)	1.17*	1.67**	2.49*	3.17*	2.13*	2.38**
	(0.58)	(0.61)	(1.00)	(1.35)	(0.88)	(0.77)
Lagged employment growth		0.0033	0.0039	0.0045	0.0036	0.0039
		(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Emp. change in firm's county		0.89*	0.85+	0.86+	0.87+	0.89+
		(0.43)	(0.46)	(0.48)	(0.45)	(0.46)
2-digit SIC, state, loan year FE	No	Yes	Yes	Yes	Yes	Yes
Firm size bin FE	No	Yes	Yes	Yes	Yes	Yes
Firm age bin FE	No	Yes	Yes	Yes	Yes	Yes
Bond access/public/private FE	No	Yes	Yes	Yes	Yes	Yes
Additional Dealscan controls	No	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic			15.5	8.5	18.5	23.1
J-statistic p-value			.	.	.	0.190
$E[g_j^y]$	−0.092	−0.092	−0.092	−0.093	−0.092	−0.093
$E[\hat{g}_j^y : \Delta\tilde{L}_{p90} - \Delta\tilde{L}_{p10}]$	0.027	0.039	0.058	0.074	0.050	0.055
Lead lender 1 clusters	43	43	43	40	43	40
Lead lender 2 clusters	43	43	43	40	43	40
Observations	2,040	2,040	2,040	2,015	2,040	2,015

- One std. reduction in lender's health →1.2 p.p. reduction in the employment growth

Larger Effect on Small Firms without Bond Market Access

The Effect of Lender Credit Supply on Employment with Heterogeneous Treatment Effects

	(1)	(2)	(3)
	Employment growth rate 2008:3–2009:3		
Explanatory variables			
$\Delta\tilde{L}_{i,s}$ * Large	0.54		
	(0.97)		
$\Delta\tilde{L}_{i,s}$ * Medium	1.84+		
	(0.97)		
$\Delta\tilde{L}_{i,s}$ * Small	2.16**		
	(0.79)		
$\Delta\tilde{L}_{i,s}$ * Bond market access		1.04	
		(1.00)	
$\Delta\tilde{L}_{i,s}$ * No access		2.01**	
		(0.60)	
$\Delta\tilde{L}_{i,s}$ * Bond access & large			0.23
			(1.15)
$\Delta\tilde{L}_{i,s}$ * Bond access & small/medium			1.47
			(1.06)
$\Delta\tilde{L}_{i,s}$ * No access & large			0.79
			(1.21)
$\Delta\tilde{L}_{i,s}$ * No access & small/medium			2.26**
			(0.58)
Lagged employment growth	Yes	Yes	Yes
Emp. change in firm's county	Yes	Yes	Yes
2-digit SIC, state, loan year FE	Yes	Yes	Yes
Firm size and age bin FE	Yes	Yes	Yes
Bond access/public/private FE	Yes	Yes	Yes
Additional Dealscan controls	Yes	Yes	Yes
Observations (Access & large)	483	483	483
Observations (Access & small/medium)	434	434	434
Observations (No access & large)	315	315	315
Observations (No access & small/medium)	808	808	808
Observations	2,040	2,040	2,040

Placebo: No Pre-trend

THE EFFECT OF LENDER CREDIT SUPPLY ON EMPLOYMENT IN TWO PLACEBO PERIODS

	(1)	(2)	(3)	(4)	(5)
	Employment growth rate				
	OLS	$\Delta\tilde{L}_{i,s}$ instrumented using			
		Lehman exposure	ABX exposure	Bank statement items	All
	Panel A: 2005:2–2007:2				
Explanatory variables					
%Δ loans to other firms ($\Delta\tilde{L}_{i,s}$)	−0.19	−0.67	−1.57	1.63	0.92
	(0.74)	(1.63)	(1.72)	(1.24)	(1.15)
Lagged employment growth	0.028+	0.027+	0.028+	0.028+	0.028+
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
Emp. change in firm's county	0.80	0.80	0.78	0.79	0.77
	(0.49)	(0.49)	(0.50)	(0.48)	(0.49)
First-stage *F*-statistic		15.6	8.8	18.9	23.8
Observations	1,879	1,879	1,854	1,879	1,854

Micro vs. Macro

- One standard deviation reduction in the health of the main bank leads to…
  1. 2 p.p. reduction in the probability of accessing a new loan (20% reduction)
  2. 1.2 p.p. reduction in the employment growth
- Credible evidence that bank health *does* matter at the firm level
- Does this imply bank health matters at the aggregate level?
  – Not necessarily because of equilibrium spillovers

|Micro| > |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

|Micro| > |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

|Micro| < |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

Unemployed

|Micro| < |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

Unemployed

|Micro| < |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

Unemployed

|Micro| < |Macro|

CREDIT SUISSE

Firm 1

usbank

Firm 2

Unemployed

PE Aggregation

- Ignore all these spillover effects and extrapolate the estimates to macro
- 35-50% of the agg. employment decline during 08-09 due to bank health

Does the health of banks on Wall Street affect economic outcomes on Main Street?

– County-level Evidence (Huber, 2018)

Big Picture Idea

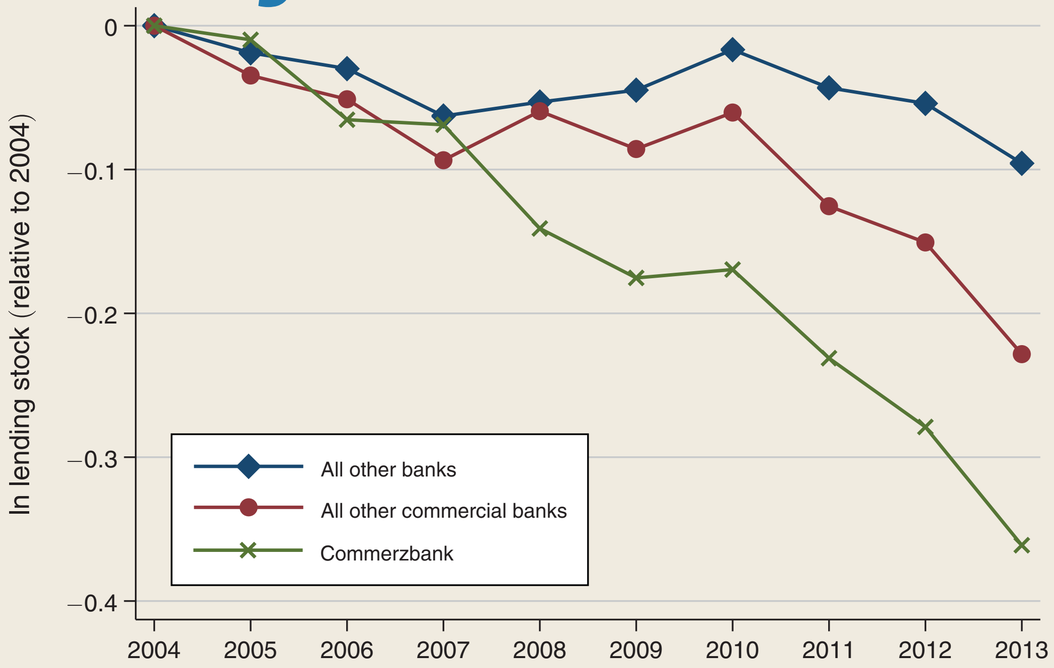
- Huber (2018):
  How did a **region** more exposed to Δ(Bank Health) perform relative to those less?
- county-level regression

$$\Delta Y_c = \beta \times \Delta\overline{(\text{Bank Health})}_c + \gamma' \mathbf{X}_c + \epsilon_c$$

  - $\overline{(\text{Bank Health})}_c$: average lender's health for firms with head office in county c

- β not only captures direct effects but also the within-county indirect effects

Big Bank Nearly Failed in Germany 08-09



- Commerzbank suffered large losses on its international trading book during 08-09
- Losses unrelated to domestic loans in Germany but had to cut loan supply
- How did Commerzbank's bank health transmit to the German economy?
- Compare regions with lots of pre-existing relationships to those with few

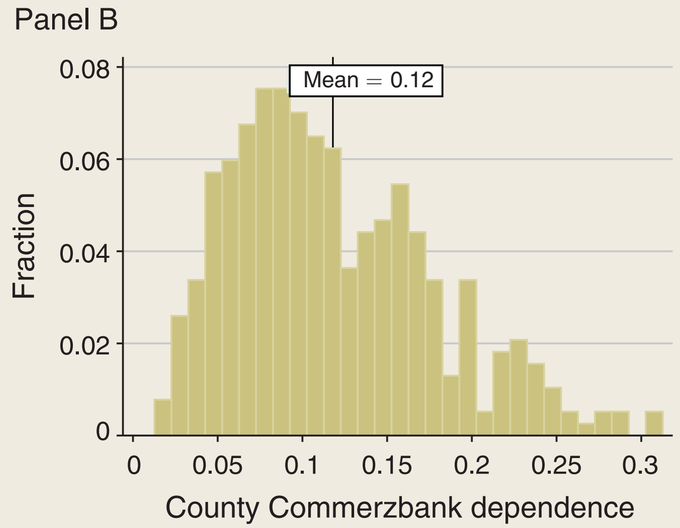
Dependence on Commerzbank

- Firm f in county c's dependence on Commerzbank in 2006:

$$CB\ dep_{fc} = \frac{number\ of\ relationship\ banks\ that\ are\ Commerzbank\ branches_{fc}}{total\ number\ of\ relationship\ banks_{fc}}.$$

- County c's dependence on Commerzbank:

$$\overline{CB\ dep}_c \equiv \frac{1}{F}\sum_f (CB\ dep_{fc})$$



GDP

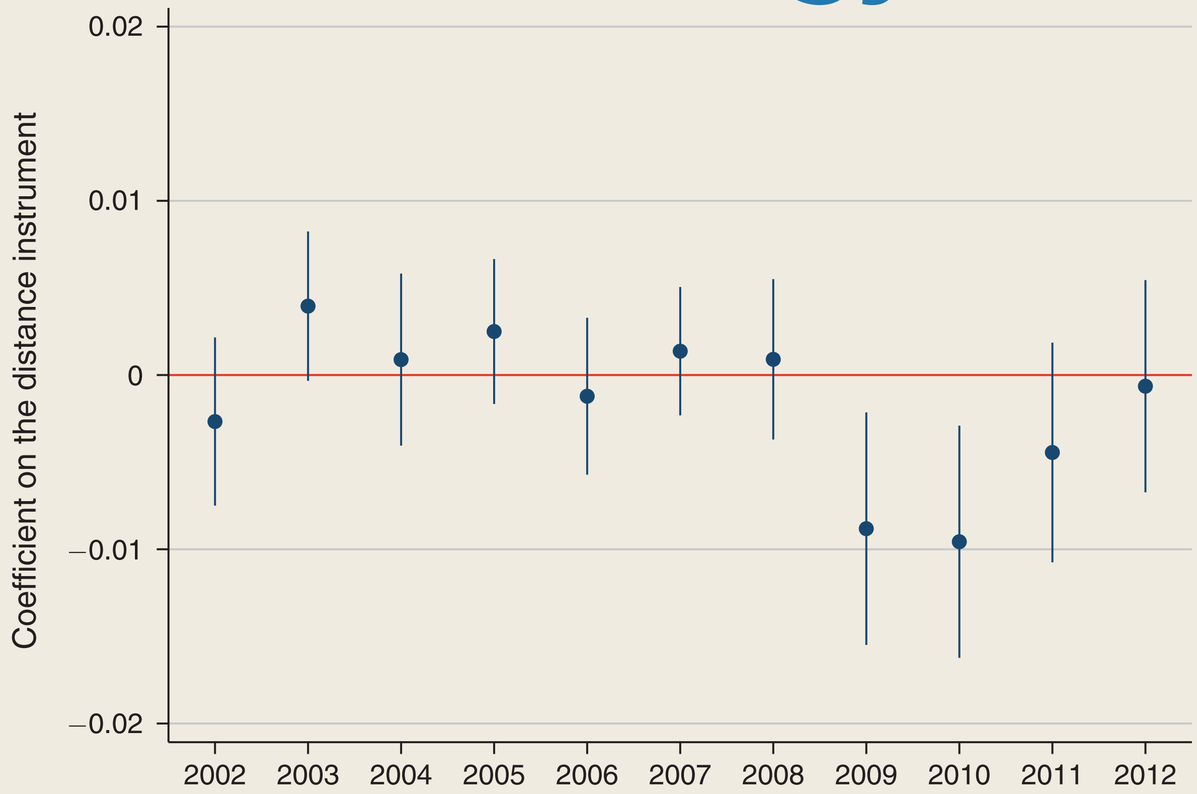
$$\Delta y_c = \beta \overline{CB\ dep}_c + \gamma' \mathbf{X}_c + \epsilon_c$$

TABLE 8—COUNTY OUTCOMES AND COMMERZBANK DEPENDENCE (OLS)

Outcome:	GDP (1)	GDP (2)	GDP (3)	Empl. (4)	Net migr. (5)
County *CB dep* × *d*	−0.132	−0.165	−0.141	−0.138	0.003
	(0.063)	(0.066)	(0.077)	(0.042)	(0.006)
Observations	5,005	5,005	5,005	5,005	1,925
R^2	0.301	0.341	0.350	0.494	0.592
Number of counties	385	385	385	385	385
County fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Former GDR fixed effects × *d*	No	Yes	Yes	Yes	Yes
Industry shares × *d*	No	Yes	Yes	Yes	Yes
Export and import shares × *d*	No	Yes	Yes	Yes	Yes
Landesbank in crisis × *d*	No	Yes	Yes	Yes	Yes
Population × *d*	No	No	Yes	No	No
Population density × *d*	No	No	Yes	No	No
GDP per capita × *d*	No	No	Yes	No	No
Debt index × *d*	No	No	Yes	No	No
Estimator	OLS	OLS	OLS	OLS	OLS

- A standard deviation increase in *CB dep* ⇒ 1% lower GDP

IV Strategy



- Identification concern: counties with high $CB\ dep$ hit by unobserved shocks
- IV: distance to temporary head offices in Düsseldorf, Frankfurt, and Hamburg
- Counties close to these cities suffer more only in 09-10

Direct vs. Indirect Effect

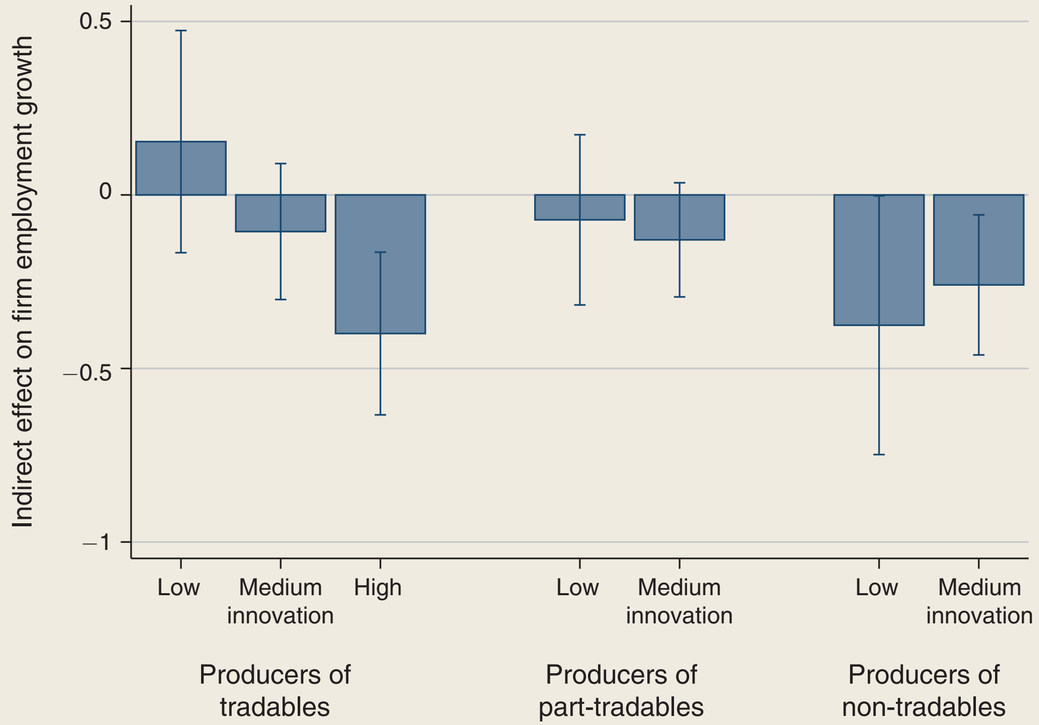
$$employment\ growth_{fc} = \zeta + \beta CB\ dep_{fc} + \sigma \overline{CB\ dep_{fc}} + \Gamma' X_{fc} + \xi_{fc}.$$

TABLE 10—THE DIRECT AND INDIRECT EFFECTS ON FIRM EMPLOYMENT GROWTH

	(1)	(2)
Firm *CB dep*	−0.030	−0.036
	(0.009)	(0.009)
CB dep of other firms in county	−0.166	−0.170
	(0.076)	(0.082)
Observations	48,101	48,101
R^2	0.012	0.017
Firm controls	Yes	Yes
County controls	No	Yes

- Direct effect: A firm fully dependent on Commerzbank cut 3.6 p.p. employment
- Would have cut 4.6 p.p. if operating in one standard deviation higher $\overline{CB\ dep}_c$

What Drives Indirect Effect?



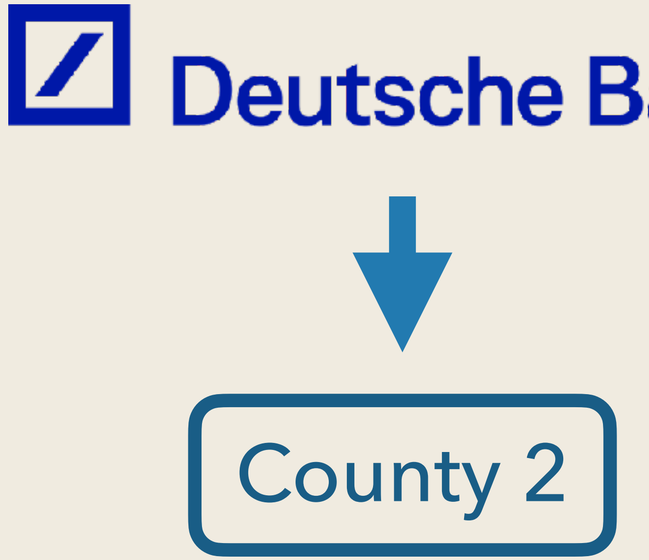
- Indirect effects are particularly large in
  - high-innovation tradable sector (agglomeration matters more!)
  - non-tradable sector (local agg. demand matters more!)
- Suggestive that agg. demand and agglomeration important channels

Firms Reduce R&D after Lending Cut

Outcome:	Growth rate of patents	Patents post lending cut	Patents pre lending cut
	(1)	(2)	(3)
Patenting × firm *CB dep*	−0.548	−0.770	0.206
	(0.245)	(0.409)	(0.409)
Non-patenting × firm *CB dep*	0.037		
	(0.065)		
ln patents, 1990–2004		0.671	0.687
		(0.088)	(0.116)
Observations	2,011	382	382
R^2	0.251		
ln age	Yes	Yes	Yes
Size bin fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
County fixed effects	Yes	No	No
State fixed effects	No	Yes	Yes
Import and export share	Yes	Yes	Yes
Only patenting firms in sample	No	Yes	Yes
Estimator	OLS	Neg bin	Neg bin

- This might explain why financial crises have a persistent effect

So, Do We Know Macro Effect of Bank Health?



- In the end, did we estimate the macro (aggregate) impact of bank health?
- Suppose counties don't interact with each other at all, then perhaps yes
- In reality, counties trade goods and assets, and people migrate
  ⇒ A county is exposed to Commerzbank's loss even if $\overline{CB\ dep}_c = 0$
- "Missing intercept" or "violation of SUVTA"

Taking Stock

A common critique of estimates based on cross-sectional identification in macroeconomics is that they don't answer the right question. While it is true that these estimates don't directly provide estimates of aggregate responses, they often provide a great deal of indirect evidence by helping researchers discriminate between different theoretical views of how the world works.... This "piecemeal" form of inference will, therefore, result in partial identification on the model space.

— Nakamura and Steinsson (2018) "Identification in Macroeconomics"