Business Complexity and Risk Management:

Evidence from Operational Risk Events in U.S. Bank Holding Companies

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- Timing of origin of OpRisk events is well identified. We know *when risk is taken*.
- Is a direct measure of materialized failures in risk management.
- In contrast:
  - Balance-sheet measures (e.g., ROA, Z-score) capture risk *after* it's realized, not when it's taken.
  - Market-based measures (e.g., bond yields, stock returns, MTB): asymmetric information; implicit government guarantees.

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- **Main finding: Business complexity is a key driver of operational risk.**

Regulators should consider OpRisk more carefully in designing stress tests for large & complex BHCs.

Operational risk event types: examples

(BIS 2008 LDCE freq.%, sev.%)

1. **Internal fraud** (# 4.2%, $ 6.1%)
   - 2010: Fidelity Nat'l Fin'l fined $5.7mln for $30 mln mortgage fraud scam
2. **External fraud** (# 26.3%, $ 8.0%)
   - 2002: Allied Irish Bank sues BoA and Citibank for providing John Rusnak with $200 mln through prime brokerage accounts that resulted in unauthorized trading
3. **Clients, products, and business practices** (# 18.2%, $ 52.4%)
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4. **Execution, delivery, and process management** (# 30.6%, $ 24.9%)
   - 2005: BoA $1.5 mln settlement, failing to ensure proper storage of employee emails in its brokerage business

Related to complexity

Key contributory factors:

"managerial action / inaction" and "lack of internal control"

5. **Employment practices and workplace safety** (# 17.5%, $ 6.0%)
   - 2000: AIG $235 mln discrimination
6. **Damage to physical assets** (# 1.2%, $ 1.4%)
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Unrelated to complexity → exclude from our analysis

Motivation

Basel II Capital Accord

Mandatory regulatory capital charge for OpRisk. Scope of application: all BHCs with consolidated assets of ≥$250 bln, or total foreign exposure of ≥$10 bln. Advanced Measurement Approach (AMA) based on internal models.

- ✶ Since 2010 (Dodd-Frank), OpRisk is part of stress testing requirements under CCAR.

Motivation

Systemically Important Financial Institutions (SIFI)

"The failure of large, complex, and interconnected financial firms can disrupt the broader financial system and the overall economy, and such firms should be regulated with that fact in mind." Ben S. Bernanke, June 2010

Recent regulations of SIFI

BIS, FRB: U.S. bank holding companies identified as global *systemically important* bank holding companies (GSIB) must hold a risk-based capital surcharge.

Goal: Increase resilience, reduce likelihood of failure.

The framework considers a GSIB's size, interconnectedness, cross-jurisdictional activity, substitutability, and complexity.

Complexity and (de)regulations

"... The growth of [...] non-bank alternatives and the continuing attempts [of banks] to work around regulations [since the 1970s] has contributed to the growth of the far more complex financial system of today." (Gorton & Metrick 2013 NBER)

Regulatory background

- **1933: Glass-Steagall Act**

  Separates commercial banking and securities activities. Commercial banks are prohibited from being affiliated with any company that is “engaged principally“ in underwriting or dealing in securities.

- **1956: Bank Holding Company Act**

  Separates commercial banking from the insurance business.

- **1987: Fed allows Section 20 subsidiaries**

  Fed permits U.S. BHCs to establish investment banking subsidiaries that are allowed to underwrite and deal in certain “bank-ineligible securities“ (e.g., mortgage-related securities, municipal revenue bonds, commercial paper). Requires authorization from the Fed under *Section 20* of the GSA. Revenues from bank-ineligible securites are capped at 5% of Section 20 subsidiary‘s gross revenue.

- **1989: 5% cap raised to 10%**

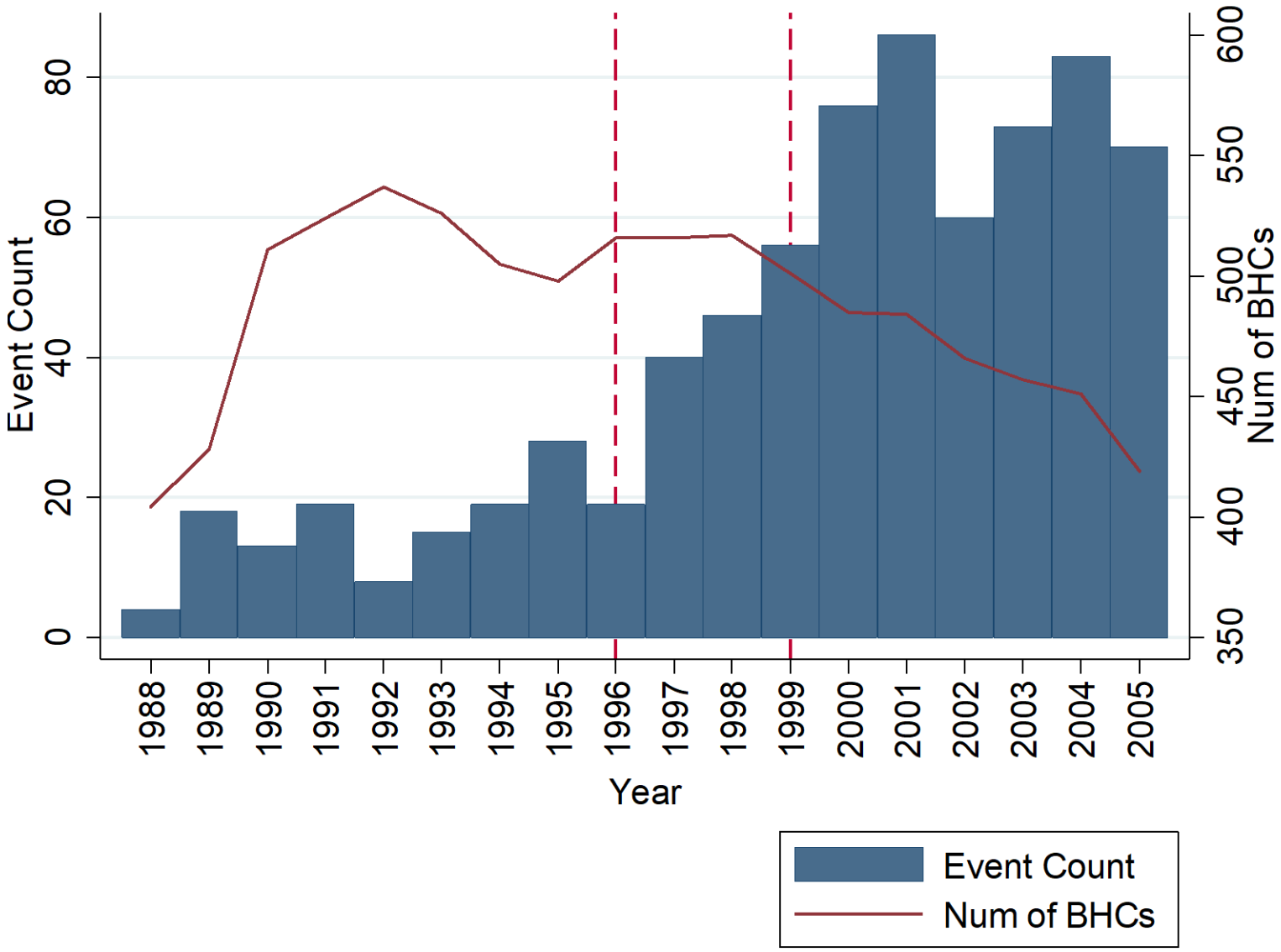
- **1996: 10% cap raised to 25%**

- **1999: Gramm-Leach-Bliley Act**

  Repeals GSA: Lifts 25% cap. Repeals parts of the Bank Holding Company Act.

  BHCs can engage in nonbank activities, incl. securites underwriting & dealing, insurance agency & underwriting activities, and merchant banking.

Motivation



Source:
our data

What we do

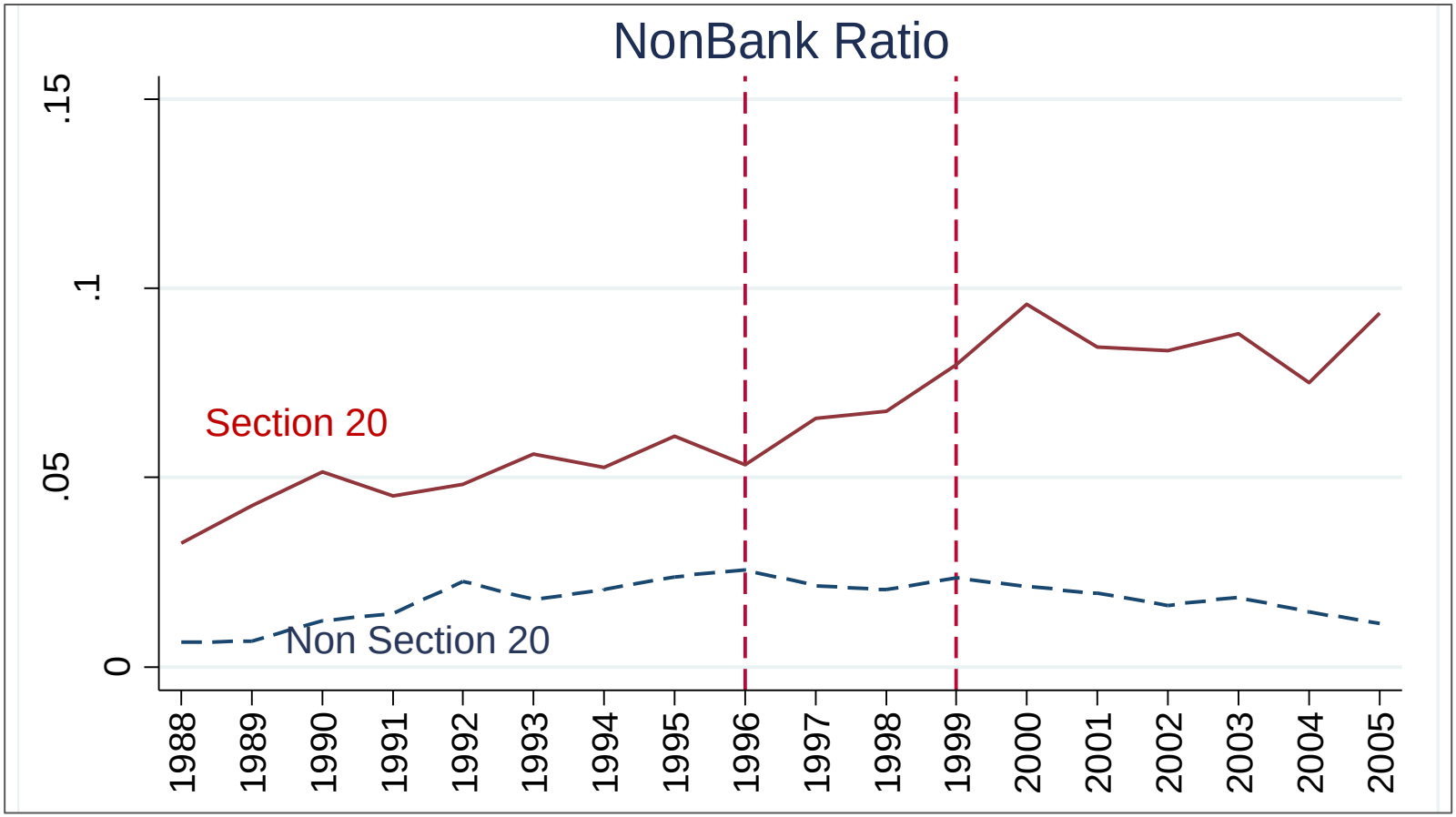
- **Deregulations expanded BHCs‘ activities into nonbank businesses**
- **How does complexity impact risk management?**

1. **Deregulations as a natural experiment**
   ⇨ Changes in complexity are *exogenous*

2. **Diversification into nonbank businesses is an indicator of complexity**
   Q: Which BHCs are more likely to take advantage of deregulations?
   A: Those BHCs that were more constrained by regulations = pre-diversified BHCs.
   Especially those BHCs that hold Section 20 subsidiary.
   } Treatment group
   ⇨ *Difference-in-difference* estimator

3. **Our proxy for risk = operational risk frequency & severity**

Effect of Deregulation on Nonbanking Activities for Treatment and Control Groups



$$\text{NonBank Ratio} = \frac{\text{Assets from nonbank subsidiaries}}{\text{Total assets}}$$

Hypotheses

Hypothesis 1

Following the deregulations from the end of 1996 to the end of 1999, BHCs that were diversified prior to 1996 (pre-diversified) observed a greater increase in their operational risk than BHCs that were not pre-diversified.

Pre-diversified BHCs are bound by regulations & have stronger motivation to expand into nonbank activities.

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Hypothesis 2

increase in op risk post-deregulation is more pronounced for pre-diversified BHCs that owned Section 20 subsidiaries prior to the repeal of the GSA than for other BHCs, including pre-diversified BHCs with other types of subsidiaries and BHCs that were not pre-diversified.

Some nonbank subsidiaries are in savings bank and thrift, that are *not* affected by 1996-1999 deregulations. Hence, not all pre-diversified BHCs are bound by regulations.

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Hypothesis 3: Managerial Failure vs Strategic Risk Taking

Market-based and balance-sheet-based performance measures for pre-diversified and Section20 BHCs did not improve relative to other BHCs. This is more consistent with managerial failure than with strategic risk taking.

Econometric framework

- **Difference-in-differences (DID)**

For each BHC i :

$$OpRisk_{it} = \alpha_i + \beta * AFTER_{it} + \gamma * AFTER_{it} \times PREDIVERSIFIED_i + \sum_{k=1}^{K} \delta_k * Control_{k,it} + \varepsilon_{it}$$

Oprisk = OpRisk # or $

After = 1 post-deregulation (2000-2002)

0 pre-deregulation (1994-1996)

PreDiversified = 1 if diversified prior to 1996

0 if not diversified

Control = lnTA, Cash/TA, Tier1, ROE, excessive growth in liab., high div. payout

α_i includes BHC fixed effects

Empirical results: Result #1

- **Dependent variable = OpRisk count**

1994-1996 vs 2000-2002

	(1)	(2)	(3)	(4)	(5)	(6)
After	0.010*	-0.125**	-0.224*			
	(1.950)	(-1.984)	(-1.871)			
After × Pre-Diversified	0.243***	0.243***	0.282**			
	(2.856)	(2.882)	(2.525)			
After × Pre-Diversified Sec20						
After × Pre-Diversified NonSec20						
Ln TA		0.171**	0.316**		0.184**	0.337***
		(2.143)	(2.190)		(2.490)	(2.614)
Market-To-Book			0.012			-0.057
			(0.234)			(-0.875)
Cash-To-TA			-0.082			-1.383
			(-0.086)			(-1.191)
Tier 1 Ratio			3.105**			2.694**
			(2.096)			(2.434)
ROE			-0.010			0.011
			(-0.775)			(0.861)
Excessive Growth			0.011			0.080
			(0.119)			(1.002)
High Dividend			-0.188			-0.141
			(-1.244)			(-1.071)
Constant	0.050***	-1.106**	-2.492**	0.050***	-1.194**	-2.561**
	(2.942)	(-1.999)	(-2.058)	(3.388)	(-2.340)	(-2.432)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Num Observations	694	694	412	694	694	412
R-squared	0.061	0.075	0.118	0.293	0.309	0.336

More complex BHCs (pre-diversified & bound by regulations) have a greater increase in the incidence of OpRisk

Similar findings for OpRisk severity

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After × Pre-Diversified	0.243***	0.243***	0.282**			
	(2.856)	(2.882)	(2.525)			
After × Pre-Diversified Sec20				1.527***	1.533***	1.569***
				(2.807)	(2.853)	(2.787)
After × Pre-Diversified NonSec20				0.051**	0.050**	0.061
				(2.151)	(2.140)	(1.555)
Ln TA					0.184**	0.337***
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Especially so for Section 20 subsidiary owners

Similar findings for OpRisk severity

Empirical results: Result #3

- **Dependent variables = balance-sheet performance & risk measures**

Market-to-book ratio

Some improvement, but temporary

ROA

St. dev. of ROA

Z-score

No significant change

Consistent with managerial failure rather than strategic risk taking.

1994-1996 vs 2000-2002

	Return on Assets		Standard Deviation of Return on Assets		*Z*-Score		Market-to-Book Ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
After	-0.050	-0.048	-0.005	-0.003	0.017	0.001	0.133	0.127
	(-1.194)	(-1.161)	(-0.258)	(-0.154)	(0.158)	(0.011)	(1.169)	(1.125)
After × Pre-Diversified	0.012		0.020		-0.016		0.228***	
	(0.404)		(1.353)		(-0.176)		(2.700)	
After × Pre-Diversified Sec20		-0.018		-0.015		0.223		0.324*
		(-0.324)		(-0.488)		(1.066)		(1.747)
After × Pre-Diversified NonSec20		0.018		0.027*		-0.062		0.210**
		(0.574)		(1.761)		(-0.666)		(2.366)
Ln TA	-0.027	-0.027	-0.022	-0.022	0.021	0.024	0.002	0.003
	(-0.							
Cash-To-TA	-0.							
	(-1.038)	(-0.961)	(-0.562)	(-0.405)	(-0.574)	(-0.757)	(0.501)	(0.401)
Tier 1 Ratio	2.257***	2.270***	0.859***	0.874***	1.990*	1.891*	-1.756	-1.796
	(3.821)	(3.830)	(2.966)	(3.033)	(1.950)	(1.905)	(-1.074)	(-1.089)
Excessive Growth	0.018	0.016	-0.068***	-0.071***	0.298**	0.314**	-0.006	-0.000
	(0.426)	(0.373)	(-2.935)	(-3.005)	(2.393)	(2.505)	(-0.057)	(-0.001)
High Dividend	0.190***	0.189***	0.073***	0.071***	-0.051	-0.036	0.237*	0.243*
	(3.756)	(3.667)	(3.330)	(3.220)	(-0.416)	(-0.303)	(1.944)	(1.954)
Constant	0.528	0.527	0.411**	0.409**	1.769***	1.780***	1.656*	1.660*
	(1.509)	(1.516)	(2.407)	(2.438)	(2.664)	(2.723)	(1.755)	(1.748)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num Observations	412	412	408	408	408	408	412	412
R-squared	0.245	0.247	0.252	0.260	0.060	0.074	0.186	0.188

No significant change

Some improvement

2000-2002 vs 2003-2005

	Return on Assets		Standard Deviation of Return on Assets		*Z*-Score		Market-to-Book Ratio	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
After	-0.064	-0.063	-0.005	-0.005	-0.152	-0.151	0.444***	0.445***
	(-1.529)	(-1.526)	(-0.278)	(-0.282)	(-0.892)	(-0.885)	(5.190)	(5.219)
After × Pre-Diversified	0.005		-0.013		0.091		-0.186**	
	(0.170)		(-0.995)		(0.858)		(-2.099)	
After × Pre-Diversified Sec20		-0.006		0.009		-0.239		-0.558***
		(-0.111)		(0.279)		(-1.186)		(-3.339)
After × Pre-Diversified NonSec20		0.007		-0.017		0.152		-0.118
		(0.245)		(-1.320)		(1.365)		(-1.314)
Ln TA	0.136	0.136	0.005	0.005	0.456	0.452	-0.259	-0.261
	(1.5							
Cash-To-TA	0.6							
	(0.655)	(0.656)	(-0.478)	(-0.491)	(0.572)	(0.617)	(0.031)	(0.058)
Tier 1 Ratio	5.762***	5.783***	1.804***	1.764***	7.195*	7.797**	-9.933***	-9.258***
	(3.658)	(3.601)	(2.918)	(2.828)	(1.948)	(2.101)	(-3.150)	(-2.925)
Excessive Growth	-0.001	-0.001	-0.014	-0.014	0.193	0.186	-0.215**	-0.223**
	(-0.014)	(-0.019)	(-0.667)	(-0.636)	(1.282)	(1.230)	(-1.974)	(-2.062)
High Dividend	0.112*	0.110*	0.001	0.004	0.421*	0.376*	0.170	0.118
	(1.743)	(1.698)	(0.038)	(0.138)	(1.895)	(1.749)	(1.443)	(0.992)
Constant	-1.264*	-1.265*	0.105	0.107	-2.724	-2.754	5.190***	5.148***
	(-1.747)	(-1.747)	(0.309)	(0.316)	(-0.784)	(-0.794)	(2.728)	(2.727)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num Observations	500	500	498	498	498	498	500	500
R-squared	0.258	0.258	0.133	0.136	0.082	0.094	0.221	0.241

No significant change

Improvement gone

Robustness tests

1. Placebo tests

Idea: Are our results driven by a nonparallel time trend caused by omitted time-variant variables?
Test #1: 1991-1993 vs 1994-1996. Results: No significance. Hence, earlier DID results valid.
Test #2: 2000-2002 vs 2003-2005. Results: Some decline in OpRisk. Overall, our treatment effect persists over time.

2. Banks vs nonbanks

Idea: (i) Nonbanks were not subject to regulations.
(ii) BHCs expand into nonbank activities (e.g., securities) that are riskier in nature.
Redefine control group: Nonbanks, securities firms.
Redefine treatment group: Section 20 holders.
Results: Greater ↑↑ in OpRisk for Section 20 BHCs than nonbanks / securities firms. Complexity is key!

3. Banking vs nonbanking events

Idea: Are our results driven by nonbanking events?
Re-estimate models for banking & nonbanking events separately.
Match treatment & control groups by annual asset growth.
Results: Complexity increases OpRisk in both nonbanking and banking business lines.

4. Other robustness tests:

i. Extended sample: 1988-2005.
ii. Use all event types.
iii. Drop BHCs with >1% income from insurance.
iv. Control for M&A activity post Riegle-Neal Act of 1997.
v. Control for media coverage.

Conclusion

- **Increased complexity through business diversification leads to weakening risk management in bank holding companies.**

- **This pattern seems to be driven by managerial failure rather than strategic risk taking.**

- **The economic impact of this is an estimated half a billion dollar drop in equity value per year for each Section 20 holder.**

The failure of large, complex, and interconnected financial firms can disrupt the broader financial system and the overall economy, and such firms should be regulated with that fact in mind.

Ben Bernanke

Thank you for your attention!

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EXTRA

Operational risk event types

ET1: Internal Fraud

– unauthorized activity, theft & fraud involving at least 1 internal party

ET2: External Fraud

– theft & fraud by a 3rd party, systems security

ET3: Employment Practices and Workplace Safety

- discrimination, general liability, compensation

ET4: Clients, Products, and Business Practices

– improper business & market practices, model errors

ET5: Damage to Physical Assets

– natural and man-made disasters, vandalism

ET6: Business Disruption and Systems Failures

– hardware & software failures, telecommunications

ET7: Execution, Delivery, and Process Management

– data entry error, missed deadline, delivery failure

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Banking and non-banking activities

1. commercial bank — banking
2. asset manager
3. broker-dealer
4. financial technology
5. insurance broker
6. insurance underwriter
7. investment company
8. real estate
9. savings bank/thrift/mutual
10. specialty lender

— non-banking

Data

OpRisk data

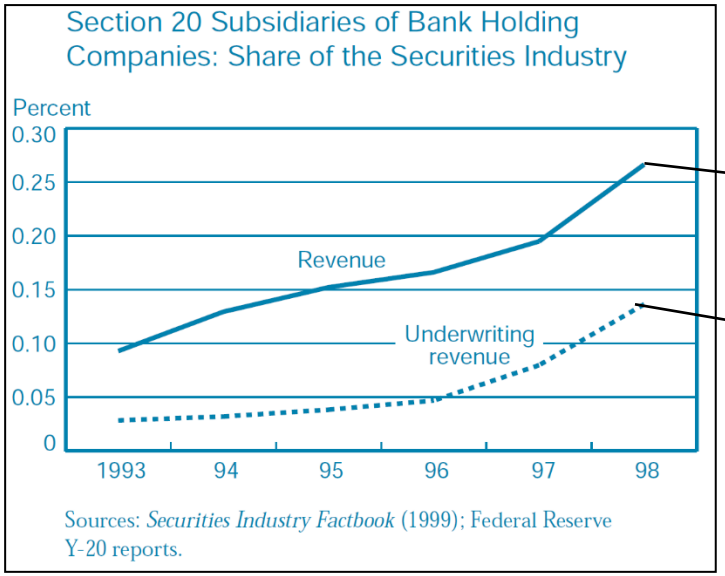
IBM Algo FIRST operational risk database:

- Firm name, date of occurrence, $ loss, event type (BIS), business line, contributory factors, claimant, event narrative.
- >10,000 public events worldwide.
- Data sources: mainly 3rd party (SEC, FINRA, NYSE, FDIC, court, customers, shareholders) → little *self-selection* bias.
- Sources: public data. Publicized events signal failures in risk management.

Sample size

- 968 BHCs
- 8,745 bank-year obs.
- Full sample period: 1988 – 2005
- Main models use 1994 – 1996 (pre-deregulation)
  2000 – 2002 (post-deregulation)

Preliminary evidence



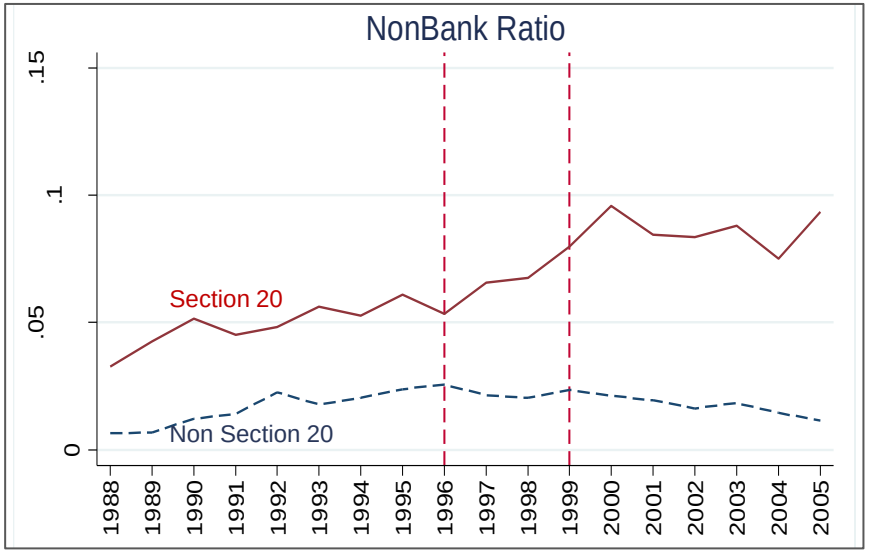
Total revenue reported by Section 20 subsidiaries

Total revenue of the securities industry

Underwriting revenue reported by Section 20 subsidiaries

Underwriting revenue of the securities industry

Preliminary evidence



$$= \frac{\text{Assets from nonbank subsidiaries}}{\text{Total assets}}$$