Business Complexity and Risk Management:
Evidence from Operational Risk Events in U.S. Bank Holding Companies

ALI OZDAGLI

ANNA CHERNOBAI – Syracuse University  JIANLIN WANG – UC Berkeley

The views expressed in this paper do not necessarily reflect those of the Federal Reserve Bank of Boston or the Federal Reserve System.

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Motivation

- How does complexity affect risk management in financial institutions?
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- Operational risk is a measure of risk management

  = “The risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events.” (BIS 2001) E.g.: fraud, business practices, system failures.
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Why operational risk?

- **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%)
   - 2013: JP Morgan $5.1 bln, overstating borrowers' capacity to repay loans underlying >$33 bln of MBSs

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

5. **Employment practices and workplace safety** (# 17.5%, $ 6.0%)
   - 2000: AIG $235 mln discrimination

6. **Damage to physical assets** (# 1.2%, $ 1.4%)
   - 2001: Losses due to 9/11

7. **Business disruption and system failures** (# 2.0%, $ 1.2%)
   - 2001: Freddie Mac $207 mln, error in computing interest

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*Related to complexity*

Key contributory factors:
“managerial action / inaction” and “lack of internal control”

*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 securities 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. securities underwriting & dealing, insurance agency & underwriting activities, and merchant banking.
Motivation

Source: our data
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.
       - *Difference-in-difference* estimator

3. Our proxy for risk = operational risk frequency & severity
Effect of Deregulation on Nonbanking Activities for Treatment and Control Groups

NonBank Ratio

Section 20

Non Section 20

Assets from nonbank subsidiaries

NonBank Ratio = NonBank Ratio

Total assets
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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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 $i$:

\[
OpRisk_{it} = \alpha_i + \beta \times AFTER_{it} + \gamma \times AFTER_{it} \times \text{PREDIVERSIFIED}_i \\
+ \sum_{k=1}^{K} \delta_k \times Control_{k, it} + \varepsilon_{it}
\]

*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

$\alpha_i$ includes BHC fixed effects
**Empirical results: Result #1**

- **Dependent variable = OpRisk count**

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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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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: No significant change
- St. dev. of ROA
- Z-score

Consistent with managerial failure rather than strategic risk taking.
<table>
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<th>Return on Assets</th>
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<td>0.527</td>
<td>0.411**</td>
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<td>(1.509)</td>
<td>(1.516)</td>
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<td>(1.755)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>408</td>
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<td>R-squared</td>
<td>0.245</td>
<td>0.247</td>
<td>0.252</td>
<td>0.186</td>
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No significant change

Some improvement
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<tr>
<th></th>
<th>Return on Assets</th>
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<th>Z-Score</th>
<th>Market-to-Book Ratio</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(1)</td>
<td>(2)</td>
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<td>After</td>
<td>-0.064</td>
<td>-0.063</td>
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<td>After × Pre-Diversified</td>
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<td>0.013</td>
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<td>(0.170)</td>
<td>(-0.995)</td>
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<td>After × Pre-Diversified Sec20</td>
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<td>0.009</td>
<td>-0.239</td>
<td>-0.558***</td>
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<td>After × Pre-Diversified NonSec20</td>
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<td>-0.017</td>
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<td>Ln TA</td>
<td>0.136</td>
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<td>(0.656)</td>
<td>(0.572)</td>
<td>(0.617)</td>
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<td>-0.215**</td>
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<td>5.783***</td>
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<td>(3.658)</td>
<td>(3.601)</td>
<td>(2.918)</td>
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<td>(-0.14)</td>
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<td>High Dividend</td>
<td>0.112*</td>
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<td>0.001</td>
<td>0.421*</td>
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<td>(1.743)</td>
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<td>Bank Fixed Effects</td>
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<td>Num Observations</td>
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<td>R-squared</td>
<td>0.258</td>
<td>0.258</td>
<td>0.133</td>
<td>0.221</td>
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</table>

**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?
   
   

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:**
   
   
   ii. Use all event types.
   
   iii. Drop BHCs with >1% income from insurance.
   
   
   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!

Ali.Ozdagli@bos.frb.org
annac@syr.edu
jianlinwang@berkeley.edu
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
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%)
   - 2013: JP Morgan $5.1 bln, overstating borrowers' capacity to repay loans underlying >$33 bln of MBSs

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

5. **Employment practices and workplace safety** (# 17.5%, $ 6.0%)
   - 2000: AIG $235 mln discrimination

6. **Damage to physical assets** (# 1.2%, $ 1.4%)
   - 2001: Losses due to 9/11

7. **Business disruption and system failures** (# 2.0%, $ 1.2%)
   - 2001: Freddie Mac $207 mln, error in computing interest

Related to complexity

Key contributory factors:
“managerial action / inaction” and “lack of internal control”

Unrelated to complexity ➔ exclude from our analysis
Banking and non-banking activities

1. commercial bank
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

banking
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

Section 20 Subsidiaries of Bank Holding Companies: Share of the Securities Industry

Percent

0.30

0.25

0.20

0.15

0.10

0.05

0

1993 94 95 96 97 98

Revenue

Underwriting revenue

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

Sources: Securities Industry Factbook (1999); Federal Reserve Y-20 reports.
Preliminary evidence

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