Risk Management in Financial Institutions

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NBER, and CEPR

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Guillaume Vuillemeey  
HEC Paris

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Chicago, IL  
April 7, 2016
Determinants of Risk Management in Financial Institutions

- **Risk management in financial institutions**
  - Since financial crisis, much debate of risk management failures
  - Yet basic patterns and determinants are not known
  - Essential for monetary and macro-prudential policy
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  - Theory: net worth of financial institutions key determinant
  - Evidence from between and within institution variation
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  - Banks largest users of tradable securities for hedging purposes
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- **Identification**
  - Drop in net income due to loan losses and local house price drops
  - IV and difference-in-difference estimation
Theory: Risk Management Subject to Financial Constraints

- Froot/Scharfstein/Stein (1993)
  - Financial constraints imply effective risk aversion
  - Counterfactual prediction: more constrained firms hedge more

- Rampini/Viswanathan (2010, 2013)
  - Risk management requires net worth
  - Financial constraints link financing and risk management
  - Basic prediction: financing and risk management trade-off
    - Constrained firms hedge less as financing dominates hedging concerns

- Vuillemey (2015)
  - Financial institutions optimally do not fully hedge interest rate risk
  - Hedging demand varies in sign in cross section
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  - Prediction for hedging in cross section and time series
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  - Positive and significant relation in cross section
    - ... and within institution over time
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  - Identification: *net worth drops lead to cut in risk management*
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- **No evidence for alternative hypotheses**
Data and Measurement

Data sources

- Call reports and CRSP
- Time frame: 1995-2013; quarterly data; up to 76 quarters
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- **Unit of observation**
  - **Bank holding companies (BHCs):** 22,723 BHC-quarter obs.
    - Advantage: Match to market data from CRSP
  - **Banks:** 603,894 bank-quarter observations
    - Advantage: More detailed hedging data from Call reports

Excluding main dealers, results robust to their inclusion.

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- **Sample**
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Data and Measurement: Gross Hedging

■ Definition: Gross hedging

\[ \text{Gross hedging}_{it} = \frac{\text{Gross notional amount of interest rate derivatives for hedging of } i \text{ at } t}{\text{Total assets}_{it}} \]
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  - Includes all derivatives (swaps, options, forwards, etc.)
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**Distribution of gross hedging – BHC level**

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<tr>
<th></th>
<th>Mean</th>
<th>Med.</th>
<th>75th</th>
<th>90th</th>
<th>95th</th>
<th>98th</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross hedging</td>
<td>0.038</td>
<td>0.006</td>
<td>0.036</td>
<td>0.103</td>
<td>0.194</td>
<td>0.354</td>
<td>0.571</td>
</tr>
<tr>
<td>Gross trading</td>
<td>0.071</td>
<td>0</td>
<td>0</td>
<td>0.017</td>
<td>0.075</td>
<td>0.589</td>
<td>8.801</td>
</tr>
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</table>

- Large number of zeros
- Most BHCs use derivatives for hedging not trading
Definition: Net hedging

Net hedging ratio_{it} = \frac{\text{Pay-fixed swaps}_{it} - \text{Pay-float swaps}_{it}}{\text{Total assets}_{it}}
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- **Measurement issues**
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- **Relation between gross hedging and net hedging**
  - Average ratio of (absolute) net hedging to gross hedging: 90.9%
Definition: Maturity gap

\[
\text{Maturity gap}_{it} = \frac{A_{it}^{IR} - L_{it}^{IR}}{\text{Total assets}_{it}}
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- \(A_{it}^{IR}\): Assets maturing or repricing within 1 year
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Measurement issues

- Effectively "net floating-rate assets"
- \( \Delta \) cash flows \( \approx \) maturity gap \( \times \) \( \Delta \) short rate
Data and Measurement: Interest Rate Exposure

- Institutions with lots of floating-rate liabilities pay fixed
  - Consistent with hedging

Net swap hedging

![Graph showing net swap hedging](image)

- Maturity gap < 25th pc.
- Maturity gap > 75th pc.
Data and Measurement: Financial Institutions’ Net Worth

- **Key state variable:** Net worth
  - Net worth determines tightness of financial constraints
Data and Measurement: Financial Institutions’ Net Worth

- **Key state variable:** Net worth
  - Net worth determines tightness of financial constraints

- **Measurement:** Net worth – financial constraints
  - Size (log Total book assets) (1)
  - Market value of equity (log)
  - Market value of equity / Market value of assets (2)
  - Net income / Total assets (3)
  - Cash dividends / Total assets (4)
  - Credit rating from S&P
  - Net worth index
    - First principal component of (1) through (4)
    - Weights: 0.149, 0.307, 0.272 and 0.272
Hedging and Net Worth: Cross-Section Evidence

- **Between variation and pooled sample: OLS** [More]
  - BHC-mean and pooled OLS regressions
  - Strong correlation between hedging and net worth in cross section
Hedging and Net Worth: Cross-Section Evidence

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- **Accounting for zeros** [More]
  - Tobit (BHC-mean and pooled)
  - Quantile regressions
  - Heckman selection model
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- **Within variation** – institution fixed effects [More]
  - Institutions hedge more when their net worth is higher
Hedging Before Distress

- **Definition: Distress**
  - Exit with market capitalization (or equity) to total assets below 4%

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Hedging Before Distress

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- **Both BHCs and banks cut hedging before distress** [More]
Instrumenting Net Worth with House Prices

- **Idea:** net worth drops due to loan losses caused by house price drop.
**Instrumenting Net Worth with House Prices**

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- **Instrument for net income: lagged house price changes**
  - **Identifying assumption**
  - House prices affect hedging only through impact on net worth
  - Focus on 2005-2013
  - Focus on institutions with above-median loans secured by real estate
  - Construct deposit-weighted average house price change by institution

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  - Construct deposit-weighted average house price change by institution

- **Validity of instrument**
  - Changes in provisions (not interest income) explain changes in net income [More]
  - Loan losses arise from loans backed by real estate [More]
  - Drop in house prices (not interest rates) key determinant of mortgage defaults (see Mayer/Pence/Sherlund (2009) and others)
Instrumenting Net Worth with House Prices

- **Construction of instrument**
  - Data – ZIP-code level: Zillow (house prices); FDIC (deposits)
  - Compute deposit-weighted avg. house price change over past 2 years
  - Assumption: loans proportional to deposits at ZIP-code level
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- **IV estimation**

<table>
<thead>
<tr>
<th></th>
<th>BHC level</th>
<th></th>
<th>Bank level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>IV</td>
<td>OLS</td>
<td>IV</td>
</tr>
<tr>
<td>First stage</td>
<td>0.251***</td>
<td></td>
<td>0.113***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.096</td>
<td></td>
<td>0.053</td>
<td></td>
</tr>
<tr>
<td>Net income</td>
<td>0.185**</td>
<td>0.254***</td>
<td>0.049**</td>
<td>0.086***</td>
</tr>
<tr>
<td></td>
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<td>(0.003)</td>
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</table>
Distribution of Net Income over Sample Period

- Large losses mostly concentrated in 2009
- 50% BHCs with negative net income in 2009Q4
Identification: Losses on Loans Secured by Real Estate

- **Difference-in-difference (DD) specification**
  - Large changes in net income occur mostly in 2009
  - Exploit heterogeneity across institutions for treatment and control
  - Focus on institutions with above-median loans secured by real estate
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- **Treatment and control group**
  - **Treatment:** bottom 30% in net income in 2009
  - **Control:** top 30% in net income in 2009

- Focus on 2005-2013; treatment year plus/minus 4 years
Gross Hedging by BHCs – Treatment and Control Group

- Treated BHCs cut hedging relative to control group

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Risk Management in Financial Institutions
# Gross Hedging by BHCs and Banks – DD Estimates

- **Treated BHCs and banks cut hedging significantly**
  - ... both with and without institution fixed effects

<table>
<thead>
<tr>
<th>Year</th>
<th>BHC level</th>
<th>Bank level</th>
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<tbody>
<tr>
<td></td>
<td>Post-event dummy</td>
<td>Year dummies</td>
</tr>
<tr>
<td>2009 and after</td>
<td>-0.029*** (0.003)</td>
<td>-0.015*** (0.009)</td>
</tr>
<tr>
<td>2009</td>
<td>-0.020 (0.136)</td>
<td>-0.019** (0.042)</td>
</tr>
<tr>
<td>2010</td>
<td>-0.039*** (0.004)</td>
<td>-0.010 (0.181)</td>
</tr>
<tr>
<td>2011</td>
<td>-0.038*** (0.005)</td>
<td>0.001 (0.910)</td>
</tr>
<tr>
<td>2012</td>
<td>-0.019 (0.153)</td>
<td>-0.021*** (0.008)</td>
</tr>
<tr>
<td>2013</td>
<td>-0.031** (0.024)</td>
<td>-0.028*** (0.000)</td>
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| BHC FE | No | No | Yes | No | No | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
Alternative Treatments

- **Alternative treatment I: house prices**
  - Exploit heterogeneity in local house price changes across institutions
  - Treatment: bottom 30% in house prices changes in 2007Q1-2008Q4
  - Control: top 30% in house prices changes in 2007Q1-2008Q4
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- **Alternative treatment II: housing supply elasticity**
  - Use Saiz (2010)'s measure of housing supply elasticity at MSA level
  - Compute deposit-weighted avg. housing supply elasticity by institution
  - Treatment: bottom 30% in weighted-avg. housing supply elasticity
  - Control: top 30% in weighted-avg. housing supply elasticity
**DD Estimates with Alternative Treatments**

- **Alternative treatments yield rather similar results**

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### Similar results at bank level
Robustness: Parallel Trends Assumption

- **Testing parallel trends assumption**
- Include year-treatment dummies in pre-treatment period

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<tr>
<td></td>
<td></td>
<td>2005</td>
<td>-0.014 (0.331)</td>
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<td></td>
<td></td>
<td>2006</td>
<td>-0.010 (0.499)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2007</td>
<td>-0.007 (0.626)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>-</td>
</tr>
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<td></td>
<td></td>
<td>2009</td>
<td>-0.028* (0.085)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
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- BHC FE: No, Yes
- Time FE: Yes, Yes

- No significant pre-treatment differences in trends
Robustness: Maturity Gap in Treatment and Control Group

- No differences in maturity gap (Statistical significance [More])
- Treated BHCs do not seem to reduce interest rate exposure

![Graph showing maturity gap (net of BHC FE) over years 2005 to 2014 for Treated and Control groups.](image)
Alternative Hypothesis 1: Risk Shifting?

- **Evidence from trading**
  - Idea: risk shifting should involve more trading
  - **Significantly positive relation between trading and net worth**
    - ... both in cross-section and within institutions [More]
Alternative Hypothesis 1: Risk Shifting?

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- **Banks cut derivatives trading before distress**

  ![Graph showing the relationship between Bank trading and Total assets over quarters before distress]

  - However, corresponding estimates not statistically significant
Alternative Hypothesis 2: Operational Risk Management?

- Cross-sectional evidence using maturity gap
  - Idea: operational hedging should involve higher maturity gap
  - **Significant, positive correlation between maturity gap and net worth** [More]
  - Poorly capitalized institutions do less operational risk management
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- **Cross-sectional evidence using maturity gap**
  - Idea: operational hedging should involve higher maturity gap
  - **Significant, positive correlation between maturity gap and net worth** [More]
  - Poorly capitalized institutions do less operational risk management

- **Maturity gap drops before distress**
  - Institutions engage in less, not more, operational risk management

![Graph showing maturity gap and BHC level](image1)

![Graph showing bank maturity gap and distress](image2)
Alternative Hypothesis 3: Regulatory Capital?

- **Measurement**
  - Total regulatory capital / Risk-weighted assets
  - Tier 1 regulatory capital / Risk-weighted assets

There is no significant relation between hedging and regulatory capital. Most coefficients are insignificant and several change signs. 

Both across (pooled OLS and pooled Tobit) and within institutions, Davidson-Mackinnon (1981)'s $J$-test of model nestedness shows that market net worth, not regulatory capital, explains hedging.
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Market net worth, not regulatory capital, explains hedging

Adriano A. Rampini, S. Viswanathan, Guillaume Vuillemey

Risk Management in Financial Institutions
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  - Net worth explains basic patterns in cross section and time series
  - Novel identification strategy allows causal interpretation
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Conclusion

- Better capitalized financial institutions hedge more
  - Net worth explains basic patterns in cross section and time series
  - Novel identification strategy allows causal interpretation

- Financing needs associated with hedging substantial barrier to risk management

- No evidence for alternative hypothesis
  - Risk shifting (from trading)
  - Operational risk management
  - Importance of regulatory capital

Adriano A. Rampini, S. Viswanathan, Guillaume Vuillemey
Risk Management in Financial Institutions
Literature

- **Rampini/Sufi/Viswanathan (2014)**
  - Empirical laboratory: airlines’ fuel price risk management
  - Advantage: measurement – fraction expected fuel expenses hedged
  - Panel data at intensive and extensive margin
  - Financial constraints impede risk management

- **Begenau/Piazzesi/Schneider (2015)**
  - New methodology to measure interest rate risk
  - Trading positions increase interest rate risk exposures

Additional literature

- **Tufano (1996)**
  - Gold price risk management by gold mining firms
  - Focus on executive compensation and incentives
  - Much of literature: single cross-section; user dummies
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### Maturity gap – Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>10th</th>
<th>25th</th>
<th>Mean</th>
<th>Med.</th>
<th>75th</th>
<th>90th</th>
<th>Max.</th>
<th>S.D.</th>
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<td>-0.59</td>
<td>-0.09</td>
<td>-0.00</td>
<td>0.09</td>
<td>0.08</td>
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<td>Gap (bank)</td>
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Back
## Net Worth – Descriptive Statistics

### Market-based measures of net worth – BHC level

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<thead>
<tr>
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<th>Min.</th>
<th>10th</th>
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<th>Mean</th>
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<th>75th</th>
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<td>Mkt. cap./A.</td>
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<td>0.10</td>
<td>0.14</td>
<td>0.14</td>
<td>0.17</td>
<td>0.20</td>
<td>0.33</td>
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<td>Net inc./ A.</td>
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<td>0.001</td>
<td>0.006</td>
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<td>0.015</td>
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<td>Payout/ A.</td>
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<td>0.001</td>
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<td>0.002</td>
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<td>Div./ A.</td>
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<td>BBB-</td>
<td>BBB</td>
<td>BBB+</td>
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## Cross-Sectional Regressions – BHC-mean and Pooled OLS

- **Positive relation between hedging and net worth**
- Cross-sectional evidence

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Mkt. cap.</th>
<th>Mkt. cap./Assets</th>
<th>Net income</th>
<th>Net payout</th>
<th>Div.</th>
<th>Rating</th>
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<tr>
<td>BHC-mean</td>
<td>0.034***</td>
<td>0.025***</td>
<td>0.060</td>
<td>0.962***</td>
<td>11.014**</td>
<td>15.884***</td>
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<td>OLS</td>
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<td>(0.000)</td>
<td>(0.313)</td>
<td>(0.000)</td>
<td>(0.024)</td>
<td>(0.004)</td>
<td>(0.033)</td>
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<tr>
<td>Pooled OLS w/ time FE</td>
<td>0.031***</td>
<td>0.023***</td>
<td>0.017</td>
<td>0.344***</td>
<td>8.115***</td>
<td>3.304***</td>
<td>0.013***</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.143)</td>
<td>(0.000)</td>
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</table>

Back
## Cross-Section – BHC level

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Mkt. cap.</th>
<th>Mkt. cap./ Assets</th>
<th>Net income</th>
<th>Div.</th>
<th>Rating</th>
<th>Net worth index</th>
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<tbody>
<tr>
<td>BHC mean</td>
<td>0.052***</td>
<td>0.040***</td>
<td>-0.059</td>
<td>0.681*</td>
<td>17.631***</td>
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<td>0.018***</td>
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<tr>
<td>Tobit</td>
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<td>(0.000)</td>
<td>(0.426)</td>
<td>(0.098)</td>
<td>(0.005)</td>
<td>(0.010)</td>
<td>(0.000)</td>
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<tr>
<td>Tobit w time FE</td>
<td>0.055***</td>
<td>0.043***</td>
<td>0.130***</td>
<td>0.695***</td>
<td>11.958***</td>
<td>0.014***</td>
<td>0.022***</td>
</tr>
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<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
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<td>(0.000)</td>
<td>(0.000)</td>
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<tr>
<td>Quantile 75th pctile</td>
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<td>0.019***</td>
<td>0.112***</td>
<td>0.338***</td>
<td>16.142***</td>
<td>0.016***</td>
<td>0.008***</td>
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<td></td>
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<td>Quantile 85th pctile</td>
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*Back*
Hedging and Net Worth: Time-Series Evidence

**Within variation** – institution fixed effects

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
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<tbody>
<tr>
<td>BHC Gross</td>
<td>0.034***</td>
<td>0.006***</td>
<td>-0.009</td>
<td>0.182***</td>
<td>0.661***</td>
<td>-0.001</td>
<td>0.002***</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.358)</td>
<td>(0.000)</td>
<td>(0.003)</td>
<td>(0.642)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Obs.</td>
<td>22,723</td>
<td>22,723</td>
<td>22,723</td>
<td>20,839</td>
<td>20,568</td>
<td>3,657</td>
<td>20,568</td>
</tr>
<tr>
<td>Bank Gross</td>
<td>0.003***</td>
<td></td>
<td>0.052***</td>
<td>0.032***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.000)</td>
<td></td>
<td>(0.000)</td>
<td>(0.003)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Obs.</td>
<td>627,219</td>
<td></td>
<td>581,207</td>
<td>418,225</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bank Net</td>
<td>0.008***</td>
<td></td>
<td>0.060</td>
<td>0.105*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.000)</td>
<td></td>
<td>(0.773)</td>
<td>(0.080)</td>
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<tr>
<td>Obs.</td>
<td>95,650</td>
<td></td>
<td>94,118</td>
<td>78,091</td>
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<td></td>
</tr>
</tbody>
</table>

Institutions hedge more when their net worth is higher
## Hedging and Net Worth: Time-Series Evidence

**Within variation** – institution fixed effects

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<td>-0.001</td>
<td>0.002***</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.358)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.003)</td>
<td>(0.642)</td>
<td>(0.000)</td>
</tr>
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<td></td>
<td>0.052***</td>
<td>0.032***</td>
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<td>(0.000)</td>
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<td></td>
<td>(0.000)</td>
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<td>(0.773)</td>
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<td>78,091</td>
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<td></td>
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</tr>
</tbody>
</table>

**Institutions hedge more when their net worth is higher**
Hedging Before Distress

- Econometric specification

\[ H_{it} = F E_i + F E_t + \sum_{j=0}^{8} \gamma_j \cdot D_{t-j} + \varepsilon_{it} \]
Hedging Before Distress

- **Econometric specification**

\[ H_{it} = F E_i + F E_t + \sum_{j=0}^{8} \gamma_j \cdot D_{t-j} + \varepsilon_{it} \]

- **Regression results**

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<th>Event time</th>
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<th>Bank level</th>
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<td>Gross hedging</td>
<td>Net hedging</td>
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<td>( t - 8 )</td>
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<td>( t - 7 )</td>
<td>-0.011</td>
<td>-0.000</td>
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<td>( t - 6 )</td>
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<td>-0.006</td>
</tr>
<tr>
<td>( t - 5 )</td>
<td>-0.020**</td>
<td>-0.013**</td>
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<td>( t - 4 )</td>
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<td>-0.014**</td>
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<td>( t )</td>
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<td>-0.023***</td>
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<td>Within-( R^2 )</td>
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## Variance Decomposition of Net Income

- **Changes in provisions explain changes in net income**
  - Changes in net interest income less important

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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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<td>0.091</td>
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<td></td>
<td>(37.15)</td>
<td>(2.09)</td>
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<td>(38.09)</td>
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<tr>
<td>(\Delta) Net noninterest income</td>
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<td>0.967</td>
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<td>(157.45)</td>
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<td>(157.45)</td>
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<td>(123.09)</td>
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<td>(\Delta) Noninterest income</td>
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<td>(-66.14)</td>
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<td>0.605</td>
<td>0.307</td>
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Back
Most nonaccrual loans are loans secured by real estate
**Robustness: Maturity Gap in Treatment and Control Group**

- **DD estimates with maturity gap as dependent variable**
- Treated BHCs increase interest rate exposure in treatment year

<table>
<thead>
<tr>
<th></th>
<th>BHC level</th>
<th></th>
<th>Bank level</th>
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</thead>
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<td>Year dummies</td>
<td>Post-event dummy</td>
<td>Year dummies</td>
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<td>2009 and after</td>
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<td>-0.006</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>-0.008</td>
<td></td>
<td>-0.014</td>
<td></td>
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</tbody>
</table>

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Regression of Hedging on Regulatory Capital

- No significant relation between hedging and regulatory capital
  - ... both in cross-section and within institution
  - ... both for Tier 1 and total regulatory capital

<table>
<thead>
<tr>
<th></th>
<th>BHC-mean OLS</th>
<th>Pooled OLS</th>
<th>Pooled Tobit</th>
<th>BHC FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg. Cap. / Assets</td>
<td>-0.224</td>
<td>0.260</td>
<td>0.192</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>(0.280)</td>
<td>(0.114)</td>
<td>(0.619)</td>
<td>(0.318)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.000</td>
<td>0.008</td>
<td>0.036</td>
<td>0.009</td>
</tr>
<tr>
<td>Tier 1 Cap. / Assets</td>
<td>0.193</td>
<td>0.086</td>
<td>-0.337</td>
<td>0.247*</td>
</tr>
<tr>
<td></td>
<td>(0.529)</td>
<td>(0.472)</td>
<td>(0.259)</td>
<td>(0.060)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>-0.000</td>
<td>0.008</td>
<td>0.036</td>
<td>0.009</td>
</tr>
</tbody>
</table>
Regression of Trading on Net Worth

- Positive and significant relation between trading and net worth
- ... both in cross-section and time dimension

<table>
<thead>
<tr>
<th>Model</th>
<th>Size</th>
<th>Mkt. cap.</th>
<th>Mkt. cap./Assets</th>
<th>Net income</th>
<th>Net payout</th>
<th>Div.</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHC-mean</td>
<td>0.579***</td>
<td>0.484***</td>
<td>0.600</td>
<td>9.361*</td>
<td>330.525***</td>
<td>374.661***</td>
<td>0.872***</td>
</tr>
<tr>
<td>Tobit</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.509)</td>
<td>(0.089)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Tobit with</td>
<td>0.590***</td>
<td>0.511***</td>
<td>3.300***</td>
<td>11.459***</td>
<td>214.900***</td>
<td>164.830***</td>
<td>0.809***</td>
</tr>
<tr>
<td>time FE</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Tobit with</td>
<td>0.318</td>
<td>0.279</td>
<td>0.014</td>
<td>0.009</td>
<td>0.029</td>
<td>0.012</td>
<td>0.045</td>
</tr>
<tr>
<td>time FE</td>
<td>(0.000)</td>
<td>(0.010)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.039)</td>
<td>(0.471)</td>
<td>(0.127)</td>
</tr>
<tr>
<td>BHC FE</td>
<td>0.082***</td>
<td>0.020***</td>
<td>0.692***</td>
<td>1.172***</td>
<td>20.334**</td>
<td>5.965</td>
<td>0.040</td>
</tr>
<tr>
<td>rating</td>
<td>(0.000)</td>
<td>(0.010)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.039)</td>
<td>(0.471)</td>
<td>(0.127)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.009</td>
<td>0.042</td>
<td>0.049</td>
<td>0.044</td>
<td>0.089</td>
<td>0.042</td>
<td>0.096</td>
</tr>
</tbody>
</table>
Regression of Maturity Gap on Net Worth

- Positive correlation between maturity gap and net worth
- Better capitalized institutions do more operational hedging

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooled OLS with time FE</td>
<td>0.042***</td>
<td>0.037***</td>
<td>0.626***</td>
<td>1.277***</td>
<td>-0.433</td>
<td>2.449</td>
<td>0.078***</td>
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<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.032)</td>
<td>(0.960)</td>
<td>(0.599)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.124</td>
<td>0.131</td>
<td>0.061</td>
<td>0.032</td>
<td>0.031</td>
<td>0.034</td>
<td>0.149</td>
</tr>
</tbody>
</table>

Back