Capital Constraints and Systemic Risk

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Balance Sheet Amplification

- Recent crisis is an example of how relatively small initial losses to asset values can be magnified and propagated.
- Balance sheet amplification is a possible mechanism (e.g. Brunnermeir, 2009, Krishnamurthy, 2009).
- A negative shock to asset values → balance sheet constraint gets tighter → asset sales → asset prices ↓ further…
- Examples of balance sheet constraints: margins, capital etc.

This Paper: Main Idea

- Identify an event (regulation) that tightened a balance-sheet constraint and could have contributed to strength of amplification mechanism

- Examine:

  – How institutions' sensitivity to common factors changes afterwards

  – Whether the effect differs for institutions, for which the constraint is more likely to be binding

Market Risk Regulation in Banking

- 1996-1998: Basel Capital Accord was amended and market-risk based capital charge was introduced (based on Value-at-Risk) to account for market risk exposure

- Possible systemic implications:
  - Asset value and VaR cycles (akin to *loss* and *margin spirals* of Brunnermeir and Pedersen (2008)):
  - Fall in asset values and/or rise in market volatility → VaR and capital limits of some banks are hit → sell → more volatility and further value decline → more selling by more banks….

Our Approach – 1

- Systematic Risk: Sensitivity of a stock return of a publicly traded bank holding company to common factors, such as a return of stock market portfolio and portfolio of banking stocks (i.e. market and financial sector betas) .

- Utilize the fact that not all banks are subject to the market risk-based capital requirements

- Study whether being subject to additional capital requirements affects bank systematic risk

  → Only banks with sufficiently high trading activities are subject to market risk-based capital requirements

  → Focus on the gap in systematic risk between high- and low-trading activity banks, and explore whether such a gap increased after 1998

Our Approach – 2

- Before 1998: higher trading activity → higher risk
- After 1998: higher trading activity → higher risk + additional regulatory constraint
- After 1998 – Before 1998: capture the effect of the additional regulatory constraint
- **Hypothesis 1**: Systematic risk gap between high and low trading banking organizations increased after the market risk-based capital requirements were introduced

Our Approach – 3

- Recognize that new capital regulation may have a stronger effect on banks with low capital ratios – banks whose capital constraint is more likely to be binding

- **Hypothesis 2**: An increase in systematic risk gap between high and low trading banking organizations is more pronounced for low-capital banking organizations

Some Related Research

- Pro-cyclicality of capital charge (summarized in Kashyap and Stein, 2003 and Borio and Zhu, 2008)
- Empirical studies on “vicious cycles”, e.g. Jorion (2005)
- Capital requirements and banks’ investment/asset choice decisions(Acharya, 2001, Cuoco and Liu, 2003)
- Measuring systemic risk (e.g. Adrian and Brunnermeier, 2008, Huang, Zhou and Zhu, 2009, Acharya, Pedersen, Philippon and Richardson, 2010)

Variables and Baseline Specifications – 1

Equation 1:

$$R_{it} = \gamma_i + \alpha_1 * f_t + \alpha_2 * f_t * HTA_{it-1} + \text{After1998} * \left(\mu + \alpha_3 * f_t + \alpha_4 * f_t * HTA_{it-1} \right) + \eta_{it}$$

Equation 2:

$$R_{it} = \psi_i + \beta_1 * f_t + \beta_2 * f_t * HTA_{it-1} + \beta_3 * f_t * HKA_{it-1} + \beta_4 * f_t * HTA_{it-1} * HKA_{it-1} +$$
$$\text{After1998} * \left(\phi + \beta_5 * f_t + \beta_6 * f_t * HTA_{it-1} + \beta_7 * f_t * HKA_{it-1} + \beta_8 * f_t * HTA_{it-1} * HKA_{it-1} \right) + \varepsilon_{it}$$

- R_{it} - individual bank's quarterly holding period return
- f_t - common factor (bank portfolio or S&P 500 return)
- HTA_{it-1} = 1 if the sum of a bank's previous quarter trading assets and liabilities is higher than $1 billion or higher than 10 per cent of its previous quarter total assets
- HKA_{it-1} = 1 if a bank's previous quarter capital-to-assets ratio > 7%
- After1998 = 1 for the period starting from the first quarter of 1998
- BHC fixed effects

Variables and Baseline Specifications – 2

Equation 1:

$$R_{it} = \gamma_i + \alpha_1 * f_t + \alpha_2 * f_t * HTA_{it-1} + \text{After1998} * \mu + \alpha_3 * f_t + \alpha_4 * f_t * HTA_{it-1} + \eta_{it}$$

Estimates of systematic risk from Equation 1

	Before 1998
Low TA	α_1
High TA	$\alpha_1 + \alpha_2$
High TA – Low TA	α_2
	After 1998
Low TA	$\alpha_1 + \alpha_3$
High TA	$\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4$
High TA – Low TA	$\alpha_2 + \alpha_4$

Hypothesis 1: $\alpha_4 > 0$

Variables and Baseline Specifications – 3

Equation 2:

$$R_{it} = \psi_i + \beta_1 * f_t + \beta_2 * f_t * HTA_{it-1} + \beta_3 * f_t * HKA_{it-1} + \beta_4 * f_t * HTA_{it-1} * HKA_{it-1} +$$
$$\text{After1998} * \phi + \beta_5 * f_t + \beta_6 * f_t * HTA_{it-1} + \beta_7 * f_t * HKA_{it-1} + \beta_8 * f_t * HTA_{it-1} * HKA_{it-1} + \varepsilon_{it}$$

Estimates of systematic risk from Equation 2

	Before 1998	
	Low KA	High KA
Low TA	β_1	$\beta_1 + \beta_3$
High TA	$\beta_1 + \beta_2$	$\beta_1 + \beta_2 + \beta_3 + \beta_4$
High TA – Low TA	β_2	$\beta_2 + \beta_4$
	After 1998	
	Low KA	High KA
Low TA	$\beta_1 + \beta_5$	$\beta_1 + \beta_3 + \beta_5 + \beta_7$
High TA	$\beta_1 + \beta_2 + \beta_5 + \beta_6$	$\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8$
High TA – Low TA	$\beta_2 + \beta_6$	$\beta_2 + \beta_4 + \beta_6 + \beta_8$

Hypothesis 2: $\beta_8 < 0$

Data

- Large (real assets above $5 billion), publicly traded bank holding companies
- Quarterly,1986:Q2 to 2007:Q4
- 8,213 observations for 240 BHCs, unbalanced panel

Data sources:

- BHC data: bank holding company financial statements (Y-9 forms)
- Returns on stocks: CRSP database
- Returns on banking and S&P 500 portfolios: Kenneth French’s web-site

Estimates of the systematic risk using equation (1)

	Before 1998
Low TA	0.9665***
High TA	1.0806***
High TA – Low TA	0.1141**
	After 1998
Low TA	0.7430***
High TA	1.0889***
High TA – Low TA	0.3459***
α_4	0.2318***

Estimates of the systematic risk using equation (2)

	Before 1998	
	Low KA	High KA
Low TA	0.9882***	0.9289***
High TA	1.0855***	1.0644***
High TA – Low TA	0.0973*	0.1355
	After 1998	
	Low KA	High KA
Low TA	0.8514***	0.7190***
High TA	1.3456***	0.9662***
High TA – Low TA	0.4942***	0.2472***
β_6	0.3969***	
$\beta_6 + \beta_8$		0.1117
β_8	-0.2852*	

Interpretation?

Suppose a poorly-capitalized bank with high trading accounts is hit by an unexpected market shock

→ needs to make adjustments to satisfy its regulatory capital requirements

→ needs to either sell its assets or raise more capital

→ 1) raising capital may be costly and may be perceived by the markets as bad news

2) simultaneous massive sales may drive prices even further down and volatility up

→ Undercapitalized bank will have higher sensitivity to market conditions after the introduction of market risk-based capital requirements

Are results stronger with lower K/A threshold and in left tail of bank return distribution?

- K/A = 6% as a threshold capital ratio
- Quantile regression

Estimates of the systematic risk using equation (2)
K/A = 6% as a threshold capital ratio

	Before 1998	
	Low KA	High KA
Low TA	1.0229***	0.9402***
High TA	1.1379***	0.9872***
High TA – Low TA	0.1150*	0.0470
	After 1998	
	Low KA	High KA
Low TA	0.6872***	0.7464***
High TA	1.5534***	1.0082***
High TA – Low TA	0.8662***	0.2618***
β_6	0.7512***	
$\beta_6 + \beta_8$		0.2148**
β_8	-0.5362***	

Quantile regression results
K/A = 6% as a threshold capital ratio

		Quantiles		
		25th	50th	75th
Difference (High TA – Low TA)	Low KA, before 98	0.1218	0.1420***	0.1664***
	Low KA, after 98	0.8960***	0.6709***	0.5902***
	High KA, before 98	0.0853	0.0554	0.0807
	High KA, after 98	0.3036***	0.2461***	0.2508***
β_6		0.7742***	0.5289***	0.4238**
$\beta_6 + \beta_8$		0.2183**	0.1907**	0.1701*
β_8		-0.5559**	-0.3382**	-0.2537

Robustness – 1

- Alternative common factor: the return on S&P 500 index
- Alternative BHC size cutoff: $10 billion real assets
- Subsample analysis to account for introduction of mark-to-market financial accounting standards: compare 1994:Q1–1997:Q4 Vs 1998:Q1–2007:Q4
- Results hold

Robustness – 2

- Controls (lagged):
  - Level of capital-to-asset ratio;
  - Ratio of non-performing loans to total loans;
  - Ratio of non-interest income to total income;
  - Log of the consolidated real BHC assets.

- Each control is interacted with a common factor and its product with *After1998*

- Results hold

Conclusions

- Increase in contribution of trading activity to systematic risk after 1998 across all types of banks
- Post-1998 increase in contribution of trading activity to systematic risk is stronger for low-capital banks
- Effects are stronger in left tails of bank capital and return distributions

Policy Implications

- Potential for an unintended systemic side effect of current capital regulation
- Case for time varying capital requirements and capital insurance (Kashyap, Rajan, Stein, 2008; Flannery, 2005)