

Community Banking
in the 21st Century

Estimating Changes in Supervisory Standards and Their Economic Effects

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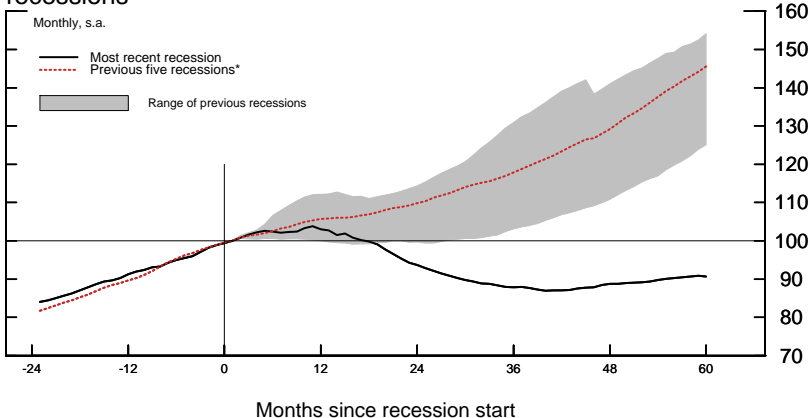
MOTIVATION: HOW PROCYCLICAL IS BANK SUPERVISION?

- Economic conditions have improved only slowly in recent years despite substantial fiscal and monetary stimulus.
- Could regulatory reform and enhanced bank supervision be one of the headwinds?
- An important goal of regulatory reform is to provide enhanced macro-prudential supervision. What does that mean?
- One potential aspect: Regulators should consider feedback loops between bank supervision and the broader economy

WEAK LOAN GROWTH AFTER THE RECESSION

Loans outstanding at domestic commercial banks during recent recessions

First month of recession = 100

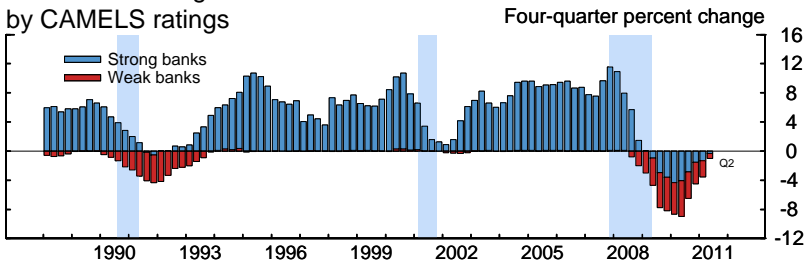


* The average index of loans outstanding in domestic offices over recessions beginning in 1973, 1980, 1981, 1990 and 2001.

Source: H.8 Release.

LOAN GROWTH - WEAK VS. STRONG BANKS

Contributions to growth in total loans at domestic banks
by CAMELS ratings



Note: Strong banks have CAMELS ratings of 1 or 2; weak banks have CAMELS ratings of 3, 4, or 5. Shaded lines represent recessions as identified by the NBER.

Source. Call Reports, FFIEC.

BROAD RESEARCH QUESTIONS

- What is the extent to which bank supervisors change their standards over time?
- Why do they change?
 - ▶ Change in risks facing banks?
 - ▶ Change in risk-aversion of supervisors?
- How do “exogenous” changes in supervision affect lending and broader economic performance?

EMPIRICAL STRATEGY

- **CAMELS ratings** are an observable supervisory metric
 - ▶ Capital adequacy, Asset quality, Management, Earnings, Liquidity, Sensitivity to market risk
 - ▶ Confidential overall supervisory assessment of bank quality (**1, 2, 3, 4, 5**), where **1** = excellent and **5** = near failure
- Define **Supervisory stringency**: The part of CAMELS ratings not explained by identifiable bank-specific or macroeconomic factors from 1991 to 2012
- Test the effects of changes in stringency using a standard monetary policy VAR framework

RELATED LITERATURE

- Literature using CAMELS or BOPEC suggests supervisory standards were stringent in the early 1990s relative to other periods
 - ▶ Commercial bank level (Bizer, 1993), (Berger, Kyle, and Scalise, 2001)
 - ▶ Bank Holding Company level (Curry, Fissel, and Hanweck, 2008), (Krainer and Lopez, 2008)
- Literature assessing macroeconomic effects of supervision suggests they are material
 - ▶ (Peek, Rosengren, and Tootell, 2003)
 - ▶ (Bassett and Marsh, 2012)

MODELING CAMELS IS DIFFICULT

(Discrete dependent variable in a fairly short, unbalanced panel)

- Bank fixed effects: Probit with relatively short time series creates incidental parameter bias
- Bank random effects: Correction for inconsistency ([Wooldridge, 2010](#)) only known to be valid for balanced panels
- Linear model or Pooled cross-section: Inefficient
- Time fixed effects: Supervisory assessments may change across rating categories and react to the macroeconomic environment

CONTRIBUTIONS OF THIS PAPER

- Supplement existing literature in two important ways
 - ① Extend the previous studies on supervisory stringency to include the most recent financial crisis
 - ② Improve on time fixed effects by incorporating supervisory reactions to the broad economic environment
- Show that results are robust to several alternative statistical models
- Introduce repeated cross-sectional regression results
 - ▶ Why? Exploit time variation of thresholds and coefficients to separate “reassessment of risks” from “reassessment of ratings”

MAIN FINDINGS

- Standards in assignment of CAMELS ratings were reasonably constant from 1991 to 2012
- Consistent evidence that standards were tighter than average during the early 1990s and in 2008 (though the degree is model dependent)
- Measured stringency in CAMELS is associated with statistically significant changes in lending standards and bank lending
 - ▶ Small measured variations in CAMELS rating standards over time may be a proxy for coincident broader supervisory efforts
 - ▶ Results provide support for an active bank lending channel in the transmission of monetary policy

DATA AND SAMPLE

- Dependent variable: Most recent **CAMELS** ratings
- Call Reports for bank income and balance sheet variables
- Bank characteristics and regulatory data from NIC database
- State-level employment and house price data weighted by Summary of Deposits to create bank-specific controls for local economic conditions
- Macroeconomic and financial conditions from various sources
- We exclude banks in the top 25 bank holding companies and outliers
- Sample Period: 1991:Q1 to 2012:Q3

TRANSITION MATRIX (1991 - 2012)

	$CAMELS_t$	$CAMELS_t$	$CAMELS_t$	$CAMELS_t$	$CAMELS_t$
	=1	=2	=3	=4	=5
$CAMELS_{t+1}=1$	84.5%	10.5%	0.5%	0.3%	0.0%
$CAMELS_{t+1}=2$	14.8%	83.7%	36.6%	7.9%	4.2%
$CAMELS_{t+1}=3$	0.7%	4.9%	56.3%	30.6%	4.2%
$CAMELS_{t+1}=4$	0.1%	0.7%	5.5%	53.1%	19.3%
$CAMELS_{t+1}=5$	0.01%	0.1%	0.6%	5.1%	42.7%
$BankFailed_{t+1}$	0.04%	0.1%	0.4%	3.0%	29.7%
Number of banks	40,934	66,079	10,237	2,182	192

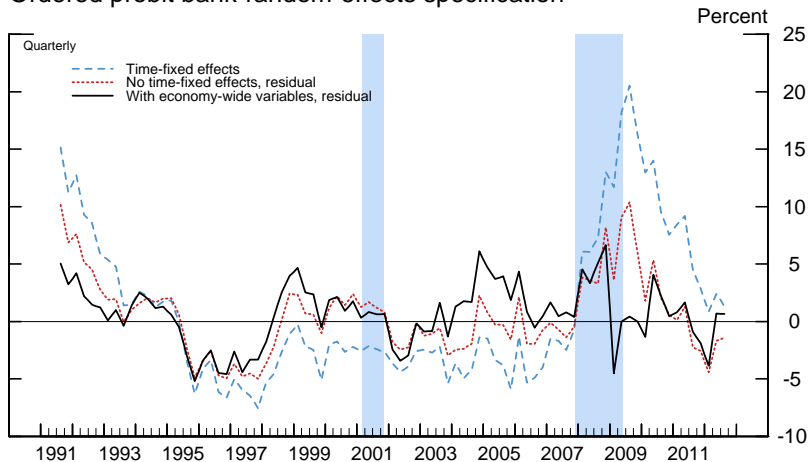
SIX PANEL SPECIFICATIONS

- Three Panel Data Frameworks
 - ① Bank-Fixed-Effects Linear Model
 - ② Bank-Random-Effects Linear Model
 - ③ Bank-Random-Effects Ordered Probit
- Two measures of “stringency”
 - ① Time series of quarterly fixed effects
 - ② Time series of residuals from model with macro-financial variables

MEASURES OF SUPERVISORY STRINGENCY

(Ordered Probit Bank-Random-Effects Specification)

Ordered probit bank-random-effects specification



REPEATED CROSS-SECTION - ORDERED PROBIT REVIEW

- Bank i 's underlying condition: $Y_{i,t}^* = X_{i,t}\beta_t + \epsilon_{i,t}$

$$CAMELS_{i,t} = \begin{cases} 1 & \text{if } Y_{i,t}^* > c_{t,1} \\ 2 & \text{if } c_{t,1} \geq Y_{i,t}^* > c_{t,2} \\ 3 & \text{if } c_{t,2} \geq Y_{i,t}^* > c_{t,3} \\ 4 & \text{if } c_{t,3} \geq Y_{i,t}^* > c_{t,4} \\ 5 & \text{if } c_{t,4} \geq Y_{i,t}^* \end{cases}$$

- Average CAMELS rating at time t :

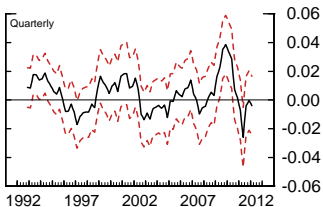
$$\begin{aligned} \overline{CAMELS}_t &= \frac{1}{N_t} \sum_{i=1}^{N_t} E[CAMELS_{i,t}] = \frac{1}{N_t} \sum_{i=1}^{N_t} \sum_{J=1}^5 J \times P(CAMELS_{i,t} = J | X_{i,t}) \\ &= \frac{1}{N_t} \sum_{i=1}^{N_t} [1 + \sum_{J=1}^4 \{\Phi(c_{t,J} - X_{it}\hat{\beta}_t)\}]. \end{aligned}$$

ADVANTAGES OF REPEATED CROSS-SECTION ANALYSIS

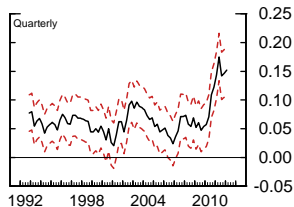
- Gain flexibility of time-varying parameters
- Use a Probit model: Provide decomposition of supervisory stringency into two sources
 - ▶ Assessment of risks, reflected in changed parameter estimates
 - ▶ Assessment of ratings, reflected in higher threshold estimates
- Reduces possible selection bias from when banks are examined - use most recent exam within two-year overlapping intervals

EXAMPLE - EFFECT OF CAPITAL ADEQUACY AND ASSET QUALITY

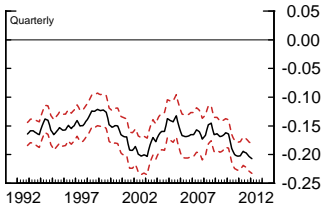
Total capital ratio



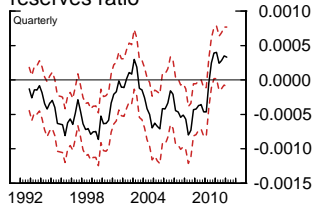
Leverage ratio



Noncurrent loan ratio

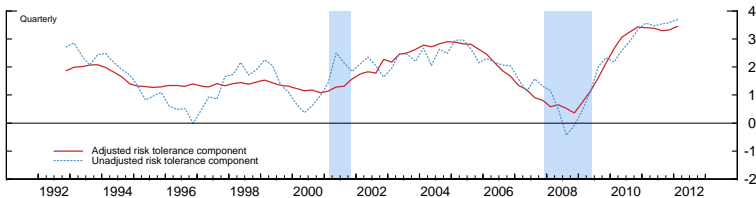


Noncurrent loans to reserves ratio



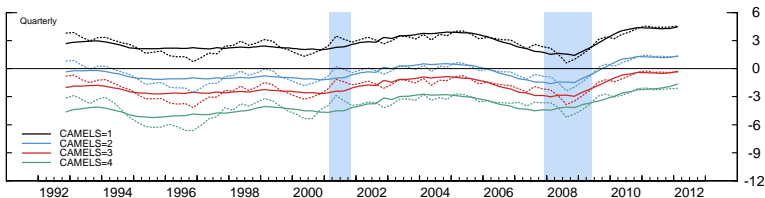
SUPERVISORY STRINGENCY BY COMPONENT

Risk tolerance component



Note: The unadjusted risk tolerance component is the risk tolerance component prior to adjustment with economy-wide variables.

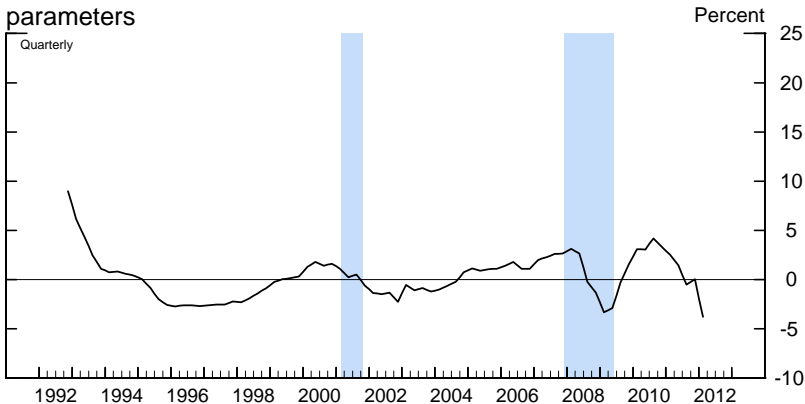
Threshold estimates for each CAMELS rating adjusted for supervisory stringency



Note: Banks must exceed the threshold to be achieve the particular rating. Dotted lines represent the threshold estimates prior to adjustment with economy-wide variables.

SUPERVISORY STRINGENCY - REPEATED CROSS SECTION

Supervisory stringency with macro indicators and time-varying parameters



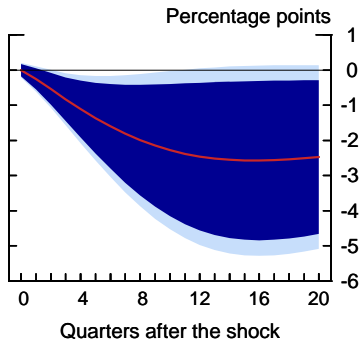
Note: Supervisory stringency is an index that can be interpreted as the percent of banks, on average, that deserve to be upgraded to the next rating according to each model's benchmark standards.

MACROECONOMIC IMPLICATIONS

- Do Supervisory Stringency Indexes help explain growth of loans and output?
- Standard monetary VAR Model - 1991:Q3-2011:Q2
- Two lags of six variables
 - ▶ Ordering: Model-implied supervisory index, real GDP growth, inflation, growth in total loans (or lending capacity), change in lending standards, federal funds rate

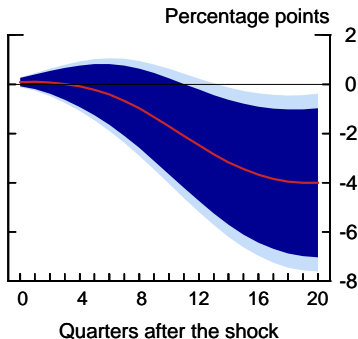
RESPONSE OF LENDING TO A SHOCK IN SUPERVISORY STRINGENCY

Ordered probit panel
Lending capacity



Note: Cumulative impulse response.

Repeated cross-section
Lending capacity



CONCLUSIONS

- Macro variables explain a lot of what previous work called “stringency” (especially during the recent financial crisis)
- Accounting for overall economic environment, supervisory stringency in the assignment of CAMELS ratings has not varied much over time
- Supervisors do not seem to have been unduly stringent since the end of the most recent recession
- Supervisory stringency appears to be associated with a modest but statistically significant reduction in subsequent loan growth

CAVEATS

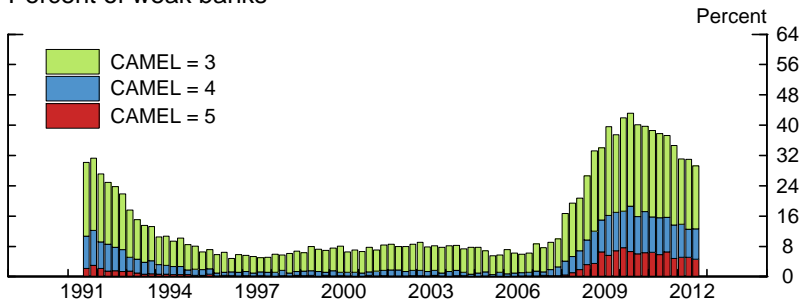
- Supervisors can pressure banks through other means
- Not include top 25 BHCs
- Management Quality and Sensitivity to Market Risk
- Inverse Mills Ratio may not capture selection
- Omitted variables

APPROACH OF PREVIOUS LITERATURE

- Modeled discrete ratings in a pooled ordered limited-dependent variable framework
 - ▶ Latent variable represents “true” condition of a bank, modeled as a function of a set of control variables
 - ▶ Controls generally included a range of bank-specific characteristics and a set of regional or state-level variables for local economic conditions, and period fixed effects
- Interpret period fixed effects as supervisory stringency

DISTRIBUTION OF WEAK BANKS (1991 - 2011)

Percent of weak banks



Note: Weak banks have CAMELS rating of 3, 4, or 5.

CALL REPORT: BALANCE SHEET AND INCOME DATA

(Proxies for each CAMELS component)

- Capital Adequacy - Total risk-based capital ratio, leverage ratio as defined in FDICIA, the ratio of delinquencies to loan loss reserves
- Asset Quality - Noncurrent loans to total loans, private securities to total assets, CRE loans to total assets, residential loans to total assets, other loans (not secured by real estate) to total assets
- Management - Noninterest expense to revenue
- Earnings - Return on assets, net interest margin
- Liquidity - Volatile liability dependence ratio, core deposit ratio
- Sensitivity to Market Risk - Return on risky assets

OTHER VARIABLES

- Other exam-related or bank-structure variables
 - ▶ Previous CAMELS, Bank size, BHC, Lead regulatory agency, Merger, Charter change, Quarter dummies, FR district dummies
- Regional economic variables (state data weighted by deposits)
 - ▶ Bank-specific unemployment rates and growth rates of house prices
- Economy-wide variables
 - ▶ Macro (growth of house prices, national unemployment rate, growth rate of real GDP)
 - ▶ Financial (effective Fed Funds rate, BBB spread, simple Treasury term premium, annual growth in S&P 500)

PANEL ANALYSIS RESULTS - LINEAR MODELS

- Impact on expected CAMELS rating from one standard deviation increase in selected variables with economy-wide variables (rather than time-fixed effects)

Panel A: Linear Specification

Explanatory Variable	Fixed Effects	Random Effects	
		Avg.	Dev.
Return on assets	-0.14	-0.11	-0.09
Leverage ratio	-0.06	-0.03	-0.02
Noncurrent ratio	0.09	0.05	0.09
CRE loans ratio	0.09	0.07	0.03
RRE loans ratio	0.02	0.03	0.01
Non-real-estate loans ratio	0.07	0.04	0.03
Term premium	0.02	0.01	–
Fed Funds effective rate	0.05	0.03	–
Aggregate unemployment rate	0.05	0.04	–
<hr/>			
R-squared	0.752	0.730	–
Number of banks	9,038	9,120	–
Number of observations	123,344	116,921	–

PANEL ANALYSIS RESULTS - PROBIT MODEL

- Impact on expected CAMELS rating from one standard deviation increase in selected variables with economy-wide variables (rather than time-fixed effects) on a bank with a previous CAMELS rating of 3 with the median characteristics of all banks with CAMELS ratings of 3

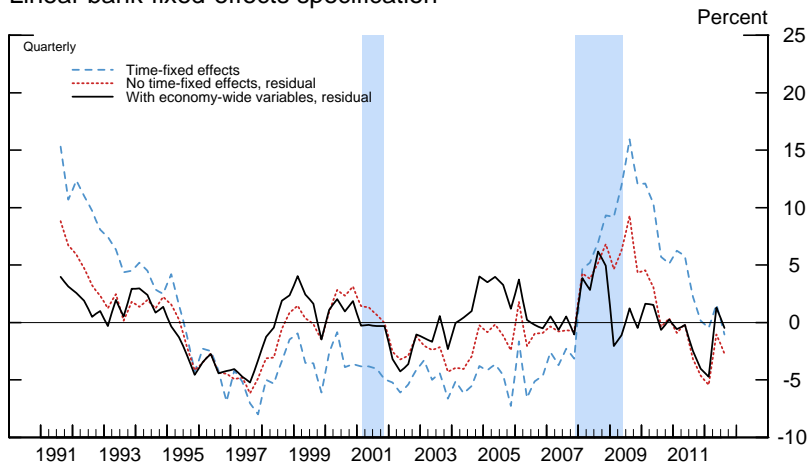
Panel B: Modified Random Effects Ordered Probit

Explanatory Variables	<i>CAMELS</i> = 2	= 3	= 4	<i>E</i> [<i>CAMELS</i>]
Return on assets (avg.)	0.122	-0.090	-0.033	-0.156
Return on assets (dev.)	0.126	-0.093	-0.034	-0.160
Leverage ratio (avg.)	0.022	-0.016	-0.006	-0.028
Leverage ratio (dev.)	0.019	-0.014	-0.005	-0.024
Noncurrent ratio (avg.)	-0.120	0.088	0.032	0.153
Noncurrent ratio (dev.)	-0.065	0.048	0.017	0.083
CRE loans ratio (avg.)	-0.074	0.054	0.020	0.094
CRE loans ratio (dev.)	-0.040	0.029	0.011	0.051
RRE loans ratio (avg.)	-0.029	0.021	0.008	0.037
RRE loans ratio (dev.)	-0.034	0.025	0.009	0.043
Non-real-estate loans ratio (avg.)	-0.045	0.033	0.012	0.058
Non-real-estate loans ratio (dev.)	-0.040	0.029	0.011	0.051
Volatile liability ratio (avg.)	-0.005	0.004	0.001	0.006
Volatile liability ratio (dev.)	-0.015	0.011	0.004	0.019
Log of total assets (avg.)	0.042	-0.031	-0.011	-0.054
Aggregate unemployment rate	-0.061	0.045	0.016	0.077
Fed Funds effective rate	-0.049	0.036	0.013	0.062
Term premium	-0.019	0.014	0.005	0.025

MEASURES OF SUPERVISORY STRINGENCY

(Linear Bank-Fixed-Effects Specification)

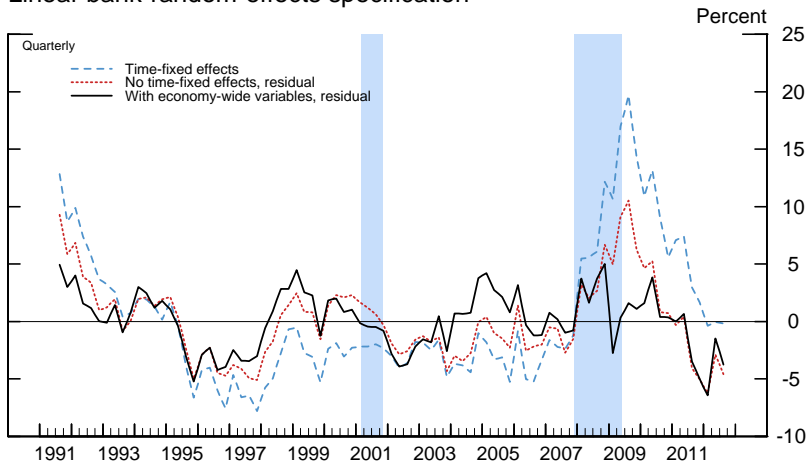
Linear bank-fixed-effects specification



MEASURES OF SUPERVISORY STRINGENCY

(Linear Bank-Random-Effects Specification)

Linear bank-random-effects specification



AGGREGATE RISK TOLERANCE

- Decompose change in average CAMELS ratings into “compositional” effect and “risk” effect using the Blinder-Oaxaca decomposition

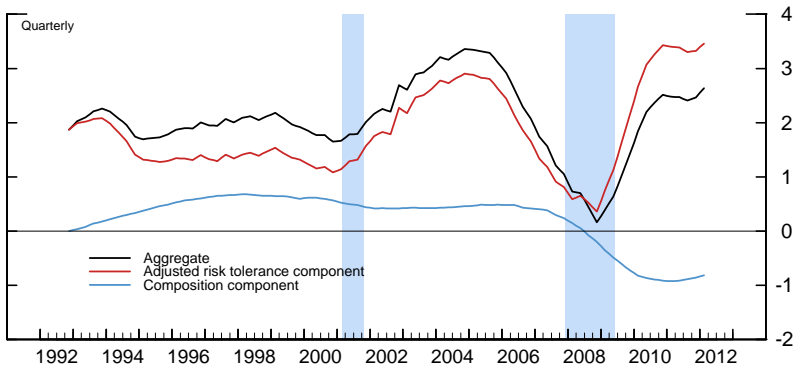
$$\bar{Y}_t^* - \bar{Y}_{t-1}^* = \frac{1}{2}(\hat{\beta}_t + \hat{\beta}_{t-1})(\bar{X}_t - \bar{X}_{t-1}) + \frac{1}{2}(\bar{X}_t + \bar{X}_{t-1})(\hat{\beta}_t - \hat{\beta}_{t-1})$$

- Can calculate an “aggregate” β_t , or “tolerance for risk”

$$R_t = \bar{Y}_0^* + \sum_{k=1}^t \frac{1}{2}(\bar{X}_k + \bar{X}_{k-1})(\hat{\beta}_k - \hat{\beta}_{k-1})$$

COMPOSITION VS. RISK EFFECTS IN BANK CONDITION

Aggregate bank conditions adjusted for supervisory stringency



Note: Aggregate bank conditions are aggregated predicted latent values (excluding thresholds) of bank conditions with macro indicators and is the sum of the risk tolerance and composition components. The risk component is adjusted with economy-wide variables.

SUPERVISORY STRINGENCY: UNEXPLAINED VARIATION IN COEFFICIENTS AND THRESHOLDS

- Decomposition of aggregate risk tolerance and thresholds into the parts that can be explained by macro fundamentals and the part that cannot
- “Lower than expected risk tolerance” = negative η_t

$$R_t = E_t \gamma^{risk} + \eta_t$$

- “Higher than expected thresholds” = positive $\nu_{t,j}$

$$c_{t,j} = E_t \gamma_j^{thres} + \nu_{t,j}$$

MEASURING TOTAL SUPERVISORY STRINGENCY

- Adjusted latent variable and CAMELS thresholds

$$adjY_{i,t}^* = X_{i,t}\beta_t - \eta_t + \epsilon_{i,t}$$

$$adjCAMELS_{i,t} = \begin{cases} 1 & \text{if } adjY_{i,t}^* > c_{t,1} - \nu_{t,1} \\ j=[2\dots 4] & \text{if } c_{t,j-1} - \nu_{t,j-1} \geq adjY_{i,t}^* > c_{t,j} - \nu_{t,j} \\ 5 & \text{if } c_{t,4} - \nu_{t,4} \geq adjY_{i,t}^* \end{cases}$$

$$\overline{adjCAMELS}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} \left[1 + \sum_{J=1}^4 \{ \Phi(c_{t,J} - \hat{\nu}_{t,J} - X_{i,t}\hat{\beta}_t + \hat{\eta}_t) \} \right],$$

- Supervisory stringency is then defined as:

$$\overline{CAMELS}_t - \overline{adjCAMELS}_t$$

ROBUSTNESS CHECKS

- Only include full-scope exams
- Changes in balance sheet and income measures
- Selection regression for whether or not examined in a particular quarter
- Inclusion of stock market variables in economy-wide-variable set