Bank Complexity, Governance, and Risk

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Outline

Motivation

- Large and complex banking organizations under scrutiny post GFC
  - Risk management
  - Systemic risks
  - Difficult to resolve
- Regulatory actions aimed at curtailing complexity (Dodd-Frank Act)
- What is the relationship between complexity and risk?
  1. Perhaps not all negative
  2. Could depend on type of complexity
  3. Bank governance and regulation could matter, influencing scope for positive vs. adverse outcomes.

Tradeoffs of complexity: Our conjectures

- Positive:
  - Diversifies Bank Holding Company (BHC) income
  - Supports synergies across businesses and countries
  - Reduces liquidity risk across affiliated entities
- Negative:
  - Agency problems may lead to "empire building"
  - Enhanced difficulties containing risks
- Balance of outcomes could:
  - Differ by form of complexity: organizational, business, geographic
  - Vary by type of risk: idiosyncratic, market, liquidity, systemic
  - Be more negative under weaker BHC governance

Our Contributions

- Provide a comprehensive analysis of complexity and risk
  - Empirical analysis of large US BHCs, 1996 to 2018
  - Complexity: Organizational, business, and geographic
  - Balance sheet diversification
  - Risk exposures: idiosyncratic, systematic, liquidity, systemic
- Study how new regulations (living wills) influence BHC complexity and risk, allowing for role of governance
- Emphasize potential unintended consequences for BHC risk profiles
  - Organizational and Geographic complexity matter most
  - Living wills mainly reduced organizational complexity
  - Systemic and market risk exposures declined. However, some diversification lost, and idiosyncratic and liquidity risk exposures rose

Related Literature

- Bank complexity:
  - Measurement: Carmassi & Herring (2016), Cetorelli & Goldberg (2014, 2016), Cetorelli, Jacobides, Stern (2017), Goldberg & Meehl (2020)
- Bank risk:
  - Governance: Gorton & Rosen (1995), DeYoung, Peng & Yan (2013)
  - Diversification: Buch, Koch & Koetter (2013), Laeven & Levine (2007), Goetz, Laeven, Levine (2013, 2016), Barth & Wihlborg (2017)
  - Risk and TBTF: Freixas, Loranth, Morrison (2007), Berger et al. (2017), Chernobai, Ozdagli, Wang (2018), Laeven & Levine (2007), Cetorelli & Traina (2018)
  - Liquidity: Luciano & Wihlborg (2018), Baggatini, Fecht & Weber (2018), Cetorelli & Goldberg (2016)

Outline

Hypotheses

Organized in 3 parts. Long run average relationship between complexity and types of risk; effects of an identified shock to complexity regime; risk consequences, including by governance and additional supervisory focus. Paper discusses, but does not explicitly study, liquidity and capital regs.

Understanding average long-run relationships

H1a: BHC complexity reduces the risk profile of banks if it is accompanied by an increase in the diversification of banks' income streams.

H1b: Higher BHC complexity should reduce risks more for those BHCs with stronger corporate governance

Hypotheses, continued

Understanding the effects of complexity-targeted regulations

H2a: Relaxed (tighter) regulatory restrictions on banks' participation in non-traditional banking activities should increase (reduce) banks' complexity.

H2b: If "empire building" motives dominate income diversification motives, complexity should increase more for banks with weaker corporate governance.

H3: More stringent regulatory frameworks, including recovery and resolution regimes, should lead to lower risk profiles for banks, especially for those with weaker corporate governance.

Testing Hypothesis 1: Average Relationship between Complexity, Risk, and Governance

$$Y_{b,t} = \alpha^1 + \theta^1 \cdot C_{b,t-1} + \beta^1 \cdot G_{b,t-1} + \gamma^1 \cdot X_{t-1} + \psi^1 \cdot Z_{b,t-1} + \delta_b + \epsilon_{b,t} \quad (1)$$

$$C^i_{b,t} = \alpha^2 + \theta^2 \cdot Y_{b,t-1} + \beta^2 \cdot G_{b,t-1} + \gamma^2 \cdot X_{t-1} + \psi^2 \cdot Z_{b,t-1} + \kappa_b + \omega_{b,t} \quad (2)$$

$C_b \equiv$ complexity, $G_b \equiv$ governance, $Y_b \equiv$ risk or diversification,
$X \equiv$ macro controls, $Z_b \equiv$ bank controls, Sample 1996Q1-2018Q2

Estimate each equation separately, and as a system using IV approach to recognize potential co-determination of BHC risk and complexity choices (Coles, Daniel, and Naveen, 2006)

Testing Hypothesis 2: Regulatory change and complexity

Living Wills under the Dodd Frank Act

- Targets reduced BHC complexity and improved resolution
- Staggered Implementation by BHC Assets: above $250 bil (July 2012); above $100 bil (July 2013); $50 to $100 bil (Dec 2013)
- Allows for differential level of treatment ($>$ $750 bil)

Difference-in-difference analysis using BHCs reporting living wills as treated. Sample 2009Q2-2018Q2.

$$C^i_{b,t} = \alpha + \beta \cdot LW_t + \theta \cdot G_{b,2009} + \phi \cdot (LW_t \cdot G_{b,2009}) + \gamma \cdot X_{t-1} + \psi \cdot Z_{b,t-1} + \epsilon_{b,t} \quad (3)$$

$C_b \equiv$ complexity, $G_b \equiv$ governance in 2009
$LW_t \equiv$ Post Living Wills, $X \equiv$ macro controls, $Z_b \equiv$ bank controls
Allow for differential level of treatment ($>$ $750 bil)

Testing Hypothesis 3: Regulatory change and Risk

Difference-in-difference analysis of BHC Risk using BHCs reporting living wills (2012) as treated. Period 2009Q2-2018Q2.

$$Y^i_{b,t} = \alpha + \beta \cdot LW_t + \theta \cdot G_{b,2009} + \phi \cdot (LW_t \cdot G_{b,2009}) + \gamma \cdot X_{t-1} + \psi \cdot Z_{b,t-1} + \epsilon_{b,t} \quad (4)$$

$Y_b \equiv$ risk or diversification, $G_b \equiv$ governance in 2009,
$LW_t \equiv$ Post Living Wills, $X \equiv$ macro controls, $Z_b \equiv$ bank controls
Allow for differential level of treatment ($>$ \$750 bil)

Outline

Large and Complex US BHCs

- Sample of US Bank Holding Companies (BHC)
  - File reports Y-6 describing the BHC structure
  - Publically traded (map Compustat CRSP codes and RSSD ID)
  - Above $25 billion in 2012 assets
- Sample period 1996Q1-2018Q4
- BHCs per quarter: min 23, max 49
- Complexity metrics use NIC reporting of entities within BHCs, plus balance sheet information: Goldberg & Meehl(2020)

Three Measures of BHC Complexity

Organizational

- *Log affiliate count*

Business

- Business scope *First principle component from: non-financial count Share, number of business types, herfindahl over business types, count of NAICS, non-interest income share*

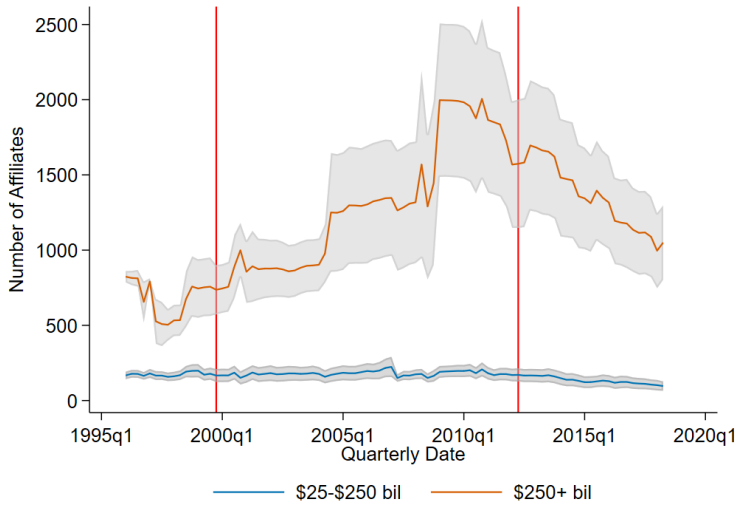
Geographic

- Geographic Scope *First principle component from: count of countries, herfindahl over number of countries, share of foreign Office claims in total assets, number of countries with internal capital market flows*

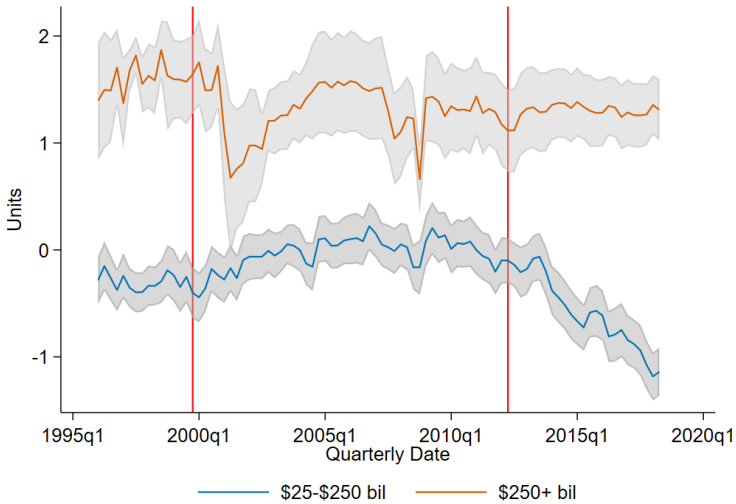
▸ Complexity table

▸ PCA table

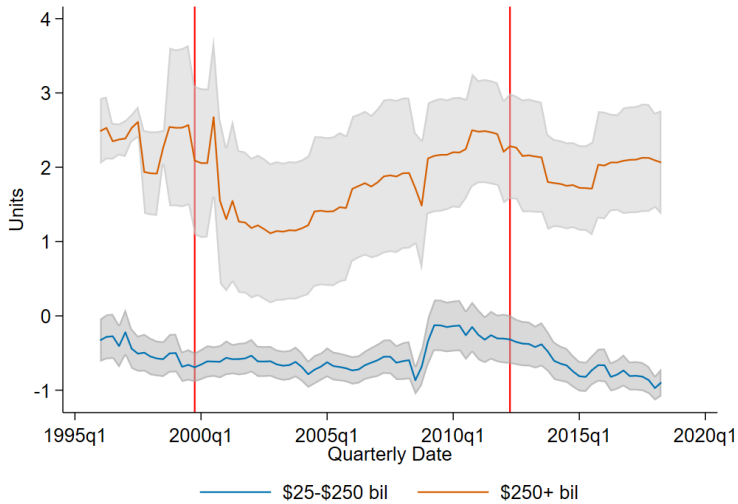
BHC complexity



Organizational



Business



Geographic

BHC Diversification and Risk

- Diversification: ▸ Diversification
  - Std. dev. of ROA, Std. dev. of idiosyncratic returns
- Idiosyncratic risk [enter with negative sign]: ▸ Idiosyncratic Risk
  - Log z-score (balance sheet) $= \frac{Avg.ROA + Avg.(Equity/Assets)}{Std.ROA}$
  - Log of market z-score $= \frac{EquityReturns+1}{SDofStockReturns}$
- Systematic or market risk: Dynamic Beta
  - GARCH MA(1)over returns of BHC vs market returns(Engle 2014)
- Liquidity risk: LIBOR-OIS Beta
  - Regression of returns of BHC vs LIBOR-OIS spread
- Systemic risk: SRISK
  - Expected Capital Shortfall if Crisis (Acharya et. al. 2012)

▸ Dynamic Beta, LIBOR-OIS Beta, SRISK

Outline

Long run relation between Complexity and Diversification

	Single Equation Estimates			IV System Estimates		
Diversification as Dependent Variable	Org.	Bus. Scope	Geo. Scope	Org.	Bus. Scope	Geo. Scope
SD ROA	−	+	−**	−***	−	−***
SD Idiosyncratic Returns	−**	−**	+	−	−	−
Complexity as Dependent Variable	Org.	Bus Scope	Geo. Scope	Org.	Bus Scope	Geo. Scope
SD ROA	−	+	−	+	−	+*
SD Idiosyncratic Returns	−*	−**	+	−	−**	+

$$Y_{b,t} = \alpha^1 + \theta^1 \cdot C_{b,t-1} + \beta^1 \cdot G_{b,t-1} + \gamma^1 \cdot X_{t-1} + \psi^1 \cdot Z_{b,t-1} + \delta_b + \epsilon_{b,t} \quad (5)$$

$$C^i_{b,t} = \alpha^2 + \theta^2 \cdot Y_{b,t-1} + \beta^2 \cdot G_{b,t-1} + \gamma^2 \cdot X_{t-1} + \psi^2 \cdot Z_{b,t-1} + \kappa_b + \omega_{b,t} \quad (6)$$

$C_b \equiv$ complexity, $G_b \equiv$ governance, $Y_b \equiv$ risk or diversification, $X \equiv$ macro controls, $Z_b \equiv$ bank controls, Sample 1996Q1-2018Q2

More organizational and geographic complexity tend to reduce fluctuations in income, improve diversification.

Long run relation between complexity and risk

	Single Equation Estimates			IV System Estimates		
Risk as Dependent Variable	Org.	Bus. Scope	Geo. Scope	Org.	Bus. Scope	Geo. Scope
Z-score	+	+	−	−**	−	−***
Market Z-score	−***	−***	+	−	−*	+
Dynamic Beta	+	−	+***	+**	+	+***
SRISK	+*	+	+**	+***	+**	+**
LIBOR-OIS Beta	−***	−	−**	−	−	−**
Complexity as Dependent Variable	Org.	Bus Scope	Geo. Scope	Org.	Bus Scope	Geo. Scope
Z-score	+	+	−	+	−	+**
Market Z-score	−**	−***	+	−	−**	+
Dynamic Beta	+	−	+***	+**	+	+***
SRISK	+***	+	+**	+***	+	+**
LIBOR-OIS Beta	−***	−*	−**	−	+	−**

Organizational and geographic complexity associated with lower idiosyncratic risk, but higher market and systemic risk exposures.

Long run relation between complexity and risk

	Single Equation Estimates			IV System Estimates		
Risk as Dependent Variable	Org.	Bus. Scope	Geo. Scope	Org.	Bus. Scope	Geo. Scope
Z-score	+	+	−	−**	−	−***
Market Z-score	−***	−***	+	−	−*	+
Dynamic Beta	+	−	+***	+**	+	+***
SRISK	+*	+	+**	+***	+**	+**
LIBOR-OIS Beta	−***	−	−**	−	−	−**
Complexity as Dependent Variable	Org.	Bus Scope	Geo. Scope	Org.	Bus Scope	Geo. Scope
Z-score	+	+	−	+	−	+**
Market Z-score	−**	−***	+	−	−**	+
Dynamic Beta	+	−	+***	+**	+	+***
SRISK	+***	+	+**	+***	+	+**
LIBOR-OIS Beta	−***	−*	−**	−	+	−**

Organizational and geographic complexity associated with lower idiosyncratic risk, but higher market and systemic risk exposures.

Economic Significance

Quantitative importance high for largest BHCs ($750+ bil assets):

- Impact of one std dev increase in organizational complexity (672 entities):
  - SD RoA: 4 std dev decline
  - Z-score[-1]: 3 std dev decline
  - Dynamic Beta: 1.3 std dev increase
- Impact of one std dev increase in geographic complexity (1.8):
  - Dynamic Beta: 1.7 std dev increase
  - LIBOR-OIS beta: 1.1 std dev decrease

Quantitative importance for smaller BHCs (less than $750 bil assets):

- a one std dev increase in organizational and geographic complexity increases dynamic beta by 1 and 1.5 std devs respectively.
- a one std dev increase in geographic complexity decreases liquidity risk by 0.6 std devs.

Hypothesis 1 - Takeaways

- Organizational and geographic complexity are associated with enhanced income diversification and lower idiosyncratic and liquidity risks. Consistent with Hypothesis 1a.
- But organizational and geographic complexity are associated with higher systematic and systemic risks, making them vulnerable to correlated events.
- However BHCs with better governance are those involved in more complex structures (consistent with Hypothesis 1b), potentially mitigating some of these risks. ▸ Governance Figures ▸ Results w/ Governance

Hypothesis 2: What changes in complexity after introduction of living wills, with role of governance?

	Organizational Complexity			Business Scope			Geographic Scope		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post LW	-0.16***	-0.12*	-0.12*	-0.05	-0.08	-0.05	-0.07	-0.09	-0.02
Post LW X 750+ bil_{2009}		-0.23**	-0.23**		0.04	0.06		0.08	0.10
Post LW X $GovPC1_{2009}$			-0.02			0.03			0.04
Post LW X CEO $Duality_{2009}$			0.08			-0.29			-0.61*
N	1183	1140	1140	1183	1140	1140	1183	1140	1140
Adj. within-R2	0.27	0.30	0.30	0.11	0.11	0.11	0.24	0.25	0.28
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks	47	43	43	47	43	43	47	43	43

Living Will regulation most impactful for organizational complexity, with largest declines in the largest BHCs. BHC governance only plays a role through geographic complexity: better governed contract more.

Hypotheses 2: Takeaways

- The introduction of living wills, a regulatory tightening, significantly reduced the organizational complexity of treated BHCs relative to other large BHCs, consistent with Hypothesis 2a.
- BHCs governance was not important for the relative scale of changes in organizational complexity. For geographic complexity, governance acted as a complement to regulation, rejecting Hypothesis 2b.

Hypothesis 3: Changes in idiosyncratic risk after introduction of living wills, with role of governance

	z-score			Market z-score		
	(1)	(2)	(3)	(4)	(5)	(6)
Post LW	-0.487***	-0.500***	-0.414**	-0.046**	-0.056***	-0.050*
Post LW X 750+ bil_{2009}		0.110	0.122		0.044	0.045
Post LW X $GovPC1_{2009}$			-0.090			0.001
Post LW X CEO $Duality_{2009}$			-0.441			-0.043
N	1120	1085	1085	1143	1100	1100
Adj. within-R2	0.39	0.39	0.40	0.82	0.82	0.82
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Banks	48	44	44	48	44	44

Treated group had larger declines in idiosyncratic risks, similar for the very largest BHCs with even greater organizational complexity declines. Possibly concentrated in better governed BHCs.

Hypothesis 3: Changes in liquidity, systematic, and systemic risk after introduction of living wills, with role of governance

	Dynamic Beta			SRISK			LIBOR-OIS Beta		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post LW	0.02	-0.01	0.03	-4.40**	0.51	1.32	0.05***	0.06***	0.07***
Post LW X 750+ bil_{2009}		0.12	0.12		-21.3***	-21.4***		-0.03**	-0.03*
Post LW X $GovPC1_{2009}$			0.002			-2.19			-0.01
Post LW X CEO $Duality_{2009}$			-0.31*			-1.65			-0.06
N	1082	1039	1039	1082	1039	1039	1143	1100	1100
Adj. within-R2	0.55	0.56	0.56	0.24	0.35	0.35	0.10	0.10	0.10
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks	44	40	40	44	40	40	48	44	44

While treated group registered more organizational complexity declines and more of a reduction in idiosyncratic risk, some relative increases in liquidity risk. (effect moderated in largest and better governed BHCs)

Hypothesis 3: Takeaways

- Systemic risk decreased more for living will reporters.
- Liquidity risk exposures were relatively higher for the treated group, relative to other large BHCs.
- Treated BHCs with stronger governance tended to have reductions in risks, making governance and regulations complementary. Rejects part of Hypothesis 3.

▸ H3 Results w/ Organizational Complexity

Outline

Conclusions

- Organizational complexity and larger geographic scope tend to reduce idiosyncratic and liquidity risks, on average, while increasing BHC exposures to systematic and systemic risks.
- Complexity entails tradeoffs across types of risks. Spillbacks of risks on complexity small.
- Living wills reduced treated BHCs organizational complexity: business scope and geographic scope were less impacted.
- Living wills generated a reduction in both idiosyncratic risks and systemic risk, and a relative increase in liquidity risk. Governance less important, but complementary in risk reduction.
- Complexity is a broad concept benefiting from careful delineations. Different types of complexity entail different tradeoffs for individual BHC risk profiles, and correlated vulnerabilities.

Complexity Variables

Variable	Definition
Organizational	
$Count_{b,t}$	Total Count of subsidiaries held by BHC
Business	
$BPC1_{b,t}$	Business scope; 1st principle component over variables below
Non-fin Count $Share_{b,t}$	Share of non-financial affiliates
$CountB_{b,t}$	Total count of business types (commercial banks, mutual/pension funds, insurance, other financial, non-fin management firms, other nonfinancial)
$BHHI_{b,t}$	$\frac{CountB}{CountB-1}\left(1-\sum_{j=1}^{B}\left(\frac{count_j}{\sum_{j=1}^{B} count_j}\right)^2\right)$ where B are business types and $count_j$ is the number of BHC's subsidiares that are classified in accordance with each business type j.
$CountN_{b,t}$	Number of 4-digit NAICS industries
Noninterest income $share_{b,t}$	Share of income from non-interest sources
Geographic	
$GPC1_{b,t}$	Geographic scope; 1st principle component over variables below
$CountC_{b,t}$	Count of countries spanned by BHC's affiliates
$CHHI_{b,t}$	$CountCHHI = \frac{CountC}{CountC-1}\left(1-\sum_{c=1}^{C}\left(\frac{count_c}{\sum_{c=1}^{C} count_c}\right)^2\right)$ where C is the set of countries and $count_c$ is the count of subsidiaries in each country c.
Share of foreign office $claims_{b,t}$	Share of foreign office claims in total assets, by bank
$CountNDT_{b,t}$	Count Net Due to Positions, countries, by bank

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PCA Results

	Comp1	Comp2
Business Complexity (BPC)		
Non-Financial Count Share	0.14	-0.76
CountB	0.55	0.23
BHHI	-0.41	0.46
CountN	0.54	-0.02
Non-interest Income Share	0.47	0.39
% Variation Explained	0.33	0.27
Geographic Complexity (GPC)		
CountC	0.52	-0.28
CHHI	0.46	0.77
Share of foreign office claims in total assets	0.51	0.14
Count Net due to positions	0.51	-0.55
% Variation Explained	0.78	0.13

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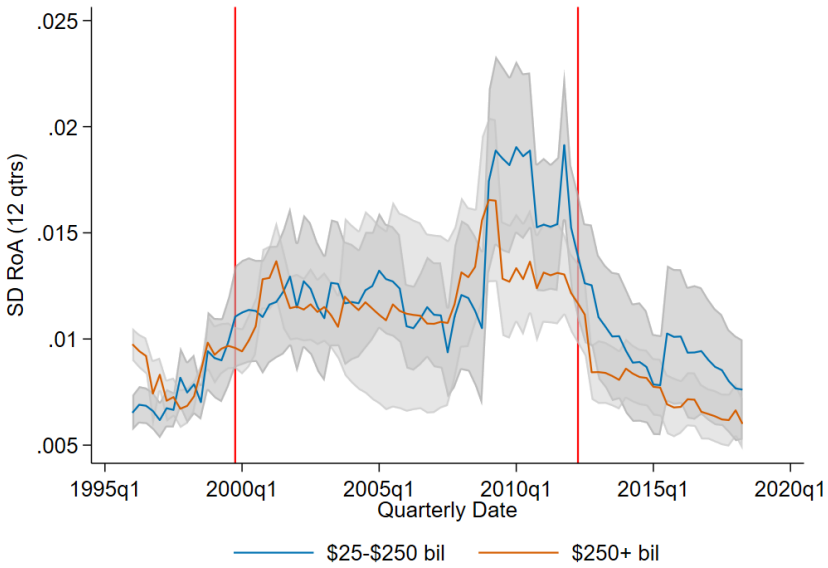
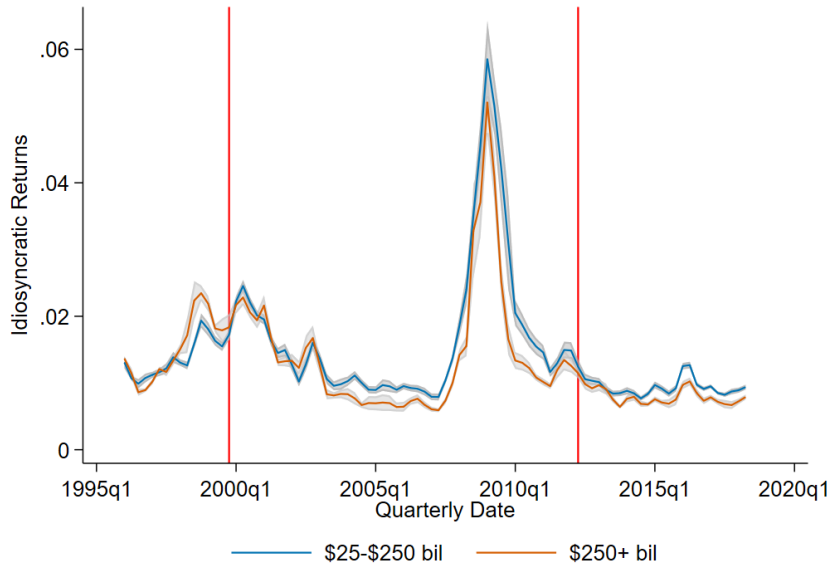
Summary Statistics

	mean	sd	min	p25	p50	p75	max	count
BHC Sample								
Assets ($2012 billions)	258.283	457.92	23.014	48.366	90.709	202.368	2541.892	3659
Loans to Assets Ratio	0.582	0.19	0.022	0.519	0.648	0.706	0.870	3658
Deposits to assets ratio	0.625	0.18	0.000	0.576	0.664	0.735	0.935	3538
Liquid assets ratio	0.256	0.15	0.002	0.155	0.215	0.308	0.824	3652
Equity to assets ratio	0.092	0.03	0.030	0.074	0.088	0.108	0.217	3659
Number of BHCs	32.917	5.55	23.000	29.000	32.000	34.000	49.000	3659
BHC Complexity								
Total affiliate count	382.352	672.69	4.000	58.000	115.000	388.000	4494.000	3601
Non-Financial Count Share	0.452	0.18	0.053	0.322	0.418	0.547	0.973	3601
CountB	5.216	0.55	3.000	5.000	5.000	6.000	6.000	3601
BHHI	0.745	0.16	0.076	0.678	0.785	0.852	1.000	3601
CountN	17.192	8.16	4.000	12.000	14.000	20.000	53.000	3601
Non-interest income share	0.447	0.19	0.000	0.311	0.406	0.531	1.000	3651
CountC	14.775	18.10	1.000	2.000	6.000	22.000	87.000	3601
CHHI	0.311	0.29	0.000	0.038	0.214	0.596	0.935	3601
Share of foreign office claims in total assets	0.080	0.12	0.000	0.001	0.014	0.125	0.518	3659
Count Net due to positions	11.657	18.07	1.000	1.000	3.000	16.000	100.000	3659
Business Scope	0.000	1.28	-3.573	-1.030	-0.169	1.057	3.265	3593
Geographic Scope	0.000	1.77	-1.533	-1.349	-0.735	1.190	6.530	3601
BHC Diversification								
SD. RoA (12 qtr)	0.010	0.01	0.000	0.004	0.007	0.011	0.078	3467
Idiosyncratic Returns	0.014	0.01	0.004	0.009	0.011	0.016	0.159	3564
BHC Risk								
-Log Z-Score (12 qtr)	-2.811	0.84	-5.885	-3.372	-2.770	-2.216	-0.565	3467
-Market Z-score	-4.043	0.47	-5.141	-4.358	-4.118	-3.796	-1.791	3565
Beta	1.160	0.43	0.173	0.903	1.087	1.336	4.381	3111
SRISK	1.794	16.44	-68.088	-2.340	-0.158	1.898	142.643	3111
LIBOR-OIS Beta	-0.030	0.11	-0.873	-0.054	-0.009	0.015	0.402	2151
BHC Governance								
Total Inst. Ownership, Pct. Shares Outstanding	0.635	0.17	0.002	0.517	0.632	0.764	1.935	2960
Share of independent directors	78.207	11.83	28.571	71.429	80.000	87.500	100.000	2619
CEO duality	0.125	0.33	0.000	0.000	0.000	0.000	1.000	2619
Macro Controls								
VIX	19.35	7.24	10.31	13.72	17.40	23.17	58.59	114
Credit to GDP Gap (BIS)	-0.50	8.41	-16.10	-6.90	1.45	7.20	12.20	134
Annualized real GDP Growth	2.66	2.32	-8.40	1.50	2.95	4.00	7.50	134

BHC Diversification Measures



Income Diversification



SD Idiosyncratic Returns

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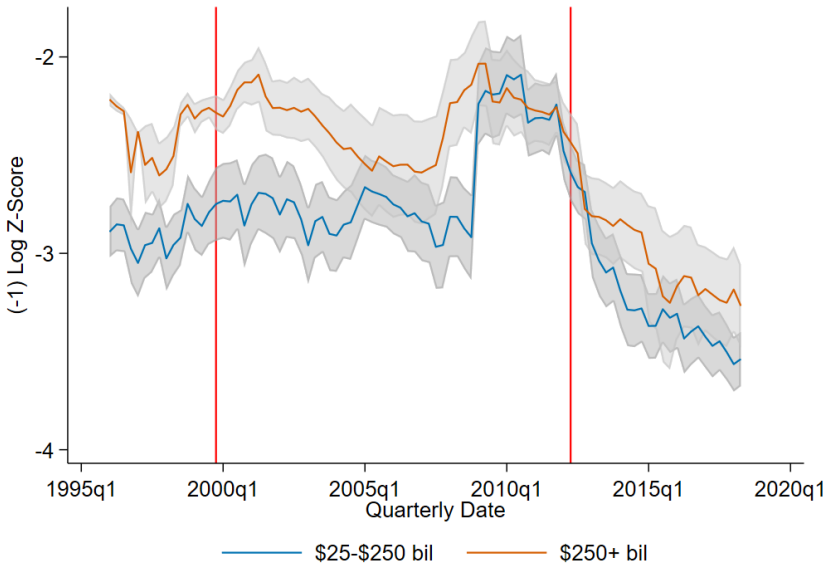
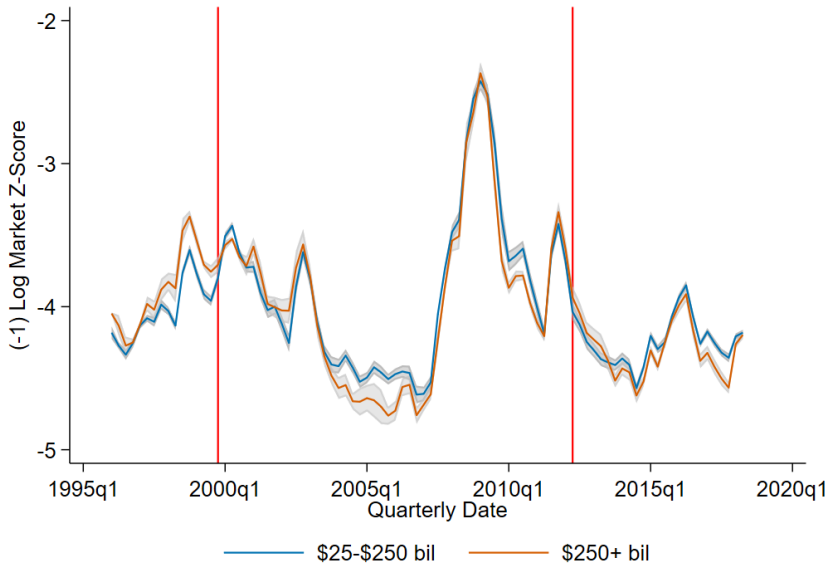
BHC Risk Measures



(-1) Log Z-score



(-1) Log Market Z-score

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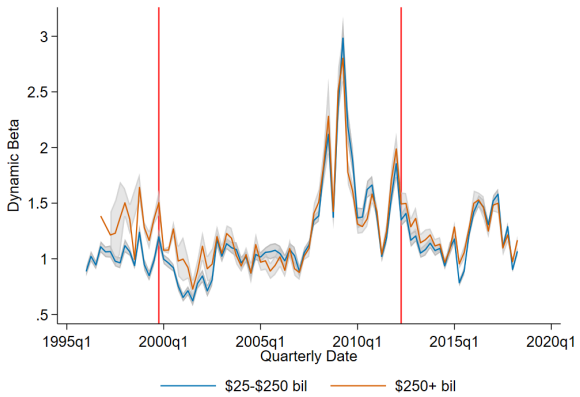
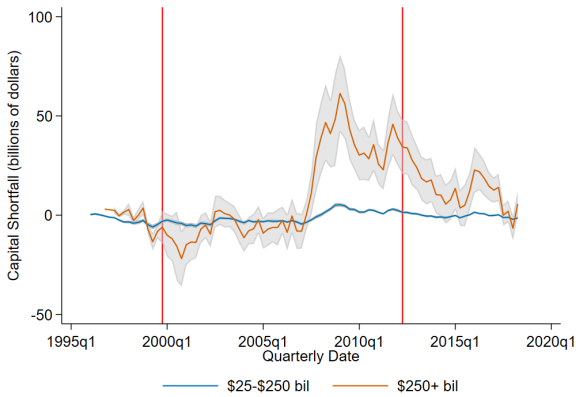
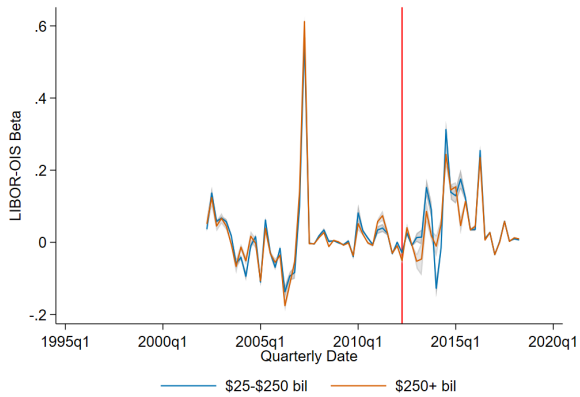
BHC Risk Measures



Dynamic Beta



SRISK



LIBOR-OIS Beta

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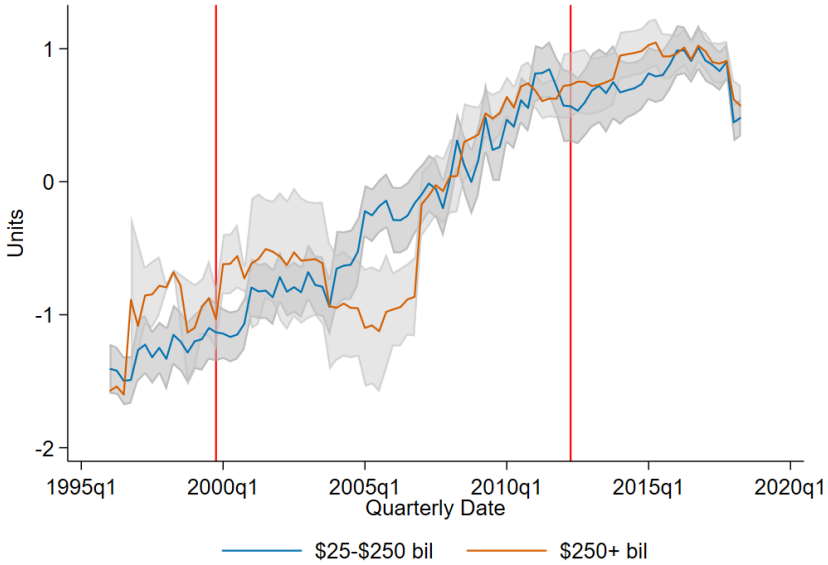
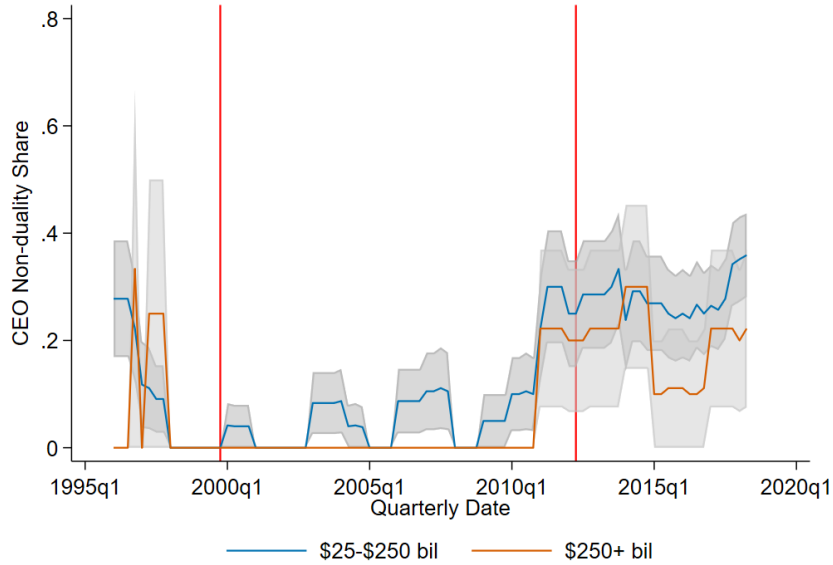
BHC Governance Measures





PC1: Bank Ownership Governance (Share of stocks owned by institutional investors)

CEO Duality

* Data Source: Capital IQ, Refinitiv, ExecuComp

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Governance effects on Long run relation between complexity and risk, Governance PC1

	Single Equation Estimates for:			IV System Estimates for:		
Risk as Dependent Variable	Org.	Bus. Scope	Geo. Scope	Org.	Bus. Scope	Geo. Scope
Income Diversification	+	+	+	+*	+	+*
Idiosyncratic Returns	+	+	+	+	+	+
Z-score	+	+	+	+*	+	+
Market Z-score	+***	+***	+**	+***	+***	+**
Dynamic Beta	+***	+***	+***	+*	+	+*
SRISK	+	+	+	−	−	−
LIBOR-OIS Beta	+**	+**	+**	+**	+**	+**
Complexity as Dependent Variable	Org.	Bus Scope	Geo. Scope	Org.	Bus Scope	Geo. Scope
Income Diversification	+**	+***	+	+**	+***	+
Idiosyncratic Returns	+*	+***	+	+*	+***	+
Z-score	+**	+***	+	+**	+***	+
Market Z-score	+**	+***	+	+**	+***	+
Dynamic Beta	+**	+***	+	+*	+***	+
SRISK	+**	+***	+	+*	+***	+
LIBOR-OIS Beta	+	−	+	+	−	+**

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Governance effects on Long run relation between complexity and risk, CEO Duality

	Single Equation Estimates			IV System Estimates		
Risk as Dependent Variable	Org.	Bus. Scope	Geo. Scope	Org.	Bus. Scope	Geo. Scope
Income Diversification	+**	+**	+**	+**	+*	+**
Idiosyncratic Returns	−**	−**	−***	−***	−***	−***
Z-score	+	+	+	+*	+	+
Market Z-score	−	−*	−**	−*	−	−**
Dynamic Beta	+	+	+	−	+	−
SRISK	+	+	+	−	−	−
LIBOR-OIS Beta	+	+	+	+	+	+
Complexity as Dependent Variable	Org.	Bus Scope	Geo. Scope	Org.	Bus Scope	Geo. Scope
Income Diversification	+**	+	+	+	+	+
Idiosyncratic Returns	+**	+	+	+**	+	+
Z-score	+**	+	+	+**	+*	+
Market Z-score	+**	+	+	+**	+	+
Dynamic Beta	+	+	+	+	+	+
SRISK	+	+	+	+	+	+
LIBOR-OIS Beta	+*	+	+*	+*	+	+**

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Hypothesis 3: Changes in diversification after introduction of living wills, with role of governance

	Income diversification			Idiosyncratic returns		
	(1)	(2)	(3)	(4)	(5)	(6)
Post LW	-0.004***	-0.004***	-0.004*	0.001	-0.000	0.001
Post LW X 750+ bil_{2009}		0.003	0.003		0.004**	0.004***
Post LW X $GovPC1_{2009}$			0.001			0.000
Post LW X CEO $Duality_{2009}$			-0.004			-0.006**
N	1120	1085	1085	1143	1100	1100
Adj. within-R2	0.24	0.25	0.25	0.62	0.63	0.64
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Banks	48	44	44	48	44	44

Post LW reduction in treated BHC income variation, interpreted as improved diversification.

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Hypothesis 3: Changes in diversification after introduction of living wills, with role of governance and organizational complexity

	Income diversification			Idiosyncratic returns		
	(1)	(2)	(3)	(4)	(5)	(6)
Post LW	-0.004***	-0.012**	-0.011*	0.001	-0.005**	-0.004**
Post LW X Org. Comp.$_{2009}$		0.002	0.002*		0.001**	0.001**
Post LW X GovPC1$_{2009}$ X Org. Complex$_{2009}$			0.000			-0.000
Post LW X CEO Duality$_{2009}$ X Org. Complex$_{2009}$			-0.001			-0.001***
N	1120	1114	1114	1143	1137	1137
Adj. within-R2	0.24	0.26	0.26	0.62	0.63	0.63
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Banks	48	47	47	48	47	47

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Hypothesis 3: Changes in idiosyncratic risk after introduction of living wills, with role of governance and organizational complexity

	z-score			Market z-score		
	(1)	(2)	(3)	(4)	(5)	(6)
Post LW	-0.487***	-1.151*	-1.135*	-0.046**	-0.092	-0.085
Post LW X Org. Complex_{2009}		0.131	0.150		0.009	0.010
Post LW X GovPC1_{2009} X Org. Complex_{2009}			-0.028			-0.001
Post LW X CEO Duality_{2009} X Org. Complex_{2009}			-0.106			-0.019
N	1120	1114	1114	1143	1137	1137
Adj. within-R2	0.39	0.40	0.41	0.82	0.82	0.82
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Banks	48	47	47	48	47	47

Ex-ante organizationally complex BHCs, not differentially affeced by regulation. Organizationally complex banks with more independent directors are able to improve diversification.

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Hypothesis 3: Changes in liquidity, systematic, and systemic risk after introduction of living wills, with role of governance and organizational complexity

	Dynamic Beta			SRISK			LIBOR-OIS Beta		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post LW	0.021	-0.277*	-0.253*	-4.404**	18.089*	19.010**	0.051***	0.077**	0.080**
Post LW X Org. Complex_{2009}		0.059*	0.062**		-4.409**	-4.126**		-0.005	-0.004
Post LW X GovPC1_{2009} X Org. Complex_{2009}			0.002			-0.677*			-0.002
Post LW X CEO Duality_{2009} X Org. Complex_{2009}			-0.065*			-2.279			-0.008
N	1082	1076	1076	1082	1076	1076	1143	1137	1137
Adj. within-R2	0.55	0.56	0.56	0.24	0.29	0.30	0.10	0.10	0.10
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banks	44	43	43	44	43	43	48	47	47

Organizationally complex banks with better governance able to relatively reduce risks after living wills implementation.

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