LBS Research Online

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Central Bank Policy and the Concentration of Risk: Empirical Estimates
Article

Online Appendix
Central Bank Policy and the Concentration of Risk: Empirical Estimates

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A. Data Construction

We use annual bank (consolidated) balance sheet data from the Compustat Fundamentals Annual (North America, 1993 – 2018) databases via WRDS. Figures A2 – A4 in Appendix B present the number of observations and summary statistics of assets, equity, leverage, returns on assets and equity for the cleaned data by period.

We construct the database as follows. First, we keep the following observations.

- Consolidated: `consol` = C.

- USD currency: `curcd` = USD.

- Not old entity: bank name (`conm`) is not tagged by OLD.

- No major mergers flag: Comparability status (`compst`) does not equal to *AB*.

Then, we we exclude financial intermediaries with the following criteria.

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- Leverage is smaller than one: $\mathtt{at}_{i,t}/(\mathtt{at}_{i,t} - \mathtt{lt}_{i,t}) \leq 1$.

- Extreme leverage (above 200): $\mathtt{at}_{i,t}/(\mathtt{at}_{i,t} - \mathtt{lt}_{i,t}) \geq 200$.

- Non-positive assets — total: $\mathtt{at}_{i,t} \leq 0$.

- Non-positive common/ordinary equity — total: $\mathtt{ceql}_{i,t} \leq 0$.

- Non-positive common equity — tangible: $\mathtt{ceqt}_{i,t} \leq 0$.

- Low assets (below 1 billion USD on average): $(1/T_i) \sum_t \mathtt{at}_{i,t} \leq 1000$

- Low equity (below 1 million USD): $\mathtt{at}_{i,t} - \mathtt{lt}_{i,t} \leq 1$

- High repurchase agreements ratio to assets (above 0.9) $(\mathtt{ceqt}_{i,t}/\mathtt{at}_{i,t} \geq 0.9)$

Lastly, for ML estimation, we calculate the bottom ten (or five) percentile of leverage based on the whole sample of database from 1993 and to 2018 (not each year). Then, we drop all observations below the bottom ten percentile in our MLE procedure. In measuring systemic risk and doing counterfactual exercises, we do not exclude the bottom percentile.

Then, we calculate variables as follows.

- Assets: $\mathtt{at}$

- Liability: $\mathtt{lt}$

- Equity: $\mathtt{at} - \mathtt{lt}$

- Leverage: $\mathtt{at}/(\mathtt{at} - \mathtt{lt})$

- RoA: $\mathtt{ib}/\mathtt{at}$

- RoE: $\mathtt{ib}/(\mathtt{at} - \mathtt{lt})$

To calculate annual stock returns, we collect monthly total returns ($\mathtt{trt1m}$) from the Compustat Security Monthly (North America, 1992 – 2018). Then, we calculate stock returns in a fiscal year. We merge stock return data using $\mathtt{cusip}$ and $\mathtt{datadate}$.

B. Additional Figures and Tables
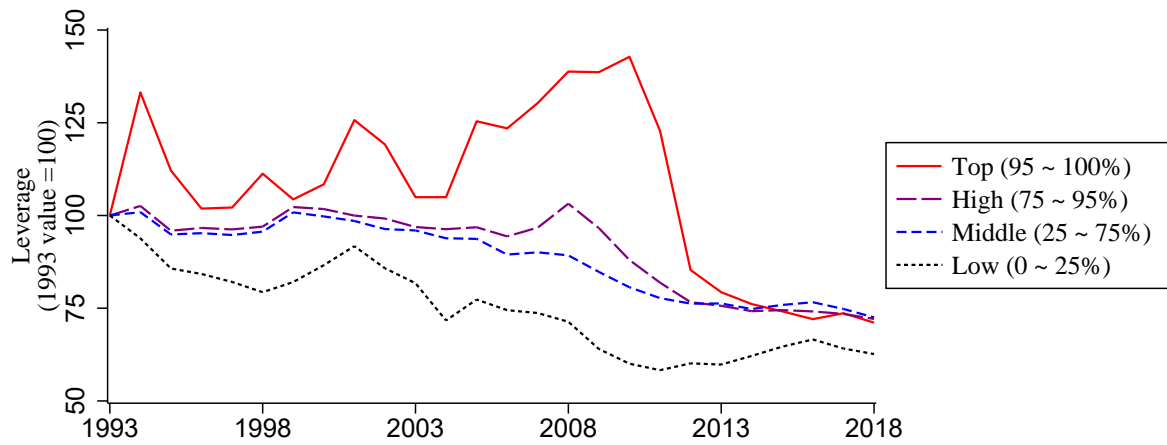
Figure A1: Evolution of unweighted leverage quantiles. Notes: The figure plots the average of the unweighted leverage's quantiles. Values were rebased to 100 for the starting year 1993, to highlight the stark difference in dynamics.
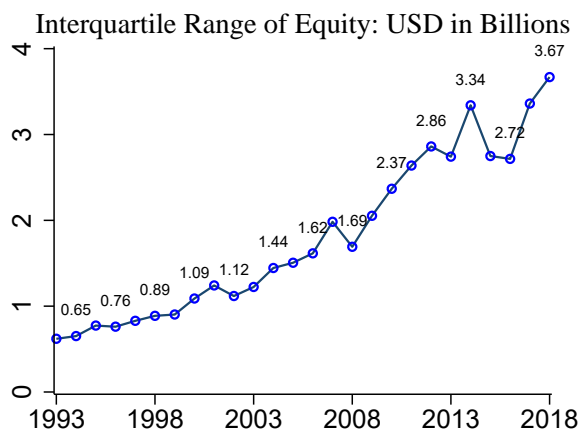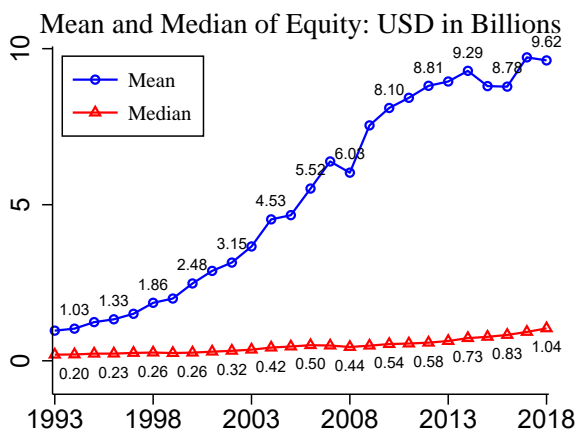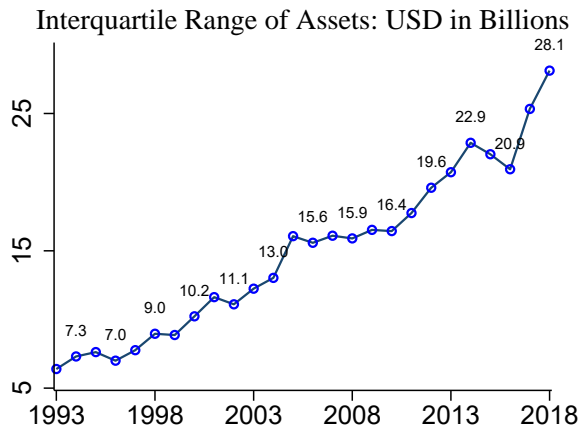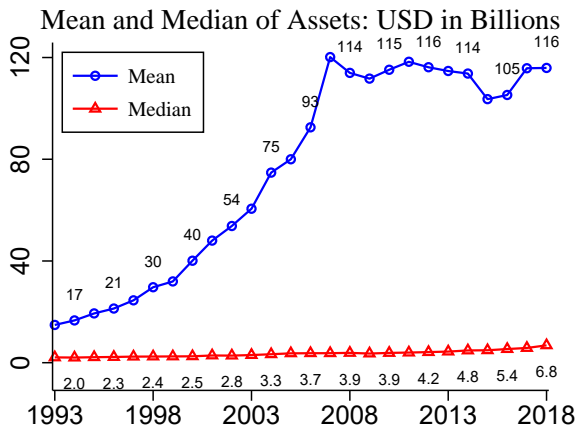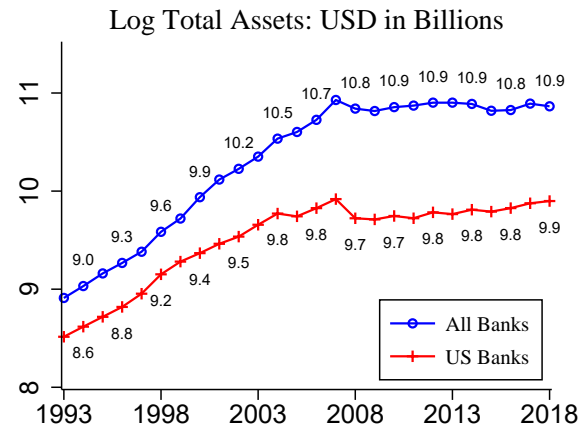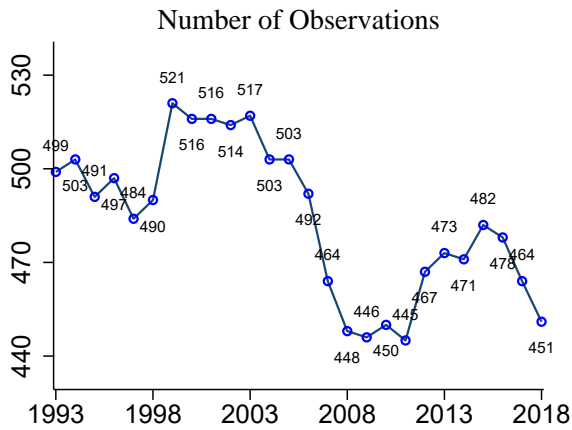
Figure A2: Summary Statistics I: Number of Observations, Assets, and Equity.
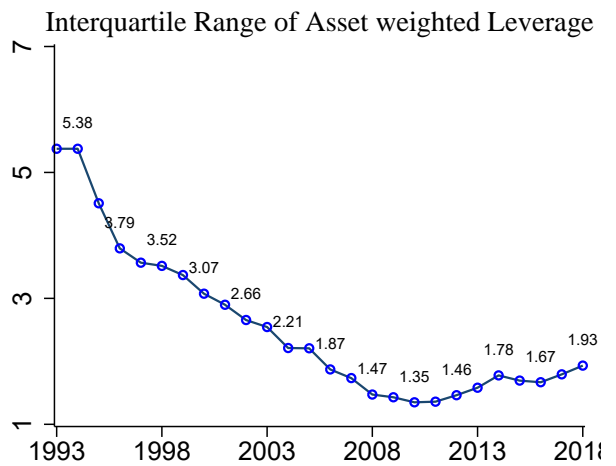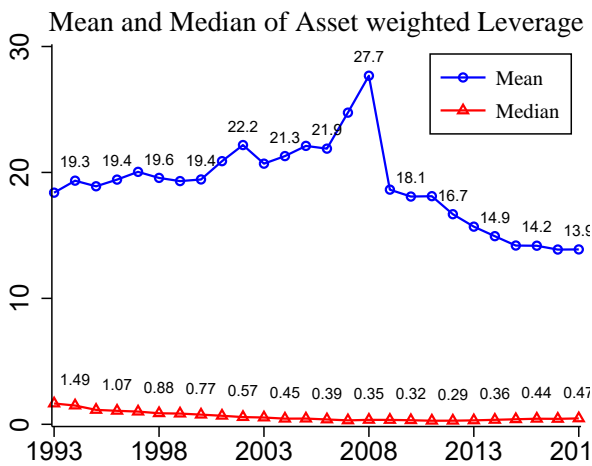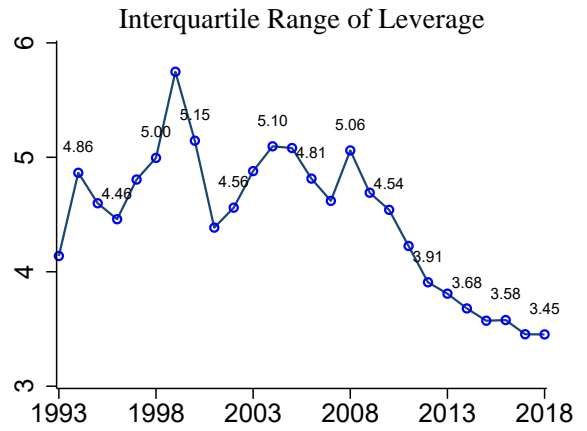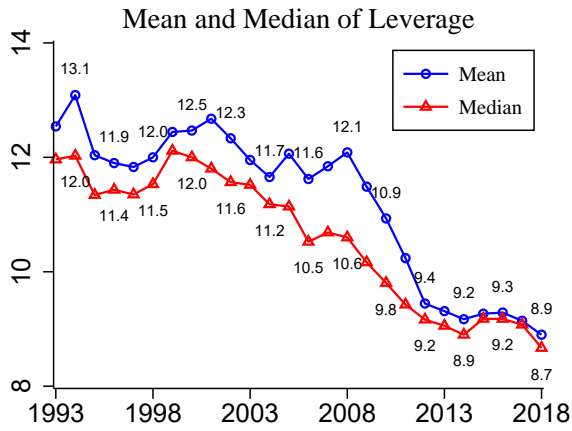
Figure A3: Summary Statistics II: Leverage and Asset-Weighted Leverage.
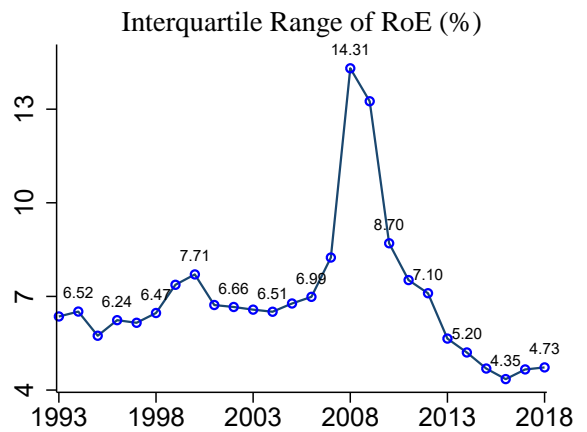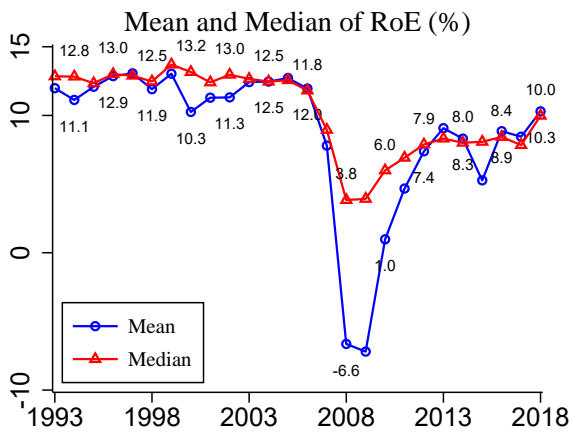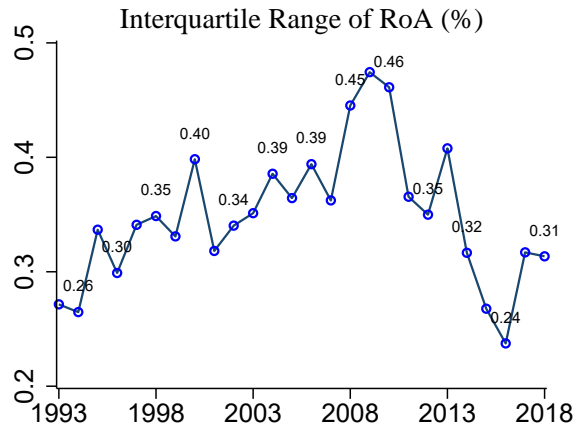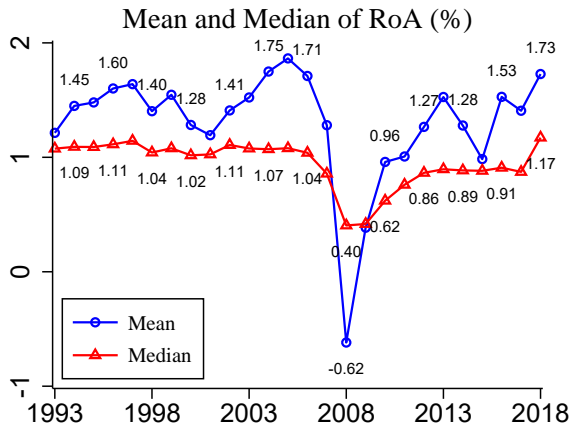
Figure A4: Summary Statistics III: Returns on Asset and Returns on Equity.
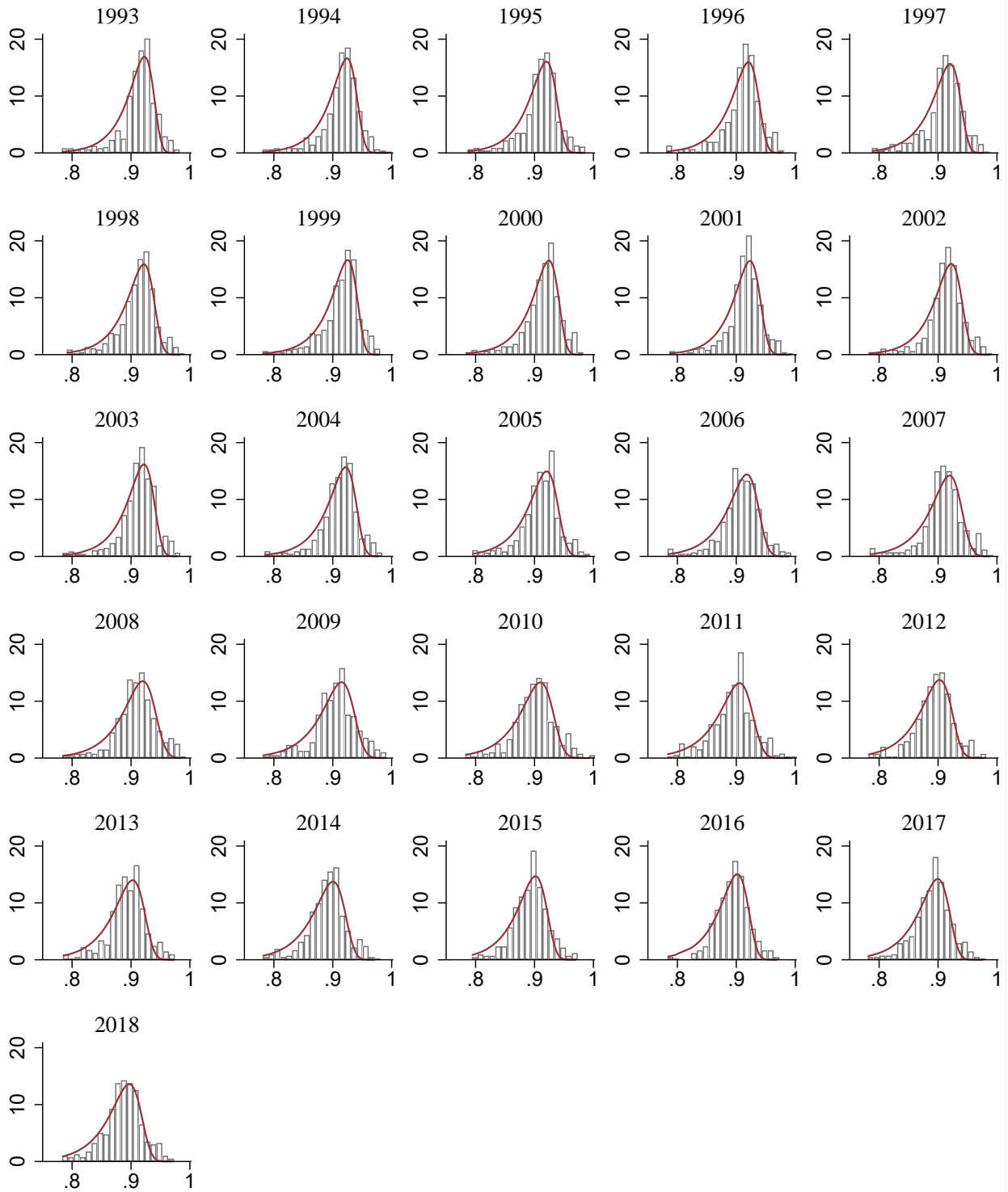
Figure A5: Estimated PDFs of Debt-to-Asset Ratio with Histograms. Notes: The red line plots the estimated probability density functions of debt-to-asset ratio with histograms (the width of bins to be 0.01). In this figure, we plot the debt-to-asset ratio by the bottom 10% (around 0.77).
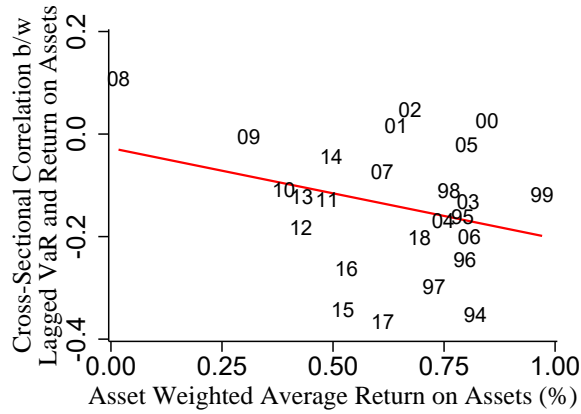
Figure A6: Risk-Taking Behavior and Return on Assets. Notes: The figures plot each year cross-sectional correlation between a bank's lagged risk-taking measure ($\alpha_{i,t}$) and its return on assets (the y-axis) and each period average return on assets of banks weighted by the assets (the x-axis).
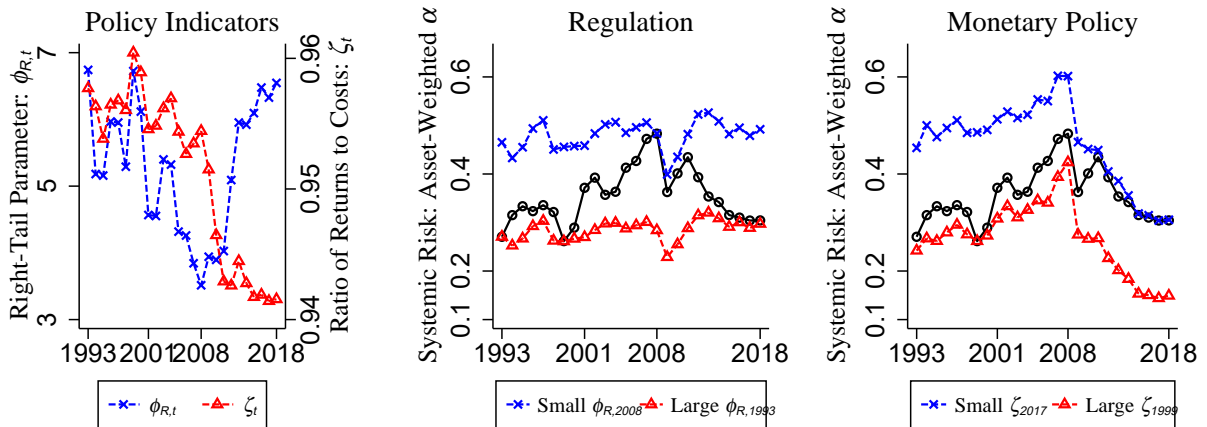
Figure A7: Systemic Risk and Counterfactuals. Notes: The figure plots estimated systemic risk measure (asset weighted mean of risk-taking) and its counterfactual values. The solid black lines with circles are implied from the data and the estimates. In the first figure, the blue dash lines with crosses and red dash lines with triangles are implied with the smallest (2008) and largest (1993) values of the estimated right tail index of risk-taking behavior ($\tilde{\phi}_{R,t}$), respectively. In the second figure, the blue and red dash lines are implied with the smallest (2017) and largest (1999) values of the estimated the ratio of the expected returns of capital to the costs of funds ($\tilde{\zeta}_t$), respectively.

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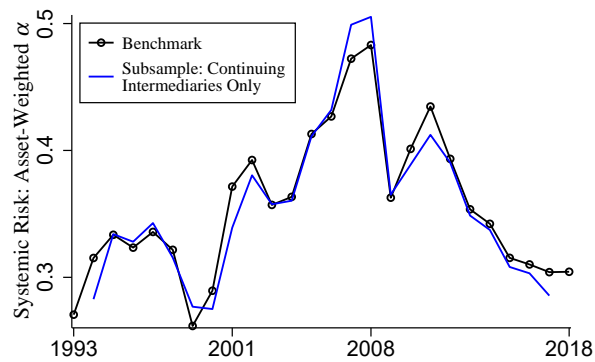
Figure A8: Systemic Risk with Continuing Financial Intermediaries. Notes: The figure plots estimated systemic risk measure (asset weighted mean of risk-taking) using data including and excluding exiting and entering financial intermediaries. The solid black line with circles is from the benchmark database including continuing, exiting, and entering intermediaries. The blue line is from the database including continuing intermediaries only but excluding exiting and entering intermediaries. At time t, the continuing intermediaries exist at $t-1$, t, and $t+1$. Exiting intermediaries exist at $t-1$ but not at t. Entterning intermediaries exist at t but not at $t-1$.

Table A1: Lists of the Top 20 Largest and Most Risk-Taking Banks

Bank Name	Year: 2006			Year: 2008			Year: 2010		
	Rank	Size	Leverage	Rank	Size	Leverage	Rank	Size	Leverage
Panel A. Top 20 Largest Banks (Assets)									
NATWEST GROUP PLC	6	3.75	19.16	1	6.88	29.83	7	4.32	18.91
DEUTSCHE BANK AG	9	3.26	34.33	2	6.00	69.01	2	4.88	37.82
BARCLAYS PLC	2	4.29	36.39	3	5.88	43.30	5	4.42	23.93
BNP PARIBAS	3	4.17	26.27	4	5.66	35.20	1	5.11	23.34
HSBC HLDGS PLC	5	4.09	16.19	5	4.95	25.22	3	4.73	15.85
JPMORGAN CHASE & CO	11	2.97	11.67	6	4.26	13.03	8	4.08	12.02
MITSUBISHI UFJ FINANCIAL GRP	8	3.48	16.45	7	3.82	29.92	4	4.74	23.40
CITIGROUP INC	4	4.14	15.73	8	3.80	13.69	10	3.69	11.54
UBS GROUP AG	1	4.31	42.97	9	3.70	49.39	16	2.71	25.40
ING GROEP NV	7	3.55	29.75	10	3.63	46.03	12	3.19	26.37
BANK OF AMERICA CORP	10	3.20	10.79	11	3.56	10.27	6	4.37	9.92
SOCIETE GENERALE GROUP	14	2.77	28.62	12	3.08	27.64	15	2.90	22.21
MIZUHO FINANCIAL GROUP INC	13	2.80	22.29	13	3.02	36.48	9	3.75	24.28
BANCO SANTANDER SA	16	2.42	17.71	14	2.86	17.49	13	3.12	15.05
WELLS FARGO & CO	31	1.06	10.51	15	2.57	13.22	17	2.43	9.84
SUMITOMO MITSUI FINANCIAL GR	18	1.88	18.92	16	2.36	25.94	11	3.21	19.32
CREDIT SUISSE GROUP	17	2.26	21.32	17	2.15	24.78	18	2.13	23.99
GOLDMAN SACHS GROUP INC	21	1.84	20.67	18	1.73	13.40	19	1.76	11.65
BBVA	28	1.19	18.46	19	1.48	20.32	21	1.41	14.75
MERRILL LYNCH & CO INC	20	1.85	21.55	20	1.31	33.37	23	1.20	12.40
Column Average	12.2	2.97	21.99	10.5	3.63	28.88	11	3.41	19.10
Panel B. Top 20 Most Risk-Taking Banks (Asset-Weighted VaR Parameter)									
DEUTSCHE BANK AG	5	3.26	34.33	1	6.00	69.01	1	4.88	37.82
BARCLAYS PLC	2	4.29	36.39	2	5.88	43.30	4	4.42	23.93
NATWEST GROUP PLC	9	3.75	19.16	3	6.88	29.83	7	4.32	18.91
BNP PARIBAS	3	4.17	26.27	4	5.66	35.20	2	5.12	23.34
UBS GROUP AG	1	4.32	42.97	5	3.70	49.39	8	2.71	25.40
ING GROEP NV	4	3.55	29.75	6	3.63	46.03	6	3.19	26.37
HSBC HLDGS PLC	13	4.09	16.19	7	4.95	25.22	12	4.74	15.85
MITSUBISHI UFJ FINANCIAL GRP	16	3.48	16.45	8	3.82	29.92	3	4.73	23.40
MIZUHO FINANCIAL GROUP INC	10	2.80	22.29	9	3.02	36.48	5	3.75	24.28
SOCIETE GENERALE GROUP	7	2.77	28.62	10	3.08	27.64	9	2.90	22.21
SUMITOMO MITSUI FINANCIAL GR	22	1.88	18.92	11	2.36	25.94	11	3.21	19.32
CREDIT SUISSE GROUP	12	2.26	21.32	12	2.15	24.78	13	2.13	23.99
LLOYDS BANKING GROUP PLC	14	1.48	29.86	13	1.25	44.96	10	2.94	21.14
DANSKE BANK AS	23	1.07	28.78	14	1.30	36.07	15	1.10	30.68
MERRILL LYNCH & CO INC	17	1.85	21.55	15	1.31	33.37	32	1.20	12.40
BANCO SANTANDER SA	21	2.42	17.71	16	2.86	17.49	14	3.12	15.05
BBVA	27	1.19	18.46	17	1.48	20.32	20	1.41	14.75
CITIGROUP INC	15	4.14	15.73	18	3.80	13.69	19	3.69	11.54
SANTANDER UK PLC	24	0.83	61.55	19	0.66	48.17	16	0.90	24.67
JPMORGAN CHASE & CO	32	2.97	11.67	20	4.26	13.03	18	4.09	12.02
Column Average	13.85	2.83	25.90	10.5	3.40	33.49	11.25	3.23	21.35

Notes: The size is defined by percentage share (%) of a bank's assets in total assets of each year sample. In Panels A and B, the ranks are based on the size and asset-weighted VaR parameter, respectively, in each year.

Table A2: Summary Estimates of Distribution

	Mean	S.D.	Min	Max	Quartiles 25%	50%	75%
Full Period: 1993 – 2018							
ϕ_{pt}: power	67.231	7.556	57.168	80.062	59.624	66.322	73.057
ϕ_{st}: scale	0.951	0.006	0.941	0.960	0.942	0.953	0.956
ϕ_{ct}: class	0.964	0.008	0.942	0.978	0.960	0.964	0.970
ϕ_{Lt}: left-tail shape	0.410	0.019	0.364	0.434	0.395	0.417	0.424
ϕ_{Rt}: right-tail shape	5.276	1.001	3.515	6.742	4.318	5.307	6.094
Period I: 1993 – 2000							
ϕ_{pt}: power	75.786	3.103	72.499	80.062	72.969	75.428	78.466
ϕ_{st}: scale	0.957	0.002	0.953	0.960	0.956	0.956	0.958
ϕ_{ct}: class	0.965	0.003	0.962	0.970	0.962	0.964	0.968
ϕ_{Lt}: left-tail shape	0.386	0.012	0.364	0.406	0.383	0.384	0.392
ϕ_{Rt}: right-tail shape	5.892	0.641	5.159	6.742	5.236	5.960	6.421
Period II: 2001 – 2008							
ϕ_{pt}: power	68.007	5.047	59.603	73.363	64.039	69.386	72.120
ϕ_{st}: scale	0.954	0.001	0.952	0.956	0.953	0.954	0.955
ϕ_{ct}: class	0.958	0.008	0.942	0.968	0.955	0.959	0.964
ϕ_{Lt}: left-tail shape	0.415	0.010	0.402	0.431	0.407	0.414	0.422
ϕ_{Rt}: right-tail shape	4.472	0.653	3.515	5.400	4.052	4.435	4.945
Period III: 2009 – 2018							
ϕ_{pt}: power	59.765	1.938	57.168	63.380	58.160	59.393	60.621
ϕ_{st}: scale	0.943	0.003	0.941	0.951	0.941	0.942	0.944
ϕ_{ct}: class	0.969	0.008	0.951	0.978	0.966	0.970	0.975
ϕ_{Lt}: left-tail shape	0.425	0.006	0.415	0.434	0.420	0.425	0.430
ϕ_{Rt}: right-tail shape	5.427	1.093	3.895	6.546	4.027	5.937	6.327

Table A3: Risk-Taking Behavior and Stock Returns: Bull vs Bear Markets

	One Year Ahead Excess Stock Returns: $r_{i,t+1}^{\text{stock}} = r_{i,t+1}^{\text{stock}} - \bar{r}_{t+1}^{\text{stock}}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	$\bar{r}_{t+1}^{\text{stock}} > 0$	$\bar{r}_{t+1}^{\text{stock}} \leq 0$	$\bar{r}_{t+1}^{\text{stock}} > 0$	$\bar{r}_{t+1}^{\text{stock}} \leq 0$	$\bar{r}_{t+1}^{\text{stock}} > 0$	$\bar{r}_{t+1}^{\text{stock}} \leq 0$
VaR parameter (log)	1.00***	0.00	1.97***	0.36*	1.69***	0.25***
	(0.30)	(0.10)	(0.32)	(0.20)	(0.03)	(0.02)
Other Controls	No	No	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	No	No
Year-Bank Type FE	No	No	No	No	Yes	Yes
Year-Country FE	No	No	No	No	Yes	Yes
Observations	5616	2461	4755	2074	4583	1998
R-squared	0.28	0.36	0.39	0.44	0.49	0.52

Notes: $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors (in parentheses) are clustered at the country-bank type level. Singleton observations are dropped in all regressions. The estimation is based on equation (??). The dependent variable is the excess stock return. Other controls are dividend yield, a book to market ratio, and asset size in logs.