Do Banks have an Edge?

Juliane Begenau[1] Erik Stafford[2]

[1]Stanford GSB & NBER & CEPR

[2]Harvard Business School

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Capital Markets Perspective on Banking

- Black (75), Fama (85), Merton (89, 90, 93), Merton-Bodie (93,95)

  $\Rightarrow$ Banks compete in the market for financial services

- Edge: customers willing to borrow (lend) at above (below) market rates and/or banks' ability to provide product below market costs

- Unique bank products

  Customers have practically no alternative

  Willing to pay higher prices relative to closest alternative

- Bank products with near substitutes

  Customers likely to pay similar prices relative to closest alternative

- Fama (85): Given regulatory tax, efficiency requires an edge among some of the bank activities

  $\Rightarrow$ Edge large enough to offset costs (opex, corp. taxes, regulation)

Research questions

1. What is the scope for an edge in banking?

2. How big is the edge and is it large enough to cover incremental costs?

3. How valuable is the improvement in financial stability due to the bank operating structure and regulatory environment?

How to measure the edge in banking?

Banking literature:

- Edge in maturity tranformation, credit & liquidity provision

Capital markets view:

- These functions embed interest rate risk & credit risk exposure

What we do:

- Apply Fama (1985)'s logic to every balance sheet element
- Create passive version of balance sheet element

  $\Rightarrow$ opportunity cost to benchmark bank performance

Example: small business loan (AAA-rated 3-yr term)

Return on small business bank loan

$$R^{Bank,L} = R^f + \text{Term}^{Bank,L} + \text{Credit}^{Bank,L} + \alpha^L$$

- 3 year term
- AAA small business credit risk
- Potentially additional rent ("α") due to e.g., skill, technology, access, monopoly power or other unmeasured risks (e.g., illiquid)

Opportunity costs for passive investor

$$R^{MF,L} = R^f + \text{Term}^{MF,L} + \text{Credit}^{MF,L}$$

- 3 year UST
- Credit spread on IG and HY vanguard corporate bond portfolio
  IG share chosen to match average loan losses

Data

Detailed disaggregated bank holding company sample

- Quarterly 1996Q1-2017Q3
- FR-Y-9C regulatory filings on bank holding companies
- Size minimum \$1B (2015\$) & deposit share $\geq 20\%$
- Publicly traded subset: stock return and issuance data from CRSP

Aggregated FDIC insured commercial banks in the U.S.

- Annual 1966-2017

Capital market alternatives

- US Treasury yields
- BoAML IG & HY corporate bond total return index
- Various investable Vanguard bond funds

Findings

1. What is the scope for an edge in banking?

   Roughly 40% of aggregate bank balance sheet

2. How big is the edge and is it large enough to cover incremental costs?

   Pre-tax & pre-expense edge:

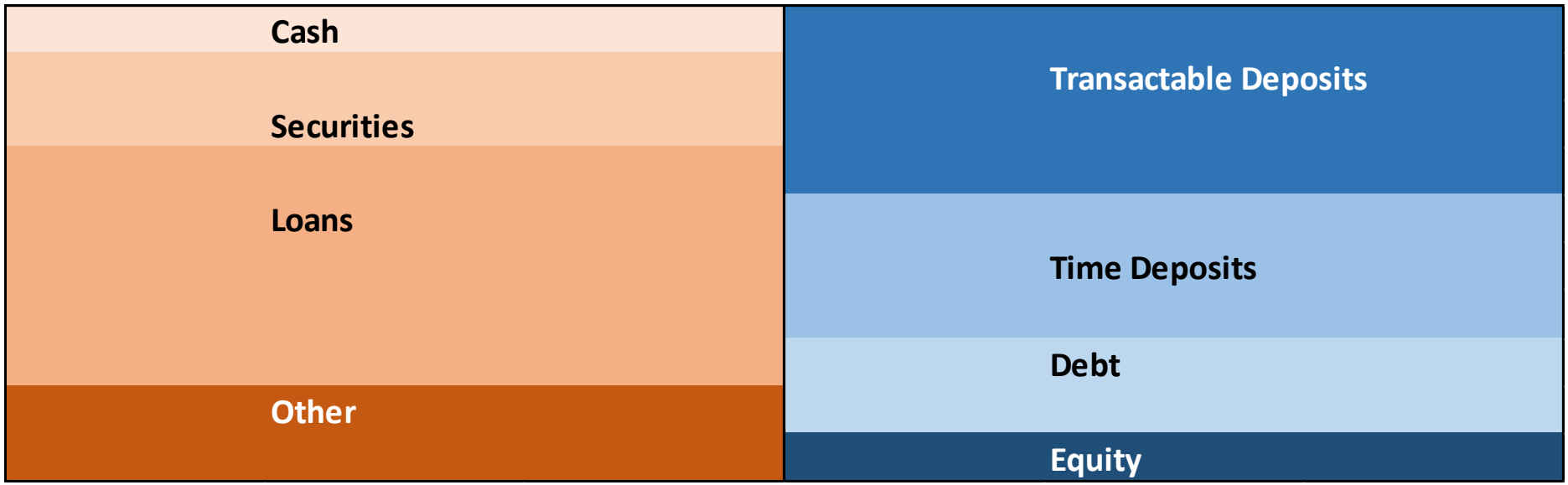
   - Transaction deposits: 2% rate advantage
   - Loans: 1.7 %
   - Bank services/ trading: difficult to isolate on its own
   - Cash, securities, time-deposits, capital market debt fairly priced

   Bank assets (incl. services/trading) no edge after taxes and expenses
   Bank deposits no edge after expenses

3. Financial stability consequences from bank operating structure relative to replicating portfolio?

   Replicating portfolio similar total risk as bank equity (volatility & 2008 drawdown), but different factor loadings & post-crisis perf.

Background: Agg. U.S. BHC balance sheet



Background: Performance of Maturity Transformation in Capital Markets

Passive Strategy

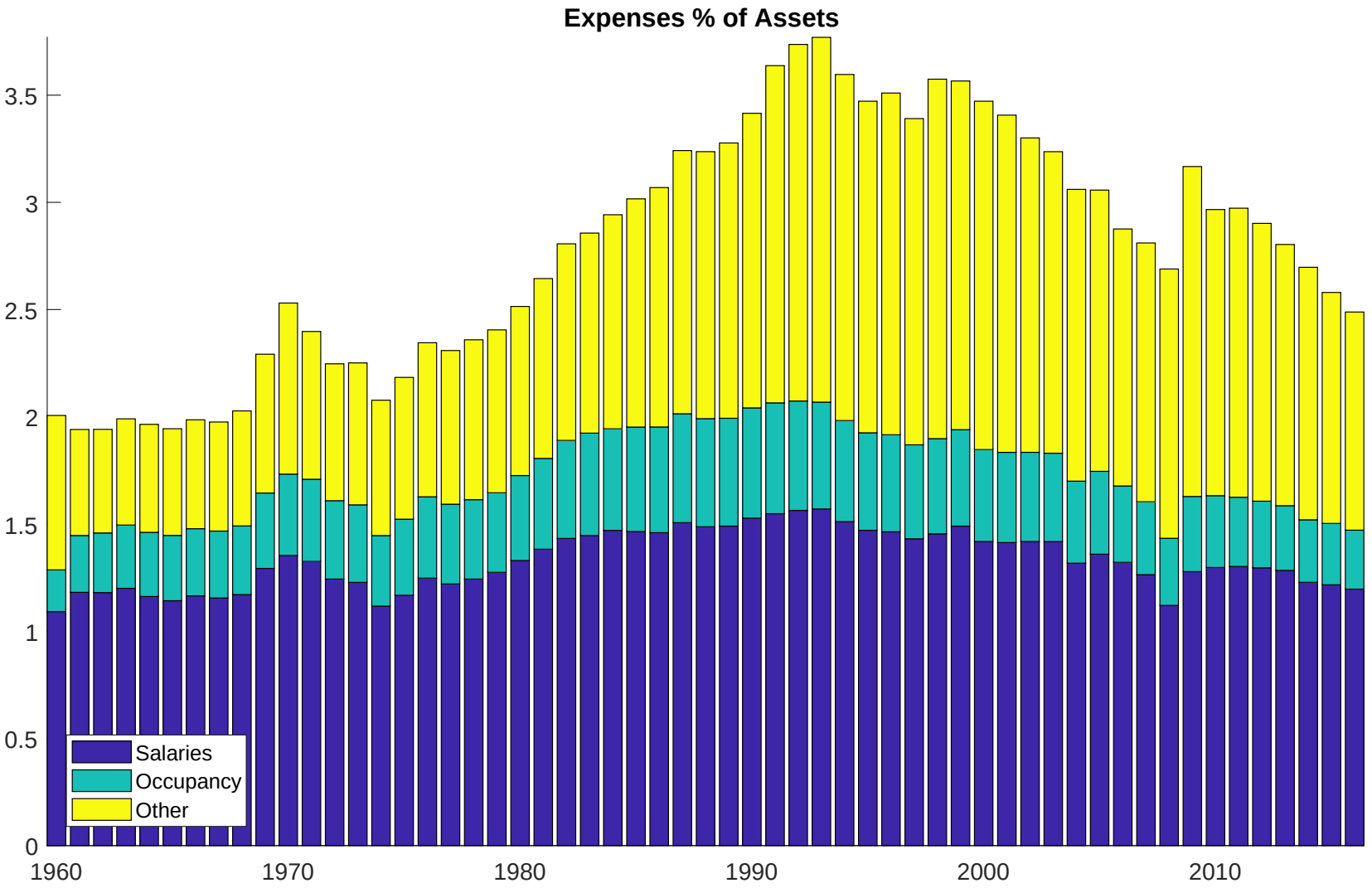
- Each month, buy 6yr UST at par & hold to maturity

CAPM regressions quarterly returns

Time Period	α	β	R^2 / **N**
1960-1980	-0.53	0.09	0.10
	(-0.50)	(3.00)	86
1981-2016	2.70	0.00	0.00
	(4.04)	(-0.13)	140

- Strategy has done well since 1981 (Fama 2006)

Background: Operating Expenses ≈ 30% fee on equity



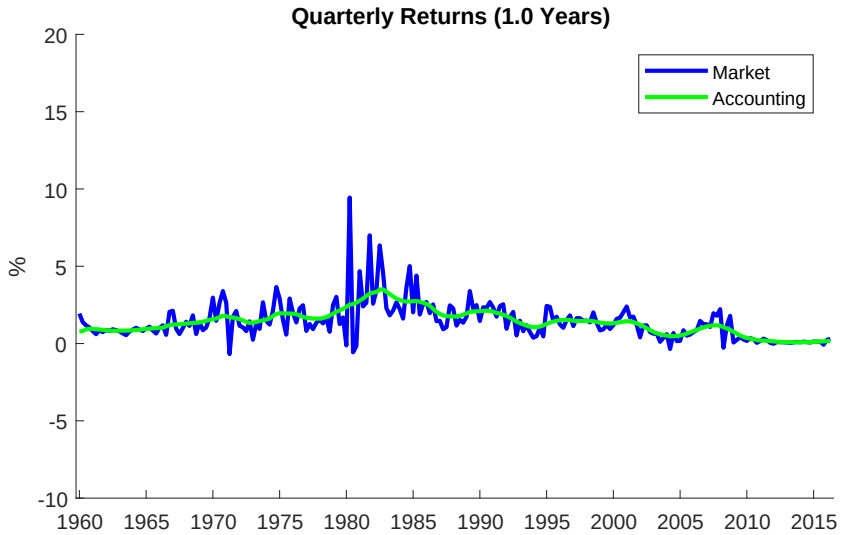
Background: Operating Expenses Allocation

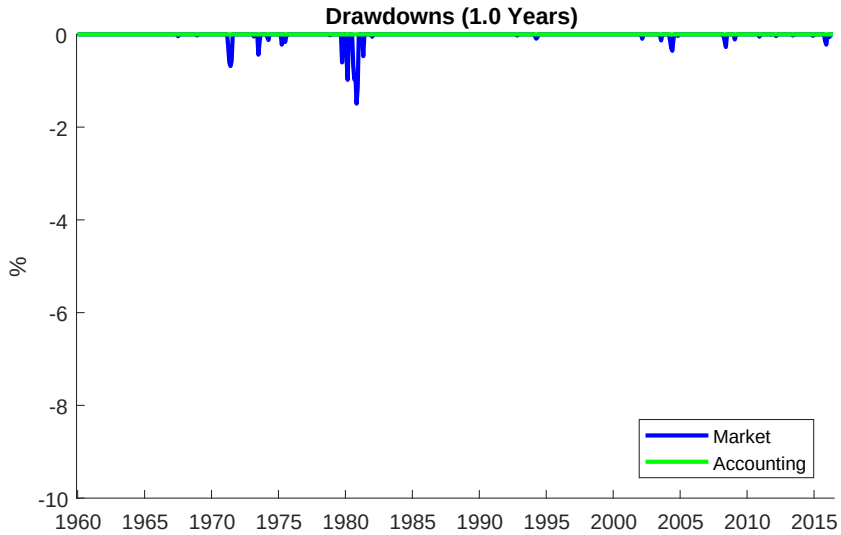
	Small	Med	Large	Mega	All
Op Ex / A	3.2	3.2	3.6	3.2	3.3

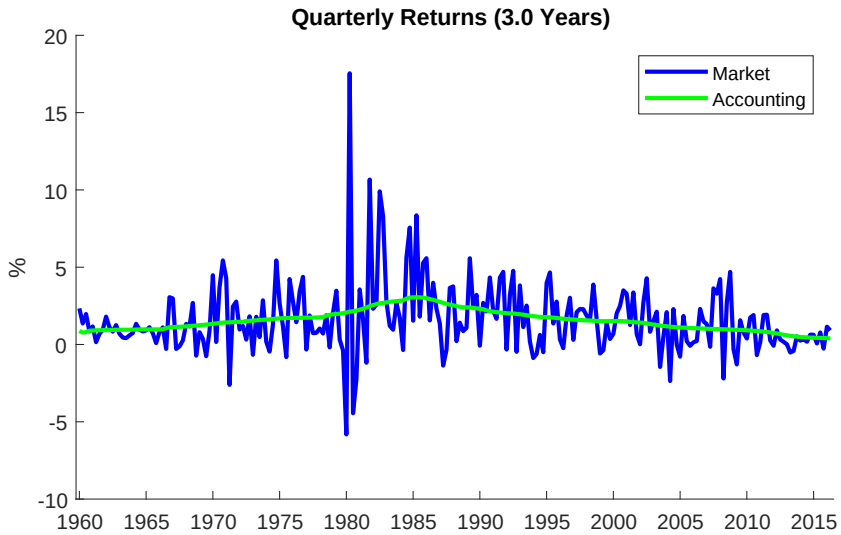
Assumption: Loan & deposit allocation based on share in 2x assets

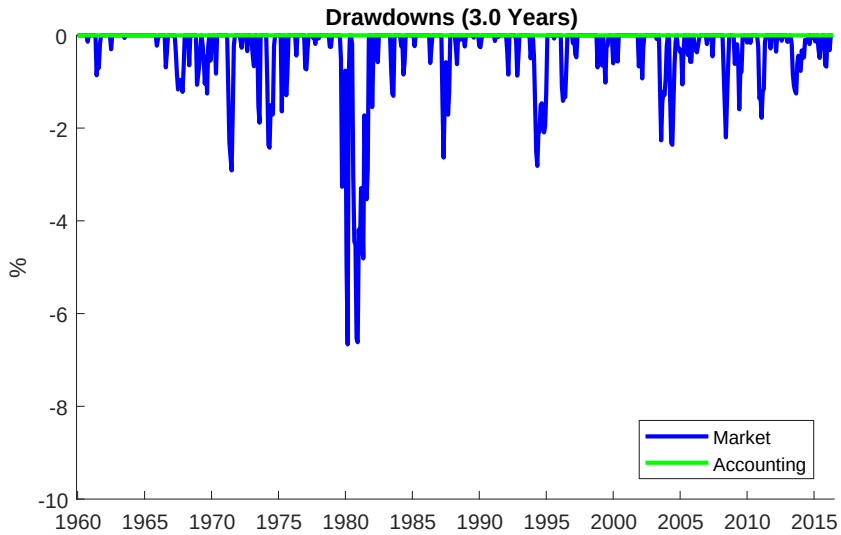
	Small	Med	Large	Mega	All
Loan OpEx / Total Opex	32.9	30.6	29.1	22.8	26.0
Deposit OpEx / Total Opex	39.2	36.4	33.1	25.5	29.4
Service OpEx / Total Opex	27.9	33.1	37.8	51.8	44.6
Loan OpEx / Loans	1.6	1.5	1.8	1.7	1.7
Deposit OpEx / Deposits	1.7	1.6	1.8	1.7	1.7
Service OpEx / Non Interest Income	95.1	89.7	59.0	69.4	66.6

Background: HTM accounting smoothes returns $\Rightarrow$ understates risk







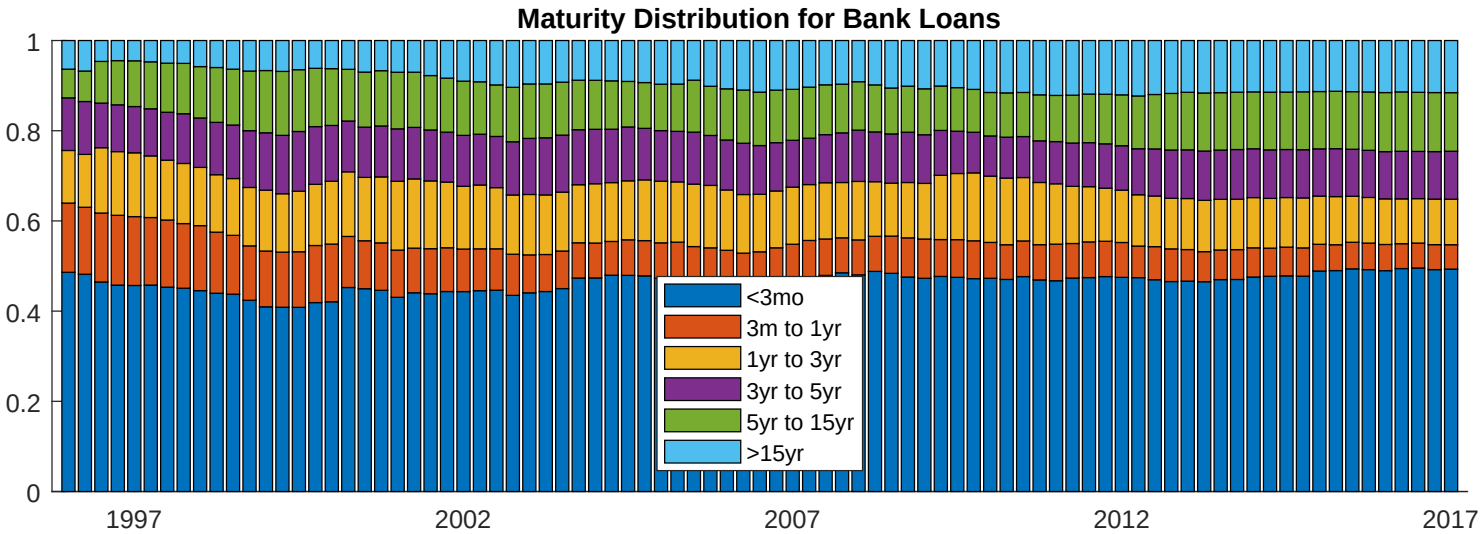


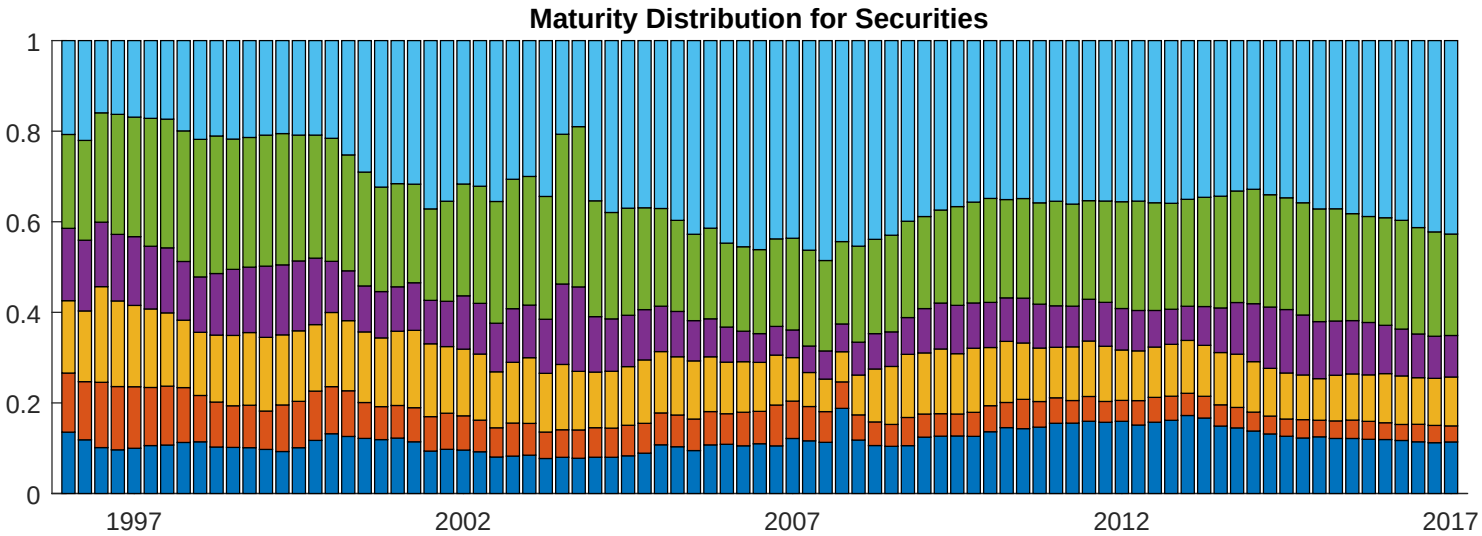
Benchmarking Bank Assets

- Classify assets
  - Interest bearing assets ($\approx$ 80% of assets):
    Isnterest-bearing cash, securities (Treasuries & MBS), loans
  - Other assets: trading assets & bank services
- Operating expenses allocation
  - Loan opex share = Loan / 2 x Assets
  - Sec opex share = 0
  - Bank services = Opex - Loan opex - Deposit opex
- Identify cash equivalent share and TERM exposure of each asset item

  Buy and hold UST portfolio w/ matching cash share & TERM
  Loans: adjust TERM downwards to account for loan amortization
- Compare bank returns to *accounting* returns on UST portfolio

Maturity Distribution: Loans and Securities



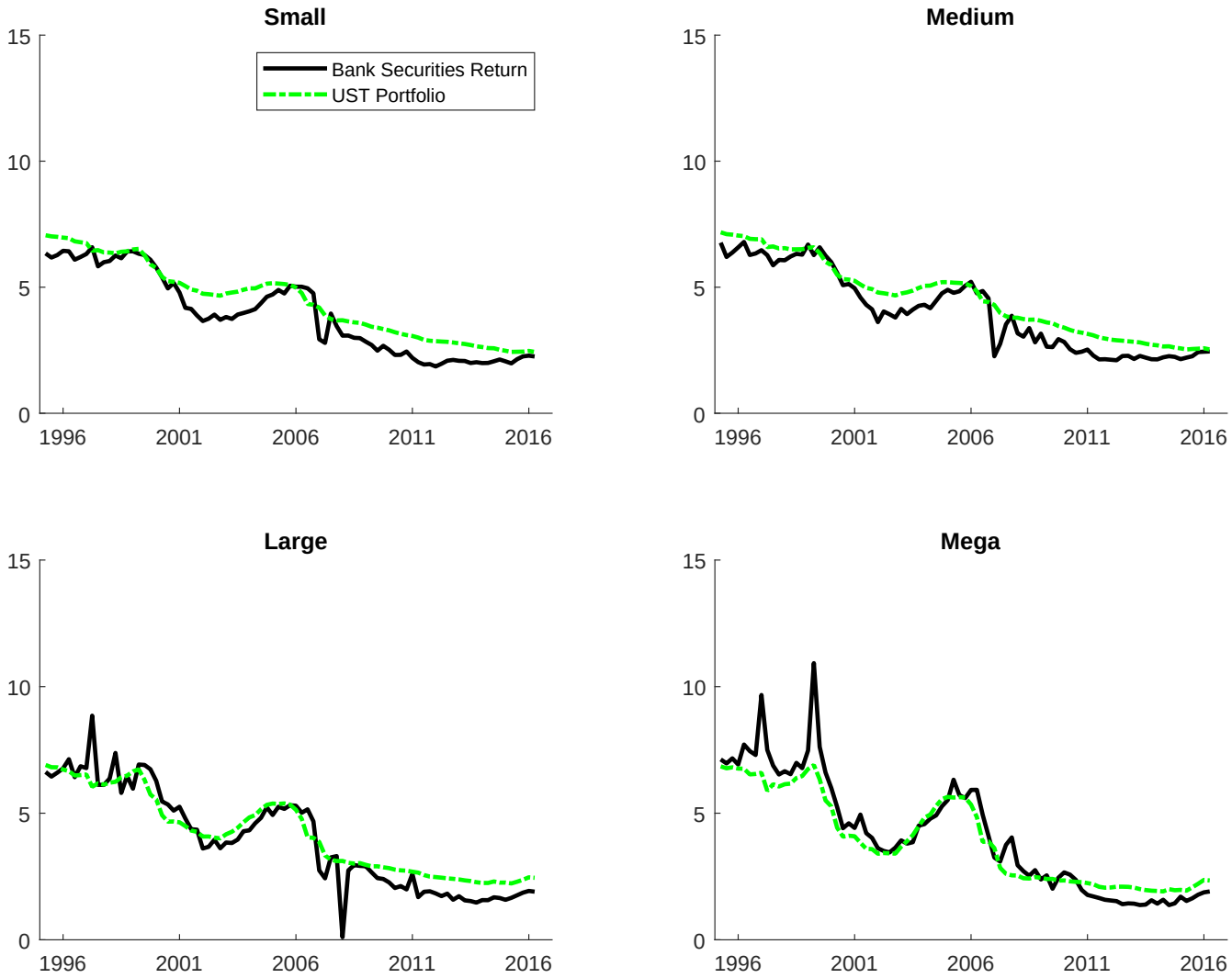


Bank Investments 35% of interest bearing assets - Pretax

$$\text{Return on Investments}_t = \frac{\text{Interest Income}_t + \text{Realized Gains/Losses}_t}{\text{Investments}_{t-1}}$$

	Small	Med	Large	Mega	All
Cash-equiv share	20.0	19.8	37.6	54.9	44.8
LT Avg	5.4	5.6	6.6	9.1	7.7
Bank Investment Return	3.94	4.06	3.96	4.13	4.03
UST-Equiv Return	4.47	4.55	4.17	3.91	4.11
Risk Premium	-0.53	-0.5	-0.21	0.22	-0.08
t-statistic	(-6.27)	(-6.11)	(-1.46)	(1.35)	(-0.66)

Bank Investment Return vs Maturity Matched UST



Pretax Bank Loan Return

$$\text{Return on Loans}_t = \frac{\text{Interest Income}_t - \text{Loan Losses}_t - \text{ Loan Opex}_t}{\text{Gross Loans}_{t-1}}$$

Bank Loans vs. UST portfolio - Pretax

	Small	Med	Large	Mega	All
Loans / IBA	72	71	69	61	65
Cash-Equiv Shr	31	35	49	52	46
LT Avg Mat	3.5	3.9	4.5	5.3	4.6
LT Eff Avg Mat	1.8	2.0	2.3	2.7	2.4
Bank Loan Ret Pre-Exp	6.08	5.80	5.46	5.42	5.51
UST Equiv Return	3.00	3.02	2.92	2.99	2.96
Risk Premium	3.07	2.79	2.54	2.43	2.55
t-statistic	(19.54)	(15.32)	(11.18)	(11.19)	(12.47)
Bank Loan Return	4.48	4.27	3.70	3.77	3.85
UST Equiv Return	3.00	3.02	2.92	2.99	2.96
Risk Premium	1.48	1.25	0.78	0.78	0.88
t-statistic	(8.93)	(6.40)	(3.33)	(3.48)	(4.12)

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Risk Premium	3.07	2.79	2.54	2.43	2.55
t-statistic	(19.54)	(15.32)	(11.18)	(11.19)	(12.47)
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t-statistic	(8.93)	(6.40)	(3.33)	(3.48)	(4.12)

Bank loans vs. UST portfolio + Credit Premium - Pretax

- Credit benchmark: Vanguard IG & HY corp. to match avg. losses

	Small	Med	Large	Mega	All
Loss Rate	0.51	0.58	0.94	1.23	1.02
IG Credit Share	83.06	80.32	66.42	55.05	63.14
Cap Mkt Credit Premium	0.72	0.73	0.81	0.87	0.83
Bank Loan Return	4.48	4.27	3.70	3.77	3.85
Cap Mkt Equiv Return	3.72	3.75	3.73	3.85	3.79
Bank Advantage	0.76	0.52	-0.03	-0.09	0.06
t-statistic	(4.57)	(2.65)	(-0.12)	(-0.38)	(0.27)

Enforcing balance sheet constraint

- Have not matched 19% of assets
- "Service asset"

  Trading assets & bank services (intangibles)

  Some bank services may not be feasible without loans & securities (i.e., maybe underestimate return on those)
  $\Rightarrow$ Calculate return on unlevered assets
  Includes all income
  Assume cash equivalent maturity

- Unlevered, post-tax return on assets

$$\text{ROA}_t = \frac{NI_t + (1-\tau)\left(\text{interest exp}_t + \text{deposit opex}_t - \text{deposit inc}_t\right)}{\text{Assets}_{t-1}}$$

Unlevered Asset Return

	Small	Med	Large	Mega	All
Pre-tax Return	4.28	4.2	4.42	3.97	4.13
UST Equiv Return	3.36	3.40	3.20	3.05	3.15
Risk Premium	0.92	0.81	1.22	0.93	0.98
t-statistic	(6.95)	(4.96)	(6.97)	(5.46)	(7.28)
After-tax Return	3.02	2.90	3.05	2.75	2.86
UST Equiv Return	3.36	3.40	3.20	3.05	3.15
Risk Premium	-0.34	-0.50	-0.15	-0.29	-0.29
t-statistic	(-1.82)	(-2.43)	(-0.87)	(-1.72)	(-1.85)

Unlevered Asset Return

	Small	Med	Large	Mega	All
Pre-tax Return	4.28	4.2	4.42	3.97	4.13
UST Equiv Return	3.36	3.40	3.20	3.05	3.15
Risk Premium	0.92	0.81	1.22	0.93	0.98
t-statistic	(6.95)	(4.96)	(6.97)	(5.46)	(7.28)
After-tax Return	3.02	2.90	3.05	2.75	2.86
UST Equiv Return	3.36	3.40	3.20	3.05	3.15
Risk Premium	-0.34	-0.50	-0.15	-0.29	-0.29
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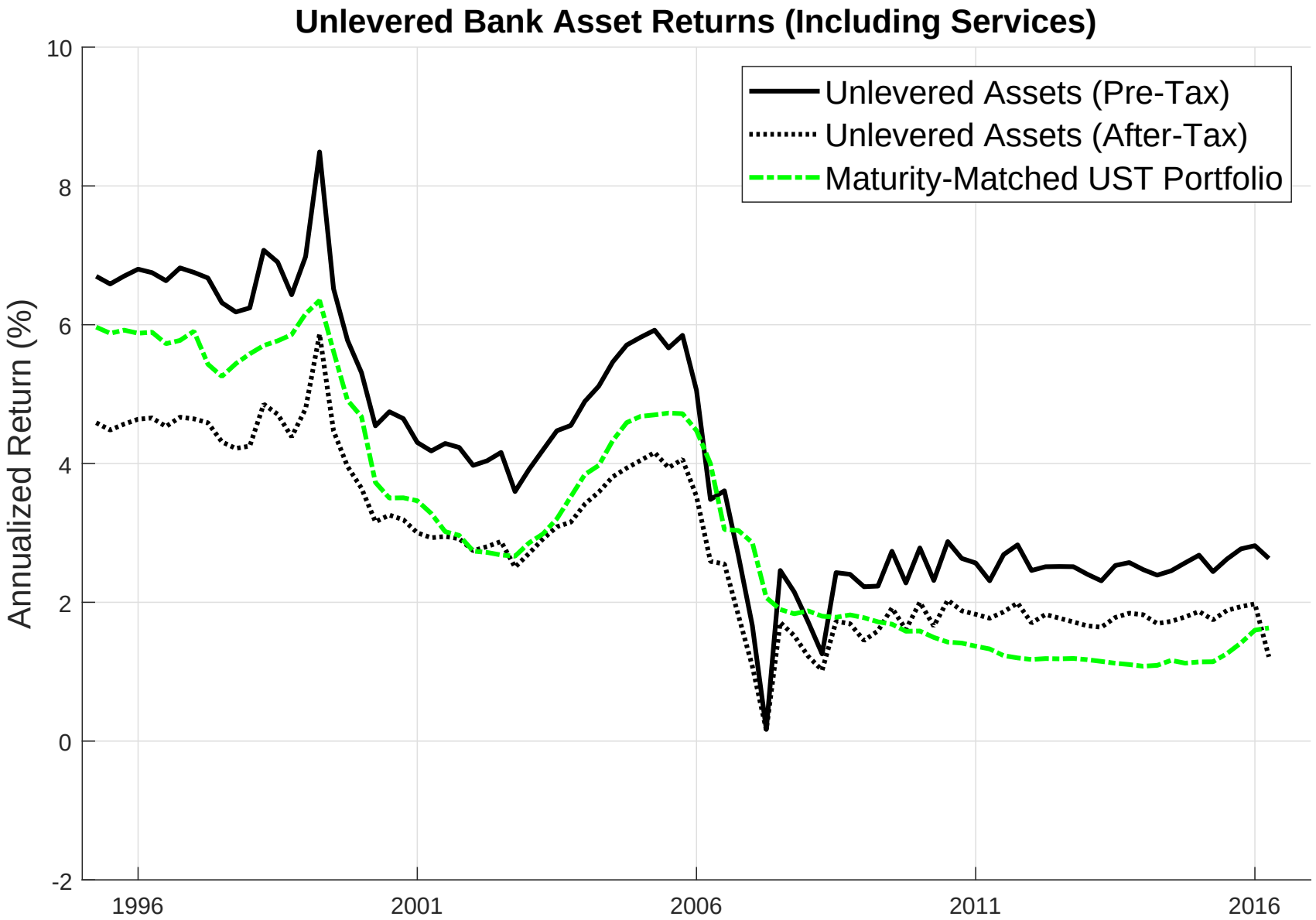
Unlevered Bank Asset Returns (Including Services)
Unlevered Assets (Pre-Tax)
Unlevered Assets (After-Tax)
Maturity-Matched UST Portfolio
Annualized Return (%)
10
8
6
4
2
0
-2
1996
2001
2006
2011
2016

Bank deposits

$$\text{Deposit Rate}_t = \frac{\text{Deposit Interest Exp}_t - \text{Deposit Inc}_t}{\text{Deposit}_{t-1}}$$

$$\text{Deposit Cost}_t = \frac{\text{Deposit Interest Exp}_t - \text{Deposit Inc}_t + \text{Deposit Opex}_t}{\text{Deposit}_{t-1}}$$

	Small	Med	Large	Mega	All
Cash-Equiv Shr	59	62	64	59	61
LT Avg Maturity (Yrs)	0.6	0.6	0.7	0.6	0.6
Deposit Rate	1.55	1.36	1.12	1.17	1.19
UST Return	2.27	2.26	2.27	2.27	2.29
Bank Advantage	0.73	0.90	1.15	1.10	1.10
t-statistic	(3.60)	(4.34)	(5.48)	(6.20)	(5.83)
Dep OpEx / Deposits	1.65	1.62	1.86	1.71	1.74
Deposit Cost	3.20	2.98	2.98	2.88	2.93
UST Return	2.27	2.26	2.27	2.27	2.29
Bank Advantage	-0.93	-0.72	-0.70	-0.61	-0.64
t-statistic	(-4.58)	(-3.59)	(-3.77)	(-3.78)	(-3.85)

Bank deposits

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UST Return	2.27	2.26	2.27	2.27	2.29
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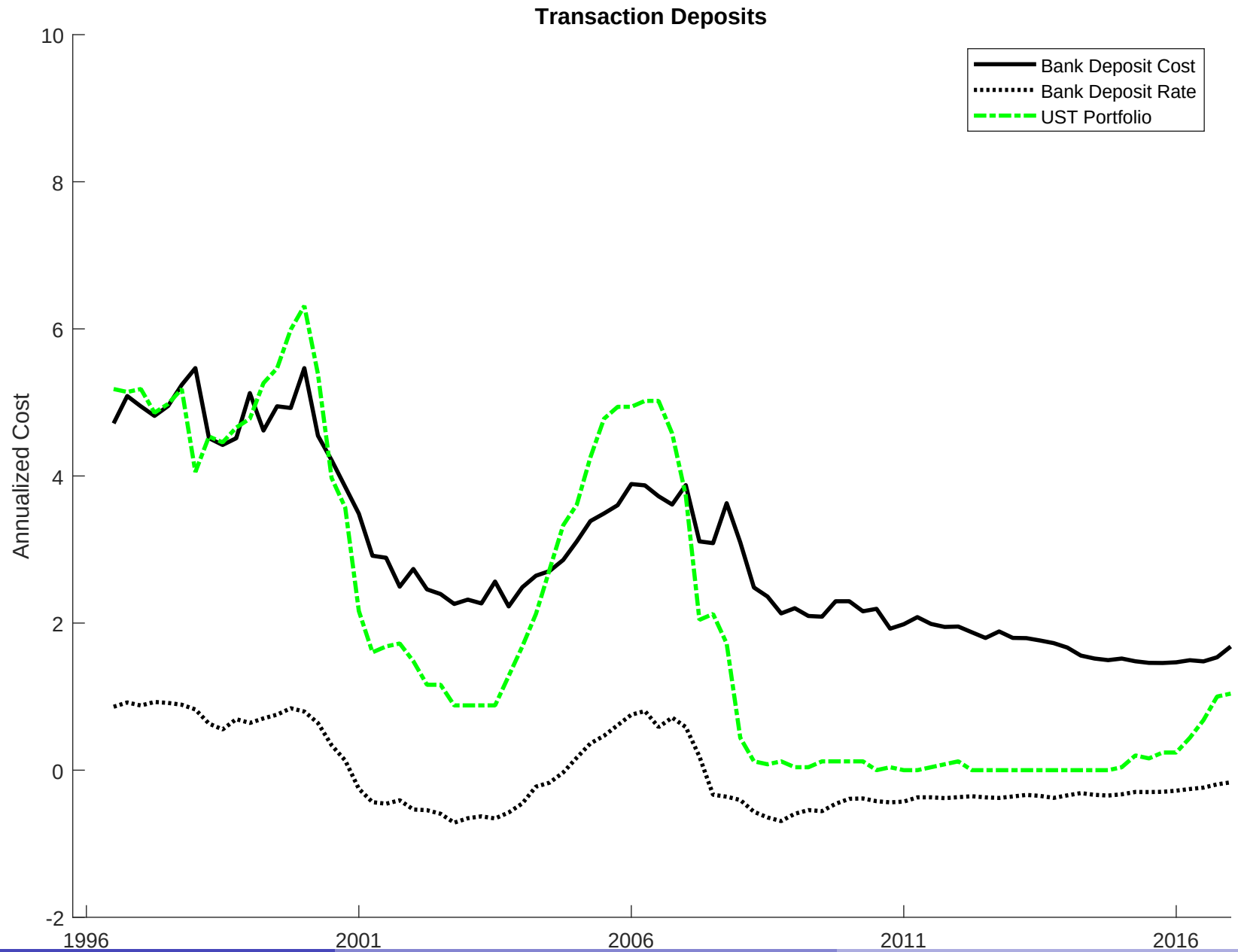
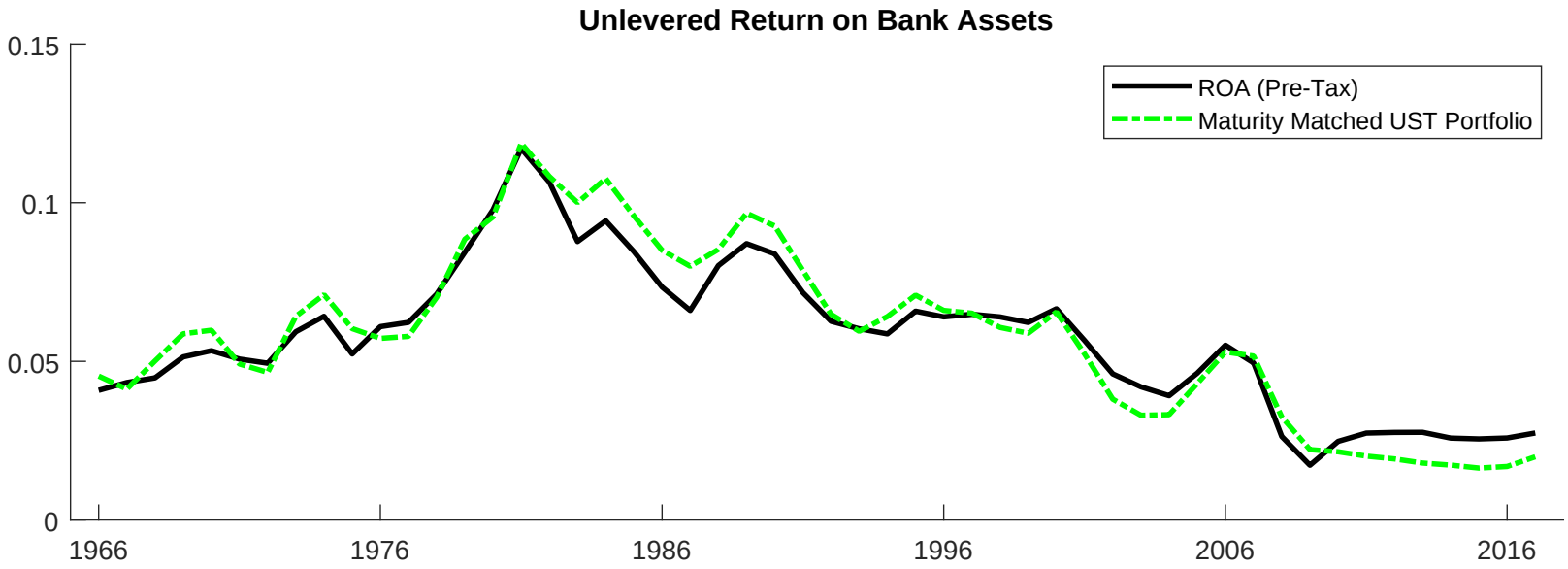
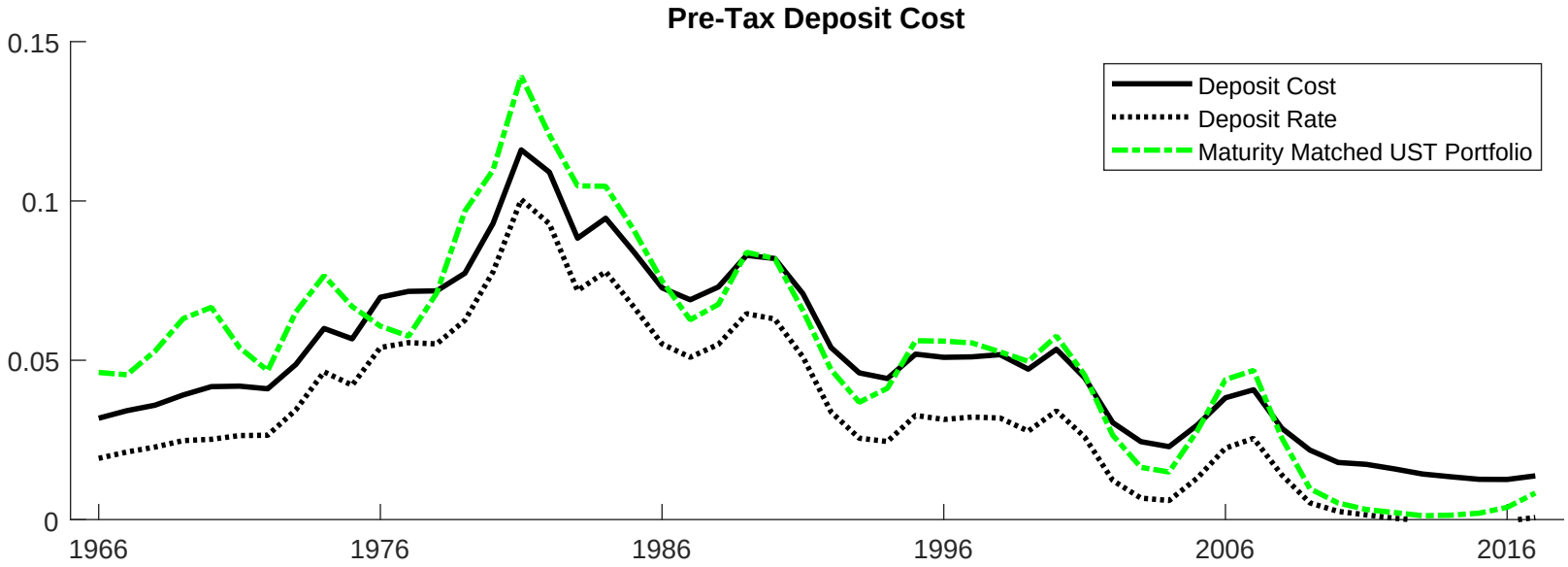
Transaction deposits (40% of funding) are most distinct



Bank debt

	Small	Med	Large	Mega	All
Debt Cash-Equiv Shr	28	40	33	57	50
LT Avg Maturity (Yrs)	0.7	0.7	0.8	0.8	0.8
Bank Debt Cost	3.84	3.65	3.56	3.12	3.25
UST Equiv Return	2.5	2.43	2.47	2.33	2.37
Bank Debt Risk Prem	1.34	1.22	1.09	0.79	0.88
t-statistic	(6.47)	(7.1)	(6.8)	(5.33)	(6.63)


Unlevered Return on Bank Assets
0.15
0.1
0.05
0
1966
1976
1986
1996
2006
2016
ROA (Pre-Tax)
Maturity Matched UST Portfolio


Pre-Tax Deposit Cost
0.15
0.1
0.05
0
1966
1976
1986
1996
2006
2016
Deposit Cost
Deposit Rate
Maturity Matched UST Portfolio

Taking stock: scope and size of edge

- Potential edge: 40% of assets (credit component of loans & services) and 40% of funding (transaction deposits)
- Remainder looks like investment portfolio s.t. corporate taxes
- Bank assets look and earn returns similar to a bond portfolio
  $\rightarrow$ It is relatively easy to replicate bank assets pre-tax and pre-expense
- Transaction deposits large source of operating costs (30% in our calculation, up to 50% for smaller banks based on FED estimates)
- Including operating costs, bank funding not advantaged
- Note: operating costs amount to 30% fee on equity

In sum: Corporate taxes and opex limit potential & scope for edge

Financial stability benefits from banks' operating structure?

Potential financial stability benefits from banks' operating structure

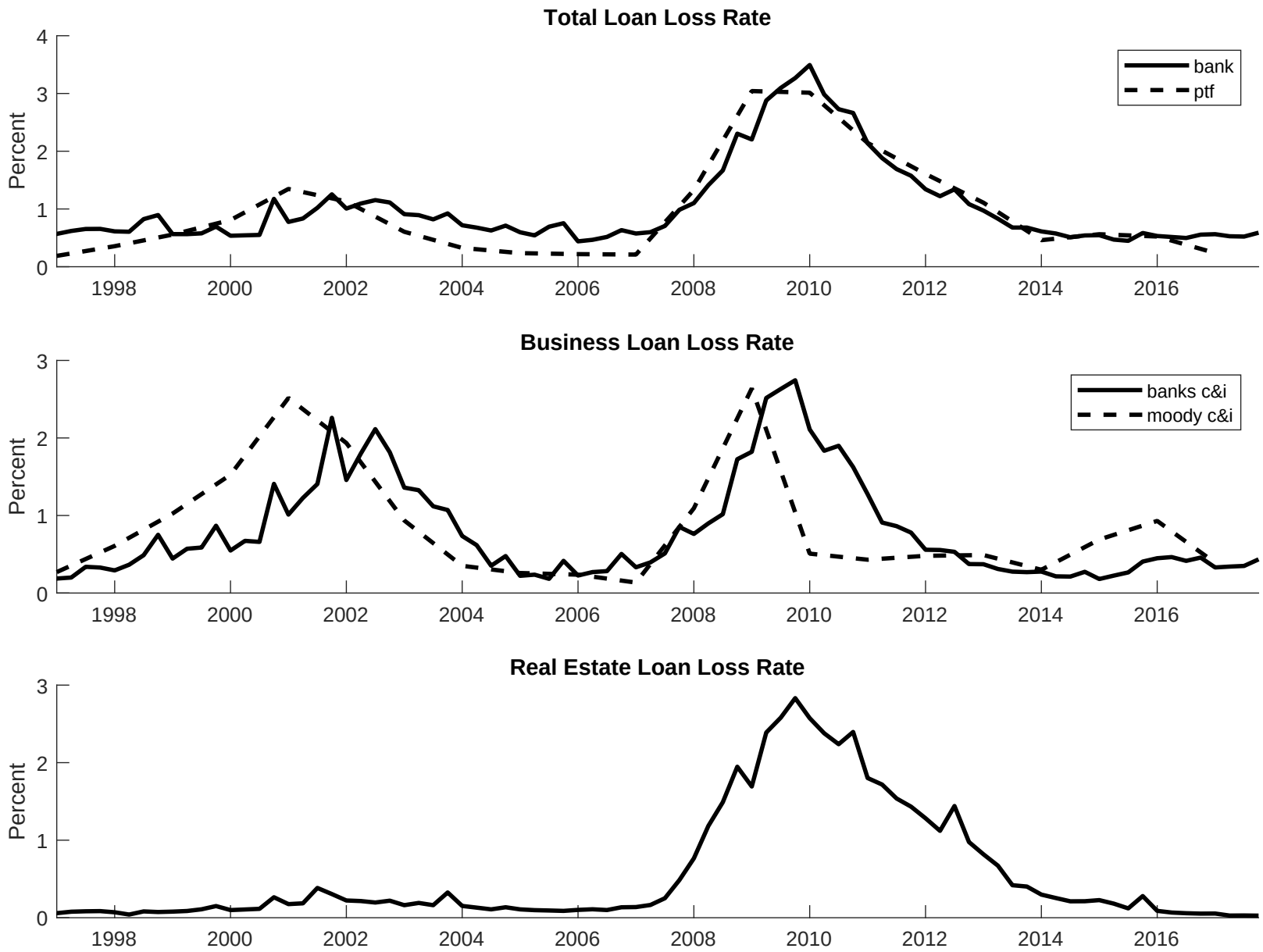
Bank Mutual Fund - Credit Risk

- Goal: replicate net interest rate, credit risk, and market exposure
- Add credit risk to loans $= 3.7 \times BE$
- Bank loans: 50% real estate, 25% business, 25% consumer
- Capital market alternatives for bank credit exposures

  (1) Mortgages and Bank loan portfolio
  - 50% in Vanguard mortgage fund
  - 25% in traded bank loan portfolio
  - 25% in 1 x levered Vanguard mortgage fund

  (2) Corporate bonds
  - 70% IG and 30% HY corporate bond portfolio to match bank losses

Loss rate


Total Loan Loss Rate
Percent
bank
ptf
Business Loan Loss Rate
banks c&i
moody c&i
Real Estate Loan Loss Rate
0
1
2
3
4
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016

Bank Mutual Fund - Interest rate risk

- How much interest rate sensitivity?

	Wt	Cash-eq	LT-eq	LT-MAT	LT-Delta	$Delta
Investments	0.28	0.45	0.55	7.72	-0.068	-0.011
Loans	0.52	0.46	0.54	2.40	-0.024	-0.007
Other Assets	0.19	1.00	0.00	0.00	0.000	0.000
Total Assets	1.00	0.56	0.44	3.44	-0.032	-0.017
Deposits	0.58	0.61	0.39	0.63	-0.007	-0.002
Debt	0.27	0.50	0.50	0.76	-0.008	-0.001
Total Liabilities	0.85	0.49	0.51	0.57	-0.006	-0.003
Residual (BE)	0.1480					-0.0146

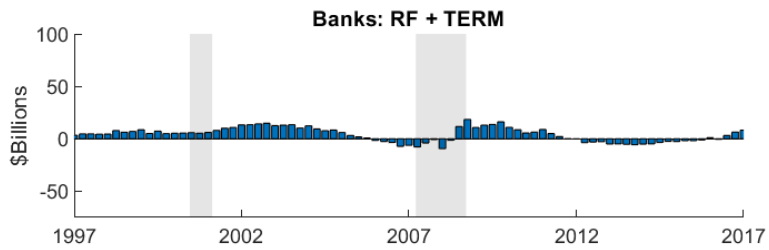
$ Deltas measure the $ value change to 1% increase in market rates

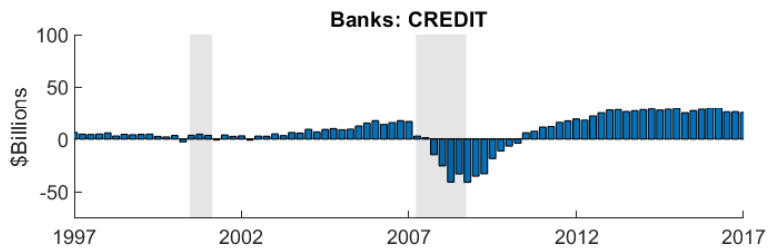
2 units 5-yr UST equivalent replicates $Delta of book equity

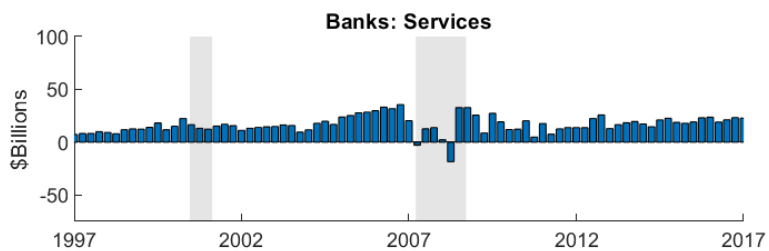
Bank Mutual Fund: Service Assets

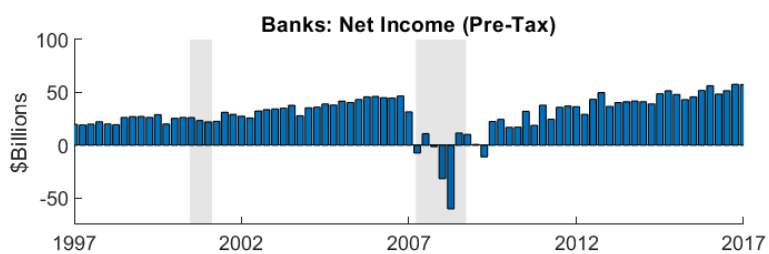
- Trading assets make up 50% of service assets (19% of total assets)
- Trading revenue pattern suggests market risk exposure
- Assume trading assets market beta $= 1$
- Assume everything else earns riskfree rate

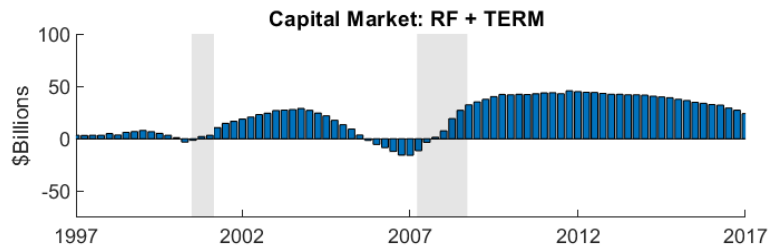
Cash Flow Comparison - Banks vs Mutual Fund

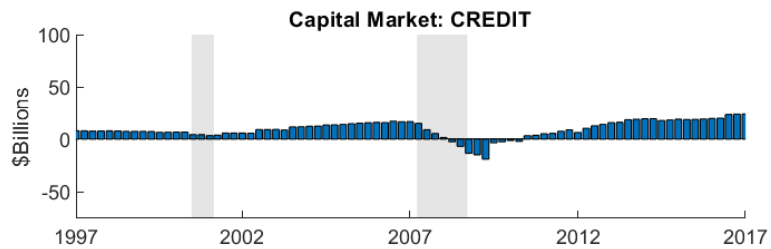


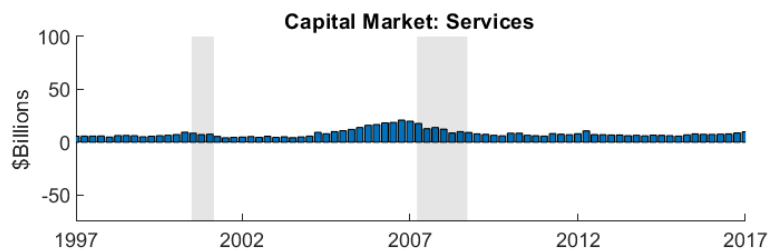


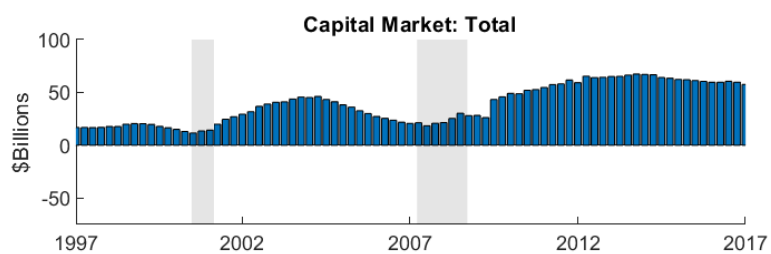






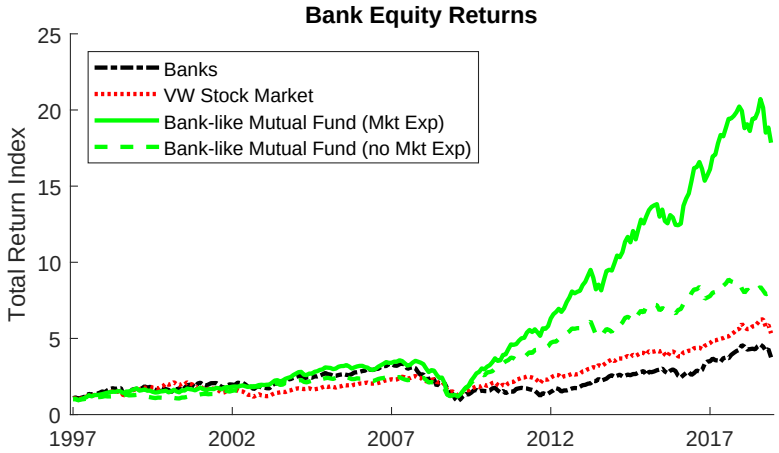


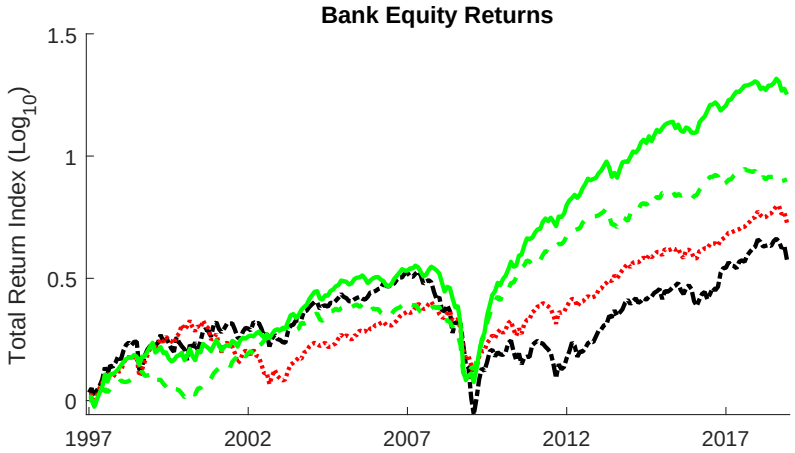


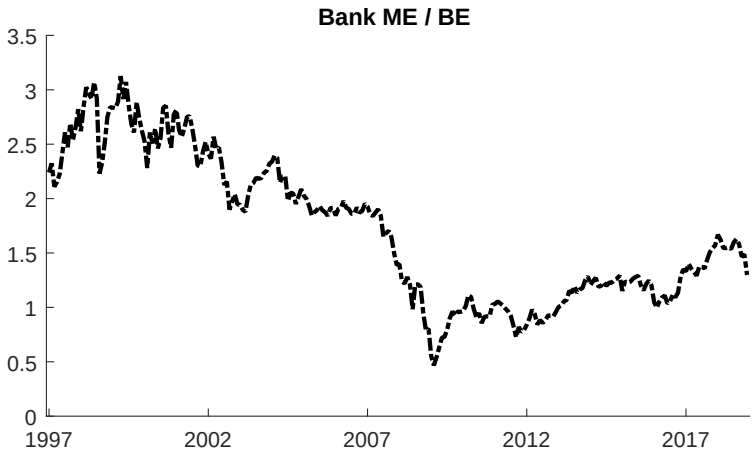


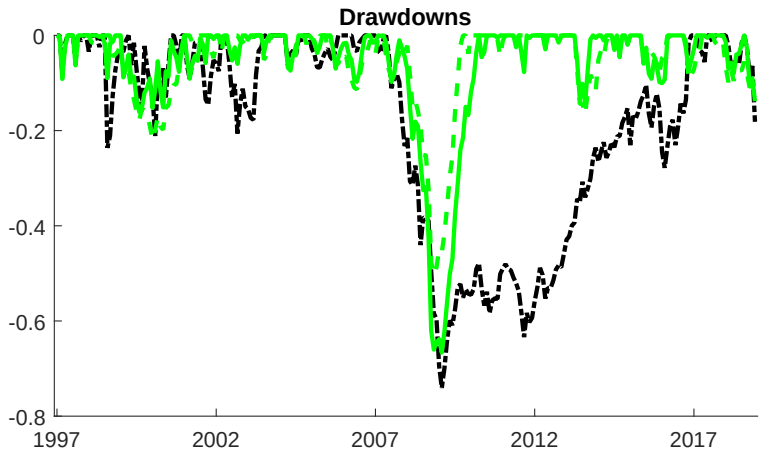
Risk & Return: Bank Equity & Bank Mutual Fund

	Mean	Std	Sharpe	CAPM_B	CAPM_a	Drawdown
Bank Stocks	6.36	21.45	0.30	1.10	-1.12	-74
Bank MF: Bank Credit	12.78	17.79	0.72	0.83	7.13	-67
Bank MF: Corp. Credit	13.89	19.65	0.71	0.97	7.30	-59
Bank MF: No β	8.28	12.61	0.66	0.17	7.13	-50
VW Stock Market	6.81	15.46	0.44	1.00	0.00	-50
TERM	2.57	4.11	0.62	-0.08	3.11	-4
IG Spread	0.62	2.06	0.3	0.06	0.22	-11
HY Spread	1.23	8.80	0.14	0.38	-1.36	-39









- Banks appear constrained since crisis

Factor exposure of bank stocks vs. bank mutual fund

Intercept	Market	Term	IG	HY	R2/N
	Bank Equity				
0.00	1.10				0.62
(-0.40)	(20.94)				264.00
0.00	1.10	-0.18	-0.87	0.09	0.63
(-0.09)	(15.35)	(-0.68)	(-1.38)	(0.43)	264.00
	Bank Mutual Fund				
0.01	0.83				0.52
(2.68)	(16.81)				264.00

- Agg. bank stocks do not trade like a levered bond portfolio
- No credit or interest rate risk exposure
  (see also Gandhi & Lustig 2015)
- Did banks hedged themselves perfectly?

Credit Market Version of Bank Loans has Interest Rate & Credit Risk Exposure

Intercept	Market	Term (5 yr)	IG	HY	R2/N
0.00	0.00	0.33	0.92	0.12	0.74
(1.99)	(-0.33)	(10.85)	(12.24)	(4.90)	264

Conclusion

(1) Scope

- Balance sheet of banks limited scope for edge
- Large share of bank assets tax-inefficient

(2) How large is the edge?

- No edge after operating expenses

(3) Financial stability implication from operating structure

- Mutual fund comes out ahead as banks appear constrained post-crisis
- Fin. stability does not seem improved during this period

(4) Do banks' have interest rate exposure?

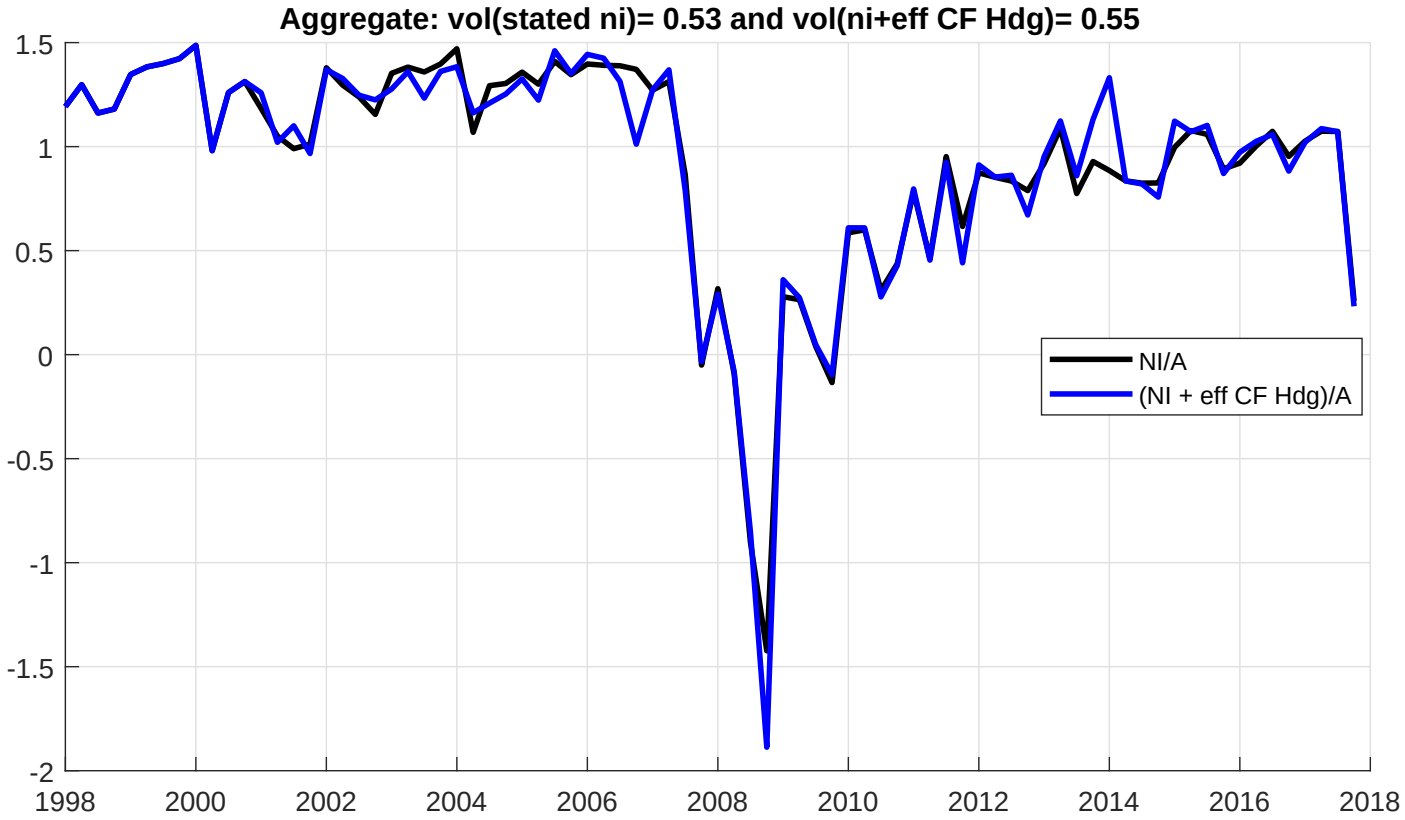
- Bond portfolios go a long way to explain bank assets
- Bank debt does not fully offset asset IRR exposure
  Requires 5-fixed-rate term on deposits - reprice more frequently
- Term exposure tail-wind: implies neg. hedging P&L but banks' is pos.
- Yet bank stocks trade as if they have no IRR (or credit) exposure

Appendix

Evidence for bank interest rate risk hedging

No explicit hedging

Net-income with and without explicit hedging



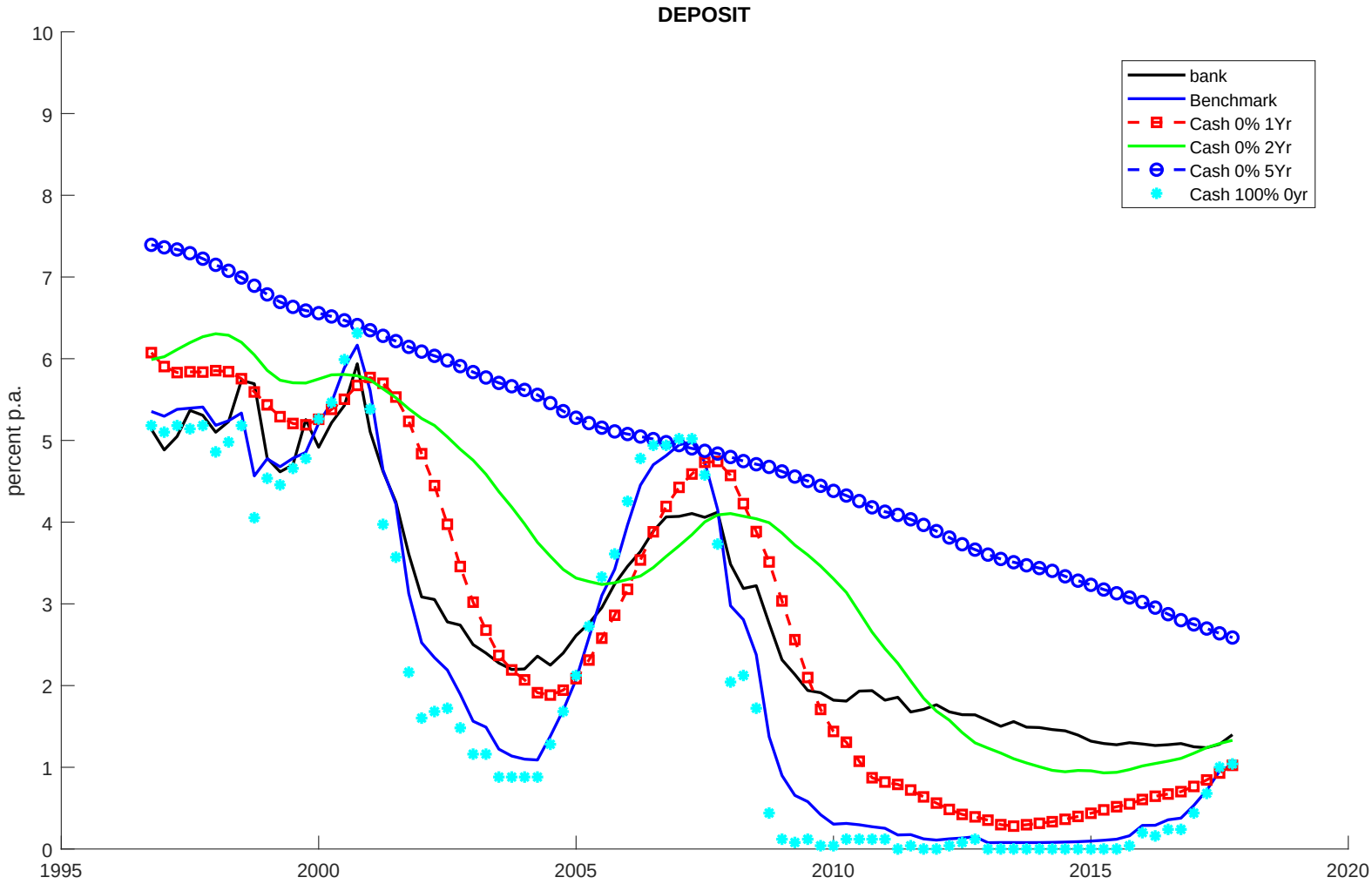
- Annual reports: banks focus on sensitivity to earnings not value
- Rampini-Viswanathan-Vuillemey: not much interest rate risk hedging
- Begenau-Piazzesi-Schneider: trading deriv. increase banks' interest rate risk

Deposit franchise as a natural hedge? No strong evidence

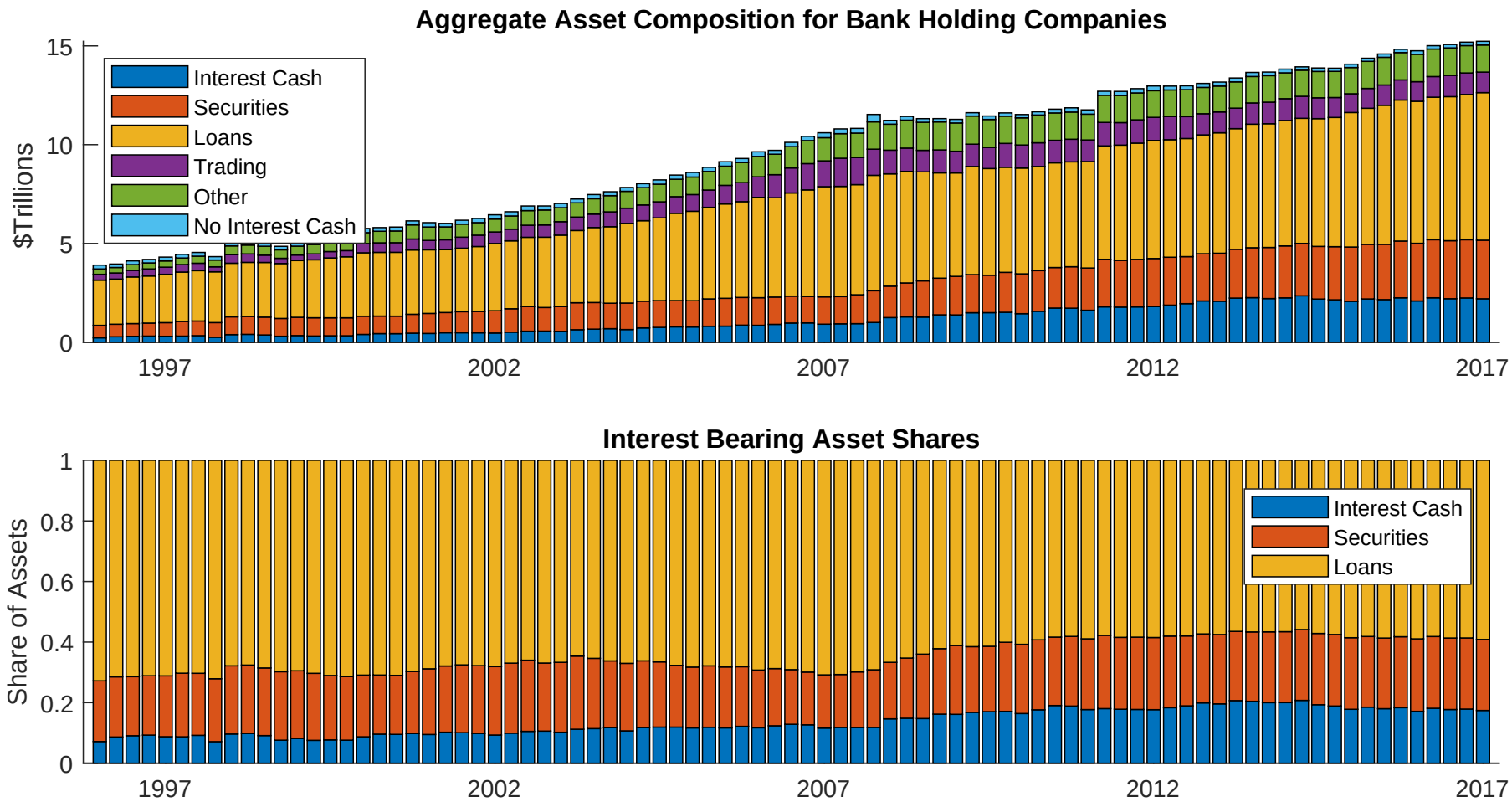
- DSS 2019 consistent with no interest rate exposure of equity
  - Argument: deposit franchise hedges interest rate risk of maturity transformation business
  - Assumes can measure risk from smoothed return
- Maturity transformation performed well as rates have been falling
  - For hedge: deposit franchise value should have been negative
  - Egan, Lewellen, Sunderam 2018 show bank stocks trade as if deposit franchise has a positive value
- To hedge asset IRR need to have five year term
  - Leads to worse fit of UST to deposit

Are deposits a natural hedge?

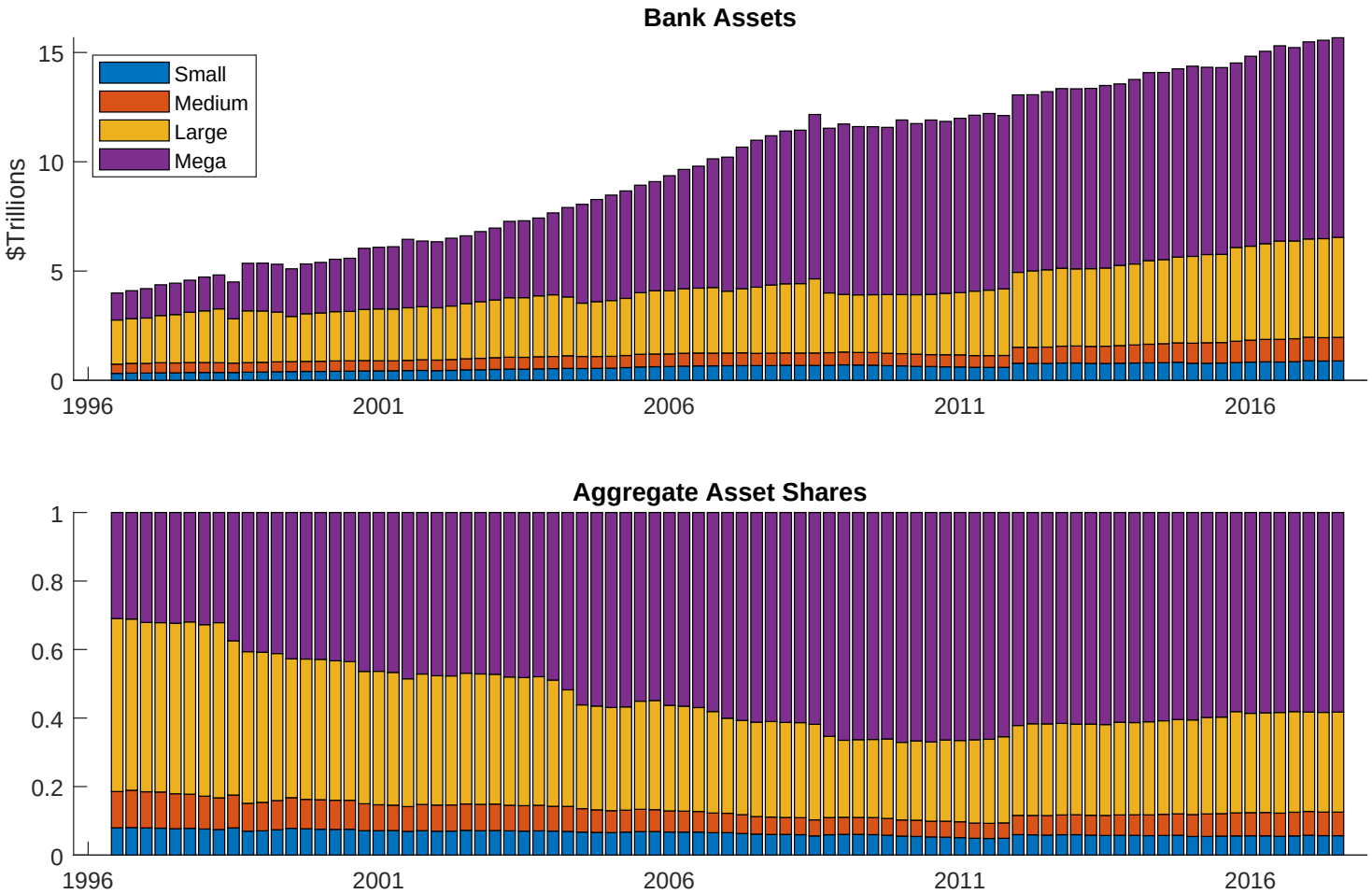
Fit is worse when treated as long term



Asset Decomposition



Banking Sector Concentration



Simple factor structure

Bank assets

$$R^A(h, q, \beta) = R^f + \text{Term}(h) + \text{Credit}(q) + \text{MKT}(\beta) + +\alpha^A$$

Bank liabilities are free of default

$$R^D(h, \beta) = R^f + \text{Term}(h) + \alpha^D$$

L = Assets/Equity

$$R^E(h, \beta) = L \times R^A(h, q, \beta) + (1 - L) \times R^D$$

Literature

Reasons for bank edge in maturity transformation:

- Diamond (1984); Boot and Thakor (2000); Diamond and Rajan (2000, 2001); Farhi and Tirole (2012); Di Tella and Kurlat (2017); Brunnermeier and Koby (2018); Hachem and Song (2018) ; Freixas and Rochet (2008); Donaldson, Piacentino and Thakor (2018)

Evidence on interest rate risk exposure

- Flannery and James (1984a,b); Gorton and Rosen (1995); Flannery, Hammed and Haries (1997); Hirtle (1997); Begenau, Piazzesi and Schneider (2015); Gomez, Landier, Sraer, and Thesmar (2016); Vuillemey (2017); English, Van den Heuvel and Zakrajsek (2018); Rampini, Viswanathan, Vuillemey (2018)

Capital markets view:

- Black (75), Fama (85), Merton (89, 90, 93), Merton and Bodie (93,95): banks compete in capital markets
- Begenau, Piazzesi and Schneider (2015): measure bank risk