

FTG Summer School: Bank Capital and Financial Stability

By
Anjan V. Thakor

John E. Simon Professor of Finance, Director of the PhD Program and Director of the
WFA Center for Finance and Accounting Research

OUTLINE OF SESSION

- Module I: **Motivation: Why Are We So Interested In Bank Capital Structure?**
 -- Link to financial crises, stability and economic output
- Module II: **Back to the Basics: What Role Does Bank Capital Play in Classical Theories of Financial Intermediary Existence?**
- Module III: **More Contemporary Theories of Bank Capital**
- Module IV: **The Role of Bank Capital Before and During Crises and Link to Financial Stability**
- Module V: **Why Are Bankers So Averse to Higher Capital?**
- Module VI: **Putting It All Together: What Do We Learn?**
- Module VII: **Open Theoretical and Empirical Questions**
- Module VIII: **Conclusion**

MODULE I:

Motivation:

Why Are We So Interested in Bank Capital Structure?

MOTIVATION

- Unlike capital structure theories for non-financial companies, the theory of bank capital structure is still in its infancy.

Surprising: Because arguably bank capital structure is a much more important issue... why?

- Safety nets, risk distortions leading to systemic risk, financial stability \Rightarrow individual bank capital structure decisions have spillover effects and social externalities.

Not surprising: Because unlike for non-financials, bank capital structure theories have to be linked to microfoundations of why banks exist ... Because of rich, unavoidable interactions between bank capital structure and *raison d'être* of banks.

MOTIVATION

- ❑ We know from extensive research that *bank capital* affects...
 - Bank asset portfolio choices;
 - Quality/default risk of bank assets (via screening and post-lending monitoring);
 - Probability of individual bank failure;
 - Probability of correlations between bank asset portfolios, contagion and hence size of *systemic risk*;
 - Real sector output and unemployment
- BANK CAPITAL IS OF CENTRAL IMPORTANCE FOR FINANCIAL STABILITY

MOTIVATION

- Financial Stability is of great interest because financial crises have significant real effects.*

* See Thakor, “The Financial Crisis of 2007-09: Why Did it Happen and What Did We Learn?” Forthcoming, *Review of Corporate Finance Studies*.

MOTIVATION

■ Real Effects

– *Luttrell, Atkinson, and Rosenblum (2013)*.

- Financial crisis of 2007–09 cost the U.S. an estimated 40%-90% one year's output: \$6-\$14 trillion.

⇒ \$50,000-\$120,000 for every U.S. household.

- Cost including human capital and PV of future wage income: \$15-\$30 trillion (100%-190% of 2007 U.S. output).

■ Credit Supply Effects

– Empirical evidence that negative shocks to bank capital due to declining asset quality led to reductions in credit supply (e.g., *Puri, Rocholl and Steffen (2011)* for German savings banks and *Campello, Graham and Harvey (2010)* survey of CFOs in 39 countries).

MOTIVATION

⇒ Syndicated lending began to fall in mid-2007 ... In 4th Q 2008, it was 79% lower than in the 2nd Q 2007.

■ Reduction in Corporate Investment and Increase in Unemployment

- ↓ in household consumption + ↓ in credit availability.
⇒ ↑ in unemployment.

Unemployment	Sep 2008	Jan 2009
	6.2%	7.6%

- 9 million jobs (6% of workforce) lost during 2008 and 2009.
- Housing prices ↓ 30%
- Stock market ↓ 50%

■ *Haltenhof, Lee and Stebunovs (2014)*

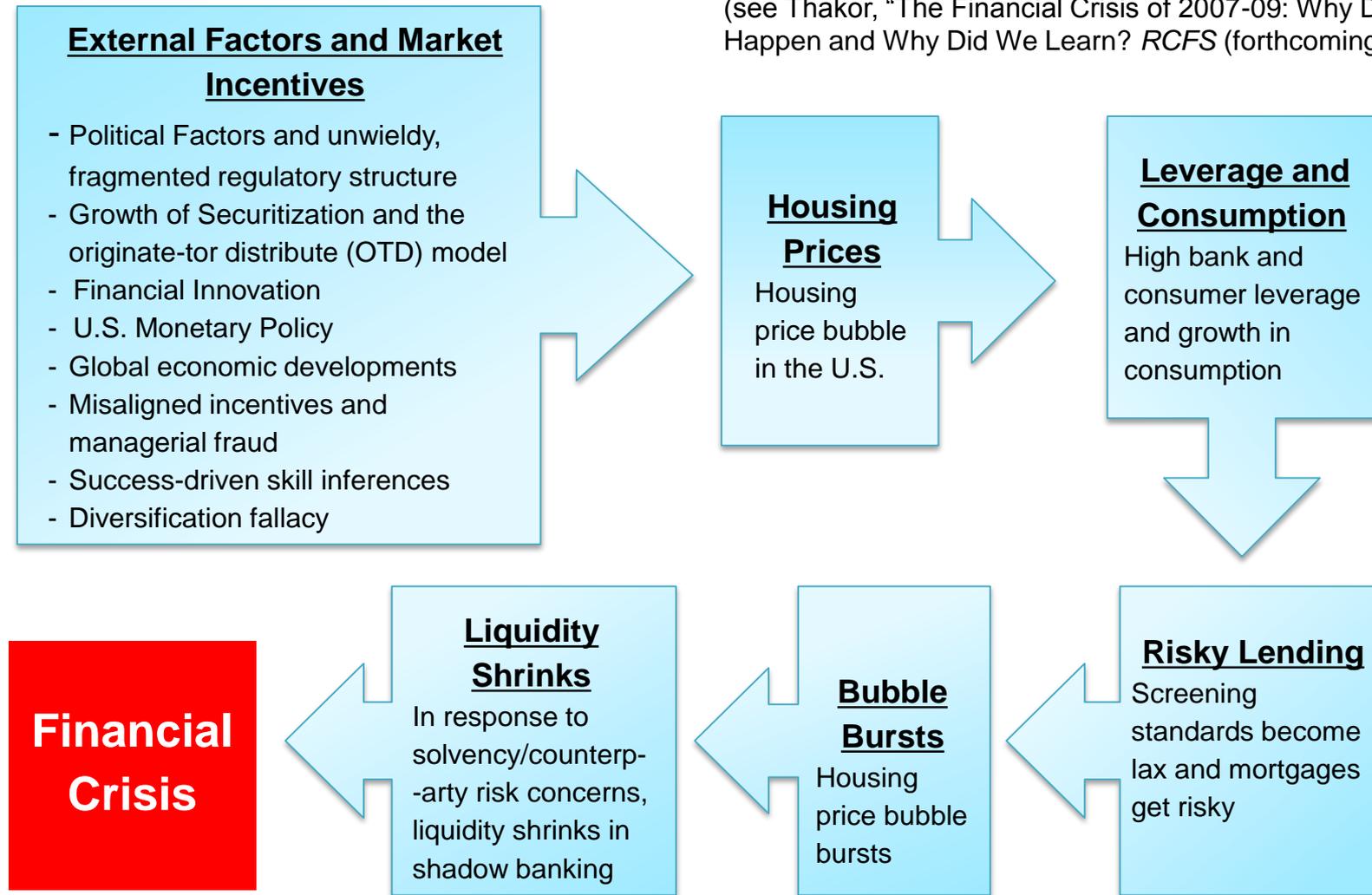
- Causal link between reduction in credit supply and ↑ in unemployment.

MOTIVATION

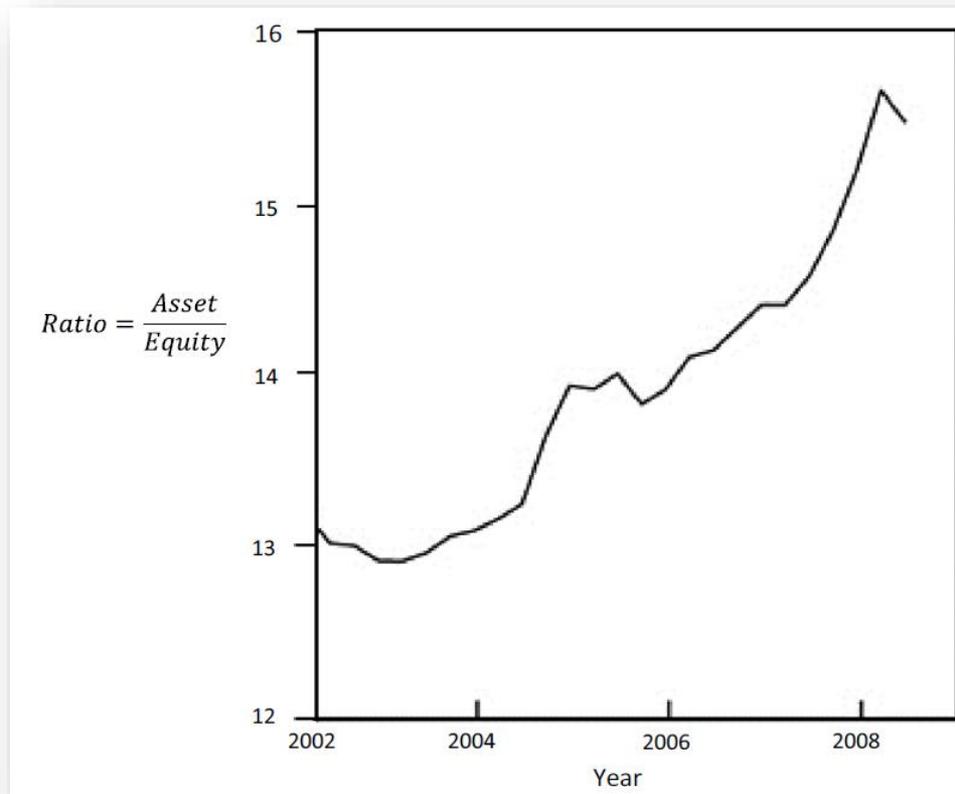
- There is considerable empirical evidence that high leverage (insufficient capital) in banking and among consumers were major factors in contributing to and sustaining this crisis.

MOTIVATION

(see Thakor, "The Financial Crisis of 2007-09: Why Did It Happen and Why Did We Learn? *RCFS* (forthcoming))



LEVERAGE – A MAJOR CONCERN

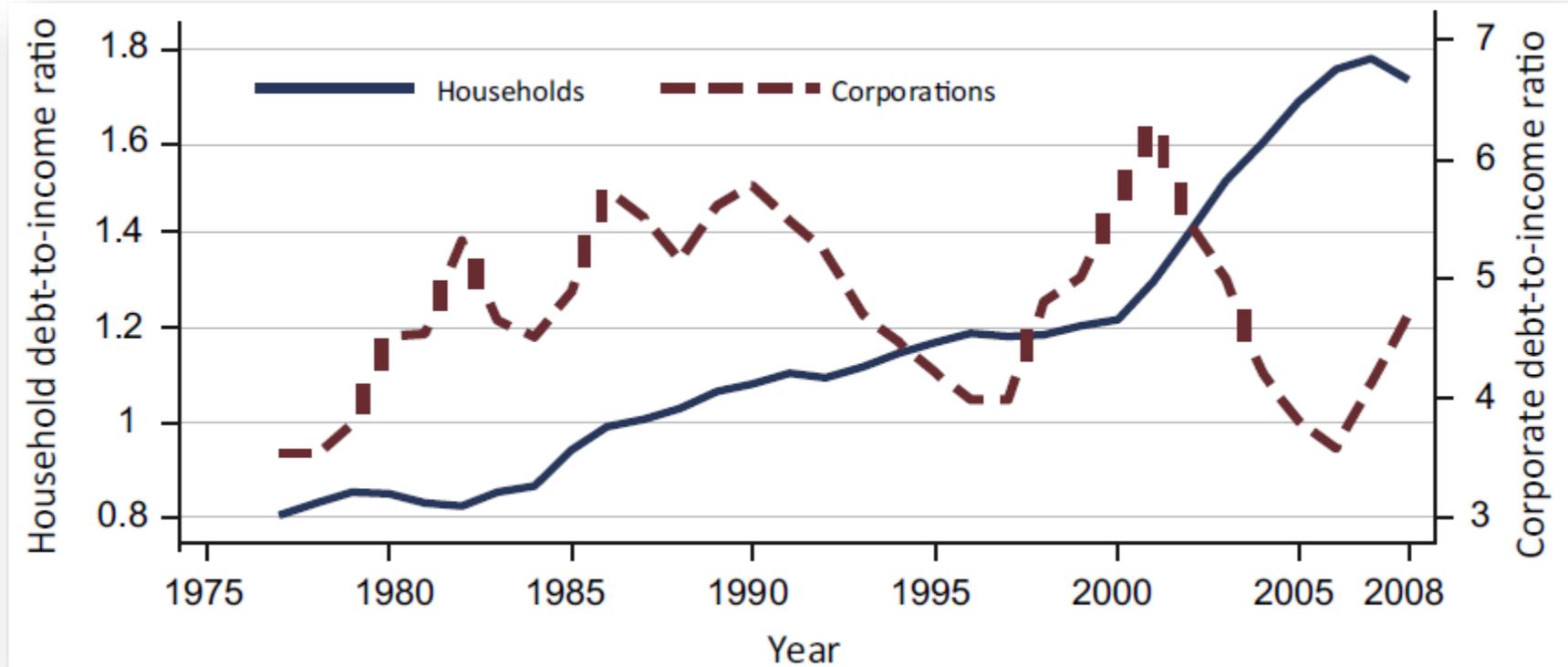


U.S. bank
(commercial
and investment)
leverage

- *Goel, Song and Thakor (JFI, 2014): Correlated leverage exacerbated the problem*

HOUSEHOLD DEBT ROSE BUT NON-FINANCIAL FIRMS' LEVERAGE DID NOT

U.S. debt-to-income ratio: households and corporations

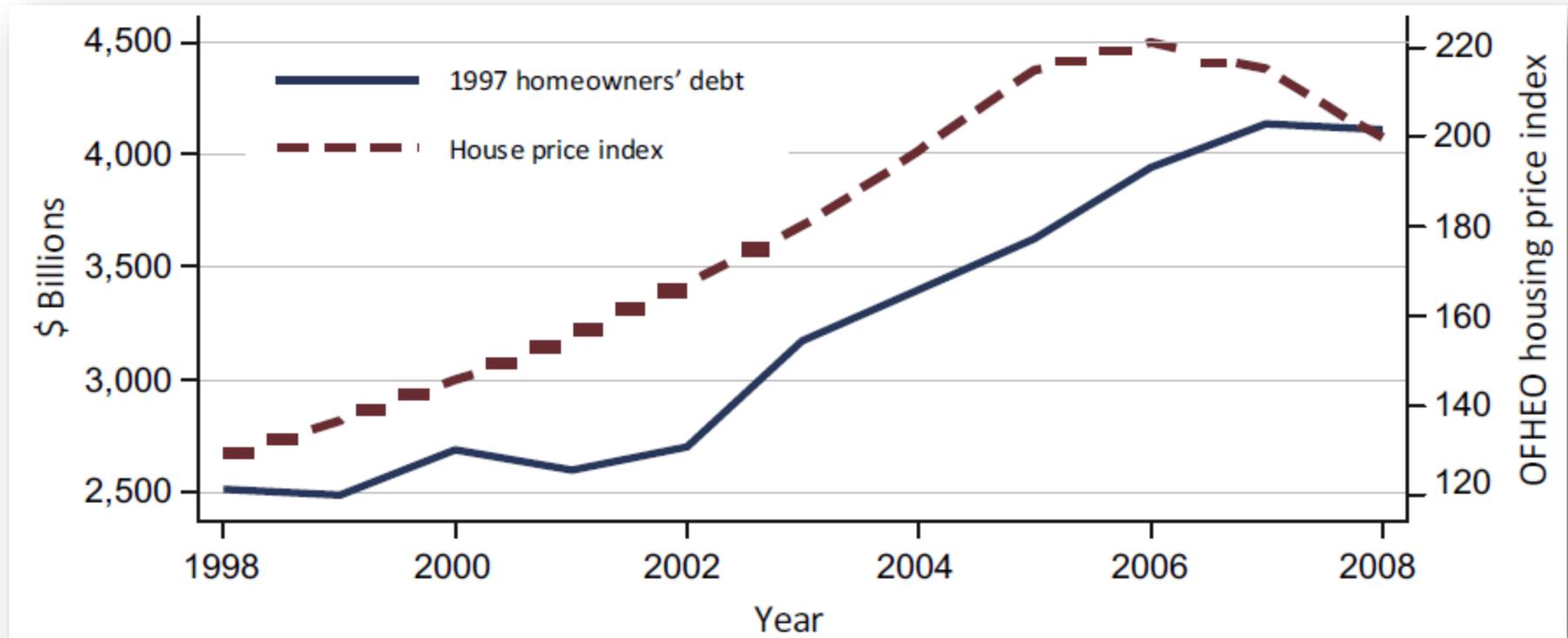


- *Goel, Song and Thakor (JFI, 2014): Correlated leverage exacerbated the problem*

HIGH HOUSEHOLD LEVERAGE WAS CORRELATED WITH RISE IN HOUSING PRICES THAT LED TO HOUSING PRICE BUBBLE

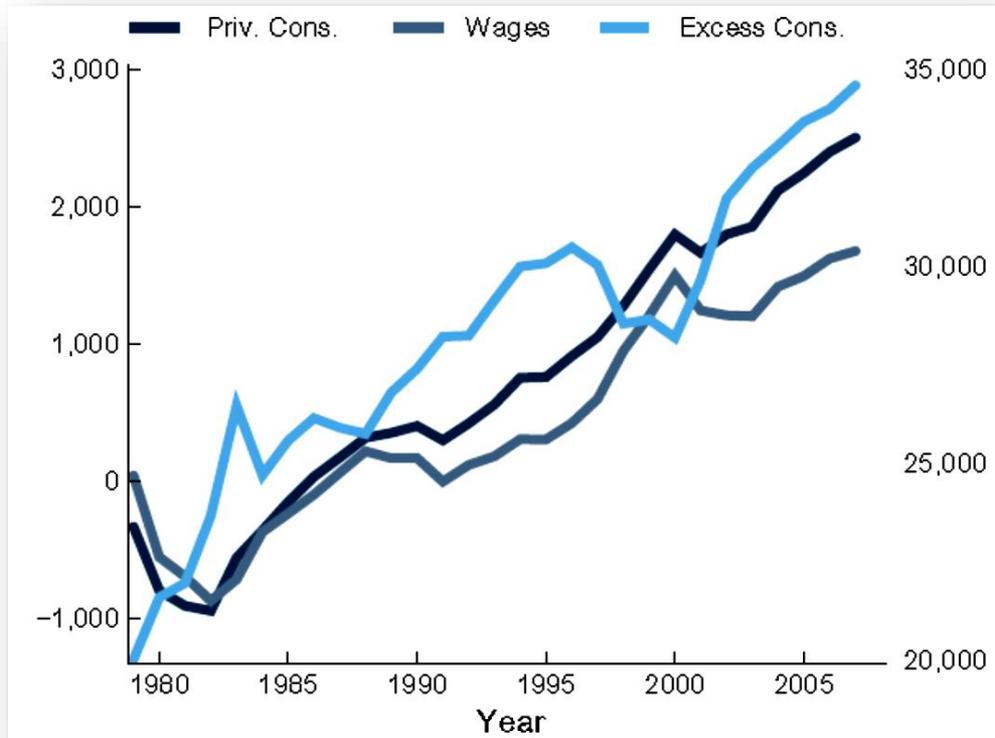
(Picture also consistent with Landvoigt, Piazzesi & Schneider [AER, April 2015] paper on San Diego house prices)

U.S. household debt for 1997 homeowners and house prices



- *Goel, Song and Thakor (JFI, 2014): Correlated leverage exacerbated the problem*

HIGH HOUSEHOLD DEBT FED EXPLOSION IN HOUSEHOLD CONSUMPTION



All numbers are in 1980 dollar per household.

- *Jagannathan, Kapoor and Schaumburg (2013) → increase in U.S. household consumption (financed by household debt) was a factor: “excess consumption” (consumption-wages) grew by 230% from 2000 to 2007.*

BOTTOM LINE:

High consumer *and* bank leverage created the perfect storm for the crisis.

MOTIVATION: CAPITAL CAN HELP

- ❑ *Not surprisingly, Gauthier, Lehar and Souissi, (Journal of Financial Intermediation, 2012) find (using a structural model that is calibrated using banking data) that a properly-designed capital requirement can reduce the probability of a systemic crisis by 25%.*

- ❑ Consistent with the endogeneity of systemic risk in the paper above... Research shows that ...
 - a. Highly correlated asset choices by banks (during 2000-06, correlated risk-taking grew - - - Bhattacharyya and Purnanandam (2011) document that idiosyncratic risk in commercial banking was cut in half and systematic risk doubled during this time).
 - This interconnectedness of banks raises likelihood of idiosyncratic shocks becoming systematic.

 - b. Banks engage in highly correlated high leverage choice (e.g., Acharya and Yorulmazer's (*JFI*, 2007) "Too Many to Fail", and Farhi and Tirole (*AER*, 2012)).

MORE BANK CAPITAL POTENTIALLY VALUABLE...BUT BANKERS DISLIKE HIGHER CAPITAL REQUIREMENTS

Why?

Standard banker view

Pfleiderer (2012) quotes Josef Ackermann, CEO of Deutsche Bank from a November 20, 2009 interview: “More equity might increase the stability of banks. At the same time, however, it would restrict their ability to provide loans to the rest of the economy. This reduces growth and has negative effects for all.”

But...what are the *real* reasons?

THIS AVERSION TO CAPITAL IS EVEN STRONGER AMONG EUROPEAN BANKS

The Economist (1-18-2014) talks about how European banks resisted the new 3% leverage ratio under Basel III and got the new rules watered down (e.g., allowing some assets to be excluded from leverage ratio calculations):

“The full extent of the new change is difficult to gauge...yet a rough calculation suggests that they [new leverage requirements] have been loosened just enough to allow most big European banks to pass the 3% test. Without the committee’s help, as many as three quarters of Europe’s big banks might have failed this test”.

“Bankers also claim that tough leverage requirements risk stemming the flow of credit to the economy, as banks shrink their balance sheets to comply. BNP Paribas, a French bank, says this would particularly disadvantage European banks...”

MODULE II:

Back to the Basics: What Role Does Capital Play in Classical Theories of Financial Intermediary Existence?

MAIN THEORIES

Diamond
(*Review of Econ. Studies*, 1984)

- *ex post* costly state
verification by bank

Ramakrishnan and Thakor
(*Review of Econ Studies*, 1984)

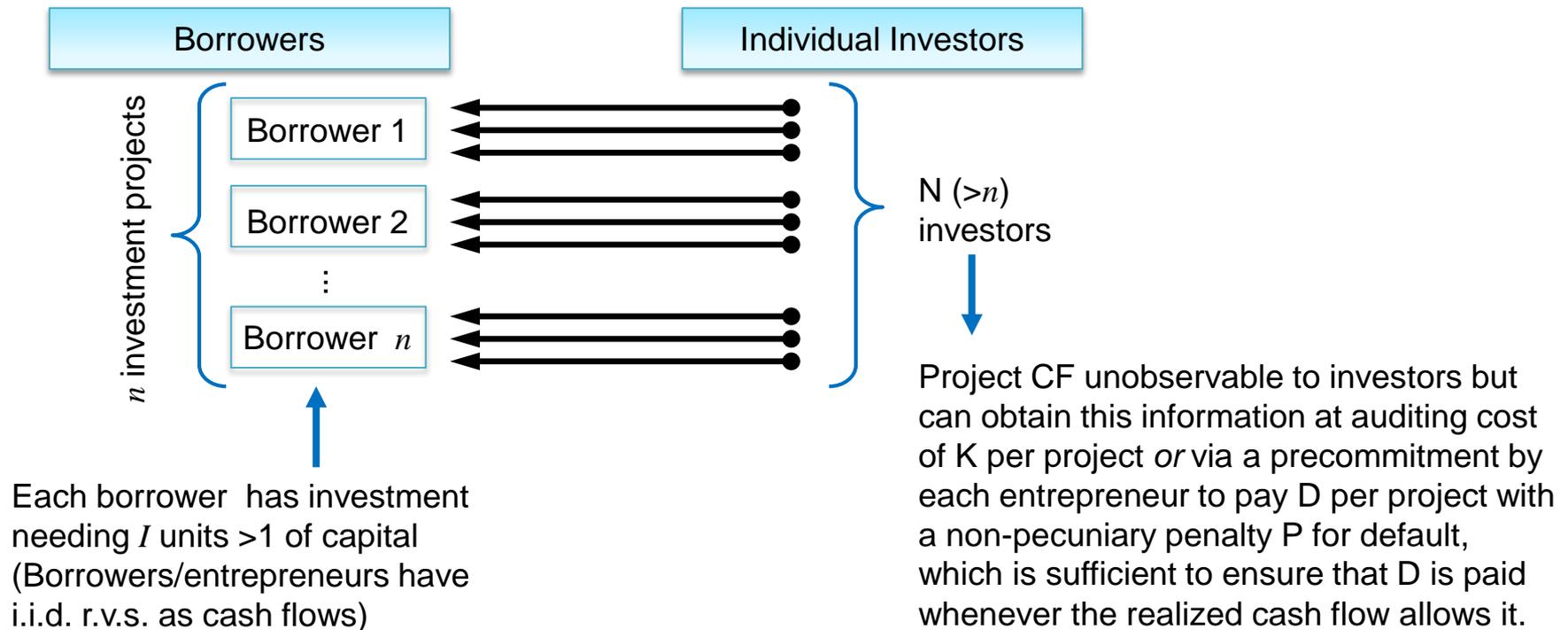
- *ex ante* costly screening of
credit risks

Discussed in Bhattacharya and
Thakor, (*Journal of Financial
Intermediation*, 1993)

THE DIAMOND MODEL

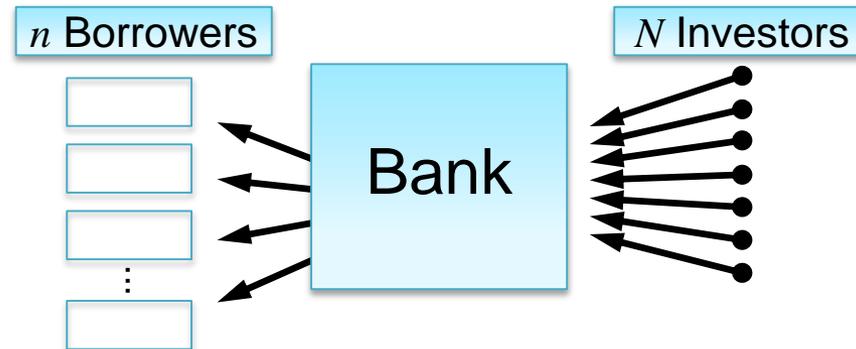
Resolution of Information Asymmetries in the Non-intermediated Case

Non-Intermediated Outcome



THE DIAMOND MODEL:

Intermediated Outcome



Research Question: When is a bank better than non-intermediated outcome?

Non-Intermediate Outcome:

a) Cost of information acquisition through direct monitoring/auditing
$$= M_a = NK \quad (1)$$

b) Expected cost of indirect information acquisition via entrepreneurial shareholdings or payout commitment

$$M_b = n \times P \times \pi(D) \quad (2)$$

where:

$\pi(D)$ = Probability that any project's CF
(i.i.d. across projects) will be $< D$.



endogenously determined in equilibrium

Intermediated Outcome:

If FI audits the outcome of each of the n projects, then:

a) Cost = $\hat{M}_a = nK$ (3)
clearly $\hat{M}_a < M_a$

However, the FI must now convince the primary investors of the value of its assets

⇒ FI must suffer non-pecuniary penalties of nP with probability $\pi^n(D)$

Thus, intermediation is Pareto improving if

$$\underbrace{\min [M_a, nP\pi(D)]}_{\text{for non-intermediated outcome}} > \underbrace{[nK + nP\pi^n(D)]}_{\text{for intermediated outcome}} \quad (4)$$

□ When will (4) be satisfied as n becomes large

$\left(\text{holding } \frac{N}{n} \text{ fixed} \right) ?$

□ With risk neutrality: answer is simple...

since $\pi^n(D) = \Pr \left(\begin{array}{l} \text{sample average of CFs} \\ \text{across } n \text{ i.i.d. projects} < D \end{array} \right)$

□ Weak law of large numbers

⇒ (4) will hold for n large enough if $D <$ population mean of n i.i.d. CFs since $\pi^n(D)$ goes to zero in the limit.

THE RAMAKRISHNAN AND THAKOR MODEL

- ❑ Borrowers/entrepreneurs know more about the values of their assets than others do.
- ❑ To avoid Akerlofian market failure, suppose a risk-averse individual information producer (i.p.) ($U(\bullet)$ over wealth) can produce information about a firm at private cost $C > 0$.
- ❑ \bar{U} = res. Util. of i.p. non-monetary
effect disutility
- ❑ Coalition of i.p.'s is a FI (like a CRA)
- ❑ *Moral hazard*: No investor or borrower can observe whether an i.p. produced info or just bluffed about borrower risk.

- Suppose each firm can monitor the i.p. to discover whether he invested
 - ⇒ Suppose this monitoring produces a noisy signal $\beta \in \{1,0\}$ that tells the firm about i.p.'s effort.
 - ⇒ Even if i.p. invests C , signal says he did this only w.p. $p \in (0,1)$. W.p. $1-p$, signal says i.p. did not produce information.
 - ⇒ If i.p. does not invest C , then signal says he did w.p. q and that he did not produce info w.p. $1-q$.

□ $p > q \Rightarrow$ signal is informative

Compensation

- Pay i.p. \$H if signal says i.p. produced info and L if signal says he did not.
- $H > L$.
- If i.p. produces info, his expected utility = $pU(H) + [1 - p]U(L) - C$ (5)
- If i.p. does not produce info,
his expected utility = $qU(H) + [1 - q]U(L)$ (6)
- IC requires $pU(H) + [1 - p]U(L) - C \geq qU(H) + [1 - q]U(L)$ (7)

Plus

$$\text{IR: } pU(H) + [1-p]U(L) - C \geq \bar{U} \quad (8)$$

- Suppose $U(x) = \sqrt{x}$, $\bar{U} = 20$, $p = 0.8$, $q = 0.2$ and $C = 10$.

$$\Rightarrow H = 10,000/9, \quad L = 10,000/36$$

\Rightarrow Each i.p.'s expected utility=20 and expected cost of information production for each firm = $0.8H + 0.2L = 944.44$.

Solution with Intermediary:

- Let two i.p.'s coalesce to form FI.
- Each u.p. still deals with one firm, but they pool payoffs.

- Each i.p.'s compensation =
$$\begin{cases} 2H / 2 = H & \text{if both signals favorable} \\ (H + L) / 2 & \text{if only one signal is favorable} \\ 2L / 2 = L & \text{if both signals unfavorable} \end{cases} \quad (9)$$

Probability of Compensation	Compensation of each i.p.
p^2 if both i.p.'s produce info and q^2 if both don't	H
$2p[1-p]$ if both i.p.'s produce info and $2q[1-q]$ if both don't	$\frac{(H+L)}{2}$
$[1-p]^2$ if both i.p.'s produce info and $[1-q]^2$ if both don't	L

- Can show both i.p.'s act in concert

New IC constraint to induce them to collaborate in producing information:

$$\begin{aligned}
 & p^2U(H) + 2p[1-p]U\left(\frac{H+L}{2}\right) + (1-p)^2U(L) - C \\
 & \geq q^2U(H) + 2q[1-q]U\left(\frac{H+L}{2}\right) + (1-q)^2U(L)
 \end{aligned} \tag{10}$$

(i.e., should be better for both to produce info than for none to do so.)

IR constraint

$$p^2 U(H) + 2p[1-p]U\left(\frac{H+L}{2}\right) + (1-p)^2 U(L) - C \geq \bar{U} \quad (11)$$

With *old* contracts ($H=10,000/9$, $L=10,000/36$], IC constraint (10) holds and LHS of (11) yields expected utility=20.43

- ⇒ each i.p. in *FI* enjoys higher expected utility than \bar{U} (20).
- ⇒ Since expected cost of information production for *FI* is the same as before (two independent i.p.'s), payment to *FI* by firms can be reduced without violating IR constraint.
- ⇒ Lower info production costs due to *FI*

Why? Better risk sharing

- R-T (1984) show, however, that while merging of i.p.'s improves risk sharing, it distorts incentives. Recognizing the pooling, now investors change contracts so that *each* firm pays FI (or i.p.):

H if $\beta = 1$ for both firms

K_1 if $\beta = 1$ for firm one and $\beta = 0$ for firm two

K_2 if $\beta = 0$ for firm one and $\beta = 1$ for firm two

L if $\beta = 0$ for both firms

- R-T (84) show $K_1 = K_2 = K$ (“Internal Monitoring Joint Contract”: *IMJC*).
- Special case of *IMJC*: “Separate contract”

⇒ Pay each i.p.

H if $\beta = 1$ for that i.p.'s firm

L if $\beta = 0$ for that i.p.'s firm

Theorem 1: Except for logarithmic preferences, IMJC always strictly dominates the separate contract. Both identical with log preferences.

Comment: Surprising in light of Holmstrom (1979)'s informative monitoring result since...
i.p. 1's signal is *uninformative* about i.p. 2's effort!

Key: In R-T (84), *both* firms are contracting with a *single* FI.

⇒ Internal monitoring means i.p.'s can pool payoffs and reduce impact of exogenous uncertainty on payoffs.

⇒ ↓ “incentive spread”

As $n \rightarrow \infty$, R-T show

Theorem 2: The outcome with FI approaches first best even though outsiders' signals are just as noisy.

⇒ Both Diamond(84) and R-T(84) imply optimality of infinitely large FIs.

□ *What is Role of Capital in FI?*

- None in either model.
- In Diamond(84), the non-pecuniary penalty P guarantees IC with no need for bank capital.
- In R-T(84), even the noisy signal β of outsiders about whether the i.p. in the FI has produced info creates “skin in the game” for FI
(in contrast to CRA models of securitization using OTD model).

⇒ No need for bank (equity) capital.

MODULE III:

More Contemporary Theories of FI Existence With a Role for Bank Capital

THEORIES IN WHICH BANK CAPITAL IS ESSENTIAL TO EXISTENCE OF BANK

- Holmstrom and Tirole (*QJE*, 1997)
 - Coval and Thakor (*JFE*, 2005)
 - Mehran and Thakor (*RFS*, 2011)
- In H-T (1997), monitoring (not auditing) by the bank helps to ensure that entrepreneurs don't select bad projects.

HOLMSTROM AND TIROLE MODEL (1997)

- Each entrepreneur can privately choose one of three projects:

	G Good (no PB and socially efficient)	B_ℓ Bad (low PB) =b	B_h Bad (high PB) =B
Probability of success	p_H	p_L	p_L

$$p_H > p_L, \quad B > b > 0$$

- Entrepreneur prefers B_h to B_ℓ .
- If FI monitors (e.g., compliance with loan covenants) at a cost $C > 0$, it can prevent entrepreneur from choosing B_h .
- Key Ideas:*
 - FI monitoring can prevent choice of B_h , but not choice of B_ℓ (which is socially inefficient).*

HOLMSTROM AND TIROLE MODEL (1997)

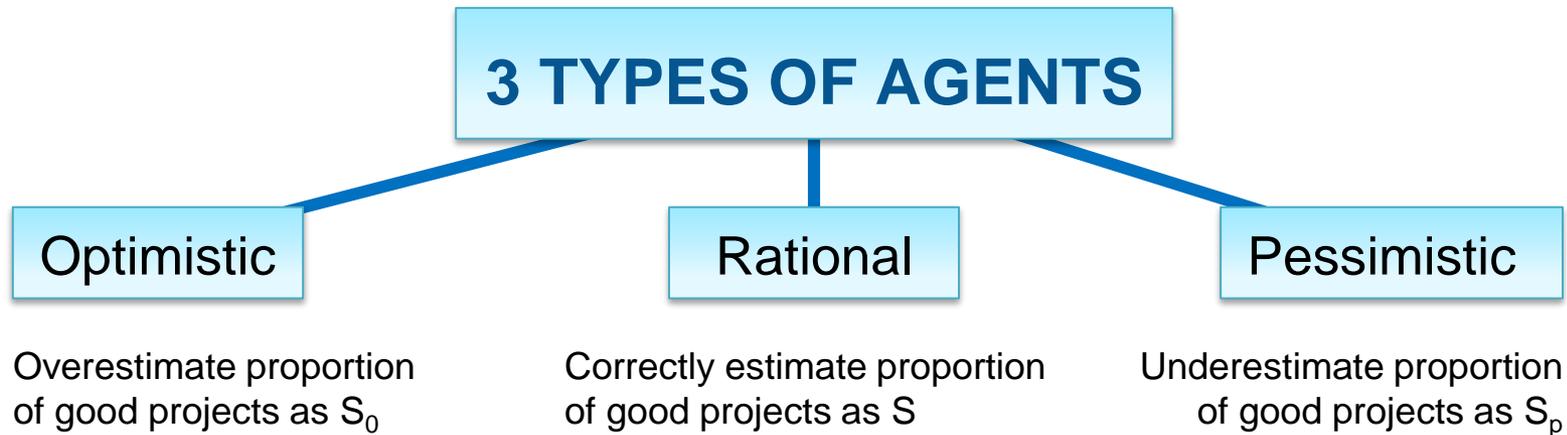
⇒ Entrepreneur needs to have enough capital to make it IC to choose G instead of B_ℓ , *assuming* FI monitors.

2. But FI's monitoring is only privately observable ⇒ FI must hold enough equity capital to make it IC for it to monitor

Important Implications:

- FI's must have sufficient capital to justify their existence (monitoring).
- Capital in the FI and capital in borrowers play *complementary* roles (recall Goel, Song, Thakor's (*JFI*, 2014) analysis of correlated leverage).
- High enough capital in banks *expands borrower's* debt capacity as bank loan makes non-bank financing cheaper (positive spillover effects of bank financing).

COVAL AND THAKOR (2005)



- $S_0 > S > S_p$
- Projects can be good ($NPV = N > 0$) or bad ($NPV = -N < 0$). Costly screening can discover project type.
- *Non-intermediated Outcome:*
 - Optimists wish to invest all their initial endowments *without* screening (they think S_0 is so high that investing C in screening is unnecessary.)

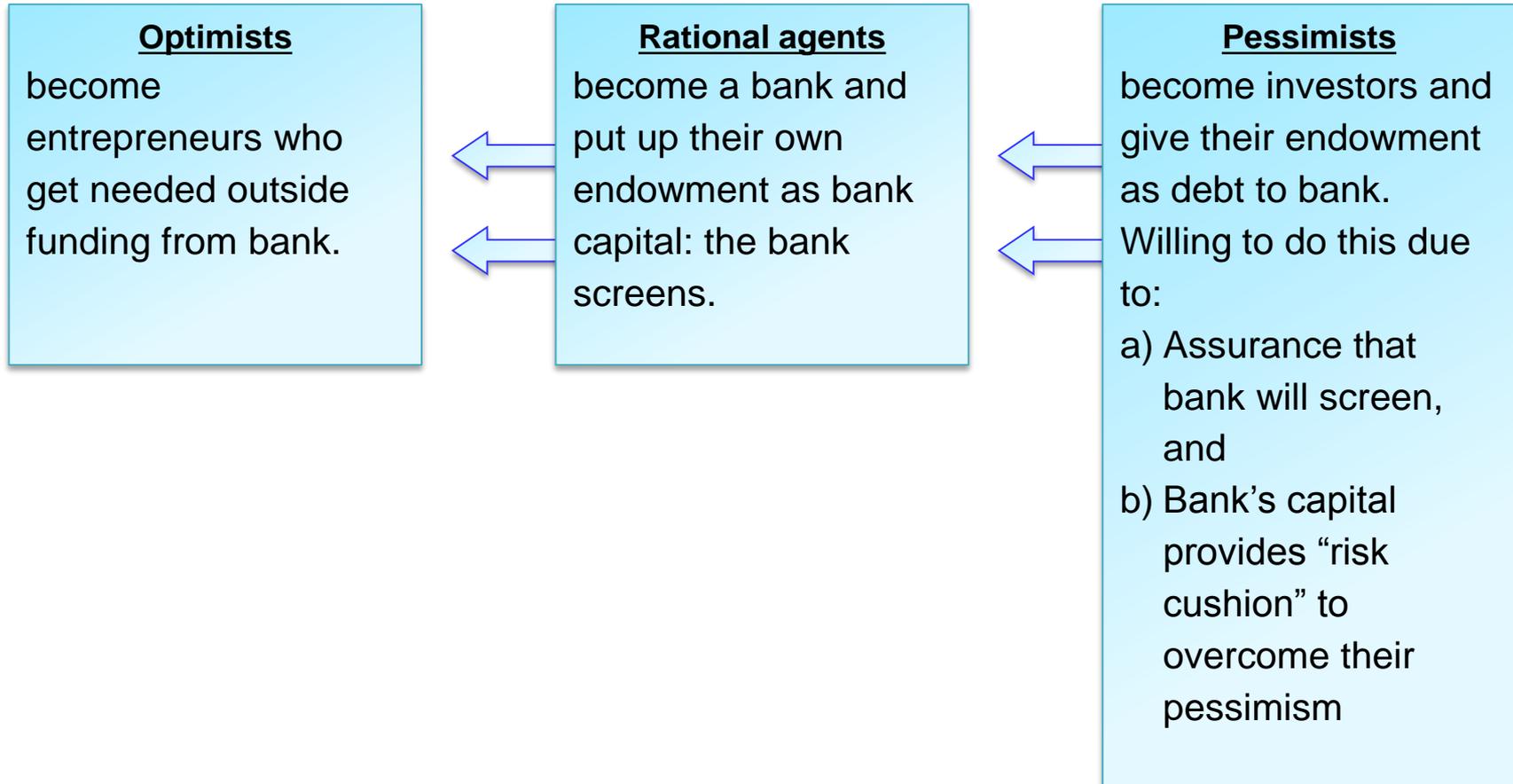
NON-INTERMEDIATED OUTCOME

- Pessimists don't want to screen (because they think S_p is low that screening is a waste of resources) and avoid investing.
- Only rational agents wish to invest, but only if there is screening. No agent has enough endowment to invest in own project. So, rational guys would want to give money to optimists to invest ... But will not because optimists won't screen.

AND

Optimists don't want to invest in projects of rational agents because they won't get as high a return as they think they should.

INTERMEDIATED OUTCOME

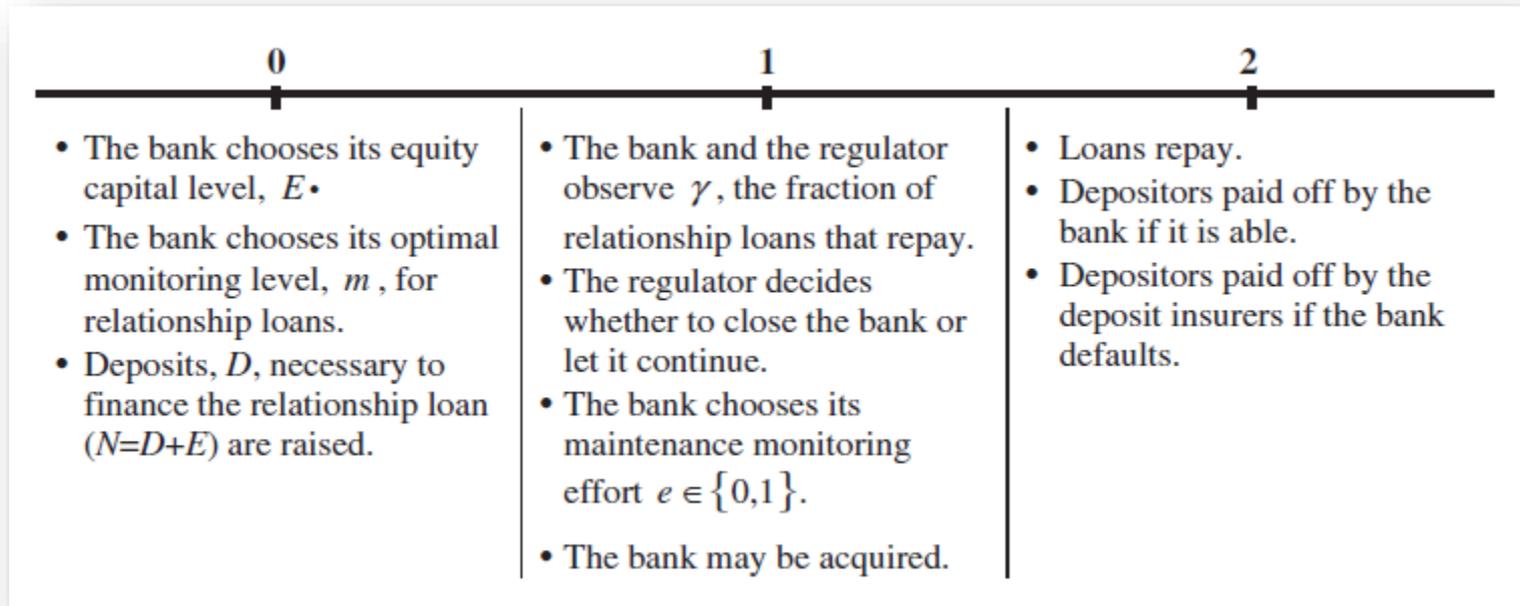


KEY IMPLICATIONS:

- Without intermediation, there is no investment in the economy.
- Intermediation is impossible without enough bank capital.
- Intermediaries arise in response to behavior irrationality of individual agents... this means intermediation can flourish even when informational frictions (like in Diamond (84) and Ramakrishnan-Thakor (84)) are small in advanced economies with good IT.

MEHRAN AND THAKOR (*RFS*, 2011)

- Dynamic (two-period) version of H-T (1997).



THE M-T MODEL

- At $t = 0$, bank starts with fixed asset size N and decides:
 - Capital structure (mix of D and E to finance loan)
 - How much loan monitoring m to do (m affects value of relationship loan)
- At $t = 1$, the fraction γ of loans that will repay at $t = 2$ becomes known: $f(\gamma) =$ density of γ (γ is exogenous).
- At $t = 1$, bank makes second monitoring decision that involves a choice of $e \in \{0,1\}$ and affects value of loans that do *not* default at $t = 2$.
- Regulator may also close bank at $t = 1$.
- Borrowers repay depositors at $t = 2$.
- Complete deposit insurance, zero premium, zero riskless rate, risk neutrality.

THE M-T MODEL (cont'd.)

- N relationship loans, each \$1
- Bank raises E from equity, cost $k(E)$, $k' > 0$, $k'' > 0$, and Inada conditions $k'(0) = 0$, $\lim_{E \rightarrow N} k'(E) = \infty$.
- $k'(E)$ varies in cross-section of banks.
- Monitoring cost $W(m)$, $W' > 0$, $W'' > 0$, $W'(0) = 0$, $W'(\bar{m}) = \infty$
- Relationship loan of \$1 allows bank to collect $1 + R(m)$, with $R' > 0$, $R'' < 0$.
- Bank chooses m , taking E as given, and chooses E anticipating effect of E on m .
- $e = 1$ at $t = 1$ needed to harvest $R(m)$.

THE M-T MODEL (cont'd.)

- Banks choice of $e = 0$ or $e = 1$ made after observing γ at $t = 1$.
- Cost of $e = 1$ is $V(1) > 0$, $V(0) = 0$.
- If $e = 1 \Rightarrow$ Value of relationship loan at $t = 2$ is $1 + R(m)$
- If $e = 0 \Rightarrow \begin{cases} \text{loan value } \Delta > 1 \text{ w.p. } \xi \\ \text{loan value } \xi\Delta < 1 \text{ w.p. } 1 - \xi \end{cases}$

i.e., choosing $e = 0$ causes loss of value created by m (initial monitoring).

- Bank has initial equity or retained earnings of B that it keeps as cash.

THE M-T MODEL (cont'd.)

- At $t = 1$, regulator observes γ and decides on subgame perfect closure policy. Cost $C > 0$ to keep bank open.

Result 1:

- Regulator allows bank to continue only if γ is high enough to induce bank to choose $e = 1$ at $t = 1$,

i.e., regulator permits bank to continue only if $\gamma \geq \gamma_c$, where

$$\gamma_c = \frac{V(1) + N - E + c}{\left[1 + R(m^*(E))\right]N} \quad (12)$$

Note: γ_c depends on $E \Rightarrow$ regulator permits continuation for a larger measure of γ realizations if bank equity is higher.

THE M-T MODEL RESULTS

○ At $t = 0$, the bank chooses m , taking E as given:

$$\max_{m \in [0, \bar{m}]} \int_{\gamma_c}^1 \left\{ \gamma N [1 + R(m)] - D - V(1) \right\} f(\gamma) d\gamma + B - k(E) - W(m) \quad (13)$$

and...using $D = N - E$, bank chooses E to

$$\max_{E \in [0, N]} \int_{\gamma_c}^1 \left\{ \gamma N [1 + R(m^*(E))] - (N - E) - V(1) \right\} f(\gamma) d\gamma + B - k(E) - E - W(m^*(E)) \quad (14)$$

Results

1. $m^*(E)$ is increasing in E .
2. E^* is decreasing in $k'(E)$.
3. Among banks of equal size, banks with higher levels of book equity capital will be acquired at higher prices;

i.e., relationship between bank capital and value is *positive* in the cross-section.

THE M-T MODEL RESULTS

4. NPV to target bank's shareholders (price P minus invested equity E) is increasing in E .
5. The *total value* of the bank (debt + equity) of the target bank in an acquisition is increasing in its optimally chosen E .

(So M&M does *NOT* hold!)

BANK CAPITAL HAS POSITIVE VALUE IN THESE THEORIES

- These theories thus make a strong case for banks to have higher levels of capital...

BUT...

There is disagreement on this even in academia.

Academics agree that higher bank capital → higher stability

But...

Disagree on whether raising capital requirements would be a good idea



Rajan (1998):

In discussing the disciplining role of bank leverage in fostering liquidity creation, Rajan (1998) notes: “Unfortunately, absent much better financial markets than those that currently exist, the theory suggests we cannot get many of the good things banks do, such as liquidity creation, credit origination, and financial innovation, without banks issuing claims susceptible to runs and thus being financially fragile.”

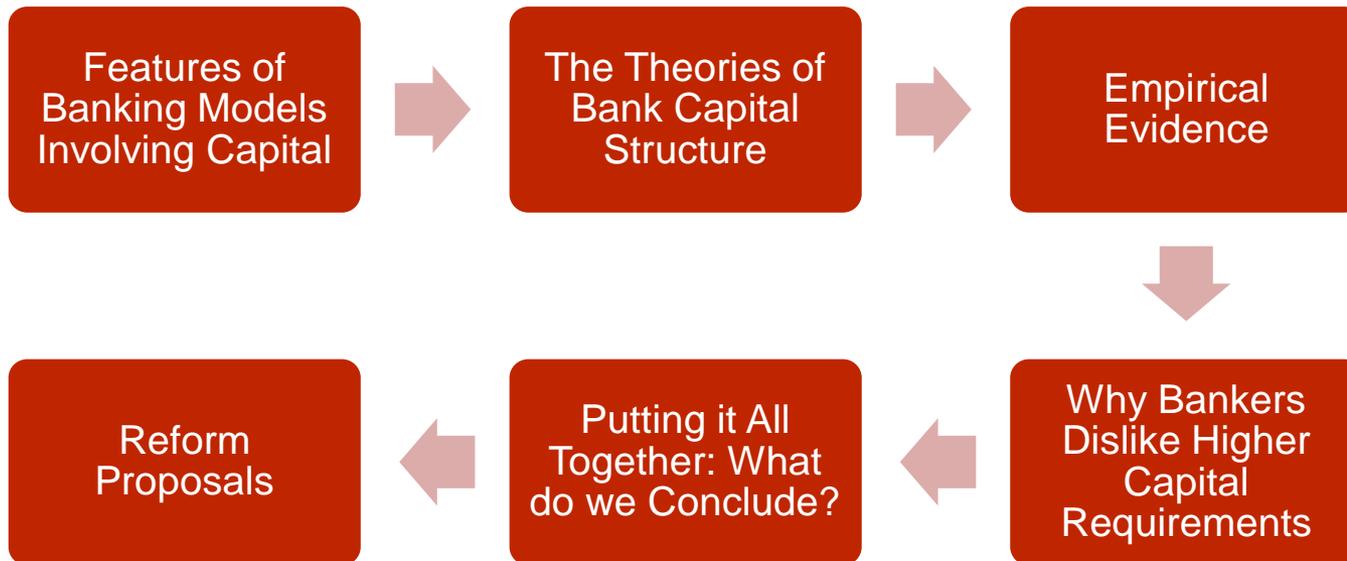
“We examine the pervasive view that “equity is expensive,” which leads to claims that high capital requirements are costly for society and would affect credit markets adversely. We find that arguments made to support this view are fallacious, irrelevant to the policy debate by confusing private and social costs, or very weak....We conclude that bank equity is not socially expensive, and that high leverage at the levels allowed, for example, by the Basel III agreement is not necessary for banks to perform *all* their socially valuable functions and likely makes banking inefficient....Setting equity requirements significantly higher than the levels currently proposed would entail large social benefits and minimal, if any, social costs”.

WHERE DOES THIS LEAVE US?

In my paper, “Bank Capital and Financial Stability: Economic Tradeoff or Faustian Bargain?” *Annual Review of Financial Economics*, 2014, I examine this issue by addressing the following questions.

- 1) Will higher capital levels in banking lead to lower lending and liquidity creation by banks?
 - 2) Will requiring banks to keep more capital increase funding costs for banks and diminish their values?
 - 3) What are the systemic risk implications of higher capital in banking?
- In addressing these questions, important to distinguish between higher levels of bank capital and higher capital requirements.

OUTLINE OF REST OF TALK



FEATURES OF BANKING MODELS INVOLVING BANK CAPITAL

Feature 1: Loan Screening and/or Monitoring:

Bank's capital impacts loan screening/monitoring choice →
affects loan payoff distribution

e.g. Holmstrom and Tirole (*QJE*, 1997)

Allen, Carletti and Marquez (*RFS*, 2011)

Mehran and Thakor (2011), Coval-Thakor(2005)

Feature 2: Asset Portfolio Choice

Bank's asset portfolio choice is affected by capital structure
→ high leverage → risk-shifting

e.g. Merton (1977)

J-M (1976)

FEATURES OF BANK CAPITAL MODELS (cont'd.)

Feature 3: The Direct Effect of Capital Structure on the Bank's Cash Flows:

- ❑ Leverage may induce creditors to monitor the bank (Calomiris and Kahn (1991)) or solves a hold-up problem (Diamond and Rajan (2001)).
or
- ❑ Core deposits produce rents due to provision of liquidity as well as transaction services, e.g. Song and Thakor (*RFS*, 2007), DeAngelo and Stulz (forthcoming, *JFE*).

Feature 4: Probability of Non-Renewal of Bank Deposits at $t=1$ followed by Liquidation Depends on the Bank's Capital Structure Decision as Well as the Capital Structure Decisions of Other Banks:

- ❑ A bank's probability of liquidation depends on its own leverage and may also depend on the decisions of *other* banks → Models of "capital structure contagion" – Acharya and Thakor "The Dark Side of Liquidity Creation---", WP 2015).

FEATURES OF BANK CAPITAL MODELS (cont'd.)

Feature 5: Probability of Non-Renewal of Bank Deposits at $t=1$ followed by Liquidation Depends on an Exogenous Uncertainty Beyond the Bank's Control or on Insolvency Concerns:

- ❑ Sunspot runs: Diamond and Dybvig (1983)
- ❑ Insolvency-induced runs: Chari and Jagannathan (1988)

Feature 6: Maturity Transformation—Deposits Mature Before Loans:

- ❑ Maturity transformation
➡ withdrawal risk faced by banks

e.g. Thakor (*JFE*, 2012)

Hellwig (1994)

Bhattacharya and Thakor (*JFI*, 1993)

FEATURES OF BANK CAPITAL MODELS (cont'd.)

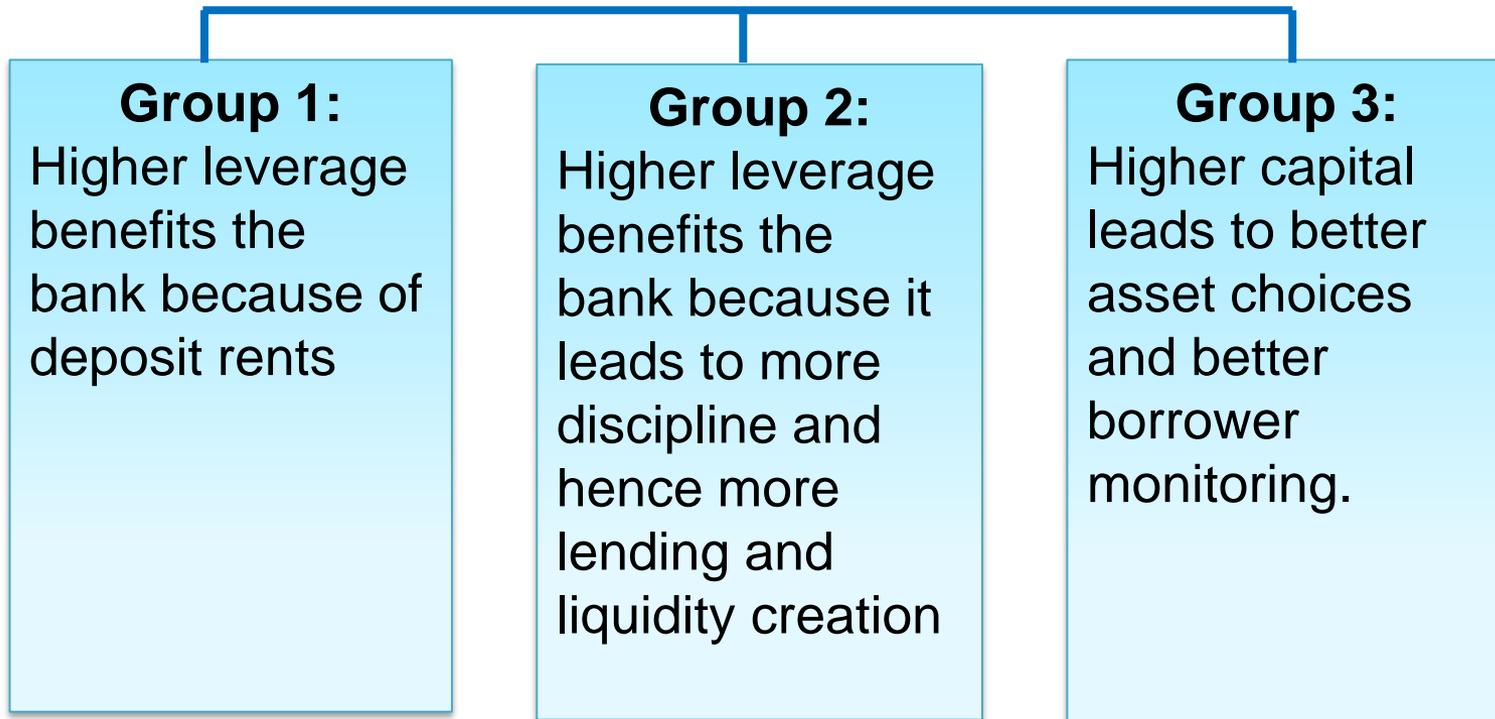
Feature 7: Cash Holdings of Banks and the Demandable Nature of Bank Deposits:

- ❑ Banks keep more cash on hand to meet deposit withdrawals than non-financials ... to meet liquidity risk associated with demand deposits
But ... holding cash is costly.
➔ Trade-off between holding cost and liquidity risk.

Feature 8: Bankruptcy Cost Associated with Premature Liquidation:

- ❑ Premature liquidation is costly.
- - - perhaps loss of charter value (Keeley (1990, *AER*)).

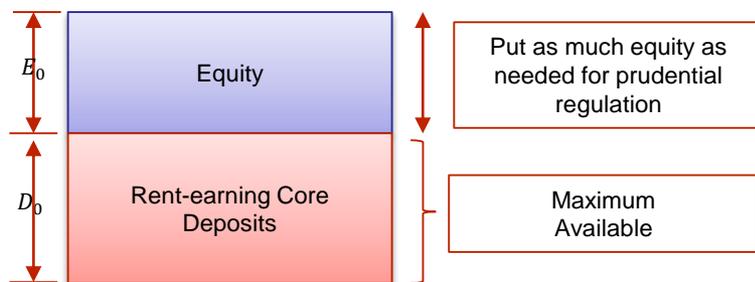
THE THEORIES OF BANK CAPITAL



GROUP 1: HIGHER LEVERAGE BENEFITS THE BANK BECAUSE OF DEPOSIT RENTS

Main Argument: Deposits are a factor of production in banking, so we should expect a lot of deposits (and hence leverage)

But...



Use enough E_0 to achieve desired capital ratio $k^* = \frac{E_0}{D_0 + E_0}$

- Note that E_0 not constrained by bank's lending opportunities – bank can invest it in marketable securities (zero NPV)

GROUP 1 THEORIES

But ... argument fails if:

- 1) Aggregate (socially) optimal level of bank deposits and higher capital requirements can force banks to keep less deposits (GE argument: Gale (2010)).
 - ➔ Not sure what this implies in a practical sense ... one would think that equity yields would rise to induce depositors to switch to bank equity ... or people may move out of government bonds or other domestic or international stocks to invest in bank equity.

- 2) Bank size is fixed and keeping deposit level fixed (so as not to replace socially-valuable deposits with equity) means adding equity on top would increase size of banking sector
 - ➔ May be costly

e.g. DeAngelo and Stulz (forthcoming).

GROUP 2 THEORIES : HIGHER LEVERAGE BENEFITS THE BANK BECAUSE IT LEADS TO MORE DISCIPLINE AND HENCE MORE LENDING AND LIQUIDITY CREATION BY BANKS

- ❑ Leverage → discipline on bank or bank manager with no deposit insurance

e.g.,

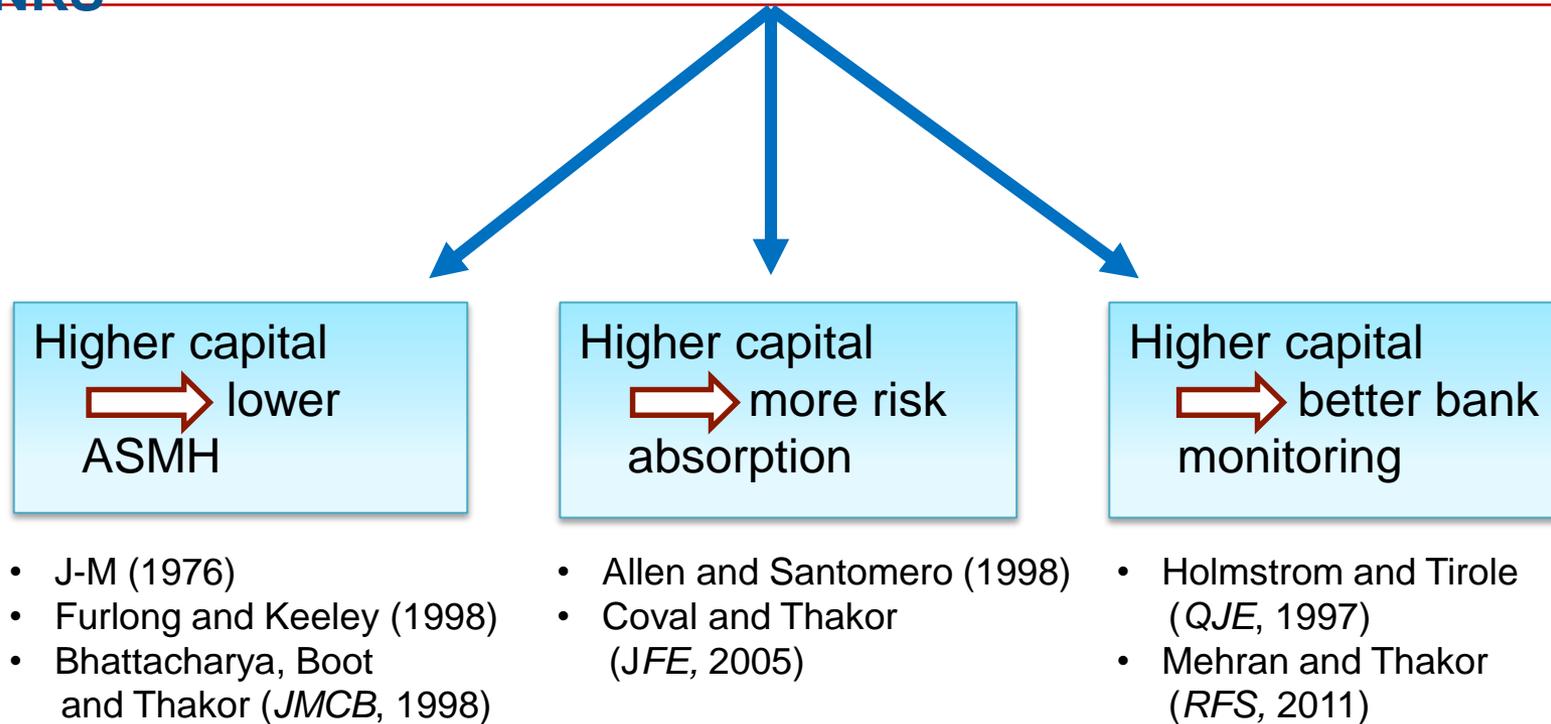
- Calomiris and Kahn (*AER*,1993) rationale for SSC
- Diamond and Rajan (*JPE*,2001)

- ❑ But...

- How effective has depositor monitoring been? (Goodhart (2013)).
- Is this due to deposit insurance and other safety net distortions?
- When creditor discipline works, it usually means shortening of debt maturity ... until it becomes overnight funding.

... Market discipline most evident when the rug is pulled out ... too late!

GROUP 3 THEORIES: HIGHER CAPITAL LEADS TO BETTER ASSET CHOICES AND MORE MONITORING OF BORROWERS BY BANKS



PUTTING THE THEORIES TOGETHER

- ❑ *Common Ground:* Higher capital leads to greater bank stability
- ❑ *Disagreement:* Benefits of leverage

<u>Group 2</u>	<u>Group 3</u>
Leverage needed for market discipline	Equity provides the appropriate incentives

But ... Group 2 → no governance role for equity
Group 3 → no governance role for debt

- ❑ *Reconciliation*

Acharya, Mehran and Thakor (“Caught Between Scylla and Charybdis...”, *WP* 2015).

WHAT ABOUT LOAN COMMITMENTS?

Huang (2010): *77% of new C&I loans in average U.S. bank's portfolio are under loan commitments

*46% of banks make no spot loans at all

Thakor (*JMCB*, 2005): loan commitments provide insurance against rationing in the spot credit market.

But ... Huang (2010) reports many banks did not honor loan commitments during the crisis.

Why?

- Boot, Greenbaum and Thakor (*AER*, 1993)  LC's as “illusory promises” and financial vs. reputational capital.

MODULE IV:

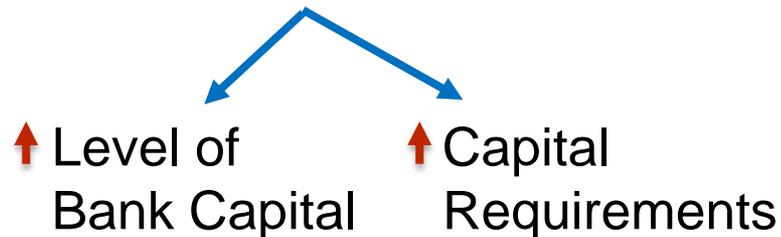
The Role of Bank Capital Before And During Crises And Link to Financial Stability: The Empirical Evidence

EMPIRICAL EVIDENCE

Effect of Capital on Bank Screening:

- Purnanandam (*RFS*, 2011) → banks with lower capital and OTD model in mortgage market originated loans of poorer quality.
- Consistent with theory of Thakor (*JF*, 1996).

Effect of Bank Capital on Lending:



EMPIRICAL EVIDENCE (cont'd.)

a) Effect of Capital on Bank Lending:

- Tough to establish causal relationship between capital and lending due to difficulty in separating supply and demand effects. Peek and Rosengren (*AER*, 1997) do this ...

1989-92 Japanese stock market crash caused:

- Japanese banks capital levels to fall
- Exogenous negative shock to capital of U.S. branches
- Lower lending
due to credit supply shock

➔ *When capital levels in banks fall, credit supply falls.*

b) Effect of Bank Capital on Liquidity Creation:

- Berger and Bouwman (*RFS*, 2009)
 - ➔ + relationship for large banks (81% of liq. creation)
 - ➔ - for small banks

EMPIRICAL EVIDENCE (cont'd.)

c) Effect of Capital on Competitive Position and Survival:

- Calomiris and Powell, (*NBER*, 2001)
Calomiris and Mason (*AER*, 2003)
Calomiris and Wilson (2004)

☐ Higher-capital banks have competitive advantage in market for loans and deposits.

☐ Berger and Bouwman (*JFE*, 2013)

➡ higher-capital banks get bigger market share and more likely to survive crises.

EFFECT OF CAPITAL REQUIREMENTS:

A. Level of Lending

- Thakor (*JF*, 1996)
- Aiyar, Calomiris and Wieladek (forthcoming, *JMCB*)
 - higher capital requirements or change in form to risk-based
 - lower lending

B. Terms of Lending

- Hanson, Kashyap and Stein (2011):
 - ↑ cap req by 10% points
 - bank loan rates ↑ by 25-45 bps

C. Bank Profits

- Kisin and Manela (2013):
 - ↑ Tier-1 risk-based cap. Req. by 10% points
 - higher cost of 4% of annual profit of the average bank

RELATIONSHIP BETWEEN BANK CAPITAL AND VALUE:

- Mehran and Thakor (2011):
 - i. Total bank value and the bank's equity capital are positively correlated in the cross-section
 - ii. The various components of bank value in an acquisitions context are also positively related to bank capital.

Calibrating Optimal Capital Requirements:

Miles, Yang and Marcheggiano (*Economic Journal*, March 2013) develop a structural model in which they take into account the expected benefit of bank capital in reducing the probability of a crisis as well as tax benefits of bank debt, and estimate that the optimal capital requirement should be 20% of RWA, which may be a leverage ratio of 7% to 10%.

MODULE V:

Why Are Bankers So Averse to Higher Capital?

WHY DO BANKERS DISLIKE HIGHER CAPITAL REQUIREMENTS?

i. Political Economy of Banking:

– Song and Thakor (*WBBER*, 2012): nature of government intervention depends on nature of economic development

➡ Compliance with regulation by banks produces private benefits for politicians

➡ Banks may comply with some regulations and ask for relief on others (e.g. capital requirements)

➡ Banks may overstate costs of higher cap. req. for “trade” as part of negotiation game to significantly lower regulatory burden on other dimensions in exchange for higher cap. req.

BANKERS' AVERSION TO CAPITAL

ii. Tax Benefits of Debt:

- Usual argument
- But...what's special about banks?
- Tax tradeoff for banks may be different...

Why?

- Banks have special close competitors who are exempt from corp. taxes (e.g. credit unions, mutual funds, securitization vehicles funded with debt and equity tranches)

 Banks try to minimize their taxes too by pumping up their leverage.

- There is evidence that bank capital structure responds to tax code changes (e.g. Schepens (*WP*, 2013)).

BANKERS' AVERSION TO CAPITAL (cont'd.)

iii. Deposit Insurance put option:

- Merton (1977)
- But effect seems empirically significant only when net worth hovers around 0 or is negative.

iv. Catering to ROE-Obsessed Investors and Exec Comp in Banking

- What if investors' ROE expectations don't take into account leverage?
- Goodhart (*WP*, 2013) argues ROE-based compensation drives bank leverage.

v. Funding Cost Advantage

- Rating agencies provide a 2-3 notch rating advantage for uninsured bank due to implicit bailout guarantees (e.g., Pfleiderer (2012)).

BANKERS' AVERSION TO CAPITAL (cont'd.)

vi. Debt Overhang

- Myers (1977)
- Bank interconnectedness means if one bank issues equity to reduce debt overhang, it has potential benefits for other banks.

vii. Politics

- Huang and Thakor (*WP*, “ Politics, Regulatory Mistrust and Bank capital”, 2015) develop theory and provide empirical evidence that when banks anticipate political pressure to make politically-favored loans, they cut back on capital by increasing dividends....because political pressure is more likely when banks are healthy and have a lot of capital (consistent with Calomiris and Haber (2014) book on politics and banking).

MODULE VI:

Putting All Together: What Do We Conclude?

WHAT DO WE CONCLUDE?

❑ Bankers dislike higher capital.

⇒ Regulatory capital requirements lower than they “should” be due to “political bargains”.

⇒ What are the “systemic risk” consequences of this high leverage?

THE ACHARYA AND THAKOR (2015) MODEL ADDRESSES THIS QUESTION

- Start with correlated asset choices.
- Bank asset portfolios suffer systematic shocks to asset value impairment/enhancement.
 - Now a bank's creditors may liquidate either because interim cash flow is too low or because asset value is impaired. Not all creditors receive signal about systematic shock.
 - Liquidation of a bank can convey noisy information about systematic asset-value shock to creditors of other banks, and higher leverage increases liquidation probability.
 - *Contagion effects and higher systemic risk.* Higher leverage of banks elevates probability of bank j being liquidated upon observing liquidation of bank i . Thus:
- **Result:** Increasing *ex ante* bank liquidity through higher leverage increases systemic risk.
 - This is a dark side of leverage.

ACHARYA AND THAKOR (2015)

- How should LOLR respond to this systemic risk that is heightened by leverage?
 - ➔ Suppose LOLR adopts unconditional bailouts that do not impose haircuts on creditors but wipe out shareholders.

EXTENSION OF ACHARYA AND THAKOR (2015) BASE MODEL

UNINTENDED CONSEQUENCES OF LOLR INTERVENTION WITH BAILOUTS WHEN LOLR IS UNINFORMED (cannot distinguish between liquidations based on systemic–shock signal, and those based on idiosyncratic asset–value shocks).

Result:

- All leverage discipline is lost. Capital structure is irrelevant because *both* debt equity rely on compensation incentives to discipline manager.
- All information about systematic shock generated by asset liquidations is also lost (liquidations are no longer always *ex post* inefficient in extended model.)

→ Illustrates *Goodhart's Law*: market discipline of debt collapses once it is used by regulator to determine when to bail out.

ACHARYA AND THAKOR

- The more highly levered banks are  the more correlated their asset choices.
- The greater the systemic risk
- *En masse* failures
- Sovereign government bailout (e.g., Acharya, Dreschler and Schnabl (2013))
- ↑ government indebtedness
- Greater taxpayer anticipation of higher future taxes to pay down debt
- Adverse consequences for real-sector productivity and economic growth
- Sovereign debt crisis!

SOLUTION?

- Ask banks to keep higher levels of capital, even though we may lose some private and social benefits of bank debt.

How?

REFORM PROPOSALS TO INCREASE BANK CAPITAL

- Directly Increase Equity Capital:
 - Admati, DeMarzo, Hellwig and Pfleiderer (2010)
 - Goodhart (2013)
- Contingent Capital:
 - Debt converted to equity due to a triggering event (Flannery (2005)).
 - *Key:* What is trigger based on?
 - Sundaresan and Wang (*JF*, 2014) show that a CoCo with a conversion trigger based on the MV of equity either leads to multiple equilibria (in equity and CoCo bond prices) or non-existence of equilibrium.
- Need a model that microfounds *why* bank equity is “too costly” before diving into CoCo design. Those frictions may affect optimal CoCo.
- Another proposal:
Acharya, Mehran and Thakor (*WP*, 2015), “Caught Between Scylla and Charybdis? Regulating Bank Leverage When There is Rent Seeking and Risk Shifting”

SCYLLA AND CHARYBDIS



TO LEVER OR NOT TO LEVER?

- Is leverage good or bad for banks?
- Scylla and Charybdis:
 - Leverage is important for market discipline to limit managerial rent-seeking (shirking in effort to monitor loans)
 - But sufficiently high leverage also induces excessive risk-taking due to equity's limited liability (asset-substitution moral hazard)
- The optimal capital structure of banks requires navigating between two unattractive moral hazard problems (third potential moral hazard: inefficient perks consumption)
- Key: Get shareholders to put in more capital (so as to increase their “skin in the game”), without reducing creditors’ skin in the game (i.e., without increasing their safety).

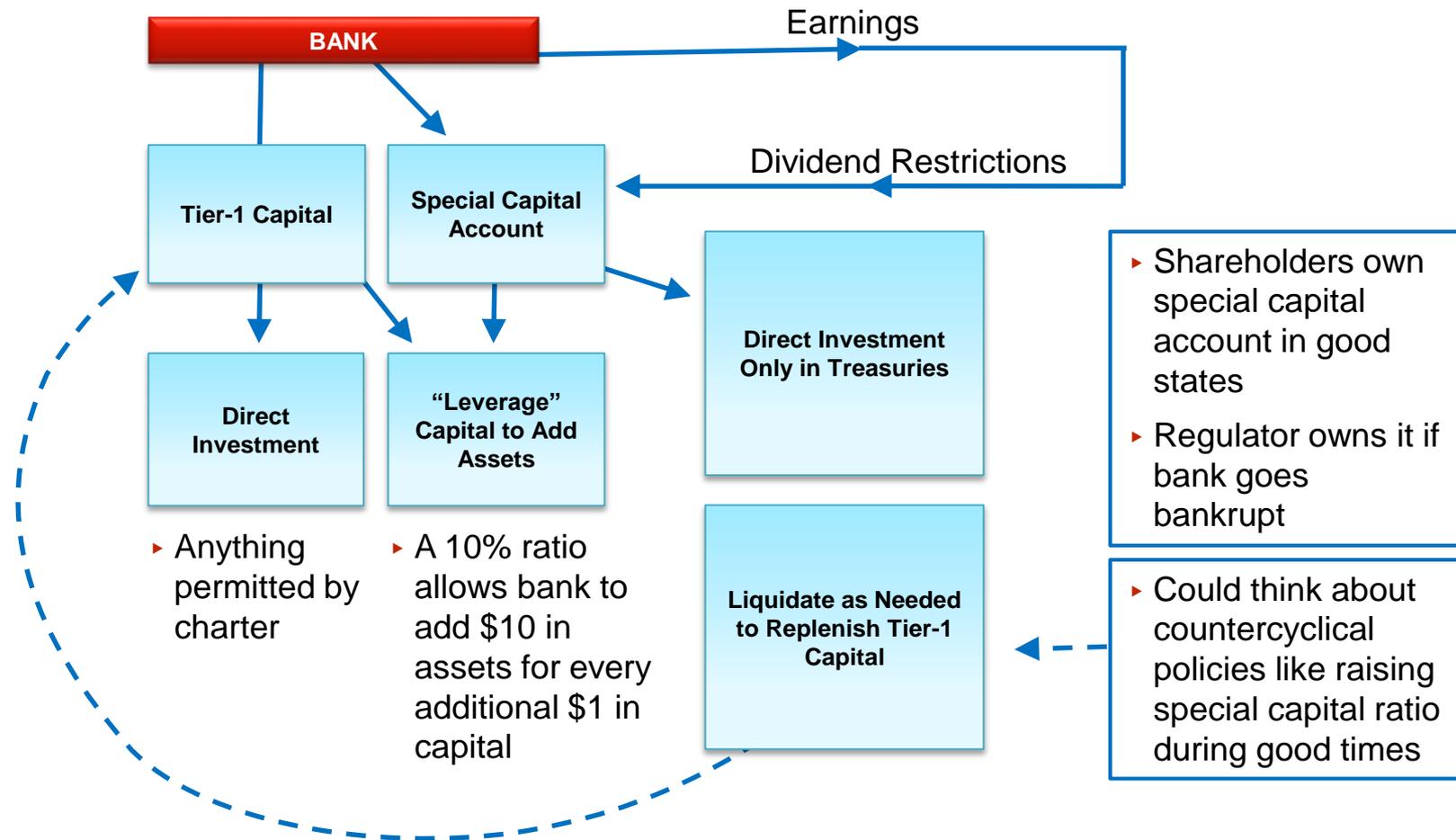
SOLUTION TO BOTH PROBLEMS:

- So the more complex capital requirement includes a “normal capital requirement” plus
- “Special capital account” with three features:
 - Dividend payments must be restricted to build up this capital via retained earnings (avoids dissipative costs of raising equity);
 - It must be invested in Treasuries (free cash flow problem);
 - In good times this capital belongs to the bank’s shareholders, and in bad times it belongs to the regulator (e.g., the LOLR) or the taxpayer, rather than creditors (so creditors still have an incentive to monitor/liquidate because they are exposed to the idiosyncratic losses associated with the bad project).

Note that *de facto*, creditors will be paid in full in case of a systemic event anyway, so it is important only that they don’t have access to this account in case of an idiosyncratic failure.

➡ With this capital requirement, banks choose G ➡ no correlated failures or bailouts.

IMPLEMENTATION DETAILS



CONCLUSION: REGULATORY IMPLICATIONS

1. Two-tiered capital proposal deals simultaneously with various forms of moral hazard and provides a theoretical reconciliation of two divergent streams of academic thought (equity discipline vs. debt discipline) that have sparked an active debate.

REGULATORY IMPLICATIONS (CONT'D.)

2. Our proposal that shareholders/managers will lose special capital account in bad state ensures that positive aspect of high capital is maintained.
 - ⇒ Precludes gradual pre-crisis erosion of bank capital during good times (through dividends and repurchases) that can convert an adverse asset shock into a crisis.

Moreover, proposal eliminates behavior that make adverse asset shocks endogenously more likely due to correlated (poor) asset choices.

REGULATORY IMPLICATIONS

3. Proposal has advantage of not requiring shareholders to infuse additional cash capital at a time when confidence in bank management is low... capital can be built up via dividend restrictions.
4. Since capital is transferred from the special capital account into the regular capital account on a continuous and mechanical basis, the issue of designing “crisis triggers” does not arise.

MODULE VII:

Open Theoretical and Empirical Questions

OPEN KEY THEORETICAL QUESTIONS:

1. What is the optimal level of capital requirements?
Need more quantitative calibrations in models that capture all key tradeoffs and provide microfoundations for why banks exist.
2. What are the allocational consequences of higher bank capital?
3. What does a theory of banking look like in which politics are integrated into what banks do?
4. What are the theoretical linkages between bank capital, liquidity creation and unemployment?

OPEN EMPIRICAL QUESTIONS

1. How does bank capital affect financial crises?
2. What is the interaction between bank capital, regulatory safety nets and the likelihood of crises?
3. How do safety nets affect the speed and quality of post-crises recoveries?
4. How does the *level* of bank capital (not changes in capital requirements) affect real outcomes: GDP growth, unemployment, etc.?

MODULE VIII:

CONCLUSION

CONCLUSION

- Whatever benefits bank debt might have (and empirically these benefits are elusive), higher bank leverage → higher systemic risk → higher sovereign indebtedness with negative productivity and growth consequences + higher prob. of crisis with devastating economic consequences...

→ *We know* negative consequences of high bank leverage, whereas benefits for banks *with deposit insurance* remain largely theoretical... and the subject of an ongoing debate
- Need creative proposals to increase capital in banking, taking into account political economy of banking
- “Special Capital Account” one such approach (now up to regulators!).