Lectures 5&6

Competition and financial stability

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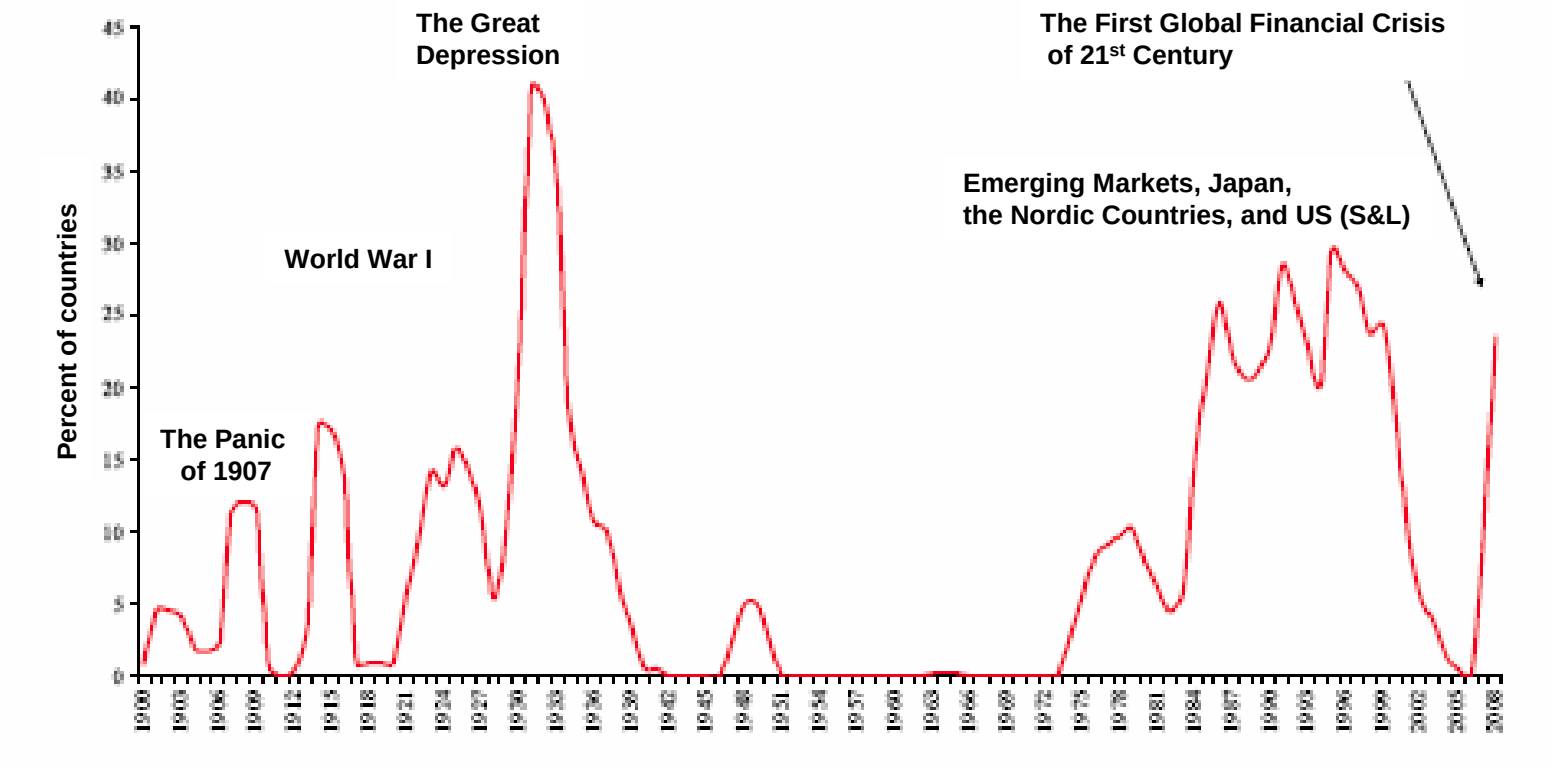
Can we have both competition and stability in banking?

Outline (I and II)

- The evolution of ideas and realities
- Competition and stability
  - Theory (models)
    - Runs
    - Risk taking
  - Evidence
- Prudential regulation and competition policy
- Can we regulate away the competition-stability trade-off?
- Assessment of regulatory reform
- Financial architecture
- Challenges for researchers, bankers and regulators

Proportion of countries with banking crises: 1900-2008

Weighted by their share of world income



Source: Figure 1 in Reinhart & Rogoff (2008), “Banking Crises, An Equal Opportunity Menace”, NBER WP 14587.

The past

- Banking used to be one of the most regulated sectors in the economy.
- Competition was thought to be detrimental to stability since the Great Depression.
- Until relatively recently
  - central banks and regulators
    - were complacent with collusion agreements among banks;
    - preferred to deal with concentrated sector;
  - competition policy was not applied fully to the sector.

The recent past

- From tight regulation to liberalization:
  - Idea that competition enhances efficiency
    - Productive, allocative, dynamic (innovation).
- The deregulation wave which followed from mutual fund competition for deposits in the US scrapped restrictions on rate setting (Regulation Q) .
  - By 1983 all depository institutions in the US could freely compete in rates offered to customers.
  - In Europe rate setting is now mostly liberalized.
- To better diversify the portfolios of banks and the belief in competition in promoting efficiency prompted a move towards:
  - Less specialization in the sector
  - Lifting of geographical barriers (US and Europe)
  - General increase in market integration and competition.

The recent past up to the crisis

- Competition policy is taken seriously in the banking sector
  - Competition law applied to banking (e.g. bank mergers) from 1960s in the US.
  - Since early 1980s the European Commission has intervened in all areas:
    - against national protectionism, mergers, price agreements, abuse of dominance, state aid (Carletti and Vives (2009)).
  - Strengthened at the national level in EU and elsewhere including emerging markets.
- Idea that competition is good for stability gains ground.
  - Up to the crisis there was a consensus about letting competition work in the banking sector and controlling risk with capital requirements, market discipline and supervision (Basel).
- Competition has a bearing on all the perceived failures associated to banking:
  - excessive risk taking,
  - credit overexpansion and exuberant growth (real estate), and
  - bank misconduct.

Consequences of the crisis shock

- Systemic crisis (post LB failure) overrides competition policy concerns.
- Massive bailout (state aid):
  - Commitments of up to 30% of GDP in public interventions (EU and US).
- Distortion of competition:
  - Cost of capital
  - Quality (safety, vertical differentiation)
  - Market power concerns on mergers overruled
    - HBOs-Lloyds TBS, …; while Abbey-Lloyds was blocked ….
    - Bear Stearns-Washington Mutual-JP Morgan, Merrill Lynch-Bank of America, Wachovia-Wells Fargo (going over 10% market share deposit threshold)
- Surviving incumbents increase market power and have lower cost of capital because they are TBTF.
- It is naive to think that banking is like any other sector in regard to competition policy: Why?

Questions

- Is there a significant trade-off between competition and stability?
- In case there is, can it be regulated away?
- In case it cannot:
  - how regulation and competition policy have to interact?
  - how should the banking sector specificity in competition policy be dealt with?
- What is the appropriate architecture for regulatory and competition agencies in the financial sector?
- What should be the role of competition policy in the banking sector in the post-crisis era?

Framework of analysis

Private and social objectives
are misaligned because of
externalities,
asymmetric information,
market power and behavioral biases

Fundamental idea

More competition will improve
social welfare for sure
only if the other sources
of market failure are eliminated.

Competition and stability

Two channels through which competition may increase instability:

By exacerbating *coordination problems* of depositors/investors and fostering runs/panics (externality).

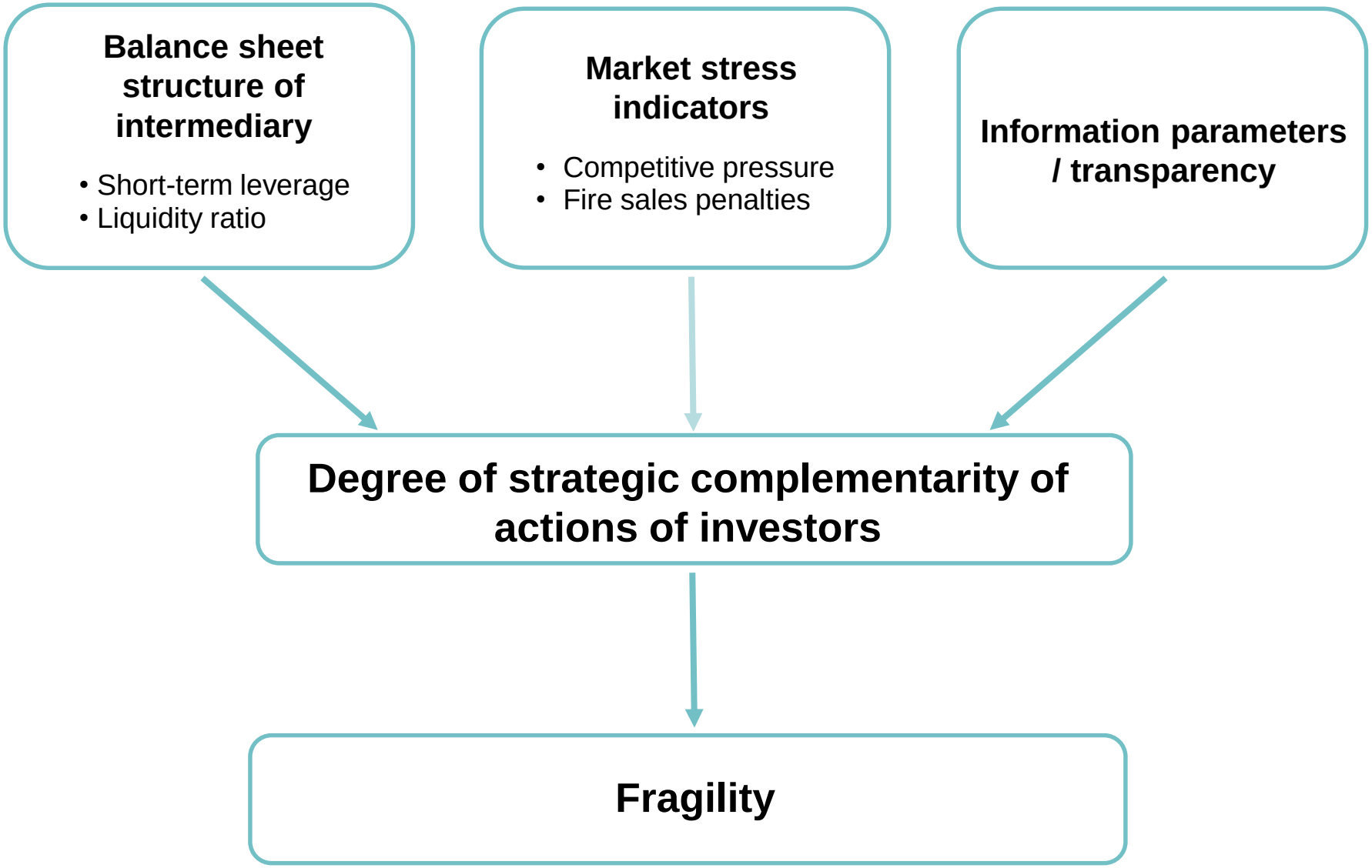
By increasing *incentives to take risk* and raise failure probabilities (asymmetric information).

Competition and runs

Competition and coordination problems (I)

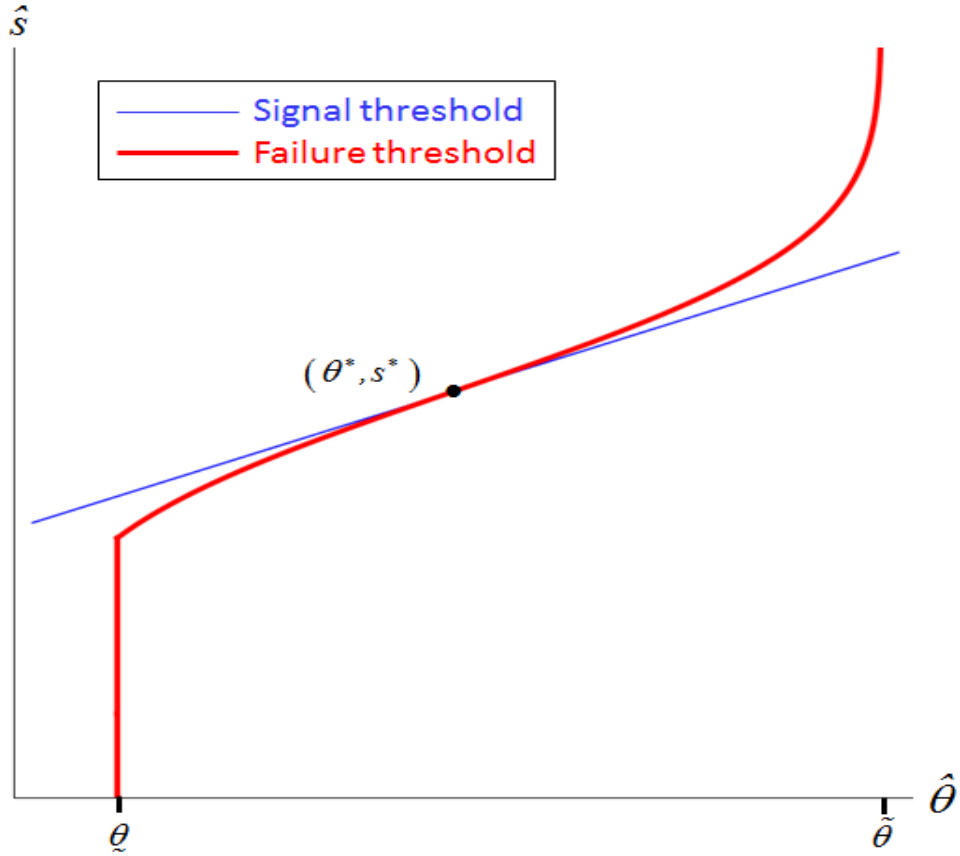
Rochet and Vives (2004), Goldstein and Pauzner (2005), Vives (2014)

- GSC with incomplete information among depositors on a bank.
- Runs can happen independently of level of competition but more competitive pressure worsens coordination problem of investors/depositors by increasing degree of strategic complementarity of actions of investors and raising:
  - Potential instability (multiplicity of equilibria region)
  - Probability of crisis
  - Range of fundamentals for which there is coordination failure (and institution is solvent but illiquid)
  - Impact of bad news on fundamentals.


Balance sheet structure of intermediary
• Short-term leverage
• Liquidity ratio
Market stress indicators
• Competitive pressure
• Fire sales penalties
Information parameters / transparency
Degree of strategic complementarity of actions of investors
Fragility

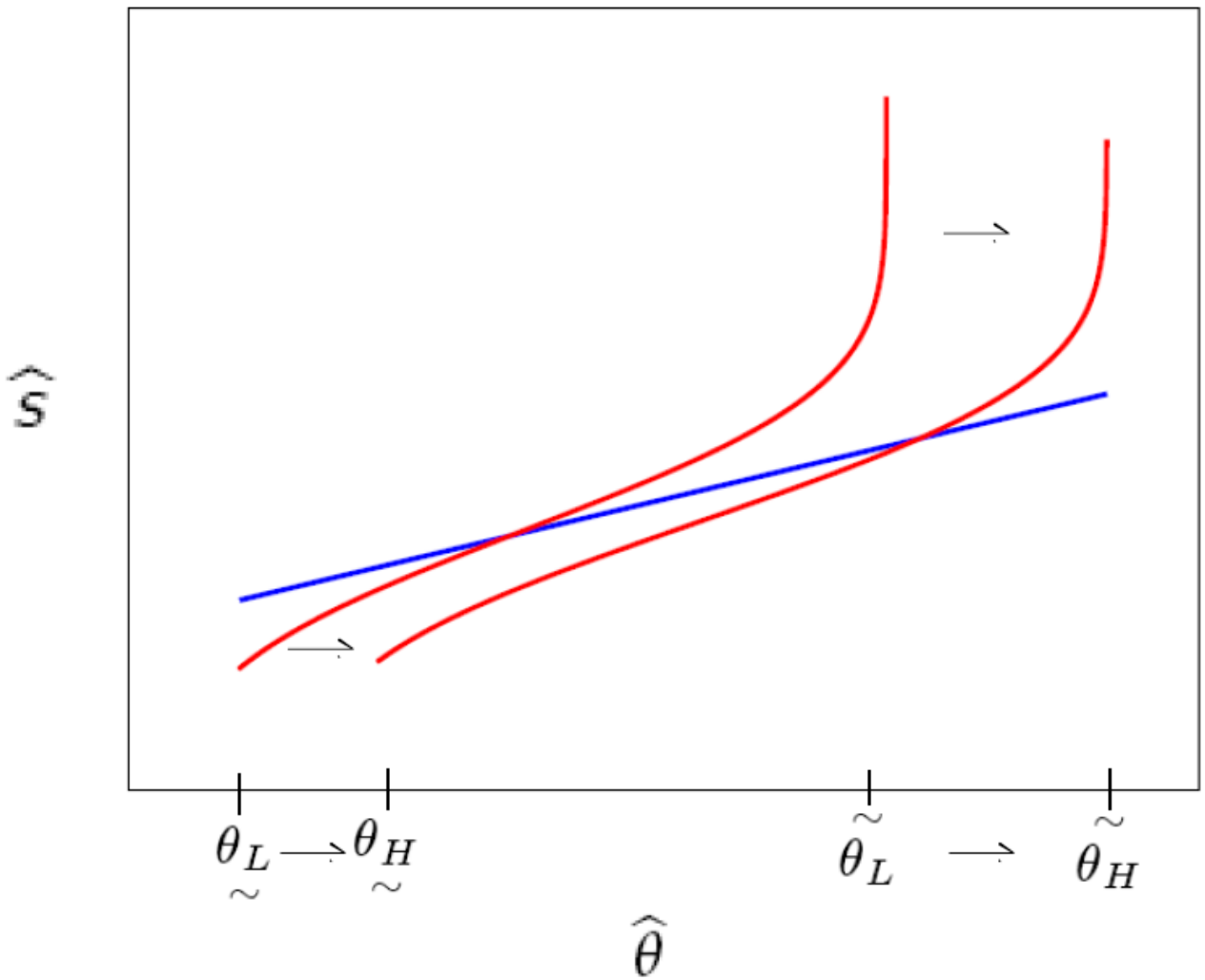
Determination of equilibrium pair

Bank run model (Vives (2014)



- Strategic complementarity: both curves are increasing and may give rise to multiple equilibria

Effects of an increase in cost of funds



Competition and coordination problems (II)

(Matutes and Vives (1996))

- Model combines Diamond (1984) with a standard deposit contract for investors in a differentiated duopolistic structure à la Hotelling.
- Probability of failure of a bank (vertical differentiation; quality) determined endogenously by the expectations of depositors with diversification-based economies of scale.
- Coordination problem between depositors (as with network externalities) does not depend on market structure and leads to multiple equilibria.
- A monopoly bank may suffer a run but increase in rivalry increases probability of failure (insolvency risk) at symmetric interior equilibrium.

Competition and coordination problems (III)

(Matutes and Vives (1996))

- Deposit insurance improves welfare by preventing collapse (coordination failure), extending the market, and minimizing frictions.
- However, deposit insurance also may induce fiercer competition for deposits and increase the deadweight losses associated with failing institutions.
- The welfare impact of deposit insurance depends on market structure, and is thus ambiguous even in a world of full liability and no moral hazard in bank investments.

The model

- Two risk neutral banks raise money from depositors and invest proceeds in loans to firms.
- Depositors cannot invest directly in firms' projects.
- Features of model:
  - Horizontal differentiation
  - Incentive contracts and price competition under full liability
  - Investment
  - Diversification and size

Horizontal differentiation

- Hotelling duopoly with bank a located at 0 and bank b located at 1.
- Depositors uniformly distributed on $[0,1]$
  - Risk neutral, and have an inelastic supply of one unit of funds with a reservation value v
  - Linear transport costs at rate $t \geq 0$
  - Decision: deposit in a bank or not? In what bank to deposit?

Matutes and Vives (1996)

Incentive contracts and price competition

- Depositors do not observe the return of the bank
- Bank i offers a fixed (gross) deposit interest rate r_i to its consumers according to a standard debt contract with nonpecuniary bankruptcy penalties as in Diamond (1984)
  - If bank i quotes a rate r_i per depositor and pays z, it suffers a nonpecuniary penalty $\delta(z) = \max(r_i -$

Matutes and Vives (1996)

Investment

- n_i: deposit market share of bank i
- $\tilde{R}_i \sim F(\cdot\,; n_i)$ of class C^2, $\tilde{R}_i \geq 0$, the random return of a unit of funds invest by bank i, with $E\tilde{R}_i = R > v$, the return of cash assets.
- Bank i investing n_i, declares bankruptcy when revenues cannot cover payment obligations $\tilde{R}_i < r_i$
- Expected profits of bank i: $\pi_i = (R - r_i)n_i$ if it invests all of its funds in risky assets
  - Expected revenue is $E\{\tilde{R}_i n_i\}$, with $E\tilde{R}_i = R$, and expected deposit costs are $n_i r_i$, given the bankruptcy penalty.
  - The bank always invests all deposit proceeds in risky loans.

Matutes and Vives (1996)

Diversification and size

- A bank needs a minimum size (a market share of s total funds) to be viable
  - Given r_i, the probability of failure of bank i is given by $F(R_i; n_i)$ with (by convention) $F(R_i; 0) = 1$.
- A bank by investing more can diversify away some of the risk it faces.
- Diversification economies exist when a smaller market share n_i results in a mean-preserving spread of the distribution of returns F.

Matutes and Vives (1996)

Timeline (I)

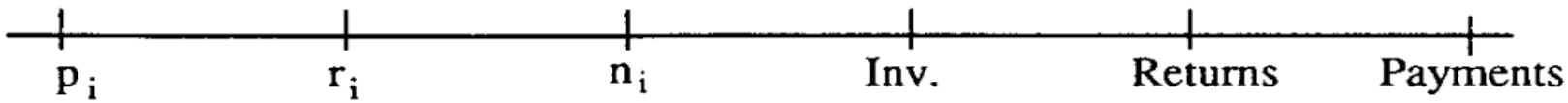


FIG. 1. Time line.

- Depositors have **homogeneous prior beliefs** (p_a, p_b) about the probabilities of success of banks.
- After observing rates, they choose bank that offers the higher expected return net of transportation costs (provided larger than *v*)
- Market share of bank i is given by $n_i = \frac{1}{2} + \frac{p_i r_i - p_j r_j}{2t}, j \neq i$

  provided that $p_i r_i - p_j r_j$ is in the interval $[-t, t]$ and $p_i r_i - t n_i \geq v, i = a, b$

  – If $p_i r_i - p_j r_j$:
    - lies in the interval $[-t, t]$ but $p_i r_i - t n_i < v$ →some depositors do not deposit and banks do not compete directly with one another but have local monopolies;
    - is not in the interval $[-t, t]$ → all consumers prefer bank with higher expected return and the other bank is left out of the market.

Matutes and Vives (1996)

Timeline (II)

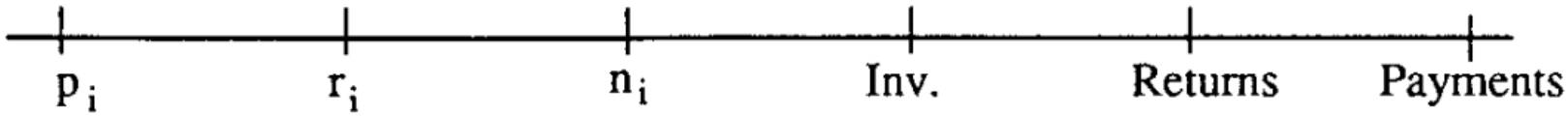


FIG. 1. Time line.

- Banks invest the funds they receive, collect the return, and make deposit payments except for failure.
- In equilibrium, depositors' expectations are fulfilled: $p_i = 1 - F(r_i^*; n_i^*)$ where r_i^* and n_i^* denote equilibrium magnitudes.

Matutes and Vives (1996)

Example (symmetric beta distribution)

- Let $\tilde{R}_i = R + \frac{1}{2} - \tilde{X}_i$, where $\tilde{X}_i$ follows a beta distribution on the interval $[0,1]$ with parameters:

$$[1 + \frac{n_i}{k}, 1 + \frac{n_i}{k}]$$

- We have then that the support of $\widetilde{R}_{\mathrm{i}}$ is:

$$\left[R - \frac{1}{2}, R + \frac{1}{2}\right], E[\tilde{R}] = R, Var[\tilde{R}_i] = \frac{1}{12 + 8\left(\frac{n_i}{k}\right)}$$

- A smaller $\frac{n_i}{k}$ represents a mean-preserving spread of the distribution of returns.
- Another example: $\tilde{R}_i$ distributed log-normally with mean R and variance $\frac{k}{n_i}$

Matutes and Vives (1996)

Bank competition with depositors' perceptions fixed (I)

- Fixed perceptions (p_a, p_b) of depositors.
- To find best response of bank a to r_b, consider r_b such that

$$p_b r_b + t \geq p_a R \geq p_b r_b - t$$

- 1st inequality → bank a cannot profitably set a rate that drives b out of the market (since to do so would require a rate above R)
- 2nd inequality → bank a can capture some deposits with a rate below R
- Best response by bank a (similar to Hotelling):

$$r_a = B_a(r_b) \equiv \frac{p_a R - t + p_b r_b}{2p_a}$$

Matutes and Vives (1996)

Bank competition with depositors' perceptions fixed (II)

- $B_a(r_b) \equiv \frac{R}{2} + \frac{p_b r_b - t}{2p_a}$
- The higher p_b, the larger the deposit interest rate set by firm a.
- The higher p_b, the lower a's market share is for a given r_a and hence it is not as costly to attract an additional customer

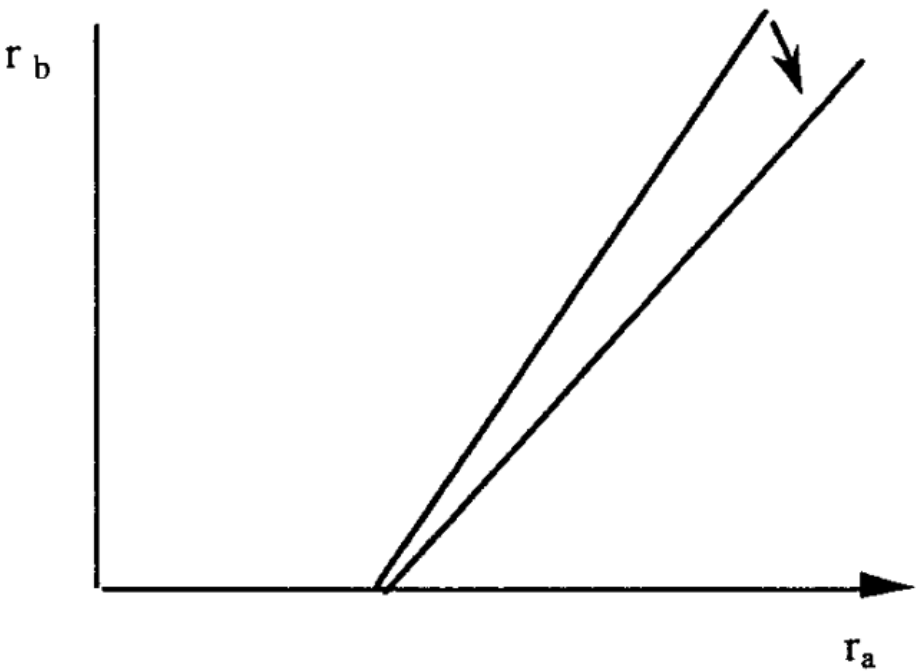


FIG. 2. Effect of increase of p_b on $B_a(r_b)$.

Matutes and Vives (1996)

Bank competition with depositors' perceptions fixed (III)

An increase in p_a has an **ambiguous impact**

$$B_a(r_b) \equiv \frac{R}{2} + \frac{p_b r_b - t}{2p_a}$$

- A slight increase in r_a attracts a larger number of new customers the larger p_a is

  →higher p_a provides bank a with an incentive to offer a larger deposit interest rate

- However, larger p_a means that, for any given r_a, bank a enjoys a larger market share hence increasing r_a become more costly
- If $p_a = p_b = p$, and given a market of fixed size, the market share **fat-cat effect** vanishes, and increasing p makes banks more aggressive

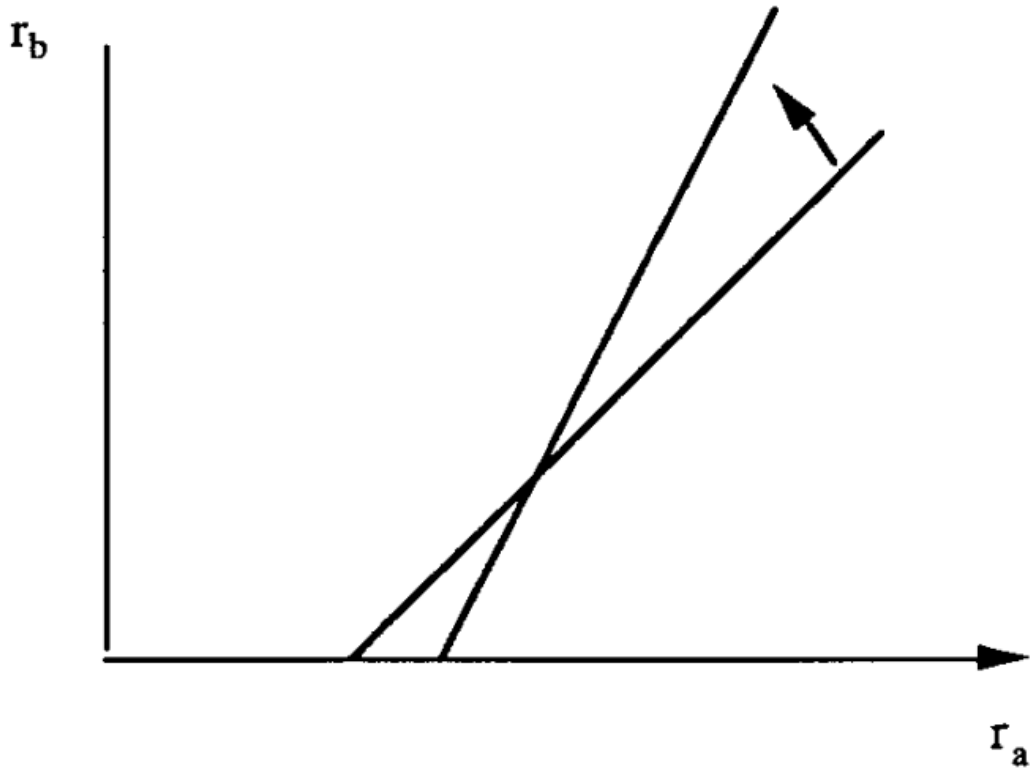


FIG. 3. Effect of increase of p_a on $B_a(r_b)$.

Matutes and Vives (1996)

Proposition 1. Given $p_a \geq p_b \geq 0$:

I. When $p_i R < v$, $i = a, b$, there is no active banking.

II. When $p_b R < v$ and $p_a R > v$, bank a is a *natural monopoly* (with blockaded entry).

III. When $p_i R \geq v$, $i = a, b$

i. If $(p_a + p_b)R > (2v + 3t)$, banks compete.

- If $3t > R(p_a - p_b)$, then *unique interior equilibrium* with margins

$$R - r_i = \frac{t}{p_i} + \frac{R(p_i - p_j)}{3p_i}$$

→ safer bank (a) enjoys higher margin and market share

- If $3t \leq R(p_a - p_b)$), bank a enjoys a *natural monopoly* (with impeded entry) with margin $R - r_a = \frac{R(p_a - p_b) - t}{p_a}$.

ii. If $2(t + v) > (p_a + p_b)R$, banks have *local monopolies* with margins $R - r_i = \left(\frac{R}{2}\right) - \left(\frac{v}{2p_i}\right)$, and market shares $n_i = \frac{p_i R - v}{2t}$.

iii. Otherwise, there are multiple "*touching markets*" equilibria, with all the markets being served.

Matutes and Vives (1996)

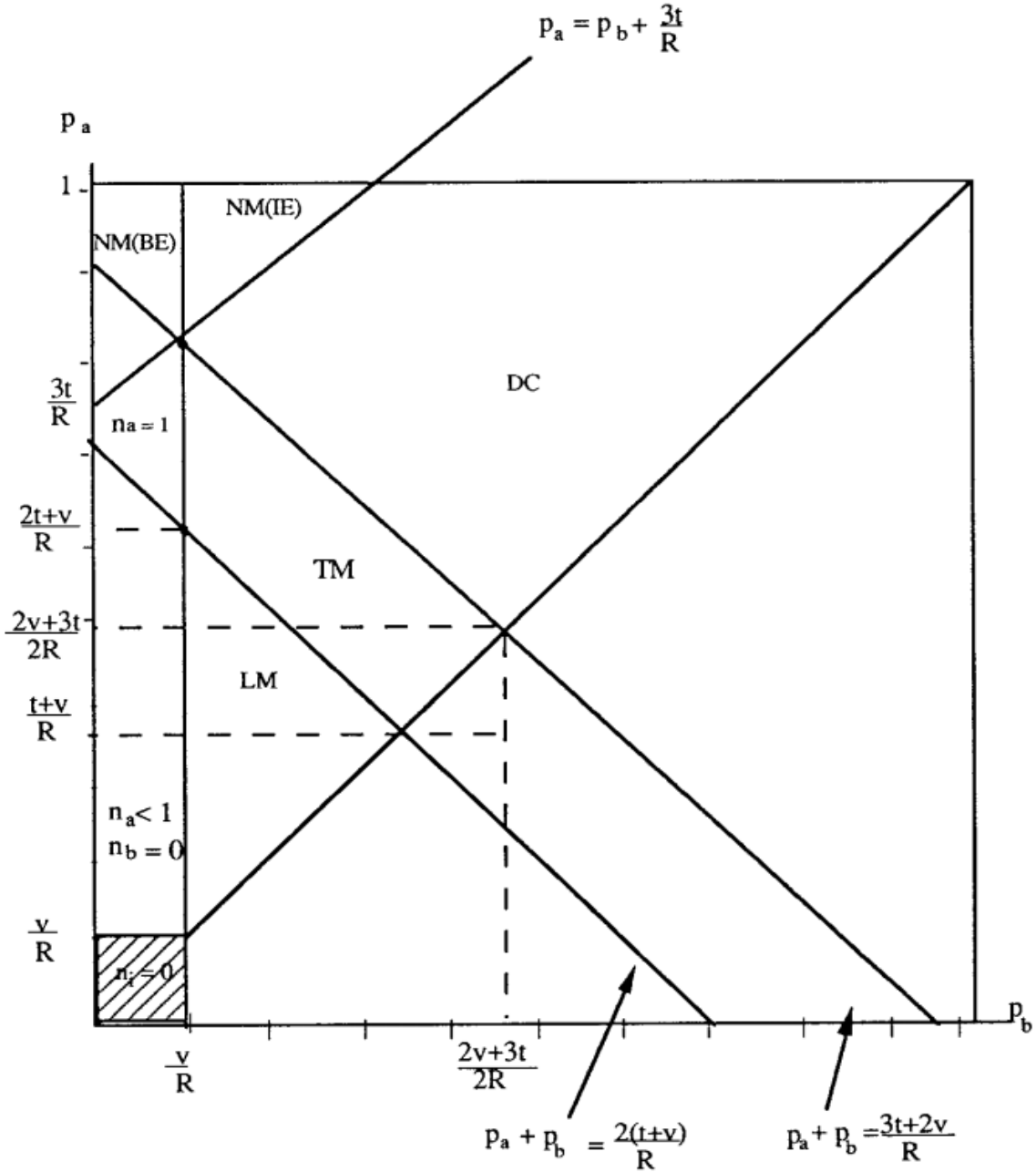


FIG. 4. Competition with fixed perceptions.

Matutes and Vives (1996)

Perceptions and equilibria (I)

- Suppose that R and t are such that with $p = 1$ the equilibrium is of the competitive type
- First case: symmetric perceptions ($p_a = p_b = p$)
  - When p is very low → both banks are out of the market since expected return is lower than reservation value v
  - Larger p's → banks enjoy local monopolies (LM) as potential market areas do not overlap
  - High values of p's → market areas just touch (TM)
  - Even higher values of p's → Banks compete directly (DC)

Matutes and Vives (1996)

Perceptions and equilibria (II)

- Note that the margin $\mathrm{x} \equiv R - \mathrm{r}$ is *not monotone in* p
  - The margin increases over the regions of LM $(x = (R/2) - v/2p)$ and also TM $(x = R - (v + t/2)/p)$, and decreases in the region of DC $(x = t/p)$
- *Fat-cat effect:* a bank perceived safer will command a larger market share and be more restrained in pricing
- A bank facing competition will become more aggressive when the perception of success increases simultaneously for both institutions

Matutes and Vives (1996)

Perceptions and equilibria (III)

- Reputation or quality of a bank (perceived probability of success) introduces vertical differentiation in banking competition
  - If all banks were to offer the same rates, depositors would prefer ‘safer’ ones
- A *natural monopoly* (a natural oligopoly in a market with m banks) may thus emerge → thus, only a few firms can survive despite low fixed costs and free entry

Matutes and Vives (1996)

Perceptions and equilibria (IV)

- Two types of monopoly may arise:
  - **1st :** one bank (b) is perceived as low quality, and thus cannot attract depositors (independently of the other bank's behavior (a))
    - Case II, NM(BE) in figure
  - **2nd:** situation permits bank b to earn positive profits as a monopolist, but the high quality bank drives it out of the market
    - Case III(i), NM(IE) in figure
- Possibility of one bank driving rival out in equilibrium depends on magnitude of transport cost
  - Only when transport cost is low relative to difference in the quality of banks → when $3t/R > p_a - p_b$, both firms share the market and compete with one another
- When direct competitors, safer bank enjoys a higher margin and market share
  - The safer bank setting a lower deposit rate can attract a larger market share

Matutes and Vives (1996)

Full equilibrium (I)

- Given perceptions, Proposition 1 characterizes possible equilibria in deposit rates.
- An equilibrium of the game requires depositors' perceptions to be *self-fulfilling:*

Probabilities of success must satisfy

$$p_i = 1 - F(r_i; n_i),\ i = a, b,$$

where n_i is the outcome of price competition among banks taking parametrically the probabilities of success p_i as in Proposition 1.

Full equilibrium (II)

- **Proposition 2**. In addition to equilibria of the touching-markets and local-monopolies type, possible equilibria, coexisting for given parameter values, are as follows:
- **i.** Interior symmetric equilibrium where banks compete with $R - r^* = t/p^*$.
- **ii.** Interior asymmetric equilibria (where the safer banks has a higher and market share).
- **iii.** Corner asymmetric equilibria: $n_i > 0$, $n_j = 0$, $i \neq$ j.
- **iv.** No banking equilibrium: $n_i = 0$ (and $p_i = 0$), $i = a, b$. it is always an equilibrium with minimum size investments.

Matutes and Vives (1996)

Full equilibrium (III)

- Source of the multiplicity of equilibria: *self-fulfilling expectations of depositors* with the standard deposit contract coupled with economies of scale

  → A bank with high perceived quality sets a lower deposit interest rate and commands a larger market share which may sustain the initial belief.
- If a minimum market share is required to invest, the nonbanking equilibrium and corner equilibria always exist
  - Consequence: equilibria of type (i), (ii), (iii) and (iv) may arise simultaneously.
- Diversification economies is an additional driving force behind multiplicity of equilibria.
- Multiplicity of equilibria would be enhanced if we allowed banks to influence depositors' expectations (say via rate setting).

Matutes and Vives (1996)

Symmetric equilibrium

- **Proposition 3.** At a symmetric equilibrium in which banks compete, whenever the distribution of $\tilde{R}_i - R$ is of the form $G(\cdot; n_i)$ (with G independent of R):
- the margin $R - r^*$ and the probability of success p^* are independent of R, and provided that $p^* < 1$, they both increase with the degree of friction t.
  - Assumption holds for symmetric distributions around R (e.g. beta). For log-normal distributions simulations show that as R increases, the equilibrium margin and the probability of failure decrease.

Matutes and Vives (1996)

Simulations with beta distribution

- If banks compete, riskier returns lead to increases in the probability of failure and the margin (increased probability of failure softens competition).
- With local monopolies:
  - **Low-risk equilibrium:** Market served, probability of success and expected profit *increase* with expected return, and decrease with transport costs and the risk of the returns.
  - **High-risk equilibrium:** Market served, probability of success and expected profit *decrease* as the expected return of investment increases, or the risk of the return decreases.

Matutes and Vives (1996)

Deposit insurance (I)

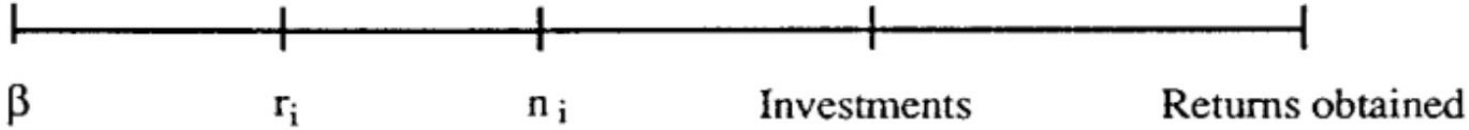


FIG. 5. Time line with deposit insurance.

- Deposit insurance fund (DIF)
  - guarantees that the banks' posted rates will be honored
  - financed with insurance premium β (bank pays βn_i to the DIF, and invests the rest; the DIF invests the funds collected).
- The contract between the bank and depositors remains the same and insurance does not introduce limited liability in the model.

Matutes and Vives (1996)

Deposit insurance (II)

- Banks' expected profit is:

$$\pi_i = (R(1-\beta) - r_i)n_i$$

- Depositors are repaid with certainty (i.e., they view $p_i = 1$, $i = a, b$)
- Equilibrium is similar to that in the classical Hotelling model and the multiplicity of equilibria is eliminated.

Matutes and Vives (1996)

Equilibrium with deposit insurance (I)

Proposition 4. With deposit insurance, equilibria are as follows:

i. If $R(1-\beta) > v + 3t/2$, then there is a unique symmetric equilibrium $R(1-\beta) - r^{DI} = t$.

ii. If $R(1-\beta) < t + v$, then there is a symmetric local monopoly equilibrium with margin $R(1-\beta) - r^{DI} = (R(1-\beta) - v)/2$ and $n_i = (R(1-\beta) - v)/2t$.

iii. If $v + t < R(1-\beta) < v + 3t/2$, then there is a symmetric touching markets equilibrium with margin $R(1-\beta) - r^{DI} = R(1-\beta) - (v + \frac{t}{2})$.

Matutes and Vives (1996)

Equilibrium with DI (II)

- With deposit insurance, competing banks are indifferent as to the level of risk they take when they compete directly
  - Indeed, the net margin is given by the degree of friction in the market and the unique equilibrium is symmetric.
  - Expected profits of a bank are thus $t/2$.
- With local monopolies, the risk assumed by banks is reflected in the expected profits only to the extent that it translates into higher premiums.
- With fair premiums, simulations with beta and log-normal returns show that the premium increases with the variability of returns and hence to decrease expected profits.

Matutes and Vives (1996)

Effects of deposit insurance (I)

1. Stability (eliminates no banking equilibria).
2. Imposes symmetric equilibrium and minimizes transportation costs but may diminish diversification economies.
3. Market-extension effect with local monopoly.
4. Increases DWL (incentive compatibility).
5. Modifies rates.

Matutes and Vives (1996)

TABLE II

WELFARE

Expected total surplus:

$$\mathrm{ETS} = (R - v)(n_a + n_b) - t\left(\frac{n_a^2 + n_b^2}{2}\right) - \mathrm{DWL}$$

Deadweight loss:

$$\mathrm{DWL} = (1 - p_a)E\left[r_a - (1-\beta)\tilde{R}_a \middle| \tilde{R}_a < \frac{r_a}{1-\beta}\right] n_a + (1 - p_b)E\left[r_b - (1-\beta)\tilde{R}_b \middle| \tilde{R}_b < \frac{r_b}{1-\beta}\right] n_b$$

with $\beta = 0$ without DIF, and $\beta > 0$ with DIF.

Matutes and Vives (1996)

Effects of deposit insurance (II)

Let r^* be the equilibrium deposit interest rate and $1 - p^*$ the probability of bankruptcy in an uninsured market.

Proposition 5. When banks are direct competitors:

i. Insurance increases the expected payment to depositors (and the probability of bankruptcy) if and only if $\beta < 1 - p^*$.

ii. Insurance enhances rate competition and decreases expected profits and expected total surplus when $\beta < (1 - p^*)(t/Rp^*)$

Proposition 6. When banks have local monopolies:

i. Insurance increases the expected payment to depositors and extends the market if and only if $\beta < 1 - p^*$.

ii. A necessary condition for insurance to increase expected profits is that it extends the market. When insurance extends the market, it increases welfare provided the insurance fund makes no losses.

Matutes and Vives (1996)

Deposit insurance and welfare

- These two propositions indicate that when premiums are relatively small the impact of insurance on welfare:
  - May be positive when banks have local monopoly power.
  - Negative when banks compete.

  (Only when there is local monopoly power a smaller premium is translated into a significantly smaller probability of bankruptcy, yielding a welfare benefit.)
- Conditions for all results are fulfilled with beta returns when premiums are fair.

Matutes and Vives (1996)

Competition for deposits and systemic risk

(Egan, Hortaçsu and Matvos (2016))

- Test model related to Matutes-Vives (1996) with US bank data for 2002-2013 and confirm that systemic expectational contagion with banks linked through competition for a pool of deposits leads to multiple equilibria.
  - Across equilibria, the survival probabilities of banks and deposit interest rates differ substantially.
- Instability of a bank spills over to other banks via competition for deposits.
  - The demand for uninsured deposits, but not for insured ones, declines with the financial distress of the bank.
  - A distressed bank offers high insured deposit rates, since the deposit insurance fund will bear the cost of failure, and the rival banks also offer higher rates to compete with the distressed bank. This in turn raises the distress probability of the rival banks.

Egan et al. (2016))

- Structural model that can be taken to the data:
  - Discrete choice demand in differentiated goods markets (Berry et al, 1995) with banks interact a la Bertrand in setting deposit rates (with limited liability)
  - Self-fulfilling expectations of default
- Demand functions are estimated using data about deposit rates and default probability of banks taken from CDS data of 16 largest US banks.
- Supply function parameters are calculated using the observed equilibrium deposit allocation.
- Equity holders of a bank decide about default, if the bank is short of funds they can inject some out of their 'deep pockets‘ (Leland (1994)).

Table 4—Multiple Equilibria 2008 (*Percent*)

	Observed eq.	(2)	(3)	(4)	(5)	(6)	(7)
Probability of default							
JPMorgan Chase	1.50	0.19	2.86	3.29	2.83	**48.35**	4.37
Bank of America	1.82	0.03	1.85	**53.34**	1.94	3.21	3.27
Wells Fargo	1.50	1.34	**46.61**	3.56	3.49	4.81	5.06
Citibank	2.11	1.92	3.36	3.74	3.33	4.63	**48.20**
Wachovia	3.28	3.14	4.74	4.92	**52.08**	5.96	6.12
FDIC insurance cost	$14bn	$8bn	$1,002bn	$979bn	$1,037bn	$1,086bn	$1,118bn
Change in welfare	—	$20bn	–$1,143bn	–$1,205bn	–$1,221bn	–$1,332bn	–$1,365bn

Source: Table 4 in Egan, Hortaçsu and Matvos (2017).

Source: Table 4 in Egan, Hortaçsu and Matvos (2017).

TABLE 4—MULTIPLE EQUILIBRIA 2008 (*Percent*)

	Observed eq.	(2)	(3)	(4)	(5)	(6)	(7)
Insured interest rate							
JPMorgan Chase	1.73	0.98	2.46	2.65	2.44	10.48	3.17
Bank of America	1.98	1.53	2.13	7.33	2.14	2.44	2.46
Wells Fargo	2.13	2.05	10.04	3.06	3.04	3.58	3.68
Citibank	2.23	2.11	3.01	3.21	2.98	3.72	12.26
Wachovia	2.08	2.04	2.59	2.62	8.75	2.93	2.98
Uninsured interest rate							
JPMorgan Chase	1.73	0.94	2.41	2.56	2.39	20.35	3.02
Bank of America	1.97	1.40	1.94	11.43	1.96	2.23	2.24
Wells Fargo	2.32	2.25	17.41	3.21	3.20	3.71	3.81
Citibank	2.23	2.13	2.94	3.09	2.92	3.52	24.35
Wachovia	2.23	2.19	2.67	2.71	14.06	3.00	3.04
Probability of default							
JPMorgan Chase	1.50	0.19	2.86	3.29	2.83	**48.35**	4.37
Bank of America	1.82	0.03	1.85	**53.34**	1.94	3.21	3.27
Wells Fargo	1.50	1.34	**46.61**	3.56	3.49	4.81	5.06
Citibank	2.11	1.92	3.36	3.74	3.33	4.63	**48.20**
Wachovia	3.28	3.14	4.74	4.92	**52.08**	5.96	6.12
Insured deposit share							
JPMorgan Chase	3.38	2.26	1.00	1.84	1.30	83.89	0.91
Bank of America	9.26	7.39	1.94	68.34	2.57	1.75	1.42
Wells Fargo	3.99	3.96	80.41	2.19	1.73	1.35	1.14
Citibank	2.07	2.00	0.63	1.17	0.82	0.72	86.68
Wachovia	5.81	5.89	1.51	2.53	74.47	1.38	1.14
Cumulative share	24.51	21.50	85.49	76.08	80.88	89.09	91.29
Uninsured deposit share							
JPMorgan Chase	15.86	16.06	15.96	16.62	16.06	1.19	17.09
Bank of America	9.23	10.32	9.76	0.08	9.75	10.03	10.04
Wells Fargo	4.30	4.25	0.19	4.40	4.16	4.43	4.39
Citibank	16.80	16.58	17.23	18.04	17.33	18.79	2.51
Wachovia	4.74	4.70	4.52	4.77	0.08	4.76	4.73
Cumulative share	50.93	51.91	47.67	43.91	47.36	39.19	38.77
FDIC insurance cost	$14bn	$8bn	$1,002bn	$979bn	$1,037bn	$1,086bn	$1,118bn
Change in welfare	—	$20bn	−$1,143bn	−$1,205bn	−$1,221bn	−$1,332bn	−$1,365bn

Competition and risk taking

Excessive risk taking

- Risk shifting:
  - Excessive incentives to take risk in the presence of *limited liability* (for shareholders and managers) and *moral hazard* (non-observable risk on asset side).
- This is exacerbated by flat premium deposit insurance and TBTF policies.
- Problem particularly acute for banks close to insolvency/bankruptcy.
- Modern banking (hard information and wholesale financing) raises capacity to take risks.
- Agency conflict or too much alignment between owners and managers?

Risk taking and competition (I)

- Intense competition may worsen excessive risk taking problem:
  - High profits provide buffer and increase “charter value” making banks conservative
    - Allen and Gale (2000, 2004), Hellman et al. (2000), Besanko and Thakor (1993), Boot and Greenbaum (1993), Matutes and Vives (2000), Cordella and Yeyati (2002).
  - Aggravates asymmetric information problem and leads to more risky portfolio’s and higher failure probabilities:
    - Reducing incentives to screen borrowers (less informational rents).
      - Allen and Gale (2004).
    - Increasing chance that bad borrowers get credit by limiting screening ability of each bank due to adverse selection/winner’s curse.
      - Broecker (1990), Riordan (1993), Gehrig (1998), Marquez (2002), Hauswald and Marquez (2006).

Risk taking and competition (II)

Caveats:

- Better finance terms for firms may induce entrepreneurs to exert more effort, increasing the return on their investment (risk-shifting effect)
  - Caminal and Matutes (2002); Boyd and De Nicoló (2005).
  - Wagner (2010): the effect is reversed when banks can adjust their loan portfolios, since when borrowers become safer banks take on more lending risk.
- U-shaped relationship between competition and the risk of bank failure:
  - Lower rates also reduce the banks' revenues from nondefaulting loans (a margin/ charter value effect).
  - When the number of banks is small the risk-shifting effect dominates while when the number of banks is sufficiently large the margin effect dominates (Martinez-Miera and Repullo (2010)).
- Effect of concentration on charter value limited in banks more exposed to trading:
  - Incentives to bet retail franchise value in the market (Boot and Ratnovski (2015)).

Allen and Gale (2000, 2004)

- n banks choose a portfolio consisting of perfectly correlated risks and compete à la Cournot on the deposit market
- Each bank i
  - receives a per-unit return $R_i \in [0, \bar{R}]$ with probability $p(R_i)$ and 0 with probability $(1 - p(R_i))$, with $p(R_i)$ satisfying $p(0) = 1$, $p(\bar{R}) = 0$, $p'(R_i) < 0$, and $p''(R_i) < 0$
  - raises an amount d_i of deposits and faces an upward-sloping supply of funds $r_D(D)$, which satisfies $r_D'(D) > 0$, $r_D''(D) > 0$, $r_D(0) = 0$, and $r_D(\infty) = \infty$, where to $D = \sum_i d_i$
- Depositors are insured and the supply of funds is independent of the banks' portfolio risk

Allen and Gale (2000, 2004)

- Payoff to bank i is given by

$$\Pi_i(\boldsymbol{R}, \boldsymbol{d}) = p(R_i)[R_i - r_D(D)]d_i$$

where $\boldsymbol{R} = (R_1, \dots, R_n)$ and $\boldsymbol{d} = (d_1, \dots, d_n)$

- A Cournot equilibrium, where each bank i chooses a strictly positive pair (R_i, d_i) satisfies

$$p(R_i)[R_i - r_D(D) - r_D'(D)d_i] = 0$$

$$p'(R_i)[R_i - r_D(D)]d_i + p(R_i)d_i = 0$$

- In a symmetric equilibrium:

$$R - r_D(nd) - r_D'(nd)d = 0$$

$$p'(R)[R - r(nd)] + p(R) = 0$$

Allen and Gale (2000, 2004)

- Symmetric equilibrium (at most one) where each bank chooses the riskiness and size of the portfolio equal to (R^*, d^*) fulfils:

$$-\frac{p(R)}{p'(R)} = R - r_D(nd) = r_D'(nd)d$$

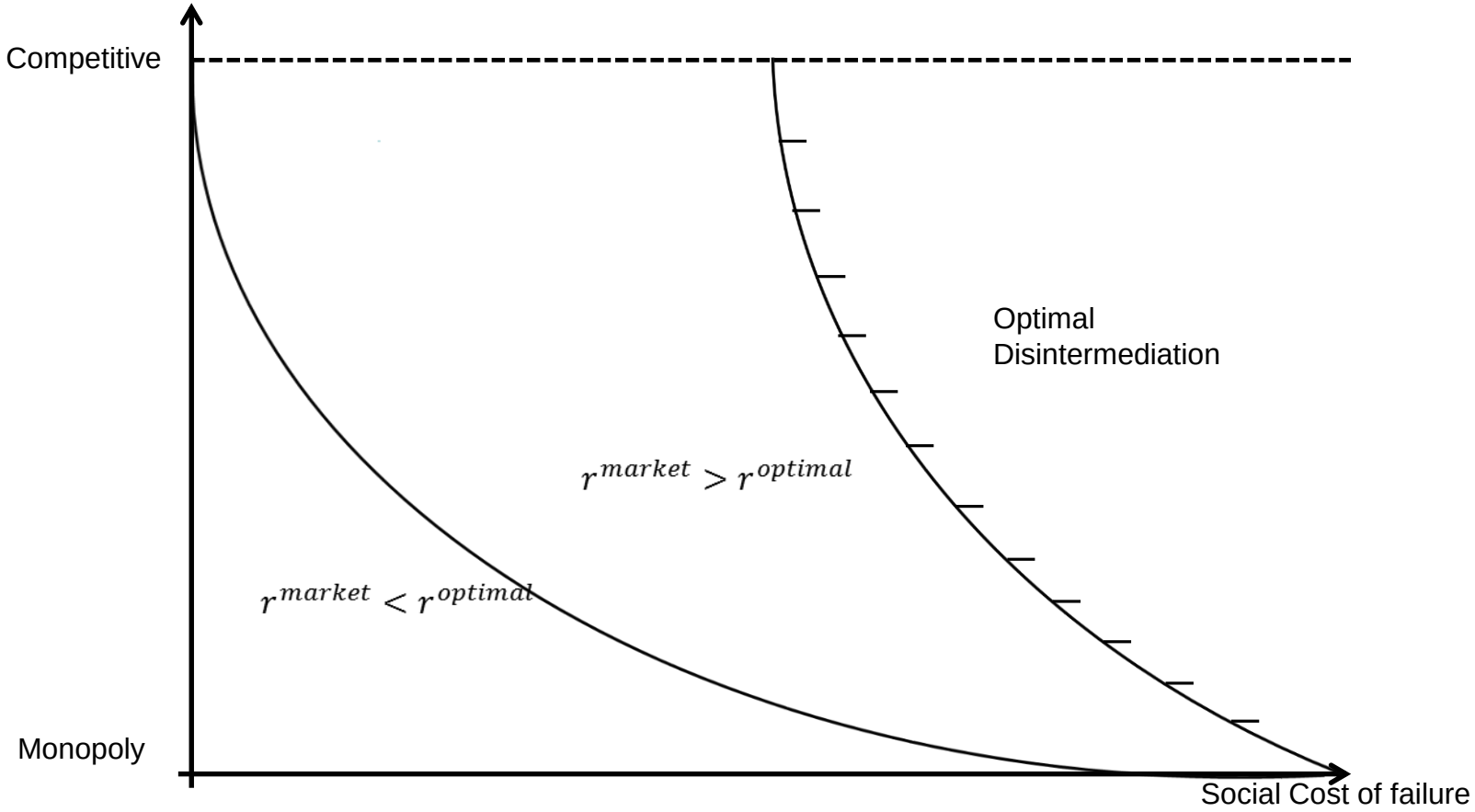
- Equilibrium depends on the number of banks n
  - As $n \to \infty$, $d = \frac{D}{n} \to 0$, assuming D is bounded above when n increases if $r_D\ (\infty) \to \infty$
  - This implies $r_D(nd)d \to 0$, and thus $R - r_D(nd) \to 0$ and $p(R) \to 0$
  - As $n \to \infty$, banks choose the maximum level of risk trying to make a positive profit; that is, $R \to \bar{R}$ as their profits converge to zero
- Competition, by reducing profits, encourages risk taking.

Matutes and Vives (2000)

- Imperfect competition model where banks are differentiated and have limited liability, and failure involves social costs (which could include a systemic component).
- Banks compete by setting deposit rates and the risk level of their portfolio (unobserved by depositors in base case).
- Results:
  - Deposit rates are too high when competition is intense and the social cost of failure high.
  - If the risk assumed by bank investments is not observable, then the incentives to take risk are maximal.
  - Flat premium deposit insurance makes banks more aggressive in competing for deposits, by increasing the elasticity of the residual supply of deposits available to the bank.
    - Then deposit rates will also be too high if competition is intense enough, even with no social cost of failure, and the discipline on risk-taking on the asset side is eliminated.

Optimal market and deposit rates

(as a function of market friction and social cost of failure) (Matutes and Vives (2000))



Matutes and Vives (2000)

A model of imperfect competition

Background:

- Banks as delegated monitors of investment projects by depositors.
- Diversification is incomplete and banks can fail.
- Model with frictions: limited liability, differentiation, social cost of failure.

Investment: Banks are risk neutral and choose the level of risk γ in their investment portfolio.

- $\tilde{R}_i$ random return of a unit of funds invested by bank i
  - $\tilde{R}_i \sim G_i$ on $[\underline{\theta}_i, \overline{\theta}_i]$, $G_i \in C^2$ with density g_i
  - $G_i = G(\cdot\,; \gamma_i)$ with $\gamma_i \in [\underline{\gamma}, \overline{\gamma}]$
  - $\uparrow \gamma_i \Leftrightarrow$ MPS of G with $E[\tilde{R}_i]=\overline{R}$
  - Investment in reserves yields a return $\alpha < \overline{R}$

Matutes and Vives (2000)

Incentive contracts and price competition

- Depositors do not observe the returns of the bank.
- Banks offer a standard debt (deposit) contract (à la Townsend/Gale-Hellwig)
  - Payment of gross rate r_i and in case of no payment (failure) depositors keep anything left.
- K: the social cost of failure of a bank (related to external effects and not internalized by the bank).

Matutes and Vives (2000)

Differentiation and market friction

- Banks are differentiated and retain some monopoly power.
- Depositors are risk neutral and supply to bank $i = A, B$:

$$S_i = a + b\Phi_i^e(r_i) - c\Phi_j^e(r_j)$$

where $\Phi_i^e(r_i)$ is the (common) assessment of depositors of the expected return of a unit deposited in bank i with nominal return r_i

  - If γ_i is observable: $\Phi_i^e(r_i)$ is the actual expected return: $E[min\{r_i, \tilde{R}_i\}]$
  - If γ_i is not observable then $\Phi_i^e(r_i) = \Phi_i\ (r_i, \gamma_i^e)$, where γ_i^e is the assessment of the asset risk position of the bank.

Matutes and Vives (2000)

Representative investor

- Representative investor (or a continuum of identical depositors) with a utility function linear in income:

$$U = r_A S_A + r_B S_B - T(S_A, S_B)$$

with $T = \alpha(S_A + S_B) + \frac{\left(\beta\left(S_A^2 + S_B^2\right) + 2\lambda S_A S_B\right)}{2}$

  - Parameter restrictions: $\overline{R} > \alpha > 0$, and $\beta \geq \lambda \geq 0$
  - The reservation value of depositors is α
  - The degree of differentiation/market power is β/λ
- Deposit supplies follow from $Max\ EU$, yielding:

$$S_i = a + b\Phi_i^e(r_i) - c\Phi_j^e\left(r_j\right)$$

where:

$a = -\alpha/(\beta + \lambda), b = \beta/(\beta^2 - \lambda^2)$ and

$c = \lambda/(\beta^2 - \lambda^2)$

Matutes and Vives (2000)

Limited liability

- Bank i declares bankruptcy when revenues can not cover payment obligations: $\tilde{R}_i < r_i$. This happens with probability $(1 - p_i)$. Its expected profits are:

$$\pi_i \equiv S_i m_i$$

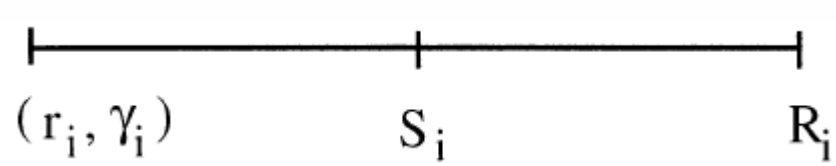
where $m_i \equiv E[max\{\tilde{R}_i - r_i, 0\}]$ is the expected margin.

- Remark: Banks will always invests all deposits in risky loans ($m_i \geq \overline{R} - r_i$ and $\overline{R} > \alpha$).
- Remark: An increase in asset risk γ_i increases m_i and decreases Φ_i (note that $m_i + \Phi_i = \overline{R}$)

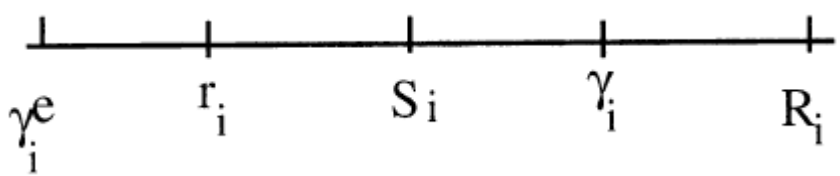
Matutes and Vives (2000)

The game

- If asset risk (γ_i) is observable, depositors decide on supplies contingent on (r_i, γ_i):



- Otherwise, depositors are endowed with a common assessment of the risk of each bank γ_i^e and invest according to $\Phi_i^e(r_i)$. In equilibrium expectations are fulfilled: $\gamma_i^e = \gamma_i$.



Matutes and Vives (2000)

Fragility and competition

Is competition responsible for fragility in (free) banking?

Economies of scale in banking (diversification-based or minimum investment requirement) induce multiple equilibria, some of which are "bad“ like a collapse of financial intermediation (systemic crisis) or an institution crisis of confidence.

Matutes and Vives (2000)

Fragility and competition

Assume a minimum size requirement: a bank to invest needs $s > 0$ funds. Then:

- For given posted deposit rates a coordination game on depositors with multiple equilibria is induced. Three types of equilibria exist:
  - No banking.
  - Only one bank active.
  - Both banks active (interior eq. with supply S_i as before).

  The interior equilibrium Pareto dominates the others.

- Consider the two-stage game: rate setting first and then depositors patronizing banks. Then:
  1. Any pair of deposit rates is a subgame perfect equilibrium.
  2. Suppose that depositors coordinate on the Pareto dominant equilibrium (of the depositors game) then there is a unique interior equilibrium.

Matutes and Vives (2000)

Fragility and competition

- “Fragility“ (multiplicity of equilibria with some bad outcomes) is due to a coordination problem of depositors:
  - different equilibria arise because of self-fulfilling expectations not because of competition.
  - the coordination problem may arise with a monopoly bank.
- However: Competition does affect the probability of failure of banks.
- Remark: Free banking episodes did not lead to chaos.

Matutes and Vives (2000)

Free market competition

- Suppose depositors coordinate on the Pareto dominant equilibrium of the depositors' game.

<u>Observable portfolio risk</u>: Suppose asset risk positions γ_i are observable (then $\Phi_i^e(r_i)$ = $\Phi_i\ (r_i; \gamma_i)$ = $E[min\{r_i, \tilde{R}_i\}]$).

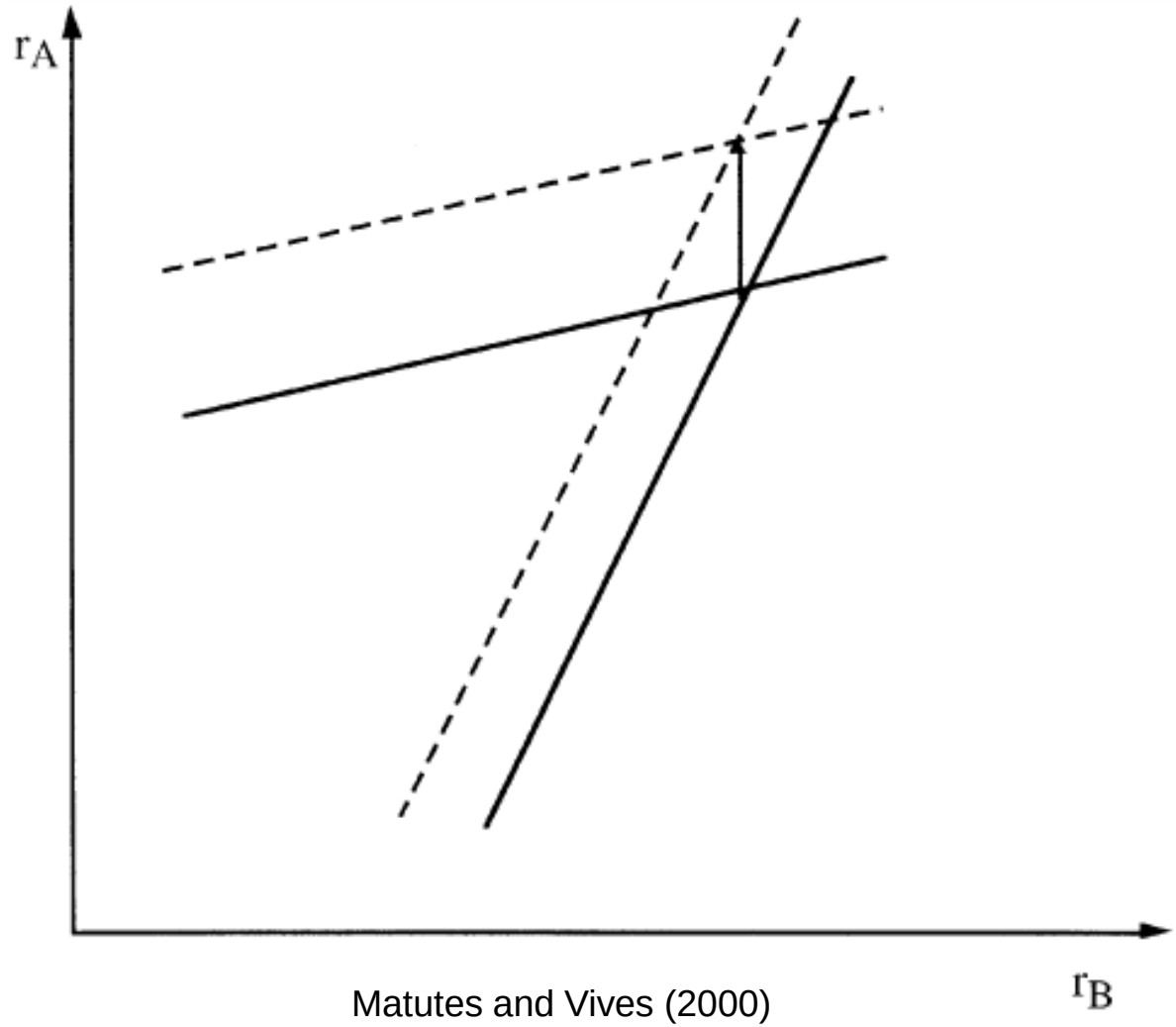
- Character of competition: The rates r_i and r_j are strategic complements and r_i and γ_i (γ_j) have increasing (decreasing) differences
  - $\mathrm{BR}_i(r_j)$ is increasing in r_j, and shifts outwards with γ_i, and inwards with in γ_j.

Matutes and Vives (2000)

Free market competition

Effect of an increase in γ_A

In equilibrium r_B remains constant



Matutes and Vives (2000)

Free market competition

With observable portfolio risk a bank by increasing its asset risk position does not manage to attract more depositors or to increase its profits.

- Fact: For a given rate of bank B as γ_A increases, the best response of bank A is to set a higher rate so that its market share and expected margin (and consequently expected profits) remain constant
- Rates with observable asset risk
  - For any given asset risks γ_i and γ_j bank competition yields a unique equilibrium, symmetric in terms of

    $m_i = \left(\overline{R} - \alpha\right)(\beta - \lambda)/(2\beta - \lambda), S_i$, and π_i.
  - The bank with a more risky portfolio sets a higher deposit rate than its rival.

Matutes and Vives (2000)

Free market competition

- Predictions are consistent with the empirical findings of Rolnick (1987); Hannan and Hanweck (1988); and simulations with ME in Egan et al. (2017):
  - riskier banks paying higher rates for uninsured deposits.
- The less differentiated are banks (λ/β higher) and the more competition there is, the smaller is the margin and consequently higher rates are offered.
  - Market power moderates risk-taking incentives on the liability side.
  - When banks are not differentiated ($\beta = \lambda$) and competition is maximal then $m = 0$ and therefore the rate offered by banks equals $\overline{\theta}$.

Matutes and Vives (2000)

Free market competition

Unobservable portfolio risk: If asset risk positions γ_i are not observable and depositors assess the asset risk positions according to a given prior γ_i^e then banks undertake maximum risk:

The conjunction of limited liability and moral hazard leads banks to undertake maximum asset risk.

Caveat:

a) If the investment choice of banks affects also the mean of returns per unit invested (and not only the spread as in our model) or

b) If the banks optimize their charter value,

then banks need not undertake maximum risk (and if risk positions are observable banks need not be indifferent with respect to the risk level of the portfolio).

Matutes and Vives (2000)

Welfare, the intensity of competition, and rate regulation

- Expected gross surplus:

$$GS = (S_A + S_B)\overline{R} - T(S_A, S_B)$$

- Expected social cost of failure:

$$F = \big((1 - p_A) + (1 - p_B)\big)K$$

- Expected total surplus:

$$TS = GS - F$$

Matutes and Vives (2000)

Welfare, the intensity of competition, and rate regulation

How do optimal rates compare with market ones?

<u>Welfare-optimal rates</u>

Let asset risks be symmetric and observable, $\gamma_i = \gamma$, let $\underline{\theta} < \alpha$, and suppose that the *hazard rate* H of the distribution of returns is nondecreasing. Then:

i. It is optimal to disintermediate when $K \geq \overline{K}(\lambda)$ ($\overline{K}(\lambda)$ is decreasing).

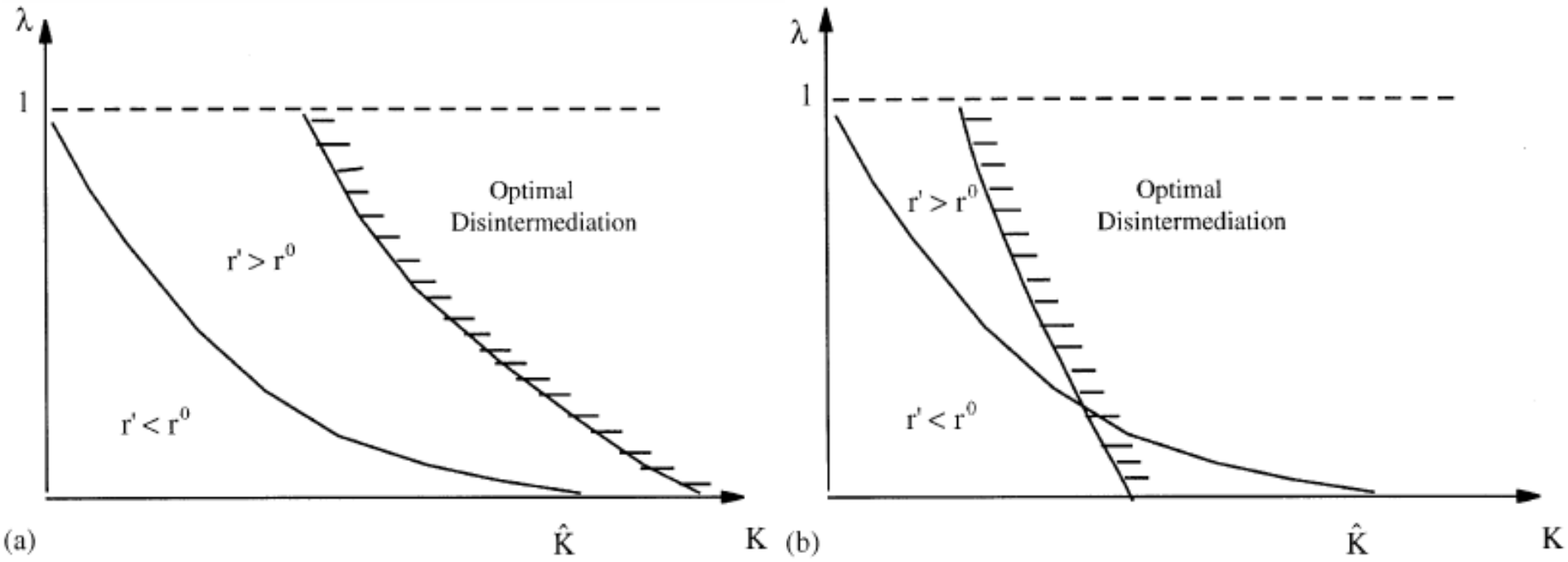
Otherwise (let $\beta = 1$):

ii. The welfare-optimal rate r° satisfies: $m(r^{\circ};\gamma) = (1+\lambda)KH(r^{\circ})$, decreasing with K and increasing with the degree of differentiation $1/\lambda$.

iii. For a given degree of differentiation (λ), market rates are higher (lower) than optimal for K large (small).

Matutes and Vives (2000)

Welfare and the intensity of competition



Matutes and Vives (2000)

Welfare and the intensity of competition

Intuition: An increase in r_A has three external effects:

- on the rival's profits: $\frac{\partial \pi_B}{\partial r_A} = -cm_B p_A < 0$
- on consumer surplus: $\frac{\partial CS}{\partial r_A} = p_A S_A > 0$
- on the social cost of failure: $g(r_A)K > 0$

The aggregate effect on welfare is:

$$\frac{\partial TS}{\partial r_A} = \frac{\partial \pi_A}{\partial r_A} + \frac{\partial \pi_B}{\partial r_A} + \frac{\partial CS}{\partial r_A} - gK,$$

which evaluated at the market solution ($bm = S$):

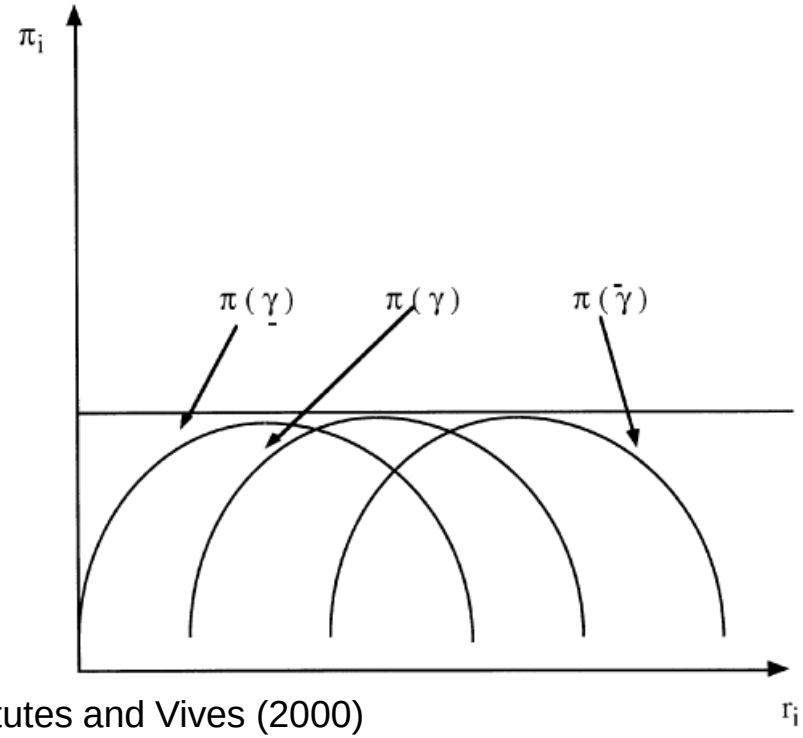
$$\frac{\partial TS}{\partial r_A} = p(m(b-c) - HK).$$

Matutes and Vives (2000)

Welfare, the intensity of competition, and rate regulation

How does rate regulation affect banks' choice of asset risk when the γ 's are observable?

<u>Result</u>. If a rate ceiling (floor) is set at a level below (above) the market rate at the minimal (maximal) level of risk, banks choose the least (maximal) level of asset risk.



Matutes and Vives (2000)

Welfare, the intensity of competition, and rate regulation

Observation:

- For most parameter configurations (and under regularity conditions: H nondecreasing and symmetric distribution of returns), whenever intermediation is optimal, the welfare-optimal policy is to set $\gamma = \underline{\gamma}$ and $r = r^{\circ}\left(\underline{\gamma}\right)$.
- It may happen though that for very small values of K and large values of α relative to $\overline{R}$ it is optimal to set $\gamma = \overline{\gamma}$.
- Focus attention on the case where K is not so large so as to have optimal disintermediation.

Matutes and Vives (2000)

Welfare, the intensity of competition, and regulation

- A deposit limit ($S \leq \bar{S}$) can be interpreted as a capital requirement:

Suppose that the capital of the bank is given (k) and that a capital requirement δ is imposed. That is, $k/A \geq \delta$, where A is the bank's investment in risky assets.

- In our case $A = S + k$ since all will be invested in risky assets. This is equivalent to $S \leq (1-\delta)k/\delta$

Matutes and Vives (2000)

Welfare, the intensity of competition, and regulation

Consider as potential regulatory instruments, deposit limits/capital requirement (or rate ceilings) and asset restrictions:

<u>Result</u>: Under regularity conditions, for a social cost of failure large (but not so large as to make intermediation suboptimal) it is optimal to impose a rate ceiling (corresponding to the optimal rate for minimal asset risk) whenever competition is intense.

If the $\gamma's$ are not observable then banks want to assume maximum risk with or without rate regulation since, due to limited liability, this always increases the expected margin and does not hurt deposit supply (the risk assessment of depositors is given). In consequence:

<u>Result</u>: When the asset risk position of banks is not observable, competition is intense, and the social cost of failure is large then rate (or deposit) regulation needs to be complemented with direct asset restrictions (which lower $\overline{\gamma}$).

Matutes and Vives (2000)

Deposit insurance

Deposit Insurance

- Deposit insurance is widespread in developed economies. The main rationale is the protection of small investors (and contribution to the prevention of systemic crisis).
- Deposit insurance eliminates the "bad" equilibria when there are economies of scale in banking .The coordination problem of depositors is solved.
  - In our model it eliminates the banking collapse and corner equilibria when there is a minimum investment requirement for banks.
- What are the costs as well as other potential benefits of deposit insurance? Which welfare trade-offs arise?

We will deal both with the usual case of insurance premiums independent of risk and with risk-based deposit insurance.

Matutes and Vives (2000)

Deposit Insurance

As long as there is *full insurance*, depositors do not face any risk and hence deposit supplies are given by

$$S_i = a + br_i - cr_j;\ i, j = A, B.$$

- They are independent of the asset risk of either bank.
- From the point of view of depositors it does not matter whether asset risk is observable or not.

Matutes and Vives (2000)

Flat-premium deposit insurance (I)

- Insurance design:
  - If a bank fails, the insurance fund pays depositors the rates set by that bank.
  - Banks contribute to the financing of the insurance scheme with a percentage of their profits (if banks do not fail, they pay the fund a tax proportional to their profits at the rate τ).
- Expected profits of bank i are given by:

$$\pi_i = (1 - \tau) m_i S_i.$$

Matutes and Vives (2000)

Flat-premium DI (II)

Impact of insurance on rate setting

- If the banks have the same asset risk positions and the reservation value of depositors is not too large ($\alpha \leq \underline{\theta}$ is sufficient) deposit insurance makes banks more aggressive.
- Intuition: With insurance depositors obtain the posted rates even if banks go bankrupt and hence a rate increase attracts more depositors than in the case without insurance (i.e., the supply of deposits becomes more elastic to the interest rate).
- Remark: If DI is partial, rates tend to grow with the degree of insurance (Cordella and Yeyati (2002)).

Matutes and Vives (2000)

Flat-premium DI (III)

<u>Proposition</u>

Suppose that the banks' portfolio is equally risky and that banks have some monopoly power $\lambda < \beta$. Then, for α small relative to the uninsured market rate, deposit insurance with flat premiums leads to a deposit rate strictly larger than the free market equilibrium.

- Example: When returns follow a beta distribution, and for a given degree of differentiation, the insured market yields higher rates than the free market when the mean of returns is above a certain critical point.
- Flat premiums cannot be fair when competition is intense.

Matutes and Vives (2000)

Flat-premium DI (IV)

Choice of asset risk

Now a bank can improve its expected profits by taking more asset risk even when it is observable.

- Consider a monopoly bank ($c = 0$). Insurance implies that higher levels of risk do not have an impact on the supply of deposits while the expected margin increases
  - Since the margin is a convex function of actual returns, its expectation shifts up with a mean preserving spread.
- The same argument applies when banks compete.

Matutes and Vives (2000)

Flat-premium DI (V)

<u>Proposition</u>

With flat-premium deposit insurance banks will take the maximum asset risk position irrespective of whether asset risk is observable or not.

Remark: With partial insurance (and when banks can influence the probability of success of their portfolio (Cordella and Yeyati (2002)) asset risk observability improves monitoring incentives and reduces risk taking.

Matutes and Vives (2000)

Risk-based deposit insurance (I)

How would the results obtained change if deposit insurance were to be risk-based?

Risk-based insurance

- In this case banks when making decisions anticipate different premiums according to different risks taken.
- With fair and risk-based premiums, bank i is confronted with a tax/premium schedule contingent on its asset risk position and deposit rate such that in expected terms the tax on the margin of the bank equals the cost of deposit insurance:

$$\tau(r_i;\gamma_i) = \frac{E[r_i - R_i | r_i > R_i]}{E[R_i - r_i | r_i < R_i]} \equiv 1 - \frac{\overline{R} - r_i}{m_i}$$

Matutes and Vives (2000)

Risk-based DI (II)

- The net expected profit of bank i is:

$$\pi_i = (1 - \tau_i) m_i S_i = \left(\overline{R} - r_i\right) S_i$$

- Remark: Risk-based premiums are such that the expected profits of a bank are independent of the asset risk taken.
- Fair risk-based premiums eliminate limited liability, i.e., banks behave as if their profits were $\tilde{\pi}_i = \left(\tilde{R}_i - r_i\right) S_i$.
- The consequence is that banks have reduced incentives to be aggressive in setting rates.

Matutes and Vives (2000)

Risk-based DI (III)

With fair and risk-based deposit insurance:

- There is a unique rate equilibrium. It is symmetric in terms of r_i, S_i and π_i, irrespective of the asset risk positions of banks.
- The expected margin is given by

$$\overline{R} - r''' = \frac{(\overline{R}-\alpha)(\beta-\lambda)}{(2\beta-\lambda)}$$

  the same as without insurance and observable asset risk.
- Banks have no incentive to take asset risk.

Matutes and Vives (2000)

Welfare (I)

Suppose insurance must be self-financing

- Total surplus is exactly as before for given deposit supplies because the full cost of insurance P must be paid:

$$GS = CS - P + \pi_A + \pi_B = (S_A + S_B)\overline{R} - T(S_A, S_B).$$

- The only difference is that the supply of funds now depends on the posted rates:

$$S_i = a + br_i - cr_j.$$

Matutes and Vives (2000)

Welfare (II)

Welfare-optimal policy with budget-balanced DI

Assume that G is symmetric and that $\underline{\theta} < \alpha$. Then there is $\widehat{K} > 0$ such that:

i. If $K < \widehat{K}$ it is optimal to set $\gamma = \underline{\gamma}$ and the optimal rate $\hat{r}^{\circ}\left(\underline{\gamma}\right)$ is such that $\overline{R} - \hat{r}^{\circ} = Kg\left(\hat{r}^{\circ}, \underline{\gamma}\right)(\beta + \lambda)$; $\hat{r}^{\circ}\left(\underline{\gamma}\right) < \overline{R}$ and decreases with K and λ.

ii. If $K \geq \widehat{K}$ disintermediation is optimal.

Remark: For a given asset risk position market rates with flat premiums will be excessive when competition is intense (λ close to β), even without a social cost of failure ($K = 0$), $r'' > \overline{R}$:

$$\frac{\partial TS}{\partial r_A} = \frac{\partial \pi_A}{\partial r_A} + \frac{\partial \pi_B}{\partial r_A} + \frac{\partial (CS - P)}{\partial r_A} - gK = (b - c)\left(\overline{R} - r''\right) - gK < 0$$

Matutes and Vives (2000)

Welfare (III)

<u>Proposition</u>

- If competition is intense rates are too high with flat-premium deposit insurance (even with no social cost of failure).
- Banks are induced to undertake maximal asset risk while (for G symmetric) it is optimal to undertake the least risk position.
- As a result, deposit limits (rate ceilings) and asset restrictions are complementary policies in order to improve welfare.

However: When competition is weak and K low, rivalry may need to be promoted (for example, by easing entry in the industry).

Matutes and Vives (2000)

Comparison of regimes

Suppose the asset risk positions are given:

- The supply of deposits is larger with flat-premium deposit insurance than in the other regimes (for which it is equal).
- Risk-based insurance induces banks to set lower deposit rates than either with no insurance or with flat premiums.
- Correspondingly, failure rates are smallest with risk-based insurance.
- Total surplus will be always higher with risk-based insurance than without insurance.

Remark: Assuming that in the uninsured case portfolio risk is unobservable (in which case banks choose $\overline{\gamma}$) the proposition holds true when banks choose γ.

Matutes and Vives (2000)

Welfare

- Remark: For α not too large relative to the uninsured market rate, rate aggressiveness (by regime and in decreasing order) is: flat-premium deposit insurance, uninsured market with unobservable γ, uninsured market with observable γ, and risk-based deposit insurance
  - If banks can influence the probability of success of their portfolio (Cordella-Yeyati (2002)) similar results apply.
  - A positive charter value reinforces the disciplining effects of asset risk observability.
- However, even with risk-based premiums, welfare can be improved by introducing deposit limits (or rate regulation)
  - For K small the market rate is too low.
  - For K large it is too high.

Matutes and Vives (2000)

Banking regimes	Risk-taking incentives: Liability (rates)	Risk-taking incentives: Asset (investment)	Regulatory instruments
No insurance			
Observable risk/ high disclosure	Medium-low	Absent	Capital requirements
Unobservable risk/ low disclosure	Medium-high	Maximal	Capital requirements + asset restrictions
Insurance			
Risk-insensitive pricing	High	Maximal	Capital requirements + asset restrictions
Risk-based pricing	Low	Absent	Capital requirements

Basic frictions: limited liability, product differentiation (market power), social cost of failure
Necessary regulatory instruments when charter values are low and the social cost of failure is high.

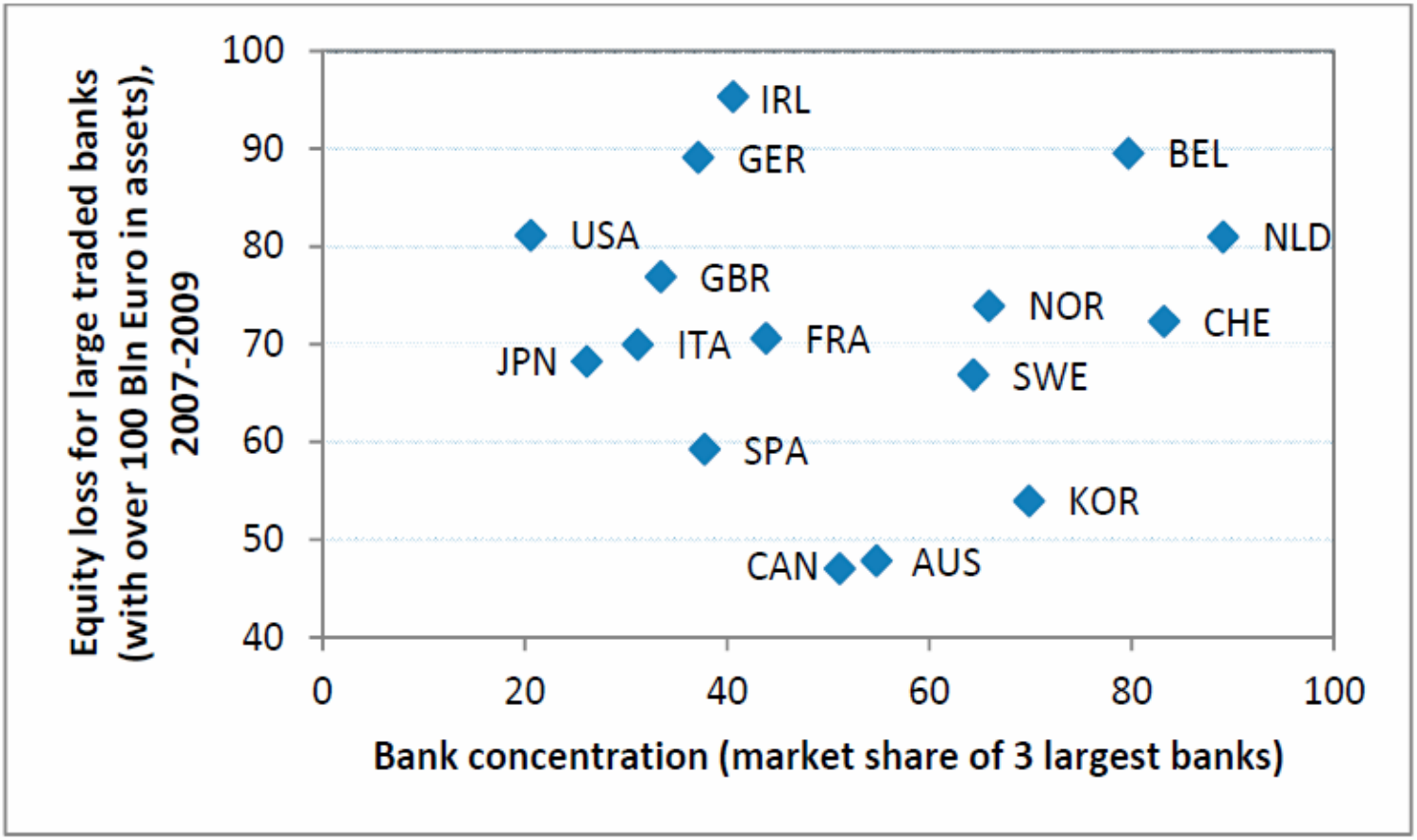
Market expansion and credit oversupply

- When markets expand, new borrowers with unknown characteristics enter the market, as in the run up to the 2007-09 crisis.
- Then competitive markets tend to oversupply credit by relaxing lending standards and extending it to both good and bad risks
  - de Meza and Webb (1987), Dell'Ariccia and Marquez (2006), Mahoney and Weyl (2014).
- Risk taking is reinforced with:
  - the behavioral bias of consumers towards over-borrowing (which survives competition; e.g. Heidhues and Koszegi (2010), Grubb (2015)).
  - loose monetary policy (Acharya and Naqvi (2012), Diamond and Rajan (2012), Dell'Ariccia et al. (2014)) and market-based banking (e.g. securitization; Boot and Ratnovski (2016)).

Concentration and stability trade-offs

- Concentrated banking system with a few large banks:
  - May be easier to monitor
  - Banks are potentially better diversified
  - Fragmented banking structure, avoiding the TBTF problem, need not be safer since it may be subject to the "too many to fail" collective moral hazard problem.
- But large banks are:
  - TBTF, receive larger subsidies and have incentive to take more risk
  - More complex and harder to monitor
  - More interdependent (more systemic risk).

Bank concentration and performance during the 2008 crisis



Source: Ratnovski (2013)

Evidence is mixed (I)

- Liberalization may induce excessive risk taking and eventually crises.
- Increased competition (measured by Tobin's q, Lerner index) after liberalization/deregulation in the US in 1980s leads to:
  - Increased (overall) risk taking by banks (Keeley (1990), Edwards and Mishkin (1995), Demsetz et al. (1996), Galloway et al. (1997));
    - in particular by large banks TBTF (Boyd and Gertler (1993));
  - Lower/higher (portfolio risk) loan losses or NPL (Jayaratne and Strahan (1998)/Dick (2006)-Salas and Saurina (2003), Jimenez et al. (2007) for Spain-Yeyati and Micco (2007) for Latam).
- Liberalization in weak institutional environment/inadequate regulation leads to risk-shifting to the taxpayer and systemic crisis (Demirgüç-Kunt and Detragiache (1999))
  - Subprime crisis and declining lending standards with securitization (Dell Ariccia et al. (2008)).

Evidence is mixed (II)
(Cross country I)

- Berger et al. (2009):
  - Market power (Lerner index, HHI on deposits/loans at national level) increases loan portfolio risk of banks but decreases overall risk (Z-score) because banks with MP hold more equity capital (23 developed nations).
- Beck et al. (2006):
  - Systemic crises less likely in concentrated banking systems
    - (controlling for macro, financial, regulatory, institutional and cultural characteristics; 69 countries, 1980-1997).
  - Fewer regulatory restrictions (on entry, activities, facility for competition) associated with less systemic fragility.
  - “More competitive banking systems are associated with less fragility when controlling for concentration”.

Evidence is mixed (III)
(Cross country II)

- Boyd, de Nicoló, Loukoinova (2009):
  - Model-based definition of stress/crisis: more concentration leads to more probability of systemic shock but not more prob. of intervention. Individual bank data.
  - Interpretation of Beck et al.:
    - More concentration leads to less intervention (more forbearance) and more systemic crises.
    - Less barriers to entry lead to less intervention and less crises.
- Boyd, de Nicoló, Jalal (2009):
  - More concentration leads to more prob. of failure of banks.
  - Bank competition fosters willingness to lend. (Emerging economies + US banks.)
- Shehzad-De Haan (2009)
  - Certain dimensions of liberalization reduce likelihood of systemic crises conditional on adequate banking supervision (1973-2002).
- Beck et al (2013)
  - on average (79 countries, 1994-2009), a positive relationship between banks' market power (Lerner index) and banks' stability (Z-score, banks' distance to insolvency), With large cross-country variation:
    - an increase in competition is associated with a larger rise in banks' fragility in countries with stricter activity restrictions, lower systemic fragility, better developed stock exchanges, more generous deposit insurance and more effective systems of credit information sharing.

Hump-shaped relationship between competition and financial stability

- Carbó-Valverde et al. (2013): panel of banks belonging to 23 OECD countries over 1996–2010, and using the Z-score as a measure of bank stability and concentration or Lerner measures for competition.
- Fernández de Guevara and Maudos (2011): 21 countries in the period 1993–2003.
- Jiménez et al. (2013): Spain, risk taking in both deposit and loan markets, standard measures of concentration.

Summary of evidence

Complex trade-off between competition and stability

- Liberalization without adequate regulation leads to crises.
- Average positive association of market power and bank-level stability but with country variation and some indications that an intermediate level of bank competition maximizes bank stability.
- Positive association of some measures of bank competition (e.g. ease of entry) and systemic stability, but instability of a bank may spill over to other banks via competition for deposits.
- Mixed results on association of aggregate concentration and stability.
- Larger banks tend to be better diversified, but assume higher risks.
- Large banking systems may be more fragile if large in relation to the size of the economy, feeding into the link between sovereign and bank risk.

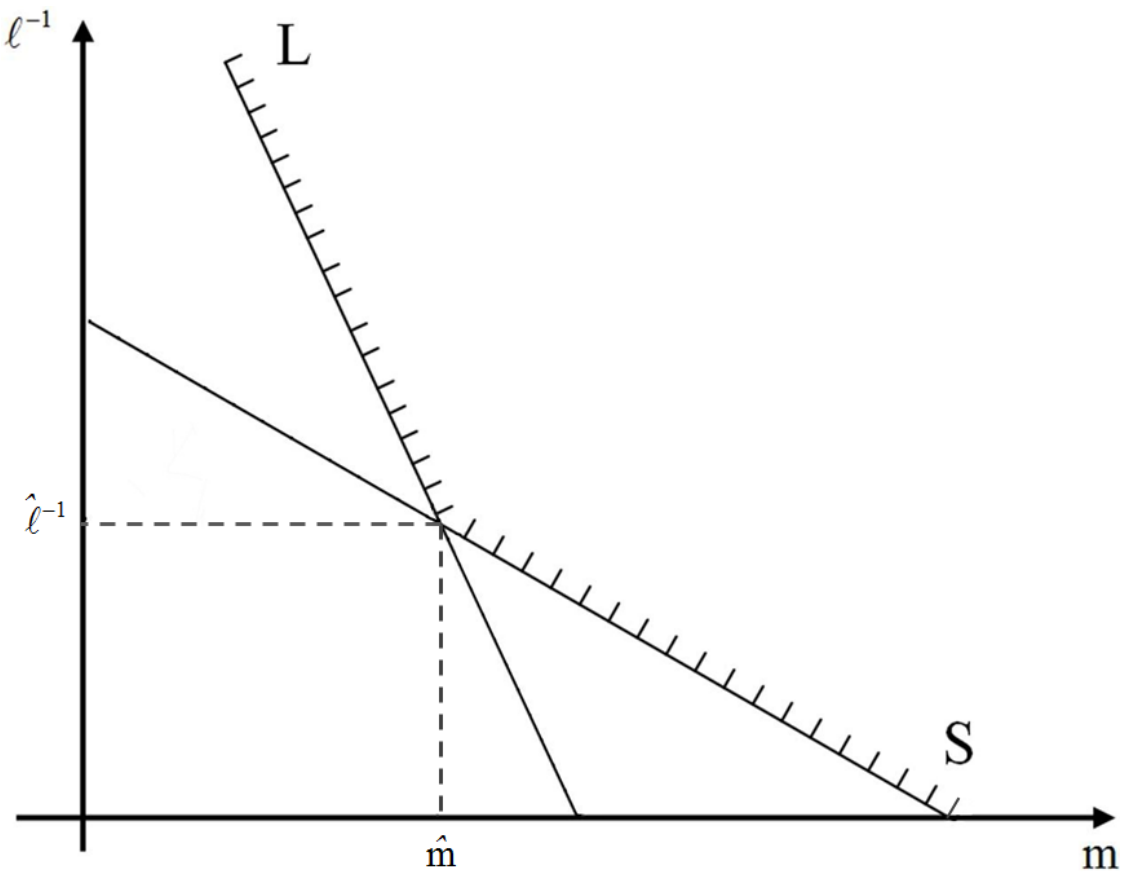
Prudential regulation and competition policy

Regulating liquidity and solvency

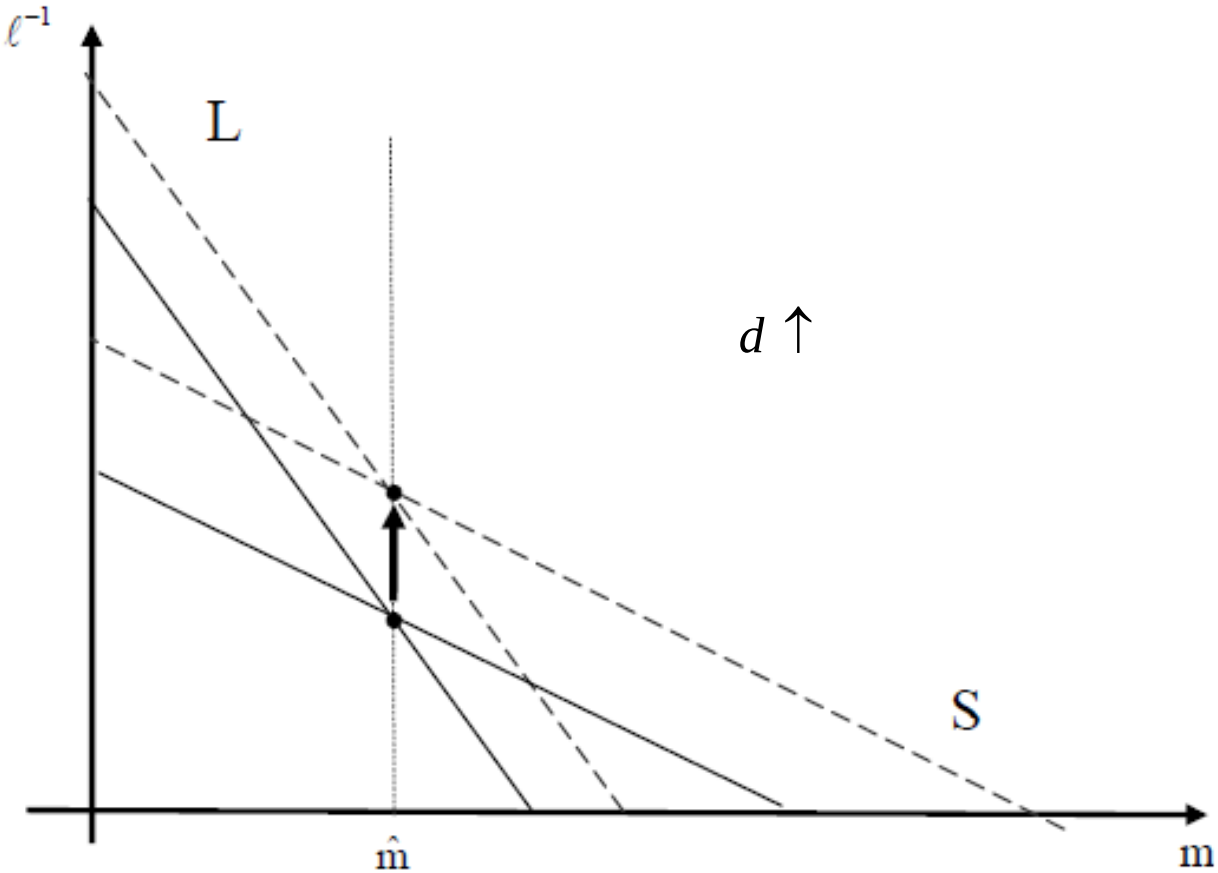
A regulator wants to control the probabilities of insolvency and illiquidity

(Vives (2014))

Solvency (S) and liquidity (L) constraints to control probabilities of insolvency and illiquidity with an inverse short-term leverage ratio ($\ell^{-1} = E/D$) and a liquidity ratio ($m = M/D$).



Effect of an increase in cost of funds/ liberalization



Prudential regulation: a piecemeal approach will not work

- Capital, liquidity, disclosure requirements, macro-prudential ratios have to be thought together (taking into account activity restrictions if present).
- Competition policy is not independent of prudential regulation.

Can we regulate away the competition-stability trade-off?

- If we would manage to eliminate market failure arising out of asymmetric information and externalities we would be better off with more competition.
- Regulation (conduct and structure) can alleviate the competition-stability trade-off but not eliminate it.
- With better regulation we can have more competition without endangering stability:
  - E.g., higher capital requirements allow more intense competition (Matutes-Vives (2000), Vives (2014)).

Coordination between prudential regulation and competition policy

Coordination between prudential regulation and competition policy

- Capping deposit rates to limit systemic risk when weak institutions exploit deposit insurance (Spain, Portugal).
- Resolution of failing entities sale (preferred by supervisor, e.g. HBOS-Lloyds) may lead to the formation of anticompetitive and TBTF market structures.
- Competition policy as a credible tool to check TBTF:
  - Competitive distortion based on the advantage of being TBTF.
  - CP authority may impose structural and conduct measures on TBTF helped entities.
    - Divergence US-EU
- Compliance costs as barrier to entry for small banks and new entrants.

Regulatory reform

- Increase resiliency of financial institutions taking into account systemic risk:
  - Macroprudential regulation: capital and liquidity.
  - Improved supervision and stress testing.
  - Structural reform (insulating banks from capital markets activity): Volcker rule, Vickers and Liikanen
- Resolution
- Corporate governance and executive compensation
- Consumer protection

Macroprudential regulation

- Cross-section dimension to address interconnectedness and contagion
  - Quantity and quality of capital
    - Leverage ratio
    - Capital surcharges for SIFIs
  - Liquidity requirements
- Time-series dimension to reduce fluctuations and volatility in the credit cycle and prevent buildup of systemic risk
  - Cyclical capital requirements and ratios to control credit growth

Assessment of regulatory reform

- Level, quality of capital and liquidity requirements, and pace of implementation
- Treatment of SIFIs
- Interaction between capital, liquidity, and transparency requirements.
- Trade-offs in structural banking reform
- Resolution, bail-in and systemic risk.
  - SPOE vs MPOE

Capital issues

- Interaction between leverage and RWA ratios.
- Target and pace of implementation.
- SIFIS surcharge
  - Assessment of externalities
  - Discontinuity effects in categorization (UK)
- Regulatory arbitrage and incentive to move to unregulated sector.
- Leverage ratio and market making.

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Basic frictions: limited liability, product differentiation (market power), social cost of failure
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Banking structural reform principles

- Risk-based insurance mechanisms for traditional banking activities (those based on soft information, e.g., inside the ring-fence in the UK) that have to be protected.
- Market discipline with strong disclosure requirements and credible resolution for market-based segments (based on hard information as in investment banking).
- Better regulation and resolution allows competition to be effective.
- Problems:
  - Regulatory boundary and migration of risky activities
  - Residual liquidation/contagion costs

Optimal regulation

- Pricing risk to deal with limited liability and externality problems:
  - Risk-based insurance for deposits
  - Systemic capital charges that internalize the social cost of failure of banks (SIFIs in particular) or equivalent Pigouvian taxes.
- Problem: calibration mistakes under conditions of uncertainty and incomplete information that may lead to large losses.
- Then quantity controls/activity restrictions superior.

Rationale for activity restrictions
Complements or substitutes with pricing risk?

- Risk-based pricing methods
  - by the market (disclosure and bail in)
  - by the regulator (insurance)

  are imperfect

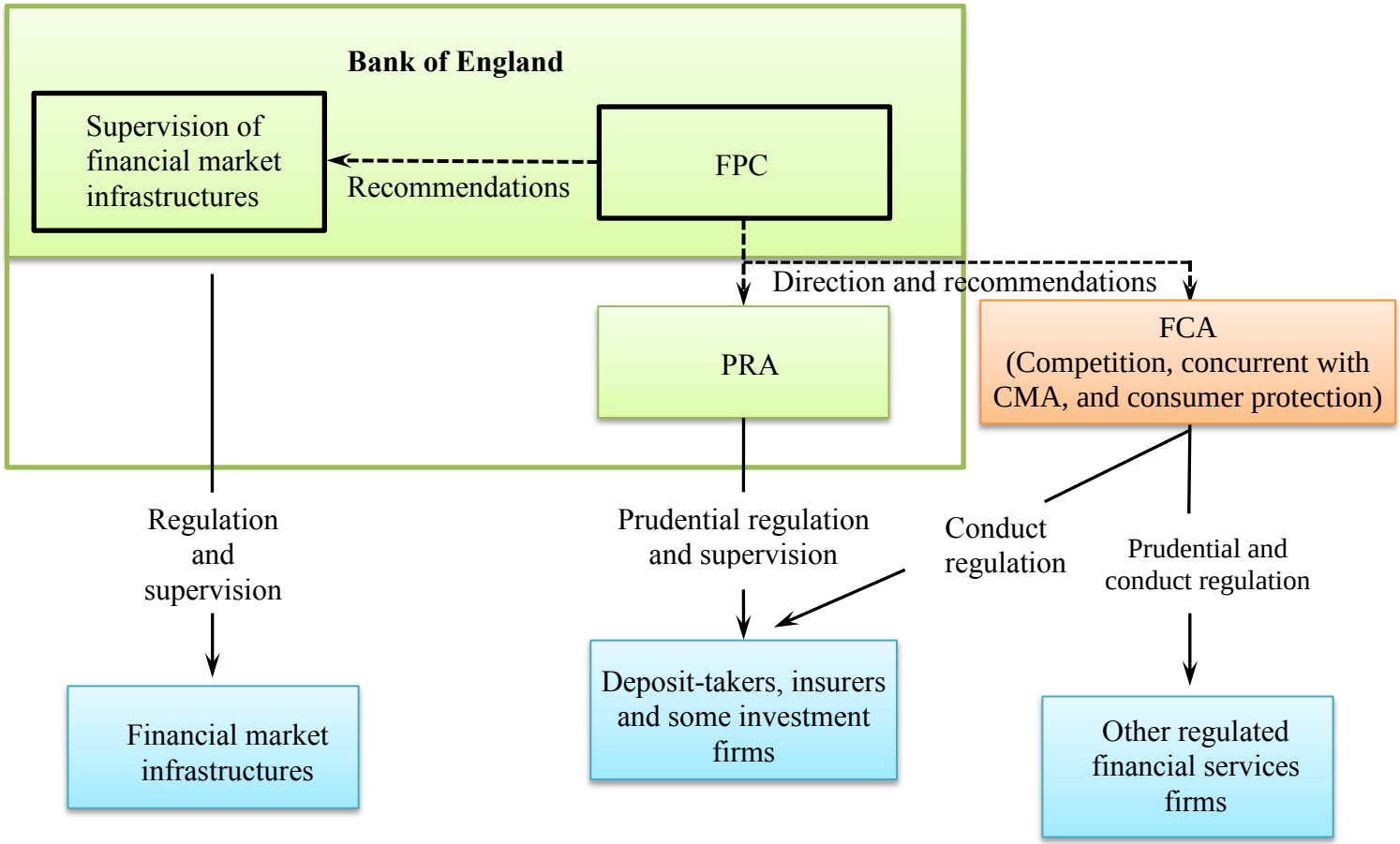
- Complementarity since separation of activities makes banking groups more easily resolvable (decreasing the social cost of failure) and lowers cost of imposing market discipline.

Financial architecture

Financial architecture

- The need for coordination of competition policy and regulation does not mean that the policies should be enforced by the same agency.
- Separate agencies for competition policy and prudential oversight with well-defined missions avoid the potential conflict of interest of competition policy and supervision (e.g. mergers).
- Case for integrating financial consumer protection agency with financial conduct/competition authority (UK FCA model).
- Agencies should cooperate (MoU).

The UK «Twin Peaks» Regulatory Framework



Source: Financial Stability Board (2013), Peer Review of the United Kingdom.

Trade-offs of separation of activities

- Pros:
  - Limit subsidizing risk-taking with insured deposits.
  - Reduce conflicts of interest.
  - Reduce complexity and improve resolution and market discipline.
- Cons:
  - Increase supervisory burden: Distinguishing «propietary trading» from market making.
  - Risk of migration of risky activities to unregulated areas (regulatory boundary).
  - Residual liquidation/contagion costs

Assessment of trade-offs

- Optimal design is open (an empirical issue)
- Case for separation of prudential and competition (as well as consumer protection) authority is strong.
- Case for integrating consumer protection agency with competition authority
  - UK but in the EU, the prudential supervisor is typically involved in consumer protection.
- Case for CB with supervisory powers:
  - Informational economies of scope, between monetary policy, the LOLR facility and supervision.
  - Single authority in crisis.

Advantages of regulatory separation

- Separation between conflicting tasks helps provide appropriate incentives to regulators.
  - Authorization/supervision and closure
- Improve measurability of tasks and focus of the agency.
  - Multitask vs clear missions
- Improve accountability in a system of “checks and balances”.
- Allow the transfer of control to avoid the “soft budget constraint” problem.
  - Closure decision form central bank to resolution agency
- Introduce competition between agencies to generate information and allow experimentation.
- Limit bureaucratic capture.

Advantages of regulatory integration

- Sharing of fixed costs.
- Gathering critical mass in expertise and sharing information.
- Limit opportunistic behavior with regulatory arbitrage.
- Avoid inconsistencies in the application of the law.
- Avoid disrupting competition between agencies, be it in terms of a race to the bottom in regulatory standards or a competition for resources.

Cross border issues

- National regulators and supervisors do not incorporate the *externalities* of their policies on foreign consumer welfare and financial stability.
- *Race to the bottom*, since lower requirements may represent a competitive advantage for local entities.
- Failures with cross-border consequences lead to difficult *resolution* issues as the failure of Lehman Brothers in 2008, Fortis and Dexia exemplify when unwinding procedures and burden sharing have not been agreed ex ante.
- The externalities among countries in regulation, supervision and resolution raise the need of *coordination* of regulators.
- A federal or centralized regulator will take into account the country externalities and may be less prone to capture or influence by local interests.
  - This issue is at the base of having the ECB as bank supervisor in the eurozone.

Conclusions (I)

- Banking should not be protected from competition:
  - To foster efficiency and consumer service. Innovation.
  - Weed out inefficient institutions and limit rent seeking.
  - To keep in check market abuse.

- Competition in banking is good for society provided that regulation and supervision are adequate.

- Competition is not responsible for fragility in banking, but there exists a trade-off between competition and financial stability along some dimensions due to regulatory imperfections /failure.

- Well-designed regulation may alleviate competition-stability trade-off but is unlikely to eliminate it.
  - There is ample margin for regulation to improve the alignment of social and private incentives.
  - Better regulation and resolution allows more competition and improves stability.

Conclusions (II)

- Two important consequences of trade-off:
  1. Competition policy specificity in banking should be recognized.
  2. Prudential regulation must be coordinated with competition policy.
- Regulation should take into account the interactions of the different conduct and structural instruments used.
- Agencies responsible for prudential regulation and competition policy should be independent with consumer protection separated from prudential supervision.

Challenges for researchers

- Elaboration of a canonical model of competition in the banking sector.
- Development of a robust structural empirical analysis of the relationship between competition and stability.
- Development of a sound theory of capital for the banking sector.
- Analysis of when price or quantity controls may be more adequate as a regulatory tool.
- Study the effectiveness of macro-prudential tools and its interactions with the intensity of market competition.
- Understand the interaction of competition, stability and behavioral biases of consumers.
- Clarification of the extent of the economies of scale and scope in banking.
- Understanding the effect of the new *fintech* competitors in the business model of banks and potential consequences for regulatory arbitrage.
- Specificities of competition and regulation in emerging economies.

Challenges for bankers

- Recover the trust of society.
- Operate with less implicit insurance and more capital, and in general with more intrusive regulation and heavy compliance.
- Maintain competitiveness against new market-based and digital-based competitors in a world where the funding advantage of banks with cheap deposits fades away.

Challenges for regulators and supervisors

- Sailing in the fog with no good instruments:
  - The basic foundations of regulation and supervision are not well developed as well as the robustness of models on which policy is based.
- The regulatory boundary problem through different entities, products and jurisdictions.
  - History has shown us repeatedly the effects of the emergence of parallel banking systems that escape regulatory control.
- Build reliable early indicators of crisis.
- Stay ahead of financial innovation.

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COMPETITION AND STABILITY IN BANKING

THE ROLE OF REGULATION AND COMPETITION POLICY

XAVIER VIVES

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