Bank competition and risk II

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Introduction

- Banks are dynamic firms (going concern)
  - They operate for more than one period
- Shocks (and regulations) can affect future rents
  - and in doing so today's decisions
- Understand possible divergences between short and long term effects
  - To do so we need a dynamic setup

Introduction - Bank Capital

- Brief introduction of effects of bank capital on risk
  - Skin in the game effect
    - $\uparrow$ capital $\rightarrow\uparrow$ losses for shareholders$\rightarrow\downarrow$risk taking
  - Franchise value effect (Blüm, 1999)
    - $\uparrow$ capital $\rightarrow\downarrow$ charter values for shareholders $\rightarrow\uparrow$risk taking
- Analyze Repullo (2004)
  - Dynamic setup + imperfect competition + capital regulation
  - Revisits discussion of Hellman Murdoch and Stiglitz (2000) which did not explicitly analyse competition (reduce form)

Repullo 2004 in a nutshell

- Main ingredients of model
  - Circular road model of the deposit market
  - Two types of assets: prudent and gambling
- Main results
  - Competition and risk-taking
    - High (low) margins $\rightarrow$prudent (gambling) equilibrium
    - Intermediate margins $\rightarrow$prudent + gambling equilibrium
  - Regulation (whole unit on this later)
    - Capital requirements and deposit rate ceilings can both ensure prudent equilibrium, possibly implying low deposit rates
    - If informationally feasible, risk-based capital requirements can dissuade risk-taking without affecting equilibrium deposit rates

Precedents of Repullo (2004)

- Bank regulation + imperfect competition:
  - Chiappori, Perez-Castrillo&Verdier (1995), Matutes &Vives (1996)
- Bank regulation + risk taking:
  - Furlong & Keeley (1989), Genotte & Pyle (1991), Rochet (1992), Besanko & Kanatas (1996)
- Bank regulation + imperfect competition + risk taking
  - 1. Static models: Keeley (1990), Matutes & Vives (2000)
  - 2. Dynamic models: Suarez (1994, unpublished treasure), HMS (2000)

Repullo (2004) - The model

- Infinite horizon (t = 0, 1, 2,...)
- $n > 2$ banks symmetrically located around a unit circle
  - would be the equilibrium position in a location game
- Each bank j receives a license at $t = 0$
  - License is withdrawn when bank is insolvent
  - If so, new bank enters the market$\longrightarrow$ always n competitors
- Continuum of overlapping generations of depositors uniformly distributed around the circle
  - Live for two dates: receive unit endowment in 1st date; want to consume in 2nd date
  - Subject to transport cost α per unit of distance
  - Basically using Salop (1979)

Repullo (2004) - Banks

- Banks' funding:
  - Banks compete for deposits offering rates r_j
  - Banks can raise capital from owners, who require rate of return ρ
- Regulatory background:
  - Banks must hold minimum capital k per unit of deposits
  - Bank deposits are fully insured (at a zero premium)
  - Deposit insurance is funded with lump-sum taxes
- Investment opportunities:
  - Prudent asset (P) with return μ_m
  - Gambling asset (G) with
    - High return μ_h with probability $1-\pi$
    - Low return μ_l with probability π

Repullo (2004) - Main assumptions

- Return assumptions

$$\mu_h > \mu_m > (1-\pi)\mu_h + \pi\mu_l$$

- Capital cost assumption

$$\rho > \mu_m$$

- Focus on symmetric equilibria
  - In equilibrium if market is covered each bank has $\frac{1}{n}$ deposits

Equilibrium characterization- Prudent

- Baseline case with the prudent asset only
- At each date t each bank j chooses
  - capital $k_j \geq k$ per unit of deposits
  - deposit rate r_j
- Demand for deposits of bank j when other banks offer r
  - Indifference condition for depositor at distance x

$$r_j - \alpha x = r_j - \alpha \left(\frac{1}{n} - x \right) \rightarrow x_j(r_j, r) = \frac{1}{2n} + \frac{r_j - r}{2\alpha}$$

- Demand function for bank j

$$D_j(r_j, r) = 2x_j(r_j, r) = \frac{1}{n} + \frac{r_j - r}{\alpha}$$

- Well behaved demand (Check reaction to prices)

Equilibrium characterization- Prudent

- Bank j problem

$$\underset{k_j, r_j}{Max} - kD_j(r_j, r) + \frac{1}{1+\rho}\left[D_j(r_j, r)\left[\mu_m - r_j + (1+\mu_m)k_j\right] + V_p\right]$$

- Foc for k_j (binding $k_j = k$)

$$-kD_j(r_j, r) + \frac{(1+\mu_m)}{1+\rho}D_j(r_j, r) < 0$$

- Foc for r_j

$$-\frac{k}{\alpha} + \frac{1}{1+\rho}\left[-\left(\frac{1}{n} + \frac{r_j - r}{\alpha}\right) + \frac{\left[\mu_m - r_j + (1+\mu_m)k\right]}{\alpha}\right] = 0$$

- applying symmetry ($r_j = r$)
- $r_j = r_p(k) = \mu_m - \frac{\alpha}{n} - \delta_P k$ ($\delta_P = \rho - \mu_m$)

Equilibrium characterization- Prudent

- In equilibrium the NPV generated per period is

$$\frac{1}{n}\left[-k+\frac{1}{1+\rho}\left[\mu_m - r_p(k) + (1+\mu_m)k\right]\right] = \frac{1}{1+\rho}\frac{\alpha}{n^2}$$

- Which implies that the charter value

$$V_p = \left[\frac{1}{1+\rho} + \frac{1}{(1+\rho)^2} + \frac{1}{(1+\rho)^3} + \ldots\right]\frac{\alpha}{n^2} = \frac{\alpha}{\rho n^2}$$

- is the present value of perpetual Salop profits

$$\begin{aligned} V_p &= \frac{1}{1+\rho}\left(\frac{\alpha}{n^2} + V_p\right) \\ \left(1-\frac{1}{1+\rho}\right)V_p &= \frac{1}{1+\rho}\frac{\alpha}{n^2} \rightarrow \left(\frac{\rho}{1+\rho}\right)V_p = \frac{1}{1+\rho}\frac{\alpha}{n^2} \\ V_p &= \frac{\alpha}{\rho n^2} \end{aligned}$$

Equilibrium characterization- Gambling

- Baseline case with the gambling asset only
- Bank j problem

$$\underset{k_j, r_j}{Max} - kD_j(r_j, r) + \frac{1-\pi}{1+\rho}\left[D_j(r_j, r)\left[\mu_h - r_j + (1+\mu_h)k_j\right] + V_p\right]$$

- Foc for k_j (binding $k_j = k$)

$$-kD_j(r_j, r) + \frac{(1-\pi)(1+\mu_h)}{1+\rho}D_j(r_j, r) < 0$$

- Foc for r_j

$$-\frac{k}{\alpha} + \frac{(1-\pi)}{1+\rho}\left[-\left(\frac{1}{n} + \frac{r_j - r}{\alpha}\right) + \frac{\left[\mu_h - r_j + (1+\mu_h)k\right]}{\alpha}\right] = 0$$

- applying symmetry $(r_j = r) \rightarrow r_j = r_G(k) = \mu_h - \frac{\alpha}{n} - \delta_G k$ $(\delta_G = \frac{1+\rho}{1-\pi} - (1+\mu_h))$
- competition makes gambling gains accrue to depositors

Equilibrium characterization- Gambling

- In equilibrium the NPV generated per period is

$$\frac{1}{n}\left[-k+\frac{1-\pi}{1+\rho}\left[\mu_h-r_G(k)+(1+\mu_h)k\right]\right]=\frac{1-\pi}{1+\rho}\frac{\alpha}{n^2}$$

- Which implies that the charter value

$$V_G=[\frac{1-\pi}{1+\rho}+\left(\frac{1-\pi}{1+\rho}\right)^2+\left(\frac{1-\pi}{1+\rho}\right)^3+...]\frac{\alpha}{n^2}=\frac{1-\pi}{\rho+\pi}\frac{\alpha}{n^2}$$

- Charter or franchise value= PV of up to 1st failure Salop profits

The general case (endogenous asset choice)

- Set $k_j = k$ and check for 2 possible types of symmetric equilibrium
- A prudent equilibrium exists if no bank finds it profitable to deviate to $(G,\ r_j')$ for one period

$$\underset{k_j, r_j}{Max} - kD_j(r_j, r_p(k)) + \tfrac{1-\pi}{1+\rho}\left[D_j(r_j, r_p(k))\left[\mu_h - r_j + (1+\mu_h)k\right] + V_p\right] \leq V_p$$

- Similarly a gambling equilibrium exists if

$$\underset{k_j, r_j}{Max} - kD_j(r_j, r_G(k)) + \tfrac{1}{1+\rho}\left[D_j(r_j, r_G(k))\left[\mu_m - r_j + (1+\mu_m)k\right] + V_G\right] \leq V_G$$

Main result

- Proposition 1: there are two critical values

$$m_P(k) = \frac{\mu_m - \mu_h - (\delta_G - \delta_P)k}{2(h-1)} \textit{ and } m_G(k) = hm_P(k)$$
$$\textit{where } h = \sqrt{\frac{\rho+\pi}{(1-\pi)\rho}} > 1$$

- such that
  - Prudent equilibrium exists if $\frac{\alpha}{n} \geq m_P(k)$
  - Gambling equilibrium exists if $\frac{\alpha}{n} \leq m_G(k)$
- Two insights
  - Lower n makes Prudent (Gambling) equilibrium more (less) likely
  - Higher k makes Prudent (Gambling) equilibrium more (less) likely
  - by more (less) likely we mean the region expands (contracts)

The proposition in a figure

- μ in the paper (figure) is α in slides

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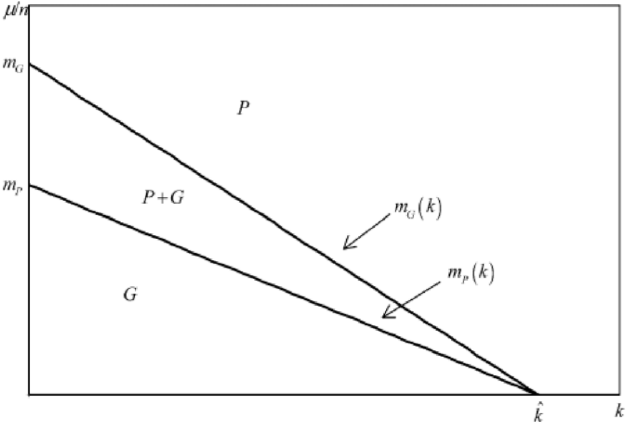

Extensions

- Risk based capital requirements $k_P = 0, k_G = k > 0$
- Proposition 2: there are two critical values

$$m'_P(k) = \frac{\mu_m - \mu_h - \delta_G k}{2(h-1)} \text{ and } m'_G(k) = h m_P(k)$$

$$\text{where } h = \sqrt{\frac{\rho + \pi}{(1-\pi)\rho}} > 1$$

- such that
  - Prudent equilibrium exists if $\frac{\alpha}{n} \geq m'_P(k)$
  - Gambling equilibrium exists if $\frac{\alpha}{n} \leq m'_G(k)$
- Insight
  - Risk based CR expand the region of existence of prudent equilibrium without reducing the prudent equilibrium deposit rates

Risk based capital requirements

- μ in the paper (figure) is α in slides

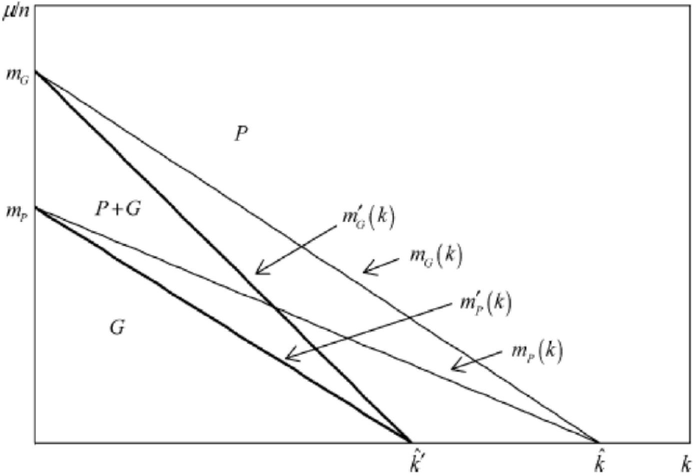

Fig. 2. Characterization of equilibrium with risk-based capital requirements.

Extensions deposit rate ceilings

- Two types of ceilings (assume $k = 0$):
  - Nonbinding if $\bar{r} \geq \bar{r}_P = \frac{\mu_m h^2 - \mu_h}{h^2 - 1}$
  - Binding if $\bar{r} \leq \bar{r}_P$
- Proposition 3 if $\bar{r} \geq \bar{r}_P$ there are two critical values $M_p(\bar{r})$ and $M_G(\bar{r})$ such that
  - Prudent equilibrium exists if $\frac{\alpha}{n} \geq M_p(\bar{r})$
  - Gambling equilibrium exists if $\frac{\alpha}{n} \leq M_G(\bar{r})$
  - If $\bar{r} \leq \bar{r}_P$ prudent equilibrium exists for all $\frac{\alpha}{n}$
- See paper for details and welfare comparisons with CR

Discussion

- The effect of CR on equilibrium deposit rates can offset the effect of capital regulation on franchise values
  - In this paper the charter value effect is zero!
- Risk based CR are better in controlling excessive risk taking (if feasible) than flat CR
- Deposit rate ceilings can also be useful (way to reduce effective competition)
  - But can have negative effects (excess entry over-investment in services)
- Supervisor could use the level of deposit rates as a signal of excessive risk taking
- Modelling choices imply full pass through to depositors