Capital Regulation and Risk Taking

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Advantages of equity funding

Among the advantages claimed for equity are that it

- reduces vulnerability to market freezes;
- reduces the risk of contagion;
- reduces the subsidy provided by deposit insurance;
- reduces the probability of a bailout;
- reduces risk shifting or asset substitution.

Outline

- Risk shifting revisited
- Target rates of return and "reaching for yield"
- Capital requirements in general-equilibrium
  - Gale and Ozgur
  - Hakenes and Schnabel
  - Martinez-Miera
  - De Nicolo and Lucchetta
- Conclusion

Risk shifting (Stiglitz and Weiss)

- A risk-neutral entrepreneur wants to undertake a risky venture that requires an investment of one unit.
- The entrepreneur has initial endowment $0 < w < 1$ and raises the rest of the funds needed in the form of debt from risk neutral investors.
- The probability of success is $p(R)$, where R is the payoff in the event of success.
- The opportunity cost of debt funding is one, so the participation constraint is $p(R)\, d = 1 - w$, where d is the face value of the debt.
- The project $\hat{R}$ is chosen to maximize $p(R)(R - d)$.

The optimal capital structure

- The efficient project R^* maximizes $p(R)R$:

$$p'(R^*)R^* + p(R^*) = 0.$$

- The FOC for $\hat{R}$,

$$p'(\hat{R})(\hat{R} - d) + p(\hat{R}) = 0,$$

  implies that

$$\hat{R} > R^* \text{ and } p(\hat{R}) < p(R^*).$$

- An increase in $w \Longrightarrow$ reduction in $d \Longrightarrow$ reduction in $\hat{R} \Longrightarrow$ increase in $p(\hat{R})$.

The cost of capital

- What is wrong with this picture?
  - exogenous supply of equity;
  - no opportunity cost of equity;
  - expected returns decreasing in R
- Admati and Pfleiderer: capital cannot be "expensive"
- Complete markets and the Modigliani-Miller Theorem
- Limited participation
- Outside options and the return on equity

Model of "return driven" asset substitution

- Equity is held by a large number of risk neutral investors.
- Debt is held by a large number of risk averse consumers.
- Banks invest in a constant return to scale investment technology. The return to a unit investment is $\tilde{R}$, where

$$\tilde{R} = \begin{cases} R & \text{w. prob. } p(R) \\ 0 & \text{w. prob. } 1 - p(R). \end{cases}$$

- The opportunity cost of investors' funds is

$$\rho > \sup_R p(R) R$$

Payoffs

- A bank raises one unit of deposits and k of capital. It invests $1+k$ units in the investment technology with return R.
- Deposits are fully insured at no cost to the bank; the return on deposits equals one.
- The bank's managers receive private benefits B if the bank survives and nothing otherwise.
- The managers choose the amount of capital k, the face value of deposits and the portfolio return R to maximize $p(R)B$ subject to the participation constraints

$$p(R)(R-d)(1+k) \geq \rho k \text{ and } d \geq 1.$$

The optimal capital structure

- Since capital is expensive and does not improve risk sharing (thanks to free deposit insurance), it is optimal to set $k = k_0$, where k_0 is the minimum amount of capital allowed under the Basel accords.
- The managers will set $d = 1$ and minimize R subject to the investors' participation constraint.

$$\begin{array}{ll} \min & R \\ \text{s.t.} & p(R)(R-1)(1+k_0) \geq \rho k_0. \end{array}$$

- $\hat{R}$ is lower than the level that maximizes $p(R)(R-1)$ so an increase in k_0 requires an increase in $\hat{R}$ to satisfy the participation constraint.

A "condominium" theory of banking

- The preceding example is very stark, but it suggests a general approach.
- Banking, as it has developed historically, requires people with very different risk tolerances to share the same institution.
- The problem is exacerbated by the transition from utility banking to casino banking, driven by high target returns on equity (Gordian Knot).
- Equity funding has benefits as well, e.g., improved risk sharing, but even then general-equilibrium effects may imply a positive relation between capital and risk.

Market failure and the need for capital regulation

- There are two functions of bank capital:
  - The *risk sharing function*;
  - The *incentive function*.
- These two functions can be **internalized**: financial institutions have incentives to adopt the optimal capital structure to improve risk sharing and reduce agency costs.
- A divergence between privately and socially optimal capital structure requires welfare-relevant **pecuniary externalities,** e.g., **incomplete markets.**
- Deposit insurance and risk shifting (Merton, 1977).

A model of intermediation

- There are three dates $t = 0, 1, 2$. Investments and contracting decisions are made at date 0; assets pay off and consumption occurs at dates 1 and 2.
- There are two assets, a short asset (storage) with return equal to one and a long asset with return $R > 1$ after two periods.
- Consumers (depositors) have Diamond-Dybvig preferences:

$$\lambda U(c_1) + (1 - \lambda) U(c_2)$$

where λ is random.

- All uncertainty is resolved at the beginning of the second date ($t = 1$).

Capital as an "input"

- We treat capital as an input, with opportunity cost ρ.
- Capital is provided by risk-neutral investors with preferences

$$-\rho k + e_1 + e_2,$$

where $k \geq 0$ is the amount of capital provided at date 0 and e_t is the dividend returned at date $t = 1, 2$.

- Capital is "expensive:"

$$\rho > R.$$

- Intermediaries offer completely contingent, incentive-compatible risk sharing contracts to consumers and equity contracts to investors, taking as given the opportunity cost of capital ρ.

Gale and Özgür (2005)

- At date 1, intermediaries are subject to idiosyncratic liquidity shocks.
- With incomplete markets and complete incentive-compatible contracts, equilibrium is *constrained inefficient*.
- *An increase in capital requirements may be welfare reducing, however*.
- **Intuition:** If risk aversion is "not too low," welfare improvement requires an increase in the asset price. To minimize the burden of meeting the opportunity cost of capital, the intermediary invests more in the long asset and less in the short asset, *lowering* the asset price.

Charter values

- The effect of charter value on risk taking is very similar to the effect of capital requirements.
- Thus, it is argued that competition can cause instability by reducing charter values (Keeley, Allen and Gale).
- Boyd and de Nicolo have argued that competition also reduces loan rates and hence the borrowers' incentive to take risks (Stiglitz-Weiss).
- So there is a tradeoff between risk shifting by banks and by firms.
- Hakenes and Schnabel use a model nesting both effects to investigate the effect of capital requirements.

Hakenes and Schnabel (2009)

- The setup is similar to Gale and Özgür, but there is no risk sharing (so banks hold the minimal amount required by regulation).
- Firms can choose the riskiness of their investments and banks can choose the correlation of loan returns.
- Increasing the capital requirement has three effects:
  - It reduces charter value and increases risk shifting.
  - It will lower the demand for deposits and hence lower the deposit rate (increasing the charter value and reducing the incentive to take on risk).
  - It will lower the supply of loans and hence increase the loan rate (causing borrowers to take on more risk).
- Under certain conditions, the net effect of higher capital requirements is to raise the riskiness of the bank's portfolio.

Martinez-Miera (2008)

- Martinez studies the effect of higher capital requirements in a one-factor model. Higher interest rates have two effects: they increase risk shifting by borrowers and raise buffers that offset potential losses.
- In Martinez's model, higher capital requirements reduce banks' leverage and, for a given asset risk, reduce the probability of bank failure.
- But higher capital requirements increase the cost of funding, which leads to higher loan rates and, possibly, riskier loans.
- Numerical simulations show that the relationship between capital requirements and the risk of bank failure is non-monotonic.

De Nicolo and Lucchetta

- There is a continuum of agents with an initial endowment qW, where $q \in [0, 1]$.
- The endowment can either be used to create $k \in (0, W)$ units of capital or can be invested in the banking sector.
- Bankers invest in projects that yield X per unit if successful and 0 otherwise.
- The probability of success p is a choice variable. Success requires effort.
- The division of returns is determined by the banks' ability to extract rents. This is measured by the return $\hat{R}$ per unit invested that is promised to investors.

Constrained efficiency

- Agents with low endowments, $q < q^*$, choose to be bankers; those with high endowments, $q > q^*$ choose to be investors.
- As $\hat{R}$ increases, the banks share of output falls. Fewer agents choose to be bankers and more choose to be investors and the economy-wide ratio of bank capital to assets *falls*; ...
- ... but economy-wide risk also *falls*, i.e., the probability of success increases.
- **Intuition:** As the ratio of bankers to investors falls, the *scale* of each bank increases. The increase in scale for each bank leads to greater efficiency both by reducing average fixed costs and increasing the banker's return *conditional on success*.

Conclusion

- Tougher capital requirements may have positive benefits:
  - it may reduce the consequences of freezes in the debt market;
  - it may encourage banks to become smaller to avoid "systemic" capital requirements;
  - it may reduce contagion, ...
- ... but can they be relied on to reduce the risk of bank portfolios?
- Other tools may be needed and, possibly, structural change (cf. Gordian Knot).