

Basel II and the Value of Bank Differentiation

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- Basel II - Pillar One: capital requirements
 - internal ratings-based (IRB) regulation and standard approach (SA)
- “Reactive” aspect of Basel II’s IRB approach:
 - banks develop internal rating systems (IRS) anyway
 - by validating systems, hope that banks share info with regulator
 - provide incentives to enhance IRS via reduced capital requirements
- 1st objective: What are effects on banking market structure?
- 2nd objective: incentives to invest in IRS
- 3rd objective: moral hazard of misreporting
- 4th objective: contribute towards Basel III discussion
 - emphasis on systemic risk of large banks

- Economies of scale in risk allocation
- Value of bank differentiation:
 - banks want to specialize in risk taking
 - It is also optimal that they do
 - banks with most advanced IRS should be large and riskfree
 - contain systematic risks in relatively small niche banks
- Two-layer approach of Basel II allows for differentiation by separating IRB-banks / SA-banks
- Agency problems of internal ratings make differentiation less attractive, but do not eliminate

- Literature on increase in risk-taking incentives and (pro-)cyclical effects of Basel II
- Little work on the two-layer approach: Repullo and Suarez (2004), Hakenes and Schnabel (2007)
- Moral hazard when using internal ratings, e.g. Morrison and White (2005), Dangl and Lehar (2004) and Pelizzon and Schaefer (2005)

- Two banks, A and B . Identical endowment of equity E
- Continuum of projects in economy, normalized to unit interval
- Two project types with mass $\frac{1}{2}$, requiring unit investment. Yield either $X > 2$ or 0 :
 - “uncorrelated” projects yield X with prob. $k > \frac{1}{2}$, i.i.d.
 - “correlated” projects yield X with prob. $\frac{1}{2}$, with systematic risk:
 - fraction t of correlated projects default, $t \in [0, 1]$, uniformly distributed
- Cost of bank default (for society): $z \cdot n^2$ ($n =$ portfolio size)
- Banks don't have an IRS, but can invest in IRS, at cost C_A and C_B , with $C_A < C_B$
- SA-banks (and ratings agencies, regulator) cannot distinguish between project types. But IRS-banks can.

- Basel II regulation: bank can submit IRS for approval. It is then regulated as an IRB-bank, otherwise as SA-bank.
- Bank regulator sets different capital requirements b_S , b_R for uncorrelated and correlated projects. For SA-banks, no distinction possible
- Regulator can also decide on subsidy or tax for IRB-approval
- There are non-bank financiers that will finance each project at $R = 2$, putting cap on rates.
- *Assumption*: $E < \frac{1-k}{2}$: bankruptcy risk unavoidable
- *Observation*: Use s to provide investment incentives, not b

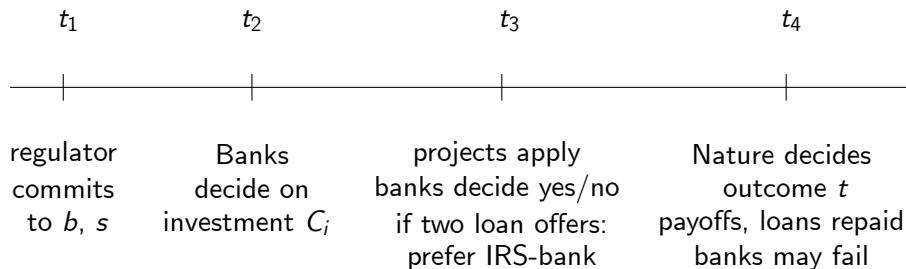


Figure 1: Time Line

Two SA-Banks

- Regulator chooses b_U that determines portfolio size, $n_u \leq \frac{E}{b_U}$.
- Bank will be insolvent if

$$\frac{n_u}{2} kR_U + \frac{n_u}{2} tR_U + E - n_u \geq 0.$$

- Defines bankruptcy threshold \tilde{t}_u and bank's (gross) profit

$$\Pi_u = (1 - \tilde{t}_u) \left(\frac{n_u}{2} kR_U + \frac{n_u}{2} E [t | t > \tilde{t}_u] R_U + E - n_u \right).$$

Proposition

Each SA-bank funds fully mixed portfolio of $n_u \geq \frac{1}{2}$.

It faces positive bankruptcy risk and it finances the maximal number of projects $n_u = \frac{1}{2}$ for small enough z .

Choice of Loan Portfolio of IRS-Bank

- Bank finances n_S uncorrelated and $n - n_S$ correlated projects. Yields profit

$$\Pi^i = (1 - \tilde{t}^A) \left(2kn_S^2 + 2E[t|t > \tilde{t}] \left(n^A - n_S^A \right) + E - n^A \right)$$

- Safe projects generate deterministic return, like increase in equity E

Lemma

Bank strictly prefers either uncorrelated projects (cherry-picking) or correlated projects (risk-shifting).

- *Intuition:* with failure risk, bank profit is a *call option* on true value of loan portfolio
 - Value of call option a convex function of risk choice. There is no interior solution.

Observable Loan Portfolios: One IRB-Bank

- *Observable Portfolios*: regulator fully monitors IRB-bank portfolio
- With one IRB-bank, one SA-bank, regulator can implement any allocation via capital requirements (b_R, b_S, b_U)

Proposition

IRB-bank finances $n^A = E + k$ projects (all safe and some risky) and has no bankruptcy risk. SA-bank funds only risky projects.

If z small, SA-bank has failure risk, funds $n^B > E$ correlated projects.

If z large, SA-bank risk-free, funds $n^B = E$ correlated projects.

- *Insight*: failure risk increases concavely in correlated projects
 - Economies-of-scale effect in risk allocation, regulator *and* banks prefer that banks specialize
- Advantage of Basel II is that it allows to differentiate
 - IRB-bank's pick of uncorrelated projects deteriorates remaining pool

Proposition

Portfolios and profits are equal. Each bank funds half of all uncorrelated projects and an equal number of all correlated projects.

Portfolio of correlated projects decreasing in z . All projects financed if z small enough., both banks risk-free if z very large.

- regulator would prefer to shelter as many projects as possible from bankruptcy risk, by allocating them to one bank that remains default-free.
- However, no longer feasible with 2 IRB-banks.

Proposition

Regulator's preferred allocation is one IRB-bank, followed by two IRB-banks and two SA-banks.

More projects funded with one IRB-bank than with two IRB-banks.

- Drawback with 2 IRB-banks or 2 SA-banks: regulator cannot differentiate between capital requirements.
- Accounting for investment costs C_A determines overall efficiency. Bank A's and regulator's preferences typically not aligned.

Proposition

The regulator can always implement the optimal outcome, with either taxes (overinvestment scenario) or subsidies (underinvestment scenario).

Unregulated Investment

- Banks might invest in an IRS *without* requesting an IRB-license.
- Similar to Basel I: regulator cannot differentiate
- If Bank *A* makes unregulated investment, it might get larger profit than as SA-bank, $\Pi^A - \Pi_u > C_A$.
- This may imply *overinvestment* from social point of view
- Regulator's best response: accommodate investment with subsidy:
 - implement one IRB-bank (two IRB-banks) whenever one (two) banks would otherwise invest in an IRS
- Unregulated investment does not occur in equilibrium, but bank can force regulator into accommodation
 - rationale for the “reactive” element in Basel II Accord

Unobservable Loan Portfolios: One IRB-Bank

- Unobservable = moral hazard: IRB-bank misrepresents true risk. Consider extreme case in which regulator observes nothing.
- IRB-banks always report project type with lowest capital requirement. Differentiating capital requirements now meaningless

Lemma

Bank A chooses cherry-picking if $n^A \leq \bar{n}^A$ and risk-shifting if $n^A > \bar{n}^A$. Threshold \bar{n}^A is strictly increasing in E and k .

Proposition

If E and k sufficiently large: set $n^A = E + k$. Bank A cherry-picks and risk-free.

Intermediate values of E and k : set $n^A < E + k$. Bank A cherry-picks and risk-free.

If E and k small: regulator allows risk-shifting. Bank A funds only correlated projects, Bank B identical in size.

Unobservable Loan Portfolios: Two IRB-Banks

- Impossible to implement different capital requirements. Effective capital requirement b_I will be identical, hence $n^A = n^B$. Thresholds and different regions similar to One IRB-bank.
 - Same outcome as with two IRS-banks that undertake unregulated investments.
- Comparing efficiency with 1 IRB-bank, 2 IRB-banks and 2 SA-banks:

Proposition

Welfare (disregarding C_A and C_B) is highest with one IRB-bank if E and k large, and welfare is highest with two SA-banks if E and k low. Choice ambiguous for intermediate values.

- Optimal regulation: as with observable portfolios, regulator can implement preferred outcome.

- Endogenous bank equity: quadratic cost of raising bank equity.
 - Regulator micromanages optimal capital E_A, E_B .
 - if One IRB-bank optimal, optimum is $E_A > E_B$, otherwise $E_A = E_B$.
- Robustness to variation in bankruptcy costs (linear case)
- Addressing procyclicality of Basel II
- More than two banks

- Economies of scale in absorption of systematic risk
- Value of bank differentiation
 - Possibly true benefitvalue of the transitory regime of two-layer approach may be there
- Analysis of three aspects of Basel II
 - Market structure in banking: banks with IRS systems will benefit, SA-banks become correlated niche players
 - Incentives to invest can be optimized via subsidies/taxes
 - moral hazard of misreporting weakens role of bank differentiation, but does not eliminate it.
- Contribution to Basel III debate: instead dismantling large banks, identify best practice banks, give them incentives to become large and safe.