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Bigger is not Always Safer: A Critical Analysis of the Subadditivity Assumption for Coherent Risk Measures

Hans Rau-Bredow

Motivation

- **Artzner et al. (1999): Theory of "coherent" risk measures, key condition is *subadditivity*:**

  The risk of a banks' portfolio is less than or equal to the sum of the risks of its parts.

- **It is generally believed that subadditivity is a self-evident requirement for a risk measure.**

- **The theory of coherent/subadditive risk measures has even lead to changes in the Basel regulatory framework.**

- **But consider SIFIs: The risk of a SIFI is higher(!) than the sum of the risk of its parts.**

Agenda

- **Coherent Risk Measures**
- **Subadditivity and Bank Mergers**
- **Subadditivity and Deposit Insurance**
- **Subadditivity and Contagion Risk**
- **Summary and Outlook**

Coherent Risk Measures (Artzner et al. (1999))

- **Translation invariance:** $\rho(X + C) = \rho(X) - C$
- **Monotonicity:** $Y \geq X \Rightarrow \rho(Y) \leq \rho(X)$
- **Homogeneity:** $\rho(\lambda X) = \lambda\, \rho(X)$
- **Subadditivity:** $\rho(X + Y) \leq \rho(X) + \rho(Y)$

Consolidated balance sheet of euro area Monetary Financial Institutions as of December 2018 (EUR trillions)

Assets	27.0	Capital and reserves	2.7
		(Other) Liabilities	24.3

- **On the most aggregated level, there is obviously no diversification effect.**

- **Losses to the banking system as a whole can't be reduced through diversification. A merger would only change the structure of the liability side, but not the size of the consolidated balance sheet.**

- **Losses are first absorbed by the capital of the institution that has granted those loans. If that capital is wiped out, creditors have to bear the remaining losses. Other banks are not liable for these losses.**

- **After a merger, the combined capital of both banks is liable for any potential losses. This should be beneficial for bank creditors, but at the expense of bank owners.**

Formal Analysis

X = asset value of a bank, D = total nominal debt

Payoff to bank creditors: $\min(X,D)$

Payoff to bank owners: $X - \min(X,D) = \max(0,X - D)$

We can compare payoffs in the stand-alone case (left side) and in case of a merger (right side):

$$\min(X_1, D_1) + \min(X_2, D_2) \leq \min(X_1+X_2, D_1+D_2)$$

$$\max(0, X_1-D_1) + \max(0, X_2-D_2) \geq \max(0, X_1+X_2-D_1-D_2)$$

Bank Mergers and Bank Solvency

Bank A	**Bank B**	**{ A + B }**
solvent	solvent	solvent
solvent	insolvent	?
insolvent	solvent	?
insolvent	insolvent	insolvent

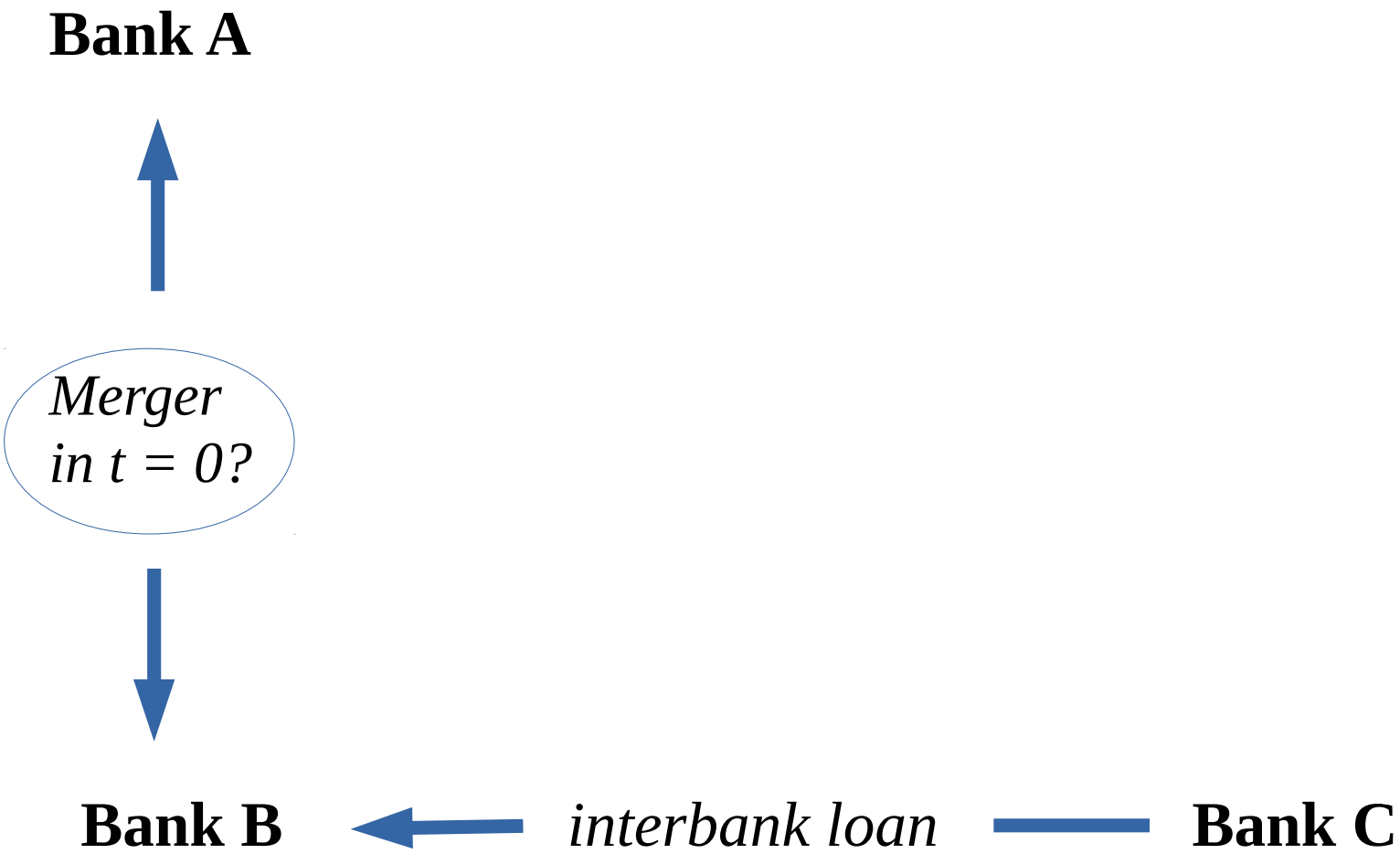
Does a merger provide extra risk for a deposit insurance scheme?

- **Under the hypothetical assumption of fully insurance, a merger would always result a in lower compensation having to be made by the deposit insurance scheme.**

- **But consider a merger between a commercial bank and an investment bank: Large losses in the investment banking part could then require compensation payments by the scheme.**

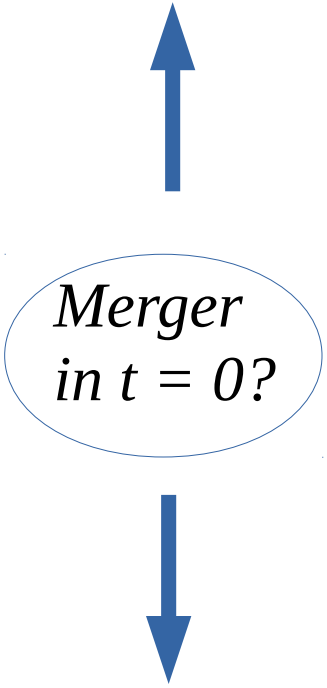
- **As I show in my paper, a merger could result in higher payouts by the scheme even if banks are exclusively funded by insured retail deposits, if deposits are only insured up to a certain amount (e.g. 100,000 €).**

Contagion Risks



In t = 1: Write-down of assets of bank A and/or bank B

Contagion Risks



Bank A	Bank B	{ A + B }
solvent	solvent	solvent
solvent	insolvent	?
insolvent	solvent	?
insolvent	insolvent	insolvent

Bank B ← *interbank loan* — **Bank C**

In t = 1: Write-down of assets of bank A and/or bank B

Summary and Outlook (1 of 2)

- **A merger is always beneficial for all bank creditors combined (but not necessarily for every single creditor) and detrimental for bank owners.**

- **Bank mergers could lead to higher payouts by the deposit insurance scheme.**

- **Bank mergers could lead to higher contagion risks.**

=> ***A subadditive risk measure, by definition,***

does <u>not</u> account for such increased risks

Summary and Outlook (2 of 2)

- **At first sight, it seems that a different approach is needed to ensure that a risk measure always accounts for the supposed risk reducing effects of diversification.**
- **But what is diversification?**
- **A more diversified bank portfolio could result in a higher(!) default probability of a bank.**
- **More diversification does not always increase the stability of the banking system.**