

Optimal Risk Weights

Macro Field Paper Presentation - First Round

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- Moral hazard leads banks to take on excessive credit risk resulting in bank failures hampering credit availability, financial stability, and economic activity (Romer and Romer 2017).
- **Broad research question:** How should bank regulation address moral hazard?

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- A bank invested in Treasuries and mortgages has lower risk weighted assets and needs to hold less capital than a comparable bank invested in corporate debt.
- RBC requirements aim to address moral hazard by forcing banks to have ‘skin in the game’ and internalize the social costs of bank failures.

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 - ▶ Possibly a blunt way to address gaming by banks?

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Given this trade-off between information and incentives,

- ▶ How do different rules about risk weights change the probability of bank failure and the quantity of credit?
- ▶ What are optimal risk weights?
- ▶ To what extent does the Basel III approach balance this trade-off?

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Develop a two-period model in the spirit of Allen and Gale (2000), Boyd and De Nicolo (2005), and Kareken and Wallace (1978):

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- Extend to dynamic setting to incorporate reputation effects (in the spirit of DAVIS and Kirpalani 2020).

Basel I Risk Weights

Risk Weight (%)	Asset types
0	Cash, bullion, Treasuries
20	MBS with AAA rating
50	Municipal bonds, residential mortgages
100	Corporate debt

The framework of weights has been kept as simple as possible and only five weights are used.

Basel (1988)

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 - ▶ These models are designed and calibrated by banks and then the estimates are approved by the bank supervisor.

Behn, Haselmann, and Vig (forthcoming)

- Use loan-level data from Germany to study the introduction of capital requirements using internal-rating based (IRB) risk weights.
- They find that banks systematically underreported risk.
- Banks with higher gains from underestimating risks underestimate risks more.
- Larger banks benefit from IRB more than smaller banks.

Back

References

Allen, Franklin and Douglas Gale (2000) “Comparing Financial Systems,” Cambridge, MA: The MIT Press, Chapter 8.

Basel Committee on Banking Supervision (1988). “International Convergence of Capital Measurement and Capital Standards.” <https://www.bis.org/publ/bcbs04a.pdf>

Basel Committee on Banking Supervision (2006). “Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework.” <https://www.bis.org/publ/bcbs128.htm>

Basel Committee on Banking Supervision (2011). “Basel III: A global regulatory framework for more resilient banks and banking systems.” <https://www.bis.org/publ/bcbs189.htm>

Behn, Markus, Rainer Haselmann, and Vikrant Vig (forthcoming). “The Limits of Model-Based Regulation.” *Journal of Finance*.

Boyd, John H. and Gianni De De Nicolo (2005) “The Theory of Bank Risk-Taking and Competition Revisited”, *Journal of Finance*, 60, p. 1329-43.

Gordy, Michael and Eric Heitfield (2012). “Risk-Based Regulatory Capital and Basel II,” *The Oxford Handbook of Banking* (1 ed.) Edited by Allen N. Berger, Philip Molyneux, and John O. S. Wilson.

Romer, Christina, and David Romer “New Evidence on the Aftermath of Financial Crisis is Advanced Countries.” *American Economic Review* 107 (10).