

Liquidity Regulation and Shadow Banking in a Dynamic Equilibrium Model

Chao Huang¹; Kunpeng Tang²; Jiayi Liu³; Ruiqi Zhang⁴

¹Beijing Jiaotong University, ²Peking University, ³Beijing Jiaotong University, ⁴Beijing Jiaotong University

Abstract

We develop a tractable dynamic equilibrium model to examine the joint impact of liquidity regulation and shadow banking on the real economy and social welfare. Our findings suggest that these regulatory measures may have divergent effects, indicating that they should be implemented in a coordinated macro-prudential manner. We also show that regulatory outcomes depend on various economic frictions and differ across economies, implying that such policies should be tailored to specific contexts. Our study provides new insights for the design of banking regulations and macro-prudential policies

Introduction

Liquidity regulation and shadow banking are often analyzed separately, overlooking their dynamic interactions within the broader financial system. This paper develops a dynamic equilibrium model to examine how liquidity rules interact with shadow banking activities, deposit insurance, and monetary policy. The framework endogenizes bank and non-bank behavior, asset flows, and regulatory arbitrage, offering new insights into the design of macroprudential policy. Results highlight the need for adaptive liquidity requirements and coordinated policy to mitigate systemic risk and promote stability.

The Model

This model analyzes interactions between banking regulations and deposit insurance in a two-period economy with banks, households, producers, and a government.

Banks

Banks issue deposits D (face value) to at gross return r and capital C , using funds to purchase loans L (subject to default) at rate R and government bonds B_b . Balance sheet constraint is:

$$C + \frac{D}{r} = L + B_b$$

Profits at time 2 :

$$\pi_b = \varepsilon + (\Omega_p R - 1)L - \left(1 - \frac{1}{r}\right)D - \xi \max\left\{0, \frac{\lambda D}{r} - B_b - \frac{B_h}{r_G}\right\} - \chi C$$

subject to capital and liquidity requirements:

$$C \geq \sigma L, \iota < \rho D$$

where $\Omega_b = Pr[\pi_b > 0]$ indicates solvency.

Households

Households allocate endowment E to consumption, government bonds B_h , and bank deposits (pay $\frac{D}{r}$ for claim D).

Utility is:

$$U_h(C_1, C_2) = \log C_1 + C_2$$

with budget consumptions:

$$C_1 = E - B_h - \frac{D}{r}, C_2 = (1 - \lambda) \left[\Omega_b D + \frac{1}{r} (1 - \Omega_b) D \right] + B_h + \frac{\lambda D}{r} - \frac{1}{2} \phi(\lambda D)^2 - T$$

Early withdrawals incentive constraint:

$$(1 - \lambda) \frac{D}{r} \leq \omega \Omega_p L + B_b + \delta \frac{D}{r}$$

Producers

Producers supply labor N_1 (output = N_1), use loans L to purchase deposits or produce capital k_p , with productivity shock τ .

Profit:

$$\pi_p = \max \left[0, \left(\tau - \frac{\varepsilon}{2} k_p \right) k_p - RL \right]$$

Utility:

$$U^p(N_1, \pi_p) = \log(n - N_1) + r\theta N_1 + \max(0, \pi_p)$$

subject to:

$$k_p \leq L + (1 - \theta)^2 N_1$$

Government

Issues bonds B_h and B_b , provides liquidity intervention at rate r_G , and levies lump-sum tax $T = c(1 - \lambda)(1 - \Omega_b)D$ for bank resolution costs.

Equilibrium

Agents maximize objectives subject to constraints, with market clearing $N_1 = C_1$.

References

- Amador, M., & Bianchi, J. (2024). Bank runs, fragility, and credit easing. *American Economic Review*, 114(7), 2073-2110.
- Bank for International Settlements (BIS). 2010. 'Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems.' Report Committee on Banking Supervision. 2011. Basel III: A global regulatory framework for more resilient banks and banking systems. 2013. Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools.
- Dávila, E., & Goldstein, I. (2023). Optimal deposit insurance. *Journal of Political Economy*, 131(7), 1676-1730.

Data

- Model calibrated to US economy (2000–2024) using FRED, FDIC, and Basel III data.
- Key parameters preset; others aligned with empirical moments (e.g., bank failures, deposit rates).
- Model fits targeted moments well and yields plausible untargeted results.
- Valid for evaluating banking regulations and deposit insurance policies.

Quantitative Results

Capital Requirements and Deposit Insurance

Higher capital requirements reduce bank stability. Banks increase lending per deposit, lowering capital buffers and raising default risk. Deposit insurance raises lending but reduces deposits. Early withdrawals decrease with insurance but rise with capital rules. Welfare gains outside banking require coordinated policy design.

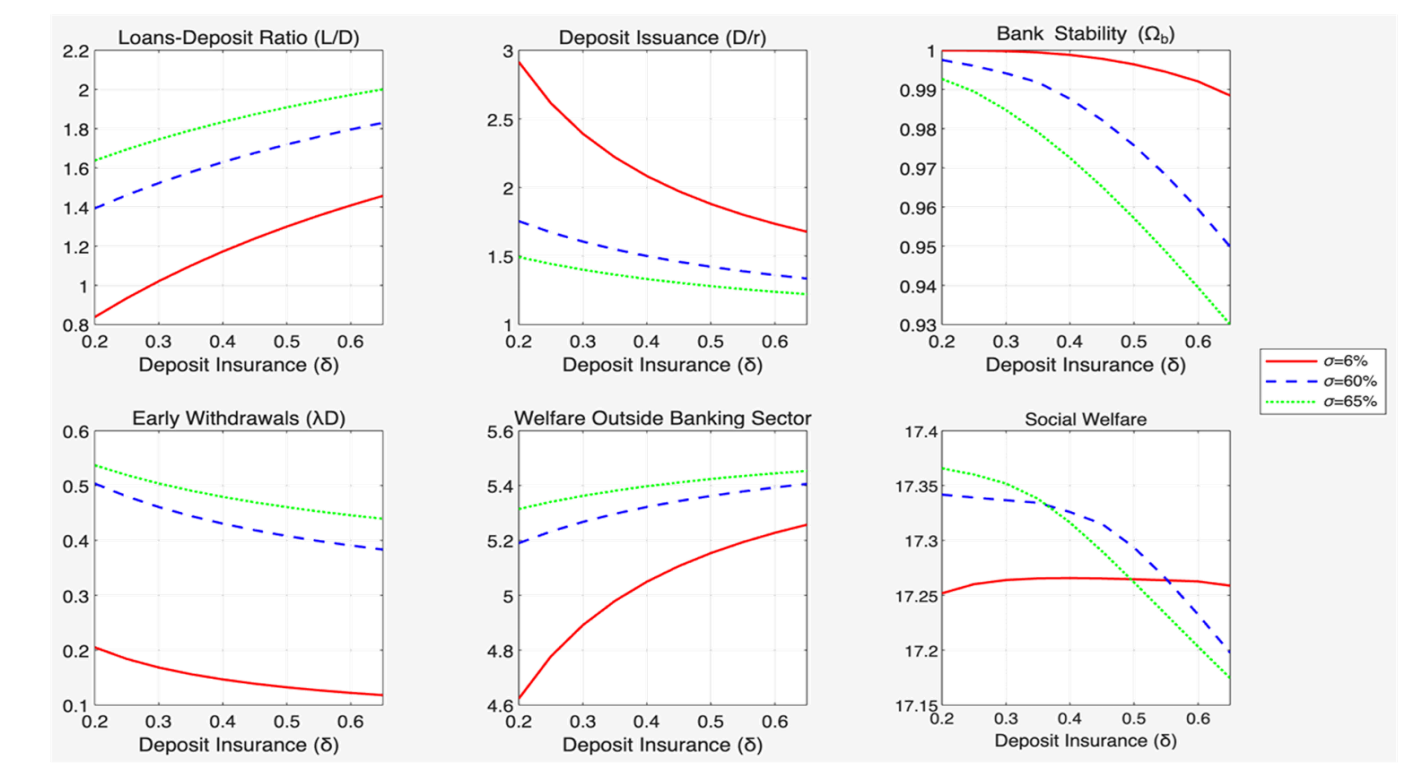


Figure 1 Capital Requirement and Deposit Insurance
This figure presents the impact of interaction between capital requirement and deposit insurance on *Loans-Deposit Ratio* (top-left), *Deposit Insurance* (top-center), *Bank Stability* (top-right), *Early Withdrawals* (bottom-left), *Welfare Outside Banking Sector* (bottom-center) and *Social Welfare* (bottom-right). We compare these impacts under three regulatory regimes, i.e., when the capital requirements are set at $\rho = 6\%$, $\rho = 60\%$, and $\rho = 65\%$, respectively.

Liquidity Requirements and Deposit Insurance

Higher liquidity requirements raise deposit issuance and enhance bank stability by reducing early withdrawals. Deposit insurance increases lending but reduces deposits. Optimal combination: 40% deposit insurance with 98% liquidity ratio maximizes social welfare.

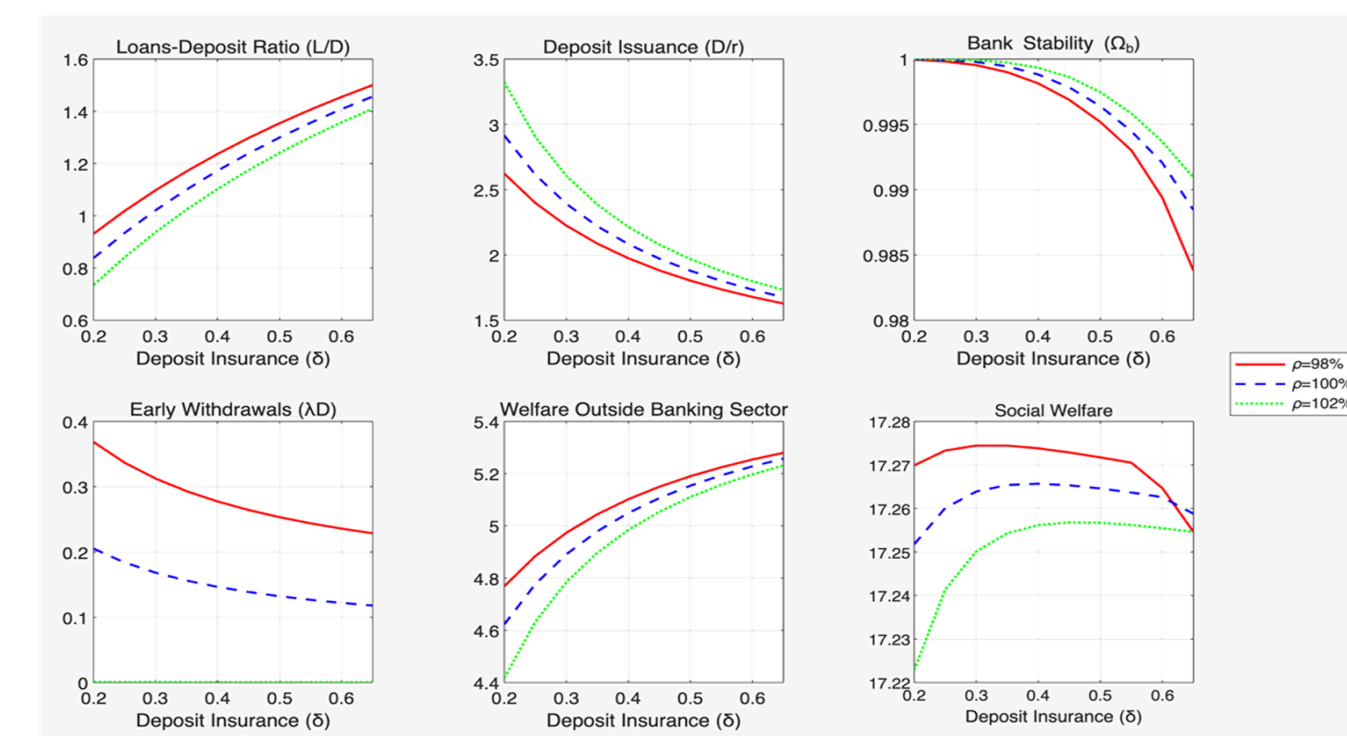


Figure 2 Liquidity Requirement and Deposit Insurance
This figure presents the impact of interaction between liquidity requirement and deposit insurance on *Loans-Deposit Ratio* (top-left), *Deposit Insurance* (top-center), *Bank Stability* (top-right), *Early Withdrawals* (bottom-left), *Welfare Outside Banking Sector* (bottom-center) and *Social Welfare* (bottom-right). We compare these impacts under three regulatory regimes, i.e., when the liquidity requirements are set at $\sigma = 98\%$, $\sigma = 100\%$, and $\sigma = 102\%$, respectively.

Liquidity Weights and Deposit Insurance

Stricter loan liquidity weights reduce deposits and increase lending. Deposit insurance improves stability but aggressive haircuts harm welfare. Optimal liquidity weight is 50% for social welfare.

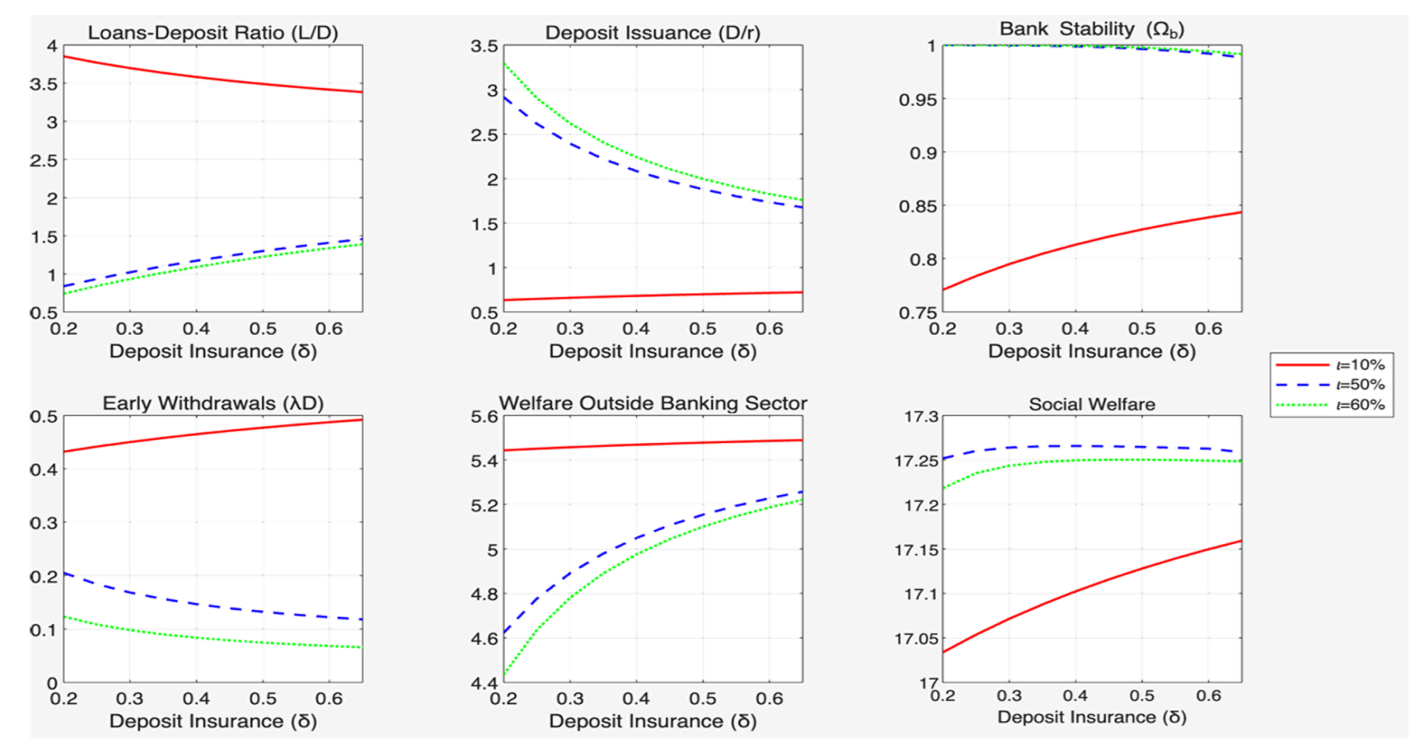


Figure 3 Liquidity Weight and Deposit Insurance
This figure presents the impact of interaction between required liquidity weight and deposit insurance on *Loans-Deposit Ratio* (top-left), *Deposit Insurance* (top-center), *Bank Stability* (top-right), *Early Withdrawals* (bottom-left), *Welfare Outside Banking Sector* (bottom-center) and *Social Welfare* (bottom-right). We compare these impacts under three regulatory regimes, i.e., when the liquidity weights are set at $\iota = 10\%$, $\iota = 50\%$, and $\iota = 60\%$, respectively.

Interest Rates and Deposit Insurance

Lower deposit rates enhance stability and reduce deposits. Higher deposit rates improve non-banking welfare but reduce social welfare. Loan rate hikes lower social welfare by raising financing costs. Deposit insurance effects are rate-dependent.

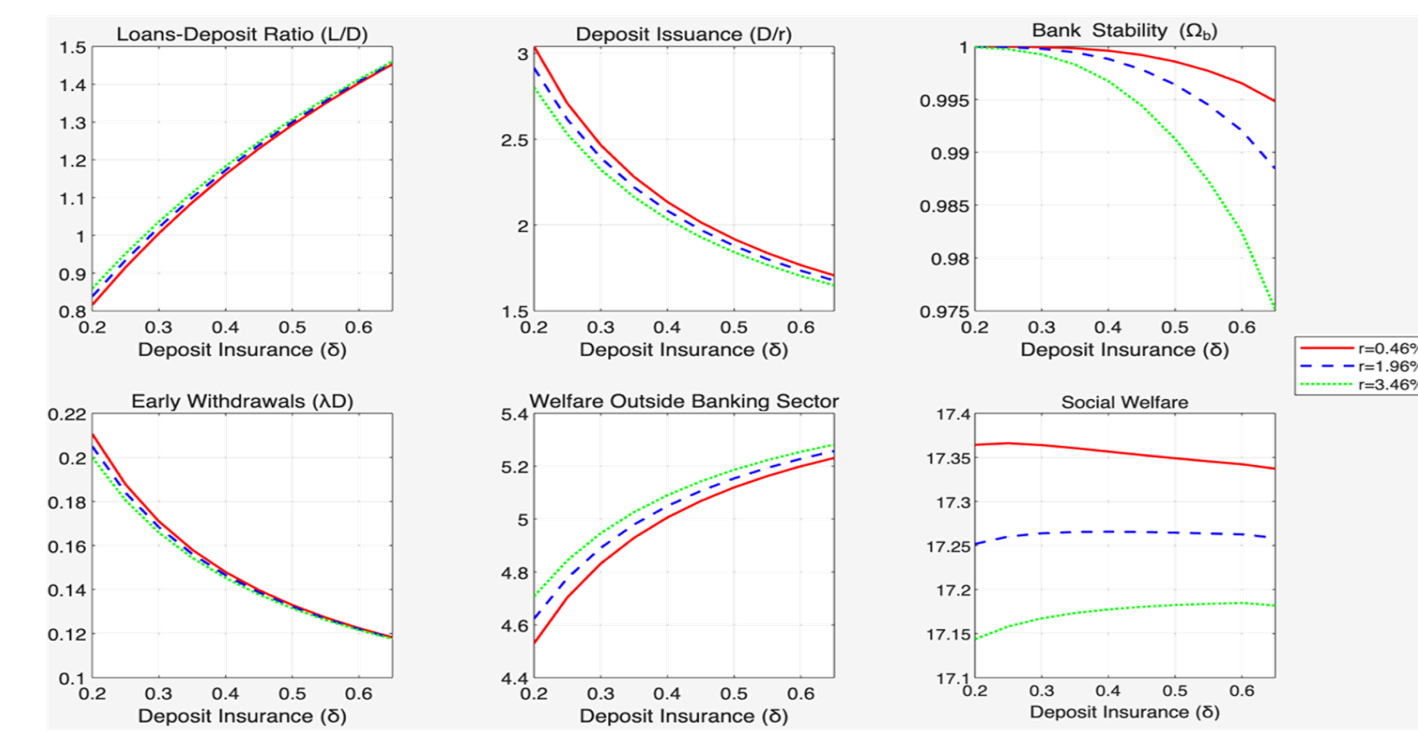


Figure 4 Deposit Rate and Deposit Insurance
This figure presents the impact of interaction between deposit rate and deposit insurance on *Loans-Deposit Ratio* (top-left), *Deposit Insurance* (top-center), *Bank Stability* (top-right), *Early Withdrawals* (bottom-left), *Welfare Outside Banking Sector* (bottom-center) and *Social Welfare* (bottom-right). We compare these impacts under three pre-set deposit rates, i.e., when the rates are set at $r = 0.46\%$, $r = 1.96\%$, and $r = 3.46\%$, respectively.

Extension

Banking Regulation and Social Welfare

Social welfare $SW = \Pi_b + U_h + U_p + T$. Optimal loan volume L balances bankruptcy costs against bank revenues and externalities. Deposit rate r affects stability and sectoral revenues. Loan rate R reduces welfare by discouraging production. Optimal deposit level D depends on frictions χ and ξ .

Deposit Insurance and Social Welfare

Insurance coverage δ interacts ambiguously with L and r , depending on moral hazard and externalities. Higher δ may justify higher r if illiquidity costs are low. Optimal δ varies with economic frictions, requiring tailored policies.

Conclusions

- ★ Our dynamic equilibrium model incorporates banks, shadow banking entities, households, and regulators.
- ★ It endogenously solves for shadow banking activities, funding flows, and financial stability outcomes.
- ★ Liquidity regulation significantly affects shadow banking expansion and systemic risk.
- ★ Macroprudential coordination between banking and shadow banking regulations enhances stability.
- ★ The study provides insights for designing liquidity rules and monitoring shadow banking.