



Optimal liquidity management and bail-out policy in the banking industry

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Abstract

We characterize the profit-maximizing reserves of a commercial bank, and the generated probability of a liquidity crisis, as a function of the penalty imposed by the Central Bank, the probability of depositors' liquidity needs, and the return on outside investment opportunities. We demonstrate that banks do not fully internalize the social cost associated with the bail-out policy if the liquidity needs of individuals are correlated, and that competitive inter-bank markets will induce banks to raise their reserves under reasonable conditions. The marginal benefits from an interbank market decrease as the correlation between the liquidity shocks of banks increases.

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1. Introduction

The literature on demand deposits has focused on liquidity crises generated by expectation-driven panics, but it has not offered any general method for calculating the probability of bank runs generated by a realization of liquidity needs by a large, but finite, number of depositors. Therefore, in this article we propose a method for calculating the probability of realizing a liquidity crisis and we characterize banks' optimal reserve ratio assuming that depositors face *real* liquidity needs as opposed to

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rumors or panics concerning a liquidity crisis. We determine the optimal response of a commercial bank to the interest rate (penalty rate) at which the Central Bank offers liquidity. We further delineate the socially optimal bail-out policy and show that the commercial bank does not fully internalize the social costs of a liquidity crisis. In particular, we establish that the socially optimal penalty rate is increasing in the correlation of the liquidity shocks facing depositors. Finally, we explore the implications of interbank markets. We prove that access to an interbank market will typically induce competing banks to raise their reserve holdings, as the interbank market offers an opportunity to benefit from potential liquidity needs of competing banks in a situation where the bank has excess reserves. However, the marginal benefits to banks from an interbank market are shown to decrease in response to an increase in the correlation between the liquidity shocks of banks.

The existing banking literature views the depository institutions as “pools of liquidity” providing consumers with insurance against idiosyncratic liquidity shocks. In the influential model by Diamond and Dybvig (1983), banks provide liquidity to depositors who are, *ex ante*, uncertain about their intertemporal preferences with respect to consumption sequences. They demonstrate how deposit contracts offer insurance to consumers and how such contracts can support a Pareto efficient allocation of risk. However, as they show, there exists a second, inefficient Nash equilibrium where the interaction between pessimistic depositor expectations generates a liquidity crisis. Such liquidity crises confronting individual banks may trigger socially costly bank panics. Against this background, most countries apply explicit or implicit deposit insurance policies as a mechanism for the elimination of inefficient Nash equilibria driven by pessimistic expectations. Despite the indisputable insurance benefits, empirical observations as well as theoretical research convincingly demonstrate how federal deposit insurance will encourage banks to engage in excessive risk taking and to keep lower levels of liquid reserves than what would be socially optimal (cf. Cooper and Ross, 1998). Consequently, researchers have systematically investigated mechanisms other than deposit insurance as instruments for reducing the instability of the banking system. Bhattacharya et al. (1998) categorize those regulatory measures.¹ In addition, all policy commitments relative to distressed financial institutions face a severe time-consistency problem as governments and Central Banks seem to have an incentive of bailing out distressed financial institutions with the intention of eliminating potential contagion problems (e.g. Chen, 1999). Freixas (1999) investigates such bail-out policies.

A meaningful evaluation of all policy measures directed towards the banking industry rely on the knowledge of how *ex-ante* uncertain liquidity needs translate into probabilities of realizing liquidity crises and of how the characteristics of this transmission mechanism interacts with banks' optimal allocation of their portfolios between liquid low-yield assets and illiquid high-yield investments. In this paper we

¹ Cordella and Yeyati (1999) offer a particularly rich study of bail-out policies which are designed to be contingent on the realization of well-specified states of nature. They show that such bailout policies might induce a risk-reducing value effect which can be so strong so as to outweigh the well-known moral hazard effect.

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