



# The dark side of liquidity creation: Leverage and systemic risk



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## ABSTRACT

We consider a model in which the threat of bank liquidations by creditors as well as equity-based compensation incentives both discipline bankers, but with different consequences. Greater use of equity leads to lower ex-ante bank liquidity, whereas greater use of debt leads to a higher probability of inefficient bank liquidation. The bank's privately-optimal capital structure trades off these two costs. With uncertainty about aggregate risk, bank creditors learn from other banks' liquidation decisions. Such inference can lead to contagious liquidations, some of which are inefficient; this is a negative externality that is ignored in privately-optimal bank capital structures. Thus, under plausible conditions, banks choose excessive leverage relative to the socially optimal level, providing a rationale for bank capital regulation. While a blanket regulatory forbearance policy can eliminate contagion, it also eliminates all market discipline. However, a regulator generating its own information about aggregate risk, rather than relying on market signals, can restore efficiency and market discipline by intervening selectively.

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“Any observed statistical regularity will tend to collapse once pressure is placed upon it for control purposes”.

Goodhart (1975)

## 1. Introduction

In ensuring that the risk of the financial system as a whole stays at “prudent” levels, regulators are tasked to meet two forms of regulatory challenges. One is *micro-prudential regulation*, which needs to ensure that risk-taking at the individual bank level is not excessive. The other is *macro-prudential regulation*, which seeks to contain the *systemic risk* that banks may be excessively exposed to collective failure. To date, these two forms of regulation have been typically dealt with in isolation of each other, especially in policy debates. Micro-prudential regulation aims to contain the distorted incentives of banks to make choices that maximize the value of bank shareholders' risk-shifting (or asset-substitution) options, especially in the presence of regulatory put options like deposit insurance.<sup>1</sup> Macro-prudential regulation, on the other hand, focuses

on containing the risk of events like systemic capital and liquidity shortages, manifesting as fire sales and the freezing up of asset markets. Macro-prudential regulation also examines ways in which regulatory interventions like bank bailouts can prevent (or engender) such occurrences and contain (or aggravate) their adverse impact. But since both forms of regulation ultimately seek to enhance financial system stability, a natural question that arises is: what are the micro foundations that possibly link these two forms of regulation? In this paper, we show that not only micro-prudential and macro-prudential regulation affect each other, but that in fact there is a fundamental tension between the two.

Let us explain. Previous papers have noted that uninsured bank debt can increase market discipline and thereby enhance bank loan quality and/or liquidity creation.<sup>2</sup> This notion is also codified in

deposit insurance, a bank has an economic incentive to invest in riskier assets and choose relatively low amounts of capital in its capital structure. This means regulatory monitoring of individual banks is necessary to control excessive risk taking designed to exploit deposit insurance.

<sup>2</sup> Calomiris and Kahn (1991) were the first to formally argue that monitoring by uninsured depositors can result in a bank manager who is making imprudent asset choices being exposed to the threat of a bank run, and that this can induce the manager to shy away from such asset choices. Diamond and Rajan (2001) note that banks invest in assets that are inherently illiquid due to the inability of bank managers to credibly pre-commit to certain actions, and that the threat of a run by uninsured creditors can make these pre-commitments credible, thereby improving liquidity creation by banks. Acharya and Viswanathan (2011) develop this point in

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<sup>1</sup> There is a long history of academic research on micro-prudential regulation. Merton (1977) aptly recognized the isomorphic correspondence between deposit insurance and common stock put options. An important implication was that, given

bank regulation with market discipline being one of the three pillars of Basel II (the other two being regulatory monitoring and capital requirements). This argument about the market discipline of debt is concerned primarily with the attenuation of *bank-specific* risks, and thus it can be viewed as a tool of micro-prudential regulation.

However, high bank leverage has also been held culpable as a contributor to the recent financial crisis. Many have argued that very high financial leverage, especially short-term leverage, induced banks to engage in illiquid and risky lending as well as securities activities that resulted in the widespread failures of these institutions (see e.g., Acharya, Schnabl and Suarez (2013), Adrian and Shin (2010), Goel, et al. (2014), Mian and Sufi (2011), and Shleifer and Vishny (2010)). There appears to be an emerging acceptance of the fact that increases in leverage seem to increase the systemic risk, or the *collective* fragility, of financial institutions. Financial crises are typically associated with a few highly-levered banks, initially suffering portfolio shocks that engender capital or liquidity shortages for those banks, with the malaise quickly ensnaring other banks as the crisis deepens.

As a result, bank-specific and systemic risks, and in turn, micro-prudential and macro-prudential regulation, become difficult to separate. In particular, there emerges a somewhat schizophrenic view of the role of leverage. On the one hand, higher leverage may mean better asset-choices by bank managers and more liquidity when banks are viewed individually. On the other hand, higher leverage also means that the system is more fragile. Faced with circumstances of possible systemic failure, regulatory interventions can play a role in the reduction of *ex-post* fragility. However, it is also precisely in these circumstances that the disciplining effect of the bank's capital structure on *ex-ante* asset choices is compromised and the lines between micro-prudential and macro-prudential regulation begin to become blurred.

The underlying linkage between leverage, *ex-ante* liquidity creation, and *ex-post* systemic risk raise some fundamental questions that we address in this paper.

First, what is the role of bank leverage *vis a vis* equity capital in affecting the bank's *ex-ante* liquidity and portfolio risk? Second, how does maximizing *individual* bank liquidity (a micro-prudential regulation concern) affect *systemic risk* (a macro-prudential regulation concern)? Third, is there a rationale for regulatory intervention, and if yes, under what circumstances? Fourth, how does the regulator affect bank leverage, and what are the implications of this for micro-prudential regulation? That is, when does the regulator interfere with the market discipline role of leverage and what are its (unintended) consequences?

To address these questions, we develop a model of an uninsured bank whose manager has asset-choice flexibility. The bank is *a priori* illiquid because the manager cannot credibly pre-commit to the right asset choices given his personal preference for a private-benefit project. The bank's *ex-ante* liquidity is measured by the financing it can raise by issuing claims against its terminal cash flows. This financing can be any mix of debt and equity. We permit *both* debt and equity to discipline the bank manager to create *ex-ante* liquidity, but this discipline is different depending upon whether it is imposed by debt or equity. Debt disciplines the bank manager by the credible threat that there will be liquidation in some interim states, conditional on interim cash-flow realizations. Equity disciplines the bank manager by providing compensation-based incentives to the manager to select the efficient project. However, since the incentives provided by equity involve payments from *ex-post* cash flows and the managerial dis-

count rate exceeds that of the firm, equity financing reduces the *ex-ante* liquidity of the bank relative to debt financing which can impose discipline without managerial cash payments. Offsetting this *ex-ante* advantage of bank leverage is that it leads to liquidation of the bank in some states, and this liquidation can be *ex-post* inefficient. The bank's privately optimal capital structure is determined by the tradeoff between the *ex-ante* efficiency of leverage relative to equity in the provision of incentives to bankers and the expected *ex-post* cost of inefficient liquidations induced by leverage.

Bank asset portfolios are then allowed to suffer systematic shocks to value that are observed by some of each bank's creditors but not commonly observed by creditors across banks. This means that the (interim) liquidation decision made by the creditors of a bank can be due to either bank-specific information or information about the systematic shock. Since not all creditors of a bank receive information about the systematic shock, but they can observe the liquidation decisions of other creditors, they learn from each other's decisions and update their beliefs about the systematic shock.<sup>3</sup> Their learning is noisy, however, because of the commingling of information about idiosyncratic and systematic risks in any bank's observed liquidation. This can give rise to contagion effects as those creditors of a bank that possess *no* adverse idiosyncratic or systematic risk information about the bank, may choose nonetheless to liquidate their bank at the interim date based solely on observing the liquidations of *other* banks.

We assume that deadweight costs of individual failures are lower than those from joint failures – such as those observed when the whole system or a large portion of it collapses – due to limited re-intermediation of bank activities and failure of payments and settlement systems in such cases. Contagion can then lead to *ex-post* inefficient liquidations in some instances because the creditors of a bank may liquidate their bank based on the mistaken inference that the observed liquidations of other banks are due to a common asset-value shock even when they are due to bank-specific shocks.<sup>4</sup> Thus, one dark side of leverage-based liquidity creation is the attendant systemic risk arising from inefficient contagious liquidations, and the higher the leverage of banks, the greater the systemic risk.

We solve for the bank's privately-optimal capital structure in the presence of the systematic asset-value shock, and the regulator's optimal level of leverage, assuming that the regulator's objective is to maximize the value of the entire banking industry.<sup>5</sup> A divergence between the regulatory and private optima arises because, in choosing its own capital structure, an individual bank internalizes neither the valuable information about the systematic shock conveyed to other banks by its own leverage and creditor-led liquidation (a positive externality) nor the higher likelihood that its liquidation may trigger the inefficient liquidation of another bank (a negative externality). We establish conditions under which the privately-optimal bank leverage will be too high relative to the reg-

<sup>3</sup> For instance, sale and repurchase agreements (repos) are rolled over each morning for dealer banks by financiers such as money market funds. Though a money market fund rolling over a mortgage-backed securities (MBS) repo may not have precise information about the overall quality revision in the housing market for today, they may see (or hear through the grapevine about) other money market funds having not rolled over their repos for some dealer, say Bear Stearns or Lehman Brothers, and, in turn, consider this information while rolling over repos for other dealers.

<sup>4</sup> Note that with the systematic asset-value shock, liquidations are *not* always *ex-post* inefficient since they are sometimes in response to creditors observing a negative shock to asset value of a bank that falls below liquidation value due to the shock, and this negative shock contains relevant information for the asset values of other banks too.

<sup>5</sup> In our model, this objective is equivalent to maximizing the banking industry's aggregate liquidity.

a model where financial intermediaries can switch to riskier assets after borrowing, and short-term debt with strong control rights ensures *ex-ante* liquidity by containing this agency problem.

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