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Debt-overhang banking crises: Detecting and preventing systemic risk

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ABSTRACT

This paper shows how the debt-overhang distortion on bank lending can generate a self-fulfilling-expectations banking crisis accompanied by a plunge in the value of banks' assets and a contraction of bank lending and economic activity. Moral hazard in banking adds an additional channel that can generate multiple equilibria, worsen the debt-overhang distortion, and deepen the crisis. Some signals of systemic risk include: high volatility and the presence of two modes in the probability distribution functions of the returns on bank-issued bonds and on portfolios of bank-issued bonds and equities; and high correlation between the returns on bank-issued bonds. Macroprudential regulation should discourage the exposure of banks to the economic and financial cycle by raising the capital requirements for banks with more cyclical assets.

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1. Introduction

Some of the most severe contractions of economic activity are accompanied by banking crises.¹ In a typical economic and banking crisis, the value of banks' assets drops, a large number of banks default or become insolvent, and bank lending and economic activity contract. The period of economic weakness and banking stress tends to be prolonged. The change in economic fundamentals appears small relative to the severity of the financial and economic effects.

To study this type of economic and banking crisis, we introduce a mechanism based on the debt-overhang distortion on bank lending.² Two features of the banking system play a crucial role in

the mechanism: the liabilities of banks distort their lending choices, inducing them to lend less than the optimal amount of funds; and the value of banks' assets is sensitive to economic prospects. These two features make the economy financially fragile. A pessimistic view of the economy can be self-fulfilling and lead to a crisis: if the economy is expected to perform poorly, then the value of banks' assets declines, the risk of bank default rises, and the debt-overhang distortion worsens; this leads to a contraction in bank lending and to a decline in economic activity, which confirms the initial pessimistic view (Fig. 1).

At the heart of this mechanism is the fact that banks' lending decisions are *strategic complementary* in the sense of Bulow et al. (1985): when other banks lend more, expected output rises, the asset value of an individual bank rises, its risk of default declines, and its incentive to lend becomes stronger. This has the potential to generate multiple equilibria, as shown by Cooper and John (1988), and can give rise to a self-fulfilling-expectations financial crisis. The mechanism is similar to the one studied by Lamont (1995), who shows that multiple equilibria can arise when firms' investments are distorted by debt overhang and have positive spillovers, i.e., when the value of an individual firm rises as other firms invest more. In our model, banks play the role that firms play in Lamont's model and banks' loans play the role of firms' investments. Unlike in Lamont's model, the positive spillovers of banks' loans arise from the dependence of the banks' asset value on economic prospects.

In our model, the fragility of the banking system results from the interaction between the loan-granting activity of banks and

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¹ In the U.S., the recessions that were accompanied by banking crises—the ones that began in 1873, 1893, 1907, 1929, and 2007—were especially severe (Bordo and Haubrich, 2010, Table 1 and Fig. 1). During the Great Depression, in particular, the rise of bank failures and the fall of bank loans in the years 1930–1933 were the factors that made the recession deep and long (Bernanke, 1983).

² Myers (1977) is the seminal article that describes how the existing debt of firms discourages their investment. The marginal cost of a firm's new investment is borne by the equity holders (or by any junior creditors). The marginal return, however, is seized by the senior creditors in the event of default. The higher the risk of default of a firm, the lower the equity-holders' expected marginal return, the smaller their incentive to invest, the lower the firm's investment level. In the case of banks, their existing liabilities discourage their lending.

Self-fulfilling-expectations crisis

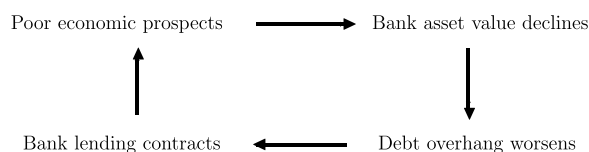


Fig. 1. Main debt-overhang mechanism leading to a self-fulfilling-expectations crisis.

the sensitivity of their assets to aggregate economic conditions. No role is played by the deposit-receiving activity of banks or by the liquidity mismatch between their assets and liabilities, which are crucial in standard models of financial fragility. This debt-overhang explanation seems, then, more promising than traditional liquidity-based ones for modern banking crises, which occur in the presence of institutions—deposit insurance and a lender of last resort—that are designed to prevent and solve liquidity crises.

We also study the impact of moral hazard on our debt-overhang mechanism. To model moral hazard, we introduce a less efficient, riskier lending technology, and we let banks choose whether to lend with the more or less efficient technology. In this context, adding moral hazard introduces an additional channel that can generate multiple equilibria. When the risk of a bank's default is higher, the bank has a stronger incentive to switch to the riskier lending technology in order to raise the value of its equity at the expense of its creditors. This makes the banks' choices of lending technology strategic complementary: when other banks switch to the riskier lending technology, expected output declines, the asset value of an individual bank declines, and its risk of default rises, discouraging its lending. As a result of the interaction between the moral hazard distortion and the debt-overhang distortion, adding moral hazard to an economy that exhibits multiple equilibria can deepen the crisis.

Finally, we study how this type of systemic risk can be detected and prevented. We show that some signals of systemic risk include: high volatility and the presence of two modes in the probability distribution functions of the returns on bank-issued bonds and on portfolios of bank-issued bonds and equities; and high correlation between the returns on bank-issued bonds. To prevent this type of systemic risk, macroprudential regulation should discourage the exposure of banks to the economic and financial cycle by raising the capital requirements for banks with more cyclical assets.

In the rest of the paper, Section 2 reviews the literature; Section 3 describes the model and the debt-overhang mechanism; Section 4 shows that the debt-overhang mechanism can give rise to a financial crisis; Section 5 investigates how systemic risk can be detected and measured; Section 6 discusses some regulatory tools that can prevent the emergence of systemic risk; Section 7 studies the impact of moral hazard on our debt-overhang mechanism; and Section 8 concludes.

2. Literature

This paper is most closely related to the growing literature that studies the debt-overhang distortion in the banking sector. Wilson

and Wu (2010) and Wilson (2012) study how to efficiently recapitalize banks when bank lending is distorted by debt overhang, showing that purchases of preferred stock are less efficient than purchases of common stock or bank assets. Philippon and Schnabl (2013) introduce a financial contagion mechanism that is similar to the one at work in this paper. When the risk of a bank's default rises, the debt-overhang distortion rises, and this induces the bank to contract its lending. At the aggregate level, this reduces payments to households, increases households' defaults, and raises the risk of default for other banks. They emphasize that this mechanism creates a negative externality, which renders the resulting equilibrium inefficient, and they study how a government should optimally intervene with a recapitalization program. Bhattacharya and Nyborg (2013) also study optimal government recapitalization of banks that suffer from debt-overhang problems. Banks have private information about the quality of their assets and new investment opportunities. Menus of bailout plans, made of equity injections and asset buyouts, are used as screening devices. Although the authors include the possibility of public benefits to bailouts in their analysis, they do not explicitly model cross-spillover effects. Hanson et al. (2011) point out that the debt-overhang problem prevents banks from raising the socially-optimal amount of capital during a crisis, and leads them to shrink their assets and balance sheets excessively, which creates the need for policy intervention.³

This paper is also related to the vast literature that studies the various causes and mechanics of financial crises. In this literature, a crisis may be caused by an aggregate risk to which banks are exposed due to their business model.⁴ More often, however, the main driver is a contagion mechanism that amplifies the effects of a small shock to economic fundamentals or generates a self-fulfilling-expectations crisis.

The contagion mechanism may transmit solvency risk, as it does in our debt-overhang model. The literature has described several contagion mechanisms that can transmit solvency risk from bank to bank. The contagion mechanism may be direct, as in Rochet and Tirole (1996): if banks lend to each other or invest in each other's equity, a rise in the risk of default of one bank lowers the value of other banks' claims to that bank, and raises directly their risk of default. More often, the contagion mechanism has two parts, as in our model: first, a rise in the risk of default of a bank induces the bank to reduce its asset holdings, i.e., to sell its securities or to reduce its loans; second, the decision to disinvest by the bank reduces the return on the other banks' investment and raises their risk of default. An example of a two-part mechanism is the following. If banks target a constant leverage ratio for risk-management or regulatory purposes, or a pro-cyclical leverage ratio as in Adrian and Shin (2013), an initial loss at a bank induces that bank to de-leverage and sell its assets; if those assets are not perfectly liquid, this depresses their price and generates losses at other banks holding the same assets. Another example is the one in Lagunoff and Schreft (2001) where the return on a bank's portfolio depends on the portfolio allocations of other banks, so a portfolio loss that induces a bank to reallocate its portfolio generates portfolio losses for other banks.

Or the contagion mechanism may transmit liquidity risk—since banks' assets are longer term than their liabilities, banks are vulnerable to bank runs, and a run on an individual bank can trigger

³ In addition, there is a growing literature that explores the aggregate implications of debt overhang on firms' investment, including Lamont (1995), Philippon (2009), Arellano et al. (2012), Gomes et al. (2013), Kobayashi and Nakajima (2014), and Occhino and Pescatori (2014, 2015).

⁴ Farhi and Tirole (2012) point out that banks may choose to be exposed to the same aggregate risk because they anticipate that the government will bail them out if that risk will materialize, threatening to generate a financial crisis.

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