Effects of government capital injection on bank and bank-dependent borrower

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ABSTRACT

We examine the impacts on bank interest margin, bank default risk, and bank-dependent borrower default risk from changes in the bailout program of government capital injections. This paper focuses on the capped credit risk, the risk of default related to borrower health states. We show that government capital injection helps to reduce default risk for the bank, but indirectly increases the default risk for the borrowing firm. Government capital injection is more likely to produce greater safety for the bank when the borrowing firm is in a distressed situation (e.g., a high-risk and low-return one). The capital effect on bank safety is underestimated when the capped credit risk is ignored. We conclude that a government capital injection program stabilizes the bank, but deteriorates the borrowing firm.

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1. Introduction

The Troubled Asset Relief Program (TARP) is the largest government bailout in U.S. history. A cornerstone of this program is the government's purchase of equity in financial institutions. TARP during the recent financial crisis raises fundamental issues about the role of bank equity capital, particularly from the standpoint of bank default risk. Public outcries for more bank capital tend to be greater after financial crises, and post-crisis reform proposals tend to focus on how capital regulation should adapt to prevent future crises (Berger and Bouwman, 2013). Several recent papers, for example, Kashyap et al. (2008), Acharya et al. (2011), and Hart and Zingales (2011) document that social efficiency can be improved by requiring banks to operate with more capital, especially during financial crises. However, literature has pointed out some negative consequences of more capital (for example, Aiyar et al., 2014; Jiménez et al., 2012, and Osborne et al., 2012). Obviously, the recent financial turmoil has underlined the importance of analyzing the link between bank balance sheets and economic activity. Given the divergent views in the literature, the issue of the effects capital due to government capital injection has on bank performance, the magnitude of these effects, and how they might differ across different states of borrower health deserves closer scrutiny. In particular, the goal of this paper is to examine the effects of government capital injection on bank spread behavior and default risk focusing on distinguishing good borrowing firm from bad during a financial crisis.

The bank interest margin, i.e., the spread between the loan rate and the deposit rate, is one of the principal elements of bank net cash flows and after-tax profits. In practice, spread management is done through a "cost of goods sold" approach in which deposits are the "material" and loans are the "work in process" (Finn and Frederick, 1992). The purpose of this paper is to follow this firm-theoretic approach by providing a broader path-dependent, barrier option model of bank spread behavior to study the determination of bank interest margins under government capital injections. Our model features a distressed bank facing credit risk explicitly captured by the risk characteristics of bank assets. The barrier options theory of corporate security valuation is applied to the contingent claims of a bank as well as a borrowing firm during a financial crisis.[1] The bank in distress is willing to participate in a government capital injection program based on the argument of Hoshi and Kashyap (2010).[2] The borrowing firm in distress as well is limited to migrate from the bank to capital markets based on the argument of Smith (2003). This paper is to call the attention to the fact that credit risk explicitly capped by the borrowing firm affects the lending function so that the standard barrier methodology (Merton, 1973) that has been used to provide market-based estimation of default risk (Brockman and Turtle, 2003) needs to be adapted.

The results of this paper show how capped credit risk and government capital injection conditions jointly determine the bank interest

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[1] The broader contingent claims approach has found a natural application in bank regulation (e.g., Bhattacharya et al., 2002, and Episcopos, 2008). These papers use path dependent options to address the problem of early bank closure. This paper develops a model of a bank-borrowing firm with this structure.

[2] Hoshi and Kashyap (2010) argue that the success of a financial rescue program depends critically on the willingness of weak banks to participate in it.

margin, and further the default risk in the bank's equity return as well as the borrowing firm's default risk under government capital injection. We have several main results. An increase in the government capital injection increases the bank interest margin, and decreases the bank's default risk, but increases the borrowing firm's default risk. When the borrowing firm is a low-return and low-risk borrower, the effect of government capital injection on bank interest margin (bank return performance) yields more significant. When the borrowing firm is low-return and high-risk, the capital effect on bank safety is more likely stronger. When the borrowing firm is high-return and high-risk, the capital effect on borrower deterioration is less likely to come into. When the capped credit risk is ignored, the capital effect on bank return performance is overestimated and on bank safety is underestimated. Overall, government capital injection as such makes the bank less prone to loan risk-taking, thereby contributing the stability of the banking system, but makes the borrowing firm more prone to investment risk-taking, thereby adversely affecting the stability of the product market.

Our approach is a significant departure from the existing literature, which typically does not explicitly differentiate among bank bankruptcy path dependency and bank-dependent borrower health states. The model will have to utilize two distinct contingent claim approaches: a "capped" barrier option as well as a "naked" barrier option. The former can be motivated based on an explicit credit risk argument in the spirit of Dermine and Lajeri (2001), while the latter can be motivated based on an argument about credit risk subject to implicit non-performance in the spirit of Episcopos (2008). Our results strongly suggest that the distinction among health states and between explicit and implicit treatment of borrower default is important. In our opinion, bank manager may set a higher loan rate to benefit greater safety for the bank from government capital injections, in particular when the risk of bank-dependent borrower default is high. From a standpoint of borrower survival, government capital injection as such indirectly leads to higher default risk for the borrowing firm, in particular when the borrowing firm is high-return and high-risk. Consequently, we may argue that government capital injection to a distressed bank may be an appropriate way for bank recapitalization and thus bank stabilization. Nevertheless, we conclude that this bailout program lacks overall efficiency, as the default risk of the bank-dependent borrower is indirectly increased by the program. Hence, we suggest that besides government capital injections, government assistance should also be conducted via government guaranteed debt issuance programs and/or purchases of distressed assets by the government.

One caveat that should be stressed is that this analysis focuses only on government capital injection issues, and does not deal with the other means of government interventions including purchases of distressed assets by the government and government guaranteed debt issuance programs. Several papers have questioned whether government capital injections were a cost-efficient solution and if alternative programs would have yielded better outcomes (Diamond and Rajan, 2010; Hoshi and Kashyap, 2010). We are silent on these questions. What this paper does demonstrate, however, is the important role played by borrower health states in affecting the effect of government capital injections on bank–borrower performance.

The remainder of this paper is organized as follows. Section 2 presents related studies as background for the paper. In Section 3, we construct a theoretical framework and derive the solutions, and discuss the comparative static results in Section 4. Section 5 presents the numerical exercises followed by the conclusion in the final section.

2. Related literature

Our theory of government capital injection (and thus) bank capital is related to three strands of the literature. The first is the recent literature on government capital injection and bank performance, in which Hoshi and Kashyap (2010), Diamond and Rajan (2010), and Bayazitova and Shivdasani (2012) are major contributors. Hoshi and Kashyap (2010) suggest that government capital injections to banks are suitable to cope with the financial crisis since no capital is rebuilt and the banking system remains undercapitalized. However, as argued by Diamond and Rajan (2010), by injecting distressed banks with illiquid assets, government capital injections increase the specter of asset fire sales and can cause liquidity to dry up in the banking system. Bayazitova and Shivdasani (2012) document that government capital injections are directed toward large banks that face high financial distress costs but have strong asset quality. They suggest that government capital injections may have had the unintended effect of prolonging banking recovery by changing investors' views about the government's incentives. While we also examine government intervention, our focus on the bank interest margin management aspects of government capital injection takes our analysis in a different direction.

The second strand is the bank-dependent borrower literature. Dahiya et al. (2003) argue that there is a significant negative wealth effect for the shareholders of the lead bank when borrowers of the bank experience distress. Their argument is consistent with the notion that borrowers' health causes deterioration in the bank's health. Smith (2003) further argues that the effect of borrower identity on bank performance is an important issue since large, high-quality firms migrated from banks to capital markets, forcing banks to lend to a wider scope of customers. The author finds that Japanese banks charge less on loans to Japanese borrowers than do foreign banks, suggesting that Japanese banks tend not to distinguish good risks from bad. The results indicate that problems at Japanese banks stem from the behavior of the banks themselves, not simply from poor economic conditions. Peek and Rosengren (2002) find that banks are more likely to offer additional loans to borrowers that are deteriorating than to otherwise similar borrowers that are healthy. Chava and Purnanandam (2011) show that adverse capital shocks to banks affect their borrowers' performance negatively. The primary difference between our model and these papers is that we examine the effects of government capital injections on bank performance, explicitly considering the borrowing firm's healthy status.

The third strand is the literature on contingent claims. The original contingent claims approach to corporate security valuation views equity as a call option on the assets of the firm (Black and Scholes, 1973) and debt as a portfolio of cash and a put on the value of the firm (Merton, 1974). Major works have recognized that corporate securities should actually be viewed as path-dependent options (see Brockman and Turtle, 2003; Episcopos, 2008, and Merton, 1973).[3] Further, the barrier option theory of corporate security valuation is applied to the two-stage contingent claims of a regulated bank during a financial crisis (Chen and Lin, forthcoming). This paper examines the relationships among government capital injection, deposit insurance fund protection, bank interest margin, and technology choice. In these papers, no attempt is made to analyze explicitly the risk characteristics of bank assets. Dermine and Lajeri (2001) model bank lending explicitly that the lending function creates the need to model equity as a capped call option. Their approach ignores the problem of early closure in a bank-borrowing firm situation particularly incurred during a financial crisis. Chang (2012) models captive bank lending to auto dealers and examines the loan-risk default probability in equity returns of the captive bank under government capital injections during a financial crisis. We also focus on credit risk affecting the distribution of bank asset returns and model the equity of a bank as a capped barrier option. What distinguishes our work from this literature is our focus on the commingling of the assessment of the bank with the assessment of the borrowing firm, and, in particular, the emphasis we put on the relationship between government capital injections and conformity in the context of bank-borrowing firm performance.

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[3] In addition, for example, a path-dependent option model is built to analyze anticipatory regret behavior (Lin and Hung, 2013), and rescue package designs (Chang, 2014).