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## Bank capital and the macroeconomy: Policy considerations

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## ABSTRACT

We develop a macroeconomic model in which the balance sheet condition of financial institutions plays an important role in the determination of asset prices and economic activity. The financial intermediaries in our model are required to make investment commitments before a complete resolution of idiosyncratic funding risk that can be addressed only by costly refinancing, forcing them to behave in a risk-averse manner. The model shows that the balance sheet condition of intermediaries can drive asset values away from their fundamentals, causing aggregate investment and output to respond to shocks to intermediaries. We use this model to evaluate several public policies designed to address balance sheet problems at financial institutions. With regard to short-run policies, we find that capital injections conditioned upon voluntary recapitalization can be a more effective tool than asset purchases. With regard to long-run policies, we demonstrate that higher capital requirements can have sizable short-run effects on economic activity, and that a long transition period helps avoid undesirable side effects. Finally, we show that the marginal effects of policies can be larger during “crises” because of the nonlinear interactions between some financial frictions and policy actions.

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## 1. Introduction

Macroeconomic policy actions in recent years have turned to a focus on the strength of the equity buffer backing banking sector liabilities – with prominent examples including the capital injections in the United States associated with the Troubled Asset Relief Program (TARP), the “bank stress tests” in the U.S. and Europe, the potential use of European Stability Mechanism (ESM) funds for bank recapitalization, and the implications of higher capital requirements for banking institutions agreed in the Basel 3 process for credit supply, macroeconomic activity, and the safety of the banking system. To assess such policy efforts, it is essential to have a model that captures key aspects of the dynamic frictions that may cause (at least short-run) deviations from the Modigliani–Miller theorem and hence make the capital structure of the banking sector important for credit provision. These links are thin to non-existent within the workhorse framework for macroeconomic analysis, although research has begun (for instance, [Adrian and Shin, 2010](#); [Brunnermeier and Pedersen, 2009](#); [Gertler and Kiyotaki, 2010](#); [He and Krishnamurthy, 2012](#)). Moreover, banking, finance, and macroeconomics are typically not integrated in the models used in policy circles (e.g., the discussion in [Boivin et al., 2010](#)).

Our goal in this paper is twofold: First, we develop a dynamic model in which the balance sheet condition of financial institutions plays an important role in the determination of asset prices and economic activity. Second, using this model, we evaluate the macroeconomic effects of short-term credit policies aimed at stabilizing the balance sheet condition of troubled

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financial institutions, and assess the transitional effects of implementing higher capital standards. These policies are stylized examples of the types considered in recent discussions. For example, the potential for either direct government recapitalization of banks or indirect recapitalization through asset purchases has been discussed in reference to the Troubled Asset Relief Program in the United States (enacted in 2008) and the use of funds from the European Stability Mechanism for bank recapitalization; also, the impact of transition arrangements on the macroeconomic impact of higher bank capital standards was an important issue in policy discussions.<sup>1</sup>

We first describe how the frictions facing households and intermediaries lead shocks to the intermediary sector to cause fluctuations in investment and output, highlighting three mechanisms. We assume, in line with recent research (e.g., Gertler and Kiyotaki, 2010; He and Krishnamurthy, 2012), that intermediaries are essential for transforming household saving into investment. Second, and more importantly, we emphasize that the mis-match between the timing of lending commitments and the realization of returns on past lending – the maturity and the liquidity mis-match at the heart of intermediation – causes intermediaries to exhibit *caution*, or behave in a “risk-averse” manner, in lending. Specifically, the financial intermediaries in our model are required to make lending commitments before a complete resolution of idiosyncratic funding risk; moreover, shortfalls in funding relative to lending commitments can be addressed only through costly external financing.<sup>2</sup> As a result, intermediaries hold back lending relative to a benchmark without frictions in external finance and adjust their willingness to lend in response to factors – such as changes in uncertainty, in the costs of external funds, or in their balance sheet capacity – that are irrelevant in the absence of financial frictions. Finally, we show how the fluctuations in output induced by adverse developments within the intermediary sector can be mitigated or amplified by public policies regarding the capital required to back lending commitments.

We consider two types of stabilization policy: asset purchases by a public authority, as in Gertler and Karadi (2011), and a capital injection conditioned on voluntary recapitalization. Our results indicate that the capital-injection policy can be much more powerful than the asset purchase policy in stabilizing output fluctuations. In our baseline simulation, the former turns out to be much more effective than the latter in terms of output stabilization effects from interventions of the same size. The key mechanism behind this difference is that an asset purchase policy suffers from a classic case of *crowding out*: While aggregate investment is lifted by the increase in government demand, government asset purchases also boost asset prices, which makes lending projects relatively less attractive and dividend payouts relatively more attractive (*ceteris paribus*). Note that this mix of forces – an ability of intermediaries to adjust lending or dividends – is absent from, for example, Gertler and Karadi (2011), which will explain some of our different results. Overall, the improvement in liquidity conditions and the business environment associated with government asset purchases boosts aggregate demand only moderately. In contrast, the capital-injection policy increases private demand for capital assets by improving the capital position directly, which boosts the appetite of intermediaries for risky assets. In effect, the capital injection exploits the willingness of the intermediaries to leverage their balance sheet, thereby spurring more aggregate investment than government asset purchases.<sup>3</sup>

Our analysis of higher capital requirements analyzes the transition costs associated with a substantial increase in the minimum capital ratio for banking institutions, a subject that has been the focus of recent debate, as discussed by Admati et al. (2010) and Hanson et al. (2011), but for which a general-equilibrium quantitative assessment has been wanting. Our model fills this gap in quantitative assessments. Though we assume that the capital structure of the financial sector is essentially neutral in the long run (consistent with the emphasis of Admati et al., 2010; Hanson et al., 2011), shifts in capital requirements can have sizable short-run effects because of the financial frictions facing intermediaries. (Note that this structure (shared by related policy work, e.g., BIS, 2010a, 2010b), by emphasizing long-run neutrality, abstracts from the potential long-run benefits of higher capital requirements associated with, for example, increased resilience – considerations left for other research.) In the short-run, external funds are costly because of financial market frictions, whereas internal funds (through retained earnings) are less costly. Because of this asymmetry in costs, a fast transition to substantially higher capital requirements, which relies to a greater extent on external funds (because retained earnings over a shorter period are less capable of covering any given increase in required equity), has more adverse effects on economic activity than a slow transition.

Finally, we find that the nonlinear interaction between the frictions facing intermediaries and public policy actions is quantitatively important: Emergency stabilization policies are substantially more effective exactly when they are needed most – in a crisis. Moreover, regulatory reforms raising capital requirements are much more costly during a financial crisis, and hence long transition arrangements are especially important for mitigating adverse macroeconomic effects.

We make several contributions relative to the previous literature. As in Gertler and Karadi (2011), we consider government asset purchases as a stabilization policy, but we also highlight distinctions between asset purchases and capital injections (and note the importance both of allowing intermediaries to adjust lending and dividends, and of the magnitude

<sup>1</sup> For a discussion of capital requirements, see BIS (2010a, 2010b). Additional information on implementation within the United States can be found at <http://www.federalreserve.gov/bankinforeg/basel/USImplementation.htm>; additional information on Euro area arrangements under CRD IV can be found at [http://ec.europa.eu/internal\\_market/bank/regcapital/legislation\\_in\\_force\\_en.htm](http://ec.europa.eu/internal_market/bank/regcapital/legislation_in_force_en.htm). For a recent summary of the Troubled Asset Relief Program (TARP), which included measures to stabilize the balance sheet position of financial intermediaries, see Office Of the Special Inspector General for the Troubled Asset Relief Program (2009) or CBO (2011). For a summary of agreements regarding the use of the ESM for bank recapitalization, see <http://eurozone.europa.eu/media/436873/20130621-ESM-direct-recaps-main-features.pdf>.

<sup>2</sup> We emphasize costly external equity financing of the type in, for example, Myers and Majluf (1984) and Bolton and Freixas (2000), although other costly external financing assumptions, including the sale of lending commitments at distressed prices, have similar implications.

<sup>3</sup> Adrian and Shin (2010) emphasize the effect of intermediary leverage. He and Krishnamurthy (2008) also suggest that capital injections are more effective than asset purchases, but their focus is on the asset market recovery. Our framework provides a more comprehensive assessment of impacts of the stabilization policies on employment, investment and output in a production-based business-cycle framework.

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