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Flight to liquidity and the Great Recession ☆

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ABSTRACT

This paper argues that counter-cyclical liquidity hoarding by financial intermediaries may strongly amplify business cycles. It develops a dynamic stochastic general equilibrium model in which banks operate subject to agency problems and funding liquidity risk in their intermediation activity. Importantly, the amount of liquidity reserves held in the financial sector is determined endogenously: Balance sheet constraints force banks to trade off insurance against funding outflows with loan scale. A financial crisis, simulated as an abrupt decline in the collateral value of bank assets, triggers a flight to liquidity, which strongly amplifies the initial shock and induces credit crunch dynamics sharing key features with the Great Recession. The paper thus develops a new balance sheet channel of shock transmission that works through the composition of banks' asset portfolios.

1. Introduction

The recent financial crisis and the ensuing Great Recession started with an abrupt surge in uncertainty about the value of assets on financial intermediaries' balance sheets. As investors became worried about counter-party risk and the quality of collateral pools, financial institutions found it difficult to roll over short-term debt. In fact, several markets for short-term refinancing experienced runs: Asset-backed commercial paper became illiquid in late 2007, followed by a freeze in the unsecured interbank-market after the demise of Lehman Brothers (Brunnermeier, 2009; Heider et al., 2009). Similarly, average haircuts on collateral assets in repurchase agreements (repo) rose from zero to 45% within the span of one year, effectively withdrawing $1.2 trillion in funding from the repo market (Gorton and Metrick, 2010; Gorton and Metrick, 2012; Duffie, 2010).

In response to the downward spiral of plummeting collateral values and rising funding liquidity risk, financial institutions took to hoarding liquid assets in order to reduce the maturity mismatch on their balance sheets. In the US, the flight to liquidity episode starting in late 2007 resulted in a starkly rising share of liquid assets in total financial sector balance sheet size (see Fig. 1). In fact, liquidity shares had been counter-cyclical since the early 2000s both in the traditional and in the shadow banking sector, with a contemporaneous cross-correlation of −0.46 and −0.40, respectively.[1] However, the hoarding of liquid reserves locked up funds otherwise available for investment into riskier assets. This curtailed the lending capacity of the financial sector and eventually impaired

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[1] I define liquid assets as the sum of checkable deposits and currency, cash and reserves at the Federal Reserve, Treasury securities as well as agency- and securities backed by Government-Sponsored-Enterprise (GSE). Of course, if these are truly liquid assets, they are expected to retain their value during a downturn, while prices of riskier assets would fall. Thus, the value of liquid assets relative to total balance sheet size would mechanically increase. However, the fact that liquidity buffers were not adjusted downwards suggests that a flight to liquidity occurred and banks' willingness to lend declined.

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non-financial firms' access to external financing, thus propagating financial sector stress to the real economy.

In order to capture these events, this paper develops a model that features flight to liquidity in the banking sector as the key amplification and propagation mechanism of financial sector stress. Financial intermediaries operate subject to moral hazard problems in their monitoring activity and funding liquidity risk. They trade off the amount of liquidity reserves to hold as insurance against funding outflows with the amount of funds available for lending. Aggregate shocks to the collateral value of bank assets trigger a flight to liquidity in the sense of higher insurance against short-term funding risk. This amplifies the initial shock and induces credit crunch dynamics sharing key features with the Great Recession.

The model extends the canonical real business cycle model with financial intermediation and liquidity risk at the bank level. In particular, banks intermediate funds between savers and capital producers and provide monitoring services for which they bear a cost. This private cost creates an agency problem between outside investors and banks: Banks need to retain an equity stake in their loans in order to receive a sufficient fraction of the return on lending that compensates them for their monitoring services. As banks retain a fraction of the return on loans, the agency problem drives a wedge between the total return on loans and the amount that is pledgeable to outside investors. Building on Holmström and Tirole (1998), liquidity shocks arrive during the life-time of loan projects that require the input of additional resources. Here, such shocks are modelled as withdrawals of external funds, which are idiosyncratic at the bank level. Economically, they amount to rollover risk arising from a maturity mismatch between bank-assets and bank-funding. Limited pledgeability of loan returns constrains the funds that can be attracted to refinance these outflows, such that even projects with a higher continuation than liquidation value may have to be terminated.

Anticipating their financial constraints at the lending and at the refinancing stage, banks need to decide on how to optimally allocate their inside and outside funding between loans and liquidity reserves simultaneously. Given limited financial resources, earmarking funds as liquidity reserves decreases the scale of loans that banks can extend before liquidity shocks arrive. This trade-off implies that banks choose not to fully insure against liquidity risks. As a consequence, funding outflows cannot be entirely diversified despite being idiosyncratic. In particular, funding withdrawals in excess of liquidity reserves lead to the termination and inefficient liquidation of investment projects by the outside financiers.

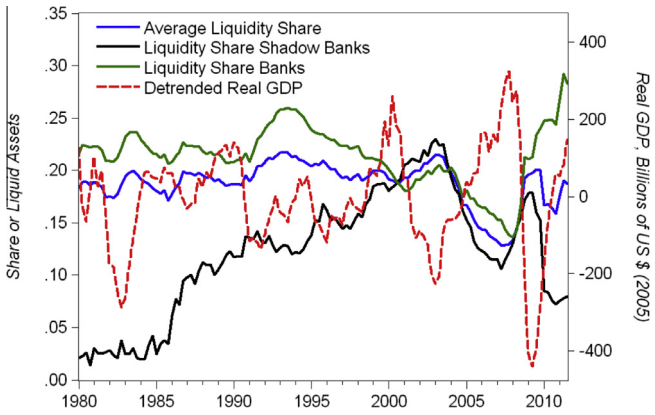

Fig. 1. Share of liquid assets of banks and market-based intermediaries. *Notes*: The liquidity share is computed as the sum of checkable deposits and currency, cash and reserves at the Federal Reserve, Treasury securities, agency and GSE-backed securities relative to total assets of the respective institutions. *Source:* US Flow of Funds (Federal Reserve).

Following evidence on rising haircuts in repo transactions for secured short-term finance, I introduce a shock to the liquidation – or collateral – value of bank assets as a novel type of aggregate risk.[2] With lower collateral values, the liquidation of loan projects becomes more costly for outside investors. Banks can thus extract more resources after liquidity shocks have occurred, which makes liquidity reserves more compelling relative to the initial scale of loans. The flight to liquidity unleashes a powerful amplification mechanism as higher liquidity reserves crowd out funds for initial bank lending (bank lending channel). These dynamics stand in sharp contrast to a frictionless economy where such crowding-out would not occur. Extending the model with nominal frictions, I also demonstrate how these interact with financial frictions to exacerbate the amplification from and recessionary impact of a liquidity crisis.

The contribution of the paper is twofold: First, it introduces funding liquidity risk arising from a maturity mismatch between banks' assets and liabilities into a dynamic stochastic general equilibrium framework. Second, it explains how shocks operating directly on the balance sheets of financial intermediaries are amplified due to an endogenous increase in aggregate liquidity demand which emerges from the interaction between agency costs and funding liquidity risk. This adds to the literature on the balance sheet channel of shock transmission. However, amplification works through the endogenous composition of balance sheets, i.e. the choice between insurance against liquidity risk and lending scale, rather than fluctuations in the net worth of borrowers as in the financial accelerator literature. The model can explain a number of salient features observed during the recent financial crisis, such as the counter-cyclical flight to liquidity phenomenon as well as pro-cyclical lending and leverage.

1.1. Related literature

This paper contributes to the growing body of literature on macro-financial linkages. It builds on two distinct strands of research. The first analyses financial frictions as the source of business cycle fluctuations. At the heart of this research is the balance sheet channel as surveyed by Bernanke and Gertler (1995), i.e. the amplification and propagation of business cycles due to a financial accelerator mechanism arising from the feedback between borrowing constraints and asset fire sales. Theoretical research in this area focuses on agency frictions between borrowers and lenders. Carlstrom and Fuerst (1997), Bernanke and Gertler (1989), Bernanke et al. (1999) and more recently Christiano et al. (2014) have embedded the costly-state-verification framework developed by Townsend (1979) in relation to financial contracts into business cycle models to study the dynamic impact of such agency costs. Other studies, such as Kiyotaki and Moore (1997), Gertler and Karadi (2011) and Gertler and Kiyotaki (2011), rely on limited or costly enforcement of financial contracts. Holmström and Tirole (1997) study an incentive model of financial intermediation where both firms and banks are capital constrained. The business cycle implications of this bank capital channel are analysed by Meh and Moran (2010), which is closely related to this paper.

However, the literature discussed so far does not accommodate the notion of endogenous liquidity demand. I introduce this feature following a second strand of literature initiated by Holmström and Tirole (1998). These authors develop a finite-horizon framework which motivates demand for corporate liquidity reserves with uncertain reinvestment needs during the lifetime of investment projects. Kato (2006) incorporates this structure into a dynamic general equilibrium setting to analyse the business cycle dynamics that result from liquidity risk at the corporate level. His model is

[2] The liquidation value of a loan measures its resale value. This corresponds to the concept of *market liquidity* as defined in Brunnermeier et al. (2012).