The Quarterly Review of Economics and Finance 66 (2017) 302–313

Contents lists available at ScienceDirect

The Quarterly Review of Economics and Finance

journal homepage: www.elsevier.com/locate/qref

Measuring heterogeneity in bank liquidity risk: Who are the winners and losers?

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ARTICLE INFO

Article history:
Received 22 December 2015
Received in revised form 7 March 2017
Accepted 7 April 2017
Available online 17 April 2017

JEL classification:
E51
G21
G28
G32

Keywords:
Bank risk management
Liquidity risk
Systemic risk

ABSTRACT

The 2007–2009 crisis stressed the importance of liquidity for banks. Aggregate liquidity indices provide an account of financial market liquidity conditions. However, these indices do not illustrate how banks individually are affected by such conditions. Similarly, balance sheet indicators only reflect degrees of potential bank exposure to liquidity shocks. Using a risk factor model, we present a way of measuring bank sensitivity to liquidity risk. Our results indicate that liquidity risk is a specific risk, and we shed light on heterogeneities among banks in terms of their exposure to liquidity risk. Liquidity conditions can hinder or benefit banks, and banks can also be insensitive to such conditions. We document large variations in exposure levels across the 2008 and 2011 crises. Larger size and higher capital levels insulate banks from aggregate liquidity risk. However, deposit shares, wholesale funding reliance and funding gaps affect only those banks benefiting from aggregate liquidity risk. These ratios reveal bank liquidity production levels. This suggests that market discipline applies to liquidity production, but only for less risky banks in cases of liquidity crisis. Thus, market discipline appears to be one-sided. This reinforces the necessity of liquidity requirements for all banks as illustrated from the Basel III liquidity ratios.

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1. Introduction

Bank overexposure to liquidity risk can have dramatic effects on the stability of financial systems and the economy. The 2007–2008 crisis revealed the disruptive effects of liquidity risk (e.g., Allen & Carletti, 2008; Brunnermeier, 2009). Banks relying on short-term funding suffered from higher short-term interest rates and lower degrees of funding availability (e.g., Cornett, McNutt, Strahan, & Tehranian, 2011). Some banks could not even rollover their short-term debt, threatening their solvency. Nevertheless, not all banks were affected to the same extent by fluctuations in market-wide liquidity conditions (e.g., Craig, Fecht, & Tümer-Alkan, 2015). This therefore raises questions concerning cross-sectional variations in bank risk as aggregate liquidity conditions change. This calls for a measurement of individual bank sensitivity to aggregate liquidity conditions. Indeed, the literature uses two main measures of liquidity risk. A first strand of the literature uses individual bank features describing potential bank exposure to liquidity shocks. These measures, which are based on balance sheet elements, assess either asset liquidity or funding stability. A second strand of the literature considers aggregate liquidity risks associated with money markets. Aggregate liquidity conditions are measured based on interbank rates or spreads. Almost no measure considers the direct effect of aggregate liquidity on individual bank liquidity risk. Therefore, this article measures individual bank exposure to liquidity shocks in consideration of aggregate liquidity conditions. Our objective is to develop a stronger understanding of how banks respond individually to aggregate liquidity risks.

This paper contributes to the literature by introducing a measure of bank exposure to aggregate liquidity conditions. We use a risk factor model as our framework. The model allows one to compute bank sensitivity to daily variations in aggregate liquidity conditions. The sample consists of listed banks across the euro area for 2005–2012.

A first result indicates that liquidity risk is mainly an idiosyncratic risk in calm markets. However, during the 2007–2008 and 2011 crises, banks faced systemic liquidity shocks, as runs occurred in most components of money markets. Liquidity risk thus tended to become systematic. A second result indicates that there is a high degree of heterogeneity across banks in terms of their exposure to liquidity conditions. Bank risk is either positively or negatively affected by general liquidity conditions: aggregate liquidity either reduces or increases bank stock volatility. Moreover, many banks are not affected by aggregate liquidity. Consequently, liquidity risk

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http://dx.doi.org/10.1016/j.qref.2017.04.006
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at the bank level reflects overly idiosyncratic decisions in terms of funding and asset liability management. However, this heterogeneity across banks decreases during liquidity crises, as most banks become negatively affected by market-wide liquidity conditions.

The paper then looks at indicators of bank exposure to liquidity risk. Our intention is to develop a stronger understanding of relationships to bank liquidity risk. Indeed, these indicators are mainly used by regulators to contain effects of aggregate liquidity conditions on bank liquidity risk (e.g., Basel III liquidity requirements). They are also currently used to assess bank liquidity creation (Berger & Bouwman, 2009). We find that the share of deposits in total funding tends to increase exposure to liquidity risk. Moreover, reliance on wholesale funding and the scale of the funding gap limits exposure to liquidity risk. However, these effects only apply for banks positively affected by liquidity conditions, i.e., whose risk measured by stock price volatility decreases as aggregate liquidity conditions deteriorate. Thus, investors consider risks associated with liquidity creation only for those banks positively affected by aggregate liquidity changes. We interpret this as reflecting a flight-to-quality behavior, as investors consider only the liquidity creation by the strongest banks, i.e., banks benefiting from aggregate liquidity. This is also consistent with benefits associated with liquidity hoarding. For banks that are negatively affected (for which risk increases as liquidity conditions deteriorate), market participants do not consider liquidity production. They likely anticipate receiving public support when needed. This belief is based on size and capitalization, which decrease exposure to liquidity risk. As capitalization helps banks face credit losses, we identify a relationship between bank liquidity and solvency risk.

The paper is organized as follows. Section 2 reviews the literature on bank liquidity risk measures. Section 3 introduces the risk factor model used to develop our individual measure of bank exposure to aggregate liquidity and specifies the variables used. Section 4 presents the results and analyses the liquidity risk measure. Section 5 studies relationships between balance sheet measures of liquidity risk and the measure of bank exposure to liquidity risk based on a Tobit model with friction. Section 6 presents our robustness check results; Section 7 concludes.

2. Literature review

Liquidity risk reflects a bank's potential to become unable to settle obligations with immediacy over a specific horizon by using available liquid assets and cash or by incurring new debt at a reasonable price (Drehmann & Nikolaou, 2013). The literature on bank liquidity risk mostly addresses balance sheet measures of liquidity risk and measures of liquidity conditions affecting all banks on interbank and money markets separately.

First, the literature studies bank potential exposure to liquidity risk based on three balance sheet characteristics: the stability of funding, the liquidity of assets, and the funding gap between assets and liabilities.

The stability of funding represents the proportion of stable liabilities used by banks to fund their assets. Deposit withdrawals or short-term lender decisions not to rollover their funding represent a loss of funding. This possibility represents a rollover risk (Acharya, Gale, & Yorulmazer, 2011). To this extent, bank liquidity refers to the capacity to raise funds at a reasonable cost at short notice. The stability of funding is approached by accounting for ratios representing the share of short-term funding over total funding or of interest expenses over total deposits, with the latter ratio being used to proxy funding costs (Dietrich, Hess, & Wanzenried, 2014). These ratios are currently known as core deposit ratios, non-core funding ratios, and brokered deposit ratios.

The liquidity of assets represents a second element of balance sheet exposure to liquidity risk. Indeed, liquid assets constitute a buffer that insures banks against rollover risks. However, the liquidity of assets is closely linked to market liquidity (Brunnermeier & Pedersen, 2009). When market liquidity dries up, banks can experience difficulties when attempting to sell specific assets without significant losses. Various ratios gauge the amount of liquid assets or cash such as the net short-term asset ratio, current ratio, acid test ratio, and government securities ratio. Asset liquidity is usually measured using the share of customer loans over total assets (Pagratis & Stringa, 2009), the reserve balance at the central bank (Acharya & Merrouche, 2012) or the daily change in bank reserve deposits (Cocco, Gomes, & Martins, 2009), among other measures.[1]

Funding gaps are the third type of accounting indicator. Funding gaps represent the difference or proportion of illiquid assets funded by demandable debt. They are approached for instance as customer loans minus short-term liabilities over customer loans (Aikman et al., 2011), as money lent to banks over money borrowed from banks, as customer loans over short-term liabilities, as liquid assets over short-term liabilities, or as liquid assets over total debt (Pagratis & Stringa, 2009).

These individual micro-level measures of bank liquidity risk present banks' potential capability to withstand fluctuations in funding liquidity, all things being equal. Nevertheless, these measures are unable to account for bank effective capacities to withstand liquidity shocks. They bear at least four shortcomings. First, balance sheet measures do not account for bank capacities to access funding sources during liquidity shocks. Bank capacities to fund themselves are not only expressed as public balance sheet variables. Bank access to funding can also depend on dimensions such as bank reputation, the diversification of bank funding sources, or central bank policies. Second, the comparison of balance sheet measures between banks and across time is not straightforward. From the previous argument, the same level of a given measure for several banks does not necessarily denote the same degree of exposure to liquidity risk. Similarly, when an accounting indicator has the same value at two different points in time, this does not imply that exposure to liquidity risk is the same. Third, balance sheet measures lack frequency, as they are dependent on yearly or at best quarterly data and are backward looking measures. They also fail to provide a precise assessment of bank individual liquidity risk across time, and especially when examining stressed liquidity conditions in financial markets. These stress events usually last for a few weeks or months. Finally, it is difficult to understand the interactions between various accounting indicators. Each balance sheet measure underlines a different aspect of bank potential exposure to liquidity risk, with no measure encompassing all of them.

Second, the literature considers measures of liquidity conditions for the banking sector. These aggregate liquidity measures are relatively frequent but at the macro level. These measures are often referred to as systemic liquidity measures. However, Hong, Huang, and Wu (2014) note that there is no commonly accepted definition of systemic liquidity risk. Drawing on Kaufman and Scott's (2003) definition of systemic risk, systemic liquidity risk can be defined as the risk or probability of breakdowns in the entire money market as opposed to breakdowns in individual components. This is evidenced by comovements among most or all parts of the money market. Systemic liquidity risk manifested during the 2007–2008 financial crisis through a general drying up of money market liquidity. The literature documents runs that occurred from 2007 to 2008 in asset-backed securities markets (Brunnermeier, 2009) such as

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[1] Acharya and Merrouche (2012) also use the reserve balance at the central bank to account for liquidity hoarding among large settlement banks in the UK occurring during the subprime crisis of 2007–2008. Cocco et al. (2009) find that banks with a larger imbalance in reserve deposits tend to borrow funds from banks with which they have a relationship and to pay lower interest rates than they would otherwise.

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