Journal of Banking & Finance 37 (2013) 3930–3950

Contents lists available at SciVerse ScienceDirect

Journal of Banking & Finance

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

Bank liquidity, the maturity ladder, and regulation

Leo de Haan *, Jan Willem van den End

De Nederlandsche Bank, Economics and Research Division, P.O. Box 98, 1000 AB Amsterdam, The Netherlands

ARTICLE INFO

Article history:
Received 17 July 2012
Accepted 5 July 2013
Available online 12 July 2013

JEL classification:
G21
G28
G32

Keywords:
Banks
Liquidity
Regulation

ABSTRACT

We investigate the liquidity management of 62 Dutch banks between January 2004 and March 2010, when these banks were subject to a liquidity regulation that is very similar to Basel III's Liquidity Coverage Ratio (LCR). We find that most banks hold more liquid assets against their stock of liquid liabilities, such as demand deposits, than strictly required under the regulation. More solvent banks hold fewer liquid assets against their stock of liquid liabilities, suggesting an interaction between capital and liquidity buffers. However, this interaction turns out to be weaker during a crisis. Although not required, some banks consider cash flows scheduled beyond 1 month ahead when setting liquidity asset holdings, but they seldom look further ahead than 1 year.

1. Introduction

The crisis that plagues the financial system since 2007 is to some extent a liquidity crisis (Banque de France, 2008), caused by a collapse in confidence in the sustainability of the banks' high leverage and maturity mismatches. Wholesale funding has almost completely dried up, in particular long-term funding, leading to an increase of the maturity mismatch. Banks responded to this by hoarding high-quality assets as a buffer against the maturity mismatch and rollover risks of short-term interbank borrowing (Acharya and Skeie, 2011).

To strengthen banks' liquidity profiles, Basel III introduces the Liquidity Coverage Ratio (LCR). The LCR prescribes that banks hold a sufficient level of high-quality assets against the net outflow of liquidity expected in stress conditions during a 30 days period. More specifically, a sufficiently high level of liquid assets should ensure that banks survive an acute stress scenario lasting for 1 month (BCBS, 2009).

Currently, it is foreseen that the LCR proposal will be implemented gradually between 2015 and 2019. So far, there is little empirical evidence on how banks have responded or will respond to such a LCR requirement. This raises the question of how the LCR relates to existing national supervisory liquidity rules, if any, and how the LCR relates to banks' actual liquidity management. The influence of liquidity regulation on bank behaviour may have wider consequences for the financial sector, financial markets and the real economy. Also from that perspective, insight into the interaction between liquidity regulation and bank behaviour is useful.

This paper contributes to our understanding of how banks will react to the LCR by investigating banks' actual liquidity management under the quantitative liquidity requirement that has been operational in the Netherlands since 2003, which resembles the Basel III proposal. Under the Dutch liquidity regulation, a bank's actual liquidity must exceed required liquidity, at horizons of both 1 week and 1 month. Actual liquidity is defined as the stock of liquid assets minus haircuts plus anticipated cash inflows weighted by the degree of liquidity. Required liquidity is defined as the anticipated calls on contingent liquidity lines, anticipated withdrawals of deposits, anticipated drying up of wholesale funding and derivative funding during a period of combined market and idiosyncratic stress. The Dutch liquidity requirement, the so-called Liquidity Balance (LB) rule, conceptually resembles the LCR under Basle III.

We examine banks' liquidity management under the Dutch LB rule. Our sample contains 62 Dutch banks, taking account of nearly 99% of total assets of the Dutch banking sector, and our sample period is January 2004 to March 2010, after which the Dutch regulatory system was changed.

Our contribution is the first to relate liquid asset holdings by banks to the full maturity ladder of future cash flows. The empirical literature until now has not considered maturity transformation as a determinant of banks' liquid asset holdings. This seems striking as liquidity transformation, and the liquidity risk resulting

* Corresponding author. Tel.: +31 20 5243539; fax: +31 20 5242526.
E-mail addresses: l.de.haan@dnb.nl (L. de Haan), w.a.van.den.end@dnb.nl (J.W. van den End).

0378-4266/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jbankfin.2013.07.008

from it, is the primary reason for banks to hold liquid assets (Goodhart, 2008). To estimate our model, we use unique monthly data on liquid assets and liabilities and scheduled cash flows for maturities ranging from 1 month to beyond 1 year. In addition, we confront the estimated relationship with the relationships implied by Dutch and international liquidity rules, which link required liquid asset holdings to future cash flows for the coming month. Finally, we examine the effects of the crisis and bank characteristics, as well as their interaction, on liquidity management.

The paper is structured as follows. After a short literature review, we discuss the liquidity regulation that has been operative since 2003 in the Netherlands and compare the Dutch system with the proposed system under Basel III. Next, we present a model of banks' liquidity management, according to which banks hold liquid assets as a buffer against maturity mismatch risk. After discussing the data, we estimate this model and subsequently examine how the estimated model relates to both Dutch regulation and regulation as proposed under Basel III. Then, we examine whether liquidity management was different before and during the crisis. Finally, we test how bank characteristics affect liquidity management, followed by the conclusion.

2. Literature review

Maturity mismatches are inherent to banks, owing to the transformation of liquid liabilities (e.g. deposits) into illiquid assets (e.g. long-term loans). This gives rise to market and funding liquidity risk, as shown by Diamond and Dybvig (1983). Market liquidity risk relates to the ability to convert assets into cash at a given price at short notice, while funding liquidity risk refers to the ability to raise cash to fund asset holdings. Rajan and Bird (2003) demonstrate that maturity transformation is inherent to banks and does not depend on implicit safety nets.

Aspachs et al. (2005) analyse the liquidity policy of 57 UK banks over the period 1985Q1 to 2003Q4 and find that the greater the potential support from the central bank in case of liquidity crises, the lower the liquidity buffer the banks hold (support is measured as the pseudo-probability of bail-out, based on the Fitch support rating). Their result raises the issue that activation of the lender of last resort (LoLR) function encourages moral hazard. Mink (2011) argues that through facilitating maturity transformation, the lender of last resort gives banks an incentive to lever, diversify, and lower their lending standards. In the recent crisis, many banks, having insufficient liquid assets as first line of defence, have become dependent on LoLR financing. Liquidity regulation aims to address this.

Bonner et al. (2013), using balance sheet data for 7000 banks from 24 OECD countries in 1998–2007, find that the main drivers of the observed variation in liquid reserves are banks' business model and size, deposit holdings as well as the intensity of disclosure requirements.

Liquidity buffers also reduce the probability and severity of systemic liquidity stress. They can prevent negative externalities due to asset fire sales, deleveraging, liquidity hoarding and restriction of credit, which may arise if banks have liquidity problems. By this, liquidity buffers are complementary to capital buffers, in particular countercyclical capital buffers as applied in Spain (Saurina, 2009). For that reason the social optimum for bank liquidity buffers usually lies higher than the private optimum (Acharya et al., 2009). However, in an extreme situation characterised by dysfunctional markets and elevated levels of systemic risk, the liquidity requirement can become a binding constraint that precipitates the undesirable externalities that the regulation seeks to mitigate (Van den End and Kruidhof, 2013).

Chadha and Corrado (2012), presenting a DSGE model where banks have an endogenous choice over holdings of liquid assets, show that the presence of incentives to increase liquid assets during economic expansions and reduce such holdings during contractions would be beneficial to the economy.

Schertler (2010), using quarterly data for 2000 German banks from 2000-III to 2008-IV, examines banks' adjustment of securities holdings, loan repayments and long-term lending, respectively, in response to payment obligations in the coming month. She finds that most banks perform 'asset-side accounting exchanges' by reducing their new long-term loans when they need more liquid assets. Holl and Schertler's (2009) model relates (changes in) liquid asset holdings of German savings banks to (sight) deposits and other short-term payment obligations, plus a number of controls. Using monthly data from July 2000 to December 2006, they find that German savings banks hold more liquid assets than required by regulation especially when they extend relatively few loans to non-banks.

Murta and Garcia (2010) estimate a model for excess reserve holdings for the aggregate of banks in the euro area, using daily data from April 2004 till December 2008. They use as explanatory variables: the spread (between Euribor and the minimum rate of MRO), the excess reserve holdings of the previous week, and a set of dummy variables capturing end-of-month and end-of-reserve-maintenance-period effects as well as a crisis dummy. These authors find that precautionary liquidity buffers are motivated by financing costs and they do not find evidence that the crisis affected the demand for excess reserves.

It is quite striking that the empirical studies do not consider maturity transformation as a determinant of banks' liquid asset holdings even though liquidity transformation, and the liquidity risk resulting from it, is the primary reason for banks to hold liquid assets (Goodhart, 2008). Maturity transformation is hard to measure, however. Moreover, data on maturities of banks' assets and liabilities is scarce. Deep and Schaefer (2004) proxy liquidity transformation by the difference between liquid liabilities and liquid assets as a percentage of total assets, which they call the liquidity transformation gap. Berger and Bouwman (2009), focusing on the extent to which banks transform illiquid assets into liquid liabilities, construct (four) liquidity creation measures, by classifying bank assets and liabilities as liquid, semi-liquid, or illiquid, and weighting these together. Both studies do not use actual maturity data. To the best of our knowledge, the only study employing maturity data is Gambacorta and Mistrulli (2004), who show the development of the weighted average for the maturity of Italian bank assets and liabilities.

Our contribution is to estimate empirically a model relating liquid asset holdings by banks to the full maturity ladder of future cash flows, using unique monthly data on maturity buckets ranging from 1 month to beyond 1 year. We confront the estimated empirical relationship with the relationship implied by Dutch and international liquidity rules. Further, we examine the effects of the crisis and bank characteristics on banks' liquidity management.

3. Liquidity regulation

3.1. Dutch regulation

In 2003, the Dutch banking regulator introduced a new quantitative liquidity supervisory system. According to this regulation, banks should have a so-called Liquidity Balance (LB) greater than or equal to zero at all times. The liquidity balance, LB, is defined as:

$$LB = \frac{Available\ liquidity - Required\ liquidity}{Required\ liquidity} \tag{1}$$

where

$$Available\ liquidity = Weighted\ stock\ of\ liquid\ assets + Weighted\ cash\ inflow\ scheduled\ within\ the\ coming\ month \tag{2}$$