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# Bank Liquidity Management during Financial Crises

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## Abstract

In this paper, we investigate the impact of financial crises on bank liquidity management. Using a sample of European publicly traded banks between 2004 and 2020, we find that financial crises shape banks' liquidity management. During the 2008 global financial crisis and the European sovereign debt crisis of 2010-2012, banks set lower liquidity targets and adjust to such targets faster than in non-crisis periods. Furthermore, during the 2008 global financial crisis liquidity is improved via a reduction in lending and market debt and through equity repurchases. During the European sovereign debt crisis of 2010-2012, banks adjust their liquidity ratios upward by increasing deposits and reducing market debt. Our findings contribute to the literature on banks' liquidity management during financial crises and bear several policy implications.

JEL classification: G01, G21.

**Keywords:** Liquidity management, financial crises, liquidity targets, adjustment speed

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## 1 Introduction

Deficiencies in bank liquidity management in Europe were pointed out as one of the main reasons for the 2008 global financial crisis (GFC) and the 2010-2012 European sovereign debt crisis (SDC). Therefore, the post-crisis Basel III accords introduced new liquidity requirements to incentivize banks to hold enough liquidity to absorb exogenous shocks and hold stable funds to perform their lending activities even under critical circumstances.

Many studies aim to uncover the determinants and the implications of the GFC (Acharya and Mora, 2015; Cornett et al., 2011) and the SDC (Acharya et al., 2018; Becker and Ivashina, 2018). Most of these studies emphasize the failure of the financial system to fuel enough liquidity and show the necessity of efficient liquidity management in the banking sector. In this vein, DeYoung and Jang (2016) analyze bank liquidity management using the partial adjustment model commonly used to study bank capital structure (e.g., Berger et al., 2008; Lepetit et al., 2015; De Jonghe and Öztekin, 2015). They analyze whether banks set targets for their liquidity ratios and how quickly they adjust towards their optimal liquidity level when they deviate from it.

Our paper aims to contribute to the liquidity adjustment and financial crises literature by addressing several questions on how banks adjust their liquidity during financial crises: How do financial crises impact banks' desired liquidity levels? When banks deviate from their target levels of liquidity, how quickly do they adjust toward their target during financial crises? Which mechanisms are used by banks to reestablish their desired levels of liquidity during financial crises?

To analyze the impact of financial crises on bank liquidity adjustment, we start by estimating a partial adjustment model of bank liquidity towards a bank-specific and time-varying desired liquidity level (see DeYoung and Jang, 2016). To address our research questions, we focus on the total deposits-to-net loans ratio, to which we add its two components (i.e., total deposits-to-total assets ratio and net loans-to-total assets ratio) and the liquid assets-to-total assets ratio for 163 publicly traded banks from 16 European countries between 2004 and 2020.

Our approach is similar to that of DeYoung and Jang (2016), who use a partial adjustment model to analyze U.S commercial banks' liquidity management. They find that banks actively manage their liquidity positions by targeting their loans-to-core deposits ratios. We augment and complement their study by drawing the following information on banks' liquidity management. First, we analyze the impact of financial crises on banks' liquidity ratios targeting and their adjustment speeds. We find that banks set lower liquidity targets during the two financial crises. Besides, they adjust faster. Second, we investigate the mechanisms banks use

to adjust toward their liquidity targets. We find that, during the 2008 global financial crisis, banks adjust their liquidity by decreasing lending and market debt but also by repurchasing their equity. During the sovereign debt crisis, banks do not decrease lending or equity. Instead, they increase deposits and decrease market debt. These findings contribute to the bank liquidity management literature, showing how financial crises shape banks' liquidity management.

The remainder of the paper proceeds as follows. Section 2 presents the data and describes the methodology. Section 3 discusses our results. Section 4 provides robustness checks and further issues. Section 5 concludes.

## 2 Data and methodology

### 2.1. Data

We collect financial statement data from the WorldScope database produced by Refinitive. It comprises balance sheet and income statement data of publicly traded banks from 2004 to 2020 for 16 Western European countries. We complement our data with macroeconomic data collected from World Development Indicators (World Bank).

Our initial sample comprises 199 banks. To prevent the undue influence of outliers, we winsorize all bank variables at the 2.5<sup>th</sup> and 97.5<sup>th</sup> percentile. We exclude banks with less than four consecutive years of observations to prevent short panel bias. To focus on pure commercial banks, we exclude banks with a deposit-to-assets ratio below 20% and a loan-to-assets ratio below 10% (Beltratti and Stulz, 2012). We end up with an unbalanced panel of 2220 annual observations corresponding to 163 publicly traded banks. Table 1 displays the number of banks per country and the representativeness of the final sample.

**[Insert Table 1]**

### 2.2. Methodology

Following DeYoung and Jang (2016), we use a partial adjustment model to model the dynamics of banks' liquidity adjustment. We measure bank liquidity using the total deposits-to-net loans ratio (TDNL), the two subcomponents of the ratio (the net loans-to-total assets ratio (NLTA) and the total deposits-to-total assets ratio (TDTA)), and the liquid assets-to-total assets ratio (LATA).

We assume that banks set a liquidity target  $L_{i,t}^*$  and would always converge toward it. This liquidity target  $L_{i,t}^*$  is unobserved and varies over time. It consists of the bank's observable characteristics  $X_{i,t-1}$ , and bank and time fixed effects.  $\beta$  is a vector of coefficients to be estimated.

$$L_{i,t}^* = \beta X_{i,t-1} \quad (1)$$

We rely on the theoretical determinants of liquidity demand (Tirole, 2011) and the variables used by DeYoung and Jang (2016) to specify the determinants of banks' liquidity target ratios. We include the natural logarithm of total assets (*Size*), total equity divided by total assets (*Equity*), and the gross domestic product growth (*GDPGrowth*). We add crisis dummy variables to assess the impact of the crises on liquidity targets (*GFC* and *SDC*).

Banks can deviate from their targets. To seize their adjustment process, we assume that in each period, banks converge toward their liquidity targets by reducing a constant proportion  $\lambda$  of the gap between  $L_{i,t-1}$  and  $L_{i,t}^*$ :

$$L_{i,t} - L_{i,t-1} = \lambda(L_{i,t}^* - L_{i,t-1}) + \varepsilon_{i,t} \quad (2)$$

Where  $\lambda$  is a scalar adjustment speed,  $\lambda \in [0; 1]$  with a higher value indicating that banks converge faster toward their liquidity targets. Substituting Eqs. (1) into (2) and rearranging yields:

$$L_{i,t} = \lambda\beta X_{i,t-1} + (1 - \lambda) L_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

To calculate bank liquidity targets  $L_{i,t}^*$ , we recover the estimated adjustment speed  $\hat{\lambda}$  from the estimated parameter  $(1 - \hat{\lambda})$  and then divide the estimated parameter  $\hat{\lambda}\hat{\beta}$  by  $\hat{\lambda}$  to recover  $\hat{\beta}$  which we use in Eq. (1).

The liquidity adjustment speed  $\lambda$  yielded by Eq.(2) is constrained to be identical for each bank every year. However, the liquidity adjustment speed may vary from one bank to another according to the characteristics and capacities of each bank. We relax this constraint by defining  $\lambda$  as follows:

$$\lambda_{i,t} = \varphi Z_{i,t-1} \quad (4)$$

where  $\lambda_{i,t}$  is the bank-specific, time-varying liquidity adjustment speed.  $Z_{i,t-1}$  is a vector of bank and time period characteristics that affect the liquidity adjustment speeds. We follow DeYoung and Jang (2016) and specify a vector of factors  $Z_{i,t-1}$  determining how fast banks adjust toward their liquidity targets. We include the deviation from the target (*Below*), *GFC*, *SDC*, *Size*, and *GDPGrowth*.  $\varphi$  is a vector of coefficients to be estimated. Substituting Eq. (4) into Eq. (2) gives:

$$L_{i,t} - L_{i,t-1} = \varphi Z_{i,t-1} (L_{i,t}^* - L_{i,t-1}) + \varepsilon_{i,t} \quad (5)$$

Rewording  $L_{i,t} - L_{i,t-1}$  as  $\Delta L_{i,t}$ , rewording  $L_{i,t}^* - L_{i,t-1}$  as  $GAP_{i,t-1}$ , and rearranging gives:

$$\Delta L_{i,t} = \varphi (Z_{i,t-1} \cdot GAP_{i,t-1}) + \varepsilon_{i,t} \quad (6)$$

The vector of coefficients  $\varphi$  can then be estimated and Eq. (4) can be used to calculate the liquidity adjustment speed  $\lambda_{i,t}$  for each bank  $i$  in each time period  $t$ .

Summary statistics and variable definitions are displayed in Table 2.

**[Insert Table 2]**

### 3. Results

We start by estimating Eq.(3) using the Blundell and Bond (1998) generalized method of moments (GMM) approach to investigate the desired level of liquidity targeted by banks. Then, we estimate Eq.(6) using the ordinary least squares (OLS) estimator to analyze how quickly banks adjust toward their liquidity targets during financial crises. We add bank fixed effects and time fixed effects in the estimations of the two equations.

#### 3.1. Liquidity targets

The estimations of the banks' liquidity targets are reported in Table 3. For the total deposits-to-net loans ratio (column 1), the mean estimated target TDNL\* is equal to 0.8015, which is very close to the mean actual ratio (0.8057). The mean adjustment speed shows that, within one year, banks reduce 48% of the gap between TDNL and TDNL\*. Such an adjustment speed enables banks to close 90% of the TDNL gap in 3.47 years<sup>2</sup>. The above results show that European publicly traded banks actively manage and target the total deposits-to-net loans ratio.

Banks set lower TDNL targets during financial crises. At the GFC and the SDC, banks set a TDNL target of 0.685 and 0.7738, respectively, which is relatively low compared to the TDNL targets set by banks before and after the two financial crises. The liquidity problems several banks face during the financial crises (Acharya and Mora, 2015) can explain why banks set lower liquidity targets during crisis periods.

The results in Table 3 show that banks do not target and actively manage the two components of the TDNL ratio separately. They actively manage and target only the total deposits component (total deposits-to-total assets ratio) and not liquidity on the asset side. This result is in line with the findings obtained by DeYoung and Jang (2016) for U.S. banks. Furthermore, we find that banks set higher targets for the liquid assets to total assets ratio during financial crises (Column 4), showing that financial crises incentivize banks to increase their liquid asset holdings, which was shown by Berrospide (2021).

**[Insert Table 3]**

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<sup>2</sup> Computed as  $\log(0.1)/\log(1-\text{speed of adjustment})$

### 3.2. Liquidity adjustment speeds

The estimations of the liquidity adjustment speeds are displayed in Table 4. For the total deposits-to-net loans ratio (column 1), the average estimated bank-specific adjustment speed  $\lambda_{i,t}$  is 0.1404, which is lower than the constrained adjustment speed<sup>3</sup> ( $\lambda=0.4848$ ). This difference shows the importance of taking into consideration the differences across banks.

Before the GFC, banks reduce 14% of the TDNL gap in one year. However, banks adjust faster during the GFC and close 16% of the TDNL gap. Furthermore, they move faster during the SDC and reduce 17% of the liquidity gap. After the crisis, banks decrease their adjustment speeds and close only 12% of their TDNL gaps.

Therefore, during financial crises, European banks change their liquidity management by adjusting faster toward their liquidity targets. Banks' higher TDNL adjustment speeds during the SDC result from a faster adjustment toward their TDTA (column 2). During the GFC, the faster banks' TDNL adjustment speeds are associated with a slower adjustment of their LATA\* (column 4).

**[Insert Table 4]**

Overall, these results indicate that the GFC and SDC incentivize banks to reconsider their liquidity management behavior. Specifically, the difficulties of raising sufficient funding during financial crises (Acharya and Mora, 2015) push banks to set lower desired liquidity levels (i.e., targets) and manage those targets more actively by allocating non-trivial portions of their resources to improve their liquidity situation. Those changes in bank liquidity management may translate into a weaker credit supply.

### 3.3. Liquidity adjustment mechanisms

We analyze the mechanisms banks use to adjust their total deposits-to-net loans ratios depending on their positions relative to their targets (shortfall or surplus).

Banks can re-establish their desired level of liquidity by increasing or decreasing the different components of their balance sheets. To capture the mechanisms banks use to return to their targets, we regress the growth rate of the different balance sheet components on the TDNL ratio deviation. Specifically, we estimate the following model:

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<sup>3</sup> In the estimation of the liquidity targets Eq.(3), we constrain all banks to have the same adjustment speed  $\lambda$ .

$$\Delta Mechanisms_{i,t} = \alpha_1 + \alpha_2 Shortfall_{i,t-1} + \alpha_3 Shortfall_{i,t-1} \times GFC_t + \alpha_4 Shortfall_{i,t-1} \times SDC_t + \alpha_2 Surplus_{i,t-1} + \alpha_3 Surplus_{i,t-1} \times GFC_t + \alpha_4 Surplus_{i,t-1} \times SDC_t + \alpha_5 GFC_t + \alpha_6 SDC_t + \alpha_7 Controls_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

Where  $\Delta Mechanisms_{i,t}$  is the growth rate of different balance sheet components (assets, loans, liquid assets, securities, deposits, total debt, long-term debt, short-term debt, and equity).  $Shortfall_{i,t-1}$  equal the absolute value<sup>4</sup> of the TDNL ratio gap if  $TDNL_{i,t-1} < TDNL_{i,t}^*$  and zero otherwise.  $Surplus_{i,t-1}$  equal the absolute value of the TDNL ratio gap if  $TDNL_{i,t-1} > TDNL_{i,t}^*$  and zero otherwise.  $GFC_t$  is a 2007-2009 global financial crisis dummy variable.  $SDC_t$  is a 2010-2012 sovereign debt crisis dummy variable.  $Controls_{i,t-1}$  corresponds to the control variables.  $MA$  is a dummy for mergers and acquisitions equal to one if total assets growth exceeds 25%.  $GDPgrowth$  is the global domestic product growth. We estimate the model presented in Eq.(7) using an OLS technique including bank and time fixed effects.

#### [Insert Table 5]

The results are displayed in Table 5. During the GFC, banks with a TDNL shortfall shrink their lending, reduce their debts, particularly short-term debts, and repurchase equity. During the SDC, they raise more deposits and decrease their debts, particularly long-term debts and do not reduce their lending. These results highlight that banks' responses to a shortfall in their liquidity ratios vary across financial crises.

Banks that face TDNL surplus adopt different adjustment mechanisms. During the GFC, they make changes at the liability side of the balance sheet by reducing their deposits and increasing their borrowings. By contrast, during the SDC, they do not expand their borrowings and reduce only their deposit funding.

Differences in the liquidity adjustment mechanisms between the two financial crises reflect the differences in terms of trigger factors and implications of the two crises. During the GFC, the interbank market froze, and banks' liquidity dried up, incentivizing banks to decrease their lending to manage their liquidity risk (Cornett et al., 2011). However, during the SDC, the sovereign bonds were impaired, which hit the balance sheets of banks holding those bonds and caused equity losses (Acharya et al., 2018). Those losses might raise doubt about affected banks' solvency, increase borrowing costs, and make their access to the funding market more difficult.

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<sup>4</sup> Following Lepetit et al. (2015), we use the absolute value of the TDNL ratio gap to ease the results' interpretation.



#### 4. Robustness checks and further issues

This section checks the robustness of our liquidity adjustment speed results and investigates further issues. In Table 6, we re-run our TDNL ratio adjustment speed model on subsamples of large banks<sup>5</sup> versus small banks, banks from GIIPS countries (Greece, Italy, Ireland, Portugal, and Spain) versus banks from non-GIIPS countries, rescued<sup>6</sup> banks versus non-rescued banks. We find that: (1) regardless of the period, large banks manage their balance sheet liquidity less actively than small banks. (2) liquidity adjustment speeds are higher for banks from GIIPS countries in all cases. And (3) rescue packages do not incentivize recipient banks to operate away from their balance sheet liquidity targets. Instead, they use this added resource to adjust faster.

Finally, we run our adjustment speed model Eq.(6) using the bootstrapped procedure<sup>7</sup> and we re-examine this model after excluding the first stage of the health crisis (i.e., 2020). Our results remain the same<sup>8</sup>.

**[Insert Table 6]**

#### 5. Conclusion

This paper investigates how banks have managed their liquidity during the GFC and the SDC. Our results reveal that financial crises shape banks' liquidity management. During financial crises, banks set lower liquidity targets, and they adjust faster by reducing larger portions of the gap between the actual liquidity ratio and the target ratio. They also use different adjustment mechanisms. Our findings contribute to the bank liquidity management literature and shed light on how financial crises change banks' liquidity behavior. The Basel III liquidity requirements announced after the GFC are expected to enable banks to better absorb possible shocks in the future. However, too stringent rules may also affect banks' profitability and risk behavior. Therefore, supervisors could periodically revise the minimum ratios that banks need to comply with and converge to depending on economic conditions but also on their individual characteristics.

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<sup>5</sup> Following Bakkar and Nyola (2021), we define large banks as banks with total assets higher than 30 billion euros.

<sup>6</sup> We base on Petrovic and Tutsh (2009) to define banks rescued during the GFC.

<sup>7</sup> As we used estimated variables (targets) to compute the gap measures, we check the robustness of our results using a bootstrap procedure with 500 replications (Pagan, 1984).

<sup>8</sup> Robustness checks results are available upon request.

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**Table 1**

Distribution of sample banks by country and representativeness

Country	Number of banks	Representativeness
Austria	8	1
Belgium	1	0.5141
Denmark	20	0.9985
Finland	3	0.9901
France	17	1
Germany	17	0.9729
Greece	5	0.4550
Ireland	3	1
Italy	11	0.9826
Netherlands	3	1
Norway	30	0.9201
Portugal	2	0.9979
Spain	6	0.9793
Sweden	3	0.9731
Switzerland	21	0.3337
United Kingdom	13	0.9944
<b>Total or Mean</b>	<b>163</b>	<b>0.8820</b>

**Table 2**

Summary statistics

Unbalanced panel of publicly traded European bank between 2004 to 2020 from WorldScope database

<b>Variable</b>	<b>Definition</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Median</b>	<b>Max</b>
<b>TDNL</b>	Total deposits/net loans	2,220	0.8057	0.3195	0.2351	0.7680	2.1334
<b>TDTA</b>	Total deposits/total assets	2,220	0.5488	0.1701	0.2030	0.5609	0.8519
<b>NLTA</b>	Net loans/total assets	2,220	0.7151	0.1577	0.1925	0.7462	0.9223
<b>LATA</b>	Liquid assets/total assets	2,220	0.3008	0.1679	0.0826	0.2603	0.9125
<b>ΔTDNL</b>	Annual change in TDNL	2,220	0.0109	0.0685	-0.1822	0.0079	0.2207
<b>ΔTDTA</b>	Annual Change in TDTA	2,220	0.0026	0.0348	-0.0890	0.0021	0.0897
<b>ΔNLTA</b>	Annual change in NLTA	2,220	-0.0048	0.0369	-0.1007	-0.0031	0.0916
<b>ΔLATA</b>	Annual change in LATA	2,220	0.0032	0.0359	-0.0855	0.0027	0.0907
<b>TargetTDNL</b>	TDNL estimated target	2,220	0.8015	0.2788	0.1260	0.8146	1.3841
<b>TargetTDTA</b>	TDTA estimated target	2,220	0.5653	0.1268	0.2354	0.5694	0.8411
<b>TargetNLTA</b>	NLTA estimated target	2,220	0.6681	0.1121	0.3738	0.6849	0.8740
<b>TargetLATA</b>	LATA estimated target	2,220	0.2449	0.0600	0.1240	0.2444	0.3688
<b>SpeedTDNL</b>	TDNL estimated adjustment speed	2,220	0.1404	0.0583	0.0336	0.1571	0.2552
<b>SpeedTDTA</b>	TDTA estimated adjustment speed	2,220	0.1189	0.0266	0.0500	0.1187	0.2084
<b>SpeedNLTA</b>	NLTA estimated adjustment speed	2,220	0.2085	0.0347	0.1020	0.2210	0.2731
<b>SpeedLATA</b>	LATA estimated adjustment speed	2,220	0.2398	0.0567	0.1247	0.2367	0.3462
<b>GFC</b>	Dummy equal to one if observation falls into global financial crisis period of 2007 to 2009	2,220	0.1689	0.3748	0	0	1
<b>SDC</b>	Dummy equal to one if observation falls into sovereign debt crisis period of 2010 to 2012	2,220	0.1788	0.3833	0	0	1
<b>Size</b>	Natural logarithm of total assets	2,220	16.5590	2.3871	12.0366	16.4383	21.1244
<b>Equity</b>	Total equity/total assets	2,220	0.0797	0.0366	0.0246	0.0704	0.2340
<b>GDPGrowth</b>	Real gross domestic product growth	2,220	0.0110	0.0278	-0.1082	0.0166	0.2518
<b>BelowTDNL</b>	Equal to one if TDNL<TargetTDNL and zero otherwise	2,220	0.5586	0.4967	0	1	1
<b>BelowTDTA</b>	Equal to one if TDTA<TargetTDTA and zero otherwise	2,220	0.5180	0.4998	0	1	1
<b>AboveNLTA</b>	Equal to one if NLTA>TargetNLTA and zero otherwise	2,220	0.6658	0.4718	0	1	1
<b>BelowLATA</b>	Equal to one if LATA<TargetLATA and zero otherwise	2,220	0.4559	0.4982	0	0	1
<b>GapTDNL</b>	TDNL* minus TDNL	2,220	0.0065	0.3764	-1.9381	0.0535	0.7029
<b>GapTDTA</b>	TDTA* minus TDTA	2,220	0.0185	0.1538	-0.4901	0.0122	0.4774
<b>GapNLTA</b>	NLTA* minus NLTA	2,220	-0.0518	0.1662	-0.3969	-0.0664	0.6407
<b>GapLATA</b>	LATA* minus LATA	2,220	-0.0529	0.1581	-0.7621	-0.0106	0.1987

**Table 3****Estimating the target liquidity ratio**

Parameters for the first stage of the partial adjustment model, estimated for an unbalanced panel of 163 European publicly traded banks from 2004 to 2020 for total deposits/net loans (TDNL), total deposits/total assets (TDTA), net loans/total assets (NLTA), and liquid assets to total assets (LATA). GFC is a dummy equal to one if observation falls into global financial crisis period of 2007 to 2009. SDC is a dummy equal to one if observation falls into sovereign debt crisis period of 2010 to 2012. Size is the natural logarithm of total assets. Equity is total equity/total assets. GDPGrowth is the real gross domestic product growth. First stage estimated using GMM (Blundell and Bond, 1988) with fixed bank effects and fixed year effects. P-values based on robust standard errors are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% level, respectively.

	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
	<b>TDNL</b>	<b>TDTA</b>	<b>NLTA</b>	<b>LATA</b>
<b>L.Dependent variable</b>	0.5152*** (0.0778)	0.8018*** (0.0495)	0.8955*** (0.0355)	0.8510*** (0.0670)
<b>GFC</b>	-0.0946*** (0.0227)	-0.0296** (0.0138)	-0.0145** (0.0059)	0.0142*** (0.0051)
<b>SDC</b>	-0.0369* (0.0187)	0.0129 (0.0122)	-0.0216*** (0.0061)	0.0203*** (0.0057)
<b>Size<sub>t-1</sub></b>	-0.0544** (0.0253)	-0.0075*** (0.0022)	-0.0033** (0.0014)	0.0037* (0.0021)
<b>Equity<sub>t-1</sub></b>	-0.0159 (0.0148)	-0.0043 (0.0027)	0.0002 (0.0015)	0.0012 (0.0012)
<b>GDPGrowth<sub>t-1</sub></b>	0.3264 (0.2001)	0.7737*** (0.2482)	0.0046 (0.0510)	0.0096 (0.0419)
<b>Constant</b>	1.3032*** (0.4391)	0.2267*** (0.0665)	0.1302*** (0.0483)	-0.0241 (0.0195)
<b>Nbr. of obs.</b>	2220	2220	2220	2220
<b>Nbr. of banks</b>	163	163	163	163
<b>AR2 p-stat</b>	0.7823	0.6633	0.5471	0.4669
<b>Hansen p-stat</b>	0.1965	0.1096	0.8487	0.2542
<b>Year FE</b>	YES	YES	YES	YES
<b>Bank FE</b>	YES	YES	YES	YES
<b>Adjustment speed <math>\lambda</math></b>	0.4848	0.1982	0.1045	0.149
<b>Years to close 90% of the gap</b>	3.4716	10.4210	20.8550	14.2724
<b>Mean estimated target by period</b>				
<b>All sample</b>	0.8015	0.5653	0.6681	0.2449
<b>Pre-Crisis</b>	0.8999	0.6196	0.7396	0.2345
<b>Global Financial Crisis</b>	0.6850	0.4718	0.5961	0.2393
<b>Sovereign Debt Crisis</b>	0.7738	0.5906	0.5227	0.2411
<b>Post-Crisis</b>	0.8194	0.5704	0.7224	0.2517

**Table 4****Liquidity Adjustment Speeds during Financial Crises**

This table displays bank liquidity adjustment speeds during financial crises using a sample of 163 European publicly traded banks during 2004-2020.  $\Delta$ TDNL is the annual change in total deposits/net loans.  $\Delta$ TDTA is the annual change in total deposits/total assets.  $\Delta$ NLTA is the annual change in net loans/total assets.  $\Delta$ LATA is the annual change in liquid assets/total assets. Gap is the difference between the actual liquidity ratio and the lagged liquidity target. GFC is a dummy equal to one if observation falls into global financial crisis period of 2007 to 2009. SDC is a dummy equal to one if observation falls into sovereign debt crisis period of 2010 to 2012. Below is a dummy equal to one if liquidity actual ratio < liquidity target. Above is a dummy equal to one if liquidity actual ratio > liquidity target. Size is the natural logarithm of total assets. GDPGrowth is the real gross domestic product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
	$\Delta$ TDNL	$\Delta$ TDTA	$\Delta$ NLTA	$\Delta$ LATA
<b>Gap<sub>t-1</sub></b>	0.2364** (0.0966)	0.2431*** (0.0566)	0.1443** (0.0561)	0.0389 (0.1230)
<b>Gap<sub>t-1</sub>xGFC</b>	0.0271*** (0.0100)	0.0174 (0.0183)	-0.0184 (0.0242)	-0.0281** (0.0126)
<b>Gap<sub>t-1</sub>xSDC</b>	0.0529*** (0.0094)	0.0397*** (0.0138)	-0.0601*** (0.0229)	-0.0056 (0.0099)
<b>Gap<sub>t-1</sub>xBelow<sub>t-1</sub></b>	0.0781* (0.0420)	0.0021 (0.0218)		0.1044** (0.0444)
<b>Gap<sub>t-1</sub>xAbove<sub>t-1</sub></b>			0.0669** (0.0312)	
<b>Gap<sub>t-1</sub>xSize<sub>t-1</sub></b>	-0.0095* (0.0053)	-0.0086*** (0.0032)	0.0019 (0.0034)	0.0097 (0.0067)
<b>Gap<sub>t-1</sub>xGDPGrowth<sub>t-1</sub></b>	0.1221 (0.2626)	0.4403 (0.3289)	0.1048 (0.2350)	-0.0645 (0.1704)
<b>Constant</b>	-0.0314*** (0.0101)	-0.0023 (0.0029)	0.0027 (0.0034)	0.0026 (0.0044)
<b>Year FE</b>	YES	YES	YES	YES
<b>Bank FE</b>	YES	YES	YES	YES
<b>Observations</b>	2,220	2,220	2,220	2,220
<b>R-squared</b>	0.1540	0.1279	0.1819	0.2015
<b>Number of banks</b>	163	163	163	163
<b>Mean estimated adjustment speed <math>\lambda</math> by period</b>				
<b>All sample</b>	0.1404	0.1189	0.2085	0.2398
<b>Pre-Crisis</b>	0.1443	0.1148	0.2155	0.2383
<b>Global Financial Crisis</b>	0.1605	0.1314	0.2124	0.2155
<b>Sovereign Debt Crisis</b>	0.1739	0.1422	0.1734	0.2383
<b>Post-Crisis</b>	0.1199	0.1075	0.2177	0.2492

**Table 5**

Adjustments Mechanisms during Financial Crises for total deposits-to-net loans (TDNL) ratio.

This table displays bank TDNL adjustment mechanisms during financial crises using a sample of 163 European publicly traded banks during 2004-2020.  $\Delta$ Assets is the annual change in total assets divided by average total assets.  $\Delta$ Loans is the annual change in net loans divided by average total assets.  $\Delta$ LiquidAssets is the annual change in liquid assets divided by average total assets.  $\Delta$ Securities is the annual change in securities divided by average total assets.  $\Delta$ Deposits is the annual change in total deposits divided by average total deposits.  $\Delta$ TotalDebt is the annual change in total debt divided by average total liabilities.  $\Delta$ LTDebt is the annual change in long-term debt divided by average total liabilities.  $\Delta$ STDebt is the annual change in short-term debt divided by average liabilities.  $\Delta$ Equity is the annual change in total equity divided by average total equity. Shortfall equal to the absolute value of the TDNL gap if  $TDNL_{i,t-1} < TDNL_{i,t}$  \* and zero otherwise. Surplus equal to the absolute value of the TDNL gap if  $TDNL_{i,t-1} > TDNL_{i,t}$  \* and zero otherwise. GFC is a dummy equal to one if observation falls into global financial crisis period of 2007 to 2009. SDC is a dummy equal to one if observation falls into sovereign debt crisis period of 2010 to 2012. MA is a dummy for mergers and acquisitions. Dummy equal to one if banks asses growth exceeds 25%. GDPGrowth is the real gross domestic product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$\Delta$ Assets	$\Delta$ Loans	$\Delta$ LiquidAssets	$\Delta$ Securities	$\Delta$ Deposits	$\Delta$ TotalDebt	$\Delta$ LTDebt	$\Delta$ STDebt	$\Delta$ Equity
<b>Shortfall<sub>t-1</sub>(<math>\beta</math>1)</b>	-0.0758* (0.0434)	-0.0725** (0.0347)	-0.0151 (0.0213)	0.0006 (0.0166)	0.0894* (0.0533)	-0.0860*** (0.0219)	-0.0410** (0.0174)	-0.0447*** (0.0169)	-0.0724 (0.0490)
<b>Shortfall<sub>t-1</sub>xGFC(<math>\beta</math>2)</b>	-0.0263 (0.0359)	-0.0628** (0.0273)	0.0148 (0.0232)	-0.0197 (0.0198)	-0.0514 (0.0410)	-0.0001 (0.0208)	0.0267 (0.0238)	-0.0218 (0.0300)	-0.1999*** (0.0514)
<b>Shortfall<sub>t-1</sub>xSDC(<math>\beta</math>3)</b>	0.1055*** (0.0381)	0.0989*** (0.0311)	0.0302* (0.0175)	0.0014 (0.0145)	0.2401*** (0.0448)	-0.0144 (0.0203)	-0.0166 (0.0208)	0.0106 (0.0201)	0.1247** (0.0503)
<b>Surplus<sub>t-1</sub>(<math>\omega</math>1)</b>	-0.0809** (0.0334)	-0.0205 (0.0219)	-0.0414* (0.0229)	-0.0300 (0.0195)	-0.1125*** (0.0378)	-0.0003 (0.0102)	0.0002 (0.0067)	0.0005 (0.0090)	-0.0915*** (0.0281)
<b>Surplus<sub>t-1</sub>xGFC(<math>\omega</math>2)</b>	0.0964** (0.0373)	-0.0092 (0.0147)	0.0453** (0.0222)	0.0343* (0.0204)	0.0105 (0.0227)	0.0383** (0.0162)	0.0077 (0.0090)	0.0324** (0.0157)	0.0286 (0.0284)
<b>Surplus<sub>t-1</sub>xSDC(<math>\omega</math>3)</b>	-0.0023 (0.0308)	0.0178 (0.0230)	0.0053 (0.0181)	-0.0157 (0.0146)	-0.0084 (0.0408)	-0.0006 (0.0148)	-0.0175 (0.0113)	0.0201 (0.0125)	0.0117 (0.0416)
<b>GFC</b>	-0.0608*** (0.0178)	-0.0409*** (0.0126)	-0.0134 (0.0099)	-0.0020 (0.0084)	0.0007 (0.0190)	-0.0477*** (0.0079)	-0.0378*** (0.0080)	-0.0101 (0.0086)	0.0600*** (0.0197)
<b>SDC</b>	-0.0426*** (0.0161)	-0.0524*** (0.0125)	0.0006 (0.0080)	-0.0012 (0.0069)	-0.0128 (0.0183)	-0.0251*** (0.0085)	-0.0130** (0.0065)	-0.0117 (0.0080)	0.0023 (0.0184)
<b>MA<sub>t-1</sub></b>	0.0029 (0.0118)	0.0076 (0.0097)	-0.0052 (0.0058)	-0.0031 (0.0039)	-0.0067 (0.0130)	0.0042 (0.0058)	0.0011 (0.0048)	0.0032 (0.0046)	0.0081 (0.0128)
<b>GDPGrowth<sub>t-1</sub></b>	0.8013*** (0.2127)	0.6623*** (0.1632)	0.1125 (0.0799)	0.0138 (0.0769)	0.5366*** (0.2038)	0.3210*** (0.1066)	0.1752** (0.0699)	0.1419 (0.0961)	0.4454** (0.2108)
<b>Constant</b>	0.0804*** (0.0148)	0.0536*** (0.0124)	0.0244*** (0.0072)	0.0214*** (0.0052)	0.0453** (0.0179)	0.0341*** (0.0074)	0.0219*** (0.0056)	0.0112* (0.0064)	0.0698*** (0.0173)
<b>Observations</b>	2,220	2,220	2,220	2,220	2,220	2,218	2,213	2,202	2,220
<b>R-squared</b>	0.2113	0.1863	0.1241	0.1068	0.1341	0.1840	0.0806	0.0518	0.1468
<b>Number of banks</b>	163	163	163	163	163	163	163	163	163
<b>Wald tests</b>									
<b><math>\beta</math>1+<math>\beta</math>2</b>	-0.1021*	-0.1353***	-0.0003	-0.0191	0.0380	-0.0860***	-0.01430	-0.0665**	-0.2723***
<b><math>\beta</math>1+<math>\beta</math>3</b>	0.0297	0.0264	0.0151	0.0020	0.3295***	-0.1004***	-0.0577**	-0.0341	0.0523
<b><math>\omega</math>1+<math>\omega</math>2</b>	0.0155	-0.0298	0.0039	0.0043	-0.1020**	0.0380**	0.0079	0.0329*	-0.0629*
<b><math>\omega</math>1+<math>\omega</math>3</b>	-0.0832*	-0.0028	-0.0362	-0.0457	-0.1209**	-0.0008	-0.01728	0.0206	-0.0798

**Table 6****TDNL Adjustment Speeds during Financial Crises: effect of size, crisis severity, and rescue packages**

This table displays cross-section analyses of bank liquidity adjustment speeds during financial crises using a sample of 163 European publicly traded banks during 2004-2020.  $\Delta$ TDNL is the annual change in total deposits/net loans. Gap is the difference between the actual liquidity ratio and the lagged liquidity target. GFC is a dummy equal to one if observation falls into global financial crisis period of 2007 to 2009. SDC is a dummy equal to one if observation falls into sovereign debt crisis period of 2010 to 2012. Below is a dummy equal to one if liquidity actual ratio < liquidity target. Size is the natural logarithm of total assets. GDPGrowth is the real gross domestic product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% level, respectively.

	$\Delta$ TDNL					
	Large Banks	Small Banks	GIIPS	NonGIIPS	Rescued	NonRescued
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
<b>Gap<sub>t-1</sub></b>	0.5717** (0.2587)	0.2100* (0.1239)	-0.6451** (0.2806)	0.2405** (0.0956)	0.1052 (0.3556)	0.2708*** (0.1009)
<b>Gap<sub>t-1</sub>xGFC</b>	0.0189 (0.0196)	0.0117 (0.0249)	0.0346 (0.0693)	0.0199** (0.0097)	0.0484* (0.0273)	0.0260** (0.0126)
<b>Gap<sub>t-1</sub>xSDC</b>	0.0369** (0.0161)	0.0770*** (0.0163)	-0.0238 (0.0515)	0.0495*** (0.0092)	0.0457*** (0.0125)	0.0665*** (0.0125)
<b>Gap<sub>t-1</sub>xBelow<sub>t-1</sub></b>	0.0178 (0.1004)	0.0700 (0.0490)	0.0772 (0.1071)	0.0705* (0.0421)	0.2541* (0.1357)	0.0529 (0.0439)
<b>Gap<sub>t-1</sub>xSize<sub>t-1</sub></b>	-0.0261** (0.0126)	-0.0075 (0.0077)	0.0489*** (0.0162)	-0.0105** (0.0050)	-0.0011 (0.0176)	-0.0120** (0.0056)
<b>Gap<sub>t-1</sub>xGDPGrowth<sub>t-1</sub></b>	0.4026 (0.4211)	-0.2710 (0.4996)	-0.7448* (0.3750)	0.3646 (0.2923)	-0.0761 (0.2976)	0.2741 (0.3577)
<b>Constant</b>	0.0111 (0.0109)	-0.0499*** (0.0144)	0.0021 (0.0139)	-0.0323*** (0.0113)	-0.0732*** (0.0254)	-0.0226** (0.0109)
<b>Year FE</b>	YES	YES	YES	YES	YES	YES
<b>Bank FE</b>	YES	YES	YES	YES	YES	YES
<b>Observations</b>	774	1,446	390	1,830	548	1,672
<b>R-squared</b>	0.2008	0.1485	0.3506	0.1425	0.2470	0.1585
<b>Number of banks</b>	53	110	27	136	37	126
<b>Mean estimated adjustment speed <math>\lambda</math> by period</b>						
<b>All sample</b>	0.0902	0.1628	0.2608	0.1336	0.2138	0.1332
<b>Pre-Crisis</b>	0.1007	0.1609	0.2520	0.1371	0.2254	0.1339
<b>Global Financial Crisis</b>	0.1073	0.1624	0.2954	0.1500	0.2560	0.1517
<b>Sovereign Debt Crisis</b>	0.1065	0.2245	0.2624	0.1644	0.2254	0.1788
<b>Post-Crisis</b>	0.0745	0.1409	0.2506	0.1158	0.1897	0.1104