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## Investor attention to bank risk during the spring 2023 bank run

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# Investor Attention to Bank Risk During the Spring 2023 Bank Run

Natalia Fischl-Lanzoni | Martin Hiti | Nathan Kaplan | Asani Sarkar

## **Investor Attention to Bank Risk During the Spring 2023 Bank Run**

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### **Abstract**

We examine how investors' perception of bank balance sheet risk evolved before and during the March-April 2023 bank run. To do so, we estimate the covariance ("beta") of bank excess stock returns with returns on factors constructed from long-short portfolios sorted on shares of uninsured deposits and unrealized losses on securities. We find that the market's perception of bank risk shifted in both the time series and the cross-section. From January 2022 to February 2023, both factor betas were mostly insignificant, but after the bank run started, they became positive and significant for all banks on average. However, in the cross-section, only the factor betas of banks put on downgrade watch on March 13 were significant, consistent with our finding that this announcement was informative. When additional banks were downgraded in April, their factor betas also became significant, even though we find the April announcements to be noninformative for these banks. We suggest that investors with limited attention focused on the banks included in the April announcements to update their priors on balance sheet risk.

JEL classification: G01, G12, G14, G21

Key words: bank run, information sensitivity, limited attention, balance sheet beta, uninsured deposits, unrealized losses

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# 1 Introduction

The bank run that started in March 2023 in the US transpired unusually rapidly, with historically high 1-day deposit withdrawal rates for Silicon Valley Bank (SVB) and Signature Bank of New York (SBNY) occurring on March 9 and 10 (see Figure 1), suggesting that depositors became aware of bank liquidity risk quite suddenly. So how did depositors process information about bank risk before and during the bank run? This is an important question because the dynamics of bank runs are intimately related to depositor information. For example, in the global games approach, depositors have slightly noisy information about bank fundamentals and, in equilibrium, even a panic run is related to these fundamentals (Goldstein and Pauzner (2005)). In these models, the runs occur instantaneously but, historically, runs have duration (Correia, Luck and Verner (2023)). During the run period, do investors quickly incorporate all relevant information, or, due to limited attention, do they update their priors only when they consider the information to be salient? If the latter, then the resulting price dynamics might make it harder for market participants and regulators to assess bank risk and respond appropriately. While there is evidence of limited investor attention in financial markets (Hirshleifer (2015)), there is less evidence of how investors attend to bank risk, particularly in the context of a bank run.

This paper studies how the market’s perception of bank risk, as reflected in bank stock prices, evolved before and during the bank run in March and April of 2023. How did these risk perceptions change as the informational environment changed – for example, as the relative emphasis on different banks and their risk exposures shifted? To what extent did stock prices incorporate relevant and readily available information about bank balance sheet risk before the run, going back to 2022Q1 when the Fed started to raise interest rates?

To measure bank risk, we estimate balance sheet “betas”— the covariance of bank excess stock returns with returns on factors constructed from long-short portfolios based on several bank balance sheet characteristics in the prior quarter. To mitigate any mechanical findings, we exclude failed and downgraded banks from the factor construction procedure and we

exclude SVB, SBNY, and Silvergate Bank from all analyses in the paper. First Republic Bank (FRC) is also omitted after April 28 (as it failed before the market opened on May 1). To capture the post-run informational environment, we make use of announcements by credit rating agencies. Specifically, Moody’s put some banks on downgrade *watch* on March 13, and, during the week between April 14 and April 21, these and other regional banks were downgraded. We form bank groups based on these announcements, as well as groups of non-downgraded regional and stress-tested banks. Comparing the balance sheet factor betas of these different groups allows us to understand how investors perceived bank risk during the bank run in both the time series and the cross-section of banks and their risk exposures. For example, the banks on downgrade watch had relatively high asset shares of uninsured deposits (denoted *UID*) while regional banks, whether downgraded or not, had higher asset shares of unrealized losses on securities in held-to-maturity (HTM) and available-for-sale (AFS) accounts (denoted *Losses*) in 2022Q4 (see Table 1).

Our main results are illustrated in Figure 2, which shows the estimates of our factor betas in 2023, before and during the bank run for the *UID* (Panel A) and *Losses* (Panel B) factors. These characteristics are widely recognized as being central to the March-April 2023 bank run (see, for example, Acharya, Richardson, Schoenholtz and Tuckman (2023)). Panel A shows that the *UID* factor beta was insignificant in January and February of 2023 but became positive and significant during the bank run (March 13-May 5). Panel B shows similar results for the *Losses* factor. In other words, during the bank run, investors required return compensation for systematic *UID* and *Losses* risk whereas, just before the run, they did not, consistent with these factors becoming more information sensitive (Dang, Gorton and Holmstrom (2018)).

We next examine the effect on banks mentioned in rating agency announcements (denoted “event banks”) during the bank run. We show that the downgrade watch announcements on March 13 were informative as the abnormal returns of event banks declined significantly on the announcement day. Further, they declined more for event banks than for non-event

banks, indicating that the announcement effect was incremental to any crisis effects. Figure 2 shows that, between March 13 and April 13, the *UID* and *Losses* betas of *only* these banks were positive and significant, while the betas of other regional banks remained insignificant. The betas of stress-tested banks (the baseline group in the regressions and so indicated by the stand-alone *Factor* estimate) were also insignificant, consistent with their higher-quality balance sheets (see Table 1). These findings are consistent with investors finding the ratings informative of event bank risks, and adjusting their risk estimates accordingly.

Next, we consider the downgrade of several banks between April 14 and 21. In contrast to the March event, the abnormal returns of newly downgraded banks (i.e., those not previously on watch) are not significantly different from zero. Nevertheless, Figure 2 shows that the betas of these banks (excluding FRC), estimated from April 21 to May 5, were positive and significant. This result suggests that the rating announcements, while uninformative, were nevertheless salient because, for instance, they indicated to investors with *limited attention* which banks they should focus on. Surprisingly, downgraded banks previously on watch in March had significantly negative announcement-day abnormal returns, and higher betas relative to stress-tested banks after the April announcements. This result might indicate a market inefficiency since all information should be incorporated when the watch was announced, as in Norden and Weber (2004)).

A concern with these results might be the small number of banks affected by rating announcements. To address this issue, we conduct a “leave-one-out” analysis. Specifically, we exclude event banks one by one and re-estimate the regressions. We find that the magnitude and standard errors of the point estimates are very similar to the original results. Therefore, the results are not driven by specific members of the event banks group.

How did investors process information about bank risk in 2022? After the Fed raised rates by 25bp on March 17, 50bp on May 5, and 75bp on June 16, subsequent regulatory reports revealed information about unrealized losses (see Figure 7), and credit rating agencies warned

of “emerging risks for U.S. regional banks” beginning in June 2022.<sup>1</sup> Moreover, information regarding deposit outflows spread as early as 2022. SVB suffered deposit outflows in 2022, albeit at a slow pace, that continued through February 2023 (FRB (2023b)). SBNY lost deposits as news reports scrutinized its involvement with the crypto industry during the crypto winter of 2022 (FDIC (2023)). On November 15, 2022, SBNY was forced to announce that deposits from FTX and related crypto entities were a minor share of its overall deposits.<sup>2</sup>

We examine rolling window betas over 2022 and find that the *Losses* beta became significant on August 19 (corresponding to the estimation window starting on June 27) but turned insignificant after December 14 and remained so through the end of February 2023. The *UID* beta was only sporadically significant during 2022Q2 and 2022Q4. Thus, investors were only intermittently sensitive to high levels of *UID* and *Losses* in 2022. The intermittent significance of bank betas in 2022 is consistent with the limited investor attention view, given that regulatory reports show that average *Losses* of regional banks increased monotonically before peaking in 2022Q3 and remaining high in 2022Q4 (see Figure 7).

**Contributions and related literature.** Our estimates of balance sheet betas using high-frequency data provide new insights into the evolution of bank risk during the bank run of Spring 2023. Jiang, Matvos, Piskorski and Seru (2023) analyze the interest rate risk of U.S. bank assets and find that the market value of bank assets is \$2.2 trillion lower than suggested by their book value of assets accounting for loan portfolios held to maturity. Drechsler, Savov, Schnabl and Wang (2023) show that the liquidity risk of banks increases with interest rates. A run equilibrium is absent at low interest rates but it appears when rates rise because the deposit franchise comes to dominate the value of the bank. Haddad, Hartman-Glaser and

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<sup>1</sup>See “Silicon Valley Bank’s Distress Wasn’t Reflected in Credit Ratings,” *The Wall Street Journal*, March 17, 2023.

<sup>2</sup>Short-selling activities may also indicate investor awareness. But, while short sellers were active in distressed bank stocks before the run in March, short position volumes were reported to be at about the average of all stocks. For example, short positions were reported to be about 5% of SVB’s float as of March 1, 2023, compared to an average of about 4.65% across all stocks, per data tracker S3 Partners. Short-selling volume shares were around 3% for FRC and 6% for Signature. See “Analysis: Short sellers play heroes and villains in the U.S. bank crisis,” by Lawrence Delevingne, *Reuters*, April 10, 2023.

Muir (2023) argues that the exposure of bank values to interest rate risk can be insensitive most of the time but highly responsive when asset losses become salient. They find evidence consistent with this non-linearity during the rate increase of 2022 and 2023, culminating with the failure of SVB. Granja (2023) finds that banks with lower capital ratios, higher shares of run-prone uninsured depositors, and greater exposures to interest rate risks were more likely to reclassify securities to HTM during 2021 and 2022. While our examination of uninsured deposits and unrealized losses is common to this literature, our focus on when and how much these balance sheet risks are incorporated into stock market prices is new.

We build on the literature that studies the importance of information and communication to bank run dynamics (Goldstein and Pauzner (2005)). Investors' attention to information on bank risk is likely to improve the disciplining of opaque banks (Morgan (2002) and Granja (2013)). More recently, Cookson, Fox, Gil-Bazo, Imbet and Schiller (2023) show that during the SVB run period, banks with higher pre-run Twitter exposure lost more stock market value, and experienced greater deposit outflows during 2023Q1. Similar to Cookson et al. (2023), our paper studies how stock prices reflect information arrival. However, we use rating announcements instead of Twitter feeds and study return comovements rather than returns. We show that return comovements reflect bank risk while Cookson et al. (2023) find that the effect of tweets on returns is unexplained by unrealized losses and uninsured deposits.

We further contribute to this literature by showing that investors are mainly sensitive to information on bank risks that are most salient at the time (i.e., due to inclusion in rating announcements) and affect prices by modulating investors' limited attention. Our result that *uninformative* rating announcements increase bank betas is consistent with a behavioral explanation of inattention, whereby publicity draws attention to neglected firms and risks (Klibanoff, Lamont and Wizman (1998), Huberman and Regev (2001), Barber and Odean (2008) and Barber, Huang, Odean and Schwarz (2022)). While the behavioral literature typically investigates the effect of media attention on returns, we examine rating announcements and betas. Research on the rational allocation of attention finds that investors allocate more



attention to common, relative to firm-specific, factors (e.g., Barberis and Shleifer (2003), Peng and Xiong (2006) and Kacperczyk, Van Nieuwerburgh and Veldkamp (2014)). We do not examine the relative comovements between common and firm-specific news but instead, address how the factor betas vary in the cross-section and time-series.

Our paper is related to research on the informativeness of credit ratings. Inaccurate credit ratings were identified as key contributors to the Great Financial Crisis due to conflicts of interest and rating shopping leading to biased ratings (e.g., Skreta and Veldkamp (2009)). However, Goldstein and Yang (2019) argue that independent research by rating agencies might reduce price efficiency if it focuses on information that the market is good at aggregating. In our paper, even when credit ratings do not convey new information, they allow investors with limited attention to focus on salient banks.

While not the main focus of our paper, we also examine bank stock returns mainly to test for the informativeness of rating announcements. Choi, Goldsmith-Pinkham and Yorulmazer (2023) find that bank stock returns are correlated with uninsured deposit shares and unrealized losses on HTM securities. They argue that the stock market partially anticipated risks from reliance on uninsured deposits. We find that return spillovers mostly affected a limited set of event banks and for limited periods before and during the bank run.<sup>3</sup> For example, after the rate hikes in March and May of 2022, returns of banks with high *Losses* turned negative but stabilized by January 2023. Different from Choi et al. (2023), we examine the covariance of bank excess stock returns with balance sheet factor returns.

The paper is organized as follows. In section 2, we discuss the data, hypotheses, and methodology. The informativeness of credit ratings is examined in section 3. Results on the evolution of bank balance sheet betas during Spring 2023 are in section 4. Section 5 reviews investor attention to bank risk in 2022. Section 6 concludes. The appendices contain additional information about our data and sample, robustness checks on our main results, and additional results not reported in the paper.

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<sup>3</sup>Our post-run results are not strictly comparable to Choi et al. (2023) since we distinguish between pre-crisis and crisis period effects while the latter estimate average effects from February to March 2023.

## 2 Data, Hypotheses and Methodology

We describe the data in section 2.1 (further details are in appendix A.) Our methodology for defining the different bank groups and estimating the factor betas are described in section 2.2. We develop hypotheses in section 2.3.1 and specify the regressions in section 2.3.2.

### 2.1 Data

We use cum-dividend stock returns from the Center for Research in Security Prices (CRSP) database for the period January 3, 2022 to May 5, 2023. The end date of the sample is chosen to occur 2 weeks after the April 21 downgrade announcements, so that we have an adequate sample size for estimating the post-announcement betas. Bank balance sheet data is from the FR Y-9C and Call Reports, and is matched to the stock price data by mapping the ticker symbols to RSSD identifiers. Appendix A.1 details how we do this.

In our analyses, we exclude banks that failed during the estimation *sample* as well as Silvergate Bank which announced its liquidation in early March. Among failed banks, we always omit SVB and SBNY and, when the estimation sample includes May 1 and beyond, FRC. Separately, banks on downgrade watch or downgraded are also excluded when constructing our *factors*, as further discussed in section 2.2.2. We omit failed banks for two reasons. First, we are interested in how investors evaluate the risk of surviving banks during the bank run. Second, the failed banks have limited data in the relevant sample. For example, when our estimation sample is from March 13 to April 14, limited data is available for Silvergate, SVB, and SBNY that were all liquidated or failed between March 8 and 12.<sup>4</sup> Similarly, when our estimation sample is from April 21 to May 5, there is little data for FRC.

Since we focus on the effects of information arrival on the market's perception of bank balance sheet risk, we ensure that the estimation of the factor betas is based on balance sheet data *only when they become available to market participants*, which we assume is following

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<sup>4</sup>Silvergate announced its intent to wind down operations and voluntarily liquidate on March 8. SVB and SBNY went into receivership on March 10 and March 12, respectively.

the last submission date for Call Reports (approximately 1 month after the end of the reporting quarter). For example, since the submission deadline for the 2022Q3 Call Report was October 30, 2022, we assume that investors become aware of the 2022Q3 balance sheets starting on October 31, 2022. Then, following January 30, 2023 – when the 2022Q4 Call Reports were due – we assume that investors became informed of the 2022Q4 balance sheet data. Table A.1 in the appendix lists the Call Report submission deadlines in our sample.

We also gather data on rating announcements to proxy for the arrival of information during the bank run. We collect this information from Moody’s Ratings and Assessment Reports Directory<sup>5</sup> and targeted internet searches for news articles between March 1, 2023 and May 5, 2023. We ignore ratings affirmations and upgrades, focusing only on negative rating announcements (i.e., downgrade watches and downgrades) since the latter is most closely related to the bank run.

The first rating announcements occurred on March 13, 2023, when Moody’s placed 6 banks on downgrade watch,<sup>6</sup> highlighting the banks’ reliance on uninsured deposit funding and their unrealized losses on AFS and HTM securities portfolios which could be realized if the banks were forced to sell these assets to meet deposit outflows.<sup>7</sup> One of these banks, INTRUST Financial Corporation, is not publicly traded and thus not in our sample. Another bank in this group, FRC, was subsequently downgraded on March 17 (issuer rating) and again on April 21 (preferred shares). On April 14, Fitch downgraded PacWest Bancorp, and S&P downgraded Schwab on April 19. On April 21, Moody’s downgraded 11 banks including all 6 that were previously on downgrade watch plus 5 new banks. The downgrade announcements on April 21 emphasized broader risks to the US banking sector, particularly regional banks, including a reduction in deposits, higher funding costs, and interest rate losses on fixed-rate

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<sup>5</sup>See <https://www.moody.com/reports/ratings-assessments-reports>.

<sup>6</sup>Silvergate, SVB and SBNY were downgraded prior to their failures or liquidation.

<sup>7</sup>For example, when placing Comerica on downgrade, Moody’s states that “Today’s rating action reflects Comerica’s high reliance on more confidence sensitive uninsured deposit funding, its high amount of unrealized losses in its available-for-sale (AFS) securities portfolio . . . In addition, if it were to face higher-than-anticipated deposit outflows, the bank could need to sell assets, thus crystallizing unrealized losses on its AFS securities . . .” See Comerica downgrade watch notice.

assets that increase their “liquidity and capital risks.”<sup>8</sup> Section A.3 in the appendix lists the event banks flagged by the various rating announcements.

## 2.2 Methodology

We describe our methods for forming bank groups (section 2.2.1 and the bank balance sheet risk factors (section 2.2.2).

### 2.2.1 Formation of Bank Groups

Banks are divided into groups: those mentioned in the rating announcements (“event banks”), non-event regional banks, and non-event stress-tested banks. Membership in these groups depends on the event. Thus, *after* the downgrade watch on March 13 but *before* the ratings downgrades on April 14, the groups are:

- The *March Downgrade (DG) Watch* group includes 5 banks that were put on a downgrade watch by Moody’s on March 13 (see appendix A.3 for the bank list). As these banks typically had relatively high *UID* (see Table 1), investors concerned about deposit risk may have considered the downgrade watch to be salient information in March.
- The *Other Regional Bank* group includes 43 banks in the KRX index that are not in the *March DG Watch* group.
- The *Stress-Tested Bank* group includes 23 large banks that participated in the Federal Reserve stress tests of 2022 and were also listed in the KBW index (see appendix A.3).

*After* the April 21 downgrade announcements, the relevant groups are as follows:

- The *DG* group includes 11 banks that were downgraded on April 21 — 4 banks previously on downgrade watch (after excluding FRC), and 7 more regional banks that rating agencies downgraded between April 14 and April 21 (denoted the *April Only*

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<sup>8</sup>See for example UMB Financial downgrade and Associated Banc-Corp downgrade.

*DG* group and listed in appendix A.3). The *April Only DG* banks typically had relatively high *Losses* (see Table 1). Given heightened concerns about unrealized losses of regionals in April, investors may have considered the downgrades salient.

- The *Non-DG Regional Bank* group is a subset of the *Other Regional Bank* after excluding the 5 regional banks downgraded in April. There were 38 such banks in the KRX index, and these are listed in appendix A.3.
- The *Non-DG Stress-Tested Bank* group is a subset of the *Stress-Tested Bank* group after excluding Schwab and US Bancorp, which were downgraded on April 19 and April 21, respectively.

### 2.2.2 Bank Balance Sheet Risk Factors

Uninsured deposits are widely considered to have been a main source of risk during the 2023 crisis due, in part, to the concentration of these deposits among certain sectors and the inability of banks to raise interest rates enough to attract new deposit inflows. A related risk arose from concerns over *unrealized losses* in banks' security holdings, which triggered further outflows of uninsured deposits. While liquidity buffers are supposed to cushion deposit shocks, interest rate increases since 2022 led to unrealized losses on liquid AFS and HTM securities such as Treasuries, adding to financial distress.<sup>9</sup> *Cash depletions* may further contribute to deposit outflows, as when SBNY lost large amounts of cash in 2022 (FDIC (2023)). Indeed, Lee and Sarkar (2023) argue that some banks experienced cash shortages in 2022 as the aggregate amount of bank reserves declined, prompting unusually high borrowing frequencies (for a non-crisis period) from the Fed's discount window facility. In this view, the bank run in 2023 may have been, in part, a continuation of prior liquidity concerns due to monetary policy tightening. High capital reserves might offset these risk

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<sup>9</sup>We use AFS + HTM losses instead of just HTM losses because banks can (and often do) strategically reclassify AFS securities as HTM (Fuster and Vickery (2023)). Further, for banks with assets of at least \$50 billion, Basel III rules require AFS losses to be reflected in CET1.

factors. However, the reported Tier 1 capital ratio  $CET1$  may overstate the available capital as it does not incorporate unrealized HTM losses.

Motivated by these considerations, we construct bank risk factors based on the following.

- $UID$ , or uninsured deposits as % of assets
- $Losses$ , or unrealized losses on AFS + HTM securities as % of assets
- $Cash$ , or cash % as of assets
- $CET1$

The bank risk factors are constructed as follows. First, we drop the banks in the downgrade watch and downgraded groups since they are likely to have the most extreme returns, and thus potentially lead to a mechanical correlation between their returns and the factor returns. We sort the remaining banks by each of the above variables, using Call Report and FR Y-9C data for the previous quarter, assuming that these reports become available following their last submission dates. We form 3 portfolios (High, Medium, Low), calculate market capitalization-weighted average stock returns of banks in each portfolio each day, and then take the difference in average returns of the highest minus the lowest terciles (High – Low). We take the negative of cash and CET1 to have a consistent interpretation across characteristics: that is, greater values indicate potentially higher balance sheet risk. To illustrate our methodology for constructing factor returns for 2023Q1, since the Call Reports filing deadlines for 2022Q4 and 2023Q1 are January 30, 2023, and April 30, 2023, respectively, we use 2022Q3 balance sheets to construct factor returns for January 1 to 30, 2023, and 2022Q4 balance sheets to calculate factor returns for January 31, 2023, to April 30, 2023. Table A.1 lists the various dates relevant to our analysis. Figure 3 illustrates how the Call Reports submission dates map to the calculation of factor returns.

Table 1 reports the means of balance sheet characteristics as of 2022Q4 for each of our bank groups. For comparison purposes, we also show SVB, SBNY, and Silvergate. The

*March DG Watch* banks were large, with average assets close to \$100B. So were the 7 additional banks downgraded in April (the *April Only DG* banks), with average assets of almost \$200B. By comparison, SVB had assets of \$212B and SBNY had assets of \$110B, whereas Silvergate was smaller with assets of \$11B. The non-downgraded stress-tested banks, of course, were the largest with average assets of almost \$850B. By comparison, the non-downgraded regional banks were smaller, with average assets of \$34B. The *March DG Watch* banks had the highest *UID* in our sample (about 60% versus 37% for stress-tested banks), topped only by SVB and SBNY. These banks, along with the *April Only DG* and non-DG regional banks, also had the highest unrealized loss shares (2.6% or higher versus 2.1% for stress-tested banks) in our sample behind SVB and SBNY. The *March DG Watch*, *April Only DG* and *Non-DG Regional* groups also had the lowest cash shares (4% or lower versus 12% for stress-tested banks). CET1 was similar across sample banks except the *March DG Watch* banks and Silvergate which had relatively low and high levels of CET1, respectively. Overall, based on 2022Q4 information, the most salient risk appears to have been that related to uninsured deposits for banks distressed in March and unrealized losses and cash shares for regional banks (whether downgraded or not) in April. Indeed, the overall balance sheet risk of non-downgraded and downgraded regional banks does not appear to be materially different at any time in 2022 (see Figure 7).

## 2.3 Hypotheses and Regression Specifications

In section 2.3.1, we develop hypotheses regarding the expected changes in abnormal returns and the factor betas, conditional on the informativeness of rating announcements. In section 2.3.2, we specify regressions to test our hypotheses.

### 2.3.1 Hypotheses Development

Suppose that rating announcements reveal information about bank risk not previously in stock prices. Following Norden and Weber (2004), we expect that, in the time series, event

bank *abnormal returns* fall after downgrade watches or downgrades. Moreover, the announcement effects should be incremental to any general crisis effects, implying that event bank returns fall more than non-event bank returns. Further, to incorporate the new information, we expect that the event bank betas increase relative to any increase in the betas of non-event banks.

*Hypothesis 1: Ratings are informative of event banks.* After rating announcements, (i) event banks' abnormal returns decrease in the absolute and relative to non-event banks, and (ii) their balance sheet betas increase relative to non-event banks.

Even if ratings are uninformative, they may nevertheless act as a coordination device by drawing investor attention to the risk exposures of event banks, thereby affecting their betas. This is likely to happen if investors have limited attention and only react to salient information – in this case, the bank names flagged in the rating announcement. The implication of limited attention on abnormal returns is ambiguous. Saliency theory argues that extreme returns indicate information salience (see, for example, Bordalo, Gennaioli and Shleifer (2012) and Bordalo, Gennaioli and Shleifer (2022)) but in our application, the rating announcements may indicate salience even absent any effect on returns.

*Hypothesis 2: Rating announcements coordinate limited attention of investors.* Following rating announcements, the betas of event banks increase relative to non-event banks, even if announcement day abnormal returns do not decrease significantly.

### 2.3.2 Regression Specifications

To test hypothesis 1 about rating informativeness, we first compute bank abnormal returns relative to the Fama-French 5-factor model. We also include the excess return on the regional bank index (KBRW-RF) to account for crisis effects on the announcement day returns.

$$R_{i,t} = \alpha_{0,i} + \sum_{j=1}^5 \delta_{j,i} FF_{j,t} + \delta_{6,i} (KBRW R_t - RF_t) + \epsilon_{it} \quad (1)$$



$R_{i,t}$  is the stock return for bank  $i$  at time  $t$ .  $FF_j$  denotes one of the 5 Fama-French factors (i.e., the market excess return RM-RF, SMB, HML, RMW and CMA).<sup>10</sup>

Let  $\hat{\alpha}_{0,i}$  and  $\hat{\delta}_{j,i}$ ,  $i = 1, \dots, 6$  be the coefficients from estimating equation (1) for 2022. Then, for day  $t$  in 2023, the abnormal returns  $AR_{i,t}$  for bank  $i$  are defined as:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_{0,i} - \sum_{j=1}^5 \hat{\delta}_{j,i} FF_{j,t} - \hat{\delta}_{6,i} (KBWR_t - RF_t) \quad (2)$$

We conduct event studies by estimating panel regressions of bank abnormal returns on time dummies for event banks only, as follows:

$$AR_{i,t} = \alpha_0 + \alpha_i + \gamma_0 Post0 + \gamma_1 Post[1, 4] + \gamma_2 Post[5, 9] + \epsilon_{it} \quad (3)$$

We estimate equation (3) separately for the March 13 announcement, consisting of a panel of 5 banks, and for the downgrade announcements of 11 banks between April 14 and 21. The time variable  $t$  indicates *event time*. Thus,  $Post0$  is a dummy variable equal to 1 on the event date;  $Post[x, y]$  are dummy variables indicating days  $x$  to  $y$  since the event. The post-event window is 10 days since the announcement. There are 2 specifications for the pre-event window. In one, the pre-event period is January and February of 2023 (so  $t = -1$  is February 28) which is free from crisis effects. Since the announcement day returns may reflect crisis effects during the omitted period, we also estimate another version using the pre-announcement period as the pre-event window. Note that, if the regional bank index captures the crisis effect adequately, the estimates should be robust across the two specifications (another robustness check is in equation (4) and discussed below). Thus, for the March 13 downgrade watches, the pre-event window is March 1-12. For the April downgrades, we use March 27 (i.e., the 11th day after the March 13 announcements) to the bank's pre-downgrade day as the pre-event window. Hypothesis 1 implies that  $\gamma_0 < 0$  and significant. All panel regressions include bank-fixed effects  $\alpha_i$ .

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<sup>10</sup>Data for the Fama-French factors are downloaded from the Kenneth R. French data library (FFData). We thank Kenneth French for use of the data.

For the downgrade announcements in April, we further estimate the announcement effects separately for the banks on downgrade watch (the *March DG Watch* group) and the remaining banks (the *April Only DG* group).

$$\begin{aligned}
AR_{i,t} = & \alpha_0 + \alpha_i + \gamma_0(\text{March DG Watch} \times \text{Post0}) + \lambda_0(\text{April DG} \times \text{Post0}) \\
& + \gamma_1(\text{March DG Watch} \times \text{Post}[1, 4]) + \lambda_1(\text{April DG} \times \text{Post}[1, 4]) \\
& + \gamma_2(\text{March DG Watch} \times \text{Post}[5, 9]) + \lambda_2(\text{April DG} \times \text{Post}[5, 9]) + \epsilon_{it} \quad (4)
\end{aligned}$$

If markets are efficient, then  $\gamma_0$  is insignificant in equation (4) — i.e., there is no announcement effect for the *March DG Watch* banks in April, as in Norden and Weber (2004) — but  $\lambda_0 < 0$  and significant if downgrades of the *April Only DG* banks are informative.

Negative event-bank abnormal returns on the announcement day may be due to background crisis effects. To account for this possibility, we estimate differences-in-difference (DiD) regressions to assess whether the announcement effect is larger for the event banks than the non-event banks, using January to February 2023 as the pre-event window.<sup>11</sup>

$$\begin{aligned}
AR_{i,t} = & \alpha_0 + \alpha_i + \gamma_0 \text{Post0} + \gamma_1 \text{Post}[1, 4] + \gamma_2 \text{Post}[5, 9] \\
& + \sum_{k=1}^2 \lambda_k \text{Post0} \times \text{BankGroup}_k + \sum_{k=3}^4 \lambda_k \text{Post}[1, 4] \times \text{BankGroup}_k \\
& + \sum_{k=5}^6 \lambda_k \text{Post}[5, 9] \times \text{BankGroup}_k + \epsilon_{it} \quad (5)
\end{aligned}$$

$\text{BankGroup}_k$  is an indicator variable equal to 1 for banks belonging to group  $k$  and is 0 otherwise. As discussed in section 2.2.1, the bank groups include the event banks and the non-event regional banks, with the non-event stress-tested banks as the control group. Hypothesis 1 implies that  $\lambda_k < 0$  and significant for  $k = \text{event bank group}$ .

To test our hypotheses about the effect of ratings on bank betas, we estimate panel regressions of bank excess returns for various samples (e.g. pre- or post-bank run), obtaining

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<sup>11</sup>Later pre-event windows may lead to a violation of the parallel trends assumption.

the beta ( $\beta$ ) as the coefficient of the bank balance sheet factor, as follows:

$$Y_{i,t} = \alpha_0 + \alpha_i + \beta BankFactor_t + \sum_{j=1}^5 \delta_j FF_{j,t} + \delta_6 Log(MVE)_{i,t-1} + \sum_{k=1}^2 \gamma_{i,k} BankFactor_t \times BankGroup_k + \epsilon_{it} \quad (6)$$

where  $Y$  is the stock return for bank  $i$  minus the 3-month Treasury bill rate on day  $t$ . The regressors include one of the bank balance sheet factors ( $UID$ ,  $Losses$ , Cash or CET1) and the (lagged) log of the bank’s market value of equity (MVE), in addition to the Fama-French factors. Hypothesis 1 implies that  $\gamma_{i,k} > 0$  if rating announcements are informative; hypothesis 2 implies that  $\gamma_{i,k} > 0$  even if announcements are not informative.

### 3 Are Credit Ratings Informative?

Section 3.1 reports descriptive statistics for abnormal bank returns around key dates in our sample. Section 3.2 examines the rating announcement effects on abnormal returns.

#### 3.1 Bank Abnormal Equity Returns: Descriptive Statistics

Table 2 shows the daily means of abnormal returns for different bank groups around information events. Panel A adjusts the returns for the 5 Fama-French factors only. Panel B also adjusts for the regional bank index return, as in specifications 1 and (2). SVB, SBNY, and Silvergate are included only as points of comparison. Observations for SVB and SBNY stock prices are dropped after they went into receivership on March 10 and March 12, respectively. For the *March DG Watch* banks, we show results with and without FRC.

Panel A, columns 1-2, of Table 2 shows minimal declines in bank stock prices, relative to the market model, in January-February or March 1-8 of 2023, except for Silvergate. On March 9 and 10, the first 2 days of the bank run, failed bank abnormal returns plunged between 12% and 56% per day. The *March DG Watch* banks had daily mean abnormal

returns of around  $-8\%$  on these days, similar to the *April Only DG* banks, while the *Non-DG Regional* banks and the *Non-DG Stress-Tested* banks' abnormal returns fell between  $1\%$  and  $2\%$  on March 9 but reverted on March 10. On March 13, the day that the downgrade watches were announced, abnormal returns of the *March DG Watch* banks fell more than  $30\%$  while the *April Only DG* bank stocks fell about  $8\%$  and the regionals and stress-tested banks fell by about  $2\%$ , suggestive of a strong announcement effect on event bank stocks, as we verify more formally later. In the 9 days following the March event (March 14-24), there were moderate declines of about  $5\%$  for the event banks and the stress-tested banks. In the 13 days before the first downgrade announcement on April 14 (March 27-April 13), the *April Only DG* banks declined by about  $5\%$  cumulatively while other bank stocks were stable. On the downgrade dates (April 14, 19, and 21), announcement effects were zero to moderate. On April 14 and 21, the *March DG Watch* banks fell about  $1\%$ - $2\%$  while the *April Only DG* and regional banks fell by about  $1\%$ . Stock prices increased for all banks on April 19 (when Schwab was downgraded) and for stress-tested banks on all announcement days. In the 10 days after the last downgrade on April 21 (April 24-May 5), *March DG Watch* banks fell another  $12\%$  while the *April Only DG* groups fell a further  $5\%$ , perhaps an effect of FRC's failure on May 1. However, when FRC is excluded from the *March DG Watch* banks (see the row labeled "ex-FRC"), the qualitative results are similar.

Figure 4 plots the abnormal returns with (solid lines) and without (dotted line) adjusting for the regional bank index. Comparing the two series, we find that while the adjustment makes little difference to abnormal returns pre-run (i.e., January-March 8 2023), it boosts abnormal returns during the bank run, suggesting that the crisis effect is mitigated, as intended. For example, Panel B of Table 2 reports that, on March 9, the *Non-DG Regional* banks and the *Non-DG Stress-Tested* banks had *positive* abnormal returns versus a reduction of  $1\%$  to  $2\%$  in Panel A. Moreover, adjusting for the regional bank index allows for sharper announcement day effects. For example, the announcement effects for non-event banks on March 13 are minimal in Panel B versus  $-2\%$  in Panel A. Finally, the *Non-DG Stress-Tested*

banks have *negative* (instead of positive in Panel A) abnormal returns on April 19 when another stress-tested bank, Schwab, was downgraded.

Since the March and April bank groups contain few banks, outliers may influence the results. Accordingly, we report in Table B.1 of the appendix the daily means of the value-weighted *median* abnormal returns and find robust results. We conclude that there is little evidence that markets anticipated bank risk events in 2023 before the run and, after March 10, spillovers were mostly limited to the small set of event banks on rating announcement days and following the failure of FRC.

### **3.2 Bank Abnormal Returns: Announcement Day Effects**

Results from estimating equations 3 and 4 are shown in Table 3. Panel A shows results for the March 13 event. The first column shows results using January-February of 2023 as the pre-event window. We find that the announcement day abnormal returns are negative and significant for the *March DG Watch* group on the event date (Post0), with no further significant effects over the following 9 days. Column 2 shows results using March 1-12 as the pre-event window. The results are qualitatively and quantitatively similar, indicating that adjusting for the regional bank index was successful in separating the announcement effect from broader crisis effects.

Panel B of the table shows results for the April downgrade announcements. The pre-event sample is either January to February 2023 (columns 1-3) or March 27 to the pre-downgrade day (columns 4-6). In both cases, we observe a significant negative announcement effect for the entire group of downgraded banks and the *March DG Watch* group. Since the latter group was previously on downgrade watch, the result suggests that the market was not informationally efficient (Norden and Weber (2004)). Notably, the announcement day returns are *insignificant* for the freshly downgraded *April Only DG* group, indicating that the announcements were not informative for these banks.

While we have found that the March 13 announcement was informative of the event

banks, abnormal returns were negative for *all* banks on that day (see Table 2). We have used the regional bank index to separate announcement and crisis effects, and Panel B of Table 2 suggests that this adjustment mitigates crisis effects on returns. Nevertheless, we show results in Table 4 from the DiD specification (4) for the March 13 event as a further robustness check. The first column of the table shows results for all banks on downgrade watch in March. We find that, on the announcement day, the event bank returns declined 28% more than stress-tested banks (the control group). By comparison, returns of regional banks *increased* by 2% relative to the control group. In the second column, we drop FRC from the event bank sample and find similar results, although the magnitude of the announcement effect decreases from 26% to 19%. These results provide convincing evidence of a negative effect on event banks from the March 13 announcement.

## 4 Announcement Effects on Bank Balance Sheet Betas

In this section, we evaluate the first question posed in the introduction: How did the betas change *during* the bank run as information about bank risk (as proxied by rating announcements) arrived for different factors and different bank groups?

If the market was cognizant of balance sheet risks, then the factor betas are expected to be positive and significant even before the bank run. Thus, we start by estimating the factor betas from regression (6) (but without the factor times bank group interactions) for January to February of 2023, the two months prior to the bank run. Table 5 shows the results. The betas for CET1 and cash are positive and significant, while those for *UID* and *Losses* are insignificant. Of the 5 Fama-French factors, the betas with respect to market excess returns, size, and value are significant in all cases. The lagged bank MVE is negatively and significantly related to bank excess returns in all cases. Overall, immediately before the bank run, stock market investors were attuned to the risk emanating from lower levels of the more “traditional” factors (capital and cash) but not to higher levels of the two factors (*UID* and

*Losses*) that were central to the bank run.

Do bank stock returns become more sensitive to balance sheet risks during the bank run? In Table 6, we estimate regression (6) without the bank factor times group interactions for March 13 to May 5, 2023. We start the estimation on March 13 as investors learned of the downgrade watch announcements on this date and we want to maintain comparability with the specifications in Table 7 showing the reaction of the factor betas to this announcement. In sharp contrast to the pre-run period, the *UID* and *Losses* betas are now positive and statistically significant. The cash and CET1 betas remain significant as was the case before the run. The significance and magnitude of these results are robust to excluding FRC during the entire sample period as shown in appendix table B.2. Hence, these results indicate a shift in investors' risk perceptions from before the crisis, consistent with increased sensitivity to *UID* and *Losses* risks following an information shock (Dang et al. (2018)).

An alternative explanation for the results in Table 6 is that there is more overlap between banks in the long-short portfolios of different factors during the run as compared to before the run. In particular, the composition of the long and short portfolios for the *UID* and *Losses* factors may have moved closer to that of the cash and CET1 factors during the run. But the results in Table A.2 in appendix A show that, for each factor pair, the number of overlapping banks in the long portfolio plus the number of such banks in the short portfolio is stable, thereby ruling out the alternative hypothesis.

How did investor perceptions change in the cross-section of banks and their risk exposures (e.g. uninsured deposits vis-a-vis unrealized losses)? We use announcements of bank ratings to proxy for information arrival. We start by estimating regression (6) from March 13 to April 13, following the announcement of downgrade watches on March 13 but before the series of downgrade announcements that began on April 14. The regression includes the factor times interactions with the *March DG Watch* and *Other Regional* bank groups, while the stress-tested banks are the omitted group. The results are reported in Table 7. The results show that all the factor betas are positive and highly statistically significant for the

*March DG Watch* banks but insignificant for all other banks (with the exception that the *Losses* beta is weakly significant at the 10% level of confidence for all banks). In particular, all factor betas are insignificant for the non-event regional banks.

To check the robustness of our results to members of the *March DG Watch* group, we report in Figure 5 the results from a “leave-one-out” analysis. Specifically, we exclude member banks one at a time from the *March DG Watch* group, re-estimate the regressions, and report the new beta coefficients and 95% confidence intervals. We find that the magnitude and standard errors of the point estimates are very similar to the baseline results in Table 7. The factor betas are positive and significant at the 5% level of confidence for the *March DG Watch* group, but insignificant for all other banks. One particular concern is that the results may be entirely driven by FRC, which was downgraded on March 17 after being placed on downgrade watch on March 13. However, the exclusion of FRC does not dampen the significance of the estimated beta for the *March DG Watch* group. Therefore, the results in Table 7 are robust to the exclusion of specific members of the *March DG Watch* group.

These results suggest that the downgrade watch information was salient to investors and affected both price changes (as previously reported) and also bank risk. *Each* of the factor betas is highly significant for the banks put on downgrade watch, consistent with ratings agency reports that emphasized a range of risks (i.e., *UID*, *Losses*, cash and capital) to rationalize their downgrade decisions during the bank run.<sup>12</sup> Notably, even though unrealized loss shares were high for the regional banks not on downgrade watch (see Table 1), the *Losses* beta for this group is only weakly significant. One possible explanation (emphasized by ratings agencies) was the announcement of the the Federal Reserve’s Bank Term Funding Program (BTFFP) on March 12 which allowed banks to delay the realization of losses on underwater liquid securities.<sup>13</sup> We conclude that investors were highly sensitive to the risks

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<sup>12</sup>See, for example, First Republic downgrade watch and Western Alliance downgrade watch. As previously discussed, we can rule out a mechanical explanation that all the factor betas are simultaneously significant or not due to increased overlap between banks in the long-short portfolios of different factors (see Table A.2 in appendix A).

<sup>13</sup>The BTFFP allowed banks to borrow against the full face value of securities with maturity of up to one year, that are eligible for purchase by the Federal Reserve Banks in open market operations, such as U.S.



of banks on downgrade watch in March but these concerns did not extend to other banks.

Did investors become concerned about more banks or particular risks as the bank run continued – for example, about the unrealized losses of regional banks more broadly? To address this question, we estimate regression (6) from April 21 to May 5. On April 21, nine – mostly regional – publicly traded banks were downgraded. In their reports, rating agencies emphasized the weakness of the US banking sector from rising rates and pointed to the recent failures of regional banks.<sup>14</sup> We estimate the regression after including interactions of the factors with the *DG banks* (i.e., those downgraded on April 14, 19 or 21 but excepting FRC), and the *Non-DG Regional* banks, with the *Non-DG stress-tested* banks as the omitted group. The results are in Panel A of Table 8; estimates for the control variables are not reported to save space. We find that the betas for the *DG* banks are positive and significant for all factors; however, the factor betas for the *Non-DG Regional* banks are insignificant, except for the cash beta which is weakly significant at the 10% level.

We carry out a “leave-one-out” analysis to check the robustness of our results to membership in the *DG* group. We find in Figure 7 that the factor betas are positive and significant at the 5% level of confidence for the *DG* group, but insignificant for other groups, indicating robustness to the exclusion of specific members of the *DG* group.

The significance of the factor betas of downgraded banks may reflect the continuing salience of the downgrade watch in March, rather than the salience of the downgrade announcement in April. To address this issue, we show results in Panel B of Table 8 separately for downgraded banks previously on downgrade watch (i.e. the *March DG Watch* group) and those that were not (i.e. the *April Only DG* group). We find that all the factor betas are significant for both groups, suggesting that investors found the downgrade announcement to be salient. Recall that we failed to find an announcement effect for the *April Only DG* bank

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Treasuries, U.S. agency securities, and U.S. agency mortgage-backed securities. See BTFP announcement.

<sup>14</sup>For example, when downgrading UMB on April 21, Moody’s states that “. . . the banking system faces rising funding and profitability pressures related to the significant and rapid tightening in monetary policy, which has led to a reduction in US banking system deposits and higher funding costs. . . the recent failures of two sizeable US regional banks have shaken depositor confidence, especially among uninsured depositors.” See UMB downgrade.

returns. A possible explanation is that the announcements drew investor attention to the risk of the *April Only DG* banks, just as media attention moves prices even when the news is stale (Huberman and Regev (2001)).

The last row of the table shows that the *UID* and *Losses* betas are significantly higher at the 5% level for the March group as compared to the April group. This might either indicate that the March group banks are riskier or that investors considered their risk more salient given they were previously on downgrade watch. In either case, these results are consistent with a broadening of investor concern to additional banks – that is, the *April Only DG* group.<sup>15</sup> However, despite the broadening of risk concerns, investor attention remains limited, as the beta of the broader group of non-downgraded regional banks remains unaffected despite having a similar risk profile as regional banks that were downgraded in April (see Figure 7).

As an additional exercise, we report results for the *CET1 with losses* factor in appendix C. *CET1 with losses* is defined as the hypothetical CET1 ratio if AFS + HTM losses were realized and the factor is constructed similarly to the others (see appendix C for more details). These results fall in between those for *Losses* and *CET1*, as to be expected. In January and February 2023, the *CET1 with losses* factor beta is positive and significant, similar to *CET1* (Table C.2). After the downgrade watch but before the April downgrade announcements, the beta remains positive and significant but only for the *March DG Watch* banks (Tables C.3 and C.4). Finally, for the post-downgrade announcement sample, the *CET1 with losses* factor beta is positive and significant for the downgraded banks but not for the non-downgraded regionals (Table C.5).

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<sup>15</sup>Even though the BTFP remained operational during this period, rating agencies emphasized that BTFP funding was short-term. For example, Moody's stated that "While Moody's expects US banks will continue to benefit from Federal Reserve liquidity backstops and Federal Home Loan Bank system funding, these funding sources come at a greater cost and also in most cases have shorter duration than core deposits." See Western Alliance downgrade. Further, the market may have become concerned about the risk in other assets such as MBS and loans (Jiang et al. (2023)) that were not eligible collateral for the BTFP.

## 5 Investor Attention in 2022

Is there evidence of limited investor attention before the bank run? For example, were investors sensitive to interest rate risk after the Fed raised rates in 2022? To provide context for our analysis of bank risk in 2022, section 5.1 describes the balance sheet characteristics and returns of the bank groups in that year. In section 5.2, we evaluate the second question posed in the introduction: How did the bank balance sheet factor betas evolve *prior* to the run around potentially salient events?

### 5.1 Bank Balance Sheet Characteristics and Returns in 2022

Figure 7 shows how *UID*, *Losses*, cash and CET1 evolved over 2022. The *March DG Watch* (*April Only DG*) banks consistently had the highest *UID* (*Losses*). Notably, while *Losses* of all banks spiked in 2022Q3 (as interest rates jumped in the first half of 2022), that of non-downgraded regional banks became the second highest in Q4, as previously discussed (see Table 1). The non-stress-tested banks had relatively low cash shares, typically less than half of the share of the stress-tested banks. The *March DG Watch* banks had the lowest CET1 ratio, with stress-tested banks also having relatively low CET1. Overall, the *March DG Watch* (stress-tested) banks were most (least) risky across the majority of balance sheet characteristics, while the the *April Only DG* banks and non-downgraded regionals had high exposure to *Losses* and cash risk. Since balance sheet information for all banks was publicly available as early as April 30, 2022 – the deadline for filing the Call Report for 2022Q1 – investors could have become aware of these bank risks early in 2022.

Figure 8 plots the cumulated abnormal returns for the different bank groups, after dropping SVB, SBNY, and Signature banks. Panel (a) plots the cumulated returns for 2022. Vertical drop lines indicate the Call Report filing deadlines for Q1, Q2 and Q3 of April 30, June 30, and October 30, respectively, along with the 75bp rate hike on June 16, and the failure of the crypto entity FTX on November 11. There is limited evidence that bank stock

prices reacted *persistently* to news events before the bank run. For example, between March 17 and May 5 of 2022, the Fed hiked rates by a cumulative 75bp. During this period, the returns of *April Only DG* banks – that had the highest *Losses* (see Figure 7) – fell a cumulative 14% but returns of other bank groups fell far less, between 4% and 7%. By the end of May, bank stock prices had partially reverted with *April Only DG* bank returns gaining 5% since May 5. Similarly, between June 16, when the Fed hiked rates by 75bp, and July 8, the week after the filing deadline for the 2022 Q2 Call Report, bank stock returns – including those of *April Only DG* banks – were mostly stable. In 2022 Q4, amidst deposit outflows and the “crypto winter”, returns of the *March DG Watch* banks – which had the highest *UID* (see Figure 7) – fell 10% but share prices of all other banks mostly improved, even as SVB, SBNY and Signature bank returns declined between 30% and 137% cumulatively.

In summary, the return dynamics in 2022 suggest some concerns with unrealized losses during 2022Q1 and deposit flights during 2022Q4 as banks with the highest *Losses* or *UID* faced downward pressure on their returns. But, these concerns had eased by January 2023.

## 5.2 Bank Balance Sheet Factor Betas in 2022

To better understand the dynamics of the factor betas in 2022, Figure 9 plots the beta coefficients and 95% confidence intervals from estimating regression 6, without the factor times bank group interactions, for a *rolling* window of 39 trading days starting on January 3, 2022. The window length was chosen to span the period from January 3 to February 28 of 2023 (the sample used in Table 5). The dates on the *x*-axis represent the end date of the rolling window. The factors are constructed using balance sheets from the quarter before the start of the rolling window and after the Call Report filing deadline (see Figure 3). The vertical drop lines are the same as those in Figure 8.

Were investors aware of bank risks in 2022? Panel A of Figure 9 shows the dynamics of factor betas in 2022. Between March 17 and May 5 of 2022 when the Fed hiked rates by a cumulative 75bp, the *Losses* beta was statistically insignificant. However, following the

Fed hike rates on June 16 by 75bp, the *Losses* beta became significant on August 19 (corresponding to the estimation window starting on June 27); it remained significant through December 14 before turning insignificant and remaining so through the end of February 2023 (as shown in Panel B of the figure). The *UID* beta became positive and significant at the end of March and remained so till May 20; it became significant again on September 9, remaining as such through February 3, 2023 (corresponding to the estimation window starting on December 8, 2022), after which it became insignificant. The cash beta also became significant on September 9, and remained so through the end of February 2023. The CET1 beta became positive and significant on October 18, later than the other factors, and also remained significant through the end of February 2023. Thus, before the bank run, while investors were intermittently sensitive to “novel” risks from high levels of *UID* and *Losses* in 2022, their concerns appear to have disappeared as 2023 approached.

Considering the evidence from the return and beta dynamics in 2022, we conclude that investors paid temporary attention to specific balance sheet risks (e.g. uninsured deposits risk) as they received salient information but their attention dissipated in short order.

## 6 Conclusion

This paper studies how the market’s perception of bank risk, as reflected in bank stock prices, evolved in 2022 and during the bank run in the Spring of 2023. To measure bank risk, we estimate balance sheet “betas”— the covariance of bank excess stock returns with returns on factors constructed from long-short portfolios based on several bank balance sheet characteristics in the prior quarter.

We find that the *UID* and *Losses* factor betas were insignificant in January and February of 2023 but became positive and significant during the bank run (March 13-May 5). Thus, in contrast to the pre-run period, investors required compensation for systematic *UID* and *Losses* risk, consistent with heightened sensitivity to these risks (Dang et al. (2018)).

We next examine whether investors reacted to rating agency announcements during the bank run. On March 13, Moody’s put some banks on downgrade watch. We show that these announcements were informative as event bank abnormal returns declined significantly on the announcement day, and more so than for non-event banks. After these announcements, the *UID* and *Losses* betas of *only* these banks were positive and significant, while the beta of other regional banks remained insignificant — even though these banks had similar risk profiles. These findings are consistent with the ratings being informative of the risk of event banks only and investors adjusting their estimates of bank risk accordingly.

When several banks (not previously on watch) were downgraded between April 14 and 21, their announcement day returns were not significantly different from zero but their betas were positive and significant following the announcements. This result suggests that the announcements, although *uninformative*, coordinated the attention of investors with *limited attention* who then adjusted their risk estimates of event banks.

These results hold after several robustness checks. A “leave-one-out” analysis shows that the results are robust to excluding specific event banks. The results are also not due to increased overlaps between banks constituting the portfolios used to create the factors.

In 2022, as the Fed raised rates, regulatory and credit agency reports, and deposit outflows, revealed information about balance sheet risks. We examine rolling window betas over 2022 and find that investors were only intermittently sensitive to high levels of *UID* and *Losses* in 2022 – further reinforcing the interpretation of limited investor attention.

The limited ability of investors to process the variety of information available during a bank run may have both positive and negative consequences. It potentially makes price dynamics more noisy, which poses challenges to market participants and policymakers. However, limited attention may also limit contagion to a broader set of banks. Indeed, the results indicate that contagion was limited in breadth (i.e., the number of banks affected) and time, although this effect is difficult to disentangle from the effects of government support.<sup>16</sup>

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<sup>16</sup>Metrick and Schmelzing (2024)) find that government actions around the March runs were unusual in their policy mix and size.

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Table 1: **Bank Balance Sheet Characteristics as of 2022Q4, by Bank Group**

	Number of Banks	Assets (\$B)	$\frac{Unin.Dep.}{Assets}$	$\frac{Losses}{Assets}$	CET1	$\frac{Cash}{Assets}$
SVB	1	211.79	74.01	8.35	12.05	6.14
SBNY	1	110.36	75.63	2.91	10.41	5.49
Silvergate	1	11.36	33.77	1.00	42.12	40.28
March DG Watch Banks	5	98.82	60.72	2.55	9.75	3.54
April Only DG Banks	7	196.72	40.14	3.05	11.57	4.00
Non-DG Regional Banks	38	34.05	45.19	2.63	11.86	4.05
Non-DG Stress-Tested Banks	21	846.77	36.71	2.10	11.14	11.59

*Note:* The table shows the average values of bank balance sheet characteristics for SVB, SBNY, Silvergate and four bank groups, reported as of 2022Q4. The ratios are reported in %. *Losses* are differences between par and fair values of AFS and HTM securities. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. The *April Only DG Banks* group includes banks downgraded between April 14 and 28. The *Non – DG Regional (Stress – Tested) Banks* groups consist of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. *DG*=Downgraded. *Unin.Dep.* = Uninsured Deposits.

Table 2: Daily Means of Abnormal Stock Returns, by Bank Group

## Panel A: Relative to FF 5-Factor Model

	1/3 – 2/28	3/1 – 3/8	3/9	3/10	DG Watch 3/13	3/14 – 3/24	3/27 – 4/13	PACW DG 4/14	4/17 – 4/18	SCHW DG 4/19	4/20	Moody's DGs 4/21	4/24 – 5/5
SVB	0.43	-0.78	-54.13	-57.86	.	.	.	.	.	.	.	.	.
SBNY	-0.06	-1.22	-5.88	-17.97	.	.	.	.	.	.	.	.	.
Silvergate	0.21	-12.06	-35.07	-3.91	-5.59	-1.59	-0.47	-1.65	-1.00	6.09	2.32	-6.66	-0.41
March DG Watch Banks	-0.03	-0.71	-8.44	-7.47	-32.49	-0.55	0.19	-2.26	0.69	9.93	-1.27	-0.72	-1.15
March DG Watch Banks Ex-FRC	0.08	-0.53	-5.46	-4.87	-23.26	0.33	0.13	-2.15	1.07	9.62	-1.36	-1.28	-0.70
April Only DG Banks	-0.16	-0.44	-7.36	-6.99	-7.70	-0.01	-0.45	-1.29	1.86	2.43	-1.50	-0.79	-0.52
Non-DG Regional Banks	-0.12	-0.58	-2.07	0.72	-2.22	-0.05	-0.02	-1.40	0.36	2.76	-0.50	-0.63	-0.29
Non-DG Stress-Tested Banks	0.12	-0.44	-1.09	0.98	-1.68	-0.48	-0.02	3.05	1.02	0.15	0.62	0.28	-0.18

## Panel B: Relative to FF 5-Factors and Regional Bank Index

	1/3 – 2/28	3/1 – 3/8	3/9	3/10	DG Watch 3/13	3/14 – 3/24	3/27 – 4/13	PACW DG 4/14	4/17 – 4/18	SCHW DG 4/19	4/20	Moody's DGs 4/21	4/24 – 5/5
SVB	0.55	-0.18	-51.30	-57.80	.	.	.	.	.	.	.	.	.
SBNY	0.06	-0.60	-3.00	-17.91	.	.	.	.	.	.	.	.	.
Silvergate	0.32	-11.56	-32.71	-3.86	-3.62	-1.52	-0.11	-0.01	-1.19	3.97	2.49	-6.23	-0.12
March DG Watch Banks	0.03	-0.37	-6.78	-7.43	-30.82	-0.46	0.54	-0.66	0.50	7.86	-1.11	-0.31	-0.84
March DG Watch Banks Ex-FRC	0.19	0.01	-2.90	-4.81	-21.10	0.41	0.53	-0.36	0.86	7.30	-1.19	-0.82	-0.38
April Only DG Banks	-0.10	-0.14	-5.97	-6.96	-6.54	0.03	-0.24	-0.33	1.75	1.19	-1.41	-0.54	-0.35
Non-DG Regional Banks	-0.02	-0.06	0.37	0.78	-0.20	0.02	0.35	0.29	0.15	0.57	-0.33	-0.19	0.01
Non-DG Stress-Tested Banks	0.18	-0.18	0.11	1.01	-0.69	-0.44	0.16	3.87	0.92	-0.92	0.71	0.49	-0.03

*Note:* The table shows value-weighted average abnormal bank stock returns (in %) from January 3, 2023 to May 5, 2023 for different banks groups and sample periods. Abnormal returns for each bank and day are calculated according to equations (1) and (2). We then take the daily market capitalization weighted average of abnormal returns across all banks in a given group. The table reports the average of daily observations for the bank-groups. In the *March DG Watch* group, First Republic Bank (FRC) is dropped on and after May 1, 2023. We include an additional row for the *March DG Watch* group excluding FRC throughout the entire sample. The *April Only DG Banks* group includes banks downgraded between April 14 and 21. The *Non – DG Regional (Stress – Tested) Banks* groups consist of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. *DG*=Downgraded.

Table 3: **Abnormal Returns for Event Banks**

**Panel A: March Event Banks**

	Relative to: Jan. – Feb.	Relative to: Mar. 1 – Mar. 12
Post[0]	-29.53*** (0.12)	-27.88*** (0.93)
Post[1,4]	0.23 (3.07)	1.88 (3.34)
Post[5,9]	-2.13 (2.78)	-0.48 (3.05)
Constant	0.12 (0.12)	-1.52 (0.93)
Obs	245	90
Adj R2	0.36	0.33
Bank FE	YES	YES

**Panel B: April Event Banks**

	Relative to: Jan. – Feb.			Relative to: March 27 – day before DG		
	All April Event Banks	Post × March DG Watch	Post × April Only DG	All April Event Banks	Post × March DG Watch	Post × April Only DG
Post[0]	-0.28*** (0.08)	-0.70*** (0.13)	-0.04 (0.09)	-0.50** (0.22)	-1.22** (0.49)	-0.06 (0.16)
Post[1,4]	-0.24 (0.31)	-0.59 (0.51)	-0.04 (0.21)	-0.46 (0.37)	-1.11 (0.70)	-0.06 (0.24)
Post[5,9]	-1.83* (1.08)	-4.27* (2.22)	-0.44 (0.61)	-2.05* (1.12)	-4.79** (2.31)	-0.46 (0.63)
Constant	0.11 (0.08)	0.11 (0.08)		0.30 (0.22)	0.30 (0.22)	
Obs	539	539		301	301	
Adj R2	0.06	0.11		0.03	0.08	
Bank FE	YES	YES		YES	YES	

*Note:* This table shows the results of estimating equations (3) and (4). Post[0] is the event date. Panel A shows the results for the March 14 event. The first (second) column uses January–February of 2023 (March 1–12) as the pre-event window, Panel B shows the results for the April downgrade announcements. The pre-event window is either January–February of 2023 (columns 1–3) or March 27 to the pre-downgrade day (columns 4–6) FRC is excluded from all regressions in Panel B. Standard errors (in parentheses) are robust and clustered by time. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Table 4: **Abnormal Returns for March 13 Announcement: Event Banks Relative to Non-Event Banks**

	Event Day: March 13	
	Full Sample	X FRC
Post[0]	-3.25*** (0.11)	-3.25*** (0.11)
Post[0] × March DG Watch Banks	-26.28*** (0.11)	-18.94*** (0.13)
Post[0] × Other Regional Banks	2.45*** (0.12)	2.45*** (0.12)
Post[1,4]	-0.48 (0.46)	-0.48 (0.46)
Post[1,4] × March DG Watch Banks	0.71 (3.16)	1.84 (1.82)
Post[1,4] × Other Regional Banks	0.62* (0.31)	0.62* (0.31)
Post[5,9]	-0.32 (0.27)	-0.32 (0.27)
Post[5,9] × March DG Watch Banks	-1.81 (2.82)	-0.27 (1.05)
Post[5,9] × Other Regional Banks	0.27 (0.48)	0.27 (0.48)
Constant	0.05 (0.04)	0.06 (0.04)
Obs	3,479	3,430
Adj R2	0.21	0.15
Bank FE	YES	YES

*Note:* This table shows the results of estimating equation (5) for the downgrade watch announcement on March 13. Post[0] is the event date. The pre-event window is January– February of 2023. FRC is excluded from the regression in column 2. Standard errors (in parentheses) are robust and clustered by time. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Table 5: **Bank Balance Sheet Factor Beta: January to February 2023**

	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.14 (0.14)	0.08 (0.16)	0.33*** (0.09)	0.27** (0.11)
Mkt-RF	1.02*** (0.14)	1.05*** (0.15)	0.95*** (0.13)	0.96*** (0.14)
SMB	0.57*** (0.19)	0.57*** (0.19)	0.42** (0.17)	0.53*** (0.17)
HML	0.63** (0.26)	0.69** (0.27)	0.59** (0.23)	0.68*** (0.25)
RMW	0.24 (0.28)	0.27 (0.27)	0.08 (0.26)	0.29 (0.26)
CMA	-0.33 (0.37)	-0.42 (0.39)	-0.23 (0.32)	-0.49 (0.36)
Log(MVE) <sub>t-1</sub>	-5.43*** (1.77)	-5.42*** (1.79)	-5.86*** (1.65)	-5.01*** (1.62)
Obs	2,769	2,769	2,769	2,769
Adj R2	0.42	0.42	0.44	0.43
Bank FE	YES	YES	YES	YES

*Note:* This table shows results from estimating regression (6), without the bank group interactions, for the period January 3 to February 28, 2023. The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*), unrealized losses on AFS and HTM securities (*Losses*), cash as shares of assets, and the common equity tier one ratio CET1. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . SVB, SBNY and Silvergate are not included in the regression.

Table 6: **Bank Balance Sheet Factor Beta: March 13 to May 5, 2023**

	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.39** (0.17)	0.43** (0.17)	0.36*** (0.11)	0.38** (0.15)
Mkt-RF	1.13*** (0.29)	1.25*** (0.29)	1.12*** (0.28)	1.26*** (0.28)
SMB	0.55 (0.49)	0.39 (0.50)	0.34 (0.48)	0.58 (0.48)
HML	1.72*** (0.40)	1.73*** (0.39)	1.81*** (0.35)	1.56*** (0.42)
RMW	-0.32 (0.61)	-0.24 (0.49)	-0.30 (0.52)	-0.10 (0.52)
CMA	-1.59*** (0.53)	-1.55** (0.57)	-1.55*** (0.53)	-1.27* (0.63)
Log(MVE) <sub>t-1</sub>	-12.06* (6.55)	-12.34* (6.40)	-12.11* (6.50)	-12.14* (6.44)
Obs	2,764	2,764	2,764	2,764
Adj R2	0.41	0.41	0.41	0.41
Bank FE	YES	YES	YES	YES

*Note:* This table shows results from estimating regression (6), without the bank group interactions, for the period March 13 to May 5, 2023. The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*), unrealized losses on AFS and HTM securities (*Losses*), cash as shares of assets, and the common equity tier one ratio CET1. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. SVB, SBNY and Silvergate are not included in the regression. FRC is dropped from the sample on and after its failure (May 1). Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Table 7: **Bank Balance Sheet Factor Beta, Interacted with Bank Groups, After Downgrade Watch but Before Downgrade Announcements**

	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.29 (0.17)	0.25* (0.14)	0.15 (0.17)	0.20 (0.17)
March DG Watch Banks $\times$ Factor	2.31*** (0.58)	2.32*** (0.49)	1.92*** (0.66)	2.19*** (0.47)
Other Regional Banks $\times$ Factor	0.08 (0.20)	0.08 (0.21)	0.26 (0.20)	0.07 (0.20)
Mkt-RF	0.99*** (0.31)	1.37*** (0.27)	0.86*** (0.26)	1.19*** (0.31)
SMB	0.29 (0.33)	-0.21 (0.38)	-0.05 (0.24)	0.15 (0.34)
HML	1.45*** (0.35)	1.60*** (0.26)	1.78*** (0.23)	1.52*** (0.36)
RMW	-0.54 (0.50)	-0.31 (0.54)	-1.00** (0.42)	-0.39 (0.59)
CMA	-1.62*** (0.42)	-1.75*** (0.37)	-1.87*** (0.38)	-1.57*** (0.49)
Log(MVE) $_{t-1}$	-19.08*** (5.62)	-19.78*** (4.94)	-20.95*** (5.48)	-19.47*** (5.11)
Obs	1,633	1,633	1,633	1,633
Adj R2	0.58	0.58	0.58	0.57
Bank FE	YES	YES	YES	YES

*Note:* This table shows results from estimating regression 6 for the period March 13 to April 13. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. The *Other Regional Banks* group consists of the regionals that were not on downgrade watch. Stress-tested US banks are the omitted group. Banks in the various groups are listed in appendix A. The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*), unrealized losses on AFS and HTM securities (*Losses*), cash as shares of assets, and the common equity tier one ratio CET1. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. SVB, SBNY and Silvergate are excluded from the regression sample. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Table 8: **Bank Balance Sheet Factor Beta, Interacted with Bank Groups, After Downgrade Announcements**

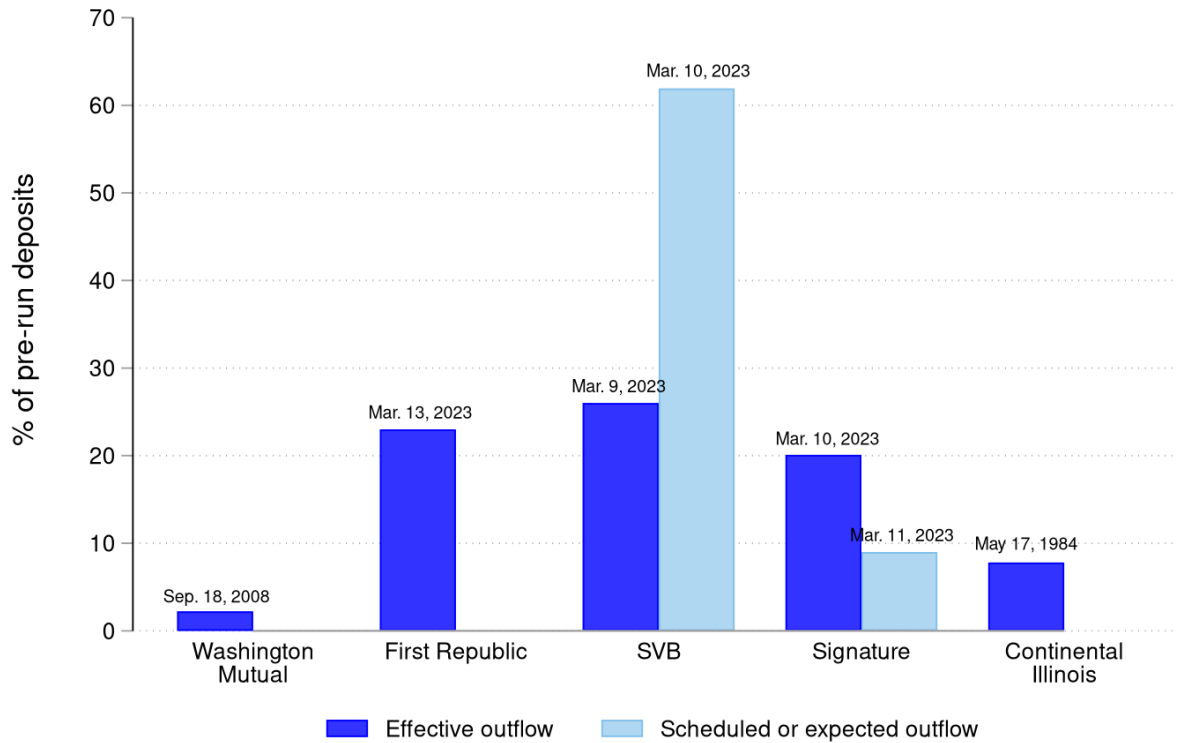
Panel A				
	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.87 (1.11)	0.14 (1.84)	0.55 (0.48)	0.42 (0.55)
DG Banks $\times$ Factor	3.25** (1.03)	3.46** (1.15)	1.68** (0.55)	1.96** (0.73)
Non-DG Regional Banks $\times$ Factor	0.34 (0.22)	0.30 (0.19)	0.26* (0.12)	0.19 (0.14)
Obs	770	770	770	770
Adj R2	0.48	0.48	0.48	0.48
Bank FE	YES	YES	YES	YES
Controls Included?	YES	YES	YES	YES

Panel B				
	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.87 (1.10)	0.15 (1.83)	0.55 (0.47)	0.42 (0.54)
DG Watch Banks $\times$ Factor ( $\alpha$ )	4.28** (1.40)	4.60** (1.54)	2.16** (0.77)	2.56** (1.02)
April Only DG Banks $\times$ Factor ( $\beta$ )	2.68*** (0.84)	2.82** (0.94)	1.41*** (0.44)	1.63** (0.57)
Non-DG Regional Banks $\times$ Factor	0.34 (0.22)	0.30 (0.19)	0.26* (0.12)	0.19 (0.14)
Obs	770	770	770	770
Adj R2	0.48	0.48	0.48	0.48
Bank FE	YES	YES	YES	YES
Controls Included?	YES	YES	YES	YES
$p$ -value from test of $\alpha = \beta$	0.03	0.03	0.07	0.09

*Note:* This table shows results from estimating regression 6 for April 21-May 5, 2023. In Panel A, *DG Banks* is a dummy variable equal to one for banks that were downgraded in April. In Panel B, *March DG Watch Banks* equals 1 for banks put on downgrade watch in March and subsequently downgraded in April while *April Only DG Banks* is 1 for downgraded banks not placed on watch previously. All banks on downgrade watch were also downgraded. In both panels, the *Non-DG Regional Banks* group consists of the regionals that were not downgraded. Non-downgraded stress-tested US banks are the omitted group. We exclude FRC, SVB, SBNY, and Silvergate from the regression sample. All regressions control for the five Fama-French factors and the (lagged) log of the bank's market value of equity, but we do report their estimates for brevity. The final row of Panel B reports the  $p$ -value for the null hypothesis that the *DG Watch Banks*  $\times$  Factor coefficient ( $\alpha$ ) is equal to the *April Only DG Banks*  $\times$  Factor coefficient ( $\beta$ ). The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*), unrealized losses on AFS and HTM securities (*Losses*), cash as shares of assets, and the common equity tier one ratio CET1. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .



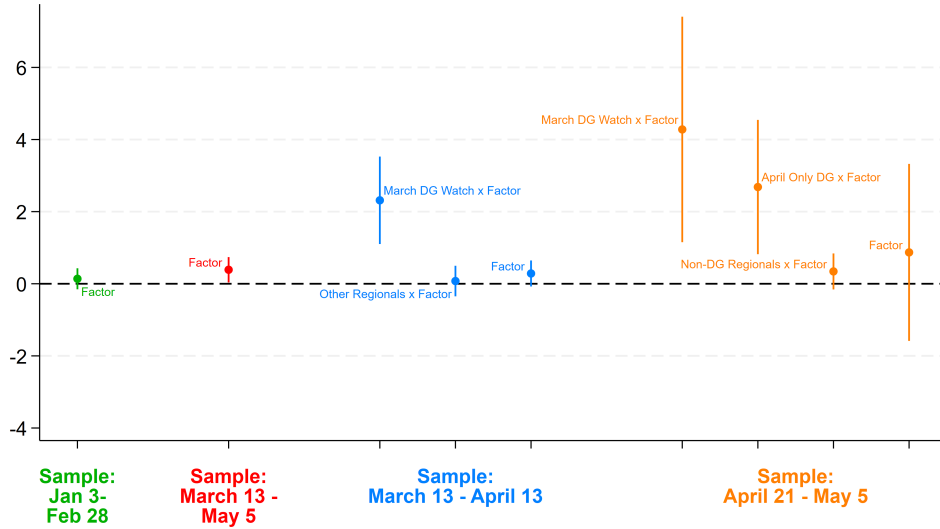
Figure 1: Peak 1-Day Deposit Withdrawal Rates



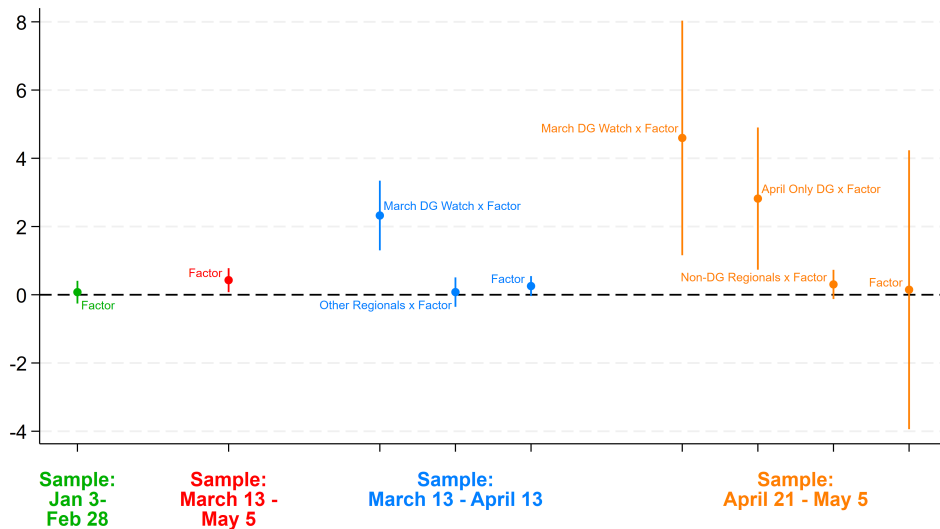
*Note:* The figure shows the 1-day peak deposit withdrawals as a percent of pre-run deposits, and the associated dates, for select banks during the March 2023 bank run, and for Continental Illinois and Washington Mutual. Banks are sorted by inflation adjusted assets from left (highest) to right (lowest). The data is from FRB (2023a) and Rose (2023).

Figure 2: Evolution of Factor Betas Before and During the Run

(a) Estimated Betas for Factor = *UID*

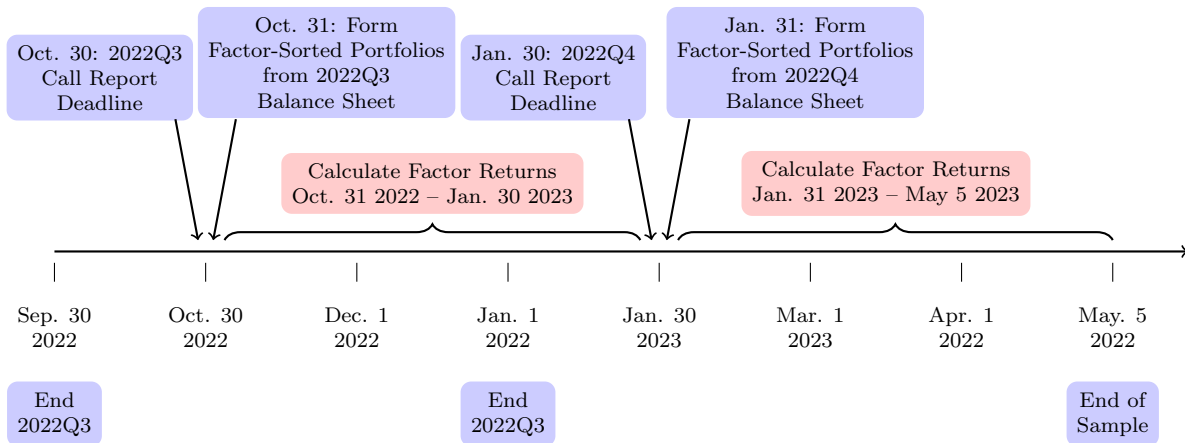


(b) Estimated Betas for Factor = *Losses*



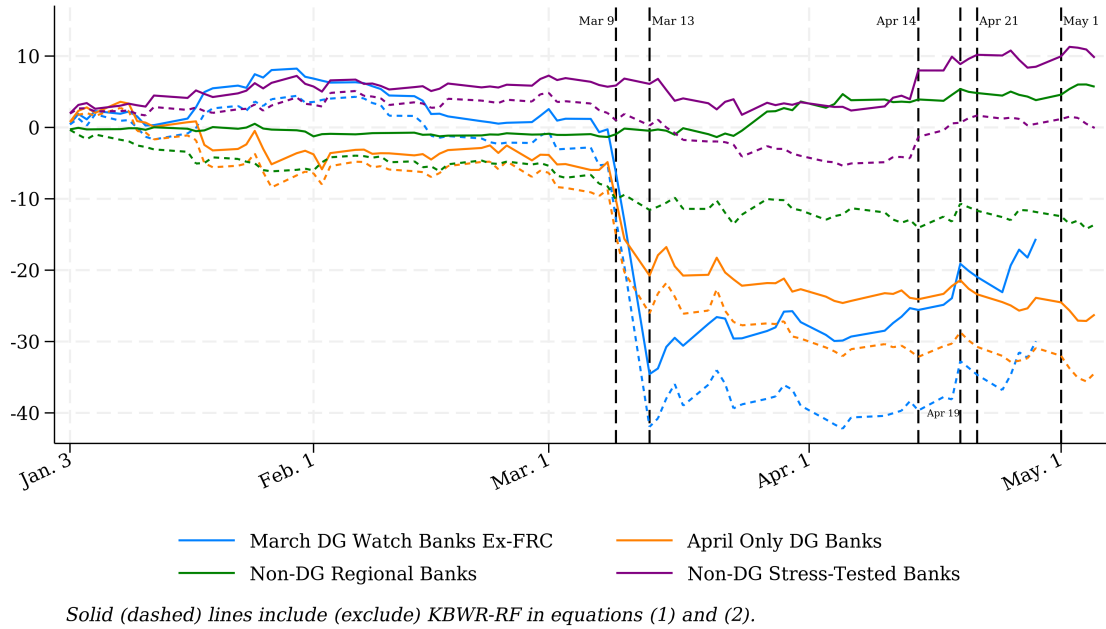
*Note:* This figure plots point estimates and 95% confidence intervals for the factor and factor times bank group interactions obtained from estimating equation (6). The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*) in Panel (a), and unrealized losses on AFS and HTM securities (*Losses*) in Panel (b). Each panel shows estimates from regressions using 4 sample dates in 2023. January 3-February 28 (green) and March 13-May 5 (red) are the pre- and post-run samples. The estimates from March 13-April 13 (blue) include interactions of the factor with 2 bank groups: those placed on downgrade watch on March 13 (*March DG Watch*) and regionals not in the March group (*Other Regionals*). The estimates from April 21 - May 5 (orange) include interactions of the factor with the *March DG Watch* banks (that were all downgraded in April), banks that were downgraded in April but not previously on downgrade watch (*April Only DG*) and non-downgraded regional banks (*Non-DG Regionals*). In all regressions, the omitted group consists of the non-downgraded stress-tested US banks.

Figure 3: Call Report Submission Dates and Construction of Factor Returns



*Note:* The figure illustrates how the Call Report submission dates inform the calculation of factor returns.

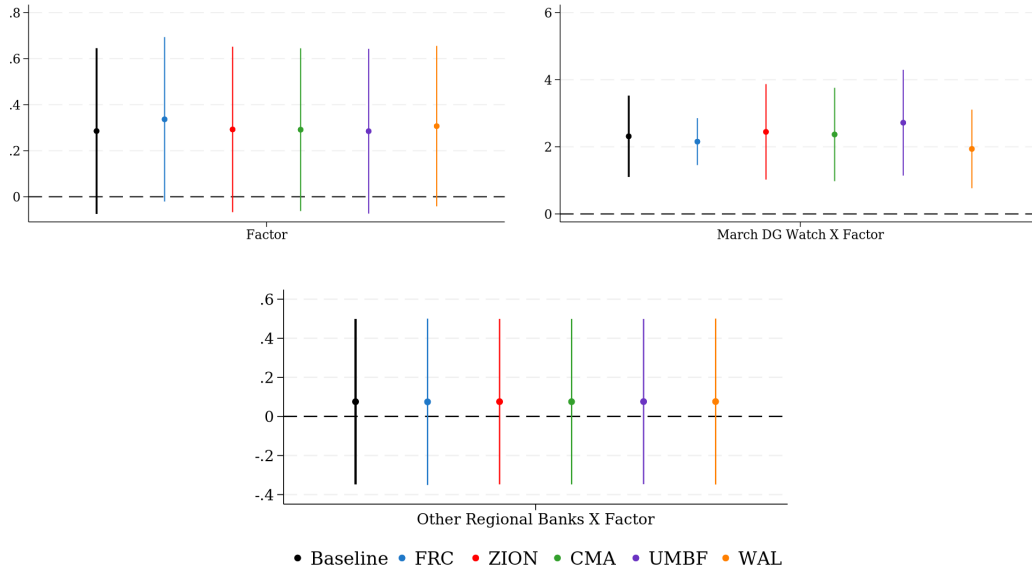
Figure 4: Cumulated Abnormal Stock Returns in 2023, By Bank Group



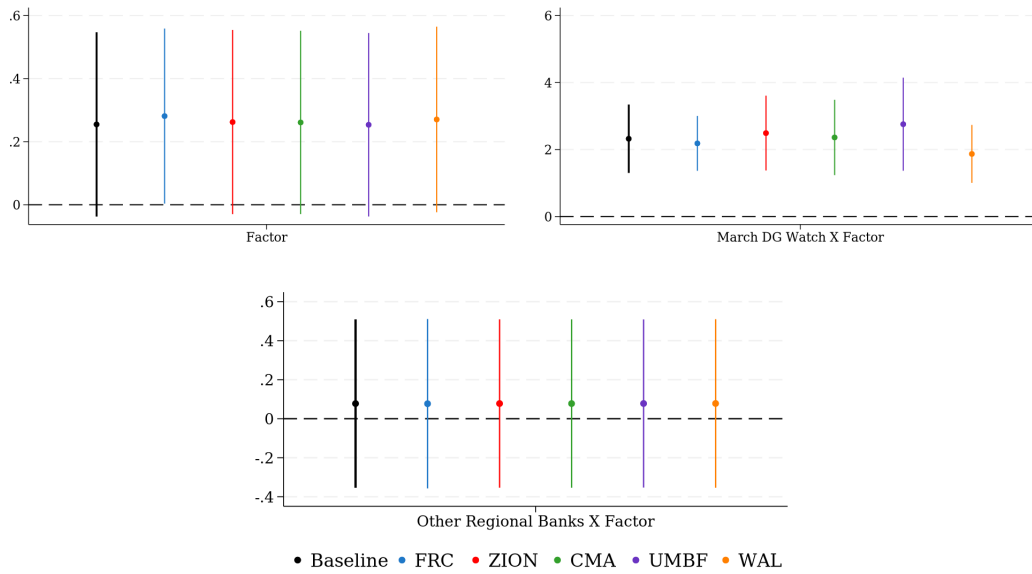
*Note:* The figure shows value-weighted cumulated bank stock returns (in %) from January 3, 2023 to May 5, 2023 for different banks groups. Abnormal returns for each bank are calculated according to equations (1) and (2). Cumulated abnormal returns are calculated as  $CAR_{i,t} = \prod_{s=3\text{jan}2023}^t AR_{i,s}$ . The solid (dashed) lines include (exclude) the KBWR-RF in equations (1) and (2). Lastly, we take the market capitalization-weighted average (using the market cap from the beginning of the year) of  $CAR_{i,t}$  for all banks in a given group. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. We also include a separate line for the *March DG Watch* group excluding FRC. The *April Only DG Banks* group includes banks downgraded between April 14 and 28. The *Non-DG Regional (Stress-Tested) Banks* group consists of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. The drop lines indicate the downgrade watch (March 13, 2023), downgrade events (April 14, 19, and 21 of 2023), and the failure of FRC (May 1, 2023). Observations for SVB, SBNY, and Silvergate stock prices are dropped for the entire period.

Figure 5: Leave-One-Out Analysis: Balance Sheet Factor Betas with Bank Group Interactions, After Downgrade Watch but Before Downgrade Announcements

(a) Uninsured Deposits (*UID*) Factor

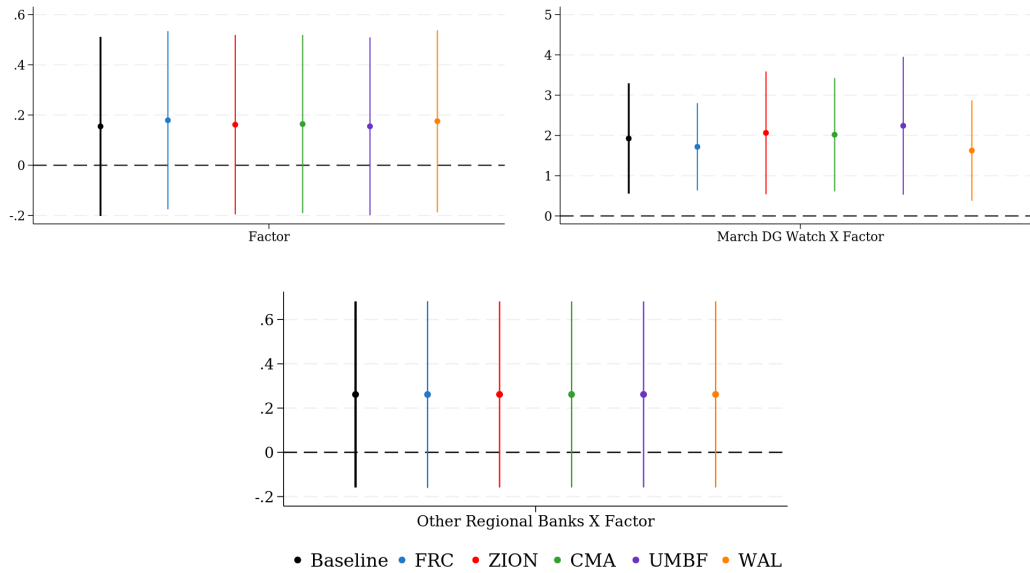


(b) Unrealized Losses (*Losses*) Factor

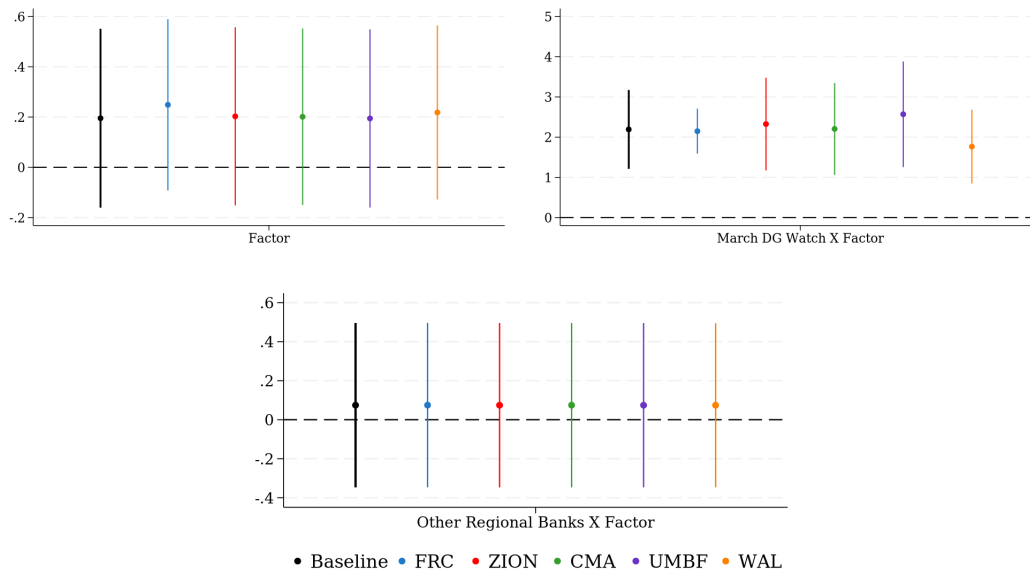


[Figure continues on next page.]

(c) Cash Factor



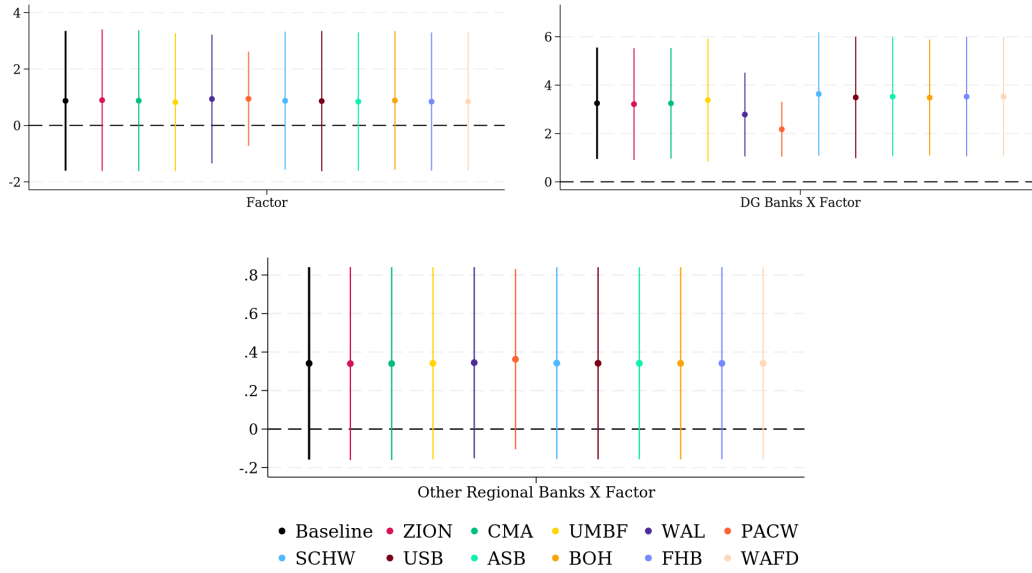
(d) CET1 Factor



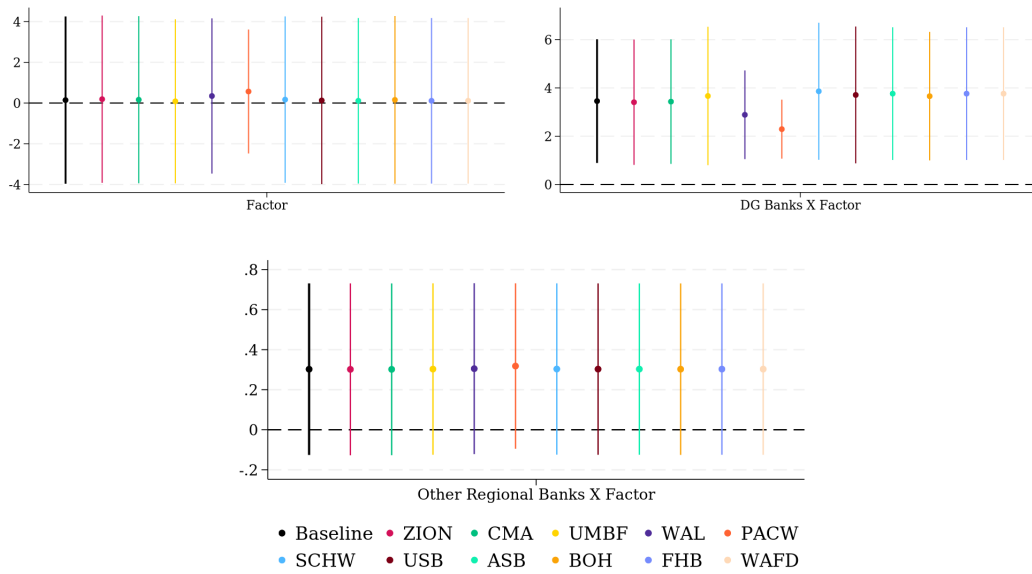
*Note:* This figure shows the results of leave-one-out robustness checks for the regression estimates in Table 7 by excluding each bank in the *March DG Watch* group one at a time. Each panel of the figure plots the point estimate and 95% confidence interval for the coefficient on the factor and the factor times bank group interactions. Within each panel, the different colors represent estimates obtained from excluding the corresponding bank in the legend. The point estimates and confidence intervals in black, labeled “Baseline” in the legend, are the estimates obtained without dropping any banks and are identical to those in Table 7.

Figure 7: Leave-One-Out Analysis: Balance Sheet Factor Betas with Bank Group Interactions, After Downgrade Announcements

(a) Uninsured Deposits (*UID*) Factor

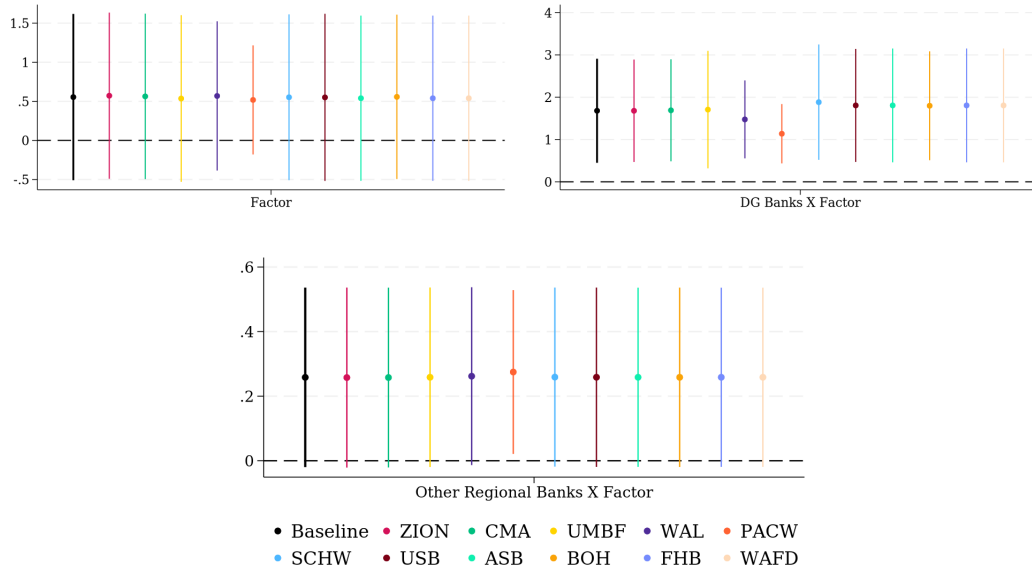


(b) Unrealized Losses (*Losses*) Factor

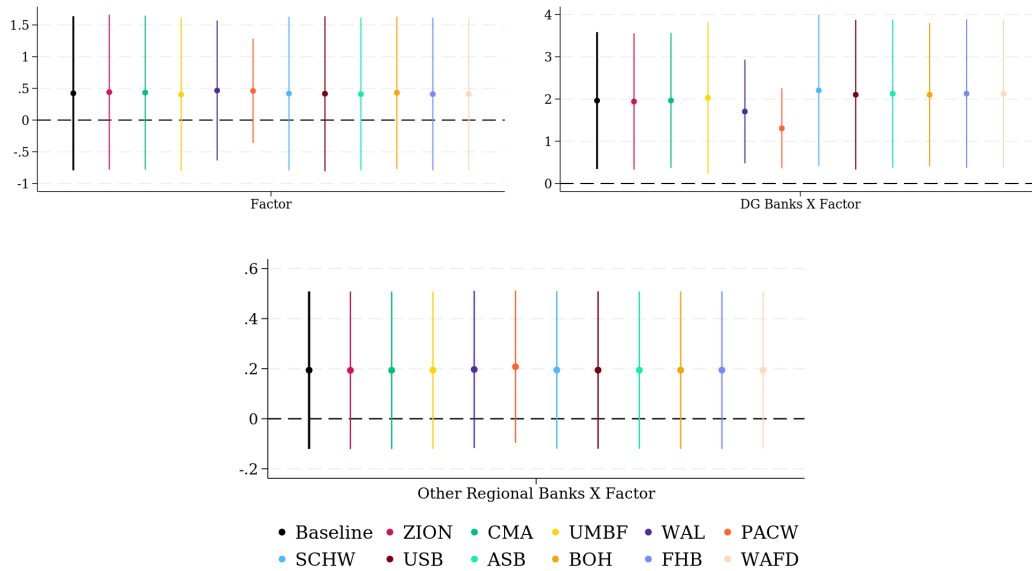


[Figure continues on next page.]

(c) Cash Factor



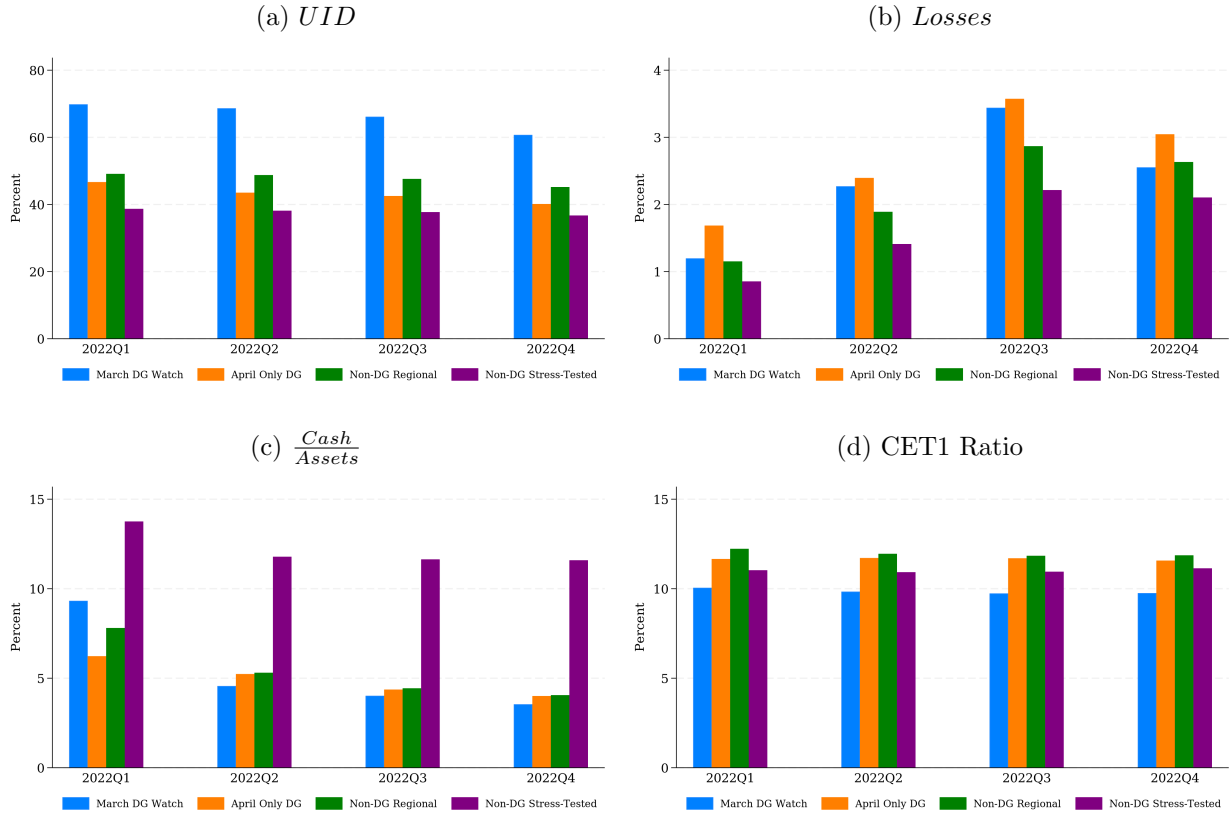
(d) CET1 Factor



*Note:* This figure shows the results of leave-one-out robustness checks for the regression estimates in Table 8 by excluding each bank in the *DG Banks* group one at a time. Each panel of the figure plots the point estimate and 95% confidence interval for the coefficient on the factor and the factor times bank group interactions. Within each panel, the different colors represent estimates obtained from excluding the corresponding bank in the legend. The point estimates and confidence intervals in black, labeled “Baseline” in the legend, are the estimates obtained without dropping any banks and are identical to those in Table 8.

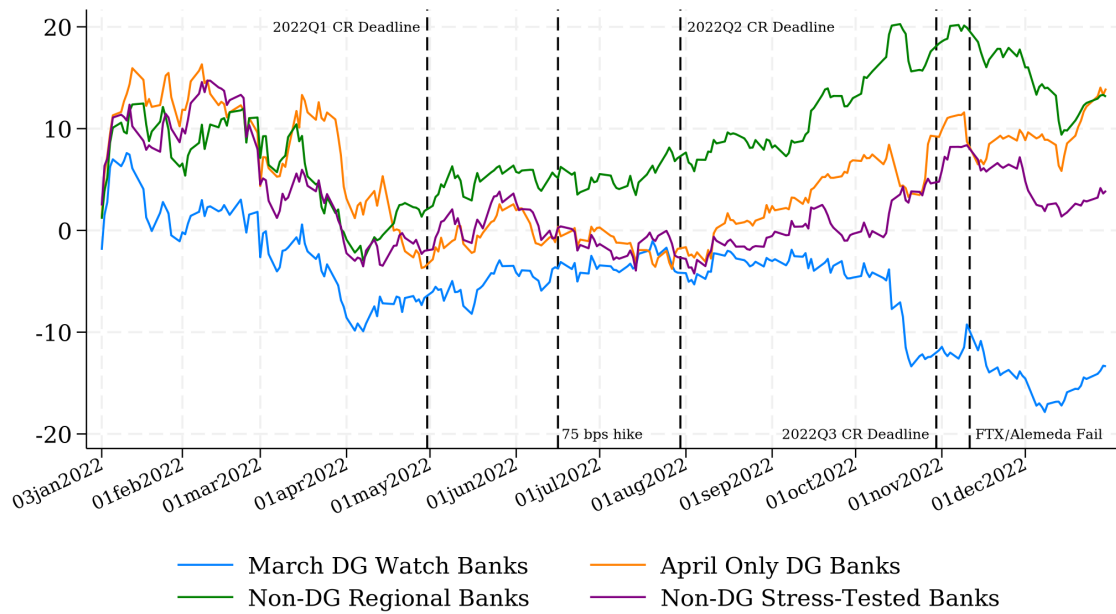


Figure 7: Bank Balance Sheet Characteristics in 2022, by Bank Group



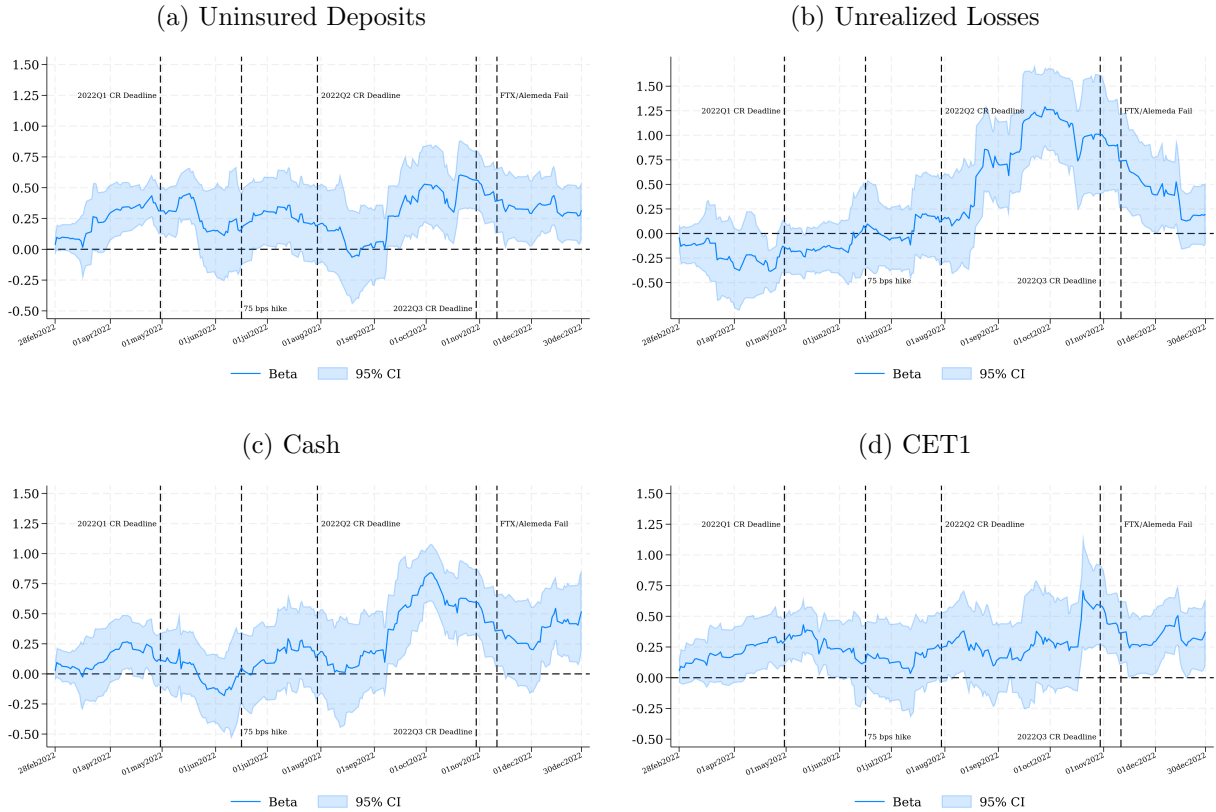
*Note:* This table shows the average values of bank balance sheet characteristics for the four bank groups throughout 2022. We do not show the average values for 2023Q1 because the deadline for Call Report submission was April 30, 2023—after the end of our sample. The ratios are reported in %. *UID* is the asset share of uninsured deposits. *Losses* is the asset share of unrealized losses on AFS and HTM securities. The *March DG Watch* group includes banks put on downgrade watch in March, 2023. The *April Only DG Banks* group includes banks downgraded between April 14 and 21, 2023. The *Non-DG Regional (Stress-Tested) Banks* groups consist of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. *DG*=Downgraded.

Figure 8: Cumulated Abnormal Stock Returns in 2022, By Bank Group



*Note:* The figure shows value-weighted cumulated bank stock returns relative to Wilshire 500 returns (in %) from January 3, 2022 to December 29, 2022 for different banks groups. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. The *April Only DG Banks* group includes banks downgraded between April 14 and 28. The *Non – DG Regional (Stress – Tested) Banks* group consists of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. The vertical drop lines in panel indicate the the submission deadlines for the 2022 Q1, Q2 and Q3 Call Reports (April 30, 2022, July 30, 2022 and October 30, 2020, respectively), the first 75bps rate increase of the Federal Reserve’s hiking cycle (June 16, 2022), and the failure of FTX (November 11, 2022). Observations for SVB, SBNY, and Silvergate stock prices are dropped for the entire period.

Figure 9: Bank Balance Sheet Factor Betas in 2022



*Note:* This figure plots the factor beta coefficients and 95% confidence intervals from estimating regression 6 for a rolling window of 39 trading days. The dates on the  $x$ -axis represent the end date of the rolling regression period. The first regression sample in 2022 is from January 3 to February 28, and the last from November 3 to December 30. The factors are constructed from long-short portfolios based on values of uninsured deposits ( $UID$ ), unrealized losses on AFS and HTM securities ( $Losses$ ), cash as shares of assets, and the common equity tier one ratio CET1 using balance sheets from the quarter before the start of the rolling window and after the Call Report filing deadline. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. The vertical drop lines indicate the submission deadlines for the 2022 Q1, Q2 and Q3 Call Reports (April 30, 2022, July 30, 2022 and October 30, 2020, respectively), the first 75bps rate increase of the Federal Reserve’s hiking cycle (June 16, 2022), and the failure of FTX (November 11, 2022). Observations for SVB, SBNY, and Silvergate stock prices are dropped for the entire period. Standard errors (used to compute the 95% confidence interval) are robust and clustered by date.

## A Appendix A: Data

### A.1 Linking Balance Sheet and Stock Data

We start with a list of 74 bank stock tickers, which include the 71 stock in our four groups along with SVB, SBNY and Silvergate. We use this list of tickers to obtain stock returns, market capitalization, permanent company code (PERMCO) and entity name from CRSP. We then merge this list of PERMCOs to the Federal Reserve Bank of New York’s PERMCO-RSSD crosswalk for all PERMCO-RSSD mappings that have an end date after the start of our sample (January 3, 2022).<sup>17</sup> This crosswalk matches with 71 of the 74 banks.<sup>18</sup> For the remaining three banks, we manually map them to an RSSD using the following procedure. We take the entity name from CRSP and paste it into the Federal Financial Institutions Examination Council’s (FFIEC) RSSD Lookup tool.<sup>19</sup> Each of the three entity names yields only one result in the FFIEC data which gives us the RSSD of the bank. Having obtained a mapping from bank stocks to RSSDs, we are able to map the returns data to balance sheet data from Call Reports and FR Y-9C filings.

### A.2 Call Report Submission Deadlines

To sort banks into the long-short portfolios, we use balance sheet data from the previous quarter, starting the day after the submission deadline for the previous quarter’s Call Report until the submission deadline of the next Call Report. The submission deadlines and dates for which we use the Call Reports are listed in Table A.1. An illustration of how the Call Reports submission dates inform the calculation of factor returns is in Figure 3.

Table A.1: Call Report Submission Deadlines

Call Report Quarter	Submission Deadline	Factor Return Dates
2021Q3	October 30, 2021	January 1, 2022 – January 30, 2022
2021Q4	January 30, 2022	January 31, 2022 – April 30, 2022
2022Q1	April 30, 2022	May 1, 2022 – July 30, 2022
2022Q2	July 30, 2022	July 31, 2022 – October 30, 2022
2022Q3	October 30, 2022	October 31, 2022 – January 30, 2023
2022Q4	January 30, 2023	January 31, 2023 – April 30, 2023
2023Q1	April 30, 2023	N/A

### A.3 Bank Group Members

#### A.3.1 March Downgrade Watch and April Downgrade Banks

1. First Republic Bank (FRC): placed on downgrade watch on March 13 and its preferred stock rating downgraded on April 21 by Moody’s; failed on May 1.

<sup>17</sup>Available here: [https://www.newyorkfed.org/research/banking\\_research/crsp-frb](https://www.newyorkfed.org/research/banking_research/crsp-frb)

<sup>18</sup>The three unmatched banks are Cadence Bank, Eastern Bankshares Inc, and Bank OZK,

<sup>19</sup>Available here: <https://www.ffiec.gov/NPW>

2. Zions Bancorporation, National Association (ZION): placed on downgrade watch on March 13 and downgraded on April 21 by Moody's.
3. Comerica Incorporated (CMA): placed on downgrade watch on March 13 and downgraded on April 21 by Moody's.
4. UMB Financial Corporation (UMBF): placed on downgrade watch on March 13 and downgraded on April 21 by Moody's.
5. Western Alliance Bancorporation (WAL): placed on downgrade watch on March 13 and downgraded on April 21 by Moody's.

### **A.3.2 April Only Downgrades**

1. PacWest Bancorp (PACW): downgraded by Fitch on April 14.
2. The Charles Schwab Corporation (SCHW): downgraded by S&P on April 19.
3. US Bancorp (USB): downgraded by Moody's on April 21.
4. Associated Banc-Corp (ASB): downgraded by Moody's on April 21.
5. Banks of Hawaii Corporation (BOH): downgraded by Moody's on April 21.
6. First Hawaiian, Inc. (FHB): downgraded by Moody's on April 21.
7. Washington Federal, Inc. (WAFD): downgraded by Moody's on April 21.

There were 6 other banks downgraded by Moody's on April 21, of which one is not publicly traded (Intrust), and five others (FRC, Zions, Comerica, UMB Financial, and Western Alliance) are in the March downgrade watch group.

### **A.3.3 Non-Downgraded Regional Banks**

Our sample contains 38 regional banks not in the March downgrade watch or April Only Downgrades group, consisting of those that are listed in the KRX index.

1. First Financial Bancorp. (FFBV)
2. CVB Financial Corp. (CVBF)
3. Brookline Bancorp, Inc. (BRKL)
4. Hope Bancorp, Inc. (HOPE)
5. Glacier Bancorp, Inc. (GBCI)
6. First Citizens BancShares, Inc. (FCNC.A)
7. Hancock Whitney Corporation (HWC)

8. Eastern Bankshares, Inc. (EBC)
9. Fulton Financial Corporation (FULT)
10. United Community Banks, Inc. (UCBI)
11. Cullen/Frost Bankers, Inc. (CFR)
12. First Interstate BancSystem, Inc. (FIBK)
13. SouthState Corporation (SSB)
14. Synchrony Financial (SYF)
15. Independent Bank Corp. (INDB)
16. Old National Bancorp (ONB)
17. Cadence Bank (CADE)
18. Prosperity Bancshares, Inc. (PB)
19. BOK Financial Corporation (BOKF)
20. Commerce Bancshares, Inc. (CBSH)
21. Home Bancshares, Inc. (HOMB)
22. Pacific Premier Bancorp, Inc. (PPBI)
23. Ameris Bancorp (ABCB)
24. First Commonwealth Financial Corporation (FCF)
25. BankUnited, Inc. (BKU)
26. Texas Capital Bancshares, Inc. (TCBI)
27. Bank OZK (OZK)
28. Simmons First National Corporation (SFNC)
29. Synovus Financial Corp. (SNV)
30. First Financial Bankshares, Inc. (FFIN)
31. Atlantic Union Bankshares Corporation (AUB)
32. Trustmark Corporation (TRMK)
33. Pinnacle Financial Partners, Inc. (PNFP)
34. Cathay General Bancorp (CATY)

35. Wintrust Financial Corporation (WTFC)
36. WSFS Financial Corporation (WSFS)
37. F.N.B. Corporation (FNB)
38. United Bankshares, Inc. (UBSI)

#### **A.3.4 Non-Downgraded Stress-Tested Banks**

This group includes 21 of the 34 banks that were part of the 2022 Federal Reserve stress tests that were also in the KBW index and not in the March downgrade watch or April Only Downgrades.<sup>20</sup>

1. Ally Financial Inc. (ALLY)
2. American Express Company (AXP)
3. Bank of America Corporation (BAC)
4. Bank of Mellon New York Corporation (BK)
5. Capital One Financial Corporation (COF)
6. Citigroup Inc.(C)
7. Citizens Financial Group, Inc. (CFG)
8. Discover Financial Services (DFS)
9. Fifth Third Bancorp (FITB)
10. Goldman Sachs Group, Inc. (GS)
11. Huntington Bancshares Incorporated (HBAN)
12. JPMorgan Chase & Co. (JPM)
13. Keycorp (KEY)
14. M&T Bank Corporation (MTB)
15. Morgan Stanley (MS)
16. Northern Trust Corporation (NTRS)
17. PNC Financial Services Group, Inc. (PNC)
18. Regions Financial Corporation (RF)

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<sup>20</sup>For the full list of stress-tested banks see Table 2 of "2022 Federal Reserve Stress Test Results," available at 2022 stress test results.

19. State Street Corporation (STT)
20. Truist Financial Corporation (TFC)
21. Wells Fargo & Company (WFC)

#### **A.4 Overlap of Banks in Long/Short Factor Portfolio Groups**

Table A.2 shows the degree of overlap in the long and short buckets for each factor. The buckets are reconstructed upon the submission deadline of the quarterly Call Report. For the given factor pair, each cell shows the number of banks that are in the long portfolio for both factors plus the number of banks that are in the short portfolio for both factors. Since there are 20 banks in each of the long portfolio and the short portfolio, the maximum overlap is 40 banks, which would occur if the long and short portfolios for two factors were identical in bank composition. For *UID* and *Losses* the long portfolio is the tercile with the highest values, and for Cash and CET1 the long portfolio is the lowest tercile.



Table A.2: **Overlap of Banks in Factor Groups**

2021Q3					2021Q4				
	Losses	UID	Cash	CET1		Losses	UID	Cash	CET1
Losses	.	.	.	.	Losses	.	.	.	.
UID	12	.	.	.	UID	10	.	.	.
Cash	12	15	.	.	Cash	15	16	.	.
CET1	14	14	14	.	CET1	13	14	16	.

2022Q1					2022Q2				
	Losses	UID	Cash	CET1		Losses	UID	Cash	CET1
Losses	.	.	.	.	Losses	.	.	.	.
UID	16	.	.	.	UID	16	.	.	.
Cash	22	17	.	.	Cash	22	15	.	.
CET1	14	11	13	.	CET1	15	13	18	.

2022Q3					2022Q4				
	Losses	UID	Cash	CET1		Losses	UID	Cash	CET1
Losses	.	.	.	.	Losses	.	.	.	.
UID	17	.	.	.	UID	15	.	.	.
Cash	22	18	.	.	Cash	22	16	.	.
CET1	13	14	15	.	CET1	14	12	15	.

*Note:* This table shows the degree of overlap in the long and short buckets for each factor. The buckets are reconstructed upon the submission deadline of the quarterly Call Report. For the given factor pair, each cell shows number of banks that are in the long portfolio for both factors plus the number of banks that are in the short portfolio for both factors. Since there are 20 banks in each the long portfolio and the short portfolio, the maximum overlap is 40 banks, which would occur if the long and short portfolios for two factors are identical in bank composition. For *UID* and *Losses* the long portfolio is the tercile with the highest values, and for *Cash* and *CET1* the long portfolio if the lowest tercile.

## B Appendix B: Robustness Checks

### B.1 Median Abnormal Returns

Table B.1: Daily Means of Median Abnormal Stock Returns, by Bank Group

## Panel A: Adjusting for KBWR–RF

	1/3 – 2/28	3/1 – 3/8	3/9	3/10	DG Watch 3/13	3/14 – 3/24	3/27 – 4/13	PACW DG 4/14	4/17 – 4/18	SCHW DG 4/19	4/20	Moody's DGs 4/21	4/24 – 5/5
SVB	0.43	-0.78	-54.13	-57.86	.	.	.	.	.	.	.	.	.
SBNY	-0.06	-1.22	-5.88	-17.97	.	.	.	.	.	.	.	.	.
Silvergate	0.21	-12.06	-35.07	-3.91	-5.59	-1.59	-0.47	-1.65	-1.00	6.09	2.32	-6.66	-0.41
March DG Watch Banks	-0.08	-0.86	-7.46	-11.58	-22.60	-0.69	0.05	-2.34	0.85	6.91	-1.05	-3.48	-0.81
March DG Watch Banks Ex-FRC	0.13	-0.63	-6.51	-2.45	-22.60	0.20	0.20	-2.34	1.37	6.91	-1.05	-3.48	-0.96
April Only DG Banks	-0.35	-0.36	-9.29	-9.96	-8.85	0.14	-0.70	-1.44	2.89	2.57	-1.19	0.15	-0.59
Non-DG Regional Banks	-0.14	-0.60	-2.02	0.62	-1.96	-0.35	-0.41	-1.53	0.20	2.89	-0.75	0.08	-0.24
Non-DG Stress-Tested Banks	0.12	-0.44	-1.64	0.87	-1.17	-0.50	0.08	1.64	0.74	0.39	1.04	0.52	-0.22

## Panel B: Adjusting for KBWR–RF

	1/3 – 2/28	3/1 – 3/8	3/9	3/10	DG Watch 3/13	3/14 – 3/24	3/27 – 4/13	PACW DG 4/14	4/17 – 4/18	SCHW DG 4/19	4/20	Moody's DGs 4/21	4/24 – 5/5
SVB	0.55	-0.18	-51.30	-57.80	.	.	.	.	.	.	.	.	.
SBNY	0.06	-0.60	-3.00	-17.91	.	.	.	.	.	.	.	.	.
Silvergate	0.32	-11.56	-32.71	-3.86	-3.62	-1.52	-0.11	-0.01	-1.19	3.97	2.49	-6.23	-0.12
March DG Watch Banks	-0.01	-0.56	-5.09	-11.57	-20.47	-0.60	0.47	-0.57	0.75	4.49	-0.87	-3.01	-0.50
March DG Watch Banks Ex-FRC	0.23	-0.07	-3.82	-2.40	-20.47	0.29	0.60	-0.57	1.09	4.49	-0.87	-3.01	-0.64
April Only DG Banks	-0.30	-0.09	-8.01	-9.93	-7.79	0.18	-0.50	-0.56	2.79	1.42	-1.10	0.38	-0.43
Non-DG Regional Banks	-0.02	-0.07	0.40	0.68	0.27	-0.22	-0.02	0.26	0.02	0.55	-0.56	0.54	-0.02
Non-DG Stress-Tested Banks	0.18	-0.27	-0.16	0.90	-0.67	-0.48	0.24	2.33	0.97	-1.24	1.10	0.70	-0.13

*Note:* The table shows value-weighted median abnormal bank stock returns (in %) from January 3, 2023 to May 5, 2023 for different banks groups and sample periods. Abnormal returns for each bank are calculated according to equations (1) and (2). The values are calculated by first taking the median return across the banks in a given group on each day. Then, we take the average of these medians over the days listed in the column headers. Observations for SVB and SBNY stock prices are dropped after they went into receivership on March 10 and March 12, respectively. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. We include an additional row for the *March DG Watch* group excluding FRC. The *April Only DG Banks* group includes banks downgraded between April 14 and 28. The *Non – DG Regional (Stress – Tested) Banks* groups consist of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. *DG*=Downgraded.

## B.2 Excluding First Republic Bank (FRC)

Table B.2: Bank Balance Sheet Factor Beta: March 13 to May 5, 2023, Excluding FRC

	Factor=%UID	Factor=% Losses	Factor=% Cash	Factor = CET1
Factor	0.39** (0.17)	0.43** (0.17)	0.36*** (0.11)	0.38** (0.15)
Mkt-RF	1.13*** (0.29)	1.25*** (0.29)	1.12*** (0.28)	1.26*** (0.28)
SMB	0.55 (0.49)	0.39 (0.50)	0.34 (0.48)	0.58 (0.48)
HML	1.72*** (0.40)	1.73*** (0.39)	1.81*** (0.35)	1.56*** (0.42)
RMW	-0.32 (0.61)	-0.24 (0.49)	-0.30 (0.52)	-0.10 (0.52)
CMA	-1.59*** (0.53)	-1.55** (0.57)	-1.55*** (0.53)	-1.27* (0.63)
Log(MVE) <sub>t-1</sub>	-12.06* (6.55)	-12.34* (6.40)	-12.11* (6.50)	-12.14* (6.44)
Obs	2,764	2,764	2,764	2,764
Adj R2	0.41	0.41	0.41	0.41
Bank FE	YES	YES	YES	YES

*Note:* This table shows that the estimates in Table 6 are robust to the exclusion of First Republic Bank (FRC). This table presents the results from estimating regression (6), without the bank group interactions, for the period March 13 to May 5, 2023. The factors are constructed from long-short portfolios based on 2022Q4 asset shares of uninsured deposits (*UID*), unrealized losses on AFS and HTM securities (*Losses*), cash as shares of assets, and the common equity tier one ratio CET1. The *negative* of the cash and CET1 factor returns is used for consistency with the other factors. Downgraded and failed banks are excluded from the factor construction. FRC, SVB, SBNY and Silvergate are not included in the regression. FRC is dropped from the sample on and after its failure (May 1). Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

## B.3 Covariance With Bank Index Returns

Table B.3: Covariance of Event Bank Returns With Bank Index Returns

	March Event Banks		April Event Banks Relative to: Jan. – Feb.		April Event Banks Relative to: Mar. 27 – DG	
	Index = KBWB	Index = KBWR	Index = KBWB	Index = KBWR	Index = KBWB	Index = KBWR
	Index Return	1.76** (0.65)	0.48 (0.32)	0.85*** (0.20)	0.54*** (0.17)	1.27** (0.52)
Post:0 × Index Return	0.89 (0.72)	3.57*** (0.58)	-0.08 (0.24)	0.42** (0.16)	0.27 (0.44)	-0.01 (0.30)
Post:1 × Index Return	2.21*** (0.15)	4.26*** (0.49)	0.94*** (0.26)	0.54** (0.22)	0.07 (0.36)	0.05 (0.36)
Post:2 × Index Return	-1.00** (0.46)	-0.82 (0.88)	0.09 (0.14)	0.14* (0.08)	0.07 (0.21)	-0.23 (0.17)
Post:3 × Index Return	1.42*** (0.18)	0.96*** (0.22)	0.03 (0.22)	1.44*** (0.26)	0.35 (0.51)	0.98* (0.49)
Post:4 × Index Return	1.09** (0.50)	1.24*** (0.33)	0.35** (0.16)	0.04 (0.10)	0.98** (0.40)	-0.32 (0.33)
Post:5-9 × Index Return	0.45 (0.55)	0.54 (0.51)	0.90*** (0.19)	0.89*** (0.16)	1.07*** (0.27)	0.48* (0.25)
Mkt-RF	-1.57 (1.28)	-0.05 (0.74)	-0.10 (0.31)	0.51** (0.22)	-0.96 (0.74)	0.41 (0.45)
SMB	0.82 (0.49)	1.03 (0.84)	0.68*** (0.20)	0.41 (0.30)	1.12** (0.51)	0.20 (0.58)
HML	1.05** (0.49)	2.00* (1.08)	0.40 (0.29)	0.48 (0.33)	-0.76 (1.00)	0.62 (0.62)
RMW	1.21** (0.59)	0.55 (0.70)	0.34 (0.29)	-0.03 (0.31)	-0.29 (0.67)	-0.28 (0.68)
CMA	-3.21** (1.53)	-3.52* (2.01)	-0.66** (0.31)	-0.18 (0.35)	-0.10 (1.50)	-0.30 (1.21)
Constant	-0.54 (0.41)	-0.42 (0.42)	-0.06 (0.11)	-0.01 (0.09)	0.10 (0.37)	0.08 (0.30)
Obs	245	245	539	539	301	301
Adj R2	0.60	0.58	0.46	0.48	0.40	0.43
Bank FE	YES	YES	YES	YES	YES	YES

Note: This table shows results of the regression

$$R_{it} = \alpha_0 + \alpha_i + \sum_{j=1}^5 \beta_j FF_{jt} + \gamma SecR_t + \sum_{k=0}^5 \zeta_k (Post_{tk} \times SecR_t) + \varepsilon_{it},$$

where  $R_{it}$  is the return for bank  $i$  on day  $t$ ,  $\alpha_i$  is a bank fixed effect,  $FF_{jt}$  are the Fama French factors,  $SecR_t$  is the return of KBW Bank Index (KBWB) or the KWB Regional Bank Index (KBWR), and  $Post_{tk}$  is a dummy variable equal to 1 on day  $k$  after the event, except for  $Post_{t5}$  which is equal to 1 on days 5 through 9 after the event. FRC is excluded from the regressions in columns 3–6. Standard errors (in parentheses) are robust and clustered by time. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Table B.4: Covariance of Event Bank Returns With Bank Index Returns

	March Event Banks		April Event Banks Relative to: Jan. – Feb.		April Event Banks Relative to: Mar. 27 – DG	
	Index = KBWB	Index = KBWR	Index = KBWB	Index = KBWR	Index = KBWB	Index = KBWR
	Index Return	1.76*** (0.41)	0.33 (0.58)	0.91*** (0.22)	0.73*** (0.13)	1.32** (0.48)
Post:0-4	2.28* (1.26)	0.91 (2.59)	0.80 (0.77)	-0.17 (0.29)	1.03 (0.68)	-0.36 (0.38)
Post:5-9	-1.52 (1.69)	-2.86* (1.61)	0.07 (0.72)	-0.63 (0.64)	-0.45 (0.63)	-0.90 (0.82)
Post:0-4 × Index Return	1.15*** (0.38)	2.01*** (0.62)	0.29 (0.18)	0.27* (0.16)	0.53 (0.36)	-0.01 (0.25)
Post:5-9 × Index Return	0.56 (0.47)	0.54 (0.42)	0.86*** (0.18)	0.76*** (0.11)	0.92*** (0.25)	0.46** (0.18)
Mkt-RF	-1.62** (0.79)	-0.32 (0.91)	-0.20 (0.35)	0.28 (0.18)	-0.87 (0.64)	0.09 (0.35)
SMB	0.71 (0.43)	1.66* (0.91)	0.73*** (0.21)	0.18 (0.23)	1.16** (0.51)	0.29 (0.64)
HML	0.75 (0.71)	3.40** (1.37)	0.42 (0.31)	0.07 (0.27)	-0.98 (1.06)	0.19 (0.83)
RMW	1.60** (0.64)	2.74** (1.22)	0.27 (0.26)	-0.17 (0.24)	-0.41 (0.56)	-0.21 (0.61)
CMA	-3.16** (1.47)	-6.13*** (2.09)	-0.71* (0.40)	0.22 (0.33)	0.49 (1.46)	-0.04 (1.45)
Constant	-0.37 (0.23)	-0.28 (0.31)	-0.13 (0.11)	0.09 (0.07)	-0.04 (0.27)	0.36 (0.23)
Obs	245	245	539	539	301	301
Adj R2	0.60	0.54	0.46	0.48	0.41	0.43
Bank FE	YES	YES	YES	YES	YES	YES

Note: This table shows results of the regression

$$R_{it} = \alpha_0 + \alpha_i + \sum_{j=1}^5 \beta_j FF_{jt} + \gamma SecR_t + \sum_{k=0}^1 \delta_k Post_{tk} + \sum_{k=0}^1 \zeta_k (Post_{tk} \times SecR_t) + \varepsilon_{it}$$

where  $R_{it}$  is the return for bank  $i$  on day  $t$ ,  $FF_{jt}$  are the Fama French factors,  $\alpha_i$  is a bank fixed effect,  $SecR_t$  is the return of KBW Bank Index (KBWB) or the KBW Regional Bank Index (KBWR),  $Post_{t0}$  is a dummy variable equal to 1 on days 0 to 4 after the event, and  $Post_{t1}$  is a dummy variable equal to 1 on days 5 to 9 after the event. FRC is excluded from the regressions in columns 3-6. Standard errors (in parentheses) are robust and clustered by time. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

## C Appendix C: Results for CET1 with Losses Factor

*CET1 with losses* is defined as the hypothetical CET1 ratio if AFS + HTM losses were realized, as follows:

$$CET1\ With\ Losses_i = \frac{CET1 - Losses \times (1 - 0.21)}{RWA} \quad (C.0)$$

*Losses*=Unrealized losses from AFS and HTM securities; *RWA*=Risk-weighted assets.

The adjustment of 0.21 reflects an adjustment for capital gains taxes. We assume that, after the unrealized securities losses become realized, the loss is recorded on the income statement along with other non-interest income as a pre-tax item. To flow down to net income (where it would hit retained earnings, and thereby capital) it would need to be taxed. We assume that this tax rate is 21%.

The factor is constructed similar to the others: we first sort banks into terciles based on the 2022Q4 balance sheet values of *CET1 with losses* and then calculate the (negative of) the return spread between the top and bottom portfolios. Table C.1 shows that the hypothetical CET1 with losses tracks the unrealized loss shares in Table 1: they are highest for the downgraded banks and the non-downgraded regionals.

Table C.1: **Average CET1 with Losses as of 2022Q4, by Bank Group**

	Number of Banks	CET1 with Losses
SVB	1	-0.25
SBNY	1	7.58
Silergate	1	35.90
March DG Watch Banks	5	7.21
April Only DG Banks	7	6.74
Non-DG Regional Banks	38	9.08
Non-DG Stress-Tested Banks	21	9.79

*Note:* The table shows the average value of CET1 Ratio with losses for SVB, SBNY, Silergate and four bank groups, reported as of 2022Q4. The ratios are reported in %. The *April Only DG Banks* group includes banks downgraded between April 14 and 28. The *Non – DG Regional (Stress – Tested) Banks* groups consist of non-downgraded regional (US stress-tested) banks. Banks in the various groups are listed in appendix A. *DG*=Downgraded.

Table C.2: **CET1 With Losses**  
**Factor Beta: January to**  
**February 2023**

	Factor = CET1 with Losses
Factor	0.27** (0.13)
Mkt-RF	0.93*** (0.13)
SMB	0.48** (0.19)
HML	0.62*** (0.22)
RMW	0.25 (0.25)
CMA	-0.41 (0.32)
Log(MVE) <sub>t-1</sub>	-5.18*** (1.65)
Obs	2,769
Adj R2	0.43
Bank FE	YES

*Note:* This table shows results from estimating regression (6), without the bank group interactions, for the period January 3 to February 28, 2023. The factor is constructed from a long-short portfolio based on values of the (negative of the) hypothetical CET1 ratio if AFS and HTM losses were realized. Downgraded and failed banks are excluded from the factor construction. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . SVB, SBNY and Silvergate are not included in the regression.



Table C.3: **CET1 With Losses**  
**Factor Beta: March 13 to**  
**May 5, 2023**

	Factor=%UID
Factor	0.34** (0.13)
Mkt-RF	1.25*** (0.28)
SMB	0.64 (0.47)
HML	1.45*** (0.43)
RMW	-0.14 (0.52)
CMA	-1.19* (0.62)
Log(MVE) <sub>t-1</sub>	-12.06* (6.48)
Obs	2,764
Adj R2	0.41
Bank FE	YES

*Note:* This table shows results from estimating regression (6), without the bank group interactions, for the period March 13 to April 5, 2023. The factor is constructed from a long-short portfolio based on values of the (negative of the) hypothetical CET1 ratio if AFS and HTM losses were realized from 2022Q4. Downgraded and failed banks are excluded from the factor construction. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . SVB, SBNY and Silvergate are not included in the regression.

Table C.4: **CET1 with Losses Factor Beta, Interacted with Bank Groups, After Downgrade Watch but Before Downgrade Announcements**

	Factor = CET1 with Losses
Factor	0.12 (0.19)
March DG Watch $\times$ Factor	1.68*** (0.58)
Other Regionals $\times$ Factor	0.10 (0.18)
Mkt-RF	1.11*** (0.36)
SMB	0.24 (0.33)
HML	1.52*** (0.43)
RMW	-0.34 (0.57)
CMA	-1.69*** (0.50)
Log(MVE) $_{t-1}$	-19.97*** (5.25)
Obs	1,633
Adj R2	0.56
Bank FE	YES

*Note:* This table shows results from estimating regression 6 for the period March 13 to April 13, 2023. The *March DG Watch* group includes banks put on downgrade (DG) watch in March. The *Other Regional Banks* group consists of the regionals that were not on downgrade watch. Stress-tested US banks are the omitted group. Banks in the various groups are listed in appendix A. The factor is constructed from a long-short portfolio based on values of the (negative of the) hypothetical CET1 ratio if AFS and HTM losses were realized. Downgraded and failed banks are excluded from the factor construction. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ . SVB, SBNY and Silvergate are excluded from the regression sample.

Table C.5: **CET1 with Losses Factor Beta, After Downgrade Announcements**

	Factor=%UID
Factor	0.48 (0.45)
DG Banks $\times$ Factor	1.48** (0.57)
Other Regional Banks $\times$ Factor	0.14 (0.10)
Mkt-RF	2.54** (1.02)
SMB	2.09* (1.13)
HML	-1.67 (2.30)
RMW	0.46 (1.17)
CMA	5.89 (4.95)
Log(MVE) $_{t-1}$	-31.85 (24.13)
Obs	770
Adj R2	0.48
Bank FE	YES

*Note:* This table shows results from estimating regression 6 for the period April 21 to May 5, 2023. *DG Banks* is a dummy variable equal to one for banks that were downgraded in April. The *Non-DG Regional Banks* group consists of the regionals that were not downgraded. Non-downgraded stress-tested US banks are the omitted group. We exclude FRC, SVB, SBNY, and Silvergate from the regression sample. The factor is constructed from a long-short portfolio based on values of the (negative of the) hypothetical CET1 ratio if AFS and HTM losses were realized. Downgraded and failed banks are excluded from the factor construction. SVB, SBNY and Silvergate are excluded from the regression sample. Standard errors (in parentheses) are robust and clustered by date. Stars represent statistical significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .