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Persistency of window dressing practices in the U.S. repo markets after the GFC: The unexplored role of the deposit insurance premium

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Abstract

We investigate whether the regulatory improvements made in the aftermath of the global financial crisis have been effective in limiting bank downward window dressing by means of repos in the United States. We find that a strict application of the Basel III regulation wipes out incentives to engage in window dressing to bolster the level of leverage Tier 1 ratio at quarter-end. We also show that the persistency of window dressing is related to the computation of the Federal Deposit Insurance Corporation assessment base, which motivates banks to engage in window dressing to reduce the deposit insurance premium.

KEYWORDS

bank holding companies, deposit insurance premium, leverage tier 1 ratio, repurchase agreements, window dressing

JEL CLASSIFICATION

G14, G21, G28, M41, M48

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1 | INTRODUCTION

The issue of bank window dressing has been under the spotlight from both regulators and academics as it affects the reliability, quality and transparency of financial and regulatory reporting. Window dressing has been defined variously in the banking literature, but in principle, it involves the use of short-term financial transactions to manipulate accounting numbers around the quarter-end reporting date (Allen & Saunders, 1992). It is a practice 'in which financial institutions adjust their activity around an anticipated period of oversight or public disclosure to appear safer or more profitable to outside monitors' (Munyan, 2017, p. 1).[1] Opaque financial information can undermine the ability of investors to make rational and optimal economic decisions (Chen et al., 2016; Lamoreaux et al., 2019). In addition, financial statement figures are used by regulators and supervisors for various reasons. For instance, this information may be used to set and monitor regulators' and supervisors' policies, as a basis to compute regulatory capital requirements or deposit insurance premiums and to define corrective supervisory actions (Whalen, 2011; Kreicher et al., 2013). However, window dressing may compromise the effectiveness of such measures (Bushman & Williams, 2012). In this regard, the Bank for International Settlement (BIS, 2018, p. 1) stated that 'window-dressing by banks is unacceptable as it undermines the intended policy objectives [...] disrupting the operations of financial markets'.

Repo markets offer banks various opportunities to engage in window dressing and, specifically, in downward window dressing. Window dressing can be detected when there is a trend difference of a financial variable that can be either upward or downward (depending on banks' incentives) between its value at the quarter-end of a reporting date and its value registered during the quarter. Specifically, upward (downward) window dressing refers to the action oriented to increase (decrease) a balance sheet indicator level near the quarter-end reporting period.[2] As a form of collateralized borrowing, repos permit banks to borrow short-term funding against some of their assets, thereby temporarily expanding their balance sheet. The cash received can be lent via reverse repos and the newly acquired collaterals be used for further borrowing. At the end of the quarter, banks can reverse the balance sheet expansion by closing part of their reverse repo positions and using the cash received to repay repos. This shrinks total assets and boosts the reported level of capital ratio (Basel Committee for Banking Supervision, 2008).[3]

In this paper, using a hand-collected data set of 70 large U.S. BHCs over 2011Q2–2016Q1 taken from the FR Y-9C Call Report, we analyze window dressing practices of U.S. BHCs. Employing panel fixed effect regressions, we estimate the extent of window-dressing by using the measure proposed by Owens and Wu (2015). This measure compares the average of the current and prior quarter-end values of repos and federal funds with their average values measured throughout the quarter. Our aim is threefold. First, we test whether, before the enforcement of Basel III regulation in 2013, U.S. BHCs engaged in downward window dressing

[1]For alternative definitions of window dressing, see Feltham and Xie (1994).

[2]In this paper, we refer to the term 'window dressing' to describe the general problem owed to accounting manipulation, but we use the term 'downward window dressing' to define the behaviour of reducing the amount of repos at quarter-end (in comparison to the amount registered during the quarter) to avoid the regulatory compliance burden.

[3]The reported level of capital ratios increases as repo transactions are collateralized, thus receiving very low weights. However, the overall amount of repo transactions is included in the denominator of the capital ratio.

to appear more capitalized than they actually were. Second, we assess whether, after 2013, the new supervisory reporting requirement of the leverage Tier 1 ratio has been effective in eliminating the incentives of U.S. BHCs to window dress their leverage Tier 1 ratio figure. Finally, we analyze how and to what extent the Federal Deposit Insurance Corporation's (FDIC) definition of the assessment base for the computation of the deposit insurance premium creates incentives for U.S. BHCs to engage in downward window dressing to pay a lower deposit insurance premium.

Numerous studies show that repo markets' instability contributed to the global financial crisis (GFC) (Adrian & Shin, 2010; Copeland et al., 2014; Du, 2017; Gorton & Metrick, 2012; Gorton, 2009; Martin et al., 2014). For instance, Lehman Brothers engaged widely in window dressing practices (so called "repo 105") to hide its actual leverage figure by accepting a relatively high (5%) haircut.[4] This allowed Lehman Brothers to record repo transactions as true sales, enabling the bank to reduce its reported level of leverage and consequently presenting a distorted view of its financial position (Smith, 2011). More recently, Krishnamurthy et al. (2014) argued that U.S. financial institutions might engage in window dressing around SEC reporting dates by means of repos, while Anbil and Senyuz (2018) show that postcrisis regulatory reforms intensified the window dressing practices of European dealers by 80% in the U.S. banking industry. These studies show that analyzing repo markets is pivotal to identify window dressing practices in the banking industry.

Differently from other countries, the enforcement of the Basel III regulation in the U.S. banking sector has been particularly important to reduce incentives to window dress (Anbil & Senyuz, 2018). Specifically, before this regulation, U.S. banks reported their leverage ratio figure to their supervisors at the quarter-end reporting period. In this context, banks had an incentive to manipulate their leverage Tier 1 ratio level by reducing the amount of repos at quarter-end (i.e., downward window dressing) to appear more capitalized (Munyan, 2017) and consequently reduce the burden of Basel capital requirement regulations. Conscious of these window dressing practices, U.S. regulators opted for a restrictive application of Basel III regulation, requiring banks to report their leverage Tier 1 ratio figures based on a daily average (Anbil & Senyuz, 2018). Many contend that, after the enforcement of this new regulation, U.S. banks have fewer reasons to engage in downward window dressing practice (Munyan, 2017; Anbil & Senyuz, 2018), although the literature has not provided strong empirical support for this hypothesis.

However, while these regulations may have limited the misaligned incentives of financial institutions concerning the disclosure of short-term funding, other postcrisis regulations might have encouraged different forms of misreporting. A particularly interesting example is that of the FDIC postcrisis regulatory reform, which has changed the definition of banks' deposit insurance assessment base. While before this reform, the deposit insurance premium was computed only as a percentage of domestic retail deposits (Whalen, 2011), after the GFC, the FDIC has required to compute the deposit insurance premium as a percentage of all tangible liabilities less capital, including wholesale funding, and consequently repos (Kreicher et al., 2013). In this context, U.S. BHCs may be incentivized to window dress their deposit insurance assessment base by reducing their repo positions at the quarter-end reporting period, to pay a lower deposit insurance premium. Indeed, the deposit insurance assessment has made

[4]A haircut is the difference between the value of an asset and the price paid for that asset at the beginning of a repo transaction.

wholesale funding significantly more costly in terms of deposit insurance premiums. As a matter of fact, after the introduction of the FDIC regulation, the assessment base of State Street Corporation, Citigroup and JP Morgan Chase increased by 576.2%, 291% and 166.5%, respectively.[5] Salzman (2011), a former Clearing House Association President, argues that this rule would also increase banking risks, hence encouraging moral hazard.

Previous studies have shown that global systemically important banks (G-SIBs)[6] (which are subject to an additional capital surcharge) engage in window dressing behaviour to reduce their G-SIB scores to appear less systematically important and, consequently, reduce their capital buffer requirements (Behn et al., 2018, 2019). In our empirical analysis, we also focus on this aspect by performing a robustness test that takes into consideration the peculiarities of these institutions. The FDIC employs a risk-based system to measure the assessment rates for small, large and the so called 'highly complex institutions'. The assessment base of small banks (whose total assets are less than $10 billion) is computed by means of CAMELS rating (Lundtofte & Nielsen, 2019). In contrast, large banks (whose total assets is greater than $10 billion) and the 'highly complex institutions' (banks that are not only large but also operationally and structurally complex) are assigned a rate based on an individual scorecard. This scorecard takes into account CAMELS ratings, the bank's ability to tolerate stressed conditions with reference to their asset and funding structure and the magnitude of the potential losses to the FDIC in the event of default of the bank.[7]

Our main findings indicate that, to appear more capitalized, BHCs engaged in downward window dressing behaviour on repos before the daily average reporting requirement of the leverage Tier 1 figure (i.e., when BHCs reported at quarter-end). However, we find that a more strict application of the computation of the leverage Tier 1 ratio under Basel III regulation in the U.S. banking sector has eliminated the incentives for BHCs to engage in downward window dressing by means of repos to appear more capitalized in the eyes of their supervisors. Nevertheless, we also provide evidence that, regardless of the elimination of this incentive, U.S. BHCs have other reasons to engage in downward window dressing by operating in the repo markets. In particular, we show that BHCs manipulate the assessment base for the computation of the deposit insurance premium to reduce the burden of the FDIC regulation. Additional analyses report that this incentive is stronger for U.S. G-SIBs, which engage in window dressing by means of repos more extensively. These findings offer important policy implications in terms of financial stability. On the one hand, if BHCs use repos to hide their real level of the leverage Tier 1 ratio, this could have a detrimental effect on financial stability owed to greater leverage (Grill et al., 2017). On the contrary, if BHCs lower the deposit insurance premium they have to pay, this can negatively impact the ability of the FDIC to insure individuals' deposits in periods of financial distress.

The incremental contribution we provide to the extant literature is manifold. Specifically, we contribute to the literature that studies bank window dressing practices, which is very scant,

[5]According to Whalen (2011) and based on calculation from IRA Bank Monitor, JP Morgan Chase deposit insurance premium increased by approximately $400 million in 2008 to 1.4 billion $ in 2011.

[6]Our empirical analysis focuses on BHCs, which are financial corporations that own a controlling interest in other banks. In contrast, G-SIBs are banks that are deemed systemically important at global level by the Basel Committee on Banking Supervision and the Financial Stability Board. In the sample analyzed in this paper, some BHCs are also G-SIBs. See Section 5 for further information.

[7]For more information please refer to https://www.fdic.gov/resources/deposit-insurance/deposit-insurance-fund/dif-calculator.html

notwithstanding its theoretical and practical importance. This topic is highly relevant because of its implications in terms of financial stability, and it is particularly interesting in the U.S. banking industry, considering the important postcrisis regulatory reforms that aimed to combat window dressing. In addition, we add to the extant literature by empirically testing whether the computation of the leverage Tier 1 ratio on a daily basis in the U.S. context has been effective in reducing U.S. BHCs' downward window dressing behaviour in the repo market. Although prior studies contend that the enforcement of this regulation has reduced incentives for U.S. banks to engage in window dressing (Munyan, 2017), there is no strong empirical support for this hypothesis in the literature. Moreover, we are the first to uncover additional incentives for U.S. BHCs to engage in downward window dressing by means of repos, namely, to manipulate the assessment base for the deposit insurance premium. While before the GFC, the deposit insurance premium was computed as a percentage of domestic retail deposits (Whalen, 2011) after the GFC, the FDIC has required BHCs to compute the deposit insurance premium as a percentage of all tangible liabilities less capital, including wholesale funding, and consequently repos, based on quarter-end figures (Kreicher et al., 2013). In this context, BHCs may be incentivized to window dress their deposit insurance assessment base by reducing their repo activities at quarter-end to pay a lower deposit insurance premium. We contribute to the literature by uncovering an unexplored channel that incentivizes U.S. BHCs to engage in window dressing to pay lower deposit insurance premiums This specific incentive has been largely overlooked by the extant literature and by postcrisis regulatory reforms, although it undermines the effectiveness of the deposit insurance scheme in the U.S. banking system. Hence, we contribute to the strand of literature that analyzes the relationship between repo markets and financial stability.

The remainder of the paper is organized as follows: Section 2 reviews the relevant academic literature and develops testable research hypotheses. Section 3 discusses the methodology and data set. Section 4 presents our results along with the robustness checks and finally, Section 5 concludes.

2 | LITERATURE REVIEW AND HYPOTHESES TESTING

The literature on window dressing in the financial industry is scant, mainly because of the difficulties to find suitable contexts and appropriate data to analyze this peculiar problem. Nevertheless, the contributions in this field have been valuable to shed light on this creative accounting practice. Although there were some early seminal studies in the first half of the 20th century (Paish, 1939), the first actual attempts to investigate bank window dressing practices date back to the early 1960s. Robertson (1963, p. 1), a member of the governor of the Federal Reserve, described banks' window dressing by making an analogy with the merchant activity: 'a merchant dresses his show window to display attractively the merchandise that is for sale in the store. If the window contains Paris gowns and only inferior copies are for sale inside, in time the merchant would lose the public's confidence and its patronage'. As far as banks are concerned, this practice is particularly problematic and difficult to detect as their financial statements represent an essential source of information for investors, regulators and stakeholders.[8] Thus, it is vital to address window dressing concerns, especially when it comes

[8]Window dressing and balance sheet manipulation is also a central issue for non-bank financial institutions (Agarwal et al., 2014; Cumming & Dai, 2010; Griffiths & Winters, 2005; Lakonishok et al., 1991; Musto, 1999) and nonfinancial firms (Dechow & Shakespeare, 2009; Firth et al., 2011; Karpoff et al., 2008; Ng & Wang, 2004).

to the banking system. Similarly, another early study on commercial banks (Johnson, 1969) suggests that balance sheet manipulations may be used to achieve a number of objectives, such as inflating both bank size and liquidity position.

More recent studies have been conducted during the 1990s, especially after the Saving and Loans Crisis. By analyzing a sample of U.S. commercial banks, Allen and Saunders (1992) find a strong presence of upward window dressing on assets, identifying repos and federal funds as the primary vehicles for such purpose. The main reasons underlying this behaviour include managers' willingness to appear 'too big to fail' as well as managerial remuneration bonuses which are linked to bank size. Allen and Saunders (1992) also recognize two possible types of window dressing, that is, exogenous and endogenous. Specifically, exogenous window dressing does not depend on bank managers' behaviour, but rather it is driven by the decisions of customers, depositors or other market participants. On the contrary, endogenous window dressing is related to the strategic manipulations of accounting measures by bank management. In this context, Allen and Saunders (1992) identify a possible agency problem (Jensen & Meckling, 1976; Fama, 1980) related to the benefits that shareholders could receive from a particular window dressing behaviour, which are not aligned with those of managers. Shareholders benefit from downward window dressing because of lower taxes and lower deposit insurance premiums and to avoid possible sanctions for not being compliant with capital requirements. In contrast, managers are better off from upward window dressing to increase their remuneration bonuses linked to bank size. At the beginning of the 1990s, Bhana (1994) already considered a 'widely held belief' that institutional investors window dress their balance sheet before the release of quarterly and annual financial reports. By analyzing the patterns of the trading activity of stock exchange markets, this author provides evidence that reporting requirements significantly affect the investment decisions of institutional investors, supporting the idea of window dressing behaviour. Furfine (2004) finds that even interbank markets are affected by window dressing issues. Specifically, his analysis provides evidence that risk premiums on overnight interbank loans drastically increase at the end of the year, as banks are willing to hold safer interbank loan portfolios on the dates when information about these portfolios is disclosed to the public. Kotomin and Winters (2006) argue that upward window dressing on assets seems to be exogenous rather than endogenous. They find balance sheet item movements around the quarter-end to be consistent with customer manoeuvres to meet their quarter-end obligations, rather than to the volatility of federal funds and repos. This finding suggests that banks and markets react to depositors' requests for liquidity and cash.

The literature provides evidence that window dressing has also been employed by nonbanking financial institutions for various reasons. Lakonishok et al. (1991) show that pension fund managers tend to oversell poorly performing stocks, especially in the fourth quarter of the year, when these funds are closely monitored by their sponsors. This finding supports the idea that pension funds engage in window dressing to impress sponsors due to costly monitoring of portfolio decisions. Along the same lines, Ling and Arias (2013) provide a theoretical model to examine agency problems in the mutual fund sector, where fund managers window dress their portfolios to attract investors' funds. In this context, managers are incentivized to window dress to improve investors' perceptions of their managerial skills. This model posits that an equilibrium where managers never engage in window dressing does not even exist. Morey and O'Neal (2006) study portfolio credit quality and return patterns in a sample of bond mutual funds, and document that bond funds tend

to hold more government bonds around disclosure dates compared to nondisclosure dates, to present a safer portfolio to potential investors and shareholders.

The GFC represents another turning point for the strand of literature on bank window dressing behaviour. Huizinga and Laeven (2012) show that U.S. banks misrepresented the balance sheet value of both their regulatory capital and distressed assets during the mortgage crisis in 2008. In particular, their findings suggest that larger banks engaged more in balance sheet manipulation. Moreover, troubled banks misclassified their asset-backed securities with the aim of inflating their assets. Their findings uncover evidence that banks engage in financial statement manipulation to give a distorted representation of their real financial position. Vasileiou (2015) focuses on the window dressing practices of Greek financial institutions, which have been notably affected by the financial crisis. His findings provide evidence of an upward deposit window dressing in the Greek deposit market, which is achieved because banks tend to increase their offered rates at the quarter-end, and consequently, they attract more deposits. Owens and Wu (2015) analyze the presence of window dressing on short-term borrowing funding, such as repos and federal funds, using a sample of U.S. bank holding companies prior and during the last financial crisis. They document strong evidence of downward window dressing on short-term liabilities due to (i) highly leveraged banks showing higher downward window dressing, and (ii) banks with a lower level of capital requirement engaged markedly in downward manipulation of short-term borrowing. Furthermore, Owens and Wu (2015) show that downward manipulation is more evident when CEO remuneration and bonuses are linked to profitability measures. Similar to Allen and Saunders (1992), they find that the stock market negatively reacts to the release of regulatory filing. The relevance of repo markets for window dressing purposes is also noted by Grill et al. (2017) that provides evidence of a decline in repo market activity at the quarter-end, which could be explained by banks attempting to improve their leverage ratio figure at reporting dates. Behn et al. (2018) studied window dressing behaviour of European G-SIBs and find that G-SIBs engaged more than other banks in window dressing behaviour, suggesting that size is an important variable to be taken into account when analyzing manipulation of bank balance sheets. Similarly, Behn et al. (2019)—by conducting another study on G-SIB window dressing practices—find that one of the main incentives to engage in window dressing is the willingness to reduce G-SIB buffer additional capital surcharges. Furthermore, banks tend to reduce activities at year-end to lower their G-SIB score, thus appearing less systemically important than they actually are. This effect is stronger for financial institutions with a large amount of repos, as they can be easily reduced on reporting days. These practices reduce the effectiveness of the regulatory requirements for G-SIBs, posing a threat to financial stability at worldwide level.

More specifically, our paper is related to the strand of literature that analyzes window dressing practices in repo markets.[9] Various studies analyze the repo markets to detect possible window dressing practices (Behn et al., 2019; Kikuchi et al., 2019). Munyan (2017) analyzes the window dressing behaviour of non-U.S. banks in the U.S. repo markets and uncovers evidence of window dressing practices by these financial institutions, which temporarily removed an average of 170 billion $ from the U.S. repo markets before each quarter-end, aiming to appear more capitalized. In addition, this amount has significantly increased after the financial crisis,

[9]The literature that analyzes repo markets, without focusing specifically on window dressing, is more developed. Among others, see Fleming et al. (2010), Fuhrer et al. (2016), Mancini et al. (2016), Boissel et al. (2017) and D'Amico et al. (2018).

regardless of the postcrisis regulatory reform, because non-U.S. banks are not required to report their leverage ratio figures based on a daily average.[10] Munyan (2017, p. 46) interprets this finding arguing that 'daily averaging of capital requirements disincentivizes window dressing, which improves the effectiveness of bank regulation'—Âİ, concluding that the reporting frequency of the regulatory ratio matters as much as the required level of the ratio itself.

Similarly, Kikuchi et al. (2019) support the idea that, to avoid window dressing by banks in repo markets, supervisors should require them to report their leverage ratio figure based on daily average rather than quarter-end values. Along the same lines, Anbil and Senyuz (2018, pp.2) analyze the window dressing behaviour of non-U.S. dealers in U.S. repo markets. They document that non-U.S. dealers extensively engaged in window dressing in the repo markets both before and after the implementation of Basel III regulation in the United States. Similar results have been obtained by Egelhof et al. (2017), who provide evidence that quarter-end reporting creates incentives for non-U.S. financial institutions to 'temporarily adjust their balance sheet'—Âİ by decreasing leverage around quarter-end and increasing it on other days. This problem has been remarked even by the Bank for International Settlement (2017, p. 22), which 'observed that repo markets have recently been characterized by volatilities in prices and volumes over period-ends (quarter-ends and year-ends). This is likely to be driven by incentives that banks face to 'window-dress' their balance sheets'.

Our paper differs from the aforementioned literature in several respects. While prior studies have shown that the daily average computation of the leverage Tier 1 ratio reduces the bank's incentive to window dress the amount of repos at quarter-end, no research has quantified the effect of the reduction in window dressing behaviour owed to this computation, notwithstanding its profound policy implications. In addition, and more importantly, we investigate the persistency in window dressing behaviour by focusing on an unexplored mechanism that induces banks to engage in window dressing by means of repos, which has been overlooked by the extant literature: that is, the manipulation of the deposit insurance assessment base to pay lower deposit insurance premiums.

2.1 | Hypotheses testing

The regulatory setting can create important incentives for BHCs to engage in downward window dressing on repos, aiming to hide their lower level of capitalization in the eyes of the supervisors (Owens & Wu, 2015). Before the enforcement of the Basel III regulation in the U.S. banking sector, which has imposed banks to report their leverage ratio figures based on a daily average (Anbil & Senyuz, 2018), BHCs had an incentive to manipulate their leverage ratio level at quarter-end by means of repos to appear more capitalized (Munyan, 2017) and consequently to reduce the burden of Basel capital requirement regulations. Repo markets offer various opportunities to avoid capital requirements. By analyzing the BHCs in the U.S. financial sector, Allahrakha et al. (2018) demonstrate that the U.S. implementation of the leverage ratio requirement of the Basel Capital Accord has induced BHCs to change their behaviour in the repo market to avoid the constraints of capital requirement. Banks were incentivized to obfuscate their actual level of capitalization to avoid capital requirement regulation, by window

[10]As an additional robustness test, we checked that the exclusion of non-U.S. dealers (four in our sample) does not significantly affect the probability of engaging in window dressing. We do not report the results for the sake of brevity. They are available from the authors upon request.

dressing their leverage ratio figure at quarter-end, given that they had to report the quarter-end figure to the supervisors. Rather than reducing their risk exposure or increasing their capitalization to comply with capital adequacy requirements, BHCs could engage in downward window dressing by decreasing their reported level of short-term liabilities and, consequently, increasing their reported level of capital. In doing so, BHCs could avoid the restrictions of the capital requirement regulation, jeopardizing the effectiveness of the whole regulatory framework and negatively affecting financial stability. This incentive to window dress the leverage ratio figure was higher for less capitalized banks because their benefit from this manipulation was higher compared to more capitalized banks. To solve this problem, after the enforcement of Basel III regulation in 2013, U.S. banks were required to report to the supervisors their leverage ratio figure based on a daily average, rather than quarter-end figures (Anbil & Senyuz, 2018; Behn et al., 2018). There is a wide consensus in the literature that this change in the computation of the leverage ratio for supervisory purposes substantially reduced the incentives for U.S. banks to window dress their leverage ratio figure by reducing their repo positions at quarter-end (Anbil & Senyuz, 2018; Munyan, 2017), although empirical analyses on this aspect are particularly rare. Based on these considerations, we expect to observe a downward window dressing behaviour for U.S. BHCs in the repo market, especially for less capitalized institutions, before the enforcement of the Basel III regulation in 2013. In contrast, after 2013, our expectation is that this window dressing behaviour should have disappeared because of the new computation method of the leverage ratio. Hence, we develop our first and second research hypotheses as follows:

H1: *Before the enforcement of the Basel III regulation in 2013, the level of leverage Tier 1 of U.S. BHCs is associated with downward window dressing on repos.*

H2: *After the enforcement of the Basel III regulation in 2013, the level of capitalization of U.S. BHCs is not associated with the extent of downward window dressing on repos.*

Although U.S. BHCs should have fewer incentives to downward window dress the amount of repos following the strict application of Basel III, Figure 1 shows substantial quarter-end deviations in the amounts of repos over 2011Q2–2016Q1 (i.e., downward window dressing behaviour) both before and after the requirement of the computation of the Tier 1 leverage ratio based on daily averages. Here, we put forward a further hypothesis that the persistency of window dressing behaviour is driven by another U.S. regulation that has created a different incentive to engage in window dressing by means of repos. Specifically, the FDIC postcrisis regulatory reform has changed the definition of banks' deposit insurance assessment base. While before the GFC, the deposit insurance premium was computed only as a percentage of domestic retail deposits (Whalen, 2011), after the GFC, the FDIC has required to compute the deposit insurance premium as a percentage of all tangible liabilities less capital, including wholesale funding, and consequently repos, based on quarter-end figures (Kreicher et al., 2013). In this context, U.S. BHCs may be incentivized to window dress their deposit insurance assessment base by reducing their repo activities at quarter-end, to pay a lower deposit insurance premium. In particular, although U.S. BHCs do not have any incentive to engage in window dressing on repos to manipulate their leverage ratio figure in the eyes of their supervisors (Munyan, 2017), we argue that the FDIC regulation offers another important incentive for BHCs to engage in window dressing on repos, as these institutions can lower their deposit insurance premium by closing their repo positions at quarter-ends to reduce their insurance assessment base. This incentive will be higher for those institutions that rely more on

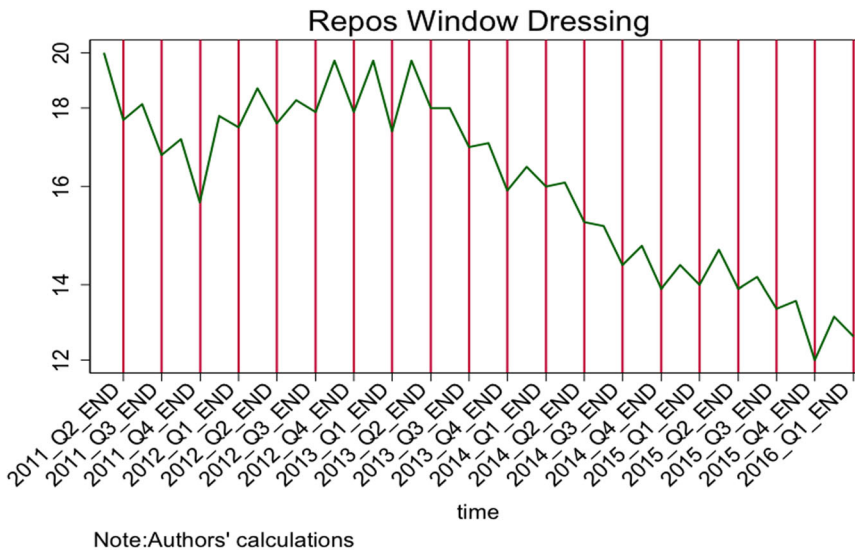

FIGURE 1 Window dressing behaviour on repurchase agreements over the period 2011Q2–2016Q1. Red vertical lines indicate the quarter-end reporting period. The vertical axis reports the amount of repos (in billion $).

wholesale funding and less on traditional deposits because the change in the FDIC assessment base has made wholesale funding significantly more costly in terms of deposit insurance premiums. For instance, the assessment base of State Street Corporation, Citigroup and JP Morgan Chase, after the GFC, increased by 576.2%, 291% and 166.5%, respectively. Given that the FDIC assessment base for the deposit insurance premium is computed on a quarterly basis (Whalen, 2011), BHCs are incentivized to operate in the repo market to manipulate their amount of wholesale funding at quarter-end. Thus, we develop our third research hypothesis as follows:

H3: *The extent of downward window dressing is related to the amount of deposits of U.S. BHCs.*

3 | METHODOLOGY AND DATA

3.1 | Measuring bank window dressing

Following Owens and Wu (2015), our measure of window dressing is based on the same rationale as the FDIC. In particular, in the evaluation phase of Call Reports (Y-9C Schedule HC-K), the FDIC compares the average of the current and prior quarter-end values of a variable to the average value of the variable measured throughout the quarter. Our repo window dressing measure is calculated as follows:

$$WD_{i,q} = \frac{\left[\left(\frac{FFR_{i,q.end} + FFR_{i,q-1.end}}{2}\right) - FFR_{i,q.avg}\right]}{TA_{i,q.avg}}, \tag{1}$$

where is window dressing on federal funds and repos for bank i in quarter q.[11] $FFR_{i,q.end}$ is the amount of repos and federal funds liabilities for bank i at quarter-end, while $FFR_{i,q-1}$ is the value of federal funds and repos liabilities of bank i at quarter-end $q-1$. $FFR_{i,q.avg}$ refers to the quarter average of repos and federal funds liabilities for bank i in quarter t, and $TA_{i,q.avg}$ is the quarterly average of bank total assets. Negative values of WD indicate downward window dressing (i.e., the quarter-end amounts of repos and federal funds are higher than the quarter average amounts), while positive values of WD indicate upward window dressing (i.e., the quarter-end amounts of repos and federal funds are lower than the quarter average amounts).

3.2 | Empirical models

We employ panel fixed effect regressions to investigate our research hypotheses: (i) BHC window dressing on repos before and after the implementation of the daily average computation of the leverage ratio and (ii) BHC window dressing on repos to reduce bank insurance assessment. The empirical model is specified as follows:

$$\begin{aligned} WD_{i,q} = \alpha_i + \beta_1 LEVTIER1_{i,q-1} + \beta_2 DAILYREG_q + \beta_3 DAILYREG_q{*}LEVTIER1_{i,q-1} \\ + \beta_4 DEPOSITS_{i,q-1} + \tau X_{i,q-1} + \gamma Z_q + \epsilon_{i,q}, \end{aligned} \tag{2}$$

where i and q refer to bank and quarter, respectively. WD is our measure of window dressing as defined in Section 3.1. LEVTIER1 is the reported level of leverage Tier 1 ratio. DAILYREG is a dummy variable that takes the value 1 after the implementation of the daily average computation of the leverage Tier 1 ratio, 0 before the implementation. In Equation (2), β_1 captures the relationship between LEVTIER1 and window dressing on repos when DAILYREG is equal to 0, that is, before the application of the daily computation of the leverage Tier 1 ratio. β_3 indicates the relationship between LEVTIER1 and WD after the regulation on the daily computation of the leverage Tier 1 ratio. DEPOSITS is the deposit-to-total asset ratio. To control for possible heterogeneity among banks, we specify a vector X that includes bank control variables, thus taking into account specific factors that might potentially affect the extent of window dressing. Specifically, we include the natural logarithm of bank total asset (SIZE), the ratio of trading assets-to-total assets (TRADING), the return on equity (ROE) and the ratio of loan loss reserves-to-total asset (LLRES). All bank-specific variables are lagged by one quarter to avoid issues related to the simultaneity of bank balance sheet variables as well as reverse causality. Vector Z includes some country-level characteristics to control for macro-economic factors (GDPGROWTH and VIX) that might affect the probability of window dressing on repos. α_i is a vector of time-invariant bank fixed effects that we use to control for unobservable characteristics that can affect bank window dressing and, more broadly, are employed to control for the omitted variable bias. In an alternative specification, we tighten the econometric identification of Equation (2) by including quarter fixed effects (φ_t) which absorb the dummy DAILYREG but not its interaction with the leverage Tier 1 ratio. This allows us to control for time-variant shocks

[11]Although Schedule HC-K combines repos and federal funds liabilities into one item, quarter-end balances show that repos comprise the large majority (Owens & Wu, 2015). For these reasons, we refer to repos throughout the text.

over the sample period that may affect bank window dressing behaviour. $\epsilon_{i,q}$ is the error term. All regressions include robust standard errors clustered at the bank level.[12]

3.3 | Data

Our sample consists of 70 U.S. BHCs whose total assets are above 10 billion $. We selected this sample because U.S. BHCs are particularly involved in short-term and overnight transactions through repos (Hördahl & King, 2008). Given that these instruments are highly liquid and characterized by low transaction costs, they are among the easiest and least expensive ways for BCHs to manipulate their balance sheets. The time horizon of our analysis runs from the second quarter of 2011 to the first quarter of 2016. We choose this time horizon to study the effects of the enforcement of Basel III regulation before and after its implementation in 2013. Our sample includes both large and complex institutions as defined by the FDIC.[13] Although the computation of the deposit insurance assessment base is different depending on whether a bank is defined as 'large' or 'complex' the difference is negligible. Among the few differences, highly complex institutions consider the exposures towards the largest 20 counterparties, whereas large institutions are subject to a measure of growth-adjusted portfolio concentration.

We hand-collected the BHCs data from the FR Y-9C report, available at the Federal Reserve Holding Company data system website.[14] U.S. BHCs with total consolidated assets above 10 billion $ are required to prepare the FR Y-9C report on the last calendar day of each quarter. The FR Y-9C report provides detailed information on BHC regulatory capital and financial statements. More specifically, this report provides information on quarterly average amounts for selected financial statement items. Hence, it allows us to identify quarter-end deviations from quarterly averages by comparing the quarterly average values with those at the quarter-end. BHCs are required to provide information on their quarterly average amounts of three types of liability items: (i) deposits, (ii) repos and federal funds purchased and (iii) other borrowed money. Data on assets, deposits, short-term funding, leverage Tier 1 and trading assets are collected from the FR Y-9C report, whereas we use the SNL financial database (S&P Global) for the other aforementioned bank-specific variables. We collect macroeconomic variables from the International Monetary Fund.

Table 1 provides definitions and sources of the variables, whereas Table 2 presents the descriptive statistics. Panel (a) of Table 2 shows that the mean of our dependent variable (WD) is negative, indicating that, on average BHCs engage in downward window dressing on repos. In addition, the value of the 1% percentile of the distribution of the window dressing measure (WD) shows that the downward quarter-end deviations are particularly significant from an economic standpoint, given that some banks deviate from the within-quarter average level by more than 4% of their total assets.

This is also confirmed in Figure 1. In particular, Figure 1 shows a quarter-by-quarter window dressing on repos (the difference between the peaks of the figure and the amount at quarter-end represents downward window dressing). As illustrated, BHCs report, on average, lower amounts of repos at the quarter-end compared to the amount registered during the quarter. Thus, from a visual

[12]Table A1 reports a correlation matrix among the variables used in our econometric specification which suggests that the control variables employed are not highly correlated.

[13]For a detailed definition of large and complex institutions as defined by the FDIC, refer to https://www.fdic.gov/resources/deposit-insurance/deposit-insurance-fund/dif-calculator.html.

[14]https://www.ffiec.gov/nicpubweb/nicweb/HCSGreaterThan10B.aspx

TABLE 1 Variables and definitions.

This table reports the list of the variables and their definitions.

	Definition	Source
WD variables		
FFR.QAVG	Quarterly averaged federal funds purchased and the security sold under agreements to repurchase for bank *i*, in quarter *t*	Hand-collected data (Schedule HC-K Quarterly Average)
FFR.QEND	Quarter-end federal funds and repurchase agreements for bank *i*, in quarter *t*	Hand-collected data (Schedule HC- Consolidated Balance Sheet)
FFR.QEND_$t-1$	Quarter-end federal funds and repurchase agreement for bank *i*, in quarter $t-1$	Hand-collected data (Schedule HC- Consolidated Balance Sheet)
Dependent variables		
WD	Extent of window dressing computed as Equation (1)	Authors' calculation on hand-collected data
WDrepos	Binary variable that takes value 1 if WD is negative and 0 otherwise	Authors' calculation on hand-collected data
Bank controls		
LEVTIER1	Quarterly leverage Tier 1 ratio for bank *i*, in quarter *t*	Hand-collected data (Schedule HC-R part 1)
ΔLEVTIER1	Quarterly change in leverage Tier 1 ratio for bank *i*, in quarter *t*	Author's calculation on data (Schedule HC-R part 1)
DEPOSITS	Quarterly deposits-to-total assets ratio for bank *i*, in quarter *t*	Hand-collected data (Schedule HC-Consolidated Balance Sheet)
SIZE	Natural logarithm of bank total assets for bank *i*, in quarter *t*	Hand-collected data (Schedule HC-Consolidated Balance Sheet)
TRADING	Quarterly trading assets-to-total asset ratio for bank *i*, in quarter *t*	Hand-collected data (Schedule HC-Consolidated Balance Sheet)
ROE	Quarterly net income-to-total shareholders' equity ratio for bank *i*, in quarter *t*	SNL Financial
LLRES	Quarterly loan loss reserves-to-total asset ratio for bank *i*, in quarter *t*	SNL Financial
Country controls		
VIX	Quarterly VIX-CBOE volatility index. Obtained using the mean of daily observations over the quarter	IMF database
GDPGROWTH	Quarterly GDP economic growth in the United States.	IMF database

TABLE 2 Summary descriptive statistics.

This table reports the descriptive statistics of the variables used in the empirical model. WD is the repo window dressing as computed in Equation (1). WDrepos is a binary variable that takes a value of 1 if WD is negative and 0 otherwise. LEVTIER1 is the quarterly average Tier 1 ratio. ΔLEVTIER1 is the quarterly change in leverage Tier 1 ratio. DEPOSITS is the ratio of quarterly deposits to total assets. SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is ratio of quarterly loan loss reserves to total assets. VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product.

Variable	Obs	Mean	SD	1st	99th
(a) Dependent variables and WD measures					
WD (%)	1400	−0.134	0.697	−4.091	1.465
WDrepos	1400	0.508	0.501	0	1
(b) Bank-specific variables					
LEVTIER1 (%)	1400	9.604	2.155	2.010	16.865
ΔLEVTIER1 (%)	1400	3.452	2.361	−0.715	10.555
DEPOSITS (%)	1400	52.219	21.167	7.314	80.149
SIZE (log)	1400	7.662	0.649	6.800	9.370
TRADING (%)	1400	2.552	6.582	0.000	37.110
ROE (%)	1400	7.639	8.887	−11.820	23.120
LLRES (%)	1400	1.635	0.748	0.360	4.210
(c) Country-specific variables					
VIX	1400	17.468	4.792	12.739	30.583
GDPGROWTH (%)	1400	0.525	0.374	−0.200	1.100

inspection, it emerges a downward window dressing behaviour by U.S. BHCs. Panels (b) and (v) of Table 2 report summary statistics on bank and country-level characteristics, respectively.

Panel (b) of Table 2 presents summary statistics of bank balance sheet data. We employ the quarterly leverage Tier 1 ratio (LEVTIER1) as one of the main variables of interest. Our hypothesis is that banks are incentivized to manipulate their reported level of capital position to lessen the burden of capital requirement regulations. We argue that banks with a lower level of leverage Tier 1 ratio engage markedly in downward window dressing behaviour through repos (WD) before the enforcement of Basel III regulation in 2013, while we expect no statistically significant association after 2013. We also expect that, throughout the sample period, banks with a lower amount of deposit-to-total assets (DEPOSITS) to window dress repos at the quarter-end reporting period to reduce the deposit insurance premium.

We include a comprehensive set of bank-specific and country-level control variables. Although we expect these control variables not to be significantly associated with the extent of window dressing, they might potentially influence bank window dressing behaviour. We include bank size (SIZE), which might be associated with window dressing behaviour because larger BHCs may have better access to money markets such as repos markets. In the European context, (Behn et al., 2018, 2019) show that size can potentially be considered a determinant of bank window dressing behaviour.

Following Owens and Wu (2015), we employ the quarterly trading portfolio revenues-to-total assets (TRADING). A positive relationship might be plausible for this variable and the extent of window dressing because BHCs strongly engaging in trading activities may have better access to money markets and repo markets. We control for BHCs profitability (ROE) as banks' incentives to misreport accounting data at the quarter-end might be stronger when profits are low. Similarly to Huizinga and Laeven (2012), we use the ratio of loan loss reserves-to-total assets (LLRES). On the one hand, BHCs with large loan losses may have limited access to repo markets (Alfonso et al., 2011). On the other hand, banks with deteriorated asset quality may face profitability pressure. This might motivate BHCs to engage in window dressing practices.

Panel (c) of Table 2 presents summary statistics of the country-specific variables. We include the quarterly growth rate of Gross Domestic Product (GDPGROWTH) and the quarterly CBOE volatility index (VIX) to control the macroeconomic environment. Lower GDP growth and higher market volatility may encourage banks to engage in window dressing behaviour. While these control variables might influence bank window dressing behaviour, we expect that these variables do not have any statistically significant association with the extent of window dressing, given that our expectation is that the two most important mechanisms that induce U.S. BHCs to window dress are: (i) the manipulation of the leverage Tier 1 ratio figure before 2013, as already contended by previous studies (Anbil & Senyuz, 2018; Munyan, 2017); and (ii) the new mechanism we identify of the manipulation of the FDIC assessment base to pay a lower deposit insurance premium.

4 | EMPIRICAL RESULTS

4.1 | Window dressing of the leverage Tier 1 ratio before and after Basel III regulation

Our baseline results from estimating Equation (2) are presented in Table 3. In column (1), we regress the window dressing measure (WD) on the lagged value of the Tier 1 leverage ratio (L.LEVTIER1), on the indicator variable that identifies the quarters after the enforcement of the Basel III regulation (DAILYREG), and on their interaction (DAILYREG∗L.LEVTIER1). In column (2), we add quarter fixed effects to the baseline regression. In column (3), we add a comprehensive set of control variables, and in column (4) we add quarter fixed effects to the regression that includes the control variables. By introducing the interaction term, the coefficient of the variable L.LEVTIER1 captures the association between the extent of window dressing and the Tier 1 leverage ratio, when the indicator variable DAILYREG is equal to zero, that is, before the enforcement of the Basel III regulation and of the computation of the leverage Tier 1 ratio based on daily averages. In contrast, the coefficient of the interaction dummy (DAILYREG∗L.LEVTIER1) captures the association between the Tier 1 leverage ratio and the extent of window dressing after the enforcement of the Basel III regulation.

The results in Table 3 show that the coefficients of the variable L.LEVTIER1 are positive and statistically significant at the 10% level in all specifications. Hence, it implies that before the implementation of Basel III regulation in the United States. and the computation of the leverage Tier 1 ratio based on daily averages, BHCs with lower levels of leverage Tier 1 ratio engage more heavily in downward window dressing by means of repos, to appear more capitalized than they actually are, consistently with our first research hypothesis. This relationship is better displayed when we plot the fitted values of the conditional relationship of our measure of window dressing at different levels of leverage Tier 1 ratio (Figure 2).

TABLE 3 Baseline results.

This table reports the baseline results of the empirical model. WD is the repo window dressing as computed in Equation (1). LEVTIER1 is the quarterly average Tier 1 ratio. DAILYREG is a dummy variable that takes the value 1 after the implementation of the daily average computation of the leverage Tier 1 ratio (in 2013) and 0 before the implementation. DEPOSITS is the ratio of quarterly deposits to total assets. SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is ratio of quarterly loan loss reserves to total assets. VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)	(3)	(4)
	WD	WD	WD	WD
L.LEVTIER1	0.0860*	0.0780*	0.0844*	0.0660*
	(0.0451)	(0.0424)	(0.0443)	(0.0374)
DAILYREG	0.1764		0.2604	
	(0.3144)		(0.3318)	
L.LEVTIER1∗DAILYREG	−0.0254	−0.0312	−0.0290	−0.0256
	(0.0246)	(0.0247)	(0.0283)	(0.0277)
L.DEPOSITS			0.0131***	0.0158***
			(0.0045)	(0.0062)
L.SIZE			0.1296	−0.5186
			(0.5424)	(0.5544)
L.ROE			0.0028	0.0033
			(0.0029)	(0.0030)
L.TRADING			−0.1066	−0.0855
			(0.0970)	(0.0846)
L.LLRES			−0.0048	−0.0898
			(0.0669)	(0.1048)
VIX			0.0090	−0.0073
			(0.0085)	(0.0220)
GDPGROWTH			0.0456	−0.0527
			(0.0662)	(0.1569)
Observations	980	980	980	980
N.Banks	70	70	70	70
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	No	Yes
Cluster	Bank	Bank	Bank	Bank

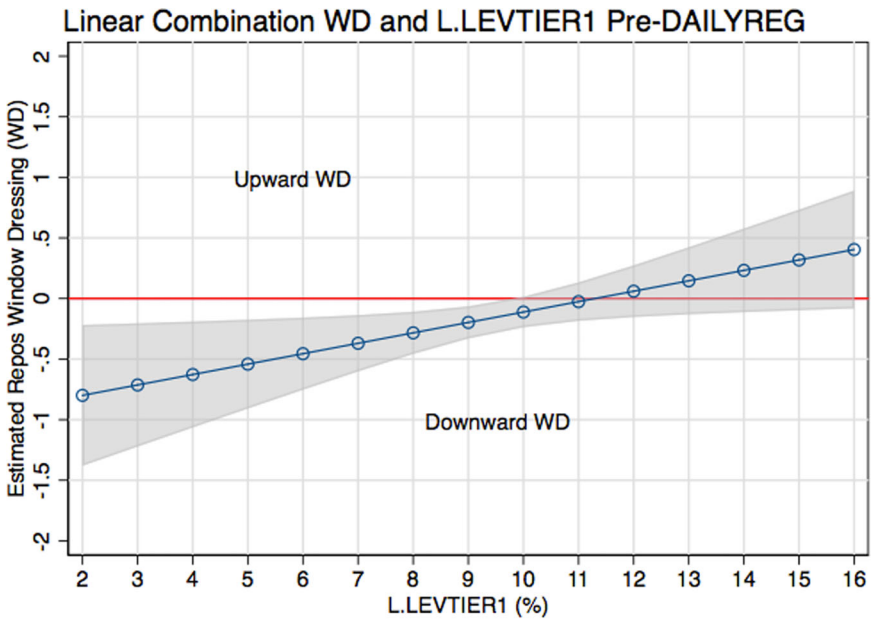

FIGURE 2 Relationship between window dressing and leverage Tier 1 ratio before Basel III. This figure illustrates the linear combination of the fitted values of the window dressing measure (WD) and the lagged leverage Tier 1 ratio (L.LEVTIER1). Values below zero of the dependent variable indicate downward window dressing. Values above zero indicate upward window dressing. Confidence interval at the 90% level in grey.

Specifically, it shows that for values of the leverage Tier 1 ratio below 11%, banks start progressively to engage in downward window dressing behaviour.[15] This result is also economically meaningful. For instance, we find that for values of L.LEVTIER1 equal to 5% (i.e., the regulatory threshold), banks reduce their repo amounts, on average, by 0.5% of their total assets in comparison to the amount reported during the quarter.

As for the interaction terms, the coefficients are statistically insignificant in all regressions. Hence, it emerges that the negative association between the leverage Tier 1 ratio and the extent of window dressing has disappeared after the implementation of the Basel III regulation in 2013 because the incentive of manipulating the level of capitalization has disappeared after the requirement for the United States. BHCs to report to the supervisor the daily average of the leverage Tier 1 ratio, rather than the quarter-end figure. These results are in line with hypothesis 2.

Finally, another interesting result emerges from Table 3. The coefficients associated with the DAILYREG are far from being statistically significant. Thus, regardless of the elimination of the incentive to manipulate the leverage Tier 1 ratio after 2013, the dynamics of the repo quarter-end deviations by BHCs have not changed. In the next section, we put forward an explanation of the reasons why U.S. BHCs still engage in window dressing by means of repos.

[15]At first glance, 11% of leverage Tier 1 may be considered high to motivate banks to engage in downward window dressing behaviour in repos. However, we clarify that, at 11% of L.LEVTIER1, downward window dressing is basically zero, whereas it becomes more evident as leverage Tier 1 tend to get closer to the regulatory threshold.

4.2 | Window dressing of the FDIC deposit insurance assessment base

Columns 3 and 4 of Table 3 show the results of the baseline model in which we introduced a set of explanatory variables aiming to check whether any of these variables are significantly associated with the window dressing measure. First, we find that the variable L.LEVTIER1 is still statistically significant in the augmented model, while the dummy variable DAILYREG and the interaction DAILYREG*L.LEVTIER1 are not, support the robustness of our baseline model to the inclusion of additional control variables. Second, we do not find any noteworthy relationship between window dressing and bank-specific characteristics, as they are not statistically different from zero. The only exception is represented by the lag of deposit-to-total asset ratio (L.DEPOSITS), which is positive and statistically significant at the 1% level in columns (3) and (4). This indicates that the lower the level of deposit-to-total assets, the lower is our measure of window dressing, that is, the greater is bank's downward window dressing behaviour. Again, to better identify this relationship, we plot the fitted values of the conditional relationship of WD at different levels of deposit-to-total assets. Figure 3 displays that for values of the L.DEPOSITS below 65%, banks start progressively to engage in downward window dressing behaviour. In addition, for low values of L.DEPOSITS, downward window dressing behaviour is also economically meaningful. Specifically, banks with a deposit-to-total asset ratio equal to 25% (i.e., wholesale-based) reduce their repo amounts, on average, by 0.5% of their total assets in comparison to the amount reported during the quarter.

This finding can be interpreted in light of the fact that the after-crisis FDIC deposit insurance premium assessment base is computed as a percentage of all tangible liabilities less capital, that is, including wholesale funding and, consequently, repos (Kreicher et al., 2013). This motivates BHCs that rely more on wholesale funding (and less on deposits) to engage in window dressing through repos to manipulate their FDIC assessment base and pay lower deposit insurance premiums. Hence, this result supports our third research hypothesis. This finding allows us to detect an important and previously unexplored channel that induces U.S. BHCs to engage in window dressing behaviour by means of repos.

4.3 | Additional evidence on the link between window dressing and deposit insurance premium: A difference-in-differences approach

To provide more robust evidence that the deposit insurance premium is the main cause of the persistency of window dressing behaviour, we perform a difference-in-differences analysis in which we analyse the effects of a change in the deposit insurance premium.[16] Specifically, in July 2016, the FDIC imposed on all banks whose total consolidated assets are above 10 billion $ an additional quarterly surcharge equal to an annual rate of 4.5

[16]For this exercise, we manually collected additional data extending the time period from 2016-Q1 to 2021-Q1. We are particularly thankful to an anonymous referee for suggesting this additional check.

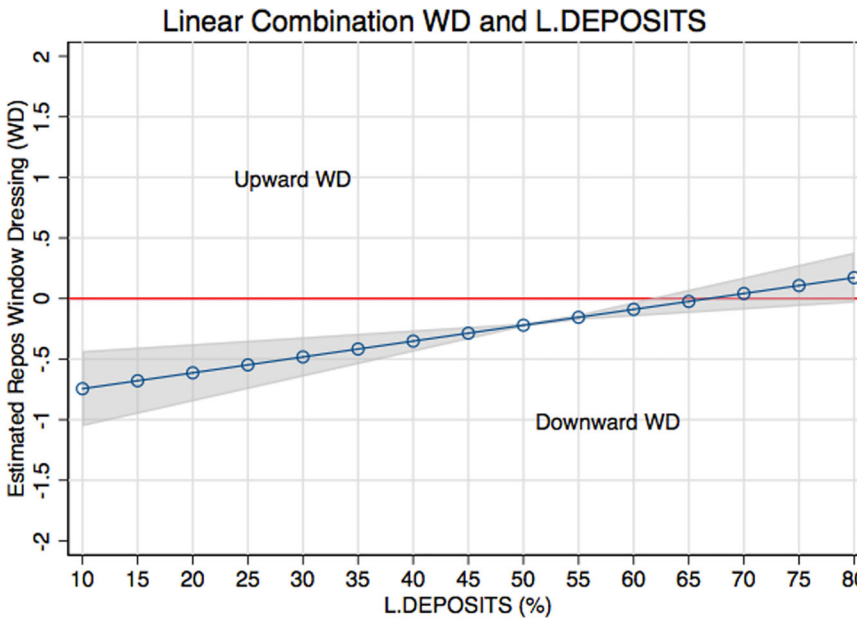

FIGURE 3 Relationship between window dressing and deposits-to-total assets ratio over the sample. This figure illustrates the linear combination of the fitted values of the window dressing measure (WD) and the lagged deposits-to-total assets ratio (L.DEPOSITS). Values below zero of the dependent variable indicate downward window dressing. Values above zero indicate upward window dressing. Confidence interval at the 90% level in grey.

basis points.[17] We expect that BHCs that before the change in regulation had a relatively higher level of repos-to-total assets, engage more in downward window dressing to manipulate their deposit insurance assessment base to pay lower deposit insurance premiums. In this difference-in-differences model, we regress our window dressing measure on an indicator variable that is the result of the interaction between the *Post* dummy equal to one after the second quarter of 2016 and zero otherwise and a *Treated* dummy equal to one for those banks that have a ratio of repo-to-total assets before the introduction of the regulation (2015-Q4) above the third quartile of the distribution.[18] We also included all control variables already used in the baseline model, quarter and bank fixed effects. In this econometric identification strategy, our treatment group consists of those banks that have a relatively higher repo-to-total asset ratio and therefore are in a better position to use repos to engage in downward window dressing, whereas the control group are the remaining banks that are less prone or capable to engage in downward window dressing as they hold fewer repos. The results reported in Table 4 show that the interaction dummy is negative and statistically significant (at the 1% level) with the window dressing measures in both columns (1) and (2) (i.e., excluding and including macroeconomic-specific characteristics and quarter fixed

[17]For additional information on the FDIC regulation refer to the following link: https://www.fdic.gov/news/financial-institution-letters/2016/fil16058.pdf.

[18]Taking the amount of repo-to-total assets before the introduction of the FDIC regulation avoids variations in the amount of repos during the treatment period, that is, the possibility that some banks may switch between the control and the treatment group.

TABLE 4 Additional analysis: Difference-in-differences.

This table reports the results of the difference-in-differences analysis. WD is the repo window dressing as computed in Equation (1). POST is a dummy variable equal to 1 after the second quarter of 2016, 0 otherwise. TREATED is a dummy variable equal to 1 for banks with an above third quartile of the repo-to-total asset ratio, 0 otherwise. LEVTIER1 is the quarterly average Tier 1 ratio. DEPOSITS is the ratio of quarterly deposits to total assets. SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is the ratio of quarterly loan loss reserves to total assets. VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)
Variables	**WD**	**WD**
POST*TREATED	−0.5937***	−0.5895***
	(0.1613)	(0.1617)
L.LEVTIER1	0.0055	−0.0008
	(0.0334)	(0.0338)
L.SIZE	−0.0239	−0.0284
	(0.0401)	(0.0403)
L.ROE	0.0099*	0.0106**
	(0.0051)	(0.0052)
L.TRADING	0.1629***	0.1643***
	(0.0333)	(0.0341)
L.LLRES	−0.3178***	−0.3057**
	(0.1131)	(0.1195)
VIX		0.0610
		(0.4217)
GDPGROWTH		−0.0352
		(0.2996)
Observations	2315	2315
R^2	0.0186	0.0289
Number of id	70	70
Bank FE	Yes	Yes
Quarter FE	Yes	Yes
Cluster	Bank	Bank

effects). This finding provides evidence that those BHCs that were in the position to manipulate their deposit insurance assessment base by means of repos engaged more in downward window dressing, aiming to reduce their deposit insurance premium. Hence, these results confirm that the deposit insurance premium is an important channel that induces large BHCs to engage in downward window dressing.

5 | ROBUSTNESS TESTS

We carry out a battery of robustness tests to confirm the results of our baseline model. We employ two alternative econometric methodologies, that is, logit and quantile regressions. In running the logit regression, our dependent variable is an indicator variable equal to 1 for those banks that engage in downward window dressing by means of repos and 0 otherwise. The logit regression allows us to test whether the probability of engaging in window dressing is associated with our variables of interest. Although the panel fixed effect regression estimates the extent of window dressing, we measure the impact of the aforementioned regulations on the probability of engaging in window dressing by running logit regression. In addition, this econometric methodology allows us to consider downward and upward window dressing separately (Owens & Wu, 2015). The results reported in Table 5 are organized in four columns: columns (1) and (3) show the results of the logit regression excluding and including quarter fixed effects, respectively, while columns (2) and (4) show the marginal effects. It shows that the variables L.LEVTIER1 and L.DEPOSITS are statistically significant at 1% and 10% levels, respectively. Ceteris paribus, a 1% decrease in L.LEVTIER1 increases the probability of

TABLE 5 Logit regressions.

This table reports the results of the logit regressions. WDrepos is a binary variable that takes a value of 1 if WD is negative and 0 otherwise. LEVTIER1 is the quarterly average Tier 1 ratio. DAILYREG is a dummy variable that takes the value 1 after the implementation of the daily average computation of the leverage Tier 1 ratio (in 2013) and 0 before the implementation. DEPOSITS is the ratio of quarterly deposits to total assets. Bank controls: SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is ratio of quarterly loan loss reserves to total assets. Country controls: VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1) WDrepos	(2) Margins	(3) WDrepos	(4) Margins
L.LEVTIER1	−0.2458***	−0.0549***	−0.2494***	−0.0556***
	(0.0689)	(0.0150)	(0.0691)	(0.0150)
DAILYREG	0.4181	0.0934		
	(0.8757)	(0.1953)		
L.LEVTIER1∗DAILYREG	−0.0200	−0.0045	−0.0217	−0.0048
	(0.0869)	(0.0194)	(0.0872)	(0.0194)
L.DEPOSITS	−0.0115*	−0.0026*	−0.0117*	−0.0026*
	(0.0064)	(0.0014)	(0.0064)	(0.0014)
Observations	980	980	980	980
N.Banks	70	70	70	70
Quarter FE	No	No	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes

engaging in downward window dressing by about 5.50%, whereas a 10% decrease in L.DEPOSITS results in a decrease in downward window dressing by 2.60%. Hence, the probability of engaging in window dressing is significantly associated with the leverage Tier 1 ratio before the enforcement of Basel III regulation and with the deposit-to-total asset ratio throughout the time horizon, supporting the robustness of the baseline model. In addition, the negative signs of both L.LEVTIER1 and L.DEPOSITS show that U.S. BHCs engage in downward window dressing.

As a second alternative methodology, we employ quantile regressions (Koenker & Siems, 1978) for two reasons. First, it accounts for the specific shape of the WD distribution which is centred on median and mean values close to zero (Figure 4).

Second, this method augments the baseline regressions by enabling us to evaluate the impact of changes in the distribution of the covariates of interest (LEVTIER1 and DEPOSITS) on quantiles of the distribution of the dependent variable (WD). Therefore, within our empirical setting, we are able to assess how changes in the selected variables of interest influence change in the WD distribution (Baur, 2013). The results reported in Table 6 show that our variables of interest (L.LEVTIER1 and L.DEPOSITS) are not statistically significant in the 50th and 75th percentile of the distribution (columns 2 and 3). In contrast, the variables L.LEVTIER1 and L.DEPOSITS are strongly and statistically significant in the 25th percentile of the distribution (column 1), showing that the results of our baseline model are driven by the U.S. BHCs that engage more in downward window dressing (i.e., in the lowest quantiles of the conditional distribution of the dependent variable). In other words, it emerges that the BHCs that engage more in downward window dressing are exactly those for which the negative association between the extent of window dressing and our main variables of interest (L.LEVTIER1 and L.DEPOSITS) is stronger. This result confirms the robustness of our baseline model.

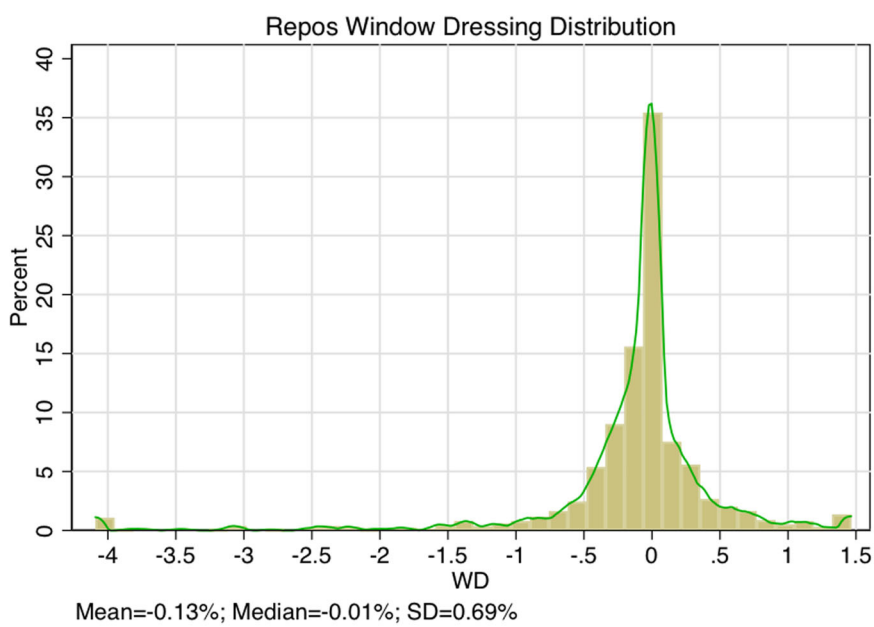

FIGURE 4 Distribution of repurchase agreements window dressing measure The chart shows the distribution of the window dressing measure (WD). Kernel density in green.

TABLE 6 Quantile regressions.

This table reports the results of the quantile regressions. WD is the repo window dressing as computed in Equation (1). LEVTIER1 is the quarterly average Tier 1 ratio. DAILYREG is a dummy variable that takes the value 1 after the implementation of the daily average computation of the leverage Tier 1 ratio (in 2013) and 0 before the implementation. DEPOSITS is the ratio of quarterly deposits to total assets. Bank controls: SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is ratio of quarterly loan loss reserves to total assets. Country controls: VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1) WD25th	(2) WD50th	(3) WD75th
L.LEVTIER1	0.0441***	0.0102	0.0002
	(0.0165)	(0.0070)	(0.0138)
DAILYREG	0.1869	0.0430	−0.0469
	(0.2452)	(0.1047)	(2059)
L.LEVTIER1∗DAILYREG	−0.0231	−0.0059	−0.0036
	(0.0197)	(0.0084)	(0.0165)
L.DEPOSITS	0.0076***	0.0008	0.0017
	(0.0018)	(0.0008)	(0.0015)
Observations	980	980	980
N.Banks	70	70	70
Quarter FE	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes
Country controls	Yes	Yes	Yes

To further test the robustness of our baseline model, we check whether the negative association between the amount of deposits and the extent of window dressing by means of repos is stronger for U.S. G-SIBs.[19] In particular, we expect that U.S. G-SIBs are more incentivized to engage in window dressing for two main reasons. First, G-SIBs can easily operate in the repo markets, and previous research has shown that they engage in window dressing practices by means of repos (Behn et al., 2018, 2019; Garcia et al., 2021). Second, the redefinition of the FDIC deposit insurance assessment base, which includes not only deposits but also all tangible liabilities less capital, disadvantages the largest banks which rely more on wholesale funding.[20] In this context, if our research hypotheses are correctly

[19]The list of G-SIBs is provided on an annual basis by the Basel Committee based on an assessment methodology. For additional information, see the following link: https://www.fsb.org/2021/11/2021-list-of-global-systemically-important-banks-g-sibs/. The G-SIBs in our sample are the following: JP Morgan, Bank of America, City Group, Goldman Sachs, Bank of New York Mellon, Morgan Stanley and Wells Fargo.

[20]Size is the first of five criteria of systemic importance adopted by the Basel Committee on Banking Supervision adopted to determine whether a bank should be considered a G-SIB or not. For further information on this assessment methodology, see the following link: https://www.bis.org/bcbs/publ/d445.pdf.

specified, then U.S. G-SIBs should be more incentivized to engage in downward window dressing on repos aiming at reducing the FDIC assessment base for the computation of the deposit insurance premium. This is due to the fact that the premium they are required to pay is larger compared to the other financial institutions. Table 7, Panel (a) shows the results of this robustness test where, in the baseline model, we include all control variables and an interaction term between the deposit-to-total asset ratio (L.DEPOSITS) and an indicator variable equal to 1 if the U.S. BHCs is a G-SIB and 0 otherwise (G-SIBs). The aforementioned G-SIB interaction dummy (L.DEPOSITS*G-SIBs) is negative and statistically significant at the 1% level, indicating that the negative association between the deposit-to-total asset ratio is stronger for U.S. G-SIBs.

Finally, we employ also an alternative dependent variable by replacing the L.LEVTIER1 variable with the change in L.LEVTIER1 in two different quarters (L.ΔLEVITIER1). We use this alternative dependent variable to check whether those BHCs that experienced higher variations in their Tier 1 leverage ratio between quarters engage more in window dressing. The results in Table 7, Panel (b) show a positive and statistically significant association between L.ΔLEVITIER1 and the extent of window dressing. Large changes in the leverage Tier 1 ratio across quarters push banks to take prompt corrective actions. Hence, before the daily average reporting requirement, banks engaged in repo window dressing to reduce excessive volatility in reported leverage ratio figures. This result also supports the robustness of our baseline analysis.[21]

6 | CONCLUSION

Window dressing behaviour has attracted attention from supervisory and regulatory authorities, as it undermines the effectiveness of their policy objectives. This practice may lead to adverse effects on the success of regulatory measures as well as underestimation of the overall risk in the banking sector by regulators and supervisors. The postcrisis regulatory reform aimed to combat window dressing practices by banks, which have been considered unacceptable because they compromise the intended policy objectives of national and international regulatory and supervisory authorities (BIS, 2018).

Unlike other countries, the enforcement of the Basel III regulation in the U.S. banking sector has been crucial to eliminate incentives to window dress the leverage Tier 1 ratio figures (Anbil & Senyuz, 2018). U.S. supervisory authorities have adopted a more strict application of the Basel III regulation requiring banks to report their leverage Tier 1 ratio figure on a daily basis rather than at the end of the quarter. The effectiveness of this regulation in limiting bank window dressing behaviour has been overlooked by the extant literature. Our first aim is to fill this gap by providing empirical evidence of the relation between capital requirements and window dressing behaviour prior and after the introduction of the daily leverage Tier 1 ratio reporting requirement.

The results of our empirical analysis show that before the implementation of Basel III regulation in the United States, BHCs with lower levels of Tier 1 capital ratio engaged in downward window dressing by means of repos, to appear more capitalized than they actually were. The

[21]Unreported results show that our model is robust to alternative specifications in which we substitute loan loss provisions with alternative risk measures such as risk weight density and the ratio of nonperforming loans to gross loans. The results are available from the authors upon request. We also included an additional robustness test in which we exclude those banks with a ratio of deposits-to-total assets below the 10th percentile. The (unreported) results are in line with the baseline model further validating our findings.

TABLE 7 Additional robustness.

This table reports the results of the robustness tests. WD is the repo window dressing as computed in Equation (1). DEPOSITS is the ratio of quarterly deposits to total assets. G-SIBS is a dummy variable equal to 1 if the U.S. BHCs is a G-SIB and 0 otherwise. DAILYREG is a dummy variable that takes the value 1 after the implementation of the daily average computation of the leverage Tier 1 ratio (in 2013) and 0 before the implementation. ΔLEVITIER1 is the quarterly change in the average leverage Tier 1 ratio. DEPOSITS is the ratio of quarterly deposits to total assets. Bank controls: SIZE is the quarterly logarithm of bank total assets. TRADING is the ratio of quarterly trading assets to total assets. ROE is the quarterly return on equity. LLRES is ratio of quarterly loan loss reserves to total assets. Country controls: VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

	(1)	(2)
	WD	**WD**
(a) G-SIBs		
L.DEPOSITS	0.0099**	0.0128**
	(0.0041)	(0.0063)
G-SIBS*L.DEPOSITS	0.1700***	0.1576***
	(0.0589)	(0.0693)
Observations	980	980
N.Banks	70	70
Bank FE	Yes	Yes
Quarter FE	No	Yes
Bank controls	Yes	Yes
Country controls	Yes	Yes
Cluster	Bank	Bank
(b) ΔLEVITIER1		
L.ΔLEVITIER1	−0.1236**	−0.1296**
	(0.0502)	(0.0510)
DAILYREG	−0.1084	0.0661
	(0.1088)	(0.1743)
DAILYREG*L.ΔLEVITIER1	0.0247	0.0227
	(0.0425)	(0.0432)
Observations	980	980
N.Banks	70	70
Bank FE	Yes	Yes
Quarter FE	No	Yes
Bank controls	Yes	Yes
Country controls	Yes	Yes
Cluster	Bank	Bank

negative association between the leverage Tier 1 ratio and the extent of window dressing has disappeared after the implementation of the Basel III regulation in 2013 because the incentive of manipulating the level of capitalization has disappeared after the requirement for U.S. BHCs to report to the supervisor the daily average of the leverage Tier 1 ratio, rather than the quarter-end figure. This result has important policy implications in terms of financial stability and can offer guidance to supervisory authorities in other jurisdictions. Since the association between the extent of window dressing and the Tier 1 leverage ratio figure has disappeared after the requirement for U.S. BHCs to report to the supervisor the daily average of the leverage Tier 1 ratio, we argue that this supervisory practice should also be adopted in the other countries that still require banks to report the quarter-end level of their leverage ratio, including Europe (Behn et al., 2018). If supervisors adopt this approach, then they would eliminate an important incentive for banks to engage in window dressing in the repo markets.

However, we identify persistency in downward window dressing behaviour on repos and uncover evidence of an unexplored mechanism that incentivizes U.S. BHCs to engage in window dressing by means of repos. We find that U.S. BHCs characterized by lower levels of deposits engage more in window dressing in the repo markets. This finding can be interpreted in light of the fact that the FDIC has redistributed the costs of the deposit insurance premium from small commercial banks that rely more on deposits to investment banks that rely on wholesale funding, including repos (Whalen, 2011). Given that the assessment base for the FDIC deposit insurance premium is computed as a percentage of quarter-end figures of all tangible liabilities less capital, including wholesale funding, and consequently repos, U.S. BHCs that have lower levels of deposits, and consequently rely more on wholesale , engage more in downward window dressing through repos to manipulate their FDIC assessment base and pay lower deposit insurance premiums. Additional analyses also show that this incentive is stronger for U.S. G-SIBs because they can easily operate in the repo markets and they are more incentivized in manipulating their assessment base for the computation of the deposit insurance premium. Again, this result has important policy implications. In particular, if BHCs lower the deposit insurance premium they have to pay, this can negatively impact the ability of the FDIC to insure individuals' deposits in periods of financial distress. Given that U.S. BHCs are incentivized to engage in window dressing at quarter-end by means of repos to manipulate their FDIC assessment base, supervisors should eliminate this problem by requiring banks to compute this figure based on daily averages, rather than reporting quarter-end figures. This change would also eliminate this window dressing incentive for U.S. BHCs, resulting in a more effective FDIC regulation, and consequently in a more stable and sound banking system. In other words, the main implication of our results is that the reporting frequency of a regulatory figure matters as much as the level of the figure itself. This paper calls for greater scrutiny by supervisors on bank window-dressing behaviour not only in the United States but also in other jurisdictions. Our results offer important policy implications for the design of a robust deposit insurance scheme in Europe. Given that the European Deposit Insurance Scheme is still in-progress,[22] EU regulators should consider the results of this paper to create a deposit insurance scheme that can offer adequate protection to depositors and mitigate window dressing behaviour by banks.

[22]For an in-depth analysis of the Banking Union refer to https://www.europarl.europa.eu/RegData/etudes/IDAN/2020/645707/IPOL_IDA(2020)645707_EN.pdf.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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APPENDIX A

Table A1

TABLE A1 Correlation matrix.

This table reports the correlation matrix among the variables included in the baseline regression. Correlations that are significant at least at the 5% level are reported using bold italics. The number on the horizontal axis indicates the variables in the vertical axis. Each horizontal number matches with the variable's position in the vertical. LEVTIER1 is the quarterly average Tier 1 ratio. DEPOSITS is the ratio of quarterly deposits to total assets. SIZE is the quarterly logarithm of bank total assets. ROE is the quarterly return on equity. TRADING is the ratio of quarterly trading assets to total assets. LLRES is ratio of quarterly loan loss reserves to total assets. VIX is the quarterly CBOE volatility index. GDPGROWTH is the quarterly growth of gross domestic product.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) LEVTIER1		**0.27**	**−0.27**	0.04	**−0.15**	**0.13**	−0.03	0.02
(2) DEPOSITS	**0.27**		**−0.50**	0.03	**−0.52**	**0.06**	0.05	0.02
(3) SIZE	**−0.27**	**−0.50**		0.00	**0.60**	**0.10**	−0.02	−0.00
(4) ROE	0.04	0.03	0.00		−0.04	**0.05**	−0.02	−0.04
(5) TRADING	**−0.15**	**−0.52**	**0.60**	−0.04		−0.02	0.00	−0.00
(6) LLRES	**0.13**	**0.06**	**0.10**	**0.05**	−0.02		**0.28**	0.00
(7) VIX	−0.03	0.05	−0.02	−0.02	0.00	**0.28**		**−0.06**
(8) GDPGROWTH	0.02	0.02	−0.00	−0.04	−0.00	0.00	**−0.06**	