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# Impact of central bank's COVID-19 policy measures on banks: evidence from India

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**Abstract:** India's central bank has responded decisively with a slew of development and regulatory policies to tackle the economic challenges posed by the pandemic crisis. This study aims to find the bank's response to the COVID-19 monetary policy announcements in India using an event study methodology. We compare the bank's response to policy measures during the pandemic crisis to the response during the 2008–2009 financial crisis and with crisis events during different monetary policy regimes. Furthermore, this paper examines if the heterogeneity in response depends on the bank's characteristics. The results suggest, on average, banks respond negatively to COVID-19 monetary policy interventions, with the sensitivity of bank's response to the policy announcements reducing with size and capitalisation of banks and increasing with profitability and poor financial health of banks.

**Keywords:** financial economics; crisis events; financial intermediation; financial market; event study; central bank policy; India.

**JEL codes:** G14, G21, G28, E58, C58, C31.

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## 1 Introduction

The economic impact of COVID-19 in India has mainly been disruptive, creating stress for Indian corporates. The unprecedented shock of the COVID-19 pandemic crisis and the lockdown measures adopted to contain it have caused the global economy into a severe slowdown. In April 2020, India's growth projection was downgraded to 1.9% for the financial year 2020–2021 by the International Monetary Fund (Scroll Staff, 2020).

The Reserve Bank of India (RBI, India's Central bank) has announced policy measures to support and boost economic activity during the COVID-19 crisis. These include a six month moratorium for all term loans, reassessing the working capital cycle, new loan reclassification, and provisioning, among other developmental measures. It also announced a cut in policy rates to improve liquidity in the economic system. The repo rates and reverse repo rates have been slashed to encourage banks to lend out loans and not park money with the RBI. As per Paul (2020), India's stimulus monetary policy measures should differ from other nations due to its distinct economic fabric and inflation models. The monetary policy actions of RBI during the pandemic crisis are "measures undertaken in the hope that banks will be lending loans and investors will make use of this opportunity to access capital at much lower costs" (Paul, 2020).

The actions taken by banks become crucial in addressing the posed economic challenge due to the COVID-19 pandemic crisis. In a bank-based financial system such as India, the monetary policy transmissions work through the bank lending channel (Aleem, 2010; RBI, 2007). Using an event study methodology, Prabu et al. (2016) discuss the impact of Indian monetary policy announcements on market indices and bank indices in India. They find a significant impact on banking stocks (positive for monetary loosening and negative for monetary tightening), suggesting a bank lending channel for the monetary policy transmissions to the economy. On the other hand, Prabu et al. (2016) do not find a significant impact of RBI announcements on market indices suggesting the insignificant role of the stock market's contribution in capital formation for bank-based financial systems as compared to the market based financial system (Ludwig and Slok, 2004). Kaen et al. (1997) investigate the response of German bank stocks; besides, Stevenson (2002) finds the response on EU bank stocks, on changes in Germany interest rates, and find that decreases in key policy rates lead to a positive market-adjusted abnormal return (AR) on bank stocks.

The perceived effectiveness of monetary policy interventions can be analysed using the information on the response of bank stocks (Yin et al., 2010; Castren et al., 2006). However, the sensitivity of the reaction of bank equity returns to policy announcements depends on the bank's characteristics. Madura and Schnusenberg (2000) examine the response of bank equity returns to changes in Fed policy tools and find the relationship between the sensitivity of returns with the financial characteristics of the banks. Madura and Schnusenberg (2000) attribute cross-sectional variation in ARs to bank size and bank capital ratio, with larger banks and banks with lower capital ratio having higher sensitivity of returns to interest rate changes. However, studies also suggest that policy interventions are like risk factors that significantly affect small banks more than large banks (Thorbecke, 1997). Ricci (2015) examines the impact of monetary policy interventions on bank stock prices during the financial crisis and find that weaker banks

were more sensitive to changes in monetary policy. Banks that are perceived as less risky and safer have lower sensitivity to monetary policy changes (Madura and Schnusenberg, 2000; Yin and Yang, 2013; Ricci, 2015). The reaction of bank equity returns to the regulatory and developmental package announcements is crucial in understanding the perceived benefit of the measures in alleviating the challenges posed by the COVID-19 pandemic to the economy. We analyse the reaction of listed banks in India to the RBI's announcement of COVID-19 policy and relief measures.

However, the banking sector in India is grappling with problems. Banks, especially the public sector banks, have been struggling to deal with mounting non-performing assets (NPAs) on their balance sheets. The economic consequence of the pandemic expects to increase NPAs of the banking sector, leading to the exposure of investors to higher credit risk. As a base case, the ratio of gross NPAs may rise to 12.5% by March 2021 and could jump to 14.7% in the worst case (Mishra, 2020). The RBI relief measures announced on March 17, 2020, and May 23, 2020, suggests an asset classification standstill for six months for standard accounts availing moratorium.

These regulatory exemptions, which have been necessitated by the pandemic, may have long-term consequences for banks' financial health. We analyse the impact of RBI's announcement of COVID-19 policy and relief measures on the stock performance of banks and study its relationship with the bank's characteristics such as the size of the bank, profitability, financial health of the bank and ownership of the bank (government-owned or private owned).

We conjecture that response of banks to the RBI's COVID-19 regulatory packages and other developmental measures will not be indiscriminate. Banks grappling with high NPAs on their balance sheets and having weak profitability will find some relief from the freezing of asset classification for six months. However, there might be an adverse implication of deferment of interest payments on the bank's financial health in the long-term. The response of bank equity returns to the COVID-19 policy and relief measures announced is an empirical question with a cross-sectional variation in the abnormal reaction of banks depending on their characteristics.

We also compare the reaction of banking stocks during the COVID-19 crisis to the reaction to the RBI's intervention during the 2008–2009 financial crisis. This helps us compare the response in two monetary policy regimes; the inflation targeting regime during the pandemic crisis and the multiple indicators approach during the financial crisis (GFC 2008–2009). We find, on average, a negative response of bank stocks to monetary policy announcements during the pandemic crisis as compared to a positive response during the financial crisis. As suggested by Lane (2020) and Mishkin (2009), the bank stock's reactions to the announcements are an average reaction to the perceived benefit of policy in maintaining market stability, credit supply maintenance and anchoring expected inflation. We also find that the response of bank stocks to monetary policy shocks depend on bank characteristics such as the size of the bank, bank's profitability, bank NPAs during the pandemic crisis suggesting the perceived effectiveness of the policy is heterogeneous across banks.

The paper discusses and develops the Hypotheses in Section 2, research design and methodology in Section 3. We discuss the results in Section 4 and provide the conclusions with policy implications in Section 5.

## 2 Hypotheses development

Extant literature studies the link between monetary policy actions (conventional and non-conventional) on asset prices in the financial market during a crisis (particularly GFC) (Aliyu, 2012; Fiordelisi et al., 2014; Kontonikas et al., 2013) and during non-crisis periods (Thorbecke, 1997; Jensen et al., 1996; Bernanke and Kuttner, 2005). The results, on average, suggest that stock market indices do not have a significant positive reaction to monetary easing and non-conventional policies during the crisis period (Kontonikas et al., Fiordelisi et al., 2014); however, the bank stocks react positively (Fiordelisi et al., 2014).

Non-conventional monetary policies play three roles during times of crisis; to avoid market instability, maintain credit supply to the market, and neutralise the crisis-related risks or policy-related risks to maintain inflation (Lane, 2020). The financial market channel funds towards good opportunity firms by processing information. During a crisis, the information flow disrupts, and price discovery is impaired. This uncertainty leads to high volatility in asset prices. This disruption or market instability may impact the real economy negatively. An economic downturn may further exacerbate the situation initiating an adverse feedback loop in which market instability might restrain the economic activity (Bernank et al., 1996, 1999; Bernanke and Gertler, 1989). A reduction in key monetary policy rates helps in reducing this macroeconomic risk by reducing the probability of an adverse feedback loop (Mishkin, 2009). The non-conventional monetary policies such as granting moratorium to maintain the credit quality of existing borrowers, other measures to improve liquidity, and a reduction in key policy rates, helps in maintaining the credit supply to the market. The policy measure should help tackle the three challenges, i.e. avoiding market instability, maintaining credit supply and maintaining inflation simultaneously. The response of bank stocks to the monetary policy actions indicates the perceived benefits from the effective transmission of monetary stance to the banks, which is crucial in tackling the three challenges mentioned before, and, subsequently, to the real economy (ECB, 2010).

However, studies such as Fiordelisi et al. (2014) suggest that bank stocks' market reactions may not always indicate the impact on the real economy, but it might suggest the impact on just banks per se. Fiordelisi et al. (2014) test the effects of monetary policy measures (both expansionary and restrictive measures) on stock indices and bank stocks from June 2007 to June 2012 for the European Union, Japan, the UK, the USA and Switzerland. They find that stock indices respond positively to monetary easing policies (though significant for 10%) and negatively to policy inactions and restrictive measures.

However, bank stocks responded positively to restrictive, expansionary, and non-conventional (such as liquidity injections) monetary policies on average during crisis periods (taking subprime crisis, GFC, and sovereign debt crisis periods). Their results suggest that bank stocks expected to gain from interest margins during restrictive monetary policies and increased credit supply or improved funding conditions with monetary easing and non-conventional policies during the crisis period.

An increase in inflation expectations is one of the major side effects of monetary policy easing. The third challenge during crisis events is to keep inflation expectations solidly anchored. For this to hold, the central bank should have developed enough credibility with financial markets through previous actions or through communication to maintain inflation targets. Studies such as Mishkin (2009) suggests that aggressive pre-emptive monetary policy rates reduction would be counter-productive if the third challenge of maintaining inflation expectations is not dealt with effectively.

The bank investors in India would react to the policy announcements as an average reaction to their perceived policy benefit on market stability, credit supply, and inflation maintenance, in addition to direct benefits to the banks. As suggested by Rao (2020), "the inevitable fear of a spike in NPAs after the end of the moratorium on loan repayment, additional provisions against rising NPAs, diminishing profitability, and other adversities have added to the already low-risk appetite of banks leading to subdued credit growth". The credit supply is expected to not increase in spite of the monetary easing policies due to asset quality woes. The estimated NPAs are likely to go up to 14.7% by March 2021 as a worst-case scenario, with 12.5% as the expected scenario from 9% in March 2020 (RBI, 2020g). As suggested by Sengupta (2020), "Lingering problems in the banking sector hamper the smooth transmission of monetary policy, potentially rendering an important macroeconomic stabilisation policy tool impotent."

In addition, during the COVID-19 period, RBI was following an inflation-targeting monetary policy regime with a target inflation of 4% (+–2%). However, in late 2019, India's retail inflation could not meet the RBI's medium-term target of 4% (ET Online, 2019). The perceived expectation related to maintenance of expected inflation for the year 2020 (at the medium-term target) would not be met as per previous data.

The pandemic crisis has a major impact on the economy, with India's Gross Domestic Product contracting by 23.9% for the April to June quarter (PIB, 2020).

We conjecture that, on average, banks would react negatively to COVID-19 regulatory policy announcements due to perceived reduction in credit supply owing to rising NPAs, and perceived expectation of inflation not being maintained, in addition to the disruptive impact of the pandemic crisis on the Indian economy as a whole.

H1 Bank returns are sensitive to RBI's COVID-19 regulatory policy announcements, with banks responding negatively on average to policy announcements.

Extant literature such as Bernanke and Blinder (1988) suggests that for bank lending channel of monetary policy transmission to exist in an economy, some firms might borrow from banks for financing, and the central bank, through open market operations, can influence the bank's money supply.

Bernanke and Blinder (1992) establish that the monetary policy tightening leads to a contraction in deposits to all banks. Studies suggest that based on the lending view, the effect of monetary policy shocks on banks will depend on the bank characteristics such as size (Kashyap and Stein, 1995; Kishan and Opeila, 2000; Kakes and Sturm, 2002; Ehrmann et al., 2003; Lapteacru, 2010), bank balance sheets (Akinci et al., 2013), bank equity as a proxy of size (Kashyap and Stein, 1995; Lapteacru, 2010), bank liquidity (Kashyap and Stein, 2000). Studies suggest that the monetary policy matters more for smaller banks, banks with poor balance sheets, less capitalised banks, and banks with lower liquidity. Studies suggest that smaller banks (Ricci, 2015; Heryan and Tzeremes, 2017), banks with weaker balance sheet and higher risk (Ricci, 2015) and with lower liquidity (Heryan and Tzeremes, 2017) were more sensitive to the central bank's policy

interventions during the financial crisis. Therefore, we conjecture that the impact of the central bank's monetary policy announcements on bank equity returns will depend on bank characteristics such as bank ownership (the public sector banks in India have on average higher gross NPAs as compared to private sector banks in India (Arun et al., 2020), bank size, gross NPAs (a proxy for weaker balance sheet), bank price to book ratio (a proxy for bank market capitalisation), bank profitability (credit risk is expected to increase which negatively impacts the bank profitability (Ruziqa, 2013), in addition to the impact of policy rate cuts), and other bank-specific characteristics like efficiency [Lapteacru (2010) suggests that more efficient banks respond less to monetary policy changes].

H2 The abnormal response of bank equity returns to the RBI's COVID-19 regulatory policy announcements depends on the characteristics of the banks (with the response being higher for smaller banks relative to largest banks; higher for high NPAs banks relative to low NPAs banks; higher for low capitalisation banks relative to high capitalisation banks; higher for less efficient banks as compared to more efficient banks; higher for PSBs as compared to private sector banks).

As far as we are aware, the literature has not analysed the impact of the monetary policy interventions on bank returns in the event of a pandemic like the COVID-19 crisis. The studies in India have not tested the heterogeneity in the response of bank stocks to the regulatory policy measures. We are trying to fill this gap in the literature. We also compare the abnormal response of banking stocks during the pandemic crisis to the response to the RBI's intervention during the financial crisis. This helps us compare the response in two monetary policy regimes; the inflation targeting regime during the COVID-19 pandemic crisis and the multiple indicators approach during the financial crisis (GFC 2008–2009). We conjecture that the effect of monetary policy interventions on bank stocks during the financial crisis will be different than during the pandemic crisis. The impact of the financial crisis on the Indian economy (India's GDP growth rate was 6.7% in 2008) was not as destructive as the pandemic crisis (India's GDP growth rate was 10.29% in 2020). Misra (2009) suggests that credit growth declined to 17.3% in 2008–2009 from 22.3% in the previous year (2007–2008). The bank credit growth stood at 6.3% in March 2020 (RBI, 2020f); 6.2% in December 2020 (RBI, 2021a) as compared to 12% in March 2019 across all populations, with banks being risk-averse. The bank lending channel of monetary policy was not quite effective in India during the pandemic crisis as compared to the financial crisis. The RBI followed the multiple indicators approach strategy for monetary policy during the financial crisis compared to the inflation targeting regime during the pandemic crisis. As suggested by Viswanathan (2010), the RBI policies led to adequate liquidity in the market and stabilised inflation rates to 5.6% as of January 10, 2009 (RBI, 2009). The inflation rate has been consistently above the target for most of 2020 (Dhasmana, 2020) and breached the medium-term target in November 2019 (ET Online, 2019). We expect, on average, a positive reaction of bank stocks to monetary policy actions during the financial crisis as compared to an adverse reaction during the pandemic crisis.

H3 The abnormal response of bank equity returns to the RBI's monetary policy announcements is negative for the pandemic crisis and positive for the financial crisis.

## 3 Research design and methodology

We follow the event study methodology using research apps (Schimmer et al., 2014) to determine the stock market reaction to the event of policy announcements. The difference between expected returns from actual returns gives us ARs. The expected returns are calculated based on asset pricing models, such as the one-factor market model. Equation (1) provides the market model where the daily returns of the security are denoted by $R(i)$ for the estimation period, $R(m)$ is the daily returns of the market index. We calculate the daily returns at day $t$ by using logarithm (base $e$) of adjusted closing prices ratio of $t$ to previous $t - 1$ of securities downloaded from 'https://in.finance.yahoo.com/'.

$$R(it) = \alpha(i) + \beta(i)R(mt) + e(i) \tag{1}$$

We calculate the expected returns as per equation 2, with the estimated values of α and β coefficients.

$$E(Rit) = \tilde{a}_t + \tilde{\beta}_t Rmt \tag{2}$$

The RBI's announcements on the COVID-19 regulatory and developmental package is the events for our study. The RBI, India's Central bank, announced specific regulatory measures on March 27, 2020 (RBI, 2020c), April 17, 2020 (RBI, 2020d) and May 23, 2020 (RBI, 2020b). In addition, the Central bank also announced key policy rate cuts on these dates (RBI, 2020a, 2020e). Table 1 summarises the event with the specifics of the announcement of COVID-19 regulatory measures by RBI.

The actions taken were to reduce the burden of servicing the liabilities brought about by COVID-19 pandemic disruptions. The key policy rates were reduced to improve and inject liquidity into the economy. The announcement on April 17, 2020 (RBI, 2020d) also discussed asset classification and provisioning aimed at alleviating the lingering impact of the COVID-19 pandemic on businesses and financial institutions in India.

We have considered the dates as 21-04-2009, 4-03-2009, 2-01-2009, 6-12-2008, 1-11-2008, 20-10-2008 as event dates with a reduction in repo rates during the financial crisis period (2008–2009). We got this information from the RBI announcements.

We perform a short-run event study with an event window of 21, 11, and 7 days –10 to +10, –5 to +5 and –3 to 3 days relative to the event). We use an estimation window of 220 days relative to the event with a gap (excluding February 2020 return values) to estimate market model coefficients.

The impact of an event on an entity is quantified using ARs and cumulative abnormal returns (CAR).

$$AR_t = Rit - E(Rit) \tag{3}$$

$$CAR(t_1, t_2) = \sum_{t_1}^{t_2} AR_t \tag{4}$$

When considering multiple events and entities, the average abnormal return (AAR) and cumulative abnormal returns (CAAR) across the bank events (a combination of bank and announcement date) are used.

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{5}$$

$$CAAR(t_1, t_2) = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{6}$$

We use the Patell-Z statistic to calculate the significance of CAAR as it is not affected by the distribution of ARs over the cumulative event window (Patell, 1976).

**Table 1** Event dates - RBI's announcement on COVID-19 Regulatory and Monetary package

| *Announcement by RBI* | *Event date* | *Salient features to the announcement* |
|---|---|---|
| COVID-19 – regulatory package and notifications | March 27, 2020 | • A moratorium benefit of three months is granted for term loans due between March 1 and May 31, 2020, with interest getting accrued if availing the benefit.<br>• A delay of interest payments on the working capital loan is allowed for the same period.<br>• A reduction in the repo rates by 75 basis points to 4.4%. A reduction in the reverse repo rates by 90 basis points to 4%. With effect from March 28 for one year, the CRR of all banks to be reduced by 100 basis points to 3% |
| COVID19 regulatory package – asset classification and provisioning and notifications | April 17, 2020 | • All standard term loans availing moratorium to be excluded from the classification of assets as NPAs during the period availed.<br>• Provisioning of not less than 10% of the total outstanding default<br>• Reduction in the reverse repo rates by 25 basis points to 3.75% |
| COVID-19 – regulatory package and notifications | May 22/23, 2020 | • An extension of the moratorium by another three months, till August 31, 2020.<br>• Easing of working capital financing.<br>• A reduction in the reverse repo rate to 3.35% and the repo rate to 4% is announced. |

Notes: The table mentions the salient features of the RBI, India's central bank's announcement, along with the event dates. There are three event dates for our analysis.

*Source:* RBI (2020c, 2020d, 2020b)

**Table 2** Descriptive statistics (panel A) and correlation matrix (panel B)

| *Panel A* | *Overall (no. of banks 34)* | | | *Public (no. of banks 13)* | | | *Private (no. of banks 21)* | | |
|---|---|---|---|---|---|---|---|---|---|
| *Parameters* | *Average* | *Median* | *Standard deviation* | *Average* | *Median* | *Standard deviation* | *Average* | *Median* | *Standard deviation* |
| ROA% | –0.16% | 0.21% | 1.89% | –0.78% | –0.35% | 1.42% | 0.23% | 0.56% | 2.07% |
| ROE% | –4.91% | 2.85% | 23.23% | –10.86% | –5.83% | 18.63% | –1.22% | 7.95% | 25.39% |
| Net interest margin (NIM)% | 3.13% | 2.65% | 1.43% | 2.23% | 2.15% | 0.22% | 3.69% | 3.36% | 1.59% |
| Gross NPA (%) | 8.74% | 6.00% | 7.02% | 13.77% | 14.0% | 5.82% | 5.62% | 4.00% | 5.85% |
| Total income(In INR Cr) | 42,012 | 17,984 | 68,729 | 62756 | 27,297 | 94,770 | 29,171.11333 | 8,996.66 | 44,186.48 |
| Net NPA (%) | 3.24% | 3.11% | 2.38% | 4.87% | 4.77% | 1.69% | 2.23% | 1.55% | 2.19% |
| P/E | 38.13 | 9.69 | 95.93 | 29.16 | –12.49 | 113.13 | 43.68 | 14.17 | 86.14 |
| P/B | 0.92 | 0.60 | 0.93 | 0.42 | 0.33 | 0.22 | 1.23 | 0.93 | 1.07 |
| Operating expenses/total assets | 2.33% | 2.02% | 1.04% | 1.68% | 1.59% | 0.26% | 2.73% | 2.55% | 1.14% |
| Size = Ln(Total income) | 9.80 | 9.80 | 1.35 | 10.51 | 10.21 | 0.96 | 9.37 | 9.10 | 1.38 |
| Age = Ln(Age) | 3.96 | 4.45 | 0.95 | 4.49 | 4.69 | 0.42 | 3.64 | 3.56 | 1.05 |

| *Panel B* | *ROA%* | *ROE%* | *Net interest margin%* | *Gross NPA (%)* | *P/B* | *Operating expenses/total assets* | *Ln(Size)* | *Ln(Age)* |
|---|---|---|---|---|---|---|---|---|
| ROA% | 1.00 | | | | | | | |
| ROE% | 0.96 | 1.00 | | | | | | |
| Net interest margin% | 0.51 | 0.41 | 1.00 | | | | | |
| Gross NPA (%) | –0.77 | –0.78 | –0.57 | 1.00 | | | | |
| P/B | 0.38 | 0.30 | 0.51 | –0.45 | 1.00 | | | |
| Operating expenses/total assets | 0.13 | 0.03 | 0.81 | –0.29 | 0.29 | 1.00 | | |
| Ln(Size) | –0.02 | 0.04 | –0.27 | 0.06 | 0.09 | –0.46 | 1.00 | |
| Ln(Age) | –0.11 | –0.06 | –0.75 | 0.35 | –0.53 | –0.64 | –0.02 | 1.00 |

Notes: We have a sample of 34 listed banks and three event dates for our analysis, 102 banks-event combinations. Out of the 34 listed banks, 13 banks are owned by the government, and 21 banks are privately owned. The performance of banks is measured using variables such as return on assets (ROA%), return on equity (ROE%), net interest margin (NIM%). The ratio of NPAs to gross advances is mentioned as gross NPA (%), which provides the financial health position of the bank. The ratio of NPAs to net advances is mentioned as net NPA%. The total income of the bank measures the size of the bank, and an Ln of total income is considered as the proxy for size. P/B ratio and P/E ratio are valuation multiples provided. Age is calculated as Ln(year 2020–incorporation year). Panel B is the correlation matrix of all the variables.

We categorise the banks based on size (proxy used total income), profitability (proxy used ROA%), financial health (proxy used NPA/gross advances), using median split, and ownership (government or private owned) characteristics as on March 2020 data. The data relating to bank characteristics are taken from 'https://www.moneycontrol.com/'. Table II provides descriptive statistics of a sample of 40 listed banks and three event dates for our analysis, 120 bank-event combinations. Out of the 40 listed banks, 20 banks are government-owned, and 20 banks are privately owned. The sample further reduces to 34 banks with 102 bank-event combinations for CAR calculations due to six public sector banks getting merged in April 2020. Table 2 shows that the average ROA of 40 listed banks as of March 2020 is (–ve) 3.17% suggesting, on average negative profitability of listed banks with no difference in means for public and private banks. The ratio of NPAs to gross advances, in addition to the profitability ratios, provides the financial health position of the bank. The average of all banks for gross NPA% is 9.26%, with PSBs having a 14.3% as compared to 4.23% for private sector banks, with the difference in means being significantly different (10.07%, t stat = 6.9, 1% significance level). We find that public sector banks are larger and older (measured as Ln(Age)) than private sector banks (difference in means for size; t stat = 2.405, 5% significance level, and difference in means for age; t stat = 3.86, 1% significance level). Table 2 also provides the correlation matrix for the variables under study, and our independent variables related to the bank's characteristics for regression analysis are not highly correlated.

We performed univariate and multivariate analysis for our study. We present the univariate results for CAAR values of bank stocks and its' significance, obtained as a result of the effect of monetary policy announcements during the pandemic crisis in panel A. We control for the previous year's, i.e., 2019 CAR values for the respective banks obtained as an impact of monetary policy easing announcements in the year 2019 to capture the partial effect of non-conventional monetary policy during the pandemic crisis in panel B. For Tables 4 and beyond for univariate analysis, the CAAR values of bank stocks and their significance were obtained due to the effect of monetary policy easing announcements during the financial crisis in panel C. The difference in means of the CAAR values between pandemic crisis and financial crisis is tested in panel D. The univariate results are shown for two event windows, CAR [–3, +3] and CAR [–5, +5]. The multivariate regression (on a pooled cross-section) is run for various event windows' CAR values as the dependent variable, with bank characteristics controlling for monetary policy announcement event-date dummies in the independent variable.

## 4 Results and discussion

We examine the reaction of bank equity to the announcement of monetary and development policy announcements by India's central bank. Table 3, panel A shows that, on average, the CAAR is negative for all banks taken together (–1.44% for a six-day event window, and significant at 1% level), indicating an adverse reaction to the RBI announcement and eventually its perceived poor effectiveness to the economy. On the contrary, we find no adverse reaction to RBI's policy announcements during the financial crisis (1.33% for an 11-day event window, 1% significance level). The results confirm our conjecture (Hypothesis 3). The reaction of bank stocks to monetary policy announcements is an average reaction to the perceived effectiveness of policy in maintaining market stability, ensuring maintenance of credit supply to the market and to

anchor expected inflation (Lane, 2020; Mishkin, 2009). The impact of the pandemic crisis on the Indian economy has been devastating as compared to the financial crisis, as shown by the GDP numbers (6.7% in 2008 and –10.29% in 2020), credit growth (6.3% in March 2020 as compared to 12% in March 2019; 17.3% in 2008-09 as compared to 22.3% previous to 2008–2009), inflation rates (5.6% as of January 10, 2009, in a multiple indicators monetary policy regime and beyond 6% for most months during the pandemic crisis in an inflation-targeting monetary policy regime). We also control for the previous year's reaction to RBI monetary policy announcements related to policy rate cuts and find the insignificant partial impact of the non-conventional policy during the pandemic in Table 3, Panel B.

**Table 3** CAARs of banks for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks overall* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Overall (pandemic crisis) | –0.0492***<br>Patell Z = –7.27 | –0.0144***<br>Patell Z = –2.80 | 102 |
| Overall (financial crisis) | 0.0133**<br>Patell Z = 2.14 | 0.0075<br>Patell Z = 1.61 | 192 |
| Difference (pandemic – financial) | –0.0624***<br>Tstat = –3.55 | –0.022*<br>Tstat = –1.54 | |
| *Panel B: Pandemic crisis CAAR is the dependent variable* | | | |
| *Banks overall* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Constant | –0.028 (0.021) | 0.010 (0.018) | 96 |
| Overall $ACAR_{t-1}$ | 0.945 (0.442) | 1.096 (0.483) | 96 |

Notes: An event study methodology is followed. The market model calculates the expected return. The ARs are calculated as the difference between actual returns and expected returns. CARs are cumulative ARs for the various event windows. The event windows considered are 11, and 7. CAARs are the average cumulative ARs for the bank events considered. The event dates are March 27, April 17, and May 23, 2020, corresponding to RBI Covid-19 regulatory package announcements in addition to RBI press releases. $ACAR_{t-1}$ controls for banks' average CARs for the respective event windows in the year 2019 related to repo rate cuts.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.

Table 4 displays the relationship between the ownership of the bank and its CAAR. Table 4 panel A shows that the reaction to monetary policy announcements during the pandemic crisis was significantly negative for both public sector banks and private sector banks. Table 4 panel B, results show that controlling for previous year's bank reactions, the CAAR for Public sector banks is more negative as compared to private sector bank (panel B, PSB dummy is –ve 0.0091 and significant at 1% level), suggesting that the reaction of public sector banks is more negative for non-conventional monetary policy announcement during the pandemic crisis. The result suggests that the public sector banks perceive a higher increase in stressed assets from an already poor state of NPAs (Arun et al., 2020) due to the moratorium policy as compared to private sector banks. Table 4 panel C shows that there was no difference in bank reaction based on ownership during the financial crisis and panel D shows that the difference in CARs between banks during the pandemic and financial crisis is significantly negative for both public sector banks and private sector banks.

**Table 4** CAARs of banks based on ownership for RBI COVID-19 policy announcements

| *Panel A (Pandemic crisis)* | | | |
|---|---|---|---|
| *Banks public/private (pandemic)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Public | –0.037***<br>Patell Z= –4.89 | –0.0125**<br>Patell Z = –2.21 | 42 |
| Private | –0.057***<br>Patell Z= –5.37 | –0.0157*<br>Patell Z = –1.79 | 60 |
| Difference | 0.019<br>T stat = 0.59 | 0.00324<br>T stat = 0.12 | |
| *Panel B: Pandemic crisis CAAR is the dependent variable)* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | –0.0451* (0.024) | –0.0096*** (0.0023) | 96 |
| PSB dummy | 0.0458 (0.034) | –0.0091*** (0.003) | |
| $ACAR_{t-1}$ | 1.061** (0.449) | 0.823*** (0.057) | |
| *Panel C (Financial crisis)* | | | |
| *Banks public/private (financial)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Public | 0.014<br>Patell Z= 1.59 | 0.0062<br>Patell Z = 1.07 | 108 |
| Private | 0.0123<br>Patell Z = 1.42 | 0.0093<br>Patell Z = 1.21 | 84 |
| Difference | T stat = 0.50 | T stat = 0.56 | |
| *Panel D* | | | |
| *Banks public/private* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Public (pandemic crisis) | –0.037***<br>Patell Z = –4.89 | –0.0125**<br>Patell Z = –2.21 | 42 |
| Public (financial crisis) | 0.014<br>Patell Z= 1.59 | 0.0062<br>Patell Z = 1.07 | 108 |
| Difference (pandemic – financial) | –0.052**<br>T stat = –2.14 | –0.018<br>T stat = –0.89 | |
| Private (pandemic crisis) | –0.057***<br>Patell Z = –5.37 | –0.0157*<br>Patell Z = –1.79 | 60 |
| Private (financial crisis) | 0.0123<br>Patell Z= 1.42 | 0.0093<br>Patell Z = 1.21 | 84 |
| Difference (pandemic – financial) | –0.069***<br>T stat = –2.73 | –0.025<br>T stat = –1.27 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on ownership. The public sector banks correspond to banks where the government of India has a majority stake, and private sector banks are banks that are not government-owned. $ACAR_{t-1}$ controls for banks' average CARs for the respective event windows in the Year 2019 related to repo rate cuts.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.

**Table 5** CAARs of banks based on size for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks size (pandemic crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Large | –0.0685***<br>Patell Z = –7.19 | –0.0254***<br>PatellZ = –3.09 | 51 |
| Small | –0.0298***<br>Patell Z = –2.96 | –0.0033<br>Patell Z = –0.87 | 51 |
| Difference | –0.0387<br>Tstat = –1.2 | –0.0221<br>Tstat = –0.854 | |
| *Panel B* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | –0.022 (0.025) | 0.008 (0.021) | 96 |
| Large size dummy | –0.0123 (0.034) | 0.003 (0.028) | |
| $ACAR_{t-1}$ | 0.906* (0.458) | 1.117** (0.513) | |
| *Panel C* | | | |
| *Banks size (financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Large | 0.0208**<br>Patell Z = 2.296 | 0.0092<br>Patell Z = 1.38 | 90 |
| Small | 0.0041<br>Patell Z = 0.51 | 0.0052<br>Patell Z = 0.78 | 90 |
| Difference | 0.015<br>Tstat = 1.02 | 0.004<br>Tstat = 0.35 | |
| *Panel D* | | | |
| *Banks size (pandemic crisis-financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Large (pandemic crisis) | –0.0685***<br>Patell Z = –7.19 | –0.0254***<br>Patell Z = –3.09 | 51 |
| Large (financial crisis) | 0.0208**<br>Patell Z = 2.296 | 0.0092<br>Patell Z = 1.38 | 90 |
| Difference | –0.089***<br>Tstat = –3.48 | –0.036*<br>Tstat = –1.59 | |
| Small (pandemic crisis) | –0.0298***<br>Patell Z = –2.96 | –0.0033<br>Patell Z = –0.87 | 51 |
| Small (financial crisis) | 0.0041<br>Patell Z = 0.51 | 0.005<br>Patell Z = 0.78 | 90 |
| Difference | –0.03*<br>Tstat = –1.48 | –0.008<br>Tstat = –0.44 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on size. The median value of size (Ln(total income)) is calculated for the sample of listed banks. The banks which lie below the median are categorised as small banks, and above-median are categorised as large banks. $ACAR_{t-1}$ controls for banks' average CARs for the respective event windows in the year 2019 related to repo rate cuts.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level. Values in parenthesis are standard errors of coefficients.

**Table 6** CAARs of banks based on profitability for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks profitability* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Good | –0.0697***<br>Patell Z = –7.07 | –0.0345***<br>Patell Z = –4.74 | 51 |
| Poor | –0.0286***<br>Patell Z = –3.08 | 0.0058<br>Patell Z = 0.78 | 51 |
| Difference | –0.0411<br>Tstat = –1.28 | –0.0403<br>Tstat = –1.57 | |
| *Panel B* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | 0.0038 (0.028) | 0.042* (0.023) | 96 |
| Good profitability dummy | –0.055* (0.033) | –0.054** (0.026) | |
| $ACAR_{t-1}$ | 1.106** (0.449) | 1.285*** (0.484) | |
| *Panel C* | | | |
| *Banks profitability (financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Good | 0.0097<br>Patell Z = 1.04 | 0.0063<br>Patell Z = 0.97 | 84 |
| Poor | 0.016*<br>Patell Z = 1.79 | 0.009<br>Patell Z = 1.33 | 102 |
| Difference | –0.006<br>Tstat = –0.44 | –0.002<br>Tstat = –0.18 | |
| *Panel D* | | | |
| *Banks profitability (pandemic crisis-financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Good (pandemic crisis) | –0.0697***<br>Patell Z = –7.07 | –0.0345***<br>Patell Z = –4.74 | 51 |
| Good (financial crisis) | 0.0097<br>Patell Z = 1.04 | 0.0063<br>Patell Z = 0.97 | 84 |
| Difference | –0.079***<br>Tstat = –3.75 | –0.041***<br>Tstat = –2.85 | |
| Poor (pandemic crisis) | –0.0286***<br>Patell Z = –3.08 | 0.0058<br>Patell Z = 0.78 | 51 |
| Poor (financial crisis) | 0.016*<br>Patell Z = 1.79 | 0.009<br>Patell Z = 1.33 | 102 |
| Difference | –0.045*<br>Tstat = –1.59 | –0.002<br>Tstat = –0.11 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on profitability. The median value of profitability (ROA%) is calculated. The banks which lie below-median are categorised as poor profitability banks, and above-median are categorised as good profitability banks. $ACAR_{t-1}$ controls for banks' average CARs for the respective event windows in the year 2019 related to repo rate cuts.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.
Values in parenthesis are standard errors of coefficients.

We examine the impact on bank equity returns based on the size of the bank. Table 5 panel A indicates that larger banks react negatively to the event during the pandemic crisis (significant negative for a six-day event window for larger banks compared to insignificant results for smaller banks). However, for an 11-day event window, we find that there exists a negative reaction from smaller banks as well. This reaction is somewhat in line with the studies which suggest that as per the lending view, the smaller banks should gain more from monetary policy expansionary measures (Ricci, 2015; Heryan and Tzeremes, 2017). However, we do not find any significant difference in the reaction based on the size of the bank as the bank lending channel during the pandemic crisis has not been effective in India due to the bank being risk-averse (credit growth was 6.2% only in India in December 2020). Table 5 panel B suggests that there is no significant partial reaction on non-conventional monetary policy announcement based on bank size. Table 5, panel C suggests that there was no difference in reaction based on size during the financial crisis and panel D suggests that the difference in CARs between pandemic and financial crisis is significantly negative suggesting an ineffective bank lending channel during the pandemic crisis.

Table 6 highlights that higher bank profitability is correlated with a more negative reaction to the non-conventional monetary policy announcement (good profitability dummy is –ve and significant in Table 6 panel B), suggesting that non-conventional policies such as grant of moratorium and provisions were not perceived as beneficial for profitable banks (ETBFSI, 2020). Table 6 panel A suggests that the bank reaction to monetary policy announcements (both non-conventional and conventional) during the pandemic crisis was not different for the two categories of banks based on bank profitability, and both types had a significant negative reaction. Table 6 panel C suggests that during the financial crisis, the reaction did not depend on the bank profitability, and panel D suggests that the difference in means of CARs between pandemic and financial crisis is significantly negative for higher profitability banks.

Table 7 panel A show that banks with higher NPA and lower NPA, react negatively on average. The t-test difference in means results in Panel A suggests that there is no difference in the abnormal reaction due to bank NPA suggesting that, on average, all banks perceived their NPAs to further reduce due to monetary policy announcements during the pandemic crisis. The ratio of gross NPAs for banks in India may rise to 12.5% by March 2021 and could jump to 14.7% in the worst case (Mishra, 2020). However, studies (Ricci, 2015) on GFC suggested that banks with weaker balance sheets would benefit more from monetary policy expansionary measures during the crisis period. Our results do not suggest a benefit for banks with higher gross NPAs. We suggest that the beneficial reaction, as suggested by extant literature, gets negated due to non-conventional monetary policies, which might lead to an increase in the gross NPAs of banks in future (although panel B does not give any additional positive partial reaction of banks with higher NPAs). Table 7 panel C shows that CARs of banks during financial crisis did not depend on gross NPAs of banks. Panel D shows that the difference in means of CARs between pandemic and financial crisis is negative and significant for both categories of banks, i.e., banks with high and low gross NPAs.

Table 8 panels A and B results show that the difference in CARs based on bank's P/B ratio is not significant, which again goes in an opposite direction to literature that suggests that based on the lending view, low capitalised banks benefit more from monetary policy easing (Kashyap and Stein, 1995). However, as suggested, the bank lending channel is not effective in times of pandemic crisis in India; hence we do not find

a difference in abnormal reaction based on bank capitalisation proxied by the P/B ratio. Table 8 panel C also shows no difference in banks' abnormal reaction (based on bank capitalisation) on monetary easing announcements during the financial crisis.

**Table 7** CAARs of banks based on gross NPA (%) for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks NPAs (pandemic crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | –0.0415***<br>Patell Z = –4.69 | –0.0138**<br>Patell Z = –2.04 | 57 |
| Low | –0.0589***<br>Patell Z = –5.53 | –0.015*<br>Patell Z = –1.92 | 45 |
| Difference | 0.0174<br>Tstat = 0.55 | 0.0012<br>Tstat = 0.04 | |
| *Panel B* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | –0.056** (0.027) | 0.000 (0.023) | 96 |
| High NPA dummy | 0.054 (0.034) | 0.018 (0.027) | |
| $ACAR_{t-1}$ | 1.115** (0.452) | 1.139** (0.489) | |
| *Panel C* | | | |
| *Banks NPAs (financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | 0.011<br>Patell Z = 1.21 | 0.0057<br>Patell Z = 1.46 | 90 |
| Low | 0.0152*<br>Patell Z = 1.65 | 0.0097<br>Patell Z = 0.84 | 96 |
| Difference | –0.004<br>Tstat = –0.27 | –0.004<br>Tstat = –0.36 | |
| *Panel D* | | | |
| *Banks NPAs* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High (Pandemic) | –0.0415***<br>Patell Z = –4.69 | –0.0138**<br>Patell Z = –2.04 | 57 |
| High (Financial) | 0.011<br>Patell Z = 1.21 | 0.0057<br>Patell Z = 1.46 | 90 |
| Difference | –0.052**<br>Tstat = –2.03 | –0.017<br>Tstat = –0.85 | |
| Low (Pandemic) | –0.0589***<br>Patell Z = –5.53 | –0.015*<br>Patell Z = –1.92 | 45 |
| Low (Financial) | 0.0152*<br>Patell Z = 1.65 | 0.0097<br>Patell Z = 0.84 | 96 |
| Difference | –0.074***<br>Tstat = –3.26 | –0.025*<br>Tstat = –1.65 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on financial health (gross NPA (%)). The median value of gross NPA (%) is calculated. The banks which lie below-median are categorised as low NPA banks, and above the median are categorised as high NPA banks.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.

**Table 8** CAARs of banks based on P/B ratio for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks P/B* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | –0.0654***<br>Patell Z = –5.84 | –0.0257***<br>Patell Z= –2.69 | 51 |
| Low | –0.0329***<br>Patell Z = –4.31 | –0.003<br>Patell Z = –1.27 | 51 |
| Difference | –0.0325<br>Tstat=-1.009 | –0.0277<br>Tstat = –0.897 | |
| *Panel B* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | –0.003 (0.026) | 0.022 (0.023) | 96 |
| High P/B dummy | –0.051 (0.033) | –0.027 (0.027) | |
| $ACAR_{t-1}$ | 0.981** (0.440) | 1.063** (0.484) | |
| *Panel C* | | | |
| *Banks P/B (financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | 0.0184**<br>Patell Z = 1.98 | 0.0088<br>Patell Z = 1.13 | 90 |
| Low | 0.0072<br>Patell Z = 0.89 | 0.0076<br>Patell Z = 1.18 | 96 |
| Difference | 0.011<br>Tstat = 0.76 | 0.00<br>Tstat = 0.038 | |
| *Panel D* | | | |
| *Banks P/B* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High (pandemic) | –0.0654***<br>Patell Z= –5.84 | –0.0257***<br>Patell Z =–2.69 | 51 |
| High (financial) | 0.0184**<br>Patell Z = 1.98 | 0.0088<br>Patell Z = 1.13 | 90 |
| Difference | –0.0838***<br>Tstat = –2.58 | –0.0345**<br>Tstat = –1.90 | |
| Low (pandemic) | –0.0329***<br>Patell Z = –4.31 | –0.003<br>Patell Z = –1.27 | 51 |
| Low (financial) | 0.0072<br>Patell Z = 0.89 | 0.0076<br>Patell Z = 1.18 | 96 |
| Difference | –0.0401**<br>Tstat = –2.13 | –0.0106<br>Tstat = –0.03 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on market value ratio (P/B ratio). The median value of P/B ratio is calculated. The banks which lie below-median are categorised as low P/B banks, and above the median are categorised as high P/B banks.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.

**Table 9** CAARs of banks based on efficiency (operating expenses/total assets) for RBI COVID-19 policy announcements

| *Panel A* | | | |
|---|---|---|---|
| *Banks efficiency* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | –0.0451***<br>Patell Z = –6.21 | –0.0046<br>Patell Z = –1.00 | 51 |
| Low | –0.0532***<br>Patell Z = –3.94 | –0.0242***<br>Patell Z = –2.96 | 51 |
| Difference | 0.0081<br>Tstat = 0.25 | 0.0196<br>Tstat = 0.757 | |
| *Panel B* | | | |
| *Banks* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| Intercept | –0.014 (0.026) | 0.028 (0.022) | 96 |
| Low efficiency dummy | –0.028 (0.033) | –0.034 (0.026) | |
| $ACAR_{t-1}$ | 0.984** (0.446) | 1.156** (0.484) | |
| *Panel C* | | | |
| *Banks efficiency (financial crisis)* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High | 0.0159<br>Patell Z = 1.21 | 0.0157<br>Patell Z = 1.47 | 48 |
| Low | 0.0127<br>Patell Z = 1.23 | 0.0089<br>Patell Z =1.17 | 48 |
| Difference | 0.0081<br>Tstat = 0.25 | 0.0196<br>Tstat = 0.757 | |
| *Panel D* | | | |
| *Banks efficiency* | *CAAR [–5 to +5]* | *CAAR [–3 to +3]* | *No. of banks-event* |
| High (pandemic) | –0.0451***<br>Patell Z = –6.21 | –0.0046<br>Patell Z = –1.00 | 51 |
| High (financial) | 0.0159<br>Patell Z = 1.21 | 0.0157<br>Patell Z = 1.47 | 48 |
| Difference | –0.061***<br>Tstat = –3.1 | –0.0203<br>Tstat = –0.25 | |
| Low (pandemic) | –0.0532***<br>Patell Z = –3.94 | –0.0242***<br>Patell Z =–2.96 | 51 |
| Low (financial) | 0.0127<br>Patell Z =1.23 | 0.0089<br>Patell Z = 1.17 | 48 |
| Difference | –0.0659***<br>Tstat = –2.94 | –0.0331**<br>Tstat = –1.98 | |

Notes: Please refer to Table 3 for the methodology and event dates. The listed banks are categorised based on efficiency (operating expenses/total assets). The median value of operating expenses/total assets is calculated. The banks which lie below-median are categorised as high efficiency banks, and above the median are categorised as low efficiency banks.
*** is 1% significance level, ** is 5% significance level and * is 10% significant level.

**Table 10** Sensitivity of CAARs of banks and bank characteristics

| | *CAAR [–k, +k] is the dependent variable, where k is days relative to event 0.* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *[–1 to 0]* | *[–1 to 0]* | *[–1 to 1]* | *[–1 to +1]* | *[–3 to +0]* | *[–3 to +0]* | *[–3 to +3]* | *[–3 to +3]* | *[–5 to +0]* | *[–5 to +0]* | *[–5 to +5]* | *[–5to +5]* |
| Intercept | 0.500*** | 0.427*** | 0.530*** | 0.478*** | 0.194 | 0.039 | 0.239 | 0.105 | 0.212 | 0.067 | 0.161 | 0.089 |
| | (0.104) | (0.129) | (0.133) | (0.163) | (0.161) | (0.189) | (0.196) | (0.649) | (0.178) | (0.210) | (0.216) | (0.247) |
| Bank size | –0.018*** | –0.015** | –0.022*** | –0.016* | –0.011 | 0.000 | –0.019* | 0.000 | –0.022** | –0.011 | –0.034** | –0.021 |
| | (0.006) | (0.007) | (0.007) | (0.009) | (0.009) | (0.011) | (0.011) | (0.014) | (0.010) | (0.012) | (0.012) | (0.014) |
| Bank age | –0.058*** | –0.059*** | –0.055*** | –0.058*** | –0.037** | –0.036** | –0.028 | –1.375 | –0.028 | –0.030 | –0.013 | –0.007 |
| | (0.0109) | (0.011) | (0.014) | (0.014) | (0.017) | (0.017) | (0.020) | (0.021) | (0.927) | (0.019) | (0.022) | (0.023) |
| Bank profitability | 1.742*** | 2.059*** | 1.658** | 2.179** | 1.672** | 1.754* | 1.206 | –0.209 | 2.226** | 2.601** | 2.091* | 0.485 |
| | (0.543) | (0.635) | (0.689) | (0.830) | (0.837) | (0.924) | (1.102) | (1.205) | (0.927) | (1.037) | (1.124) | (1.318) |
| Bank NPAs | 0.099 | 0.166 | 0.260 | 0.363* | 0.006 | –0.039 | 0.338 | 0.099 | 0.276 | 0.347 | 0.855** | 0.709** |
| | (0.153) | (0.165) | (0.194) | (0.214) | (0.235) | (0.257) | (0.286 | (0.313) | (0.261) | (0.284) | (0.316) | (0.329) |
| Bank P/B | –0.014* | –0.018* | –0.017 | –0.022* | –0.016 | –0.027* | –0.019 | –0.036* | –0.003 | –0.014 | 0.007 | –0.003 |
| | (0.009) | (0.009) | (0.011) | (0.012) | (0.013) | (0.014) | (0.016) | (0.017) | (0.015) | (0.016) | (0.018) | (0.019) |
| Bank operating expenses/TA | –2.54** | –1.102 | –2.577** | –2.726 | –1.137 | 1.337 | –1.497 | –1.506 | –1.240 | 0.951 | –1.238 | –2.958 |
| | (0.995) | (1.755) | (1.262) | (2.194) | (1.532) | (2.609) | (1.867) | (3.133) | (1.696) | (2.904) | (2.057) | (3.355) |
| Event date 2 dummy | 0.006 | 0.009 | 0.025 | 0.027 | 0.154** | 0.159*** | 0.151*** | 0.1611*** | 0.168*** | 0.175*** | 0.216*** | 0.229*** |
| | (0.015) | (0.016) | (0.019) | (0.019) | (0.023) | (0.024) | (0.028) | (0.028) | (0.025) | (0.026) | (0.031) | (0.030) |
| Event date 3 dummy | –0.016 | –0.013 | –0.058*** | –0.055*** | 0.097** | 0.100*** | 0.074*** | 0.081*** | 0.0766*** | 0.078*** | 0.174*** | 0.181*** |
| | (0.015) | (0.016) | (0.018) | (0.019) | (0.023) | (0.024) | (0.028) | (0.028) | (0.025) | (0.026) | (0.031) | (0.030) |
| $ACAR_{t-1}$ | | 0.033 | | 0.449 | | 0.729* | | 1.602*** | | 0.477 | | 1.206*** |
| | | (0.281) | | (0.327) | | (0.409) | | (0.578) | | (0.365) | | (0.446) |
| Adjusted R square | 0.333 | 0.324 | 0.269 | 0.262 | 0.351 | 0.377 | 0.214 | 0.288 | 0.334 | 0.346 | 0.387 | 0.453 |
| Number of observations | 102 | 96 | 102 | 96 | 102 | 96 | 102 | 96 | 102 | 96 | 102 | 96 |

Notes: Regression analysis is followed with OLS estimates. CAR (–k to +k) of listed banks is the dependent variable. The independent variables are bank characteristics such as size measured as Ln (total income), age as Ln (2020-Incorporation year), Profitability as ROA%, NPAs as gross NPA (%). Event date 2 dummy takes the value of 1 if the event date is April 17, 2020, and 0 otherwise. Event date 3 dummy takes the value of 1 if the event date is May 23, 2020, and 0 otherwise.

*** is 1% significance level, ** is 5% significance level and * is 10% significant level. Values in parentheses are standard errors of the coefficients.

Table 9 panel A and panel B, univariate results show that the difference in CARs based on bank's efficiency is not significant. However, for both categories of banks (high and low efficiency), the reaction has been significantly negative again, suggesting that both types of banks perceive the ineffectiveness of monetary policy interventions during the pandemic crisis. Panel C shows that the abnormal reaction of banks based on efficiency was positive insignificant during the financial crisis. Panel D shows that there exists a difference in means for CARs during the pandemic and financial crisis.

Table 10, results of regression analysis as a pooled cross-section with monetary policy announcement event dates' dummies use the cumulative ARs for the various event windows as the dependent variable. The results suggest that the size of the bank, age of the bank, bank profitability, bank financial heath are significant drivers to the CARs of banks for most of the event windows considered. The cumulative abnormal response to the announcement of RBI's COVID-19 policy measures increases with weaker balance sheets (Ricci, 2015) (1% increase in Gross NPA%, increases CAR by 0.709 units for a 11-day event window; though result is not significant for shorter event windows), increases with profitability (1% increase in ROA%, increases CAR by around 2 units for a 11-day event window) suggesting that banks with poor profitability will perceive more reduction in profits due to monetary easing policy rate cuts, and reduces with the size of the bank (1% increase in size, decreases CAR by 3.4% for a 11-day event window) suggesting that smaller banks perceive more benefit from monetary policy easing during crisis (Ricci, 2015; Heryan and Tzeremes, 2017), reduces with bank capitalisation measured by P/B ratio for shorter event windows suggesting that banks with poor capitalisation perceive more benefits from monetary policy easing (Kashyap and Stein, 1995; Lapteacru, 2010), and reduces for shorter event windows for bank efficiency (Lapteacru, 2010). The results also suggest that the second and third announcement days have a significantly more positive impact than the first event announcement day, implying that banks reacted positively to the news of asset classification and provisioning and a further reduction in key policy rates. We also ran multivariate regression analysis for CARs of banks obtained on the announcement of measures during a financial crisis but do not find any significant heterogeneity in response based on bank characteristics.

## 5 Conclusions

Extant research has established the positive reaction of bank stocks to policy rate cuts. We find that banks reacted positively to policy rate cuts during a financial crisis. However, the reaction of bank stocks to the COVID-19 non-conventional measures, in addition to the policy rate cut measures by the Central bank, is an empirical question which the paper examines. We find, on average, a negative reaction to the announcement during the pandemic crisis, suggesting that banks perceived less effectiveness of monetary policy interventions in stabilising the market, maintaining credit supply, and maintaining inflation expectations within bounds. India is largely a bank-based system, with banks being the largest financial intermediaries. Therefore, the Indian banks should help pass on the policy rate changes to the real economy. However, problems associated with the banking sector hampered the bank lending channel of monetary policy transmission. This led to the macroeconomic stabilisation policy tool being ineffective. India's banks have been grappling with a high percentage of gross non-performing assets (gross NPAs) on their balance sheets, which is among the highest in the world. Indian

banks have become highly risk-averse with years of weaker balance sheets. The non-conventional policy related to loan moratorium would further increase gross NPAs for banks, causing them to become more risk-averse. The risk aversion of banks and the decline in demand for credit in the market have led to poor growth in credit supply despite monetary policy expansionary measures by the central bank. This led to poor monetary policy transmission to the real economy. An effective policy should be in place to address the stressed assets problem of the Indian banking sector to avoid a disruption in the bank lending channel in such times of crisis and periods of worsening macroeconomic outlook in the future. In addition, the central bank should keep inflation expectations solidly under control to respond pre-emptively during times of such crisis events.

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