EXCESS CASH OR EXCESS HEADACHE? DEMONETISATION AND BANK BEHAVIOUR

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ABSTRACT

Sudden and unannounced policy changes by the government can have significant consequences for commercial bank behaviour. Using data on Indian commercial banks during 2010-2020, we examine the impact of such an announcement – the 2016 demonetisation episode- on returns and risk. The findings reveal a decline in risk and an increase in returns of state-owned banks consistent with a flight-to-safety. The response differed in terms of market- and accounting measures and across state-owned banks with differing levels of capital and asset quality. Robustness checks lend credence to these findings.

Keywords: demonetisation, risk, Tobin's Q, state-owned banks, India

JEL classification: G21, G28

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Introduction

On November 11, 2016 the government formally announced the withdrawal of currency notes of the two largest denominations - 1000 and 500, value at INR 15.4 trillion (~US $220 billion) and constituting nearly 87% of the value of total notes in circulation – from the financial system (Government of India, 2016). This unprecedented move led to a big debate about the motivation behind and the consequences of such actions. The ever-shifting objectives included addressing the menace of black money and combating tax evasion, combating terrorism financing, undermining counterfeiters and reducing the cash in circulation. Subsequently, over 99% of the currency was returned to the Indian central bank, casting doubt on the very efficacy of the implemented policy.

The sudden announcement and the cash crunch over the subsequent several months created a massive disruption and threatened to derail the cash-heavy economy[3], as both the Government and the Indian central bank grappled with continuously evolving unforeseen challenges to steer the economy through this shock therapy.[4] As a result, a large segment of the Indian citizens shifted to using digital payments, with the total digital transactions aggregating 2600 million in November 2018, an increase of over 200% during the two-year period after demonetization; the total value of these transactions increased by over 100% to US $ 3.3 trillion during the same period (Government of India, Ministry of Electronics & Information Technology, 2018).

A whole host of studies have examined various consequences of the demonetization process, including among others, its impact on the macroeconomy (Chodorow-Reich et al., 2020), stock market (Dharmapala and Khanna 2019), on payment digitization (Agarwal et al., 2020) and domestic agricultural markets (Aggarwal and Narayanan, 2020). Others have explored the political consequences

[3] The cash-to-GDP ratio in India is typically in the range of 11-13%
[4] A total of 72 circulars (51 by Indian central bank, 21 by the government) were issued during the 50-day period from November 8 – Dec 30, 2016

of the demonetization process (Bhavnani and Copelovitch 2018). What has not been adequately addressed is the impact of demonetization on the banking sector.

To inform this debate, we examine the impact of demonetization on the banking sector. To be more specific, we address three questions. First, how did bank risk and returns evolve post-demonetisation? Second, did the response vary across bank ownership? And finally, how important was the role of bank capital and asset quality?

A focus on the banking sector is relevant for three reasons. First, the sector is the mainstay of financial intermediation: banking assets accounted for close to 90% of GDP during the post-2000 period. Second, the entire demonetisation was implemented through the banking sector, wherein banks had to accept the notes that were de-notified by the government and exchange it with fresh currency through branches and ATMs. Third and more broadly, the announcement was completely unanticipated. Most offices had closed by 8:00 PM when the Prime Minister caught the entire country off-guard by declaring that Rs.500 and Rs.1000 notes would cease to be legal tender after 11.59 PM. Within hours of the announcement, all major print, electronic and social media extensively highlighted the policy, focusing among others, its completely unanticipated nature and the challenges related to its implementation. This unique policy exercise offers a natural experiment and enables us to differentiate between an *announcement effect* which traces the behaviour of banks in the year of the announcement and an *implementation effect*, which delineates the response of banks over a medium-term horizon.

Our findings reveal that there was no discernible impact in terms of announcement effect. As compared, there was an implementation effect on bank returns and risk. The impact was pronounced for market-based measures, although there was no discernible impact on comparable accounting measures. As well, there was differential impact on public versus private banks and across banks with varying levels of capital and asset quality. We integrate the demonetisation impact with other equally relevant policy measures that were undertaken during this period, like the implementation of Goods and Services tax, and find evidence which supports that demonetisation overwhelmed these measures and dampened bank risk and raised returns.

Conventional economic theory posits situations when there is a deposit flight. Standard models (Diamond and Dyvbig, 1983) contend that while demand

deposits provide liquidity insurance, they make banks susceptible to runs. More broadly, the evidence suggests that weaker banks, defined in terms of their balance sheet fundamentals, are likely to experience greater deposit withdrawals during periods of distress (Gorton, 1988; Calomiris and Mason, 1997) which also acts as a form of discipline on riskier banks (Martinez-Peria and Schmukler, 2001; Maechler and McDill, 2006; Bennett et al., 2014).

However, the literature is much less forthcoming as to how banks respond when they are flushed with liquidity. On the one hand, higher deposits provide banks with cheap liquidity which enables them to extend loans and improve margins and profitability. In the event this is viewed as a credit positive by the market, there could be a dampening effect on bank risk. On the other hand, provided such liquidity permeates the entire banking sector, competition for market share could lead banks to compromise on lending standards so as to garner market share, leading to an increase in bank risk. As such banks in India are saddled with high levels of non-performing assets, which make them even more vulnerable. Which of these possibilities are likely to play out remains an open question?

These are relevant questions from the Indian standpoint for several reasons. First, the demonetization was the largest in the world. The magnitude of the process can be gauged because the de-notified currency notes accounted for nearly 87% of the total notes in circulation used by over 1.3 billion people. How this process impacted the banking sector, who were the main implementers of this strategy, has not been explored earlier. Second, there have been prior episodes of demonetization in India, in 1946 and 1978. However, both the scale and the scope of the present exercise were much larger in 2016, given that the economy has opened up significantly after the economic reforms of 1991. The availability of rich bank level data provides a unique opportunity to assess how this process impacted the banking sector. Finally, over the years, the government has sought to graduate the system towards a more digital economy by lowering the use of cash in large-value transactions. The demonetization exercise offered a one-shot opportunity to leapfrog towards a digitally driven society. Whether and to what did the process influence bank behavior remains to be explored.

The rest of the analysis unfolds as follows. In Section II, we provide an overview of the literature and place our contribution in this regard. Section III highlights the institutional setup of the banking sector in India. Contextually, we

also provide a background of the demonetization process that occurred in November 2016. Section IV outlines the data and key variables. This is followed by the empirical design and results, including robustness checks. The final section concludes.

II. Received Evidence

Our analysis makes several useful contributions. First and foremost, the analysis is a contribution to the modest literature on demonetization in India. Given that the process was implemented throughout the country, the empirical literature has exploited household, regional, or sectoral variations. In an early exercise, Chodorow-Reich et al. (2020) uncover a 2.5% decline in GDP during the quarter of demonetization; the effect gradually dissipated over time. Assessing the impact on the equity market, Dharmapala and Khanna (2019) report large gains in stocks returns of state-owned banks on the prospect of bigger deposit growth. Lahiri (2020) uncovers an increase in tax-to-GDP ratio consequent upon demonetization, cumulating close to US $420 million during 2017-19. Employing other measures of informality at the district level, such as – urbanization and banking access, Beyer et al. (2018) show that luminosity was lower during the demonetization quarter. Other studies have focused on either economic or political outcomes, typically in the short-run. Relatedly, several of these studies also explore the uptake of formal banking services, which was identified as one of the avowed objectives of demonetization. Thus for example, Karmakar and Narayanan (2020) examine the potential impact on income and consumption, whereas Bhavnani and Copelovitch (2018) focus on political outcomes. Agarwal et al. (2018) and Crouzet et al. (2020) document a significant increase in the use of digital technologies, post demonetization. Using longitudinal data, Chanda and Cook (2022) find that poorer households experienced large income increases in the 18 months following demonetization, highlighting the benefits that accrued to poor households with the pickup in online government transfers. Compared with the extant evidence, our research is broader in scope, in the sense that we focus on the impact on banks' risk and returns and the differential impact across ownership.

Second, our paper is a contribution to the area of natural experiment. To be more specific, we assess the "before-after" effects of a policy change. Studies have

examined the impact of changes in Sarbanes Oxley Act on risk-taking by US banks (Zhang, 2007) or the impact of credit market shocks, proxied by the Great Recession, on employment outcomes (Greenstone et al., 2020). Studies for other countries have also employed natural experiments to assess the potential impact of major policy changes on the outcome (Eberhart, 2012; Agarwal and Qian, 2014; Bose et al., 2021). In the Indian context, Besley and Burgess (2004) studies how the impact of the Industrial Dispute Act varied across real economic outcomes, in view of its differential stringency across states. Chemin (2012) exploited the implementation of a major court reform in 2002 to ascertain its real economic effects. Others have employed subsequent policy changes such as the impact of the SARFAESI Act, 2002 on corporate leverage (Vig, 2013), the effect of the Insolvency and Bankruptcy Code (IBC) on corporate behaviour (Bose et al., 2021) or even the impact of pandemics (Fenske et al.,2020) or impact of introduction of mobile phones (improved information) in the Indian state of Kerala on fisheries market (Jensen, 2007). The sudden announcement of the demonetization provides a natural setup to study the effect on the banking sector. Such an exogenous shock helps to circumvent the challenges involved in the estimation process owing to possible endogeneity concerns in the interlinkage between routine policy changes and bank behaviour.

Third, the paper is a contribution to the literature on bank ownership. In an influential paper, La Porta et al. (2002) showed that state ownership of banks is associated with lower GDP growth. The subsequent literature has explored the relevance of government involvement in banking in related contexts, including channels for politically-motivated lending (Dinc, 2005; Cole et al., 2009; Kumar, 2020), lending pro-cyclicality (Bertay et al., 2015; Brei and Schclarek, 2013), the behaviour of bank depositors towards state-owned banks during distress periods (Eichengreen and Gupta, 2013) or for transmitting the effects of monetary or even macroprudential policies (Morck et al., 2019; Mirzaei et al., 2021). In private banks, by ensuring clear separation between the principal and the agent, greater ownership concentration addresses agency problems and promotes governance discipline (Iannotta et al., 2013). We add to this literature by assessing on the differential impact of demonetisation across bank ownership.

III. Banking and demonetisation

III.1 Banking sector

The Reserve Bank of India is the regulator and supervisor of the banking and non-banking sector. Banks are required to report their audited annual returns in a uniform template, prescribed by the central bank. The financial space includes scheduled banks (commercial and regional) and non-banks.[5] The latter includes a whole array of shadow banks (formally termed as non-banking financial companies) and development banks. The total asset of these entities at end-2020 aggregated US $3.5 trillion or about 120% of GDP.[6] Within this, banks are the dominant market players, accounting on average for roughly 70% of financial system asset. The major players in this sector are state-owned banks with majority government ownership, domestic private banks (DPBs) and foreign banks. Following revised policy guidelines in 2017, newer entrants in the financial space include small finance banks and payments bank, whose asset share in banking sector has been around 1-2%.

The state-owned banks in turn comprises of State Bank of India (SBI) and its associates (these were banks constituted in former Indian princely states). Following a spate of mergers, several of these associates have been subsumed into SBI over time. In addition, there are nationalized banks which were created in the late 1970s and early 1980s after nationalization of major private banks. The smaller private banks, which escaped the nationalization are classified as old private banks. The newer banks which were licensed after the economic reforms of 1992 operate as new private banks. The presence of foreign banks is low (in terms of asset share), although they have significant presence (in terms of branches), primarily in urban areas of the country.

The changing dynamics of bank groups is reflected in the evolution of their market shares. Illustratively in 1991, just prior to the inception of financial reforms, state-owned banks dominated the banking space, accounting for 92% of commercial banking assets; private and foreign banks comprised the remaining. By 2020, the

[5] Scheduled banks are included in the Second Schedule of Reserve Bank of India Act, 1934. Every such bank enjoys liquidity support from the Reserve Bank of India and is eligible for membership of clearing house. In addition, there are certain cooperative banks, which are also scheduled. The asset mix of commercial and cooperative banks is in the ratio of 9:1. We do not consider scheduled cooperative banks owing to data limitations.

6 The financial year in India is April-March. Thus, the year 2003 covers the period 2002 (April)-2003 (March).

share of state-owned banks has declined to 65%. New private banks have filled this void, reflected in an improvement in their asset share from 1% in 1995 (their first year of operations) to 25% by 2020. Foreign banks asset share has averaged 7% during this period, while the new players and some regional banks constitute the remaining.

III.2 The demonetization process

On November 8, 2016 at 8:00 PM Indian Standard Time, the Prime Minister gave an unscheduled television address to the nation where he informed that effective midnight, INR 500 (~USD 8) and 1000 (~USD 16) notes would no longer be legal tender. Four official reasons were given behind this move: control corruption, curb the funding of terrorist activities, address the menace of tax evasion and black money and finally, fast-forward the move towards a less-cash and digitally-driven economy (Chandrasekhar and Ghosh, 2018).

What followed therefore were a set of policy announcements by the Ministry of Finance and the Indian central bank as to how the process would be regulated. November 9 was declared as a bank holiday for the system to adjust and the ATMs and bank branches to be provided with new specified bank notes (SBNs). Effective November 10 when the financial system re-opened to the public, restrictions were imposed on both withdrawals and depositing money with banks. In terms of the former, the initial limit was placed at Rs.4000 per day from respective bank account, subject to a weekly limit of Rs.20,000 (Notification 2016). This overall limit was gradually raised to Rs.50,000 and lifted altogether by mid-March 2017. Concurrently, limits were also imposed on withdrawals from ATMs, initially at Rs.2000 per day and increased gradually therefore, before being totally eliminated on February 1, 2017. In terms of deposits, threshold was placed beyond which deposits were subject to a steep tax rate (30% on an amount exceeding US $4,000, along with an additional penalty).

Incidentally, this is the second time post-independence that India has undertaken a demonetization exercise, the last one being in 1978. However, during the previous episode, large proportion of people were outside the ambit of formal banking and less than 20% of the cash was absorbed. As a result, the impact was minimal. Combined with its surprise and sudden nature, this provided the bedrock for large scale economic disruption.

Prior to the announcement on demonetization, the Indian Government had instituted various amnesty schemes to tackle the black money menace. To illustrate, during 2014-19, the government had instituted five amnesty schemes. The total amount garnered under these schemes aggregated Rs.485 bn (≈US $6.5 bn), pointing to the lukewarm response. Against this backdrop, it was increasingly perceived that measures were needed to control corruption and rein in the spread of big-ticket cash transactions (Debroy and Bhandari, 2011, Colvin, 2011). Viewed from this standpoint, the demonetization process appear to have been in the making for quite some time. Indeed, prior to the demonetization, the government had made substantial effort to financially integrate people through the JanDhan-Aadhaar-Mobile (JAM) trinity by facilitating them to open bank accounts (*JanDhan*), along with biometric identity (*Aadhaar* card) and linking the account to the person's mobile number. All these steps helped to lay the groundwork for demonetization.

From a macroeconomic standpoint, the policy had a cataclysmic effect on the monetary management of the Indian central bank. Constraints emerged due to the limited printing of new notes, contracting the currency in circulation whereas the denotification of SBNs led to a swelling of bank deposits. Reflecting this fact, aggregate deposits increased by nearly Rs.6000 billion during October 2016 to February 2017, a record of sorts for a four-month period. To manage this surplus, the Indian central bank initially absorbed the excess liquidity initially through reverse repo auctions of varying maturities and later by applying Cash Reserve Ratio (i.e., the portion of deposits banks maintain with the central bank) on the incremental amount. As a result, banks were paying interest on their deposits to the consumers, but the reserves they held did not earn interest. Subsequently, as the volume of resources surged, the Indian central bank floated Cash Management Bills (CMBs) to absorb the excess liquidity. This surplus liquidity was manifest in a halving of the deposit cost (from 7% to 3% during November 2016-March 2017) and relatedly, a decline in the median lending rate of banks by close to 70 basis points in March 2017.

IV. Data and variables

To investigate the impact of demonetization on bank behavior, we construct a detailed database of commercial banks for 2010-2020. The data includes 45 banks,

which includes state-owned and domestic private banks. The asset share of these banks averaged around 90% of commercial bank asset during this period.

Data on banks' balance sheet and profit and loss statements are extracted from *Statistical Tables Relating to Banks in India*, a yearly publication of the Indian central bank, supplemented by *Report on Trend and Progress of Banking in India*, an annual statutory publication on the financial sector.[7]

Using these two databases, we extract information on the relevant variables. These include among others, total asset, equity, fee income and operating expenses. The banking industry also witnessed several consolidations during this period, which we account for in the empirical framework. The bank-level variables are all winsorized at the 1 and 99 percent levels. We have data on 1260 bank-years at an average of 20 years of observations per bank.

We employ four measures of risk and returns, one each on the accounting and market sides. In the empirical analysis, we focus on market-based measures. These include Tobin's Q as a measure of returns and SRISK as a measure of risk. The SRISK measure is calculated using the following equation:

$$SRISK_{b,t} = k\,Debt_{b,t} - (1-k)\,(1 - LRMES_{b,t})\,Equity_{b,t} \qquad \textbf{(1)}$$

where k is the prudential level of book equity to asset (set equal to 8%, following Brownlees and Engle, (2017), LRMES is the long-run marginal expected shortfall (which is the expected loss over a 6-month period under a crisis scenario).[8] We obtain this measure for each bank-year from V-Lab (the volatility laboratory at New York University that provides real-time measurement and forecasting of financial volatility and correlations across a wide spectrum of assets).[9] We scale this variable by the respective bank's market capitalisation during the year (Berger et al., 2022). This measure is termed NRISK: it shows the proportional increase in capital that a bank would need during distress periods.

The accounting measures of return and risk include Return on Asset (RoA) and Z-score as a measure of insolvency risk. Both these measures have been widely employed in the literature (Laeven and Levine, 2009; Lepetit and Strobel, 2013;

[7] The year 1996 corresponds to the period 1995 (April 1) - 1996 (March 31), and similarly for the other years.

[8] LRMES=1- exp(log(-18*MES)), where $MES = \frac{1}{N.days}\sum_{\tau=1}^{\tau^*} R_{b,\tau}$ and R is daily returns of the bank.

[9]This statement is taken from V-Lab website [Available at [http://vlab.stern.nyu.edu/about]

Albertrazzi and Gambacorta, 2009; Boutavier et al., 2018; Hafeez et al., 2022; Junttila and Nguyen, 2022).

Our key independent variable is demonetization. To segregate between the announcement and implementation effect, we categorize the post-demonetization phase into three sub-periods: *Post 1,* which reflects the year of demonetization (i.e., 2017), *Post 2* and *Post 3*, being the period one and two year after demonetization, respectively.

We include several bank-level controls. These include bank size to address potential scale economies, equity-to-asset to control for funding structure, non-performing loan ratio to account for asset quality, fee income to total asset to control for differences in banks' income mix and finally, cost-to-income ratio to account for operating efficiencies. Larger banks can take higher risks, supportive of a positive relationship (Laeven et al., 2014). Banks with lower equity capital are likely to have less stable funding and therefore, more prone to risk-taking, consistent with the charter value argument (Hellmann et al., 2000; Laeven et al., 2014). Higher income diversity permits banks to tolerate lower risk, because of multiple sources of revenue. Finally, banks with higher cost-to-income are more susceptible to risk-taking in order to compensate for operating inefficiencies.

Over and above, we control for non-standard reporting months (which are primarily applicable for private banks which became operative at different time points) and dummy in the year of merger for the acquiring bank.

Table 1 enlists the variables and their summary statistics. Mean levels of bank profits is very low at 0.3% and the accounting risk is 3.56. Corresponding market measures as denoted by TobinsQ is 2.35 while systematic risk value is 12.19. Average lending rate was close to 10% and the funding cost around 7%.

The natural logarithm of bank asset (LTA) has an average value of 16.1, equity comprises 12% of asset and loan delinquency levels are fairly high. Efficiency parameters as measured by the ratio of bank fees to assets (Fee) is 1% while the cost to income ratio (CIR) seems to be high at around 47% for an average bank in the sample period. Three-fifths of the sample banks are state owned.

INSERT TABLE 1

Table 2 reports the correlation matrix for the key variables. Without loss of generality, POST bears a statistically significant association with all dependent

variables, with the magnitude being 14% with risk and -11% with Tobin's Q. This would suggest that demonetization raised risk and lowered returns. The correlations are statistically and significantly higher when accounting measures of risk and return are taken on board. These correlations do not onboard the economic environment or bank-level factors. We therefore resort to an econometric approach to better ascertain the impact.

INSERT TABLE 2

IV. Empirical design

To examine the impact of demonetisation on bank behaviour, for bank *b* at time *t,* we employ the following empirical specification:

$$y_{bt} = \eta_t + \alpha_1 (POST1_t * SOB_{bt}) + \alpha_2 (POST2_t * SOB_{bt}) + \alpha_3 (POST3_t * SOB_{bt}) + \beta (Trend_t * SOB_{bt}) + \gamma \boldsymbol{X}_{bkt-1} + \nu_b + \varepsilon_{bt} \quad \textbf{(2)}$$

In (2), the outcome variable (*y*) is either market-based or accounting measure of risk or returns; η_t are year effects to help control for differences in the timing and/or magnitude of shocks over time, *v* captures bank fixed effects and ε is an idiosyncratic error. The interaction – *Trend*SOB* – captures any potential trend in the outcome variable that is not directly accounted for in the regressions.

SOB is a dummy that equals one if a bank is state-owned, else zero. Our focus coefficients are the **α**'s: α_1 shows the differential response of state-owned banks consequent upon the announcement of demonetisation, whereas α_2 and α_3 identify the implementation effect. A statistically significant coefficient on α would provide evidence in support of these two effects. Across models, standard errors are clustered by bank (Bertrand et al., 2004).

The above represents a difference-in-differences (DiD) specification: it teases out the response of state-owned banks (treated group) consequent upon the demonetisation process on the response variable as compared with their private counterparts (control group).

V. Results and Discussion

V.1 Main findings

Table 3 reports the key findings. In all cases, we first do not include the control variables but include them subsequently. As Angrist and Pischke (2008) note, this helps to clearly understand the possible variation in the response variable that is not affected by confounding variation in the other variables.

In column 1, the coefficient on POST1*SOB bears a point estimate of 3.44 and is significant statistically. This suggests that the *announcement effect* of demonetisation was a nearly four-fold increase in the market valuation of state-owned banks. The *implementation effect* one year after demonetisation bears a coefficient of 7.62 and therefore, even after one year of demonetisation, state-owned banks continued to command higher market valuation compared with their private counterparts. From the economic viewpoint, the stock market perceived that the surge in deposit and that too, at a low cost would primarily accrue to state-owned banks, enabling them to raise lending and generate higher margins. Reflecting such considerations, the manifestation of these perceptions was an increase in bank valuation. Inclusive of bank-level controls, the announcement effect loses its significance. Our most preferred specification is column 3, which includes the entire set of control variables, including time trend. In this case, the *implementation effect* one year after demonetisation equals 7.6 (although it is significant at the borderline) and as a result, the market perceived a significant and lagged positive impact of the demonetisation on bank valuation.

The next three columns focus on RISK. In the most preferred specification (column 6), the coefficient on POST3*SOB is statistically significant. Based on the point estimate, we can infer that there was a nearly 10% decline in the riskiness of state-owned banks. From an economic standpoint, the higher deposit accrual – primarily for state-owned banks - improved their funding position and lowered funding costs by over 300 percentage points. Even after lowering lending rates, this enabled them to maintain significant spreads and relatedly, profitability. This helped augment their capital position, which the market perceived as a 'credit positive'. As a reflection, their riskiness declined.

Collectively, the results point to the fact that demonetisation improved valuation and lowered riskiness of state-owned banks.

INSERT TABLE 3

V.2 Accounting measures of risk and returns

Table 4 repeats the previous analysis, except for the fact that the focus is on accounting measures of risk and returns. The most preferred specification for these variables (columns 3 and 6), which controls for potential trend as well as banking controls including other relevant effects. The findings affirm that demonetisation had no perceptible impact on accounting measures of risk and returns. What this would suggest is that neither the *announcement* nor the *implementation effect* entailed any significant impact on the profitability or risk of state-owned banks, possibly because its impact was expected to be temporary. This is also evidenced from the fact that the magnitude of the coefficient erodes over time. The monetary management measures by the Indian central bank also lowered these banks' lendable resources, negating any improvements in profitability or risk metrics in the longer-run.

INSERT TABLE 4

V.3 Banks with differing capital and NPL levels

It is possible to argue that the *announcement* and *implementation effect* would likely differ across banks, depending on their capital and asset quality status. To be more specific, banks with adequate capital might not have any significant *incremental* use of the windfall resources, since their funding base already permits adequate lending activity. In such a case, the additional resources might only serve to improve their market valuation and lower their riskiness further. In contrast, banks with weaker asset quality might be inclined to employ these resources to shore up lending in order to improve margins and raise provisioning.

To investigate this further, we analyse the impact of demonetisation on these two categories of banks. In particular, we estimate equation (1) as above, separately for banks with high *versus* low capital and likewise, for banks with high *versus* low asset quality. The variables *high* and *low* are defined based on in-sample median: banks with capital higher than in-sample median are categorised as having high-capital, the rest are classified as low-capital banks. Likewise, banks with higher than in-sample median NPL are categorised as high NPL banks, the others are classified as having low NPL. In essence, this represents a difference-in-differences-in-differences (DiDiD) strategy: it analyses the response of state-owned banks (first difference) with varying levels of capital and non-performing loans (second

difference) in response to the demonetisation (natural experiment). **Table 5** sets out the coefficients on the key variables.

INSERT TABLE 5

Three findings are of relevance. First and more generally, the impact was manifest primarily in regard to capital, there was no discernible impact on non-performing loans. Second and more specifically, the impact on capital was evidenced mainly for high-capital banks, the impact on banks with low capital was at best, muted.

In terms of specifics, the coefficient on *POST1*SOB* equals 8.54 and *POST2*SOB* equals 15.42, indicating both an *announcement* as well as an *implementation effect* of the demonetisation for high capital state-owned banks. From a statistical standpoint, there was an 8.5 times immediate improvement and a 15 times improvement after one year, in the market valuation of well-capitalised state-owned banks. Intuitively, the market expected most of the windfall resources to get deposited in these well-capitalised state banks, raising their market valuation on an immediate as well as long-term basis. The higher capital would also likely lower their systemic risk as reflected in the large magnitude of the coefficient on RISK in column 5.

For low capitalised banks, there was no noticeable impact on their capital; on the contrary, there was an increase in risk, suggesting that the low capital and the *perceived* imprudent credit extension driven by the additional resource inflow raised their systemic risk even further.

To sum up, the evidence shows that demonetisation exerted a differential impact on state-owned banks depending on their capital position, although there was no differential impact in terms of their asset quality.

V.4 Impact on deposit and lending rates

If accounting measures of bank profitability and risk metrics are not impacted by demonetisation, it appears likely that their lending and deposit rates would also be unaffected in the process. To test this, we rerun our baseline specification, except for the fact that our dependent variables are deposit rates and lending rates. To account for any potential differential impact for well-capitalised and low loan delinquency banks, we present the findings separately by their capital

and NPL position. The findings reveal that there was no significant change in deposit rate of adequately capitalised state-owned banks, although low-capitalised banks raised their deposit rates, presumably on expectations of garnering additional resources driven by the demonetization windfall and perhaps increase lending. As earlier, there is no impact on deposit rate for banks with varying asset quality.

Lending rates on the other hand were by and large, unaffected since banks anyway garnered windfall resources at cheap rates, which even with unchanged lending rates, would ensure adequate margins. All in all, the evidence suggests no noticeable impact on deposit and lending rates of banks, consequent upon the recapitalisation exercise.

INSERT TABLE 6

VI. Robustness

VI.1 Impact of other contemporaneous measures

Policies rarely take place in isolation in an ideal world. Driven by domestic exigencies, India implemented a goods and services taxes (GST) in 2018, just one year after the demonetisation. From an accounting standpoint, GST was a five-tiered indirect (consumption) tax on the supply of goods and services, which replaced the erstwhile multiple tax rates imposed earlier. Accordingly, a dummy variable (GST) is included which equals one for the years 2018 through 2020, else zero. In the baseline model, we include the interaction term GST*SOB, in addition to the variables already included earlier. This enables us to understand which of the two major policies - demonetisation or GST - impacted bank behaviour. In effect, the interactive term GST*SOB indicates its impact on the risk and returns profile of state-owned banks, over and above the demonetisation effect. The estimates of the key coefficients are presented in **Table 7.**

INSERT TABLE 7

The results clearly show that GST exerted no discernible impact on bank risk and returns; on the contrary, the coefficient on POST*SOB was statistically significant across all specifications, indicating that the impact of demonetisation overwhelmed that of GST in explaining bank behaviour.

V1.2 Regulatory impacts on demonetisation

An equally compelling question is how did the impact on bank financials consequent upon the demonetisation impact/ interact with the balance sheet of the Indian central bank. Within a fortnight of the demonetisation episode, the central bank increased the Cash Reserve Ratio on *incremental deposits* to absorb part of the excess liquidity. This was valid for a couple of months, before being finally withdrawn effective December 10, 2016. Somewhat parallel with this measure, the RBI announced that the oil bonds issued by the government were made eligible for Repo transactions effective November 28, 2016, in effect, therefore, providing another possible way to mop up the initial excess liquidity. These policy decisions manifest in the currency in circulation which declined by INR 2 trillion between 2016 and 2017.

We assess the potential impact of the demonetisation on the central bank vs. commercial bank balance sheet within our econometric framework. Towards this end, we create a new variable CUR defined as the difference in currency in circulation between two successive periods, scaled by total RBI asset in the initial period, in order to circumvent potential endogeneity concerns. We interact this variable with time dummies for policy intervention of demonetisation as earlier and ascertain the response.

Results are set out in Table 8 for each of the market-related and accounting measures of bank risk and returns, first without onboarding the impact on state-owned banks and including it subsequently. The results show that the regulatory effects are stronger that the demonetisation effects with significant coefficients. The immediate effect of regulatory pronouncements is positive, significant and muted while later in 2018, the impact on Tobin's Q is negative and subsequently the effect of regulatory pronouncements increased in magnitude. Even after the introduction of policy intervention of demonetisation as captured by the interaction term of POST and state-owned banks (the 'treated' group), the effect of RBI's regulatory pronouncement lingered.

INSERT TABLE 8

In case of Tobin's Q (market valuation), there is an immediate (announcement) effect of RBI's actions, leading to an increase in market valuation of banks, which overwhelms the impact on public banks (column 2). The implementation effect, which kicks in during the next several years shows that the liquidity absorption initially led to a decline in Tobin's Q and an increase thereafter, as the market "understood" the positive impact of the RBI's actions (for example, mopping up excess cash so as to rein in potential inflation), bank's market valuation initially spiked (560.33) and then tapered down to more manageable levels (247.3), roughly half of the previous.

The results for market risk mirror inversely to those of market valuation. The initial announcement effect on market risk is not significant but declines (lower risk) and increases (higher risk) thereafter during the implementation phase only to subsequently decline significantly thereafter (410.84) as the market perceives the regulatory pronouncement in a more nuanced manner. The perception of market risk presumably consistent with the logic that higher funding base of banks would improve their capital base and lower risk profile. As pointed out earlier, the market responses overwhelm the bank-level impact, supportive of the strong policy interventions in the aftermath of demonetisation that outweighed the bank-specific response.

To sum up, this exercise shows that regulatory policy initiatives exerted an overbearing impact and dominate the usual policy intervention of demonetisation.

VI.2 Checking for parallel trends

The DiD methodology employed exploits longitudinal data for a cross section of banks by segregating into control and treatment groups to derive an appropriate counterfactual to estimate a causal effect. The treatment group comprising of SOBs are likely to be differentially affected by the policy intervention of demonetisation. For the estimates to be unbiased, the technique relies on the fact that in the absence of treatment, the unobserved differences between treatment and control group remain unaltered over time. For this condition to be satisfied, the estimation process requires that the treated and control groups have parallel trends in outcome.

INSERT TABLE 9

To implement this, two dummy variables denoting years prior to the intervention and another two dummy variables denoting years after the intervention are created. PRE1(=1 for year 2014) and PRE2(=1 for year 2015) are prior dummies, whereas POST1(=1 for year 2017) and POST2(=1 for year 2018) are post dummies. The dummy variable Demon (=1 for year 2016) refers to the year of demonetisation. Regression results in **Table 9** show that except for the Demon dummy, all the other prior and post dummies are not significant with respect to valuation and risk respectively. In essence, this means that after controlling for the intervention year and other factors, there appears no significant difference (intercept) between the prior and post demonetisation phases. Similarly, the interaction term of prior and treatment group (Treated) for both the dependent variables is not significant.

However, the interaction term of the intervention year (Demon) with the treatment group dummy (Treated) as well as post dummies (POST1 and POST2) with the treatment group dummy (Treated) are highly significant. Therefore, it may be inferred that the perceptible difference in the market valuation and market risk for the treatment group (Treated) post demonetisation are not contaminated by other factors after controlling for the fixed effects and controls. This confirms the requirements for parallel trends for the DiD estimates to be free of biases.

VII. Concluding remarks

Using disaggregated data on Indian banks, the paper employs the natural experiment of demonetisation to examine the impact on bank risk and returns. Within a difference-in-difference framework, the findings reveal an increase in market valuation and a decline in risk of state-owned banks. This evidence is consistent with prior research which shows that during episodes of uncertainty, state-owned banks become a preferred vehicle for investors, presumably owing to the implicit government guarantees (Acharya and Subramanian, 2012; Acharya and Kulkarni, 2013). Robustness checks reveal that these findings differ across risk and returns measures as also for banks with differing capital and asset quality status.

The findings in the paper lend themselves to several policy implications, First and foremost, during periods of distress, it might be useful to focus on fast-moving (forward looking) and market-based measures of risk and returns, which holds greater reliability as opposed to accounting (or, relatively backward-looking) indicators. Second, the response of banks to unforeseen events needs to make a distinction between the immediate impact (or, announcement effect) and the medium-term impact (or, implementation effect), since the latter onboards several challenges that the system might be confront with in the interim. This helps to provide a clearer picture of whether and how far the impact is immediate and to what extent does it percolate over the medium-term. And third, notwithstanding the high focus on banks' loan quality, the importance of capital often dominates asset quality concerns, especially when market-based risk-return matrices are concerned.

It is possible to extend the ideas presented in several directions. For instance, how far did the additional resource gain to banks get utilised in extending loans and to which sectors? Which corporates benefitted the most from the process: business

group entities or private entities? Apart from capital and non-performing, what other risk and return metrics of state-owned banks influence the behaviour of investors? Addressing these questions can help to inform the policy debate in a more comprehensive fashion, in turn, providing a more holistic assessment of how demonetisation shaped bank behaviour.

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Table 1: Variable definition and summary statistics

Variable	Definition	N	Mean (SD)	p.25 (p.75)
Dependent				
RoA	Net profit/ Total asset	452	0.003 (0.011)	0.001 (0.010)
TobinsQ	(Market value of equity + book value of debt)/ Total asset	406	2.355 (9.067)	0.100 (0.919)
Ln(1+z)	Z=(RoA+Equity/ Asset)/ SD(RoA), where SD(RoA) is the standard deviation of RoA for the years t-2, t-1 and t	364	3.565 (1.297)	2.592 (4.436)
RISK	Systemic risk measure developed by Acharya et al. (2012) and refined by Brownless and Engle (2017) normalised by the bank's market capitalisation	401	12.199 (14.564)	0.531 (19.682)
DEPRT	Interest paid on deposits/ Total deposits	452	0.065 (0.009)	0.056 (0.072)
LENDRT	Interest earned on loans/ Total loans	452	0.096 (0.013)	0.087 (0.104)
Independent: Bank level				
LTA	Ln (Total asset, deflated by price index)	452	16.118 (1.102)	15.475 (16.800)
CRAR	Capital adequacy ratio/ Risk weighted asset	453	0.128 (0.022)	0.110 (0.140)
NPL	Non-performing loans/ Total loans	452	0.059 (0.057)	0.020 (0.077)
Fee	Fee income/ Total asset	452	0.010 (0.004)	0.008 (0.012)
CIR	Cost-to-income, i.e., Total expenses/ (Total income – interest expense)	452	0.471 (0.118)	0.401 (0.505)
Independent: Others				
ARM	Dummy=1 if annual reporting months for a bank is different from 12, else zero	495	0.004 (0.063)	0 (0)
Merger	Dummy=1 for the acquirer bank in year of merger, else zero	495	0.006 (0.077)	0 (0)
POST	Dummy=1 for the years 2017-2019, else zero	495	0.364 (0.482)	0 (1)

Table 2: Correlation matrix of key variables

	POST	TobinsQ	RISK	RoA	Ln(1+z)	DEPRT	LENDRT
POST							
TobinsQ	-0.109***						
RISK	0.139***	-0.198***					
RoA	-0.487***	0.152***	-0.497***				
Ln (1+z)	-0.382***	0.134***	-0.461***	0.821***			
DEPRT	-0.419***	-0.115***	0.042	0.113***	0.254***		
LENDRT	-0.322***	-0.098***	-0.119***	0.132***	0.255***	0.816***	

***p < 0.01; ** p< 0.05; * p< 0.10

Table 3 : Main results

	RISK					
	(1)	(2)	(3)	(4)	(5)	(6)
POST1*SOB	3.44**	3.55*	3.07	3.19*	-1.07**	-0.89
	(1.64)	(1.92)	(2.13)	(1.90)	(3.25)	(3.29)
POST2*SOB	7.62**	7.75**	7.62*	6.53**	0.991	-0.24
	(3.33)	(3.58)	(3.98)	(2.55)	(4.15)	(3.87)
POST3*SOB	3.25	3.42	2.52	-2.49	-9.37**	-9.03*
	(2.07)	(2.67)	(2.65)	(2.34)	(4.57)	(4.66)
Trend*SOB		-0.032	-0.01		1.33**	1.13*
		(0.35)	(0.33)		(0.62)	(0.68)
Bank controls	N	N	Y	N	N	Y
Bank FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N.Obs	406	406	402	401	401	400
Adj. R-sq.	0.259	0.257	0.256	0.664	0.677	0.69

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10

Table 4: Main results – Alternate measures of returns and risk

Variable	Ln(1+z)					
	(1)	(2)	(3)	(4)	(5)	(6)
POST1*SOB	-0.006**	-0.004**	0.001	-0.904**	-0.701*	-0.164
	(0.002)	(0.003)	(0.001)	(0.388)	(0.404)	(0.341)
POST2*SOB	-0.01***	-0.007***	-0.0002	-0.726**	-0.434	0.207
	(0.002)	(0.002)	(0.001)	(0.28)	(0.323)	(0.302)
POST3*SOB	-0.01***	-0.006	-0.003	-0.832***	-0.447	-0.342
	(0.003)	(0.004)	(0.002)	(0.317)	(0.379)	(0.319)
Trend*SOB		-0.0007*	0.0003		-0.095*	-0.014
		(0.0003)	(0.0002)		(0.047)	(0.041)
Bank controls	N	N	Y	N	N	Y
Bank FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N.Obs	452	452	452	364	364	364
Adj. R-sq.	.626	.633	.857	.545	.55	.677

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10

Table 5 : Demonetisation, bank return and risk – DiDiD specification

Variable	TobinsQ				RISK			
	Hi CRAR	Low CRAR	Hi NPL	Low NPL	Hi CRAR	Low CRAR	Hi NPL	Low NPL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST1*SOB	8.544*	.597	3.377		-9.943**	6.917	0.067	
	(4.633)	(.993)	(5.001)		(4.83)	(5.426)	(4.986)	
POST2*SOB	15.42*	5.739	11.462		-9.357	14.804*	5.733	
	(8.537)	(3.674)	(7.055)		(5.752)	(7.678)	(5.469)	
POST3*SOB	4.738	-0.195	1.811		-12.664**	11.514	0.522	
	(4.683)	(1.44)	(3.49)		(5.05)	(9.249)	(6.376)	
Trend*SOB	0.27	0.088	0.214		2.221**	-1.084	-0.903	
	(.512)	(0.254)	(0.676)		(.979)	(1.167)	(1.189)	
Bank controls	Y	Y	Y		Y	Y	Y	
Bank FE	Y	Y	Y		Y	Y	Y	
Year FE	Y	Y	Y		Y	Y	Y	
N.Obs	186	216	204		188	212	203	
Adj. R-sq.	0.208	0.142	0.2368		0.743	0.608	0.591	

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10

Table 6. Impact on deposit and lending rates

Variable	Deposit Rate				Lending Rate			
	Hi CRAR	Low CRAR	Hi NPL	Low NPL	Hi CRAR	Low CRAR	Hi NPL	Low NPL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
POST1*SOB	.002	0.0013	-0.0006		-0.0009	0.0058	0.0013	
	(0.0017)	(0.0017)	(0.0012)		(.0027)	(0.0031)	(0.0026)	
POST2*SOB	.0006	0.0049**	0.0011		-.0016	0.0081	0.0007	
	(.0019)	(0.0019)	(0.0016)		(.0026)	(0.0025)	(0.0027)	
POST3*SOB	.0016	0.0007	0.0002		0.0039	0.0076	0.0036	
	(.002)	(0.002)	(0.0015)		(.0039)	(0.0032)	(0.0023)	
Trend*SOB	.00002	-0.0007*	0.0001		-.001*	-0.0022	-0.0007	
	(.0002)	(0.0003)	(0.0003)		(0.0004)	(0.0004)	(0.0003)	
Bank controls	Y	Y	Y		Y	Y	Y	
Bank FE	Y	Y	Y		Y	Y	Y	
Year FE	Y	Y	Y		Y	Y	Y	
N. Obs	207	245	225		207	245	225	
Adj. R-Sq.	.853	.857	.885		.837	.771	.795	

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10

Table 7: Demonetisation vs. GST – Which dominates?

Variable	TobinsQ	RISK	ROA	Ln(1+z)
POST*SOB	3.865**	3.151*	-0.0069***	-0.948**
	(1.725)	(1.764)	(0.002)	(0.39)
GST*SOB	0.902	-1.954	-0.001	0.29
	(1.673)	(2.979)	(0.003)	(0.402)
Bank FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
N.Obs	406	401	452	364
Adj. R-sq.	.261	.66	.621	.544

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10

Table : 8 Regulatory Impacts on Demonetisation

Variable	TobinsQ		RISK		ROA		Ln(1+z)	
POST1*CUR	64.91** (20.76)	71.02** (22.39)	-4.44 (13.65)	-2.506 (12.95)	-.004 (.007)	.003 (.008)	-.703 (2.191)	-1.321 (2.414)
POST2*CUR	-96.09** (37.50)	-104.18** (38.51)	46.11* (25.43)	42.06* (25.42)	-.010 (.009)	-.012 (.009)	1.35 (3.97)	1.15 (4.00)
POST3*CUR	573.82** (252.46)	560.33** (259.67)	-433.75** (194.88)	-410.84** (194.98)	.033 (.079)	.046 (.078)	-12.88 (26.86)	-11.41 (27.11)
POST4*CUR	253.87** (126.71	247.34* (130.64)	-39.28 (114.14)	-35.21 (117.08)	.015 (.048)	.013 (.047)	-6.15 (12.54)	-6.394 (12.69)
POST1*Treated		2.84 (1.94)		.674 (2.578)		.002* (.001)		-.256 (.339)
POST2*Treated		7.35* (3.93)		2.718 (2.884)		.001 (.001)		.113 (.283)
POST3*Treated		2.53 (2.43)		-3.267 (3.334)		-.001 (.002)		.113 (.283)
POST4*Treated		3.19 (2.33)		.611 (7.301)		.003 (.002)		-.410 (.280)
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	N	N	N	N
N.Obs	402	402	400	400	452	452	364	364
Adj. R-sq.	.209	.21	0.662	0.6609	0.855	0.857	0.669	0.668

Robust standard errors (clustered by bank) in brackets. ***, ** and * denote statistical significance at 1, 5 and 10%, respectively

Table 9: Testing for parallel trends

Regressors	Tobin's Q	RISK
PRE 2	Omitted	Omitted
PRE 1	-0.893	2.287
	(2.257)	(2.232)
DEMON	12.990***	4.208*
	(5.533)	(2.524)
POST 1	-2.785	3.339
	(2.394)	(3.268)
POST 2	-5.957	12.653***
	(4.213)	(5.214)
PRE 2* Treated	Omitted	Omitted
PRE 1* Treated	1.715	4.844
	(2.049)	(3.723)
Demon* Treated	-13.049***	15.688***
	(5.239)	(2.536)
POST 1* Treated	0.516	5.939***
	(1.700)	(2.351)
POST 2* Treated	4.994	7.496***
	(3.631)	(2.685)
Bank controls	Y	Y
Bank FE	Y	Y
Year FE	Y	Y
N.Obs	402	400
Adj. R-sq.	0.3035	0.7053

Robust standard errors (clustered by bank) in brackets
***p < 0.01; ** p< 0.05; * p< 0.10