Unearthing Zombies

Abstract

Bankruptcy reforms that improve lenders' ability to recover claims from financially distressed borrowers can mitigate zombie lending. However, we show that after a 2016 bankruptcy reform in India, lenders are reluctant to recognize zombie credit as non-performing, impeding reform efficacy. A subsequent complementary regulation targeting lender discretion in recognizing non-performing assets improves zombie recognition five-fold. The lender disincentive to recognize zombies arises from undercapitalized banks' reluctance to realize loan losses and political economy frictions at state-owned banks. Resolving zombie credit allows lenders to redirect credit to healthy borrowers but effects are muted at banks more exposed to zombie borrowers.

Recent evidence suggests that the proliferation of 'zombie' borrowers — insolvent firms kept afloat solely through repeated extensions of credit by complicit lenders — is associated with weak insolvency regimes (Andrews and Petroulakis, 2019; Becker and Ivashina, 2022; Jordà et al., 2022). Improving debt resolution mechanisms through bankruptcy reform is therefore a possible policy solution to mitigate zombie lending. Bankruptcy reforms that improve lender ability to recover claims from financially distressed borrowers (La Porta et al., 1997), particularly zombie borrowers, also have positive economy-wide spillover effects (Li and Ponticelli, 2021). For bankruptcy reforms to work, however, they need to be effective (Ponticelli and Alecnar, 2018).

Our paper has two objectives. First, motivated by the previous work that suggests that zombie lending arises from weak debt resolution, we analyze how bankruptcy reforms address zombie lending. Second, we highlight a unique hindrance to bankruptcy reform efficacy: lender reluctance to pursue preexisting delinquent borrowers, particularly zombie borrowers.

Using a new supervisory database on borrower repayment history, we exploit a unique experimental setting in India. Following a protracted banking crisis since the late 2000s that saw a steady build-up of stressed assets, the Indian government implemented the Insolvency and Bankruptcy Code (IBC) in 2016 with the goal of improving distressed debt resolution. Though the IBC was a major overhaul of the bankruptcy system, lender take-up was limited. In response to this issue, the Reserve Bank of India (RBI) — India's central bank and bank regulator — unexpectedly issued a complementary set of guidelines on February 12th, 2018 ("Feb. 12th", henceforth) that removed lender discretion in recognizing delinquent loans as non-performing.

Our unique setting allows us to identify two distinct elements of bankruptcy reform. Consider the debt resolution process. First, once a borrower is delinquent on a loan for more than 90 days, a lender recognizes it as non-performing (*bad loan recognition*). Second, a non-performing asset enters the debt resolution process, and is restructured or

liquidated (*judicial resolution*). Previous work has tackled the second step, that is, judicial enforcement at bankruptcy courts (Ponticelli and Alecnar, 2018). Media and policy reports at the time of the IBC also focused on the lack of judicial infrastructure (Economic Survey, 2021; Financial Express, 2021), ignoring lender disincentives in pursuing delinquent borrowers through bankruptcy as an additional limiting factor. We highlight the importance of the first step by analyzing the impact of the IBC and Feb. 12th on lender recognition of zombie borrowers as non-performing.

Following reform, if lender payoffs from bankruptcy increase substantially, then at the margin, lenders would prefer to liquidate or restructure through bankruptcy rather than continue lending to zombie borrowers. However, we hypothesize that bankruptcy reforms can have limited results if some lenders continue to be unwilling to recognize zombie borrowers as delinquent. For example, undercapitalized banks might delay recognition in order to avoid having to provision for loan losses on their balance sheets (Peek and Rosengren, 2005) or state-owned banks might face political interference (Qu, 2018). Merely comparing outcomes before and after a bankruptcy reform runs the risk of conflating limitations due to lack of judicial enforcement (or alternatively ineffective reform that does not substantially change recovery rates) with inefficiencies due to limited bad loan recognition, providing an incomplete accounting of policy efficacy. For example, if bankruptcy reform is limited by zombie lending at weakly capitalized banks, then bank recapitalization may be the more appropriate policy action as opposed to further improvements in judicial infrastructure.

The advantage of the Indian setting is that it allows us to hold constant the impact of the improvements in judicial enforcement post-IBC and estimate the impact due to Feb. 12th, precisely pinpointing inefficiencies arising from the bad loan recognition channel. However, our analysis has relevance beyond India. As documented by Andrews and Petroulakis (2019), several advanced economies with weak insolvency regimes have experienced high zombie lending. Becker and Ivashina (2022) argue that this kind of

insolvency-driven zombie lending can be addressed only by reforming existing insolvency frameworks. Our focus on zombie lending and bankruptcy reforms is thus motivated by an intrinsic link between the two.

To carry out our analysis, we use a difference-in-differences research design to examine the impact of IBC and Feb. 12th on: (i) recognition of loans to zombie borrowers as non-performing assets (NPAs) by banks, (ii) credit allocation to zombie and healthy borrowers, and (iii) real effects on firm-level investment and profitability.

We find that the IBC leads to only a modest increase in recognition of zombie loans as NPAs. However, we find a near five-fold increase in zombie recognition post the Feb. 12th intervention that targeted lender discretion in recognizing bad loans. Mechanisms explaining limited zombie recognition following the bankruptcy reform include lenders' reluctance to avoid realizing loan losses and political economy frictions at state-owned banks. Credit to zombie borrowers declines but increases to healthy borrowers. Among healthy borrowers, entrants in industries with a high proportion of zombies benefit. However, banks with high exposure to zombies are less likely to initiate new lending relationships with healthy borrowers, potentially due to capital constraints arising from bad asset recognition. This credit reallocation also has real effects as zombie firms cut investment compared to healthy firms. Together, our evidence suggests that lender willingness to recognize zombie borrowers is critical to debt resolution and determines bankruptcy reform efficacy.

We focus on zombies because recent evidence indicates that zombie borrowers are a product of weak insolvency regimes (Andrews and Petroulakis, 2019; Becker and Ivashina, 2022; Jordà et al., 2022). As such, an improvement in debt resolution should particularly affect such firms. A key contribution of our paper is to construct a novel zombie classification. Essentially, zombies are delinquent borrowers that continue to receive credit. We classify a borrower as a zombie if, over an eight-quarter period before our analysis window, the borrower is reported 60-90 days overdue by at least one bank and then expe-

riences credit growth in the following quarter. We exclude from this set borrowers which were rated AA or AAA or formed a new bank relationship during this period. Our classification captures borrowers who receive funding through an existing relationship even though they are significantly delinquent, not highly rated, and no new lender is willing to issue credit to them.

We believe our zombie classification is an improvement over previous measures. The standard approach is to identify zombie borrowers based on whether they receive credit at interest rates below the highest rated firms in the economy (Acharya et al., 2019; Caballero et al., 2008). Focusing exclusively on interest rates may be misleading as other features of the contract (e.g. covenants and collateral) could reflect the borrower riskiness. It is especially problematic in the Indian context as lenders can capitalize interest payments and issue new loans to cover payments while charging nominally high interest rates. Relatedly, declining policy rates can confound rate-based classification (Banerjee and Hofmann, 2018). Instead, rather than determining counterfactual interest rates, we rely on *actual* delinquency, which is objective and standardized across borrowers. We illustrate our approach through the following real (but anonymous) example: firm X, which borrowed exclusively from bank Y, was consistently reported by bank Y as 60–90 days delinquent every quarter from June 2015 to December 2017. Over this period, borrower X's total loan exposure grew from INR 1.38 billion to INR 3.4 billion. Its credit rating dropped from BBB to BB.

We center our analysis on the recognition of zombie borrowers as non-performing, the point at which the zombie is 'unearthed' and the bankruptcy resolution process can start. The key dependent variable is the categorization of a loan as non-performing. We analyze separately the impact of the IBC and Feb. 12th interventions on bad loan recognition among zombie borrowers. These are captured by the coefficients on two key independent variables — interactions of a dummy variable indicating whether a borrower is a zombie with two separate time indicators, one corresponding to the period when *only* the

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IBC was in effect (between the first and fourth quarter of 2017) and since the introduction of Feb. 12th (first quarter of 2018 to the first quarter of 2019). Our detailed micro data allow us to include bank-borrower, bank-time, and industry-time fixed effects in order to estimate the difference in NPA recognition for zombies relative to non-zombies in the same broad industry borrrowing from the same bank in a quarter. The IBC by itself leads to a modest 1.4 percentage point (pp) increase in the likelihood of zombie relationships being recognized as NPAs while the effect of Feb. 12th is over five times higher, at 8 pp. Prior to either policy action, only 35% of zombie relationships were recognized as NPAs, indicating a 23% improvement in zombie recognition after Feb. 12th. While the improved zombie recognition immediately following IBC is the consequence of improved judicial resolution, the Feb. 12th treatment isolates the effect due to better bad loan recognition.

For causal identification, we exploit size thresholds prescribed in the Feb. 12th intervention that significantly increased the costs of avoiding recognition of delinquent borrowers for borrowers with debt exceeding INR 1 billion. Exploiting this size threshold in both a triple-differences and regression-discontinuity setting, we compare the interventions' impact on borrowers with credit exposures above and below the threshold. We observe a 8 pp increase in recognition of zombie relationships as NPAs post-Feb. 12th but no effect post-IBC. This is expected since IBC rules are size-independent. We also show that the control and treatment groups are on similar trends in the pre-treatment period. This analysis rules out concerns that the causal impact attributed to the Feb. 12th intervention is merely a lagged response to IBC.

We also confirm that the recognition of zombie borrowers as non-performing is accompanied by an increase in lender initiation of bankruptcy proceedings. In line with the results on zombie recognition, the effects of IBC is minimal. In contrast, zombie borrowers are 3 pp more likely to be referred to the bankruptcy courts after Feb. 12th. This establishes the final link in the debt resolution process: Feb. 12th improved both the recognition of zombies as non-performing, and kick-started their resolution through the IBC.

To explore the mechanisms underlying limited bad loan recognition following the bankruptcy reform, we draw on previous literature on the causes of zombie lending, which include (i) bank undercapitalization, that makes banks reluctant to provision for bad loans; and (ii) political economy frictions at state-owned banks. We operationalize each hypothesis by examining the differential effect of banks' capital and state-ownership on zombie recognition. Zombie recognition post-Feb. 12th is strongest at weakly capitalized banks, pointing to bank undercapitalization as the mechanism limiting bankruptcy reform efficacy post-IBC. Despite the higher prevalence of zombies among state-owned banks pre-reform, zombie recognition is muted at state-owned banks even after Feb. 12th. At banks for which the two main frictions we test, bank undercapitalization and government ownership, are not relevant, that is, well-capitalized privately owned banks, the effect of the IBC is comparable to the unconditional effect of Feb. 12th, indicating that inadequate bank capitalization and government ownership were the two main mechanisms impeding the efficacy of the IBC. This also speaks to the external validity of our result. Our findings indicate that bankruptcy reform, on its own, will be less effective in economies with undercapitalized banks and/or significant state-ownership.

After establishing the effects on zombie recognition, we turn to the resulting impact on credit. Overall, zombie firms experience a decline in credit relative to healthy firms on the intensive margin. This is consistent with a supply-driven bank lending channel as lenders cut credit to zombie borrowers since they no longer need to evergreen, allowing credit to reallocate to healthier borrowers. Whereas previous literature has focused on reallocation due to improved recovery rates (Bian, 2018; Li and Ponticelli, 2021), our empirical setting allows us to rule this channel out — Feb. 12th has a near-immediate impact on credit reallocation, contrary to the lagged effect expected from improvements to the judicial bankruptcy process.

However, consistent with the idea that banks keep zombie borrowers afloat in order to avoid resulting capital crunches, we find the credit reallocation to healthier borrow-

ers is significantly smaller at banks with greater ex-ante exposure to zombie borrowers. This result is consistent with Chopra et al. (2020) who find that undercapitalized banks in India underinvest. We also show that younger, healthy firms in high-zombie industries get more credit, emphasizing that zombie decongestion leads to a within-industry reallocation of resources a la Caballero et al. (2008).

Finally, we examine how this reallocation translates to firm-level outcomes. If firms are credit constrained, and the interventions direct credit toward healthier, more productive uses, we would expect an increase in investment and profitability for healthy firms. Zombie firms cut investment more after Feb. 12th than after IBC, though effects on profitability are mixed.

Related Literature   We primarily contribute to the literature on zombie lending, which is a global phenomenon (Albertazzi and Marchetti, 2010; Banerjee and Hofmann, 2018; Gopinath et al., 2017; Schivardi et al., 2018). Zombie lending can harm productivity by misallocating resources (Blattner et al., 2023) and hinder the process of creative destruction (Acharya et al., 2022; Caballero et al., 2008). An emerging literature studies how countries can recover from zombie lending crises through private restructuring efforts (Fukuda and Nakamura, 2011), large bank capital injections (Acharya et al., 2019; Giannetti and Simonov, 2013), more frequent supervisory inspections (Bonfim et al., 2023; Passalacqua et al., 2020), or by introducing specialized bankruptcy courts (Li and Ponticelli, 2021). We contribute by examining bankruptcy reforms as a possible policy to address zombie lending and in doing so, are the first to use Indian supervisory data on bank-borrower relationships which allows us to classify zombies based on actual delinquencies.

Our paper examines the intersection of two phenomena: bankruptcy reforms and zombie lending. Indeed, many of the mechanisms that we find hindering bankruptcy reform effectiveness, such as weak bank capitalization and state-ownership, have been

previously highlighted in the literature on zombie lending (Peek and Rosengren, 2005; Qu, 2018; Shen and Chen, 2017; Storz et al., 2017; Tan et al., 2016). Newer work, however, emphasizes the importance of efficient restructuring and bankruptcy processes in curtailing zombie lending. Becker and Ivashina (2022) and Andrews and Petroulakis (2019) hypothesize that weak insolvency resolution frameworks can drive zombie lending. Becker and Ivashina (2022) focus on the private debt market and contend that insolvency-driven zombie lending cannot be addressed through traditional bank capital requirements and supervision but also needs complementary reforms of the insolvency framework. Our paper contributes to this debate by showing that lenders themselves can limit the impact of bankruptcy reform if they refuse to pursue zombie borrowers. This finding is important for policy in contexts with weakly capitalized banks and significant state-ownership. If zombie recognition were the main channel hindering bankruptcy reform efficacy, then policy needs to simultaneously address bank capitalization and political interference in order to improve reform take-up.

Our work is also related to the literature on slow recoveries following crises (Reinhart and Rogoff, 2009; Taylor, 2014). Jordà et al. (2022) point to inefficient debt resolution that allows zombie to survive leading to slow recoveries post-recessions. Macroeconomic stabilization policies can delay the requisite financial restructuring (Laeven and Valencia, 2020), possibly slowing recovery. Acharya et al. (2021) build a theoretical model to show that slow recoveries may be the result of unconventional policies, such as regulatory forbearance. India, too, witnessed a build-up of stressed assets after forbearance measures were introduced post the 2008 Global Financial Crisis (Chopra et al., 2020; Flanagan and Purnanandam, 2019). Though such forbearance policies are meant to address temporary shocks, they can lead to zombie lending traps and drag out recovery (Chari et al., 2020; Gropp et al., 2022). Our paper cautions that even if countries were to undertake reforms to address poor debt resolution, they may fail to accelerate recovery if lender incentives limit zombie recognition.

Finally, our work is related to the literature on law and finance examining how both better legal rules protecting creditor rights and enforcement quality (Claessens and Klapper, 2005; Djankov et al., 2008; Safavian and Sharma, 2007) are necessary for capital market development. While one literature focuses on the impact of legal reforms that strengthen creditor rights on firms' credit access and credit market development (La Porta et al., 1997, 1998), a related literature examines the quality of enforcement (Visaria, 2009). A relatively understudied area is the intersection of the two: how does the quality of enforcement affect the impact of legal reforms? One exception, and our nearest neighbor, is Ponticelli and Alecnar (2018) who exploit ex-ante congestion of civil courts across Brazilian municipalities and the introduction of a bankruptcy reform to study the effects of enforcement on firms' access to finance. We contribute by showing that lender utilization is a key determinant of bankruptcy reform efficacy.

1 Institutional background

India has a bank-dependent economy with underdeveloped corporate bond markets. The corporate bond to GDP ratio in June 2018 was only 17%, compared to 123% in the U.S. (Reserve Bank of India, 2019). The Indian banking system is dominated by state-owned or public-sector banks (PSBs), which as of March 2019 accounted for 61% of banking assets (Reserve Bank of India, DBIE, 2021). These banks, while nominally independent, have been criticized for operating inefficiently (Acharya and Subramanian, 2016) and having inflexible lending policies due to poor loan officer incentives (Banerjee et al., 2004). They are also susceptible to political interference (Cole, 2009).

While the RBI is the main banking regulator, its authority over corporate governance is weaker at PSBs (Patel, 2020). Unlike with private sector banks, the RBI cannot unilaterally remove directors or the management of PSBs; nor can it force a merger or liquidation of a PSB or revoke its banking license. Concurrence of the federal government is required for the above actions.

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1.1 The 2016 Insolvency and Bankruptcy Code

The aftermath of the 2008 Global Financial Crisis (GFC) was marked by a build-up in stressed assets in the Indian banking system. Subsequent efforts such as the Asset Quality Review that forced banks to recognize non-performing loans were unsuccessful in cleaning up banks' balance sheets (Chopra et al., 2020). To address this nearly decade long issue, both the RBI and the government recommended a bankruptcy code that would create a clear pathway for the resolution of unviable assets (Patel, 2020).[1]

In May 2016, Parliament adopted the Insolvency and Bankruptcy Code (IBC), a sweeping overhaul of the bankruptcy system which came into effect in December 2016. Before the IBC, the bankruptcy system was characterized by an assortment of resolution mechanisms, notorious for its inordinate delays and low recovery rates. Large cases took an average of six years to resolve (Sengupta et al., 2016) and recovery rates averaged around 26% – amongst the lowest in the world (Patel, 2020). The primary objective of the IBC was to subsume all resolution mechanisms, streamline the recovery process, and set time constraints.

Under the IBC, upon default, either borrowers or creditors can initiate insolvency proceedings. A case may be dismissed before it is admitted to the National Company Law Tribunal (NCLT), but once it is admitted, an interim resolution professional takes possession of the firm's assets. This person forms a committee representing creditors, who can then appoint a permanent trustee. The trustee solicits and vets applicants for the submission of resolution plans. The applicants can be existing parties or outside prospective buyers. Once resolution plans are submitted, the creditors' committee selects a plan by a vote of at least 75%. If a plan is not selected, liquidation procedures commence. The entire process, after admission to the NCLT, is mandated to take fewer than 180 days.[2]

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[1]Section A.1 describes the bankrupty system prior to 2016 and Section A.2 provides more details on the stressed asset problem.

[2]As certain rules continued to be challenged, most large cases initially referred to the NCLT under the IBC have taken over 180 days to resolve. The law also allows extension up to 270 days.

1.2 The February 12th Circular

Limited lender utilization of the IBC prompted the RBI to unexpectedly unveil new guidelines through a "circular" (executive directions to bureaucrats) on February 12th, 2018. We use the circular's colloquial name "Feb. 12th" as a shorthand throughout. The circular specifically aimed to improve reporting norms for delinquent borrowers, allowing for better supervision. It also mandated that banks use the IBC as the sole avenue for loan resolution. Importantly, bankers and market participants had no advance notice that these guidelines were being developed, and the RBI required immediate compliance with the new guidelines, limiting the ability of lenders and borrowers alike to adjust to the regulatory intervention.[3] The circular noted that non-compliance by lenders would attract monetary penalties, increased provisioning requirements, and directives from the regulator to initiate bankruptcy proceedings under the IBC.

The new guidelines had three main components. First, they directed lenders to immediately report any delinquencies, meaning that banks had to report borrowers overdue by even *one* day, on a weekly basis. They were also required to draft bilateral resolution plans for how the borrower would emerge from delinquency. Second, if the resolution plan was not implemented within 180 days of the original default, Feb. 12th required lenders to initiate bankruptcy proceedings for borrowers with aggregate exposures exceeding INR 20 billion, with similar regulations for exposures between INR 1 and 20 billion to be implemented within the year. Third, the Feb. 12th circular eliminated all existing forbearance schemes, requiring any borrower currently enjoying "restructuring" facilities to be classified as non-performing. Taken together, the first component removed lender discretion in recognizing delinquent borrowers, the second component streamlined the debt resolution process, and the third component re-characterized restructured assets as NPA. We utilize the exposure cutoff of INR 1 billion discussed here in our empirical strategy.

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[3]This is in contrast to most policy decisions that are extensively debated in the public sphere. Private communications with the central bank revealed that only a handful of officials were involved in the drafting of the new regulations, reducing the likelihood of information leaking(The Economic Times, 2019).

Conversations with policymakers confirm our interpretation that the one-day disclosure norms and the resolution plan requirements were the most important aspects of the Feb. 12th circular. Contemporary media coverage highlighted how the one-day disclosure under Feb. 12th significantly altered the banking landscape for firms, banks, and the government. The circular faced strong opposition from firms in various industries and its validity was challenged in the courts. Banks also solicited relaxations to the one-day default disclosure resolution plan implementation norms (Financial Express, 2019). Even the government, which was initially on board with the guidelines in Feb. 12th, started backtracking on its earlier resolve to pursue delinquent borrowers as the costs of recognizing these loans on PSB balance sheets became evident (Patel, 2020). On April 2nd, 2019, the Supreme Court of India struck down the circular on the grounds that the RBI overstepped its authority by directing banks to initiate bankruptcy proceedings against borrowers exceeding a size threshold. The RBI subsequently issued a revised circular on June 7th, 2019 asking banks to report defaults within 30 days and ceded to banks the discretionary power to initiate bankruptcy proceedings against delinquent borrowers. At the time of writing, these revised guidelines are in effect.

2 Data and Summary Statistics

2.1 Data Sources

CRILC: Detailed data on bank-borrower lending relationships comes from the Central Repository of Information on Large Credits (CRILC), a proprietary database maintained by the RBI. Beginning in June 2014, all commercial banks in India were required to provide quarterly updates for any borrower whose aggregate outstanding debt exceeded INR 50 million. Reporting frequency became monthly in 2018 and we aggregate all observations to the quarterly level. To the best of our knowledge, ours is the first study to use the CRILC data for academic research. Every quarter, for borrowers above the reporting threshold, banks report the total exposure of the borrower and its asset quality at the

end of the quarter. Information is also provided on the borrower's credit rating, as well as the borrower's industry. A unique borrower ID allows us to track borrowers across banks and time. CRILC includes over 100,000 bank-borrower observations per quarter for the 20 quarters between June 2014 and March 2019. The number of unique borrowers covered exceeds 100,000.

Asset quality is classified into two main categories: (1) Standard, if a borrower is currently in good standing and has not missed any scheduled payments; and (2) non-performing (NPA), if a borrower has not made any payments towards interest or principal for over 90 days. A borrower is classified as NPA if even a single loan in the portfolio is more than 90 days overdue. Between standard and NPA, there are three sub-categories of delinquency: (1) 0-30 days overdue, (2) 30-60 days overdue, and (3) 60-90 days overdue. The NPA designation extends to the entire credit exposure the bank has towards that borrower. Importantly, if a borrower is an NPA of a certain bank, other banks transacting with the borrower are not obligated to declare it an NPA.

Prowess: For a subset of borrowers in the CRILC database, banks also report the corporate identification number issued by the Ministry of Corporate Affairs. We use this to match borrowers to the Prowess database, providing balance-sheet data from firms' annual financial statements. Prowess includes both publicly traded and unlisted firms, and has been used in prior studies of Indian corporations (Bertrand et al., 2002; Lilienfeld-Toal et al., 2012; Vig, 2013). Matching firms in CRILC to Prowess allows us to identify the impact of the IBC and Feb. 12th on firm outcomes. We can match 9,888 firms reported in CRILC to the Prowess database. While this reflects only a third of the borrowers within CRILC, they account for over 70% of CRILC exposures, consistent with Prowess over-sampling large borrowers. The variables used in our analysis are defined in Table A.1.

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2.2 Classification of Zombies

The normative nature of zombies makes their identification challenging. A zombie is a firm that *should not* have received credit, at least not on the terms offered, but *did* receive credit. Broadly, we define a zombie as a firm that is delinquent in loan repayment but continues to receive additional credit. Our method of identifying zombies is a departure from prior literature, where many papers define a zombie as a firm that receives subsidized credit (e.g., Caballero et al. (2008) and Acharya et al. (2019)). This definition is problematic for several reasons, however. First, loans come in many forms, so it is hard to define subsidized credit in a standardized manner. For instance, banks may be willing to accept favorable contractual features such as stronger covenants, callability provisions or more valuable collateral in exchange for lower interest rates. Another downside of identifying zombies based on subsidized credit is that there are times when subsidized credit is socially desirable. For instance, during the COVID-19 crisis, governments around the world extended subsidized credit in the form of fiscal stimulus to preserve economic value. Although such policies can create zombies, subsidized credit does not automatically imply the existence of zombies. Finally, misallocated credit need not show up in interest rates: a bank engaged in evergreening may capitalize interest payments or issue new loans to cover scheduled repayments, while still charging nominally high interest rates. We contend that our zombie classification is an improvement over existing measures as we do not need to specify a counterfactual interest rate, or assume that all subsidized lending is problematic. Instead, we rely on actual delinquency, which is both objective, and standardized across borrowers.[4]

Using data over eight quarters between June 2014 and March 2016, we classify a firm as a zombie if it experienced non-negative credit growth in quarter t, despite being reported as 60-90 days delinquent by some bank in quarter $t-1$. Importantly, the CRILC

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[4]Some papers define zombies as firms with interest coverage ratios (ICR) less than one (e.g., Banerjee and Hofmann (2018) and McGowan et al. (2017).) While this measure may capture firm-level financial distress, it is silent on the issue of credit misallocation.

system makes the 60-90 days delinquency information accessible to all banks. To reduce false positives, we exclude from our zombie classification firms rated AAA or AA between June 2014 and March 2016 as well as borrowers that initiated a new banking relationship in this period.

Our zombie definition by design freezes the number of zombies in March 2016 —three quarters prior to the introduction of the IBC. The static zombie classification is motivated by the observation that zombies in the current context owed their origin to the credit boom and bust cycle from the early 2000s to the mid 2010s. We also treat zombie classification as an "absorbing state" — namely, a borrower remains zombie once it is classified as such. From an econometric perspective, this also ensures that our zombie measure is not contaminated by the subsequent policy interventions.

Figure 1 visually depicts how the sample is split between a "Classification" window (June 2014-March 2016) in which zombies are defined, and an "Analysis" window (June 2016-March 2019) in which we compare credit outcomes for zombies to non-zombies. We emphasize that credit outcomes in the "Analysis" window play no role in our zombie definition.

To summarize, we categorize a borrower as a zombie if, in the "Classification" window (June 2014-March 2016) of our sample, the borrower (a) was reported 60-90 days delinquent at least once, (b) experienced weakly positive total credit growth in the quarter after being 60-90 days delinquent, (c) was never rated AA or AAA, and (d) did not form any new banking relationships.

Importantly, our zombie classification distinguishes between scenarios related to missed or delayed payments in a way that is consistent with the theoretical understanding of zombies. Based on conversations with regulators and industry experts in India, we consider three common scenarios. Consider a standard amortizing loan with quarterly repayments. In the first scenario, a borrower misses three scheduled repayments, does not make up for them, but makes subsequent payments. In effect, it is always 60-90 days

delinquent. However, this is not a zombie —it is just late. We choose to not categorize this borrower as a zombie as its loan balance decreases following delinquency since it subsequently makes timely repayments. A second scenario concerns a firm 60-90 days overdue, which uses a credit extension from an existing relationship to pay off the old loan. This is evergreening, since the loan balance increases (net of repayments) due to the credit extension. In the third scenario, a borrower is 60-90 days overdue, misses another payment and should be categorized as non-performing but the lender misreports it as continuing to be 60-90 days overdue. Since no money is exchanging hands, the loan balance will continue to rise due to capitalized interest payments. We characterize such a borrower as a zombie since the loan balance rises after the firm becomes 60-90 days overdue, and the firm is not recognized as non-performing.

2.3 Summary Statistics

Panel A of Table 1 presents summary statistics for the CRILC sample at the bank-borrower level over 12 quarters between March 2016 and March 2019. The sample is restricted to borrowers with aggregate debt exceeding INR 0.25 billion, (approximately USD 3.63 million as of June, 2019) as borrowers under this threshold were governed by an alternate set of regulations. On average, there are about 14,000 borrowers per quarter, and 18% of all observations are classified as zombies. Only 55% of observations are in the standard (non-delinquent) category, 26% are classified as NPA and the remaining are overdue between 0-90 days. The median borrower size across all observations is INR 0.71 billion, whereas the median borrower size for NPAs is INR 0.62 billion. Nearly 74% of borrower relationships are with PSBs. Around 34% of all observations are investment-grade, though over 40% are unrated.

Summary statistics at the firm-year level for the matched CRILC-Prowess sample are presented in Panel B of Table 1. Observations in Panel B are at the firm-year level. The median firm has total assets of INR 2.1 billion. The median debt ratio is 34.6% and the

median return on assets is 10.7%.

Tables A.2 and A.3 compare the ex-ante characteristics of zombie and non-zombie (healthy) borrowers. We focus on the cross-section reported in March 2016 – the last quarter of the zombie classification window. In Table A.2 (A.3), we compares means for firm (borrowing) characteristics based on data from the Prowess (CRILC) database. Table A.2 shows that non-zombie firms are much larger, both in terms of assets and sales. They are also better performing along several dimensions – they have a higher ROA and operating margin, have lower debt levels and higher liquidity, and are much less likely to have an interest coverage ratio below 1. At the same time, healthy borrowers have similar effective interest rates to zombie borrowers (10.4% v. 10.5%) which is consistent with the literature emphasizing that zombies receive subsidized credit. The fraction of firms in manufacturing is very similar while healthy borrowers are slightly older on average.

The inferiority of zombies is also reflected in characteristics dealing with bank debt exposure and delinquency. Table A.3 shows that, while non-zombies have larger exposures on average, over 75% of non-zombies are reported as standard, whereas less than 30% of zombies are reported as standard. Conversely, about twice as many zombies are reported as NPA. Still, only 30% of zombies are NPAs at the start of our sample period. 22.4% of zombie borrowers have previously restructured loans. Empirically, we also find that almost half of the borrowers who were restructured at some point during their relationship histories are also classified as zombies as per our preferred measure. Zombie borrowers also have fewer banking relationships, are more likely to have a relationship with a PSB, and are less likely to receive investment-grade credit ratings.

Tables A.4 and A.5 show that the firms we classify as zombies do not improve over the analysis period. Over 70% of zombies remain zombies or become NPA by the end of March 2019 compared to less than 20% for non-zombies. Only 11% of zombies become investment grade. These results assauage concerns that our static zombie classification is damaging since it treats "zombie-ness" as an absorbing state. Most zombie firms do not

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recover over our sample period.

Turing to the outcomes we are interested in, in Figure A.1, we plot the quarterly new NPA shares as well as new bankruptcy initiations at the aggregate level. There is a spike in new NPA share in the quarter of Feb. 12th and a spike in bankruptcy initiation soon after. Figure 2 plots new NPA shares separately for zombies and non-zombies. Panel A (Panel B) shows the fraction of borrowers (total exposures) that were newly reported as NPA in a quarter. Both panels reveal a dramatic increase in first-time NPA reporting of zombies in the quarter of the Feb. 12th intervention as well as the following quarter. The proportion of zombie borrowers newly-reported as NPA jumped from less than 5% in January of 2018 to over 10% in March of 2018, while for non-zombies, it barely increased.

3 Empirical Strategy

We center our analysis on whether lenders recognize zombie borrowers as non-performing after the IBC and Feb. 12th reforms. Section A.3 provides a simple conceptual framework motivating our focus on the recognition of zombie borrowers as non-performing. To summarize, consider the following. Lender payoffs from liquidation/restructuring increase post-bankruptcy reforms (IBC), and at the margin, lenders would prefer liquidating/restructuring through bankruptcy rather than continue lending to zombie borrowers. However, we hypothesize that bankruptcy reforms can have limited results if some lenders continue to be unwilling to recognize zombie borrowers as delinquent. The advantage of our empirical setting is that we can condition on the improvements in judicial resolution (post-IBC period), and isolate lenders' reluctance to recognize zombies as NPAs (post-Feb. 12th period), allowing us to pinpoint the inefficiency arising from bad loan recognition.

We use a standard difference-in-differences (DD) specification to estimate the effect of IBC and Feb. 12th on the recognition of zombie borrowers as NPAs. Observations are at

the borrower-bank level. Our specification is:

$$Y_{ijbt} = \alpha_{ib} + \lambda_{bt} + \gamma_{jt} + \beta_{IBC} \text{ IBC} \times \text{Zombie}_{ijb} + \beta_{Feb12^{th}} \text{ Feb. } 12^{th} \times \text{Zombie}_{ij} + \eta \mathbf{X}_{ijbt} + \epsilon_{ijbt}$$

(1)

where Y is the outcome variable for borrower i operating in industry j in quarter-year t. We have two outcomes of interest: (i) a dummy equaling 1 if borrower i is recognized as NPA by bank b in quarter-year t; and (ii) the log of NPA exposures.[5] The IBC dummy equals 1 for the quarters ending in March, June, September, and December 2017. Similarly, the Feb. 12th dummy equals 1 for all quarters succeeding the December 2017 quarter.

Our coefficients of interest are β_{IBC} and $\beta_{Feb12^{th}}$. β_{IBC} estimates the impact on zombie recognition as NPA for the period when *only* the IBC was in effect (quarters ending in March, June, September, and December 2017), relative to the pre-reform period (June 2016, September 2016, December 2016). β_{Feb12} estimates the impact on zombie recognition for the quarters when the Feb. 12th was in effect (quarters ending in March, June, September, and December of 2018 and March 2019).

We estimate (1) conditioning on multiple sets of fixed effects. Borrower-bank fixed effects control for time-invariant lending relationship characteristics. Bank-time fixed effects soak up any bank-specific variation that might affect outcomes. Two-digit industry-quarter fixed effects control for time-varying industry shocks affecting NPA recognition. These fixed effects mean that our DD coefficients tell us how the difference in NPA recognition zombie and non-zombie borrowers within the same industry borrowing from the same bank in a quarter changes after each of the two treatments. In order to control for borrower-specific factors that might affect NPA recognition, we include a set of covariates.[6] We cluster standard errors at the borrower level since zombies are classified at that

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[5]As NPA exposures for non-NPA borrowers is 0, we add 1 to all exposure values before taking the log of the dependent variable. Our results are robust to a) using raw NPA exposure values and b) an inverse hyperbolic sine transformation of NPA exposure values (results available upon request).

[6]These are i) the borrower's initial credit exposure, binned across six categories; ii) dummies for the borrower's initial credit rating; iii) dummies for ownership; iv) number of bank relationships; v) dummies for whether the borrower was classified as 0-30, 30-60, or 60-90 days delinquent in the quarter; vi) a dummy

level.

The identifying assumption for a causal interpretation of β_{IBC} and $\beta_{Feb12^{th}}$ is that, conditional on the fixed effects and time-varying covariates, NPA recognition of zombies and non-zombies would have followed comparable trends in the absence of the two policy interventions. We examine the validity of this parallel trends assumption using an event-study design. We estimate the following dynamic specification:

$$Y_{ijbt} = \alpha_{ib} + \lambda_{bt} + \gamma_{jt} + \sum_{q=-3}^{8} \eta_q D_{Dec16+q} \times Zombie_{ij} + \eta \mathbf{X}_{ijbt} + \epsilon_{ijbt}. \qquad (2)$$

In (2), the *Zombie* indicator is interacted with a dummy for each quarter, with December 2016 as the reference period (the quarter prior to the IBC). We plot β_q to test for the presence of differential pre-treatment trends.

4   Results

We begin this section by identifying the impact of the IBC and Feb. 12th on the recognition of zombies as non-performing. Then, we highlight the mechanisms through which zombie recognition affects the efficacy of bankruptcy reforms. Finally, we examine the impact on credit allocation and borrower-level outcomes.

4.1   Recognition of Zombies as NPA

Panel A of Table 2 presents our baseline results from estimating (1) with covariates. The sample is restricted to the 12 quarters between June 2016 and March 2019 and borrowers with exposures exceeding INR 0.25 billion in all 12 quarters. In column (1) we restrict the sample to the 7 quarters prior to Feb. 12th, i.e., June 2016 to December 2017. The outcome of interest is a dummy variable equaling 1 if the borrower is NPA and we use

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for whether the borrower borrowed from a consortium or multiple lending facility; and vii) a dummy for whether the borrower was recognized as NPA in the past year. These time-invariant borrower-level covariates are interacted with post-IBC and post-Feb. 12th dummies.

a linear probability model to estimate the specification. The coefficient suggests that, relative to non-zombies, the likelihood of zombie recognition as NPA increases by nearly 2 pp after the passage of the IBC. Column (2) provides the results for the impact of Feb. 12th. Here, we use the entire sample period of 12 quarters between June 2016 to March 2019. Relative to non-zombies, zombies had a 7 pp higher likelihood of being recognized as NPA after the regulatory intervention. Column (3) jointly estimates the impact of the two policies. The reference period is the last three quarters of 2016 – the period preceding both treatments. The estimated coefficients suggest that the impact of Feb. 12th was over five times larger than that of the IBC, and we can reject the equality of the coefficients on IBC (β_{IBC}) and Feb. 12th (β_{Feb12}) at the 1% level.[7] The impact of Feb. 12th is particularly salient given the extent of the under-recognition of zombies as NPA at the beginning of the analysis period. Relative to March 2016 when only 35% of zombies were recognized as NPA (Table A.3), the coefficient corresponding to Feb. 12th in column (3) of Table 2, panel A reflects a 23% (or 8 pp/35.5 pp) increase in the likelihood of zombie recognition as NPA.

We next estimate the impact on zombie credit recognized as non-performing. In columns (4) through (6), we re-estimate the specifications in columns (1) through (3) with logged NPA exposures as the outcome variable, and obtain qualitatively similar results. When the effect of the IBC and Feb. 12th interventions are jointly estimated in column (6), the impact of Feb. 12th exceeds that of the IBC by a factor of ten, amounting to a staggering 32% increase in the amount of zombie credit recognized as non-performing.

While our baseline estimates control for borrower-specific covariates and their inter-action with post-IBC and post-Feb. 12th indicators, Panel B excludes these covariates with the exception of the fixed effects. The magnitude of the coefficients in Panel B estimating the impact of the IBC and Feb. 12th on NPA recognition are roughly double the coefficients in Panel A. Some of the covariates, such as the borrower's initial credit rating, possibly

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[7]This result on the difference between the coefficients on IBC and Feb. 12th continues to be true in all subsequent tables in the analysis, though we do not explicitly report it in the interest of brevity.

absorb variation arising from our independent variables of interest. Nonetheless, we opt for a conservative approach and continue to include covariates in subsequent analysis.

A plausible alternative explanation of our main results is that banks responded with a lag to the reforms enacted by the IBC. If banks took time to learn about the changes to the bankruptcy process, it is possible that the enhancement in NPA recognition attributed to the Feb. 12th intervention is but a delayed effect of the IBC. To rule this out, we employ the dynamic specification (2). The coefficients are plotted in Figure 3. Consistent with Table 2, the IBC had a limited impact on NPA recognition in three out of four quarters with the corresponding coefficients not statistically distinguishable from 0. In contrast, there is a sharp increase in zombie recognition post-Feb. 12th across both outcomes of interest. The immediate reaction to Feb. 12th bolsters our hypothesis that the baseline results do not simply reflect a delayed response to the IBC. There is also no evidence of differential pre-treatment trends.

4.1.1 Exploiting the Size Threshold in the February 12th Circular

Another possible explanation is tht other shocks correlated with the timing of the Feb. 12th could be driving our results. To rule out this explanation, we exploit size cutoffs referenced by the Feb. 12th circular. As noted in Section 1.2, Feb. 12th required banks to refer borrowers to the IBC if the borrower was at least 180 days delinquent and its exposure to the bank exceeded INR 20 billion. It also intimated that similar guidelines would soon be issued for borrowers with exposures between INR 1 and 20 billion. Additionally, stringent guidelines applied to borrowers with exposures over INR 1 billion previously under restructuring schemes. This suggests that INR 1 billion is a natural threshold to test the differential impact of Feb. 12th, using a triple-difference specification:

$$Y_{ijbt} = \alpha_{ib} + \lambda_{bt} + \gamma_{jt} + \beta_1 Post_t \times Zombie_{ij} + \beta_2 Post_t \times Zombie_{ijb} \times Large_{ijbt} + \epsilon_{ijbt}, \quad (3)$$

where $Large_{ijbt}$ is a dummy equaling 1 if the borrower's exposures with the bank in a quarter exceeds INR 1 billion. β_2 estimates the differential impact of the interventions on the recognition of larger zombie borrowers as NPA. As the IBC applied uniformly across borrower size, we would not expect any differential impact of the IBC by size; as Feb. 12th was targeted towards larger borrowers, we expect $\beta_2 > 0$ when Post$_t$ refers to Feb. 12th.

Table 3 contains the results from estimating (3). The outcome variable in columns (1) – (3) is a dummy equaling 1 if the borrower is reported as NPA, while in columns (4) – (6) it is logged NPA exposures. In columns (3) and (6), we report results from a joint estimation of the differential effect of the two interventions across large borrowers and confirm that Feb. 12th had a significantly larger impact on larger borrowers. The triple interaction coefficient in both columns is positive and significant. No such effect is seen for IBC — the $Post_t \times Zombie_{ijbt} \times Large_{ijbt}$ coefficient corresponding to IBC does not indicate any differential effect for large borrowers, while the $Post_t \times Zombie_{ijbt}$ coefficient remains significantly smaller for the IBC relative to Feb. 12th.

The size threshold also allows us to employ regression-discontinuity as an alternate strategy to causally estimate the impact of Feb. 12th. The intuition is that since INR 1 billion is a plausibly exogenous size threshold, zombie borrowers just below the threshold should see lower NPA recognition than those just above the threshold. The identifying assumption is that borrowers and banks are unable to manipulate their exposures around the threshold. This is plausible in our setting due to the sudden, unexpected nature of Feb. 12th. To ensure that manipulation following the release of the circular does not contaminate our results, we estimate the regression-discontinuity analysis only in the quarter of Feb. 12th, i.e, first quarter of 2018.

The details of the estimation and the graphical results are shown in Figure A.2. In the two panels on the left, we see statistically significant evidence of a jump in both the probability of NPA recognition and the amount of NPA exposures for zombie borrowers as they cross the INR 1 billion threshold. In the right two panels, we look at non-zombies

and find no such differential effect. This placebo test provides further support for the idea that zombie borrowers were the ones that explicitly bore the brunt of the regulatory intervention.

Together, these analyses help rule out alternative explanations. For an alternate phenomenon to explain our results, it must occur in the same quarter as Feb. 12th and also have a sharp discontinuous effect around the INR 1 billion exposure threshold. We are not aware of any such phenomenon.

While we exploit the size threshold for causal identification, the large effect in this segment is also economically meaningful. Since June 2015, the RBI was engaged in a concerted attempt to nudge lenders into recognizing delinquent borrowers. It is possible that banks were unwilling to recognize large zombie borrowers as non-performing prior to the two reforms because capital provisioning requirements are increasing in borrower size, resolution of larger borrowers can be more complex, and larger borrowers are more likely to enjoy political patronage. Indeed, after the IBC we see a slight decline in zombie recognition for borrowers above the threshold relative to those below the threshold, which is subsequently reversed by Feb. 12th.

4.1.2 Robustness tests

Our results are robust to several alternate specifications. Section A.4 discusses the results in detail and we summarize the main findings here.

Our results are robust to a number of alternative zombie definitions. Table A.6 presents results based on using four alternate zombie measures, each of which relaxes a single assumption in our baseline measure. Throughout all four of the alternative zombie measures that we explore, the coefficient on the impact of Feb. 12th is positive and significant at the 1% level. The coefficient showing the impact of the IBC is much smaller in magnitude, and significant only in a subset of specifications.

When we use alternate measures of distress (Table A.7) such as whether the borrower

was ever restructured or if it was 60-90 days delinquent or had an ICR less than 1, we again find that distressed borrowers are much more likely to be recognized as NPA following the Feb. 12th circular.

We also relax the static classification of zombie borrowers. To do so, we employ a rolling eight-quarter classification window. Thus, the classification of a firm as zombie is updated every quarter, rather than being fixed at the beginning of the analysis period. Table A.8 shows the results using this dynamic zombie definition. Although the impact of the IBC loses statistical significance, the impact of Feb. 12th on zombie recognition remains positive and significant at the 1% level, with magnitudes even larger than those in our baseline static classification results.

In Table A.9, we show our results are robust to excluding borrowers that have been restructured under previous schemes which were eliminated by the Feb. 12th circular indicating that this subset of borrowers do not drive our findings. In the same table, we tackle the concern that loan demand changes for zombie borrowers relative to healthy borrowers. Even when we restrict the control group to only 60-90 day delinquent borrowers (making the treatment and control groups more comparable), we show consistent findings. In unreported results, we find the results are robust to clustering at the borrower-bank level and to the inclusion of fewer sets of fixed effects.

Our results raise the question of whether NPA recognition actually translates into an increase in the number of bankruptcies. In Table A.10 we examine whether the IBC and Feb. 12th had an impact on referrals to the bankruptcy courts using referral dates in the CRILC database. The table shows that the impact of Feb. 12th is strongly significant and four-times that of IBC which has an insignificant impact on referrals.

Finally, we explore the impact of the Supreme Court striking down the Feb. 12th circular in April 2019. Because borrowers reported as NPAs must commence resolution proceedings, we would not expect banks to reverse reporting on borrowers already reported. At the same time, however, we would expect little further action on NPA report-

ing. Table A.11 shows that after the Supreme Court handed down its decision, further NPA reporting was not significantly different from zero, and this result is invariant to the size of the borrower.

4.2 Mechanisms

We now examine the mechanisms moderating zombie recognition. As previously noted, our unique empirical setting allows us to disentangle the specific channel contributing to improved bad loan recognition by comparing the effects post-Feb. 12$^{\text{th}}$ to post-IBC. The IBC strengthened debt resolution but was relatively ineffective in "unearthing" zombies. While weak judicial enforcement of the IBC may contaminate the post-IBC effects, our empirical setting allows us to abstract from judicial enforcement and focus on how lender disincentives to recognize zombies hinder the efficacy of bankruptcy reform.

4.2.1 The Roles of Bank Capitalization and Government Ownership

The first mechanism we test for is whether the limited effect post-IBC can be attributed to bank under-capitalization. Weakly capitalized banks have an incentive to engage in zombie lending as it allows them to postpone provisioning for these loans on their balance sheets (Peek and Rosengren, 2005). If banks are unwilling to take advantage of the IBC due to low levels of capital, we would expect the bankruptcy reform to have a weaker effect on undercapitalized banks. A closely related channel through which zombie lending can arise at weakly capitalized banks is through risk-shifting due to banks' limited liability (Bruche and Llobet, 2013). However, nearly all loans in the sample are secured implying that the risk-shifting motive may be a secondary incentive for banks to lend to zombies. Nonetheless, it is difficult to disentangle these two channels since both rely on measures of bank health. Instead, we examine the heterogeneity across bank capitalization and remain agnostic as to whether the effects are due to loan provisioning requirements or banks' risk-shifting motives and interpret our results as the combined effect of

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frictions arising from bank undercapitalization.

We measure bank capitalization based on banks' average Tier-I capital-to-assets ratio over the twelve quarters between June 2012 and March 2015. Based on this ratio, we split banks into terciles and test for the differential effects on zombie recognition using the specification:

$$Y_{ijbt} = \alpha_{ib} + \lambda_{bt} + \gamma_{jt} + \beta_{IBC}IBC \times Zombie_{ij} + \sum_{k=2}^{3} \beta_{IBC}^k IBC \times Zombie_{ij} \times Capital_b^k \quad (4)$$

$$+ \beta_{Feb12}Feb12 \times Zombie_{ij} + \sum_{k=2}^{3} \beta_{Feb12}^k Feb12 \times Zombie_{ij} \times Capital_b^k + \epsilon_{ijbt}.$$

In (4), the base category is the most undercapitalized banks whose pre-treatment Tier-I capital-to-assets ratio falls in the bottom tercile. β_{IBC} and β_{Feb12} estimate the impact of each intervention on zombie recognition in the most undercapitalized banks. Each β^k ($k \in \{2,3\}$) estimates the differential impact of the IBC and Feb. 12th on NPA recognition of zombies for banks in the kth tercile of bank capital.

The outcome of interest in columns (1) – (3) of Table 4 (Panel A) is a dummy equaling 1 if the borrower is an NPA; in columns (4) – (6), logged NPA exposures. Focusing on column (3) which estimates the differential impact of the two interventions across varying levels of bank capital, we find that the IBC had no impact on NPA recognition in the most undercapitalized banks. The triple interaction coefficients are positive and statistically significant for the top two terciles of bank capital, implying that healthier banks took advantage of the IBC and recognized zombies as non-performing. Thus, for banks in the top tercile of Tier-I capital, the IBC caused a 6 to 7 pp increase in the likelihood of zombies being recognized as NPA. This is consistent with the hypothesis that the absence of an effective debt resolution mechanism was precluding some banks from terminating zombie relationships pre-IBC.

In contrast, the Feb. 12th intervention pushed even the most undercapitalized banks to recognize zombies as NPA. The β_{Feb12} coefficient in column (3) is positive and signifi-

cant, suggesting an 7 pp increase in the likelihood of zombie borrowers being recognized as NPA in the most undercapitalized banks. However, as seen from the triple interaction coefficient, Feb. 12th too had a differentially larger impact on the NPA recognition of zombies in well-capitalized banks: banks in the top tercile of Tier-I capital-to-assets ratio saw a 10 pp increase in zombie recognition as NPA. This suggests that while Feb. 12th impacted zombie recognition as NPA across all banks, the aggregate impact on relatively under-capitalized banks continued to be *lower*, despite these banks having a significantly higher pre-treatment concentration of zombies. The results are similar when the outcome is measured as logged NPA exposures [column (6)].

Panel A of Table 4 confirms that under-capitalized banks are less likely to recognize zombies as NPAs after the IBC, consistent with previous findings that inadequate bank capital incentivizes banks to engage in zombie lending. In such a situation, improvements in the bankruptcy framework alone would be insufficient to nudge undercapitalized lenders to recognize losses stemming from insolvent borrowers. On the contrary, Feb. 12th, by eliminating lender discretion in initiating resolution proceedings is successful in pushing even the most undercapitalized banks to recognize zombies as NPAs. However, the impact of Feb. 12th on zombie recognition continues to remain lower in undercapitalized banks (bottom two terciles), pointing to the presence of factors apart from capital inadequacy in hindering zombie recognition. Hence, we turn to government ownership of banks as a possible channel limiting zombie recognition.

The Indian banking system is dominated by government-owned banks (also referred to as public sector banks or PSBs), which likely face different incentives when it comes to allowing the evergreening of loans. We test whether bank ownership also explains the muted effect of the IBC compared to the Feb. 12th intervention by estimating (1) separately for PSBs and privately owned banks. The results are presented in Panel B of Table 4. In column (1), the results for the PSB subsample indicate that the IBC led to a statistically insignificant 1 pp increase in NPA recognition. The impact of Feb. 12th among PSBs

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is seven times that of the IBC. Private banks, on the other hand, have a much stronger reaction to both the IBC and Feb. 12th compared to PSBs [Column (2)]. Even among this sub-sample, though, the effects of Feb. 12th are over four times those of the IBC.[8]

The strong correlation between capitalization and bank ownership, with PSBs more likely to be undercapitalized, complicates the interpretation of Panels A and B in Table 4. In Panel C, we disentangle this by estimating (4) separately for PSBs and private banks. If bank capital were the principal constraint inhibiting zombie recognition, we would expect relatively well-capitalized banks to increase NPA recognition of zombies not long after the IBC. Moreover, we would expect to observe comparable effects of the IBC across well-capitalized banks, irrespective of their ownership. Relatively under-capitalized banks, on the other hand, should see higher NPA recognition of zombies only after Feb. 12th, and this again should be ownership neutral. However, if government ownership serves as an additional disincentive for lenders to recognize zombies as NPA, we would expect to see a lower impact of Feb. 12th or IBC on NPA recognition of zombies in relatively undercapitalized PSBs relative to private banks.

The results in Panel C of Table 4 are striking. In the odd-numbered columns, we restrict the sample to borrowers in PSBs while in the even-numbered columns, we restrict it to private banks.[9] PSBs had an insignificant reaction to the IBC, irrespective of their capitalization. Their response to Feb. 12th is significantly larger (a 6.8 pp increase in zombie recognition), but again there is no differential effect across levels of capitalization. For privately owned banks, we find that the reaction to the IBC increases in the level of capitalization, with those in the highest tercile having a 15.3 pp higher recognition of NPAs compared to those in the lower tercile. This confirms that low capital indeed disincen-

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[8]What explains the limited zombie recognition at PSBs? One possibility is rent-seeking by politically connected firms. Another is a fiscally constrained government postponing costly bank recapitalization by avoiding loan loss recognition (the "fiscal dominance" channel in Acharya (2020)). In unreported results, we do not find evidence that NPA recognition is lower in politically connected industries. However, as we are unable to directly test the "fiscal dominance" channel, we remain agnostic on this question.

[9]The β_3 coefficients in columns (1) and (3) cannot be estimated as there are no PSBs in the top tercile of the overall bank capital distribution.

tivized NPA recognition of zombies even for lenders not afflicted by political interference. After Feb. 12th, private banks in the lowest tercile experienced a large 31 pp increase in zombie recognition, while those in the second and third terciles of capitalization exhibited a weaker response (18 pp and 13 pp increase, respectively). The weaker response of well-capitalized private banks is possibly explained by a) their initial robust response to the IBC, and b) the fact that they had fewer zombie borrowers to begin with.

One concern with the results presented above is that there may be time-varying borrower-level factors, such as loan demand, that affected NPA recognition around the time of the two interventions. To address this concern, Table 5 adds borrower-time fixed effects in the style of Khwaja and Mian (2008). These results are necessarily estimated based off of firms with multiple banking relationships. Although zombies were more prevalent at PSBs than private banks in the beginning of our sample period, columns (1) and (3) confirm that the impacts of the IBC and Feb. 12th were weaker at PSBs. Columns (2) and (4) also confirm that there was a strong and significant IBC effect among the banks in the highest tercile of capitalization which, again, consist only of private banks. These results also reveal the non-linear pattern of response to Feb. 12th across capitalization terciles exhibited in Panel A of Table 4. However, as suggested by Panel C of that table, this is likely due to the concentration of private banks in the highest tercile of capitalization.

A popular argument (Financial Express, 2021; Indian Express, 2021) about the lack of IBC utilization was that it was driven by uncertainty about the the efficacy of the new legal process. Our results on well-capitalized private banks inveigh against this interpretation. Upon removing the two main frictions frustrating zombie recognition – namely, bank under-capitalization and government ownership – the effect of the IBC is much stronger. In columns (2) and (4) of Panel C in Table 4, the post-IBC effect for well-capitalized private banks is comparable to the unconditional effect of Feb. 12th from Table 2. These results further indicate that inadequate bank capitalization and government ownership are the two main mechanisms through which Feb. 12th improved zombie

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recognition.[10]

Collectively, the results on mechanisms show that the reaction to both policy changes was stronger in private banks. If weak capitalization were the key friction restricting the use of the bankruptcy reforms to eliminate zombie lending, we would have expected no difference in the impact of Feb. 12th across PSBs and private banks. However, we see that while Feb. 12th "unearthed" zombies even in PSBS falling in the lowest tercile of bank capital, the point estimates are significantly smaller than private banks, despite PSBs having a higher pre-treatment share of zombie borrowers. Thus, a considerable fraction of zombies continue to remain undisclosed and are now even more concentrated among PSBs relative to the pre-treatment period. Overall, the muted effects at PSBs point to the importance of political economy frictions affecting zombie recognition. Indeed, the limited effects on PSBs of a stringent action such as Feb. 12th underscores the RBI's lack of authority over governance at PSBs as a key friction perpetuating zombie borrowers in the Indian banking system.

4.3 Firm-level impact on credit to zombie and healthy borrowers

The analysis so far has focused on lenders recognizing zombie accounts as NPA. We now turn to the effects on credit allocation across zombie and non-zombie (healthy) borrowers. For this analysis, we relax the INR 0.25 billion constraint and include all borrowers in CRILC. As our baseline, presented in column (1) of Table 6, we estimate equation 1 with credit outcomes. The specific outcomes of interest are logged total credit exposures (intensive margin) and whether a borrower forms a new relationship with a bank (extensive margin). In the latter case, instead of running the regression at the quarterly level, we collapse the analysis period into three sub-periods: Pre, IBC, and Feb. 12th and do the

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[10]Previous literature has also highlighted zombie lending incentives arising from CEO's career concerns (Flanagan and Purnanandam, 2019; Rajan, 1994), and from information asymmetry between the bank and the market (Hu and Varas, 2021). Since the post-IBC effects are comparable to the post-Feb. 12th effect after removing state-ownership and bank capital frictions, we believe these remaining zombie lending channels are less relevant to our empirical context.

estimation at the borrower-bank-subperiod level.[11]

We first focus on credit reallocation between zombie and non-zombie borrowers. In column (1) of Table 6 (Panel A), the outcome of interest is aggregate credit exposures across all bank relationships in the expanded CRILC sample. The results indicate that aggregate credit exposures to zombie firms decreased after both interventions. Relative to non-zombie firms, zombie firms see a 1.2% decline in credit post-IBC and a 2.7% decrease after Feb. 12th. Only the reduction after Feb. 12th is significant, however. This intensive margin reallocation is consistent with a supply-side bank lending channel where lenders reallocate funds previously earmarked to evergreen zombie borrowers. Column (1) of Panel B examines changes along the extensive margin, using the formation of a new relationship as the dependent variable. Neither intervention had an effect on the probability of a new banking relationship indicating that the reallocation is largely to existing healthy borrowers..

4.3.1 Credit Reallocation Among Non-Zombies

Columns (2) through (6) of both panels of Table 6 restrict the sample to non-zombies. Having established that total credit to zombies fell after Feb. 12th, the purpose of this sample restriction is to explore which types of firms or lenders experienced increases in credit, if any.

We first examine the bank lending channel in more detail. To explore whether the reallocation effects are due to banks freeing up capital previously allocated to zombie borrowers, we examine the heterogeneity across banks with differing exposures to zombie borrowers prior to the analysis period. In column (2) of Table 6, we interact each treatment with a dummy variable that equals one if the borrower borrowed from a bank with above-median levels of credit exposure to zombies in March 2016. We expect to find that

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[11]The practical reason to do this is that firms form a new relationship with a bank only once. Collapsing the data allows us to make a balanced panel for borrower-bank relationships which is not dominated by zeros.

high-zombie banks increase lending to healthy borrowers relative to low-zombie banks. However, we find the opposite result. High-zombie banks lend less to healthy borrowers after the intervention compared to low-zombie banks both on the intensive and extensive margin.

A challenge in interpreting these results is that perhaps worse non-zombies matched specifically to high-zombie banks and these firms have lower credit demand after the policy changes. In order to rule this out, we restrict the sample in column (3) to firms that transacted with both high and low zombie banks. The coefficient on Feb. 12$^{\text{th}}$ increases in absolute magnitude but loses its significance when it comes to the intensive margin (Panel A). In column (4), we cleanly remove the confounding effect of credit demand by implementing a Khwaja and Mian (2008) estimator with borrower-time fixed effects. In column (4), although the coefficient on Feb. 12$^{\text{th}}$ becomes positive, neither coefficient is statistically significant. On the extensive margin, high-zombie banks continue to form significantly fewer new relationships.

While credit did reallocate from zombies to non-zombies, it was driven by banks with a *low* exposure to zombies. Why did high-zombie banks react less? One possibility is that zombie recognition created stronger capital constraints for these banks. After all, the argument for undercapitalized banks sustaining zombies has been that loan loss recognition would stress these banks' capital position. This argument is consistent with Chopra et al. (2020) who find that undercapitalized Indian banks reduced investment in this period. Another possibility is suggested by our results in Section 4.2 — we find that zombies became even more concentrated in high-zombie banks because these banks, primarily undercapitalized government-owned banks, remained less likely to recognize zombies even after the interventions. This would imply the supply-side bank lending channel should operate more weakly at such banks.

A second potential channel for credit reallocation is a within-industry channel. It involves healthy firms increasing their demand for credit as resources (such as labor and

capital) previously tied up in zombie firms is now freed up for healthier firms. Caballero et al. (2008) examine zombie lending in Japan in the 1990s and show healthy firms in zombie-congested industries see a decline in employment and investment. Analogously, reduction in zombie borrowers should result in a freeing up of resources such as labor and capital for healthier firms, which then increase their credit demand. Thus, this effect should dominate in zombie-congested industries.

Column (5) of Table 6 shows the effects of each treatment on credit to non-zombie firms in industries most affected by zombie decongestion. *High Zombie Industry* is a dummy variable equaling 1 if the two-digit industry in which the firm operates had above-median exposure to zombie borrowers in March 2015. We find in Panel A that there does not appear to be a significant difference in exposures in high zombie industries relative to low ones. If anything, there was a decrease in credit exposures, albeit weakly significant, in high zombie industries after Feb. 12th. In contrast, column (5) of Panel B indicates that high zombie industries experienced a significant increase in banking relationships of approximately 2.5%. Interestingly, this increase took place after the IBC and remained roughly constant after Feb. 12th. One possible explanation of this result is the "creditor rights" channel, wherein improvements in expected recovery rates on distressed loans following the passage of the IBC led banks to form new relationships with marginal borrowers.

In Column (6) of Panel A, we set out to test the Caballero et al. (2008) channel. If a high concentration of zombies gives rise to a profitability wedge that interferes with creative destruction, eliminating zombies should lead to the extension of credit to healthy entrants within formerly high-zombie industries. We choose firm age as a proxy for entrant, and define a *Young* firm as one that was incorporated in 2010 or after. Firms incorporated in 2010 did not suffer from the effects of the financial crisis, and are at the 25th percentile of the firm age distribution. Our coefficients of interest are the triple interactions between *Young*, *High Zombie Industry*, and each of the interventions. Consistent with Caballero

et al. (2008), we find that lending to entrants within high zombie industries increased, with a large and significant effect of nearly 7 pp after Feb. 12th. The effect on banking relationships, on the other hand, manifested after the IBC but not Feb. 12th. This is evidence that the creditor rights and Caballero et al. (2008) channels worked together. That is, after the IBC, banks formed relationships with entrants into high zombie industries in anticipation of improved recovery rates, but it was not until Feb. 12th that profitable opportunities for these new entrants, accompanied by increased credit allocation, arose in earnest.

In summary, we find evidence for the bank lending channel, i.e., that the interventions freed up capital which was reallocated to non-zombies. However, banks with a high share of zombie borrowers reacted much more weakly.We also find evidence consistent with the Caballero et al. (2008) within-industry reallocation channel. Young firm within high-zombie industries experienced a significant increase in lending after Feb. 12th.

4.4 Real Effects

Finally, we examine how the credit reallocation from zombies to healthy firms affects real outcomes. In this section, we implement firm-level regressions using financial data from 9,888 firms in Prowess which we are able to match to the lending data. We use a specification similar to (1) with observations at the firm-year level. We include separate firm and two-digit industry-year fixed effects. Finally, we control for size by including log assets. Our outcomes of interest are capital expenditure growth, compensation growth, the cash ratio, return on assets (ROA), and operating margin.[12] Since the financial year ends in the first calendar quarter for almost all firms in our sample, we consider 2017 and 2018 to be post-IBC periods and 2019 to be post-Feb. 12th.

Table 7 show us the results of the interaction of each intervention with our zombie classification. Column (1) shows that the growth rate in capital expenditure reduces for zombies following both treatments, with a significant and large effect (22%) following

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[12]We winsorize financial data from Prowess at the 2.5% level due to significant outliers.

Feb. 12th. This is consistent with our previous evidence showing that Feb. 12th is more effective in curbing zombie lending than the IBC. Although capital expenditure growth is reduced by both treatments, there is no effect on compensation growth or the cash ratio of zombies compared to non-zombies. The lack of an impact on compensation growth could possibly be due to the employee-friendly labor regulations in India which restrict the ability of large registered firms to alter worker contracts, even in the face of delinquency. There was a minor positive impact of Feb. 12th on zombie ROA, significant at the 1% level. This could be partly mechanical, to the extent that reducing capital expenditures decreases assets, which are in the denominator of the ratio. These results suggest that, prior to the treatments, zombie firms were able to invest despite being unprofitable. The treatments bring a decline in this malinvestment. When we use operating margin instead, we find an insignificant difference between zombies and non-zombies.

Overall, the real effects of the IBC and Feb. 12th are concentrated in reductions in firm investment, with limited effects on firm profitability. Since we have only one year of financial data following Feb. 12th, this could explain the subdued effects on firm profitability. Alternatively, the limited impact on firm profitability may also reflect the gradual slowdown in the Indian economy (Reserve Bank of India, 2020) during the period.

Table A.12 documents differential real effects for investment grade, large, and listed firms in the sample of healthy firms. We consider all three to be proxies for better financial position among healthy firms. We find, across proxy used, that capital expenditure growth is larger among these firms with strong effects post-Feb. 12th. Investment-grade and listed firms also increase their wage bill. The results on profitability are again weak, likely due to the same factors discussed above.

5   Conclusion

Recent work has highlighted how countries with weak insolvency frameworks are associated with greater zombie lending (Andrews and Petroulakis, 2019; Becker and Ivashina,

2022). We examine whether bankruptcy reforms that improve lenders' ability to recover claims from financially distressed borrowers are a possible way to address existing zombie lending. We introduce a novel measure of zombie lending and show that the introduction of a 2016 bankruptcy law in India had only a limited effect on zombie recognition, impeding the reform's efficacy. The unexpected announcement of a complementary set of regulations on February 12th, 2018 removed lender discretion in when to recognize delinquency and improved zombie recognition. Mechanisms include weak bank capitalization making lenders reluctant to recognize loan losses on their balance sheets and political economy frictions at state-owned banks. Overall, our paper highlights that lender incentives in recognizing zombie credit as non-performing are an impediment to bankruptcy reform efficacy.

Our findings are topical. During the height of COVID-19, many countries adopted unconventional forbearance measures to help firms tide over economic shocks (International Monetary Fund, 2021). Experience suggests such measures could lead to zombie lending (Gropp et al., 2022). Indeed, the build-up of stressed assets in India is possibly due to various policy measures undertaken after the Global Financial Crisis (Chari et al., 2020; Flanagan and Purnanandam, 2019). As the global economy recovers, policymakers will likely need to address zombie problems. Fixing inefficient debt resolution mechanisms is one such remedy. Our paper cautions that, in economies with undercapitalized banks and/or significant state-ownership of banks, complementary policy actions might be needed as lender incentives are an important factor determining reform efficacy.

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Figure 1
Timeline of Classification and Analysis
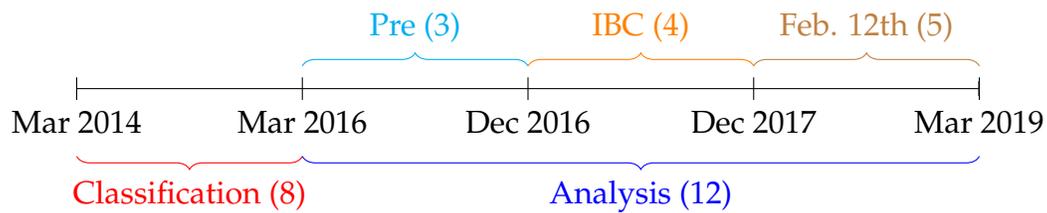
Notes: This figure shows a timeline depicting how the sample period from the second quarter of 2014 to the first quarter of 2019 is divided into different periods. The Classification period is the window over which firms are classified as zombies. This period begins in the second quarter of 2014 and ends in the first quarter of 2016. The Analysis period refers to the time period over which we conduct the empirical analysis in the paper. It begins in the second quarter of 2016 and ends in the first quarter of 2019. The Analysis period is further split into three sub-periods. The Pre sub-period is from the second quarter of 2016 to the fourth quarter of 2016, and covers the period before either of the policy interventions came into effect. The IBC sub-period is from the first quarter of 2017 to the fourth quarter of 2017. The Feb. 12th sub-period is from the first quarter of 2018 to the first quarter of 2019. The number in parantheses next to the name of each period denotes the number of quarters included in each period. The labels on the timeline show a month and year which correspond to the end of a quarter.

Figure 2
Fresh Non-Performing Asset Recognition for Zombie and Non-Zombie Borrowers
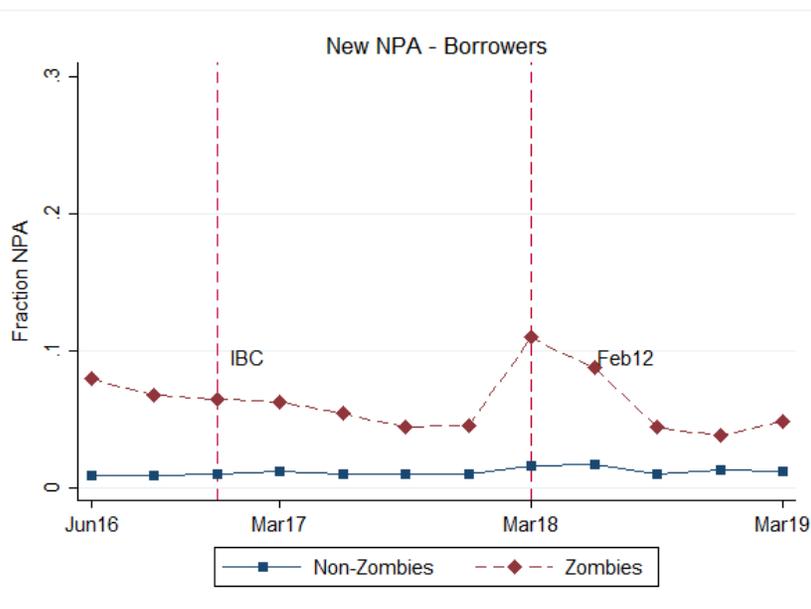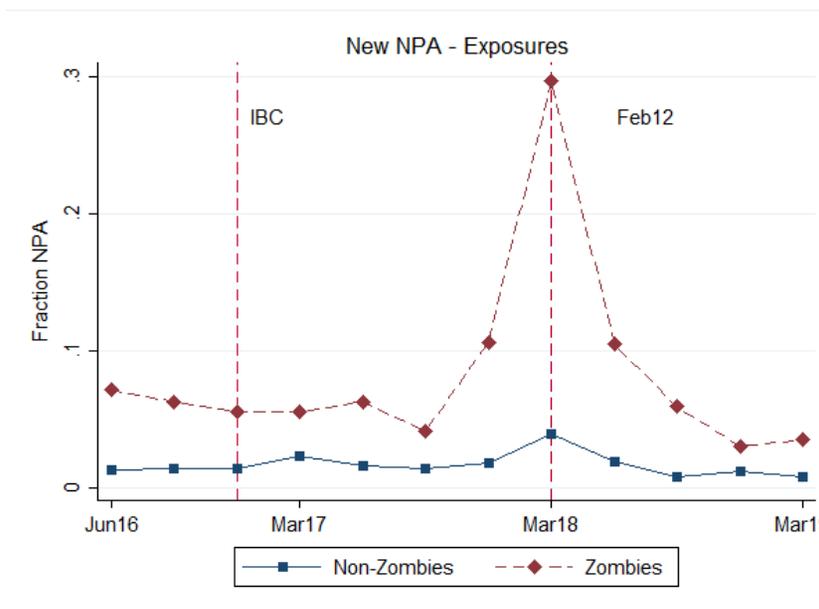
| Panel A | Panel B |
| New NPA – Borrowers | New NPA – Exposures |

Notes: This figure presents the quarterly trends in fresh NPA recognition for zombie and non-zombie borrowers for the period June 2016 to March 2019. Panel A shows the fraction (by number) of bank-borrower relationships that are freshly classified as non-performing assets (NPA) in the quarter. Panel B shows the fraction (by volume) of bank-borrower relationships that are freshly classified as non-performing assets (NPA). Both figures separate bank-borrower relationships into zombie and non-zombies. In Panel A (Panel B), the y-axis shows the number (volume) of new NPA (exposures) recognized in a quarter, as a fraction of the total non-NPA borrowers (exposures) in the previous quarter. A borrower is designated as a zombie if between June 2014 and March 2016 a) it had positive growth in exposures in the quarter after being delinquent between 60-90 days ; b) the borrower did not have a credit rating of AAA or AA even once; and c) the borrower had not formed any new banking relationship. Data is from CRILC.

Figure 3
NPA Recognition of Zombie Borrowers: Event Study Plot

Panel A: Probability NPA **Panel B: NPA Exposures (Log)**
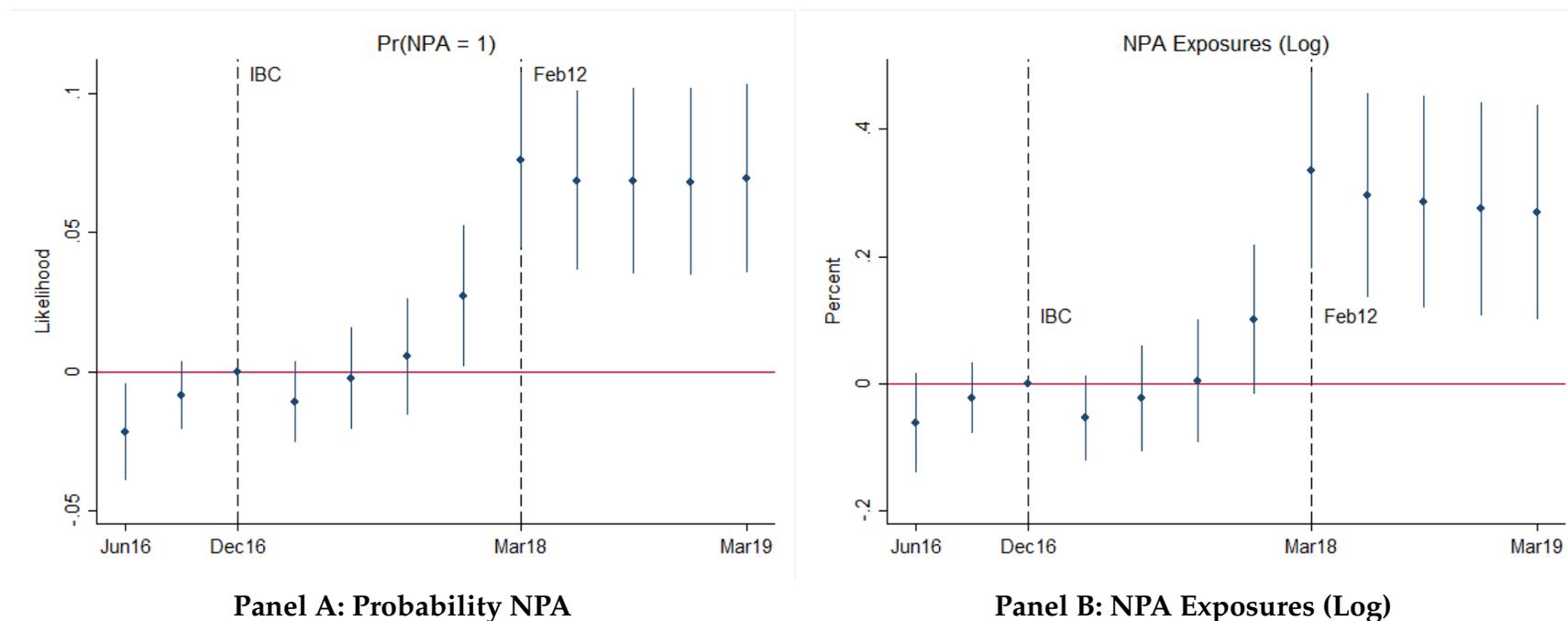
Notes: These figures present coefficient plots showing the average quarterly impact of the bankruptcy reform (IBC) and regulatory intervention (Feb. 12th) on the recognition of zombie borrowers as non-performing assets (NPA). The sample is restricted to the 12 quarters between June 2016 and March 2019. The unit of observation is borrower-bank. The dependent variable in the left panel is the likelihood of a borrower being classified as NPA; in the right panel, logged NPA exposures. All specifications include borrower-bank, two-digit industry quarter, and bank-quarter fixed effects, in addition to borrower-specific covariates. Standard errors are clustered by borrower-bank. Vertical bars represent 95% confidence intervals. Vertical lines shown are for the quarter in which the IBC (December 2016) and Feb. 12th are introduced (March 2018). The quarter in which the IBC was introduced (ending December 2016) is omitted and forms the reference category.

Table 1
Summary Statistics

Panel A: Bank-borrower Credit Data

	Observations	Mean	SD	P10	P50	P90
Zombies	168,214	0.180	0.384	0.000	0.000	1.000
Exposures (INR Billion)	168,214	1.801	5.093	0.294	0.712	3.599
Standard Asset	1682,14	0.545	0.498	0.000	1.000	1.000
0-30 days payment overdue	168,214	0.078	0.269	0.000	0.000	0.000
30-60 days payment overdue	168,214	0.035	0.183	0.000	0.000	0.000
60-90 days payment overdue	168,214	0.082	0.275	0.000	0.000	0.000
NPA	168,214	0.259	0.438	0.000	0.000	1.000
Exposures if NPA (INR Billion)	43,612	1.400	3.403	0.271	0.620	2.719
Bank Relationships	168,214	6.296	6.328	1.000	4.000	15.000
Public Sector Bank	168,214	0.740	0.438	0.000	1.000	1.000
Restructured	168,214	0.052	0.222	0.000	0.000	0.000
Investment Grade	168,214	0.343	0.475	0.000	0.000	1.000
Non-Investment Grade	168,214	0.243	0.429	0.000	0.000	1.000
Unrated	168,214	0.414	0.492	0.000	0.000	1.000

Panel B: Firm-level data

	Observations	Mean	SD	P10	P50	P90
Assets (INR bn)	41052	25.1	240.1	0.4	2.1	25.4
Debt Ratio	41052	0.385	0.300	0.036	0.346	0.736
Capex Growth	41052	-0.041	1.424	-2.000	-0.032	2.000
Compensation Growth	41052	0.116	0.295	-0.144	0.104	0.383
Cash Ratio	41052	0.015	0.077	0.000	0.003	0.032
Return on Assets	41052	0.112	0.093	0.010	0.107	0.222
Operating Margin	39503	0.322	1.274	0.014	0.103	0.418

Notes: This table shows the summary statistics for bank-borrower-quarter observations (panel A) and firm-year observations (panel B). The sample is restricted to the 12 quarters between June 2016 and March 2019 and borrowers with exposures in excess of INR 0.25 billion in every quarter. The calculation of NPA exposures is restricted to the sample of borrowers recognized as NPAs. Variables definitions and data sources are as in Table A.1.

Table 2
Impact on NPA Recognition of Zombie Borrowers

Panel A: With Covariates

Dependent Variable:	Pr (NPA = 1)			Log (NPA Exposures)		
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie × IBC	0.018**		0.014	0.049		0.032
	(0.009)		(0.009)	(0.040)		(0.040)
Zombie × Feb. 12th		0.072***	0.080***		0.304***	0.322***
		(0.014)	(0.015)		(0.070)	(0.075)
Observations	106065	167319	167319	106065	167319	167319
R^2	0.890	0.861	0.862	0.882	0.850	0.850
Bank-Borrower FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
$\beta_{IBC} = \beta_{Feb12}$ (*p-value*)			.000			.000

Panel B: Without Covariates

Dependent Variable:	Pr (NPA = 1)			Log (NPA Exposures)		
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie × IBC	0.036***		0.035***	0.111**		0.108**
	(0.010)		(0.010)	(0.045)		(0.045)
Zombie × Feb. 12th		0.119***	0.139***		0.492***	0.554***
		(0.017)	(0.019)		(0.088)	(0.096)
Observations	106065	167319	167319	106065	167319	167319
R^2	0.872	0.817	0.817	0.865	0.807	0.807
Bank-Borrower FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
$\beta_{IBC} = \beta_{Feb12}$ (*p-value*)			.000			.000

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Notes: This table presents the difference-in-difference estimates for the impact of the bankruptcy reform (IBC) and the regulatory intervention (Feb. 12th) on non-performing asset (NPA) recognition at the borrower-bank-quarter level. The sample is restricted to borrowers with exposures in excess of INR 0.25 billion in every quarter between June 2016 and March 2019. The dependent variable in columns (1)-(3) is a dummy equaling 1 if the borrower is reported NPA in the bank; and in columns (4)-(6), the log of NPA exposures of the borrower. In columns (1) and (4), the sample is restricted to quarters between June 2016 and December 2017. All specifications include borrower-bank, industry-quarter and bank-quarter fixed effects. Panel A also includes the following borrower-specific covariates: a) dummies for initial exposure; b) dummies for initial credit rating; c) dummies for ownership; d) number of bank relationships; e) whether the borrower was classified as delinquent between 0-30, 30-60 and 60-90 days in the quarter; f) whether the borrower was borrowing from a consortium or multiple lending facility; and g) whether the borrower was classified as non-performing in the past year. Borrower specific covariates affect the outcome variable differentially in the post-IBC and post-Feb12th periods. Standard errors in parentheses, clustered by borrower.

Table 3
Causal Impact on NPA Recognition of Zombie Borrowers

Dependent Variable:	Pr (NPA = 1)			Log (NPA Exposures)		
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie $\times$ IBC	0.019**		0.014*	0.039		0.018
	(0.008)		(0.008)	(0.034)		(0.034)
Zombie $\times$ Large $\times$ IBC	-0.002		-0.000	0.039		0.050
	(0.015)		(0.015)	(0.077)		(0.077)
Zombie $\times$ Feb. 12th		0.045***	0.053***		0.112**	0.122**
		(0.011)	(0.013)		(0.044)	(0.051)
Zombie $\times$ Large $\times$ Feb. 12th		0.086***	0.085***		0.622***	0.650***
		(0.026)	(0.028)		(0.149)	(0.158)
Observations	106065	167319	167319	106065	167319	167319
R^2	0.890	0.862	0.862	0.882	0.851	0.851
Bank-Borrower FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents the triple difference estimates of the bankruptcy reform (IBC) and the regulatory intervention (Feb. 12th) on the non-performing asset (NPA) recognition across size of lender exposure to borrowers. The sample is restricted to borrowers with exposures in excess of INR 0.25 billion in every quarter between June 2016 and March 2019. The unit of observation is the borrower-bank-quarter. The dependent variable in columns (1)-(3) is a dummy equaling 1 if the borrower is reported NPA in the bank; and in columns (4)-(6), the logged NPA exposures of the borrower. Large is a dummy variable equaling 1 if the borrower's exposures in the bank in a quarter exceed INR 1 billion. Columns (1) and (4) restrict the sample to the quarters between June 2016 and December 2017. All specifications include borrower-bank, bank-quarter and industry-quarter fixed effects, in addition to borrower-specific covariates. Standard errors in parentheses, clustered by borrower.

Table 4

Mechanisms determining NPA Recognition of Zombie Borrowers

Panel A: Heterogeneity by Bank Capital

Dependent Variable:	Pr (NPA = 1)			Log (NPA Exposures)		
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie × IBC	0.003		0.001	-0.006		-0.014
	(0.010)		(0.010)	(0.048)		(0.048)
Zombie × Bank Capital$_{middle}$ × IBC	0.025**		0.021**	0.093*		0.073
	(0.011)		(0.011)	(0.051)		(0.051)
Zombie × Bank Capital$_{highest}$ × IBC	0.071***		0.064***	0.289***		0.259**
	(0.023)		(0.023)	(0.104)		(0.103)
Zombie × Feb. 12th		0.065***	0.066***		0.283***	0.276***
		(0.016)	(0.017)		(0.080)	(0.086)
Zombie × Bank Capital$_{middle}$ × Feb. 12th		0.008	0.020		0.019	0.061
		(0.012)	(0.014)		(0.058)	(0.067)
Zombie × Bank Capital$_{highest}$ × Feb. 12th		0.061**	0.097***		0.207*	0.354**
		(0.026)	(0.032)		(0.122)	(0.146)
Observations	106065	167319	167319	106065	167319	167319
R^2	0.890	0.862	0.862	0.882	0.850	0.850
Bank-Borrower FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y

Panel B: Heterogeneity by Bank Ownership

Dependent Variable:	Pr (NPA=1)		Log (NPA Exposures)	
	Public Banks	Private Banks	Public Banks	Private Bank
	(1)	(2)	(3)	(4)
Zombie × IBC	0.009	0.039**	0.012	0.127*
	(0.009)	(0.016)	(0.041)	(0.073)
Zombie × Feb. 12th	0.067***	0.160***	0.271***	0.666***
	(0.016)	(0.024)	(0.080)	(0.110)
Observations	123866	43411	123866	43411
R^2	0.861	0.832	0.850	0.820
Bank-Borrower FE	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel C: Heterogeneity by Bank Ownership and Bank Capital

Dependent Variable:	Pr (NPA=1)		Log (NPA Exposures)	
	Public Banks	Private Banks	Public Banks	Private Bank
	(1)	(2)	(3)	(4)
Zombie × IBC	0.002	-0.103**	-0.008	-0.446**
	(0.010)	(0.052)	(0.048)	(0.225)
Zombie × Bank Capital$_{middle}$ × IBC	0.017	0.139**	0.053	0.564**
	(0.011)	(0.055)	(0.053)	(0.236)
Zombie × Bank Capital$_{highest}$ × IBC		0.153***		0.615***
		(0.053)		(0.229)
Zombie × Feb. 12th	0.068***	0.312*	0.285***	1.422*
	(0.017)	(0.178)	(0.086)	(0.775)
Zombie × Bank Capital$_{middle}$ × Feb. 12th	-0.001	-0.132	-0.041	-0.637
	(0.015)	(0.178)	(0.069)	(0.779)
Zombie × Bank Capital$_{highest}$ × Feb. 12th		-0.183		-0.937
		(0.177)		(0.772)
Observations	123866	43411	123866	43411
R^2	0.861	0.832	0.850	0.820
Bank-Borrower FE	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the differential impact of the bankruptcy reform (IBC) and the regulatory inter-vention (Feb. 12th) on non-performing asset (NPA) recognition for zombie borrowers across bank capital and bank ownership. Heterogeneity by bank capital, by bank ownership, and by both bank capital and bank ownwership are shown in Panels A, B, and C respectively. The sample is restricted to borrowers with exposures in excess of INR 0.25 billion in every quarter between June 2016 and March 2019. The unit of observation is the borrower-bank-quarter. The dependent variable as indicated in each panel are (i) a dummy equaling 1 if the borrower is reported NPA in the bank, (ii) the logged NPA exposures of the borrower. In Panel A in columns (1) and (4), the sample is restricted to the quarters between June 2016 and December 2017. In Panels B and C, in columns (1) and (3), the sample is borrowers at public sector banks; in columns (2) and (4), the sample is borrowers at private sector banks. Bank Capital$_{middle}$ and Bank Capital$_{highest}$ refer to the middle and top terciles of bank capital as defined in Table A.1. All specifications include borrower-bank, bank-quarter and industry-quarter fixed effects, in addition to borrower-specific covariates. Standard errors in parentheses, clustered by borrower.

Table 5
Impact on NPA Recognition Conditional on Loan Demand

	Pr (NPA = 1)		Log (NPA Exposures)	
	(1)	(2)	(3)	(4)
Zombie $\times$ Government $\times$ IBC	-0.050**		-0.193**	
	(0.022)		(0.094)	
Zombie $\times$ Government $\times$ Feb. 12$^{\text{th}}$	-0.107***		-0.389***	
	(0.032)		(0.147)	
Zombie $\times$ Bank Capital$_{\text{middle}}$ $\times$ IBC		0.025**		0.099*
		(0.011)		(0.056)
Zombie $\times$ Bank Capital$_{\text{highest}}$ $\times$ IBC		0.118***		0.494***
		(0.043)		(0.181)
Zombie $\times$ Bank Capital$_{\text{middle}}$ $\times$ Feb. 12$^{\text{th}}$		0.014		0.083
		(0.014)		(0.071)
Zombie $\times$ Bank Capital$_{\text{highest}}$ $\times$ Feb. 12$^{\text{th}}$		0.132**		0.445*
		(0.053)		(0.246)
Observations	63730	87957	63730	87957
R^2	0.927	0.935	0.923	0.930
Bank-Borrower FE	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y
Borrower-Time FE	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the impact of the IBC and Feb12 regulation on NPA recognition of zombie borrowers, conditional on borrower demand. The unit of observation is the borrower and the sample is restricted to the 12 quarters between June 2016 and March 2019. The outcome of interest in columns (1) and (3) is a dummy equaling 1 if the borrower is classified as non-performing; in columns (2) and (4), the logged amount of outstanding non-performing loans. The sample in columns (1) and (2) is restricted to borrowers transacting with both government and private banks in a quarter; in columns (3) and (4), borrowers transacting with banks across the three terciles of bank capital. All specifications include borrower-quarter fixed effects. Standard errors are in parentheses, clustered by borrower.

Table 6
Firm-level Impact on Credit to Zombie and Healthy Borrowers
Panel A: Intensive Margin

Dependent Variable:	Exposures(Log)					
	All	Non-Zombies				
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie $\times$ IBC	-.012					
	(.009)					
Zombie $\times$ Feb. 12$^{\text{th}}$	-.027**					
	(.013)					
High Zombie Bank $\times$ IBC		.005	.002	-.029		
		(.006)	(.016)	(.022)		
High Zombie Bank $\times$ Feb. 12$^{\text{th}}$		-.018**	-.024	.013		
		(.009)	(.023)	(.033)		
High Zombie Industry $\times$ IBC					-.002	
					(.005)	
High Zombie Industry $\times$ Feb. 12$^{\text{th}}$					-.015*	
					(.008)	
Young $\times$ IBC						.005
						(.010)
Young $\times$ Feb. 12$^{\text{th}}$						-.030*
						(.016)
Young $\times$ High Zombie Industry $\times$ IBC						.030*
						(.015)
Young $\times$ High Zombie Industry $\times$ Feb. 12$^{\text{th}}$						.066***
						(.024)
Observations	619200	588968	153235	154557	588977	355258
R^2	.89	.89	.88	.64	.89	.89
Bank-Borrower FE	Y	Y	Y	N	Y	Y
Industry-Time FE	Y	Y	Y	Y	N	Y
Bank-Time FE	Y	N	N	N	Y	Y
Borrower-Time FE	N	N	N	Y	N	N

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the impact of the IBC and Feb. 12$^{\text{th}}$ intervention on credit reallocation to borrowers along the intensive margin. The unit of observation is the borrower-bank and the outcome of interest is logged borrower exposures. The sample is restricted to 12 quarters between June 2016 and March 2018, and borrowers who have never been classified as non-performing. Columns (2)-(6) also excludes zombie borrowers. *High Zombie Bank* is a dummy equaling 1 if the bank had relatively high (above median) exposure to zombie borrowers between June 2014 and March 2016; *High Zombie Industry* is a dummy equaling 1 if the industry had relatively high (above median) exposure to zombie borrowers between June 2014 and March 2016. *Young* is a dummy equaling 1 if the borrower was incorporated in 2010 or later. Columns (3) and (4) restrict the sample to the subset of borrowers transacting with both high and low zombie banks. All specifications include borrower-bank and industry fixed effects, in addition to borrower-specific covariates. Columns (1), (5) and (6) include bank-quarter fixed effects while columns (1), (2), (3), (4) and (6) include industry-quarter fixed effects. Column (4) include borrower-time fixed effects. Standard errors in parentheses, clustered by borrower.

Panel B: Extensive Margin

Dependent Variable:	Pr(New Relations)=1					
	All	Non-Zombies				
	(1)	(2)	(3)	(4)	(5)	(6)
Zombie × IBC	0.004 (0.008)					
Zombie × Feb. 12th	0.007 (0.012)					
High Zombie Bank × IBC		-0.018*** (0.003)	-0.034*** (0.004)	-0.028*** (0.005)		
High Zombie Bank × Feb. 12th		-0.059*** (0.004)	-0.105*** (0.006)	-0.094*** (0.006)		
High Zombie Industry × IBC					0.027*** (0.003)	
High Zombie Industry × Feb. 12th					0.025*** (0.004)	
Young × IBC						-0.013* (0.008)
Young × Feb. 12th						-0.019* (0.011)
Young × High Zombie Industry × IBC						0.014 (0.010)
Young × High Zombie Industry × Feb. 12th						0.001 (0.015)
Observations	302109	270825	134964	134523	290433	186228
R^2	0.612	0.584	0.600	0.292	0.608	0.628
Bank-Borrower FE	Y	Y	Y	N	Y	Y
Industry-Time FE	Y	Y	Y	Y	N	Y
Bank-Time FE	Y	N	N	N	Y	Y
Borrower-Time FE	N	N	N	Y	N	N

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the impact of the IBC and Feb. 12th intervention on credit reallocation to borrowers along the extensive margin. The unit of observation is borrower-bank. The sample is collapsed as a bank-borrower panel, with one observation per bank-borrower for each of 3 time periods; pre-IBC, Feb. 12th; post-IBC, and post-Feb. 12th. The sample is restricted to 12 quarters between June 2016 and March 2018, and borrowers who have never been classified as non-performing. Columns (2)-(6) also excludes zombie borrowers. *High Zombie Bank* is a dummy equaling 1 if the bank had relatively high (above median) exposure to zombie borrowers between June 2014 and March 2016; *High Zombie Industry* is a dummy equaling 1 if the industry had relatively high (above median) exposure to zombie borrowers between June 2014 and March 2016. *Young* is a dummy equaling 1 if the borrower was incorporated in 2010 or later. Columns (3) and (4) restrict the sample to the subset of borrowers transacting with both high and low zombie banks. All specifications include borrower-bank and industry fixed effects, in addition to borrower-specific covariates. Columns (1), (5) and (6) include bank-quarter fixed effects while columns (1), (2), (3), (4) and (6) include industry-quarter fixed effects. Column (4) include borrower-time fixed effects. Standard errors in parentheses, clustered by borrower.

Table 7
Impact on Real Outcomes of Zombie and Healthy Firms

Dependent Variable:	Capex Growth	Comp Growth	Cash Ratio	ROA	Op. Margin
	(1)	(2)	(3)	(4)	(5)
Zombie × IBC	-0.068	0.022	-0.006	-0.001	-0.022
	(0.064)	(0.016)	(0.004)	(0.003)	(0.026)
Zombie × Feb. 12th	-0.218**	0.011	-0.007	0.015***	-0.004
	(0.086)	(0.018)	(0.006)	(0.005)	(0.037)
Observations	41052	41052	41052	41052	39503
R^2	0.101	0.333	0.539	0.738	0.885
Controls	Y	Y	Y	Y	Y
Firm and Ind-Year FE	Y	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table estimates the impact of the bankruptcy reform (IBC) and the regulatory intervention (Feb. 12th) on firm-level outcomes. The unit of observation is the firm-year. The dependent variables are growth in capital expenditure (column 1), growth in compensation expenditure (column 2), cash ratio (column 3), return on assets (column 4), and operating margin (column 5). Firm and industry-year fixed effects are included in all specifications, and we control for firm size using log of assets. Standard errors are clustered by firm. Variables and data sources are as in Table A.1.

Unearthing Zombies

Internet Appendix

A.1 Bankruptcy System Prior to 2016

Before the passage of the Insolvency and Bankruptcy Code (IBC) in 2016, corporate insolvency in India was characterized by a fragmented system of governing authorities. Specialized restructuring courts were established in 1956 under the Companies Act, which designated the National Company Law Tribunals (NCLTs) to oversee insolvency cases, among other corporate affairs. Because secured creditors at the time did not have the power to foreclose in the event of default, and NCLTs were subject to political pressures to preserve jobs, the system was viewed as management-friendly (Sengupta et al., 2016).

Stemming from prolonged weakness in the industrial sector, the Sick Industrial Companies Act (also known as the Special Provisions Act) was passed in 1985. This created a new adjudicating authority, the Board for Industrial and Financial Reconstruction (BIFR), to resolve financial distress. This process was only available to industrial firms, however, and because the law was passed with job-preserving objectives in mind, the BIFR was also considered to be friendly to management.

Restructuring cases took notoriously long to resolve. The average BIFR case lasted nearly 6 years (Sengupta et al. (2016)). In order to speed up asset sales, legislation in 1993 created specialized Debt Recovery Tribunals that were not required to follow civil procedures to which the NCLTs were bound (Visaria, 2009). The same institutional challenges that plagued the NCLTs (namely a lack of resources) led to delays at the tribunals as well. Banks were also the only creditors allowed to use these tribunals to recover from distressed debtors.

In an attempt to strengthen secured creditor rights, India passed the Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act in 2002, empowering banks to foreclose on properties (Vig, 2013). This Act also facilitated the formation of specialized intermediaries, known as Asset Reconstruction Companies, designed to help manage the asset reallocation process. This Act was not successful in generating high recovery rates for banks, however. An RBI report from 2004 cited recovery rates of less than 9% for public sector banks under this regime.

The RBI also exerts significant control over distressed asset resolution procedures, in part because it dictates provisioning requirements for banks. In 2008, the RBI put forward

a set of guidelines to dictate private debt work-outs.[13] Designed for large distressed borrowers, this work-out mechanism facilitated negotiations that would bring debt loads to manageable levels. In exchange for participating in the negotiation process, the RBI relaxed provisioning requirements for banks participating in these work-outs. In 2015, a modified work-out scheme was proposed that encouraged debt-for-equity swaps and granted banks the power to replace management in certain circumstances.

The piece-meal introduction of various insolvency regimes resulted in a web of uncoordinated procedural alternatives. Firms exploited ambiguities and engaged in forum shopping, leading to a significant amount of litigation. In addition, even with several alternatives in place, there was still no process that would allow all creditors to participate in a unified structured bargaining process.

On passage of the IBC, the NCLT continued to remain the adjudicating authority, the BIFR was done away with, and debt recovery tribunals were assigned to handle individual and unincorporated insolvency cases. The private work-out schemes promoted by the RBI were abolished. The powers of foreclosure granted to secured creditors under the SARFAESI Act remained in place, although an automatic stay applied if the firm was referred to the IBC.

A.2 Stressed asset build-up leading up to the bankruptcy reform

Relaxed loan provisioning, allowing banks to postpone loss recognition, formed the basis of the forbearance schemes in India after the 2008 Global Financial Crisis (GFC). Although India was relatively insulated from the GFC, the RBI announced relaxed provisioning norms for restructured loans as a precautionary measure. While this asset quality forbearance was designed to provide temporary relief to illiquid firms, lenders increasingly used them to delay the recognition of troubled assets, causing an increase in zombie lending (Chari et al., 2020). In 2013, RBI began tightening the prudential norms for asset classification and undertook the Asset Quality Review, nudging banks to recognize restructured assets as non-performing. However, the withdrawal of these forbearance schemes had limited impact on reducing zombie lending, which continued nonetheless (Chopra et al., 2020).

The Asset Quality Review pushed lenders to recognize the true capital inadequacy on bank balance sheets. A regulatory structure was also put in place as a stop-gap measure with the aim of outlining an action plan to identify problematic accounts and initiate the

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[13]These mechanisms were established in 2001, but it was not until 2008 that the guidelines were clarified.

recovery (or liquidation) of unviable assets. Since an overhaul of the bankruptcy frame-work was still under progress and alternate methods used to recover stressed assets were inadequate (see Appendix A.1 for details on the debt resolution systems in this period), the so-called 'alphabet soup' regulation was introduced, aimed at structuring credit facil-ities, aid restructuring of loans, and help in transitioning ownership.[14] Importantly, the lax loan provisioning that made the earlier schemes popular with banks were now made more stringent and hence lender take-up of these new schemes was poor. As a result, the estimated stressed assets increased even after 2013. To address this build-up of stressed assets (by all accounts likely more severe at PSBs) and clean up banks' balance sheets, policymakers considered two choices. Commentators and stakeholders proposed a "bad bank" that would house the stressed assets, but policymakers opposed the idea, arguing that it would create perverse moral hazard incentives for lenders in the future. Instead, both the RBI and the government recommended a bankruptcy code that would provide a centralized marketplace for distressed assets and create a clear pathway for the resolution of unviable assets, while still holding various stakeholders accountable (Patel, 2020).

A.3   Conceptual framework

This section provides a simple framework to motivate our focus on the recognition of zombie borrowers as non-performing. Previous literature hypothesizes that zombie lend-ing can arise due to (i) bank undercapitalization and costly loan provisioning (Peek and Rosengren, 2005), (ii) risk-shifting by distressed banks (Bruche and Llobet, 2013); and (iii) political economy frictions at state-owned banks, either through political connections (Cole, 2009; Dinc, 2005; Khwaja and Mian, 2005; Qu, 2018) or through the "fiscal domi-nance" channel stipulated in Acharya (2020), in which a constrained government wishes to avoid a costly recapitalization of the banking sector. To elucidate our analysis, we fo-cus on point (i) above. However, a similar logic applies to the remaining cases of zombie lending.

Consider a bank that makes a loan in period t to a given firm for one period. Now suppose in period $(t+1)$, the firm faces an idiosyncratic shock and is unable to repay the loan. The bank is faced with two choices, that is, either to initiate bankruptcy pro-ceedings or roll over (evergreen) the loan. In the former case, the bank first declares the loan non-performing and then takes it through the bankruptcy process to either liquidate

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[14]One such mechanism was the was the Strategic Debt Restructuring scheme that allowed for the conver-sion of debt into equity. An alternate scheme, Sustainable Structuring of Stressed Assets similarly allowed banks to acquire equity in stressed projects. A related scheme was the 5/25 scheme introduced in July 2014 and specifically aimed at the infrastructure sector and allowed banks to fix longer amortization periods (say 25 years) with periodic refinancing (say every 5 years).

or restructure with a payoff given by $r - c(k)$, where r is the recovery rate and $c(k)$ is a capital cost incurred by the lender, which is a function of bank capital (k). The capital cost derives from banking regulations that usually require that banks set aside capital as part of provisioning requirements. For example, in 2016, the provisioning requirement in India was 0.25%-1% for standard loans, 10% for loans classified as non-performing for less than 12 months, and 20%-100% for loans classified as non-performing for more than 12 months. In addition, banks are also required to ensure that capital exceeds certain regulatory thresholds, e.g., a minimum 8% capital ratio. Therefore, if the bank were to choose to pursue bankruptcy (and subsequently liquidate or restructure), the bank would need to first declare the loan non-performing and also provision for it in accordance with capital requirements. For a weakly capitalized bank that is close to the regulatory minimum, such provisioning will imply that the bank needs to raise additional costly capital to meet the regulatory minimum requirement. This explains the dependence of capital costs on bank capitalization in c(k).

After bankruptcy reform, recovery from liquidation or restructuring increases. If this increase is substantial, lenders will be willing to declare even zombie borrowers as non-performing and push them to bankruptcy; the presence of zombie loans has no bearing on the bankruptcy reform's efficacy. However, when the recovery rate r is low or bankruptcy resolution is time-consuming, as is often the case in developing economies (Li and Ponticelli, 2021), provisioning costs $c(k)$ may start to matter. Lenders will then delay the recognition of zombie borrowers as non-performing and dampen the bankruptcy reform's efficacy.

One can therefore think of two distinct parts that determine the effectiveness of the bankruptcy reform, or in general the debt resolution of delinquent borrowers. First is the bad loan recognition step in which lenders recognize zombie borrowers as non-performing. Second is the judicial resolution step in which the non-performing asset is either restructured or liquidated through bankruptcy courts. Our empirical setting allows us to disentangle the two. The IBC improved judicial resolution by improving r. Feb. 12th streamlined the first stage of the debt resolution process by addressing lender incentives and removing lender discretion over the recognition of delinquent borrowers as non-performing. If we only examined the effects on zombie recognition post the bankruptcy reform, we would end up conflating the effects due to improved recovery and the judicial resolution channel. Our unique setting allows us to hold constant the effects due to improvements in judicial enforcement (captured by the IBC) and focus on lender reluctance to recognize zombie loans as NPAs (captured by Feb. 12th). We are thus able to pinpoint the inefficiency arising from the bad loan recognition channel.

Why is the distinction between bad loan recognition and judicial enforcement important? Indeed, if r were high, bad loan recognition would automatically improve and hence policy should focus on improving r. We argue that the distinction between the two is important because policy needs to take into account the origin of the inefficiency. If most of the inefficiency post-reform arises from the bad loan recognition channel, bank recapitalization is paramount in resolving zombie credit. Further, as previously highlighted, the link between improving debt resolution and zombie lending is not just an India-specific phenomenon. Even advanced countries that have high zombie lending are associated with weak insolvency regimes, suggesting that bankruptcy reform is an appropriate policy response to address zombie lending across countries (Andrews and Petroulakis, 2019; Becker and Ivashina, 2022), underscoring the importance of delineating the two channels in reform efficacy.

A.4 Robustness checks

Here we present results on robustness of our analysis to alternative zombie measures and in different sub-samples.

Modifications to baseline zombie measures: We also show that our results are robust to modifications to the baseline borrower-level zombie measure.

In our baseline measure, we restrict zombie classification to borrowers that see a weakly positive growth in credit exposure in the pre-period. One argument could be that if borrowers capitalize interest payments, this may be reflected as an increase in credit. Alternatively, the loan contracts may simply allow for a moratorium in loan payments for a certain period. To account for these cases, in "Zombie Measure 1", we restrict zombie relationships to borrowers who exhibited relatively high growth in exposures in the quarter after which they are reported as 60-90 days delinquent in the system. Thus, a borrower is zombie if the borrower exhibits growth in real exposures in excess of 4% in the quarter after which it is reported as 60-90 days delinquent in the system and a) the borrower is never rated as AAA or AA between June 2014 and March 2016; and b) the borrower did not start a new relationship with a bank during this period. The first two columns of Table A.6 show that the effect of IBC is only weakly significant using this measure but Feb. 12th continues to have a large, positive impact on NPA recognition of zombies.

In "Zombie Measure 2", we relax the condition that a zombie borrower is never rated AAA or AA during the classification window. Thus, a borrower is zombie if the borrower exhibits weakly positive growth in real exposures in the quarter after which it is reported as 60-90 days delinquent in the system and the borrower forms no new banking relation-

ship between June 2014 and March 2016. Results in columns (3) and (4) of Table A.6 show that the effect of IBC is again only weakly significant but Feb. 12th continues to have a large, positive impact on NPA recognition of zombies.

In "Zombie Measure 3", we relax the condition that a zombie borrower does not form new relationships during the classification window. Thus, a borrower is zombie if the borrower exhibits weakly positive growth in real exposures in the quarter after which it is reported as 60-90 days delinquent in the system and the borrower is never rated AAA or AA between June 2014 and March 2016. Results, using this measure, in columns (5) and (6) of Table A.6 show that the IBC has a modest but significant positive impact on NPA recognition of zombies while Feb. 12th has a much larger impact.

Finally, in "Zombie Measure 4", we use interest coverage ratio (ICR) as a measure of distress. We define a firm as zombie if it had an ICR less than 1 in any year between 2012 and 2015, and exhibits weakly positive growth in real exposures in the quarter after which it is reported as 60-90 days delinquent in the classification window. Since we get the ICR from Prowess, we can use this measure only for firms in CRILC that can be matched to Prowess. Results in columns (7) and (8) of Table A.6 show that the IBC has a modest but significant positive impact on NPA recognition of zombies while Feb. 12th has a much larger impact.

Dynamic zombie classification: Section 2.2 argued for using a static classification of zombie borrowers to ensure that our zombie measure was uncontaminated by the treatment interventions. However, this can bias our findings if we are omitting a large number of bank-borrower relationships which satisfy the "zombie" criterion quarters after March 2016. Depending on how the interventions of interest affect banks' NPA recognition of such borrowers, this has the potential to bias our results in either direction.

We guard against this critique by considering a "dynamic" definition of zombie borrowers where for any quarter t, a borrower is classified as zombie if a) the borrower exhibits weakly positive growth in exposures in quarter t, and was reported 60-90 days delinquent in the CRILC system in quarter t-1; b) was not rated AAA or AA in quarters $\{t-1, ..., t-8\}$; c) did not initiate a new lending relationship with another bank in quarters $\{t-1, ..., t-8\}$. While being dynamic in nature, this classification is still cumulative, i.e. borrowers once identified as a zombie continue to remains a zombie until the end of the analysis window.

In aggregate, relative to the dynamic zombie definition, our preferred static definition which "freezes" zombies in March 2016 accounts for over 80 percent of zombie exposures and 50 percent of zombie borrowers in the sample. When considering borrowers with

exposures in excess of INR 0.25 billion which came under the purview of Feb. 12th, we account for over 82 percent of the bank-borrower relationships (by volume – 66 percent by number). Formally, Table A.8 shows the results using this dynamic zombie definition. While IBC now has an insignificant impact on NPA recognition of zombies, the impact of Feb. 12th on zombie recognition remains positive and significant at the 1% level, with magnitudes even larger than those in our baseline static classification results.

Using measures of distress: Here, we show that our results are robust to using simple measures of financial distress that do not involve having to define a zombie as satisfying a set of conditions. We employ three such measures. The first is if a borrower was *restructured*, i.e., it received regulatory forbearance under one of the RBI's restructuring schemes in the period before the passage of the IBC. The second measure simply is if the borrower was ever 60-90 days overdue on a payment during the classification window. The third measure is based on debt serviceability — a firm is distressed if it ever had an ICR less than 1 between 2012 and 2015. The results from using these measures in the baseline specification are presented in Table A.7. The results are largely consistent with Feb. 12th having a large positive impact on NPA recognition of zombies irrespective of the distress measure used. While these measures provide similar results to those using our baseline zombie definition, we prefer to stick with the zombie measure as our primary object because we think it better captures both delinquency and misallocated credit to undeserving firms – hallmarks of a firm being a zombie.

Excluding previously restructured assets: The third component of the Feb. 12th circular (Section 1) also eliminated all existing specialized regulatory forbearance schemes. One interpretation of this is that our results on zombie recognition simply reflect reduced forbearance post-Feb. 12th. While at face-value this interpretation seems consistent with our results, conversations with policymakers and the prevailing banking environment suggest otherwise. Instead, the third component of Feb. 12th had implications only for firms that had been receiving forbearance under multiple restructuring schemes since the early 2000s. The changes in the provisioning requirements and modifications to the post-GFC restructuring schemes after Asset Quality Review (AQR) announcement in 2013 meant that these forbearance measures had already been diluted post-AQR, making it less attractive for lenders to provide forbearance lending post-AQR (Chari et al., 2020). As Chari et al. (2020) show, while AQR arrested the build-up of zombie borrowers, it did not reverse the stock of zombie borrowers built up since AQR. Hence, we do not interpret the third component of Feb. 12th as directly affecting the degree of forbearance to bor-

rowers (which had previously already been addressed by AQR), but instead as targeting borrowers that had received repeated credit extensions spanning nearly a decade.

20.8% of the zombie borrowers are restructured borrowers (shown in Table A.3). Empirically, nearly 50% of all restructured borrowers are classified as a zombie, further supporting our zombie classification measure: As we argue, a large proportion of the restructured accounts simply were borrowers that received repeated forbearance since the early 2000s, and our zombie measure manages to capture these accounts. Consistent with this logic, our baseline includes the restructured borrowers. Nonetheless, in columns (1) and (2) of Table A.9, we remove accounts under any restructuring scheme and confirm that our results of the Feb. 12$^{\text{th}}$ intervention are large and positive. This ameliorates the concern that our results are driven solely by the removal of restructuring schemes.

Limiting the sample to delinquent borrowers: Our baseline sample includes both healthy and zombie borrowers and one may be concerned that the decline in lending reflects reduced demand by zombie borrowers relative to healthy firms. Hence, in columns (3) and (4) of Table A.9, we restrict the sample to borrowers who have been classified as 60-90 days delinquent at least once in the classification window, i.e., at the threshold of non-performing. This makes our control group more comparable if borrowers delinquent between 60-90 days (but not classified as zombie according to our definition) signify borrowers facing temporary idiosyncratic liquidity shocks. This implies that we are estimating the impact of the two interventions on insolvent borrowers, relative to temporarily illiquid borrowers.

We lose almost half our sample but still identify a positive and significant impact of the regulatory intervention on NPA recognition of zombie borrowers, relative to non-zombie borrowers in an advanced stage of delinquency, but who did not receive credit extensions after being reported 60-90 days delinquent. Intriguingly, upon restricting the control group to delinquent (but non-zombie) borrowers, we see that the bankruptcy reform has no impact on the NPA recognition of zombies. These findings underline the role played by the Feb. 12$^{\text{th}}$ intervention in separating borrowers who faced temporary liquidity shocks from insolvent borrowers who continued to receive zombie credit.

Linking to IBC referrals: While our primary analysis focuses on zombie recognition, Section 1 details how the second component of the Feb. 12th circular streamlined the process once a distressed account was recognized as non-performing. Here, we examine whether lenders started initiating bankruptcy proceedings following the circular. Specifically, we examine the impact on referrals to the National Company Law Tribunal (bankruptcy

courts through the IBC) using referral dates in the CRILC database. Results using the specification in equation (1) is present in Table A.10. The dependent variable is a dummy equaling 1 in the quarter in which the borrower gets referred to the bankruptcy court and stays so for the remainder of the sample. Column (1) shows that there is an insignificant increase in zombie referral post-IBC. The impact of post-Feb. 12th on IBC referrals is significant and four times larger. The results are consistent when we jointly estimate the impact of the two interventions [column (3)].

Supreme Court Decision: On April 2nd, 2019, the Supreme Court of India struck down the Feb. 12th circular as being unconstitutional. While our main analysis ends two days before the court decision, here we look at how the decision impacted NPA recognition in the following two quarters – June 2019 and September 2019. We cannot analyze effects beyond this since our CRILC access ends in the quarter ending September 2019

We create a dummy *SC* which takes the value 1 for the two quarters following the court decision. The control period in this analysis is the Feb. 12th period, i.e., March 2018 to March 2019.

Results using the specification in equation (1) and (3) are shown in Table A.11. We see there is no differential effect of the Supreme Court decision on NPA recognition for all borrowers and large borrowers separately. While this might initially seem surprising, it is possibly explained by the fact that the RBI issued a revised circular two months later on June 7th, 2019. While this revised circular removed the mandatory requirement to initiate bankruptcy proceedings, it did ask banks to report all defaults within 30 days. While less stringent, the new requirement potentially kept banks from rolling back their NPA recognition activities.

Figure A.1
NPA Recognition and Bankruptcy Initiation
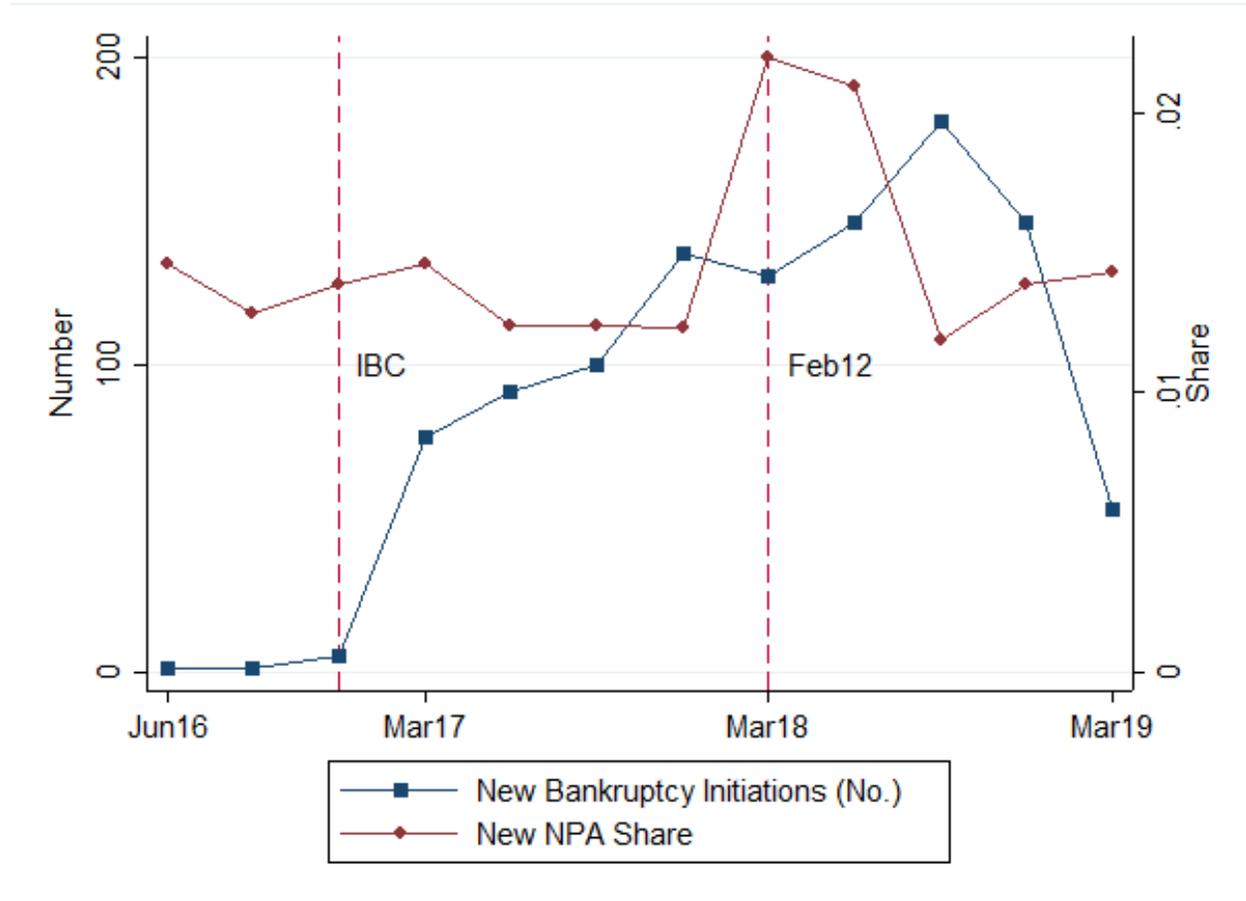
Notes: This figure shows the aggregate trends in new bankruptcy initiations and new NPA recognitions for each quarter between June 2016 and March 2019. The left-hand vertical axis depicts the number of new firms referred by banks for the initiation of bankruptcy proceedings. The right-hand vertical axis depicts new NPA recognition by banks. New NPA recognitions are expressed as a share of total non-NPA borrowers in the previous quarter. Vertical broken lines correspond to the timing of the IBC and Feb. 12th circular.

Figure A.2
NPA Recognition of Zombie Borrowers: Regression Discontinuity Analysis

NPA Recognition
Zombies

Discontinuity Estimate: .193; se: .066

NPA Recognition
Non-Zombies

Discontinuity Estimate: -.002; se: .02

NPA Amount
Zombies

Discontinuity Estimate: .868; se: .311

NPA Amount
Non-Zombies

Discontinuity Estimate: -.004; se: .11
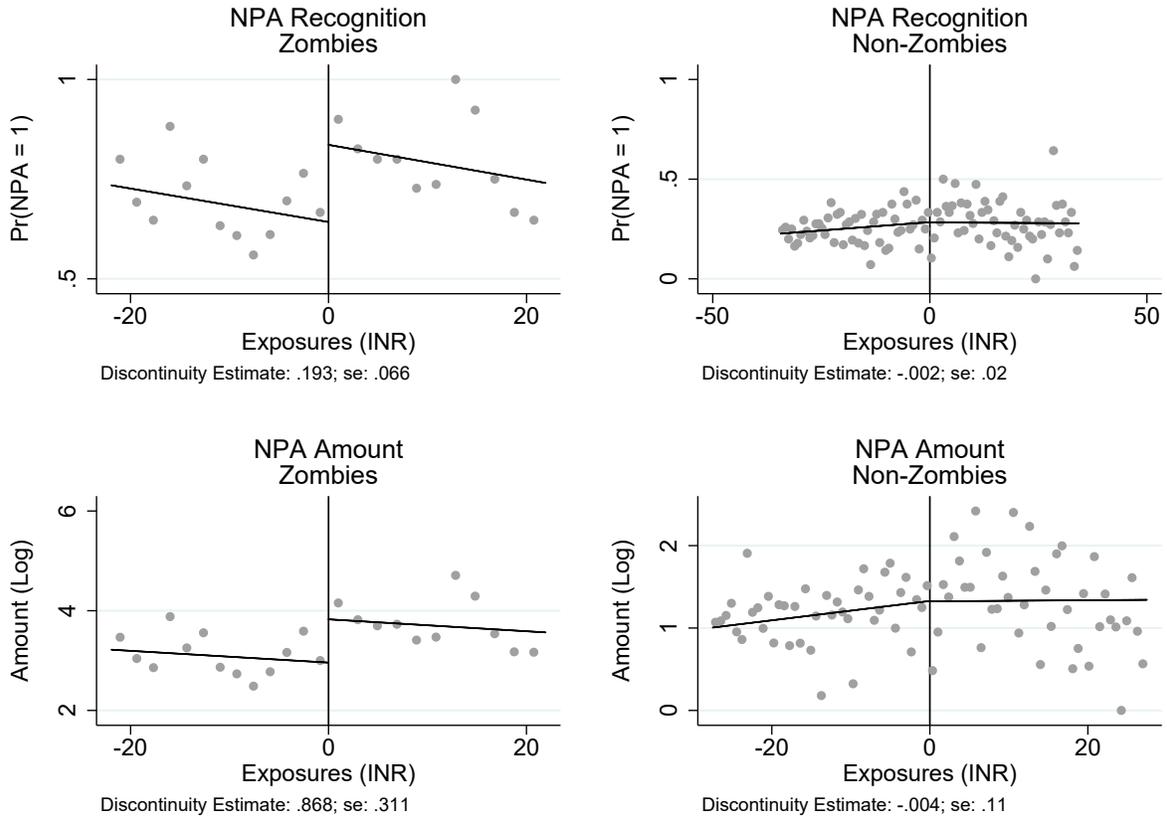
Notes: These figures present regression-discontinuity plots for the NPA recognition of zombie borrowers. The unit of observation is borrower; the sample is restricted to the quarter ending in March 2018. The left-panel restricts the sample to zombie borrowers; the right panel restricts the sample to non-zombie borrowers. The outcome of interest in the top-panel is a dummy equaling 1 if the borrower is classified as non-performing; in the bottom panel, logged exposures of non-performing borrowers. The running variable is defined the difference in outstanding loans from the INR 1 billion threshold. MSERD optimal bandwidths are used in all instances. All specifications include a triangular kernel and a linear polynomial in the running variable, in addition to industry and bank fixed effects.

Table A.1
Variable Definitions

Variable	Definition
Source: CRILC	
Zombie	A bank-borrower pair is designated as a zombie if between June 2014 and March 2016 it has had positive growth in exposures in the quarter after having a payment overdue between 60-90 days; the firm (borrower) does not have a credit rating of AAA or AA even once; and the firm (borrower) has not formed any new banking relationship.
Standard Asset	A loan is classified as 'standard' if a borrower is currently in good standing and has not missed any scheduled payments.
NPA	A loan is classified as an NPA if the borrower has not made any payments towards interest or principal in excess of 90 days.
Banking Relationships	The number of banks with whom a firm has debt outstanding in that year.
Public Sector Bank (PSB)	A dummy variable equaling 1 if the bank is a government-owned bank and 0 otherwise.
Restructured	A loan is classified as restructured if an illiquid borrower, pre-2015 is offered a forbearance scheme, wherein they are offered flexible repayment schedules, additional credit lines, or lower interest rates.
Investment Grade	A dummy variable equaling 1 in a quarter if the firm has an investment grade rating across all banks it transacts with.
Unrated	A dummy variable equaling 1 in a quarter if the firm is not rated by any rating agency.
Large	A dummy variable equaling 1 if the borrower's exposures in the bank in a quarter exceed INR 1 billion.
IBC	A dummy variable equaling 1 for the quarters ending in March, June, September, and December 2017.
Feb. 12$^{\text{th}}$	A dummy variable equaling 1 for all quarters from the one ending in March 2018 onwards.
Bankruptcy Initiation	A dummy variable equaling 1 in the quarter in which the borrower gets referred to the National Company Law Tribunal (NCLT) and stays so for the remainder of the borrower's relationship history in the bank.
Bank Capital$_{\text{middle}}$	A dummy variable equaling 1 if the bank's average Tier-I capital-to-assets ratio lie in the second tercile, between 2012 and 2015.

Table A.1
Variable Definitions (contd.)

Variable	Definition
Bank Capital$_{\text{highest}}$	A dummy variable equaling 1 if the bank's average Tier-I capital-to-assets ratio lie in the third (highest) tercile, between 2012 and 2015.
High Zombie Industry	A dummy variable equaling 1 for two-digit industries which had a above median exposure to zombie borrowers in March 2015.
IG	Investment grade (IG) is a dummy equaling 1 in a quarter if the firm has an investment grade rating across all banks it transacts with.
Listed	A dummy variable equaling 1 if the firm is listed for public trading on either of the two national stock exchanges – NSE and BSE.
Young	A dummy variable equaling 1 if the borrower's year of incorporation is 2010 onwards.
Large$_{\text{Firm}}$	A dummy equaling 1 if the firm's exposures exceed those of the median borrower in the quarter.
Zombie Measure 1	A firm is classified as a zombie if it did not have any new bank relationships between June 2014 and March 2016, was not classified as AAA or AA during any quarter during this period, and during any quarter between June 2014 and March 2016, had quarterly growth in aggregate exposures in excess of 4% in the quarter after it was reported 60-90 days delinquent in the CRILC system.
Zombie Measure 2	A firm is classified as a zombie if it did not have any new bank relationships between June 2014 and March 2016, and during any quarter between June 2014 and March 2016, had weakly positive quarterly growth in exposures in the quarter after it was reported 60-90 days in the CRILC system.
Zombie Measure 3	A firm is classified as a zombie if it was not classified as AAA or AA during any quarter during this period, and during any quarter between June 2014 and March 2016, and during any quarter between June 2014 and March 2016, had weakly positive quarterly growth in exposures in the quarter after it was reported 60-90 days in the CRILC system.
Source: Prowess	
Interest Coverage Ratio (ICR)	Profit before interest and tax scaled by interest expense
Zombie Measure 4	A firm is classified as a zombie if it was reported as having ICR less than 1 in any year between 2012 and 2015, and during any quarter between June 2014 and March 2016, had weakly positive quarterly growth in exposures in the quarter after it was reported 60-90 days in the CRILC system.

Table A.1
Variable Definitions (contd.)

Variable	Definition
CapEx Growth	The symmetric growth rate of capital expenditure defined as $\frac{Y_{it}-Y_{i,t-1}}{0.5\times(Y_{it}+Y_{i,t-1})}$.
Compensation Growth	The symmetric growth rate of wages defined as $\frac{Y_{it}-Y_{i,t-1}}{0.5\times(Y_{it}+Y_{i,t-1})}$.
Cash Ratio	The ratio of cash and bank balances in a year to total assets.
Return on Assets (ROA)	The profit before interest, taxes, depreciation, and amortization in a year scaled by average assets.
Operating Margin	The profit before interest, taxes, depreciation, and amortization in a year scaled by sales in that year.

Notes: This table describes all the variables used in our analysis. First the variables based on the CRILC database are listed and then the variables based on the Prowess database are listed.

Table A.2
Zombie and Non-Zombie Comparison: Firm Characteristics

	Healthy	Zombie	Diff of Means
	(1)	(2)	(3)
Assets (INR billion)	18.586	7.035	11.551***
			(1.911)
Sales (INR billion)	8.369	2.123	6.247***
			(0.570)
Return on Assets	0.109	0.043	0.067***
			(0.003)
Operating Margin	0.214	0.147	0.067***
			(0.016)
Fixed Assets Share	0.276	0.332	-0.056***
			(0.010)
Debt Ratio	0.395	0.621	-0.226***
			(0.010)
Current Ratio	1.371	0.987	0.384***
			(0.036)
Interest Coverage Ratio<1	0.198	0.552	-0.353***
			(0.018)
Interest Expense/Average Debt	0.104	0.105	-0.001
			(0.002)
Manufacturing	0.411	0.411	0.000
			(0.018)
Age (Years)	21.974	19.947	2.027***
			(0.555)
Observations	8372	852	9224

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table compares firm characteristics of zombie and healthy (non-zombie) borrowers as of March 2016. The data is from the Prowess database. The first (second) column has the mean value for healthy (zombie) borrowers. The third column has the point estimate and standard error (in parentheses) for a t-test comparing the means of the two groups.

Table A.3
Zombie and Non-Zombie Comparison: Borrowing Characteristics

	Healthy	Zombie	Diff of Means
	(1)	(2)	(3)
Exposures (INR Billion)	2.026	1.229	.797***
			(.125)
Exposures > 1 Billion (INR)	0.410	0.339	0.071***
			(0.010)
Standard Asset	.748	0.248	-.501***
			(0.009)
0-30 days payment delinquent	.025	0.033	-0.008**
			(0.001)
30-60 days payment delinquent	0.038	0.095	-0.057***
			(0.004)
60-90 days payment delinquent	0.057	0.271	-0.213***
			(0.006)
NPA	0.132	0.355	-0.223***
			(0.007)
Restructured	0.052	0.208	-0.156***
			(0.005)
Bank Relationships	6.973	5.230	-1.744***
			(0.134)
Public Sector Bank	0.709	0.868	-0.160***
			(0.009)
Investment Grade	0.330	0.096	-0.233***
			(0.009)
Non-Investment Grade	0.180	0.467	-0.287***
			(0.009)
Unrated	0.490	0.436	0.053***
			(0.010)
Observations	14229	3026	17255

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table compares borrowing characteristics of zombie and healthy (non-zombie) borrowers in the quarter of March 2016. The data is from the CRILC database. The first (second) column has the mean value for healthy (zombie) borrowers. The third column has the point estimate and standard error (in parentheses) for a t-test comparing the means of the two groups.

Table A.4
Transition of Zombie Borrowers Over Time

	(1)	(2)	(3)	(4)
	(Zombie – Jun14-Mar16)		(Non-Zombie – Jun14-Mar16)	
	Zombie	NPA	Zombie	NPA
Jun16-Dec17	.168	.528	.045	.124
Mar18-Mar19	.078	.571	.032	.133

Notes: This table shows the transition of zombie borrowers over time. The unit of observation is borrower. A borrower is classified as a zombie if it witnessed positive loan growth in the quarter after being classified as 60-90 days delinquent, and the borrower was a) not rated AAA or AA once in the past 8 quarters, and b) did not start a new relationship with another bank. For the period between June 2018 and March 2019, we consider the credit ratings and bank relations over the past 4 quarters. NPA indicates if the borrower was classified as non-performing in any quarter during the time period considered.

Table A.5
Transition of Zombie and Non-Zombie Borrowers Over Time

	(1)	(2)	(3)
	Non-Zombies	Zombies	Difference
Pr (NPA = 1)	.148	.581	.433***
Pr (Delinquent = 1)	.489	.652	.163***
Pr (60-90 Days Delinquent = 1)	.182	.541	.359***
Pr (Any IG = 1)	.185	.113	-.072***
Pr (Any AAA-AA = 1)	.058	.018	-.040***
Pr (Any NonIG = 1)	.367	.516	.149***

Notes: The above table shows descriptive features about zombie and non-zombie borrowers between June 2016 and March 2019. The unit of observation is the borrower. Delinquent means missing at least one repayment. IG refers to being rated as either AAA, AA, A or BBB; AAA-AA refers to being rated as either AAA or AA; NonIG refers to being rated as either BB, B, C or D.

Table A.6
Robustness to Alternate Zombie Definitions

Dependent Variable	Measure 1		Measure 2		Measure 3		Measure 4	
	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zombie $\times$ IBC	0.019*	0.068	0.015*	0.030	0.023***	0.082**	0.073***	0.311***
	(0.014)	(0.048)	(0.009)	(0.041)	(0.008)	(0.039)	(0.013)	(0.067)
Zombie $\times$ Feb. 12th	0.097***	0.433***	0.091***	0.377***	0.090***	0.372***	0.347***	0.710***
	(0.018)	(0.092)	(0.016)	(0.078)	(0.013)	(0.065)	(0.022)	(0.114)
Observations	167319	167319	167319	167319	167319	167319	100030	100030
R^2	0.862	0.850	0.862	0.850	0.862	0.850	0.848	0.841
Bank-Borrower FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y	Y	Y

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the robustness of the baseline results to alternate definitions of zombie borrowers. The measures used are defined in Table A.1. The unit of observation is the borrower-bank. The outcome of interest in odd-numbered columns is a dummy equaling 1 if the borrower is a non-performing asset; in even-numbered columns, logged NPA exposures. All specifications include borrower-bank, 2-digit industry-quarter and bank-quarter fixed effects, in addition to borrower-specific covariates. The sample is restricted to 12 quarters between June 2016 and March 2019 and borrowers with outstanding loans in excess of INR 0.25 Bn. Standard errors in parentheses, clustered by borrower.

Table A.7
Robustness to Alternate Definitions of Distress

Dependent Variable	Restructured Borrower		60-90 Days Delinquent		ICR < 1	
	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{Distress} \times$ IBC	0.004	0.047***	0.196***	0.117***	0.028***	0.127***
	(0.015)	(0.073)	(0.006)	(0.029)	(0.009)	(0.048)
$\mathbb{1}_{Distress} \times$ Feb. 12th	0.095***	0.481***	0.097***	0.407***	0.050***	0.238***
	(0.024)	(0.128)	(0.011)	(0.056)	(0.015)	(0.074)
Observations	167319	167319	167319	167319	100030	100030
R^2	0.861	0.850	0.862	0.850	0.847	0.839
Bank-Borrower FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the robustness of the baseline results to alternate definitions of distressed borrowers. The unit of observation is the borrower-bank. All specifications include borrower-bank, 2-digit industry-quarter and bank-quarter fixed effects, in addition to borrower-specific covariates. *Restructured Borrower* refers to borrowers who have received regulatory forbearance; *60-90 Days Delinquent* refers to borrowers who have been reported as 60-90 days delinquent in at least one quarter prior to March 2016. ICR < 1 refers to firms which have reported an Interest Coverage Ratio less than 1 at least once between 2012 and 2015. The ICR measure is available solely for borrowers which can be linked to the Prowess database. The sample is restricted to 12 quarters between June 2016 and March 2019 and borrowers with outstanding loans in excess of INR 0.25 Bn. Standard errors in parentheses, clustered by borrower.

Table A.8
Robustness to Dynamic Zombie Definition

	Pr (NPA = 1)	Log (NPA Exposures)
	(1)	(2)
Zombie × IBC	0.020	0.060
	(0.016)	(0.074)
Zombie × Feb. 12th	0.088***	0.421***
	(0.023)	(0.107)
Observations	154511	154511
R^2	0.864	0.853
Bank-Borrower FE	Y	Y
Industry-Time FE	Y	Y
Bank-Time FE	Y	Y

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the robustness of the baseline results to a dynamic definition of zombie borrowers. The unit of observation is the borrower-bank. The outcome of interest in column (1) is a dummy equaling 1 if the borrower is classified as non-performing; in column (2), logged NPA exposures. All specifications include borrower-bank, 2-digit industry-quarter and bank-quarter fixed effects, in addition to borrower-specific covariates. The sample is restricted to 12 quarters between June 2016 and March 2019 and borrowers with outstanding loans in excess of INR 0.25 Bn. Zombie is a dummy equaling 1 if the borrower had positive growth in outstanding credit in the quarter after being classified as 60-90 days delinquent, and have in the past 8 quarters not been a) rated AAA or AA in the system, and b) not started a new relationship with a bank. Standard errors in parentheses, clustered by borrower.

Table A.9
Robustness to Alternate Samples

Dependent Variable	Excluding Rest. Borr		60-90 Days Delinquent	
	Pr(NPA = 1)	Log (NPA Exp.)	Pr(NPA = 1)	Log (NPA Exp.)
	(1)	(2)	(3)	(4)
Zombie × IBC	0.013	0.019	-0.008	-0.055
	(0.008)	(0.038)	(0.010)	(0.045)
Zombie × Feb. 12th	0.058***	0.201***	0.036**	0.159*
	(0.014)	(0.067)	(0.017)	(0.084)
Observations	140084	96874	140084	96874
R^2	0.873	0.827	0.862	0.818
Bank-Borrower FE	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y

Notes: This table shows the robustness of the baseline results when we change the sample being employed. The unit of observation is the borrower-bank. The outcome of interest in odd-numbered columns is a dummy equaling 1 if the borrower is classified as non-performing; in even-numbered columns, logged NPA exposures. All specifications include borrower-bank, 2-digit industry-quarter and bank-quarter fixed effects, in addition to borrower-specific covariates. The sample is restricted to 12 quarters between June 2016 and March 2019 and borrowers with outstanding loans in excess of INR 0.25 Bn. Standard errors in parentheses, clustered by borrower.

Table A.10
Bankruptcy Referral of Zombie Borrowers

Dependent Variable:	Pr (Bankruptcy Initiation = 1)		
	(1)	(2)	(3)
Zombie × IBC	0.007		0.007
	(0.005)		(0.005)
Zombie × Feb. 12th		0.026***	0.030***
		(0.008)	(0.010)
Observations	106065	167319	167319
R^2	0.458	0.571	0.571
Bank-Borrower FE	Y	Y	Y
Industry-Time FE	Y	Y	Y
Bank-Time FE	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents the difference-in-differences estimates of the bankruptcy reform (IBC) and the regulatory intervention (Feb. 12th) on the probability of a borrower being referred to National Company Law Tribunal (NCLT) — defined as an indicator for whether a bankruptcy proceeding has been initiated. The sample is restricted to borrowers with exposures in excess of INR 0.25 billion in every quarter between June 2016 and March 2019. The unit of observation is the borrower-bank-quarter. The dependent variable in all the columns is a dummy equaling 1 in the quarter in which the borrower gets referred to NCLT and stays so for the remainder of the borrower's relationship history in the bank. Columns (1) and (4) restrict the sample to the quarters between June 2016 and December 2017. All specifications include borrower-bank, bank-quarter and industry-quarter fixed effects, in addition to borrower-specific covariates. Standard errors in parentheses and clustered by borrower.

Table A.11
Impact on NPA Recognition of Supreme Court Ruling

	Pr (NPA = 1)		Log (NPA Exposures)	
	(1)	(2)	(3)	(4)
Zombie × SC	0.004	0.002	0.005	-0.004
	(0.009)	(0.009)	(0.040)	(0.035)
Large × Zombie × SC		0.010		0.045
		(0.014)		(0.071)
Observations	78488	78488	78488	78488
R^2	0.929	0.929	0.930	0.930
Bank-Borrower FE	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table shows the impact of the Supreme Court ruling in April 2019 which led to the withdrawal of the Feb. 12th circular, to be replaced with a new circular within 2 months of the ruling. The unit of observation is the borrower-bank. The outcome variable in columns (1)-(2) is a dummy equaling 1 if the borrower is classified as non-performing; in columns (3)-(4), the logged volume of outstanding non-performing loans. SC is a dummy that takes the value 1 for quarters following the Supreme Court ruling, i.e., June 2019 onwards. All specifications include borrower-bank, 2-digit industry-quarter and bank-quarter fixed effects, in addition to borrower-specific covariates. The sample is restricted to 7 quarters between March 2018 and September 2019 and borrowers with outstanding loans in excess of INR 0.25 Bn. *Large* is a dummy equaling 1 if the borrower has outstanding loans in the bank exceeding INR 1 billion. Standard errors in parentheses, clustered by borrower.

Table A.12
Effect on Real Outcomes of Healthy Firms

Panel A: By Credit Rating

	Capex Growth	Comp Growth	Cash Ratio	ROA	Op. Margin
	(1)	(2)	(3)	(4)	(5)
IG × IBC	0.210***	0.001	0.005*	-0.004**	-0.018
	(0.034)	(0.007)	(0.003)	(0.002)	(0.012)
IG × Feb. 12th	0.234***	0.018**	0.005***	-0.003	-0.017
	(0.040)	(0.008)	(0.002)	(0.002)	(0.014)
Observations	36855	36855	36855	36855	35429
R^2	0.102	0.326	0.536	0.742	0.896
Controls	Y	Y	Y	Y	Y
Firm and Ind-Year FE	Y	Y	Y	Y	Y

Panel B: By Size

	Capex Growth	Comp Growth	Cash Ratio	ROA	Op. Margin
	(1)	(2)	(3)	(4)	(5)
Large$_{Firm}$ × IBC	0.160***	-0.028**	0.002	-0.003	0.002
	(0.047)	(0.011)	(0.009)	(0.002)	(0.011)
Large$_{Firm}$ × Feb. 12th	0.243***	-0.019	0.008	-0.003	0.005
	(0.057)	(0.012)	(0.007)	(0.003)	(0.017)
Observations	36378	36378	36378	36378	34976
R^2	0.099	0.322	0.535	0.741	0.895
Controls	Y	Y	Y	Y	Y
Firm and Ind-Year FE	Y	Y	Y	Y	Y

Panel C: By Listing Status

	Capex Growth	Comp Growth	Cash Ratio	ROA	Op. Margin
	(1)	(2)	(3)	(4)	(5)
Listed × IBC	0.214***	0.033***	0.000	-0.002	0.012
	(0.036)	(0.007)	(0.001)	(0.002)	(0.015)
Listed × Feb. 12th	0.100**	0.062***	-0.001	-0.007***	0.013
	(0.045)	(0.008)	(0.001)	(0.003)	(0.020)
Observations	36855	36855	36855	36855	35429
R^2	0.102	0.327	0.536	0.742	0.896
Controls	Y	Y	Y	Y	Y
Firm and Ind-Year FE	Y	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Notes: This table estimates the impact of the bankruptcy reform (IBC) and the regulatory intervention (Feb. 12th) on firm-level outcomes for healthy, i.e., non-zombie firms, excluding non-performing borrowers and zombie borrowers. The differential impact on investment grade (Panel A), size (Panel B), and listing status (Panel C) is shown. The unit of observation is the firm-year. The dependent variables are growth in capital expenditure (column 1), growth in compensation expenditure (column 2), cash ratio (column 3), return on assets (column 4), and operating margin (column 5). Firm and industry-year fixed effects are included in all specifications, and we control for firm size using log of assets. Standard errors are clustered by firm. All variables are as defined in Table A.1.

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