# Unearthing Zombies:

# Regulatory Intervention To Aid Legal Reform*

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October 7, 2019

**Abstract**

We study how regulatory interventions can bridge the gap between the passage of bankruptcy laws and their effective implementation. In 2016, India introduced a bankruptcy law giving creditors the power to refer defaulting borrowers to a quasi-judicial body for resolution. Using supervisory data on the universe of large bank-borrower relationships, we examine the likelihood of loans being classified as distressed, a precursor to starting bankruptcy proceedings. We find that the bankruptcy law had only a limited impact on banks classifying loans as distressed, and this impact was particularly muted for larger borrowers. Consequently, the law change had minimal impact on credit allocation and borrower behavior. However, a 2018 regulatory intervention from the central bank compelling all banks to immediately recognize defaulting borrowers and to refer them for bankruptcy proceedings resulted in a 60 percent increase in recognition of distressed assets, though with *more* muted effects in weaker banks. Identifying effects based on bank-borrower size thresholds targeted by the intervention, we show that the regulatory action led to reallocation of credit from distressed firms to creditworthy firms in the same industry. Overall, our results indicate that regulatory action might be necessary, above and beyond bankruptcy reform, to target "zombie" lending in the presence of an undercapitalized banking system."

**JEL Classification:** F34, G23, G28, G33, K42, O53

**Keywords:** NPA; Zombie; Bankruptcy; Banking Regulation; India; Creative Destruction

*Preliminary and incomplete. Please do not cite. We are indebted to Viral Acharya for his invaluable guidance. We are grateful to Pallavi Chavan, R. Ravikumar and M.K. Subhashree for several helpful insights and suggestions. We thank Rishab Devnani, Jay Prakash Nagar and Kavya Ravindranath for excellent research assistance. We express our gratitude to the Reserve Bank of India for permission to use the data. All the opinions expressed in this paper reflect those of the authors and not necessarily those of the Reserve Bank of India or CAFRAL.

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# 1 Introduction

"Zombie" borrowers, or insolvent firms that are sustained by continued extension of credit by complicit banks, can inhibit growth by tying up financial and human capital (Caballero et al. (2008)). While the deleterious effects of these borrowing arrangements have been well documented, there is less consensus on how to curtail zombie lending once it has become a sizeable presence within a country's banking system. The literature on financial frictions suggests that, when creditor rights are weak, improvements to those rights can boost economic growth.[1] Can bankruptcy reform that affords creditors greater protection be the solution to the zombie problem? We study this question in the context of India, where there has been a rise in extreme delinquency in the post-Great Recession period (Acharya (2017)).

Using administrative data from India on bank-borrower accounts, we study the impact of a new bankruptcy regime on the recognition of zombie borrowers. We first examine the period immediately surrounding the enactment of the Insolvency and Bankruptcy Code (IBC) in December 2016, which significantly strengthened creditor rights and unified India's insolvency framework. We then compare this to changes in recognition after the passage of a rule that eliminated lender discretion in the initiation of bankruptcy proceedings against delinquent borrowers. This broadly unanticipated rule (henceforth referred to as the "regulatory intervention") was issued by the Reserve Bank of India (RBI) on February 12$^{th}$, 2018. It advanced the timeline for lenders' recognition of borrower defaults, did away with various forbearance measures, and eliminated lender discretion in the initiation of bankruptcy proceedings against large borrowers.[2] In summary, these guidelines directed banks to immediately report large borrower defaults and initiate bankruptcy proceedings once they had been delinquent for 180 days.

We construct a novel classification of zombie accounts by combining information on borrowers' repayment histories, credit growth within bank, and external credit ratings. We subsequently exploit the introduction of the bankruptcy reform and the regulatory intervention through a difference-in-differences framework to causally identify the impact of each treatment on the recognition of zombie accounts by banks as non-performing assets (NPAs), a status that serves as a precursor to the initiation of bankruptcy proceedings.

[1] La Porta et al. (1997, 1998); Levine (1998, 1999); Beck and Levine (2005); Djankov and Shleifer (2005)

[2] One of the core operations of the RBI is to annually supervise banks and ensure financial stability. This accords RBI with the ability to issue directives to commercial and co-operative banks, which are typically termed as "circulars" and shared with the public through the RBI's website.

Our baseline empirical results show that the regulatory intervention issued by the central bank through the February 12$^{th}$ circular had a significantly larger impact on the recognition of zombie borrowers as NPA than the bankruptcy reform itself. Along the extensive margin, the regulatory intervention increased the likelihood that zombie borrowers were recognized as NPA by 15 percentage points, while the comparable effect of the bankruptcy reform was 3 percentage points. The coefficients are economically significant when considering that the average recognition of zombie borrowers as NPA in the prior period was 24 percent. Along the intensive margin, the regulatory intervention caused a 80 percent increase in delinquent loan amounts, while the corresponding increase for the bankruptcy reform was only 12 percent.

As the regulatory intervention is applied to borrowers with debt in excess of Rs. 1 billion, we test for differential effects of the intervention for larger zombie borrowers.[3] The results are striking: the regulatory intervention had the strongest effect for larger zombie borrowers, increasing their likelihood of being recognized as NPAs by an additional 6 percentage points (with a net impact of 10 percentage points) in the post-intervention period. The bankruptcy reform, in the absence of the regulatory intervention, had a relatively *lower* impact on larger zombie borrowers: thus, the reform by itself had a 3.5 percentage lower impact on the recognition of larger zombie borrowers as NPA, relative to a base impact of a 5 percentage point increase in NPA recognition for smaller zombie borrowers.

We explore the limited effect of the bankruptcy reform on lenders' recognition of zombie borrowers by testing Acharya et al. (2019)'s hypothesis that under-capitalized banks face perverse incentives to extend credit to zombie borrowers in effort to delay the recognition of losses and preclude provisioning costs. Using a measure of bank capitalization based on banks' capital to risk-weighted assets ratio (CRAR), we test for differential effects of the regulatory intervention and bankruptcy reform across banks located in the bottom quartile of CRAR. The results provide partial support to the hypothesis that the limited effect of bankruptcy reforms was driven by under-capitalized lenders' unwillingness to recognize zombie borrowers as non-performing assets. We find that while there was no differential effect of the regulatory intervention on the recognition of large zombie borrowers as NPA across the most under-capitalized banks, the impact of the bankruptcy reform was particularly muted for larger borrowers in these banks.

Collectively, our results document the limitations of bankruptcy reform in eliminating zombie borrowers when adopted in an environment with under-capitalized banks that retain the discretion

[3]While the intervention applied immediately to borrowers above Rs. 20 billion, an "information intervention" extended to borrowers over Rs. 1 billion. Details are discussed further in Section 2.

to choose the borrowers against whom bankruptcy proceedings are initiated. The February 12$^{th}$ circular complemented the bankruptcy reform by making it harder for banks to continue zombie lending through the discontinuation of regulatory forbearance and elimination of lender discretion in initiating bankruptcy proceedings against large borrowers. The paper thereby documents that improved creditor rights can aid in the recognition of zombie borrowers by banks but only when implemented by a credible regulator.

Finally, our paper identifies whether an increase in the recognition of zombie borrowers as non-performing also facilitates a reallocation of credit toward healthier borrowers. While we have only one year of data in the post-treatment period and can only observe borrowers' aggregate lending from banks (and not fresh credit issued), we show that aggregate lending for creditworthy borrowers increased by 8 percent in the aftermath of the regulatory intervention, and this was driven by large creditworthy borrowers whose exposures exceeded Rs. 1 billion. The increase in lending is also higher in banks that had an ex-ante higher concentration of zombie borrowers, confirming that the decline in banks' extension of credit to zombie borrowers due to the regulatory intervention caused the expansion of credit to healthier borrowers. There is no reallocation of credit away from sectors which had an ex-ante high concentration of zombie borrowers, providing evidence in support of Caballero et al. (2008) who finds that zombie lending by banks depresses healthy firms operating in industries dominated by zombie borrowers. The expansion in credit, however, is concentrated along the extensive margin with a very limited impact of the regulatory intervention on the entry of new borrowers into the banking system.

Our paper makes several contributions. While improvements in creditor rights via bankruptcy reform can alleviate financial frictions, particularly for developing countries, *de jure* bankruptcy laws can differ significantly from *de facto* bankruptcy laws (La Porta et al. (1997)). Prior literature has found that judicial delay arising from congested bankruptcy courts (Ponticelli and Alecnar (2018)) and political influence (Li and Ponticelli (2019)) can weaken the impact of bankruptcy reform. By contrast, we show that a weakly capitalized banking system can *also* lead to weak enforcement of bankruptcy reform, rendering the reform nearly ineffective. Importantly, we show that the regulatory intervention, which removed lender discretion in loan resolution once a borrower defaulted, was effective in overcoming weak enforcement due to agency problems associated with a weak banking sector. This is in contrast to Li and Ponticelli (2019) who find that experienced judges liquidated state-owned firms controlled by local (but not central) governments after bankruptcy reform in China, thus overcoming

only some of the political economy problems associated with liquidations. In our setting, removing all lender discretion over bankruptcy initiation overcomes many of the political economy problems associated with bankruptcy liquidations.

Our unique regulatory panel data on bank-borrower relationships allows us to pinpoint the impact of the regulatory intervention on NPA reporting and precisely estimate follow-on reallocation effects. We are one of only several empirical papers that analyze the means by which countries recover from NPA crises. A particular problem in the emerging market context is the problem of loan "evergreening" wherein banks are reluctant to recognize bad loans on their books and continue lending to otherwise insolvent borrowers (zombies) at subsidized rates. Reasons for evergreening include onerous capital provisioning requirements, cronyism, political economy problems, and the fear of criminal penalties imposed on lenders that are triggered upon the recognition of a loan as non-performing (Banerjee et al. (2004)). Zombie lending can impose negative externalities on an economy by inhibiting the process of creative destruction in investment and employment by healthier borrowers as observed in Japan in the 1990s (Caballero et al. (2008)). Improving creditor rights can reduce zombie lending by removing the hold-up problem associated with weak creditor rights and reallocating credit and resources to the good firms in the economy (Kulkarni (2018)). However, our paper shows that even increasing creditor rights may not be enough to mitigate these externalities when the banking system is entrenched and hence creditor rights are poorly enforced. Specifically, we show that removing all lender discretion in whether a bank pursues insolvency proceedings can force banks to cut credit to zombie borrowers which then has spillover effects on the good borrowers by allowing banks to reallocate credit to these firms.

**Related literature:** This paper relates to three main strands of literature. First is the large literature on creditor rights which has found that better creditor rights can increase borrower access to credit (La Porta et al. (1997), La Porta et al. (1998)). Recent papers have emphasized that, to be effective, creditor rights need to be enforced in a timely manner. Costs associated with judicial delay (Ponticelli and Alecnar (2018)) and weak resolution of contract disputes (Jappelli et al. (2005)) can limit borrower access to credit. Our paper emphasizes how weak enforcement can arise from a weakly capitalized banking sector and how removing lender discretion in whom to pursue for liquidations can improve enforcement. Our paper also builds on a body of research that has evaluated the impact of credit market reforms in India (Visaria (2009); Vig (2013); Kulkarni (2018); Lilienfeld-Toal et al. (2012))

Second, our paper is related to the large and growing literature on zombie lending. Caballero et al. (2008), in their seminal paper focusing on Japan in the 1990s, show that a proliferation of zombies can inhibit the process of creative destruction, reducing overall profits and discouraging the entry of good firms. Fukuda and Nakamura (2011), however, argue that the private restructuring efforts were often successful in lifting firms out of zombie status.[4] Peek and Rosengren (2005) attribute the higher restructuring to government complicity and lax oversight to the costliness of bank bailouts and political pressure to limit firm closures.[5] An increase in zombie lending and the resulting negative spillovers due to zombie congestion has been observed in other developed economies such as Italy and Spain have also experienced drag from zombie firms (McGowan et al. (2017); Albertazzi and Marchetti (2010)). More recently, however, zombies have become increasingly associated with developing economies and state-owned banks. Tan; Shen and Chen (2017) highlight the inefficiencies in lending practices in China, particularly by state-owned banks.

Because of the specific institutional and political factors that contribute to zombie lending, it is difficult to approach solutions strictly from a mechanism design perspective. Bruche and Llobet (2013) suggest that the problem can be addressed by subsidizing loan modification or facilitating asset buybacks. Zombies in their model are generated by risk shifting incentives. Using data from OECD countries, Andrews and Petroulakis (2019) estimate that poor bank health is responsible for approximately one third of the impact that zombies have on capital misallocation. They emphasize the importance of reorganization-friendly insolvency regimes combined with policies that support bank health in combating zombie lending. This is consistent with our finding that a weakly capitalized banking sector did mute the positive impact of the bankruptcy reform. As opposed to recapitalization of banks, we show that a well formulated regulatory reform can also be successful in encouraging the process of creative destruction.

The rest of this paper is organized as follows: Section 2 provides a summary of the institutional details relevant to the February 12th circular. Section 3 describes our data sources while Section 4 presents our empirical strategy. Results are described in Section 5. Section 6 concludes.

[4] It is worth noting two important features that make Japan's recovery a special case, however. First, its zombie loan glut was instigated by a sudden and severe financial crisis, and the problem eventually dissipated once macroeconomic conditions recovered in the mid-2000s. Second, although the Japanese government exerts a significant amount of control over the banking sector, it does not retain outright ownership over large banks.

[5] See Sekine et al. (2003); Caballero et al. (2008); Ahearne and Shinada (2005); Fukao and Ug Kwon (2006); Nishimura et al. (2005) , and Kim (2004) for other papers focusing on Japan in the 1990s.

## 2 Institutional Background

Since the early 1990s, when it implemented a number of policy measures aimed at economic liberalization, India has made significant strides in financial market development. Despite its many advances, however, India still differs from most developed economies in certain key aspects of its financial system, particularly those pertaining to credit markets. This section provides a brief background of India's lending practices as well as the evolution of its insolvency system.

### 2.1 Lending Practices

Following an economic crisis in 1991, the newly-elected Prime Minister P. V. Narasimha Rao recruited Manmohan Singh as Minister of Finance to aid in the liberalization of the country's economy. One of the key elements of their agenda was to promote competition in the banking sector, which had previously been dominated by state-owned banks whose lending policies were largely dictated by the government. In order to encourage the entry of private banks, public sector banks were deregulated and a unified set of prudential norms were established to ensure a level playing field. These norms included capital provisioning standards that depended, among other factors, on loan quality.

Although private banks have steadily been gaining market share, public sector banks still retain close to 70% of all Indian banking assets as of 2018. Despite the objective of promoting competition in the banking sector, the government still monitors new banks closely and enforces control over which borrowers are eligible for loans. The implicit government backing of public sector banks also confers an advantage in attracting deposits.

Public sector banks, while nominally independent owing to the structural changes of the Rao government, still attract criticism for operating inefficiently. Banerjee et al. (2004) argue that public sector banks underlend, due in part to inflexible lending policies. In addition, they show that anti-corruption laws subject individual loan officers to extreme personal downside risk, but fixed promotional practices limit personal upside. As a result, loan officers are not properly incentivized in their loan choices. Acharya and Subramanian (2016) also fault hiring standards at public sector banks for lower human capital. They characterize public sector banks as massive in size and, as a result, slow-moving.

Bank lending is the primary source of debt financing in India, as debt markets have been slow to develop relative to equity markets. According to an RBI report, the corporate bond to GDP ratio in India is only 17% as of 2018, compared with 123% in the U.S. Indian firms also rely heavily on trade credit which, together with unpaid wages, is collectively referred to as operational credit. As we dis-

cuss in the next section, bondholders and operational creditors have been relatively disenfranchised compared to banks until the bankruptcy reforms that took place in 2016.

### 2.2 Insolvency Rules 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 with rules that applied to a differential set of firms and, at times, favored banks over other creditors. 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 under the Companies Act was viewed as management-friendly.

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 known to be as friendly to management, if not friendlier, than the NCLTs.

Restructuring cases under the NCLT and BIFR took notoriously long to resolve. The average BIFR case lasted for nearly 6 years (Sengupta et al. (2016)). In order to speed asset sales, new legislation was passed in 1993 that created specialized Debt Recovery Tribunals that were not required to follow civil procedures to which the NCLTs were bound. The same institutional challenges that plagued the NCLTs – namely a lack of resources – however led to delays at the tribunals as well. Banks were also the only creditors that were 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. The SARFAESI Act also facilitated the formation of specialized intermediaries, known as Asset Reconstruction Companies, that were designed to help manage the asset reallocation process. The SARFAESI 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.[6] 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. Although some restructuring mechanisms were supposed to replace old and ineffective procedures, the older systems usually stayed in place. This meant that firms could exploit ambiguities and engage in forum shopping, which led 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.

### 2.3 The IBC and Insolvency Rules After 2016

In 2016, the government implemented the IBC, which was a sweeping overhaul of the bankruptcy system. The new code repealed, replaced, or clarified all of the prior insolvency systems. Although the NCLT remains the adjudicating authority under the IBC, 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 remain in place, although an automatic stay applied if the firm was admitted to proceedings under the IBC.

Insolvency rules under the IBC are markedly less friendly towards management than previous regimes. Anyone can initiate insolvency proceedings, and by the end of 2017, most cases were referred by operational creditors. A case may be dismissed before it is admitted to the NCLT, but once it is admitted, an interim resolution professional takes possession of the firm's assets. The professional's first main task is to form a committee of creditors, representing both operational and financial creditors, who then have the option of replacing the interim professional with a permanent trustee. This trustee solicits and vets applicants for the submission of resolution plans, and those applicants may be existing parties or outside prospective buyers.[7] Once resolution plans are submitted, the creditors'

[6] These mechanisms were actually established in 2001, but it was not until 2008 that the guidelines were effectively clarified

[7] Rules about who can submit plans have been in flux since the implementation of the IBC. In particular, previous man-

committee selects a plan by a vote of at least 75%. If a plan is not selected, liquidation procedures commence. This entire process, after admission to the NCLT, is supposed to be resolved within 180 days, although extensions can be made to 270 days.[8]

The IBC was a solution to one problem, namely, the lack of a unified and effective insolvency regime. It still did not solve some of the political and institutional factors that contributed to the NPA crisis, however. For example, banks and loan officers fearing personal consequences arising from the referral of distressed borrowers to the IBC still had incentives to continue evergreening and delay the recognition of bad assets. And, to the extent that bankers may have structured quid pro quo arrangements with under performing borrowers, the rules of the IBC could have further disincentivized the reporting of NPA accounts. Thus, in conjunction with the IBC, the RBI assumed the task of policing non-compliant *lenders* that were either delaying NPA recognition or insolvency proceedings.

The RBI began the process of identifying the largest distressed accounts in 2015 with the Asset Quality Review. It conducted its own assessment of the creditworthiness of the country's largest borrowers and focused on companies that were reported as NPA by some banks but not others. Equipped with this information, it took action on both underperforming borrowers and lenders in the years following the passage of the IBC. Starting in 2017, the RBI instructed banks to refer several rounds of borrowers to commence insolvency proceedings.[9] On the lending side, the RBI put several banks under close watch according to what was known as the Prompt Corrective Framework (PCA).

The Asset Quality Review and its resulting disciplinary actions were primarily targeted towards the largest non-performing borrowers in the economy. The NPA problem was pervasive, however. In order to facilitate adherence to prudential norms and a time bound resolution of stressed assets in the banking system, the RBI in a shock announcement on February 12$^{th}$, 2018, issued a new set of regulatory guidelines for lenders which advanced the recognition of borrower defaults and laid down time-bound rules for the referral of large defaulters to the IBC. Specifically, the guidelines (subsequently refererred to as the Feb12 circular) instructed banks to begin curing defaults as soon as the default occurred, i.e. within one day. It also mandated that lenders begin formal insolvency proceedings under the IBC if a borrower is delinquent for 180 days. The Feb. 12$^{th}$ circular was directly

agement (known as promoters) were initially free to submit plans, although these rights have since been curtailed.

[8]Because certain rules are still being challenged, however, most large cases initially referred to the NCLT under the IBC have taken over 270 days to resolve.

[9]The first of these rounds took place in June 2017. 12 borrowers were referred to the NCLT: Bhushan Steel, Bhushan Power & Steel, Essar Steel, Jaypee Infratech, Lanco Infratech, Monnet Ispat & Energy, Jyoti Structures, Electrosteel Steels, Amtek Auto, Era Infra Engineering, Alok Industries, and ABG Shipyard. While the first round of referrals was highly publicized, the identities of firms referred in ensuing rounds were not disclosed.

applicable to all accounts involving over Rs. 20 billion, although the RBI announced that it would soon be extended to borrowers with over Rs. 1 billion in exposures.[10] Finally, it eliminated the practice of regulatory forebearance by directing lenders to recognize all "restructured" assets as non-performing with immediate effect.[11]

The Feb. 12th circular was largely unancipated by both market participants and most regulators. Unlike many of its other initiatives, the RBI did not lauch a discussion paper or invite suggestions from the public.[12] Several petitioners, including manufacturing and energy producers, responded by challenging the legality of the circular in the courts. On April 2nd, 2019, the Supreme Court ruled against the RBI and struck down the circular on the grounds that the RBI does not derive such issuance powers from Section 35A of the Banking Regulation Act of 1949. Two months later, however, the RBI issued a revised circular that called for banks to begin curing defaults within 30 days. At the time of writing, the revised circular is in effect.

# 3 Data and Summary Statistics

## 3.1 Data Sources

The primary dataset used for the empirical analysis of the paper is a proprietary bank-borrower matched dataset hosted by the RBI. Additionally, we also use a firm-level financial database to study the impact of regulatory interventions on firm outcomes.

***CRILC:*** Detailed data on bank-borower lending relationships comes from the Central Repository of Information on Large Credits (CRILC), a novel proprietary database maintained by the RBI. Starting June 2014, all commercial banks operating in India are mandated to provide quarterly returns for any borrower whose aggregate lending from the bank exceeded Rs. 50 million.[13] Every quarter, for borrowers above the 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 external credit rating[14] (including the rating agency), and the borrower's industry of operation. Importantly, CRILC reports

[10] Rs. 1 billion is approximately 14.6 million USD as of June 30th, 2019.

[11] Additionally, the circular also instructed banks that large restructured borrowers (exposures in excess of Rs. 1 billion) would have to furnish two investment grade credit ratings from accredited external credit rating agencies in order to be upgraded from the non-performing category.

[12] Anecdotally, even upper-ranking officials in charge of banking regulation were unaware of the circular.

[13] CRILC does not have information on individual loans of borrowers but has information aggregated across loans of large borrowers.

[14] While credit ratings are assigned to each loan undertaken by the borrower, banks aggregates this and reports to CRILC the worst rating for each borrower across all loans undertaken.

a unique borrower ID permitting the matching of borrowers across banks in the same quarter, as well as across quarters. This permits us to track borrower relationships across multiple lenders over time. CRILC has over 100,000 bank-borrower observations per quarter for the 20 quarters between June 2014 and March 2019. The number of unique borrowers over this period exceeds 100,000. As the Feb12 circular did not apply to borrowers with bank exposures below Rs. 0.25 billion, we restrict our primary sample solely to borrowers whose exposures exceed Rs. 0.25 billion in every quarter of the CRILC database.

***CMIE Prowess:*** For a subset of borrowers in the CRILC database, banks also report the corporate identification number (CIN), issued by the Ministry of Corporate Affairs in India. We use the CIN to match this subset of borrowers to the Prowess database, maintained by the Centre for Monitoring Indian Economy (CMIE). The database has been used in a number of prior studies of Indian corporations (Bertrand et al., 2002; Lilienfeld-Toal et al., 2012; Vig, 2013; Gopalan et al., 2016) and includes annual balance sheet and income data such as firm capital expenditures, cash flow, sales, profits and wages, as well as daily data on stock prices. This allows us to identify the downstream effects of the regulatory interventions on firm outcomes. The Prowess also provides a wealth of descriptive information such as age, place of incorporation and industry codes for covered entities. A total of 30,101 unique firms – both listed and unlisted – are covered by Prowess over the period of our study, with about 25,000 firms covered every year. Of these, we can match over 12,000 firms to the CRILC database. While this reflects only a third of the borrowers within CRILC, they account for over 70 percent of CRILC exposures, consistent with the fact that the Prowess over-samples large borrowers.

### 3.2 Reporting of Asset Quality

Asset quality is classified into two main categories: Standard, whereby a borrower is currently in good standing and has not missed any scheduled repayments; and non-performing (NPA), whereby a borrower has not made any payments towards the interest or the principal in excess of 90 days (approximately 1 quarter). A borrower is classified as non-performing or NPA in the database if it is classified by the bank as an NPA on even a single loan in the portfolio.[15] Once a bank classifies a borrower as NPA, the designation extends to the entire credit exposure the bank has towards that borrower.

[15]However, if a borrower is an NPA of a certain bank, other banks transacting with the borrower are not obligated to declare it as an NPA until the borrower is 90 days overdue with respect to their loans.

Within the Standard category, borrowers are classified as "special mention accounts" if they are between 0 and 90 days overdue on scheduled repayments. Thus, a borrower is classified as SMA0 (Special Mention Account-0) if it has not made any payments towards the interest or the principal between 0 and 30 days. Similarly, borrowers classified as SMA1 and SMA2 are those who have not made any repayments between 30 and 60, and 60 and 90 days. Effectively therefore, the SMA2 category immediately precedes a borrower being classified as NPA.

While banks report a borrower's gross credit exposure and asset quality at the end of each quarter, the CRILC, until February 2018, mandated banks to report any fresh slippage of a borrower to the SMA2 category at the end of every fortnight. Borrowers who were overdue in excess of 60 days (but not yet NPA) were thus reported on a fortnightly basis and the system sent out a flash warning to all other lenders exposed to the borrower (in excess of Rs. 50 million) that the borrower was overdue in excess of 60 days.

The Feb12 circular revised this and mandated the reporting of slippage to SMA0 on a weekly basis. Thus, between February 2018 and March 2019, lenders were mandated to report, within a week, any borrower who was even a single day overdue. Thus, while the classification for NPAs remained unaltered (overdue in excess of 90 days) under the February 12 circular, banks were now forced to recognize defaults on an immediate basis. The reporting frequency of the CRILC data was also increased to monthly instead of quarterly. For the purposes of our paper, we aggregate all weekly, fortnightly and monthly reporting to the level of the quarter by assigning borrowers to the worst asset quality reported during the quarter. Thus, a borrower which is reported as Standard at the end of the quarter but was reported as SMA2 during some week in the quarter is considered to be SMA2 at the end of the quarter.

***Classification of Zombie Relationships:*** The classic papers documenting the presence of zombie lending relationships define zombie lending based on a borrower's ability to access subsidized credit (Caballero et al. 2008). Thus, Acharya et al. (2019) classify zombie lending as lending relationships where banks charge borrowers a rate of interest which is less than the rate charged to the best borrowers in bank, based on their external credit ratings. Unfortunately though, the disadvantage in our current setting is that CRILC has no information on interest rates charged by lenders. In this regard, we come up with an alternate classification to identify zombie lending relationships based on banks' extension of credit to borrowers who are clearly not creditworthy based on observable characteristics.

Thus, we define a borrower to be engaged in a zombie relationship with a lender if the borrower between June 2014 and March 2016 (8 quarters) has a) exhibited positive growth in real exposures; b) has been classified as SMA2 at least once in the system; c) has not formed any new banking relationships; d) has not been rated AAA or AA.

Thus, our measure of zombie borrowers captures borrowers who have experienced positive growth in their exposures from a bank, even though no new bank has lent to them in this period and the borrower is not rated in the top two rating categories by external rating agencies. Moreover, as the borrower has hit the SMA2 category at least once and banks receive notice through CRILC of any fresh slippages into SMA2, banks are also aware that the borrower has been at the cusp of default at least once (non-repayment between 60 and 90 days). Thus, our classification of zombie borrowers essentially includes borrowers who are clearly sub-optimal based on the CRILC data which is accessible to all banks, but banks continue lending to such borrowers, despite being aware of their non-creditworthiness. Thus, the zombie relationship is defined at the *bank-borrower* level and 20% of borrower-bank relationships in our sample can be classified as a zombie relationship.[16]

We confirm that our classification of zombie borrowing indeed captures ex-ante distressed borrowers. Based on the sub-sample of borrowers common to both Prowess and CRILC, we non-parametrically plot the relationship between the zombie borrowers and the interest coverage ratio of firms (ICR) in Figure 1. ICR is the ratio between a firm's annual income and annual interest expense. The x-axis is split into 60 equally spaced bins of size 0.25 of firm ICR between -5 and 10. The red vertical line represents ICR equaling 1, below which a firm's annual income is less than its interest expense. Within each bin of ICR, we plot the unconditional share of zombie borrowers in that bin. Figure 1 documents a clear negative relationship between firms' ICR and the likelihood of firms being classified as a zombie borrower, confirming that our measure of zombie borrowing indeed captures distressed borrowers.

### 3.3 Descriptive Analysis

Summary statistics are presented in Table 1. We present separately statistics for all borrowers (Panel A), zombie borrowers (Panel B) and non-zombie borrowers (Panel C). An extraordinary 24% of the bank-borrower relationships in the sample are non-performing, emphasizing the magnitude of the distressed asset crisis in India (Acharya, 2017). By our zombie definition, about 23% of bank-borrower relationships in our sample are zombie relationships. We see that zombie relationships are more concentrated in government-owned banks compared to privately owned banks. Zombie relationships

[16]The total number of unique bank-borrower relationships covered by CRILC is 17,472.

are much more likely to turn non-performing compared to non-zombie relationships, indicating our zombie definition does a good job identifying firms that are distressed.

We provide some simple descriptive trends to motivate our empirical strategy. Figure 2 plots the quarterly gross NPA ratio (GNPA) for large borrowers in the CRILC database in terms of borrowers and volume of exposures between June 2014 and March 2019. We see that since March 2016, corresponding to the end of the AQR, the quarterly GNPA measured in terms of borrowers exceeds the GNPA measured as volume of exposures. Since March 2016 however, the GNPA when measured as exposures remains significantly higher than the GNPA measured in terms of borrowers. This suggests that till March 2016, smaller borrowers had a higher propensity of being recognized as NPAs, which was reversed post March 2016.

Additionally, there are two sharp increases in the quarterly GNPA ratio (in terms of exposures) corresponding to the two regulatory interventions undertaken by the RBI in this period – namely the AQR which ended in March 2016, and the Feb12 circular, introduced during the quarter ending in March 2018. During these quarters, the aggregate GNPA ratio jumped by at least 12 percent, documenting a positive correlation between NPA recognition and the central bank's regulatory interventions.

Focusing on zombie borrowers, Figure A1 compares the average quarterly exposure for zombie and non-zombie borrowers with the vertical line denoting the Feb12 circular. We see a small but steady growth in the exposure of zombie borrowers (solid line) which stagnates since the inception of the Feb12 circular. On the contrary, there's a modest increase in the exposure size of non-zombie borrowers (dashed line) since the introduction of the Feb12 circular.

Regarding lenders who engage in zombie relationships, we investigate whether there is any descriptive evidence supporting Acharya et al. (2019) finding that under-capitalized banks have an incentive to engage in zombie lending. In this regard, we disaggregate banks by their average risk weighted capital to assets ratio (CRAR) and plot the fraction of zombie borrowers (dashed line) and exposures (solid line) within each quartile of the bank CRAR distribution.[17] We see some support for this in Figure A2 – while there's a steady decline in the share of zombie borrowers and exposures over time, zombie borrowers are concentrated primarily in banks falling in the bottom three quartiles of the CRAR distribution.

To summarize, these descriptive trends provide us with 3 takeaways – first, the increase in NPA

[17] The CRAR distribution is based on the average CRAR between 2009 and 2014, prior to the introduction of CRILC.

recognition, particularly for larger borrowers coincided with the regulatory interventions undertaken by the RBI. Second, while zombie borrowers exhibited a steady growth in exposure size till the Feb12 circular, this stagnated in the aftermath of the circular, suggesting an elimination of zombie lending coinciding with the introduction of the circular and a reallocation of credit to non-zombie borrowers. Third, zombie borrowers were concentrated in under-capitalized banks. The descriptive evidence thereby suggests that the regulatory intervention through the Feb12 circular possibly induced banks to recognize zombie borrowers as NPAs and facilitated a reallocation of credit towards non-zombie borrowers. The remainder of the paper attempts to rigorously confirm these descriptive patterns using a difference-in-difference framework.

# 4 Empirical Strategy

We structure our empirical analysis in two stages. We first test how the bankruptcy reform (IBC) and regulatory intervention (February 12 circular) separately impact borrowers' asset quality. Subsequently, we test how an improvement in creditor rights through these events altered banks' lending behavior, particularly towards creditworthy borrowers.

## 4.1 Baseline Effect on Asset Quality

We test the causal impact of bankruptcy reform and regulatory intervention on asset quality recognition using a standard difference-in-differences design. The treatment is alternately the passage of the IBC and the February 12 circular. To identify a treated group, we recognize that both the bankruptcy reform and the regulatory intervention served to strengthen creditor rights and aid creditors in the recovery of bad assets. We thereby identify whether lenders responded to a strengthening of creditor rights by recognizing zombie borrowers as non-performing assets (NPA), which forms the pre-cursor to the bankruptcy process. The treatment group thereby is the set of zombie borrowers. Recall that zombie borrowers are borrowers who have positive growth in exposures in the first 8 quarters of the CRILC database, despite having hit the SMA2 status at least once, while not being rated in the top two rating categories, or starting new banking relationships. The classification of zombie borrowers thereby is at the bank-borrower level. Specifically, we estimate an equation of the form:

$$Y_{ijbt} = \alpha_i + \gamma_{jt} + \phi_b + \beta_1 Post_t \times Treat_{ijt} + \eta \mathbf{X}_{ijt} + \epsilon_{ijbt} \tag{1}$$

In (1), the outcome variable $Y$ is (i) a dummy equaling 1 if the asset quality of firm $i$, operating in

industry $j$ and transacting with bank $b$, turns NPA in quarter $t$, and 0 otherwise; or (ii) the amount of NPA exposure that firm $i$, operating in industry $j$ and transacting with bank $b$, has in quarter $t$.

*Post* is a dummy equaling 1 for all quarters following the treatment, and 0 otherwise. *Treat* takes the value 1 for our definition of "zombie" borrowers described above. The coefficient of interest, $\beta_1$, is the average treatment effect in the quarters following treatment. It estimates the differential impact of our treatments (regulatory intervention and bankruptcy reform) had across zombie borrowers relative to the quarters prior to the treatment

$\alpha$ and $\phi$ denote firm and bank fixed effects while $\gamma$ is an industry-time fixed effect with $t$ representing the quarter-year. $\mathbf{X}$ is a vector of firm-specific time-varying characteristics. We include here the firm's initial exposure and credit rating as reported by the bank in CRILC, interacted with a time trend. Standard errors are clustered by firm-bank.

The identifying assumption for a causal interpretation of $\beta_1$ is that NPA recognition for zombie and non-zombie borrowers would have been comparable in the absence of the bankruptcy reform (IBC) and the regulatory intervention (Feb12 circular). The industry-time fixed effects control for shocks common to all borrowers in an industry during a quarter which can affect their repayment abilities. This is complemented with borrower and bank fixed effects, accounting for time-invariant borrower and bank-level characteristics affecting NPA recognition. The threat to identification thereby comes from time-varying shocks to individual borrowers which affect their repayment ability and also coincide with the timing of either of our treatment interventions.

To verify our identifying assumption, we use a distributed lag specification and assess the quarterly impact of the IBC and Feb12 circular across zombie borrowers. We estimate the following specification:

$$Y_{ijbt} = \alpha_i + \gamma_{jt} + \phi_b + \sum_{q=-3}^{9} \beta_q Large_{ijbt} * D_{Dec16+q} + \eta \mathbf{X}_{ijt} + \epsilon_{ijbt} \tag{2}$$

$D$ above is a dummy indicating the quarter of interest, with the reference period being September 2016 – the quarter prior to the introduction of the IBC. $\beta_q$ estimates the average quarterly impact of the IBC and Feb12 circular on zombie borrowers. If NPA recognition of zombie borrowers is attributable to the Feb12 circular (IBC), we would expect a sharp jump in the $\beta$ coefficients in $q = 5$ ($q = 1$) which corresponds to the introduction of the Feb12 circular (IBC). Moreover, we would also expect $\beta_q = 0$ for quarters prior to the introduction of the IBC. This would test the counterfactual argument that there

were no pre-trends in outcomes in the period prior to the introduction of the regulatory interventions and bankruptcy reforms.

### 4.2 Causal Effect of Regulatory Intervention on Asset Quality

Utilizing size thresholds specified in the Feb12 circular, we causally test how the intervention affected the reporting of asset quality. As outlined before, the regulatory intervention mandated borrowers to recognize borrowers with immediate effect (non-repayment for even 1 day) and layout resolution plans. Along with that, it clearly outlined for banks steps for the referral of delinquent borrowers to the IBC for resolution of such stressed assets. The time-bound referral of delinquent borrowers to the IBC applied immediately to the largest borrowers whose exposures exceeded Rs. 20 billion. However, the circular also included an information intervention in the form of a declaration that they would soon be coming out with similar steps for the referral of delinquent borrowers with exposures between Rs. 1 and Rs. 20 billion. Moreover, the Feb12 circular also blocked the upgradation of restructured borrowers with exposures in excess of Rs. 1 billion unless they were able to furnish two investment grade (ratings of AAA, AA, A or BBB) credit ratings (in addition to timely repayments). This leads us to test whether the Feb12 circular had a enhanced effect for "large" (exposures exceeding Rs. 1 billion) zombie borrowers for whom the circular's provisions applied most stringently.

We exploit the size-based differential treatment of borrowers in the circular using a triple difference approach wherein we further interact the DID term in equation 1 with an indicator for borrower size. Specifically, we estimate:

$$Y_{ijbt} = \alpha_{it} + \phi_b + \beta_1 Post_t \times Treat_{ijt} + \beta_2 Post_t \times Treat_{ijt} \times Large_{ijbt} + \epsilon_{ijbt} \tag{3}$$

In (3) *Large* is a dummy equaling 1 if the borrower $i$'s exposures in bank $b$ exceeds Rs. 1 billion in quarter $t$ and the remaining variables are defined as per (1). The coefficient of interest is $\beta_2$ which estimates the differential effect of the Feb12 circular (IBC) on large zombie borrowers with exposures exceeding Rs. 1 billion while $\beta_1$ estimates the impact of the interventions on zombie borrowers with exposures below Rs. 1 billion.

## 5 Results

We now present the results of our analysis. We first identify the impact of the regulatory intervention and bankruptcy reform on NPA recognition of zombie borrowers. We then consider the differential

effects of each intervention by borrowers' exposure size as the regulatory intervention was targeted towards larger borrowers. Next, we move on to the impact of each reform by bank health, as measured by CRAR quartiles. We conclude by examining whether the improvement in creditor rights due to the bankruptcy reform and regulatory intervention facilitated a reallocation of credit towards healthier borrowers.

### 5.1 Main Results on NPA Recognition

We begin by examining the direct impact of the Feb12 circular and IBC on whether and to what extent zombie firms were recognized as non-performing.

Table 2 presents the baseline difference-in-differences results according to the regression specification in equation 1. Columns 1 through 3 examine NPA recognition on the extensive margin, i.e. the dependent variable equals one if a borrower is reported by a bank as NPA and zero otherwise. Columns 4 through 6 examine NPA recognition on the intensive margin, as measured by the log of exposures reported as NPA. All results include borrower, industry-time, and bank fixed effects as well as linear time trends in initial exposures and credit ratings. The sample is restricted to 12 quarters between June 2016 and March 2019 and standard errors are clustered by firm-bank

Considering the extensive margin first, columns 1 and 2 of Table 2 treat each regulatory intervention as separate events. Column 2 focuses on the IBC, and the sample horizon ends before the introduction of the February 12th circular. We see that zombie accounts were 3.5% more likely to be classified as NPA following the IBC. Column 1, which encompasses the entire sample, indicates that zombie accounts were 12.3% more likely to be classified as NPA following the circular. Column 3 runs a horse race between the two treatment interventions, yielding outcomes that are similar in magnitude. The base period in column 3 is the pre-regulatory intervention, pre-bankruptcy reform period between March 2016 and September 2016. Columns 4 through 6 repeat the same sequence of analyses for NPA exposures. Once again, the coefficients on each intervention for zombie accounts are positive and statistically significant at the 1% level. This holds true when the two treatment interventions are compared side-by-side in column 6.

As a whole, the baseline results in Table 2 indicate that while both interventions were met by an increase in zombie accounts reported as non-performing, the response to the IBC was relatively muted while the jump in NPAs after the circular was sizable. Coefficient magnitudes for the zombie and Feb12 interaction variable are consistently four to five times larger in magnitude than the coef-

ficients on the zombie and IBC interaction variable. As the average share zombie borrowers as NPA between June 2014 and March 2016 was 24 percent, the coefficient estimate in column 3 represents a 60% increase in the likelihood of zombie borrowers being recognized as NPA in response to the introduction of the regulatory intervention.

As discussed in Section 4, the circular had differential impacts on borrowers based on certain size thresholds. Although the circular's provisions on initiating bankruptcy proceedings against borrowers in default for over 180 days applied with immediate effect only to extremely large borrowers with exposures in excess of Rs. 20 billion, there was an information intervention that stipulated that similar rules would soon apply also to borrowers with exposures in excess of Rs. 1 billion. There were no such size thresholds in the implementation of the IBC, however. Thus, we would expect that the Feb12 circular's effect would be increasing in borrower size, particularly once a borrower's debt exceeds Rs. 1 billion, while no such effect would be expected for the IBC. This allows us to verify our identification strategy by testing for differential treatment effects across this Rs. 1 billion exposure threshold. For instance, if banks were responding to the bankruptcy reform with a lag and the impact of the regulatory intervention is but a lagged effect of the IBC, we would not expect a differential impact for borrowers with exposures exceeding Rs. 1 billion.

Table 3 investigates this hypothesis, and its results provide causal support for the effects of the Feb12 circular. The first three columns apply to the extensive margin while the last three apply to the intensive margin. Column 1 focuses on the circular in isolation, and the independent variable of interest is the triple interaction term between our zombie measure, the post period after the circular, and a size cut-off over Rs. 1 billion. The triple interaction coefficient is positive and significant at the 1% level, verifying that larger zombies indeed had a higher chance of being recognized as NPA in the aftermath of the Feb12 circular. Interestingly, the coefficient on the double interaction term (zombie and post-Feb12 indicators) is also positive and significant. This indicates that while large zombie borrowers may have been more likely to be pronounced NPA following the circular, smaller zombie firms also experienced an increase in NPA recognition. This coefficient may be explained in part by the elimination of regulatory forbearance schemes by the central bank. As 20% of zombie borrowers as per our classification were also "restructured" using one of these regulatory forbearance schemes and the Feb12 circular mandated all such "restructured" borrowers to be recognized as NPA with immediate effect, it is possible that the Feb12 circular's impact on the smaller zombie borrowers is an upshot of this.

Column 2 focuses on the IBC, and the sample horizon ends before the introduction of the February 12th circular. The triple interaction coefficient between our zombie measure, the period after the IBC, and the size cut-off may be loosely interpreted as a placebo test, since there were no size exclusions for the IBC. We see that the triple interaction term of zombie, IBC and exposure above Rs. 1 billion is negative and significant. Even though the IBC had no differential effect across size, we see that banks are less likely to recognize larger zombie borrowers as NPA following the passage of the IBC. This reluctance could be due to larger provisioning requirements for larger borrowers combined with a longer expected resolution process for larger borrowers.

Column 3 estimates the impact of the Feb12 circular and the IBC in the same specification. As in column 1, the triple interaction term between the zombie measure, the period after the circular, and the Rs. 1 billion size cut-off is positive and statistically significant. The double interaction (excluding the size cut-off) is also positive and statistically significant.[18] For the IBC, while the zombie and post-period interaction term is positive and statistically significant, the triple interaction term including the size cut-off is negative and significant. This suggests that banks, in some circumstances, were incentivized to report zombie borrowers as NPA following the IBC, but that the effect was significantly weaker for larger borrowers.

Columns 4-6 are consistent with the steps laid out in the first half of the table, except with the log of NPA exposures as the dependent variable. The results are consistent in that the impact of both the IBC and the Feb12 circular is positive for relatively smaller borrowers (although the Feb12 circular continues to have a significantly higher impact on NPA exposures), but NPA recognition following the Feb12 circular was significantly larger for borrowers with exposures above Rs. 1 billion. On the contrary, the IBC, in the absence of the Feb12 circular, had a significantly weaker effect on NPA recognition of zombie borrowers with exposures in excess of Rs. 1 billion.

Table A1 expands on the results in Table 3 to identify non-linearities in the impact of the Feb12 circular and IBC across large borrowers. We undertake a specification similar to a spline regression where we include dummies for whether a borrower's debt is between Rs. 1 and Rs. 2.5 billion, or in excess of Rs. 2.5 billion and test for differential effects of the regulatory intervention and bankruptcy reform across these cutoffs for zombie borrowers.[19] The base category thereby is borrowers with exposures below Rs. 1 billion. The results in columns 2 and 4 show that the Feb12 circular was

[18] The magnitudes of the double and triple interaction terms change slightly from column 1, indicating that the restructuring effect may have dominated the size effect.

[19] The Rs. 1 and 2.5 billion cutoffs reflect approximately the 50th and 75th percentile of the exposure size distribution.

significantly more effective for both subsets of large borrowers: while the triple interaction coefficient is larger (8 percentage points vs 5 percentage points in column 2) for zombie borrowers with exposures in excess of Rs. 2.5 billion, we cannot rule out the equality of the two triple interaction coefficients. On the other hand, the IBC continues to have a significantly lower effect across both subsets of larger borrowers. The results from this flexible specification confirm the hypothesis that the effects of the Feb12 circular were increasing in borrower size. In addition, the placebo results, or the coefficients on the triple interaction terms around the IBC, show that this was not the case in the earlier intervention.

Prior to assessing why the bankruptcy reforms had a weaker effect for larger borrowers, relative to the regulatory intervention, we provide evidence in support of our identification strategy by testing for pre-trends in outcomes using the distributional lag framework discussed in equation (2). As the Feb12 circular was targeted towards larger borrowers with exposures in excess of Rs. 1 billion, we split our sample by borrowers' initial exposures in their banks and estimate (2) separately for borrowers with initial exposures in excess of Rs. 1 billion and those with initial exposures below Rs. 1 billion. The results are shown in Figures 4 and 5 in the form of coefficient plots with the vertical lines representing the 95% confidence intervals. In each figure, the first dashed vertical line denotes the onset of the IBC (quarter ending December 2016) while the second dashed vertical line denotes the onset of the Feb12 circular (quarter ending March 2018). For each figure, the outcome of interest in the left-hand panel is a dummy equaling 1 if the borrower is an NPA; in the right-hand panel, logged NPA exposures.

For larger borrowers, Figure 4 shows little evidence of pre-trends in outcomes and a muted impact of the IBC till the quarter just prior to the introduction of the Feb12 circular. Subsequently though, there is a sharp jump in the likelihood of NPA recognition for large borrowers (and logged NPA exposures), coinciding with the introduction of the Feb12 circular, and the coefficients remain stable at that level for the next 4 quarters when the circular was in effect. The figure confirms that for larger zombie borrowers, the likelihood of NPA recognition changed sharply in the quarter the Feb12 circular was introduced. In the absence of any other legislative or regulatory intervention affecting banks' recognition of zombie borrowers, we can only attribute this sharp jump in NPA recognition to the implementation of the new regulatory guidelines introduced by the Feb12 circular. Figure 5 shows the corresponding effects for the smaller borrowers. The assumption of parallel trends however does not hold as we see a steady increase in NPA recognition for zombie borrowers through the entire time period. However, we still discern a sharp jump in NPA recognition for zombie borrowers in the quarter of introduction of the Feb12 circular, suggesting that even for these relatively smaller

borrowers, the Feb12 circular had a relatively higher impact than only the IBC.

### 5.2 Heterogeneity of NPA Recognition by Bank Health

Having established that NPA recognition of zombie borrowers jumped after the circular and increased, to a considerably lesser extent, after the passage of the IBC, we now seek to explore why the bankruptcy reform by itself had a muted effect on the recognition of larger borrowers. Similar to the hypothesis in Acharya et al. (2019), we envision a simple trade-off from the bank's perspective. Initiating bankruptcy proceedings against a zombie borrower in the pre-Feb12 circular period warranted banks to first recognize the borrower as a non-performing asset, which is associated with the direct and immediate cost of increased provisioning requirements. This cost is increasing in certain agency frictions, such as reputational damages, and decreasing in the amount that a bank might recover from initiating insolvency proceedings against the zombie borrower. On the other side of the trade-off, banks face uncertain punitive costs from refusing to comply with the circular. These factors give rise to two hypotheses. First, other things equal, banks that are weakly capitalized or subject to strong agency frictions should be less likely to voluntarily report zombies as non-performing following the IBC. Second, conditional on having an unreported zombie borrower in the period immediately prior to the circular, banks that are weakly capitalized or subject to strong agency frictions should be less likely to comply with the circular.[20] In this respect, we test for differential effects of the bankruptcy reform and regulatory intervention on zombie recognition across under capitalized banks.

We measure a bank's capital based on its ratio of capital to risk-weighted assets (CRAR). For each bank, we compute the average CRAR in the pre-CRILC period between 2009 and 2014. Based on the average CRAR in this period, we classify banks as "weakly capitalized" if they fall in the bottom quartile. These banks are closest to the regulatory threshold for capital requirements and we test for differential effects of the bankruptcy reform and regulatory intervention on NPA recognition for zombie borrowers across this subset of banks.

The results are shown in Table 4. As in earlier tables, the dependent variable in columns 1 through 3 is a dummy variable that equals one if a borrower account is reported as NPA, and the dependent variable in columns 4 through 6 is the log of borrowers' NPA exposures. From column 1, we see once again that zombie borrowers were approximately 13% more likely to be reported as NPA after February 12th. Consistent with our hypothesis, banks in the bottom CRAR quartile were less likely

[20]The second hypothesis assumes that agency frictions are costly enough and punitive damages weak enough that there exist some banks that will refuse to comply with the circular. If all banks complied with the circular, we would expect the null hypothesis, which is that all banks would be affected equally.

than healthier banks to report zombies as NPA after the Feb12 circular's implementation. Column 2 focuses on the IBC, and the sample horizon ends before the introduction of the February 12th circular. We see that the triple interaction term of zombie, IBC and poor capitalized banks is negative but insignificant. Column 3 includes IBC interaction terms in addition to February 12th interaction terms. The double interaction terms (our zombie measure interacted with the timing of each of the regulatory interventions) are similar in magnitude to those in Table 2. The triple interaction term between our zombie measure, the period after the IBC, and low-CRAR banks, while negative, is not statistically significant. Thus, we cannot reject the null hypothesis that the effect of the IBC was the same for banks with high versus low measures of capital adequacy.

Columns 4 through 6 display the same set of specifications as in columns 1 through 3 except with the log of NPA exposures as the dependent variable. They tell a story that is broadly consistent. The strongest result is that the exposures of zombies reported as NPA increased sharply after the Feb12 circular. Also, weaker banks react less strongly to the Feb12 circular compared to better capitalized banks

In Table A2, we test the hypotheses regarding weak banks' responses to the regulatory interventions except with alternate measures of bank weakness. In columns 1 and 3, we observe the response of public sector banks relative to private sector banks. In columns 2 and 4, we compare the response of the bottom three quartiles of CRAR relative to the top quartile. As in earlier tables the first half of the results (columns 1 and 2) study the extensive margin while the second half (columns 3 and 4) study the intensive margin. In all specifications, we limit the sample to more conservative set of borrowers that were unaffected by direct RBI referrals through the NPA ordinance and that were over Rs. 1.2 billion in exposure.

Using modified measures, we find that weaker banks are consistently less likely to recognize zombies following both the IBC and the circular. In column 1, the coefficients on the triple interaction terms between zombie measure, the post-intervention periods, and the public-sector bank indicator are negative and statistically significant. The same holds for column 2, in which weakness is measured by the bottom three quartiles of CRAR. In both columns 1 and 2, the magnitude of the effect following the circular is nearly twice the size of the effect following the IBC. That is, while weak banks were significantly less likely to report zombies as NPA following both the IBC and the February 12th circular, the relationship between bank weakness and zombie non-reporting was stronger after the circular. As in earlier tables, the results for the intensive margin are broadly consistent, in terms of

sign and significance, with those in the first half of the table.

### 5.3 Credit Reallocation Post Regulatory Intervention

Section 5.1 established that the introduction of the Feb12 circular resulted in a sharp increase in the recognition of zombie borrowers as non-performing assets with the effects being amplified for larger zombie borrowers with exposures exceeding Rs. 1 billion. On the contrary, in the absence of the regulatory intervention, bankruptcy reforms had a much smaller effect on the NPA recognition of zombie borrowers – particularly large zombie borrowers. We now test whether the increased recognition of zombie borrowers as NPA due to the regulatory intervention also facilitated a reallocation of credit to healthier borrowers.

We envisage three channels which could have influenced credit reallocation: first, as banks were forced to recognize zombie borrowers as NPA in the aftermath of the regulatory intervention, this should have arrested zombie lending, freeing up this credit for other borrowers. Second, as the Feb12 circular eliminated lender discretion in the referral of large borrowers to the bankruptcy process, banks were forced to initiate bankruptcy proceedings against large borrowers, which would potentially result in the partial recovery of bad assets. This expected recovery of assets in the future could have influenced banks' decision to expand lending. Finally, the strengthening of creditor rights in itself due to the combined effects of the IBC and Feb12 circular can incentivize banks to lend as they are now empowered with stronger regulations to pursue borrowers in the event of a default.

We start by verifying that the Feb12 circular indeed arrested zombie lending undertaken by banks and estimate a specification identical to (3) to test for differential effects of the Feb12 circular on exposures to large zombie borrowers. The outcome of interest is logged borrower exposures (measured in March 2019 rupees). The specifications include borrower, industry-time and bank fixed effects and the standard errors are clustered by firm-bank. We restrict the sample to borrowers who are not recognized as NPAs.

The results in column 1 of Table 5 show that the difference-in-difference term is negative but very small suggesting no effect of the Feb12 circular on the exposure levels of relatively small (exposures below Rs. 1 billion) zombie borrowers. The triple interaction coefficient is negative and significant, implying that large zombie borrowers experienced a 6 percent decline in exposures in the post-treatment period. On the contrary, the coefficient on the interaction term between the post-treatment indicator and the dummy for exposures in excess of Rs. 1 billion is positive and statistically significant, suggest-

ing that outstanding exposures grew by 12 percent for large non-zombie borrowers in the aftermath of the regulatory intervention. Column 1 thereby provides evidence in support of our first channel: while the outstanding debt of large non-zombie borrowers grew in the post Feb12 circular period, this growth was significantly lower for large zombie borrowers.

Column 2 of Table 5 examines the quality of borrowers whose exposures increased after the introduction of the Feb12 circular. We determine borrowers' creditworthiness based on their external credit ratings. Thus, borrowers with an investment grade rating – rated AAA, AA, A or BBB – are considered to be creditworthy. As there is a large proliferation of unrated borrowers in the CRILC system, we separately examine whether unrated borrowers also experience an increase in outstanding debt. The base category thereby are non-investment grade borrowers rated below BBB. The results in column 2 show that while investment grade borrowers experienced an 8 percent increase in exposures in the post-treatment period (relative to non-investment grade borrowers), the corresponding increase for unrated borrowers was only a modest 2 percent.

Column 3 expands upon the results in column 1 to test for differential effects of the Feb12 circular across large investment grade borrowers. As the Feb12 circular applied most stringently for borrowers with exposures in excess of Rs. 1 billion, we examine whether this empowered banks to direct credit towards borrowers for whom creditor rights were the strongest. The results strongly support this hypothesis: the triple difference coefficient is positive and statistically significant for both large investment grade and unrated borrowers, who experience an additional 13 and 7 percent increase in outstanding debt in the aftermath of the Feb12 circular. On the contrary, the interaction between the post-treatment and investment grade (unrated) indicator, while positive, is much smaller in magnitude (3 and 2 percent respectively) indicating that the expansion in debt in the aftermath of the Feb12 circular was concentrated amongst the larger borrowers.

The additional impact of the Feb12 circular for large unrated borrowers supports the argument that the strengthening of creditor rights with regard to larger borrowers enabled banks to increase credit to these borrowers, even if their ex-ante creditworthiness was unknown. However, the Feb12 circular has no impact on the exposures of large non-investment grade borrowers. Columns 4 and 5 of Table 5 replicates the analysis in columns 2 and 3 but along the extensive margin. The dependent variable is a dummy equaling 1 if the borrower has formed a new banking relationship and 0 otherwise. The results from estimating this specification however is muted, implying that the Feb12 circular had little impact, at least during the first 5 quarters, on inducing new bank-borrower relationships.

In summary, Table 5 verifies that the Feb12 circular resulted in a reallocation of credit across borrowers: while there was an expansion in outstanding debt of large non-zombie borrowers, there was a corresponding decline in the outstanding debt of zombie borrowers. Within large non-zombie borrowers, the increase in debt in the post-Feb12 circular period was concentrated amongst large investment grade borrowers, while large unrated borrowers also experienced a modest increase in exposures. There was however no increase in the exposures of large non-investment grade borrowers. Finally, the increase in exposures occurred primarily along the intensive margin, across borrowers with existing banking relationships – if anything, the likelihood of banks forming new banking relationships, even with large investment grade borrowers was lower in the post Feb12 circular period.

Having established that the Feb12 circular indeed led to a reallocation of credit, we examine the channels through which this reallocation is effectuated. Of specific interest is whether this was driven by banks with an ex-ante low share of zombie borrowers, and whether credit was allocated to sectors with an ex-ante high share of zombie borrowers. The first question examines whether the increase in credit in the post Feb12 circular period can be attributed to a reduction in credit towards zombie borrowers. If the Feb12 circular indeed terminated zombie lending by banks and resulted in an improved allocation of credit, we would expect to see this effect to be concentrated in banks with a high share of zombie borrowers. The second question tests whether an improvement in creditor rights aids the process of creative destruction or facilitates a reallocation of credit to more profitable sectors. We would expect the former if sectors with a high share of zombie borrowers were otherwise profitable sectors but controlled by zombie borrowers who prevented the entry of profitable firms by restricting access to bank credit (Caballero et al. (2008)). If zombie borrowers however were concentrated in unprofitable sectors and banks were lending to these unprofitable sectors simply to avoid losses which would have arisen from the recognition of zombie borrowers as NPA, we would expect a reallocation of credit to more profitable sectors in the aftermath of the Feb12 circular.

To this effect, we obtain the share of zombie exposures in each bank (2-digit industry) in March 2015 and define the dummy *HighZombieBank* (*HighZombieInd*) to equal 1 if the bank's (industry's) share of exposures to zombie borrowers exceeded the median share of exposures allocated to zombie borrowers across all banks (industries). We first test for differential effects of the Feb12 circular on the exposure of large borrowers across banks (industries) with high exposure to zombie borrowers. We subsequently test for differential treatment effects across large creditworthy borrowers within each of these bank (industry) groups.

The results are shown in Table 6. Columns (1)-(2) test for the intensive margin effect and the outcome variable is log exposures (deflated to March 2019 rupees); columns (3)-(4) test for the extensive margin effect with the outcome being a dummy equaling 1 if a new banking relationship is formed. Column (1) confirms our hypothesis that the increase in bank lending can be attributed to a reduction in zombie lending. The coefficient on the triple interaction term is positive and significant, suggesting that credit expansion is 5 percent higher for larger borrowers in the aftermath of the Feb12 circular in banks with an ex-ante high exposure to zombie borrowers. Column (2) finds partial support to the hypothesis that the Feb12 circular facilitated the process of creative destruction in industries with an ex-ante high share of zombie borrowers. The triple interaction coefficient is small and positive but not statistically significant while the interaction between the post-treatment indicator and the indicator for large borrowers is positive and statistically significant. Thus large borrowers in industries with an ex-ante low share of zombie borrowers witness a 9 percent increase in outstanding credit in the aftermath of the Feb12 circular and there is no differential effect across industries with a relatively high share of zombie borrowers.

The fact that there is no active reallocation of credit away from sectors with an ex-ante high share of zombie exposures suggests that these were not necessarily unprofitable sectors but sectors where the prevalence of zombie borrowers precluded the entry of new firms. This explanation is further supported from the extensive margin results in column (4), where we find a 1 percentage point increase in the likelihood of a new banking relationship being formed for large borrowers in sectors with a previously high share of zombie exposures. Our findings in this regard are consistent with those of Caballero et al. (2008) who find that the presence of zombie borrowers depresses the growth of other competitors in the same sectors.

Collectively, Table 6 provides us with two key insights: first, it confirms that an improvement in creditor rights through the regulatory intervention facilitates an improvement in credit allocation by stopping the flow of credit to zombie borrowers. Second, the regulatory intervention assisted in the process of creative destruction by redirecting bank credit towards large borrowers in sectors with an ex-ante high share of zombie borrowers. Thus, the strengthening of creditor rights, when implemented by a credible regulator, can both result in the elimination of zombie borrowers, and contribute towards growth and economic development by initiating the process of creative destruction through an improved allocation of bank credit.

# 6 Conclusion

Zombie borrowers continue to inhibit economic growth across the developing world. Our paper examines two mechanisms that may be used to combat zombies through NPA recognition: an improvement in creditor rights and a disclosure mandate. We should that both interventions improve NPA recognition, although effects vary by lender. In particular, banks that are poorly-capitalized or run by the government are less likely to be induced by "soft" incentives such as creditor protections to report all NPAs. To establish the causal effect of the February 12th circular, we employ an identification strategy that exploits a size threshold in the applicability of the mandate. We also use a within-bank estimator to show that NPA recognition is not driven by time-varying borrower characteristics. Our findings are consistent with the existence of multiple frictions, both financial and institutional, that give rise to the problem of zombie borrowing.

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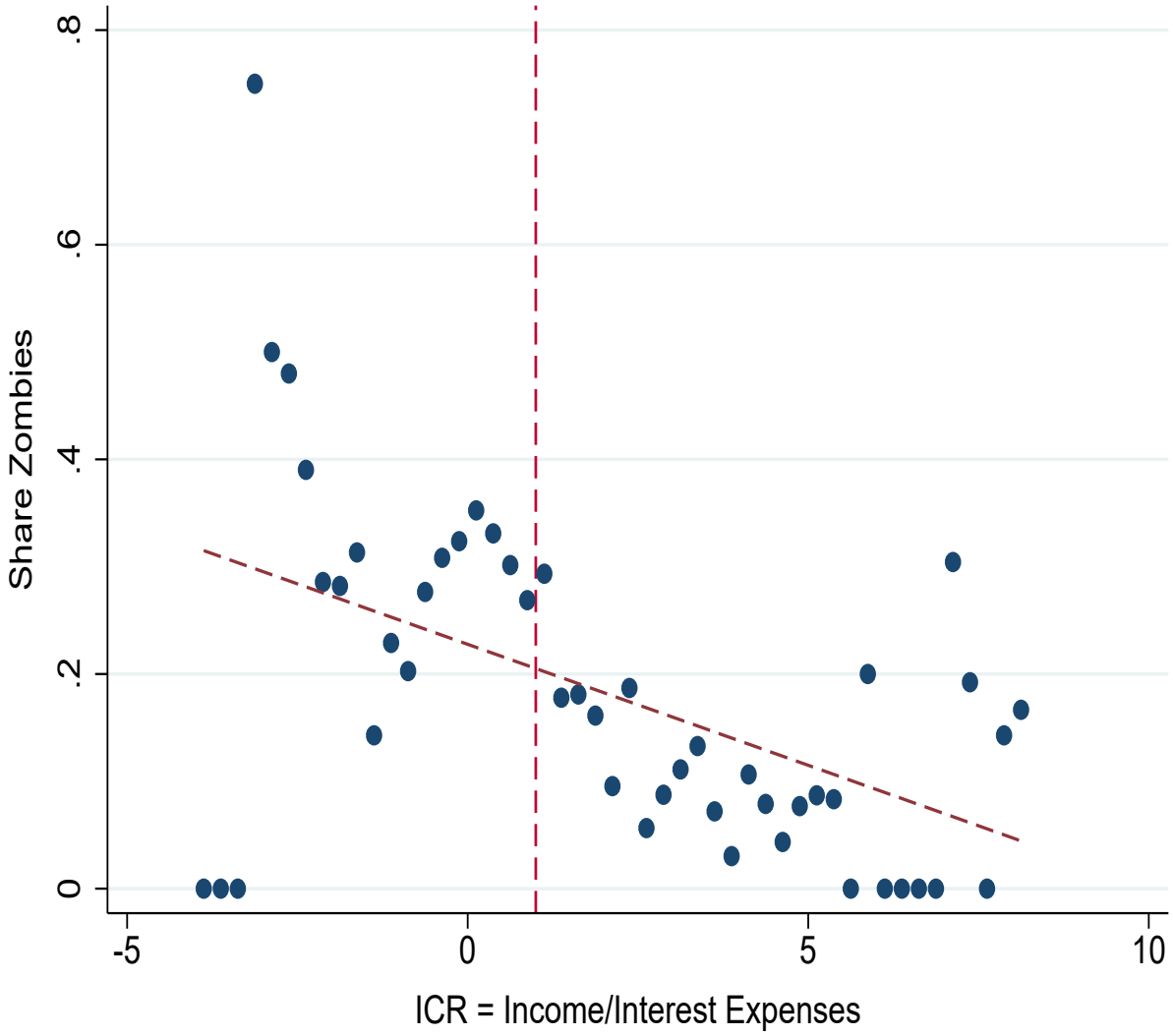
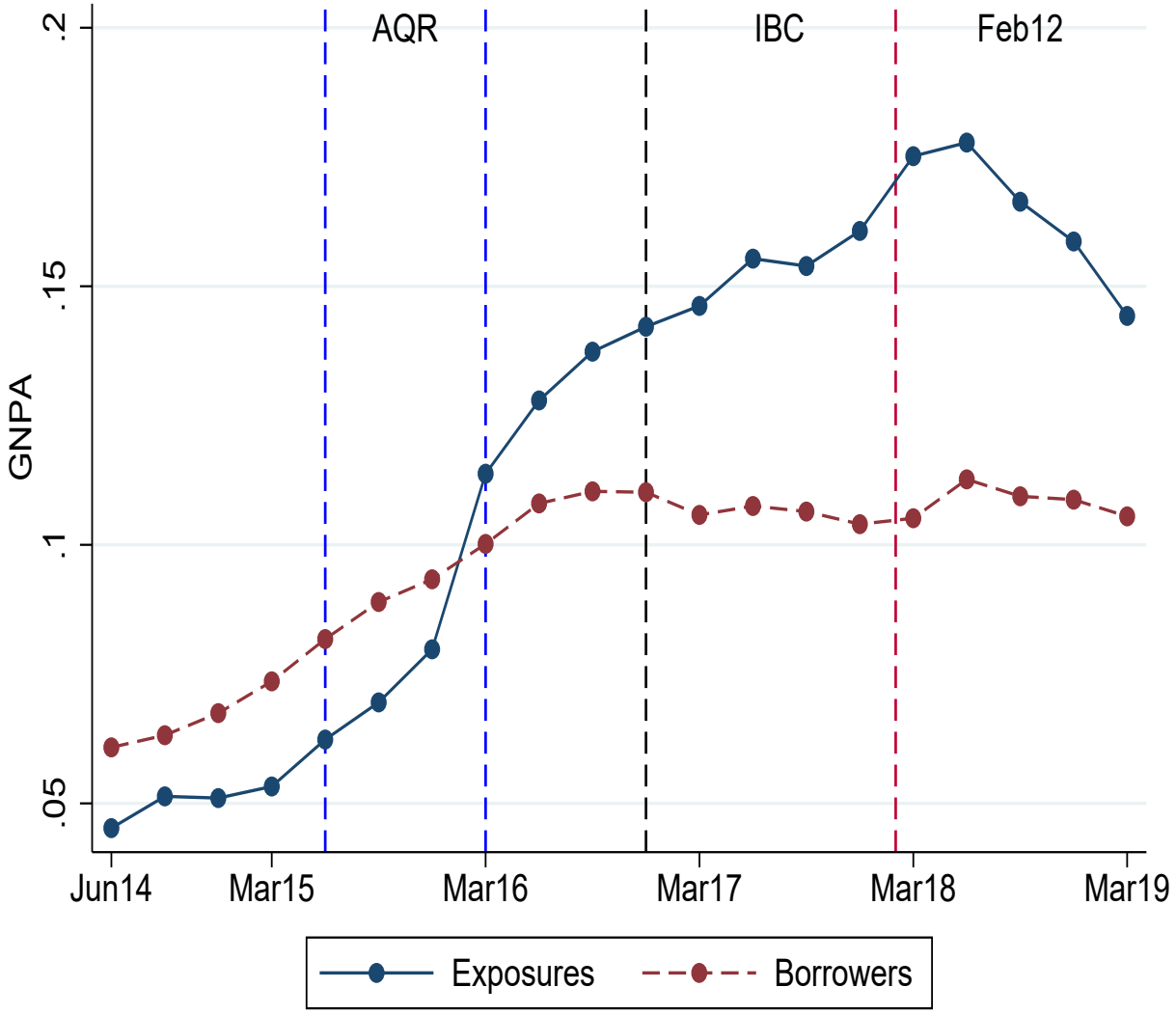
**Figure 1:** Zombie Borrowers and Interest Coverage Ratio



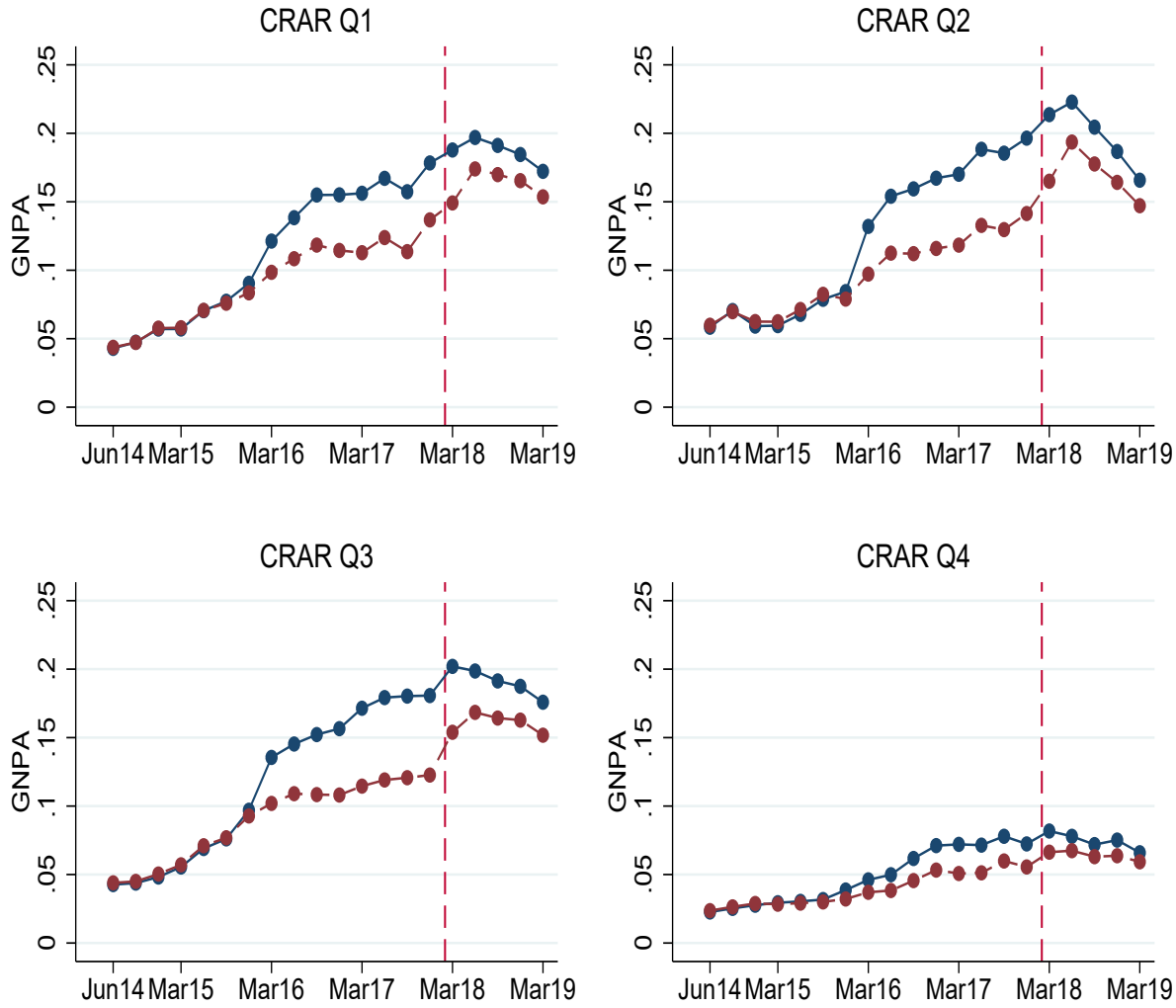

*Notes:* The above figure presents the non-parametric relationship between interest coverage ratio and zombie borrowers. The x-axis is divided into equally spaced 0.25 bins of firm ICR between -5 and 10. The dots represent the unconditional share of zombie borrowers in each bin of ICR. The red vertical line represents ICR of 1, below which the firm's annual interest expense exceeds annual income. The red dashed line plots the linear relationship between the two variables. A borrower is classified as a new NPA if it was not a NPA in March of the previous fiscal year, but is a NPA in March of the current fiscal year. The sample is restricted to borrowers common to both CRILC and Prowess.

**Figure 2:** Gross NPA Ratio by Number of Borrowers and Volume of Exposures



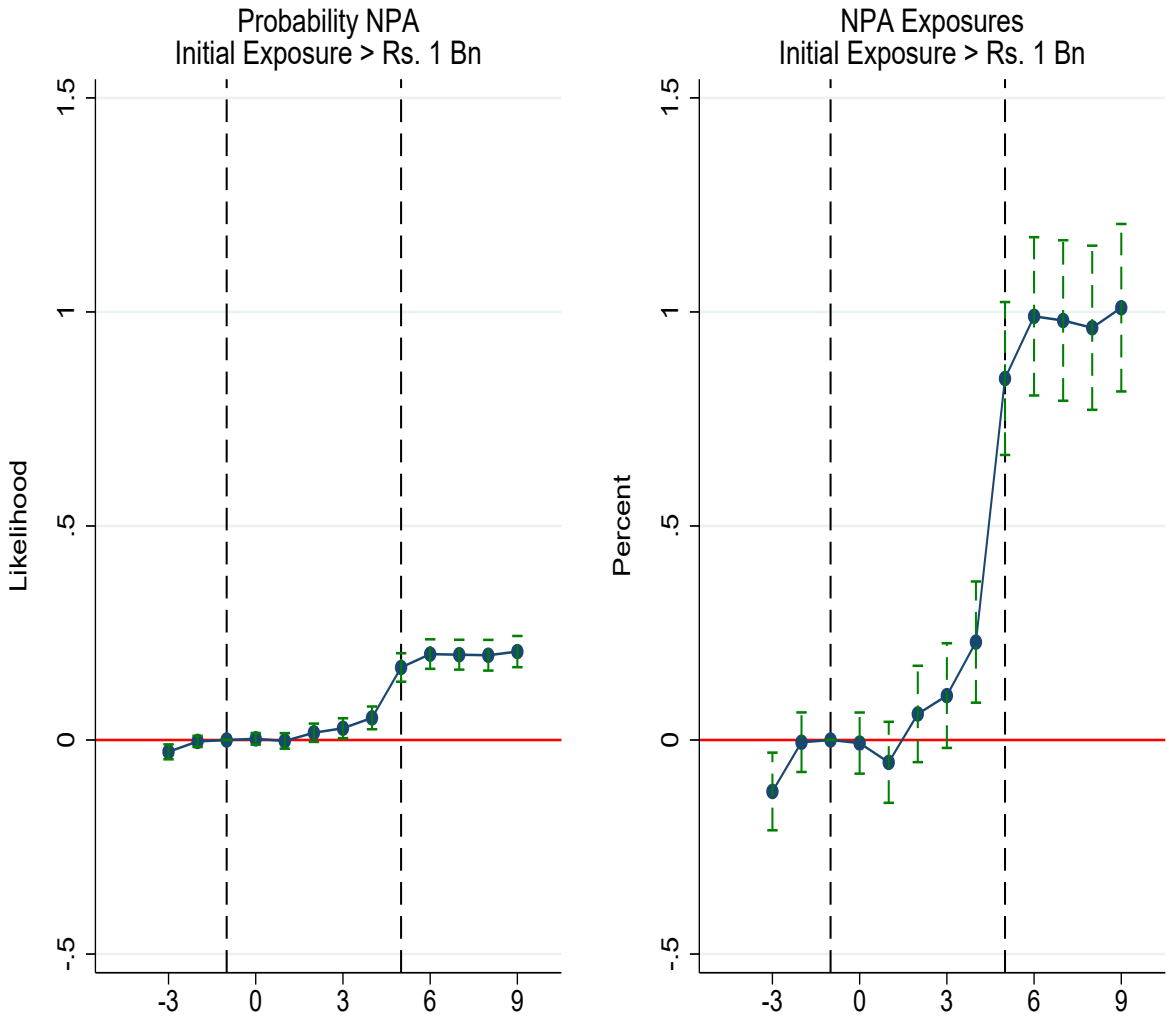

*Notes:* The above figure presents the quarterly trends in gross NPA ratio of large borrowers in the CRILC database. The dashed line expresses the GNPA ratio as total borrowers who are classified as NPA in the quarter, scaled by the total number of borrowers in the CRILC system in that quarter. The solid line expresses the GNPA ratio as the total debt which accounted for by all NPA borrowers in the quarter, scaled by the total debt to all borrowers in the CRILC system in the quarter.

**Figure 3:** Gross NPA Ratio for Borrowers by Bank Proximity to the Regulatory Threshold



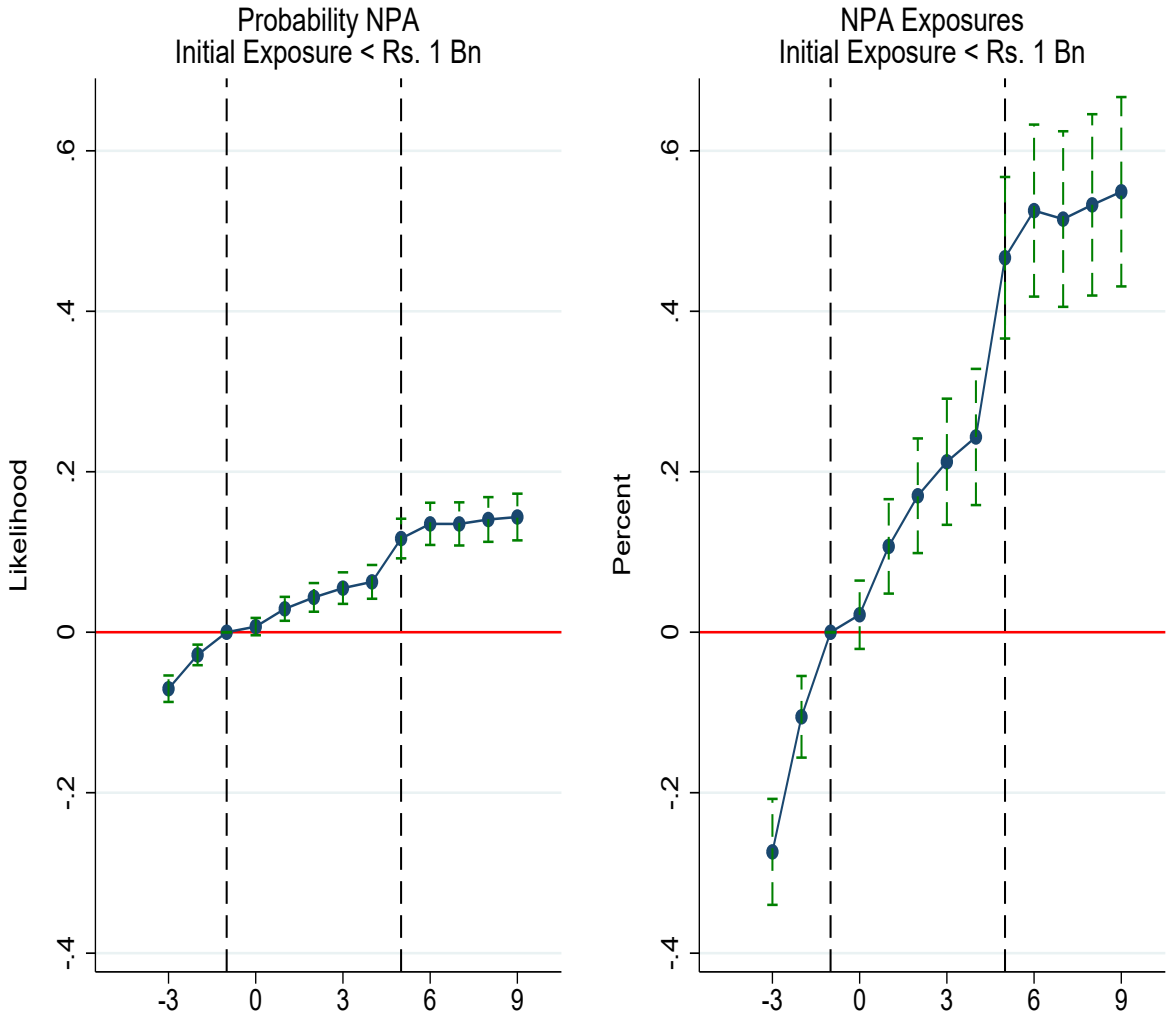

*Notes:* The above figure plots the gross NPA ratio by banks' proximity to the regulatory threshold. The top left hand panel presents the GNPA ratio in banks in the bottom CRAR quartile; the top right hand panel presents the GNPA ratio in banks in the second CRAR quartile; the bottom left hand panel presents the GNPA ratio in banks in the third CRAR quartile; the bottom right hand panel presents the GNPA ratio in banks in the top CRAR quartile. The solid line is for all borrowers; the dashed line is for borrowers not referred to the bankruptcy code by the RBI. The dashed vertical line represents the month in which the February 12 circular was introduced in 2018.

**Figure 4:** Average Quarterly Impact of Bankruptcy Reform and Regulatory Intervention on NPA Recognition for Large Borrowers




*Notes:* The above figures present coefficient plots showing the average quarterly impact of the bankruptcy reform and regulatory intervention on NPA recognition for large borrowers. Large borrowers are those with initial exposures in excess of Rs. 1.2 billion and not referred by the RBI to the bankruptcy code. The outcome of interest in the left-hand panel is the likelihood of a borrower being classified as NPA; in the right-hand panel, logged NPA exposures. The unit of observation is borrower-bank. All specifications include borrower, industry, time and bank fixed effects, along with a linear time trend in initial borrower exposures and initial external credit rating. Standard errors are clustered by borrower-bank. The vertical lines represent 95 percent confidence intervals. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship. The time period is restricted to quarters between March 2016 and March 2019. The first vertical line depicts the quarter in which the bankruptcy reform (IBC) was introduced (December 2016); the second vertical line depicts the quarter in which the regulatory intervention (February 12 circular) was introduced (March 2018).

**Figure 5:** Average Quarterly Impact of Bankruptcy Reform and Regulatory Intervention on NPA Recognition for Smaller Borrowers




*Notes:* The above figures present coefficient plots showing the average quarterly impact of the bankruptcy reform and regulatory intervention on NPA recognition for large borrowers. The sample is restricted to relatively smaller borrowers with initial exposures less than Rs. 1.2 billion and not referred by the RBI to the bankruptcy code. The outcome of interest in the left-hand panel is the likelihood of a borrower being classified as NPA; in the right-hand panel, logged NPA exposures. The unit of observation is borrower-bank. All specifications include borrower, industry, time and bank fixed effects, along with a linear time trend in initial borrower exposures and initial external credit rating. Standard errors are clustered by borrower-bank. The vertical lines represent 95 percent confidence intervals. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship. The time period is restricted to quarters between March 2016 and March 2019. The first vertical line depicts the quarter in which the bankruptcy reform (IBC) was introduced (December 2016); the second vertical line depicts the quarter in which the regulatory intervention (February 12 circular) was introduced (March 2018).

**Table 1:** Summary Statistics

| | | | **Panel A: All Borrowers** | | | |
|---|---|---|---|---|---|---|
| | N | Mean | SD | P10 | P50 | P90 |
| Zombies | 190745 | .228871 | .4201071 | 0 | 0 | 1 |
| Exposures (Rs. Billion) | 190745 | 2.151267 | 5.049329 | 0.361549 | 0.917987 | 4.369025 |
| Investment Grade | 190745 | .3666728 | .4818974 | 0 | 0 | 1 |
| Non-Investment Grade | 190745 | .2491966 | .432549 | 0 | 0 | 1 |
| Unrated | 190745 | .3841306 | .4863903 | 0 | 0 | 1 |
| Public Sector Bank | 190745 | .7750714 | .4175364 | 0 | 1 | 1 |
| Bank Relationships | 190745 | 5.464421 | 6.059681 | 1 | 3 | 14 |
| Restructured | 190745 | .076694 | .266106 | 0 | 0 | 0 |
| Standard | 190745 | .5630816 | .496006 | 0 | 1 | 1 |
| Non-Performing | 190745 | .2390417 | .4264993 | 0 | 0 | 1 |
| SMA2 | 190745 | .1004849 | .3006463 | 0 | 0 | 1 |
| SMA0 | 190745 | .0599439 | .2373835 | 0 | 0 | 0 |
| SMA1 | 190745 | .0374479 | .1898572 | 0 | 0 | 0 |
| NPA Exposures (Rs. Billion) | 45596 | 1.628848 | 3.724506 | 0.326627 | 0.7621 | 3.138919 |
| | | | **Panel B: Zombie Borrowers** | | | |
| Exposures (Rs. Billion) | 43656 | 1.612854 | 3.373383 | 0.354777 | 0.8289895 | 3.076729 |
| Investment Grade | 43656 | .1369113 | .3437576 | 0 | 0 | 1 |
| Non-Investment Grade | 43656 | .4207898 | .4936915 | 0 | 0 | 1 |
| Unrated | 43656 | .4422989 | .4966651 | 0 | 0 | 1 |
| Public Sector Bank | 43656 | .8658375 | .3408308 | 0 | 1 | 1 |
| Bank Relationships | 43656 | 5.1395 | 4.919404 | 1 | 3 | 12 |
| Restructured | 43656 | .169278 | .3750016 | 0 | 0 | 1 |
| Standard | 43656 | .2368059 | .4251271 | 0 | 0 | 1 |
| Non-Performing | 43656 | .4539582 | .4978813 | 0 | 0 | 1 |
| SMA2 | 43656 | .211586 | .4084375 | 0 | 0 | 1 |
| SMA0 | 43656 | .0414834 | .1994078 | 0 | 0 | 0 |
| SMA1 | 43656 | .0561664 | .2302454 | 0 | 0 | 0 |
| NPA Exposures (Rs. Billion) | 19818 | 1.523281 | 3.277197 | 0.3419 | 0.7872385 | 2.8772 |
| | | | **Panel B: Non-Zombie Borrowers** | | | |
| Exposures (Rs. Billion) | 147089 | 2.311069 | 5.438187 | 0.364101 | 0.950755 | 4.819671 |
| Investment Grade | 147089 | .434866 | .4957411 | 0 | 0 | 1 |
| Non-Investment Grade | 147089 | .1982677 | .3986963 | 0 | 0 | 1 |
| Unrated | 147089 | .3668663 | .4819512 | 0 | 0 | 1 |
| Public Sector Bank | 147089 | .7481321 | .4340873 | 0 | 1 | 1 |
| Bank Relationships | 147089 | 5.560858 | 6.355705 | 1 | 3 | 15 |
| Restructured | 147089 | .0492151 | .2163176 | 0 | 0 | 0 |
| Standard | 147089 | .6599202 | .4737373 | 0 | 1 | 1 |
| Non-Performing | 147089 | .1752544 | .3801859 | 0 | 0 | 1 |
| SMA2 | 147089 | .0675101 | .2509043 | 0 | 0 | 0 |
| SMA0 | 147089 | .065423 | .2472716 | 0 | 0 | 0 |
| SMA1 | 147089 | .0318923 | .1757138 | 0 | 0 | 0 |
| NPA Exposures (Rs. Billion) | 25778 | 1.710007 | 4.033003 | 0.31597 | 0.739875 | 3.3101 |

*Notes*: The sample is restricted to borrowers who have exposures in excess of Rs. 0.25 billion in every quarter and were observed at least once between June 2014 and March 2016. NPA exposures restrict the sample to borrowers recognized as NPAs. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship.

**Table 2:** Baseline Results: Average Treatment Effect of Regulatory Intervention and Bankruptcy Reform for Zombie Borrowers

| | (1) NPA | (2) NPA | (3) NPA | (4) Exposures | (5) Exposures | (6) Exposures |
|---|---|---|---|---|---|---|
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .123*** | | .146*** | .547*** | | .630*** |
| | (.008) | | (.010) | (.040) | | (.046) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | .035*** | .033*** | | .128*** | .120*** |
| | | (.006) | (.006) | | (.027) | (.026) |
| Observations | 132392 | 85847 | 132392 | 132392 | 85847 | 132392 |
| $R^2$ | .79 | .83 | .79 | .76 | .80 | .76 |
| Dep Var Mean | .24 | .24 | .24 | 27.25 | 27.25 | 27.25 |
| Firm FE | Y | Y | Y | Y | Y | Y |
| Industry Time FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

*Notes*: This table presents the difference-in-difference estimates identifying the impact of the Feb12 circular and IBC on NPA recognition for zombie borrowers. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(3) is a dummy equaling 1 if the borrower is a NPA in the bank; in columns (4)-(6), logged NPA exposures. Columns (2) and (5) restrict the sample to the quarters between March 2016 and December 2017. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship.

**Table 3:** Differential Treatment Effects of Regulatory Intervention and Bankruptcy Reform on NPA Recognition for Zombie Borrowers by Exposure Threshold

| | (1) NPA | (2) NPA | (3) NPA | (4) Exposures | (5) Exposures | (6) Exposures |
|---|---|---|---|---|---|---|
| $\mathbb{1}_{Exp>1Bn}$ | .004 | -.003 | .002 | .086*** | .015 | .013 |
| | (.004) | (.005) | (.005) | (.021) | (.025) | (.027) |
| $\mathbb{1}_{Zombie}$ | -.052*** | -.052*** | -.084*** | -.199*** | -.172*** | -.313*** |
| | (.010) | (.012) | (.012) | (.050) | (.058) | (.055) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12}$ | .003 | | .005 | .174*** | | .249*** |
| | (.006) | | (.007) | (.030) | | (.036) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .087*** | | .120*** | .325*** | | .443*** |
| | (.010) | | (.012) | (.039) | | (.048) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{Exp>1Bn}$ | -.023** | .023** | .001 | .119** | .338*** | .194*** |
| | (.009) | (.012) | (.013) | (.049) | (.059) | (.063) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12}$ | .086*** | | .062*** | .561*** | | .483*** |
| | (.016) | | (.019) | (.080) | | (.092) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostIBC}$ | | .002 | .003 | | .104*** | .107*** |
| | | (.004) | (.004) | | (.021) | (.021) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | .046*** | .047*** | | .162*** | .169*** |
| | | (.008) | (.007) | | (.030) | (.030) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostIBC}$ | | -.026** | -.035*** | | -.071 | -.112** |
| | | (.011) | (.011) | | (.055) | (.054) |
| Observations | 132392 | 85847 | 132392 | 132392 | 85847 | 132392 |
| $R^2$ | .79 | .83 | .79 | .77 | .80 | .77 |
| Dep Var Mean | .24 | .24 | .24 | 27.25 | 27.25 | 27.25 |
| Firm FE | Y | Y | Y | Y | Y | Y |
| Industry Time FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

*Notes*: This table estimates the differential effect of the regulatory intervention and bankruptcy reform on NPA recognition across borrowers' exposure threshold. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(2) is a dummy equaling 1 if the borrower is a NPA in the bank; in columns (3)-(4), logged NPA exposures. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship.

**Table 4:** Differential Treatment Effects of Regulatory Intervention and Bankruptcy Reform on NPA Recognition for Zombie Borrowers Across Bank Capitalization

| | (1) NPA | (2) NPA | (3) NPA | (4) Exposures | (5) Exposures | (6) Exposures |
|---|---|---|---|---|---|---|
| $\mathbb{1}_{Zombie} * \mathbb{1}_{CRARQ1}$ | .018* | .013 | .027* | .078 | .013 | .122* |
| | (.009) | (.013) | (.014) | (.048) | (.013) | (.066) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .133*** | | .157*** | .592*** | | .684*** |
| | (.010) | | (.011) | (.046) | | (.054) |
| $\mathbb{1}_{PostFeb12} * \mathbb{1}_{CRARQ1}$ | .018** | | .021** | .068* | | .074* |
| | (.008) | | (.009) | (.037) | | (.044) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{CRARQ1}$ | -.042** | | -.051** | -.186** | | -.231** |
| | (.018) | | (.021) | (.088) | | (.101) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | .037*** | .035*** | | .037*** | .132*** |
| | | (.007) | (.007) | | (.007) | (.031) |
| $\mathbb{1}_{PostIBC} * \mathbb{1}_{CRARQ1}$ | | .006 | .005 | | .006 | .008 |
| | | (.005) | (.005) | | (.005) | (.024) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC} * \mathbb{1}_{CRARQ1}$ | | -.014 | -.012 | | -.014 | -.065 |
| | | (.013) | (.013) | | (.013) | (.058) |
| Observations | 129279 | 83881 | 129279 | 129279 | 83881 | 129279 |
| $R^2$ | .79 | .83 | .79 | .76 | .83 | .76 |
| Dep Var Mean | .24 | .24 | .24 | 27.25 | .24 | 27.25 |
| Firm FE | Y | Y | Y | Y | Y | Y |
| Industry Time FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

*Notes*: This table estimates the differential effect of the February 12 circular and IBC on NPA recognition across banks close to the regulatory capital threshold. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(3) is a dummy equaling 1 if the borrower is a NPA in the bank; in columns (4)-(6), logged NPA exposures. *CRAR Q1* is a dummy equaling 1 if the bank's CRAR falls in the bottom quartile of the pre-CRILC CRAR distribution. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship.

**Table 5:** Regulatory Interventions and Credit for Creditworthy Borrowers

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Log(Exposures) | | | Pr(New Bank Relation = 1) | |
| $\mathbb{1}_{Exp>1Bn}$ | .690*** | | 1.480*** | | .097*** |
| | (.012) | | (.023) | | (.003) |
| $\mathbb{1}_{Zombie}$ | .209*** | | | | |
| | (.029) | | | | |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12}$ | .117*** | | -.008 | | .011*** |
| | (.010) | | (.021) | | (.003) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | -.007 | | | | |
| | (.011) | | | | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{Exp>1Bn}$ | -.197*** | | | | |
| | (.019) | | | | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12}$ | -.061*** | | | | |
| | (.023) | | | | |
| $\mathbb{1}_{InvestmentGrade}$ | | .034*** | .004 | .003** | .002 |
| | | (.007) | (.007) | (.001) | (.001) |
| $\mathbb{1}_{Unrated}$ | | -.030*** | -.048*** | .068*** | .070*** |
| | | (.004) | (.004) | (.001) | (.001) |
| $\mathbb{1}_{PostFeb12} * \mathbb{1}_{InvestmentGrade}$ | | .084*** | .031*** | -.008*** | -.009*** |
| | | (.007) | (.007) | (.001) | (.001) |
| $\mathbb{1}_{PostFeb12} * \mathbb{1}_{Unrated}$ | | .019*** | .018*** | -.046*** | -.047*** |
| | | (.004) | (.004) | (.001) | (.001) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{InvestmentGrade}$ | | | .302*** | | -.003 |
| | | | (.025) | | (.003) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{Unrated}$ | | | .276*** | | -.027*** |
| | | | (.024) | | (.004) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{InvestmentGrade}$ | | | .128*** | | -.012*** |
| | | | (.024) | | (.004) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{Unrated}$ | | | .073*** | | .011** |
| | | | (.025) | | (.005) |
| Observations | 95586 | 1023987 | 1023987 | 1023987 | 1023987 |
| $R^2$ | .89 | .79 | .84 | .25 | .25 |
| Dependent Variable Mean | 145.15 | 97.88 | 97.88 | 97.88 | 97.88 |

*Notes*: This table estimates the impact of the February 12 circular on outstanding debt of borrowers. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(3) is logged exposures; in columns (4)-(5), a dummy equaling 1 if the borrower has started a new banking relationship with the bank in the concerned quarter. Investment grade refers to borrowers rated AAA-BBB. All specifications include borrower-time, industry and bank fixed effects, in addition to linear time trends in borrowers' initial exposures and external credit ratings. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship. Column (1) restricts the sample to borrowers with exposures in excess of Rs. 0.25 billion in every quarter.

**Table 6:** Regulatory Interventions and Exposure Size: Differential Effects for Banks and Industries with High Ex-Ante Share of Zombie Borrowers

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Log(Exposures) | | Pr(New Bank Relation = 1) | |
| $\mathbb{1}_{Exp>1Bn}$ | 1.775*** | 1.841*** | .083*** | .087*** |
| | (.019) | (.022) | (.003) | (.003) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12}$ | .079*** | .094*** | .014*** | .011*** |
| | (.012) | (.013) | (.002) | (.003) |
| $\mathbb{1}_{HighZombieBank} * \mathbb{1}_{PostFeb12}$ | -.024*** | | .012*** | |
| | (.004) | | (.001) | |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{HighZombieBank}$ | -.133*** | | .003 | |
| | (.019) | | (.003) | |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{HighZombieBank}$ | .047*** | | .003 | |
| | (.017) | | (.003) | |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{HighZombieInd}$ | | -.203*** | | -.007* |
| | | (.024) | | (.004) |
| $\mathbb{1}_{Exp>1Bn} * \mathbb{1}_{HighZombieInd}$ | | .010 | | .008** |
| | | (.019) | | (.004) |
| Observations | 1005463 | 1020253 | 1005463 | 1020253 |
| $R^2$ | .84 | .84 | .25 | .25 |
| Dependent Variable Mean | 43.59 | 48.77 | .07 | .07 |

*Notes*: This table estimates the impact of the regulatory intervention on outstanding debt of borrowers across banks and industries' ex-ante exposure to zombie borrowers. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(2) is logged exposures; in columns (3)-(4), a dummy equaling 1 if the borrower has started a new banking relationship with that bank in the concerned quarter. All specifications include borrower, industry-time and bank fixed effects, in addition to linear time trends in borrowers' initial exposures and external credit ratings. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship. *HighZombieBank* is a dummy equaling 1 if the share of exposures to zombie borrowers in the bank exceeded the median share of exposures to zombie borrowers across all banks in March 2015; *HighZombieInd* is a dummy equaling 1 if the share of exposures to zombie borrowers in the 2-digit industry exceeded the median share of exposures to zombie borrowers across all 2-digit industries in March 2015;

# Unearthing Zombies: Regulatory Intervention To Aid Legal Reform

## Online Appendix

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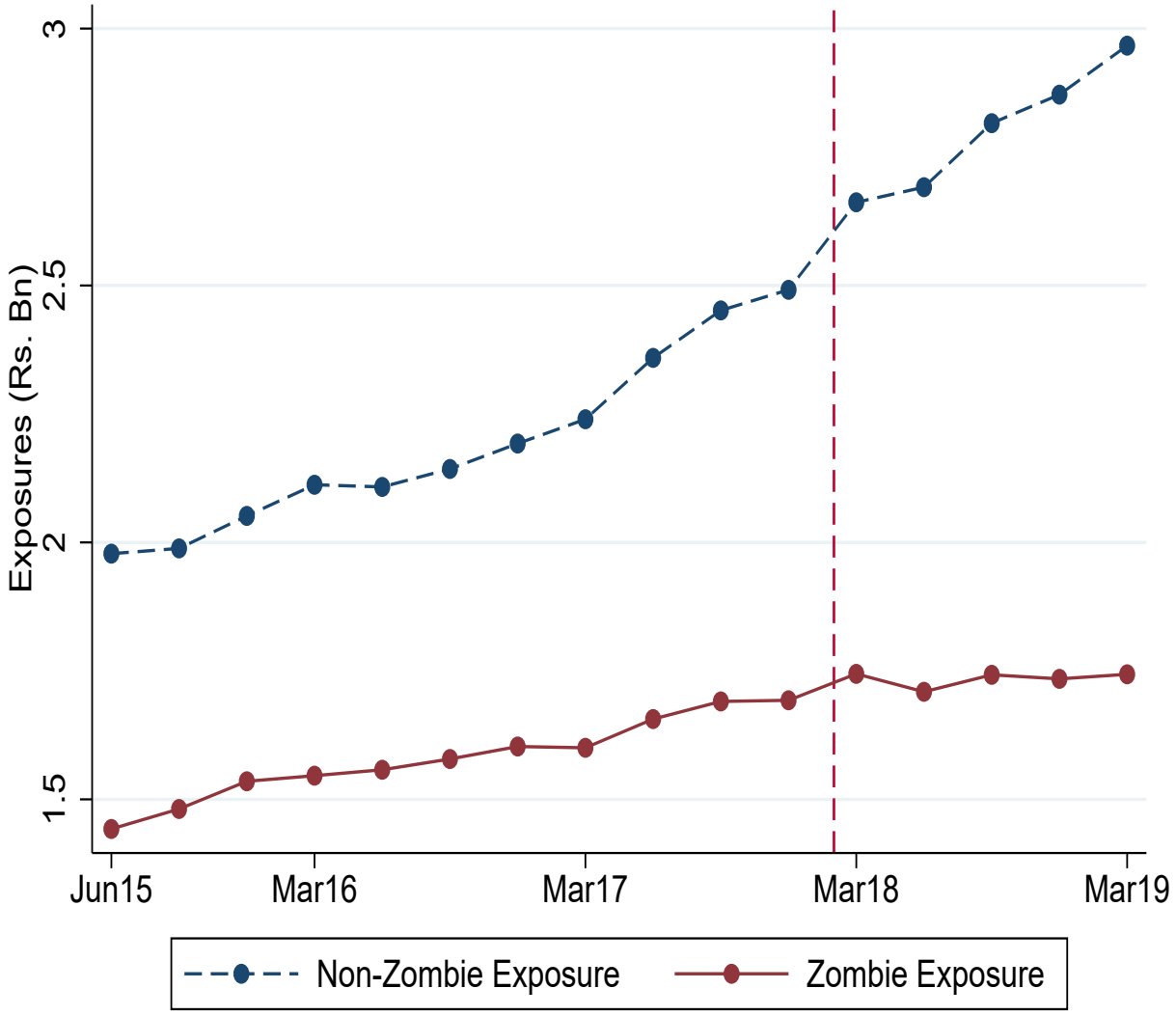
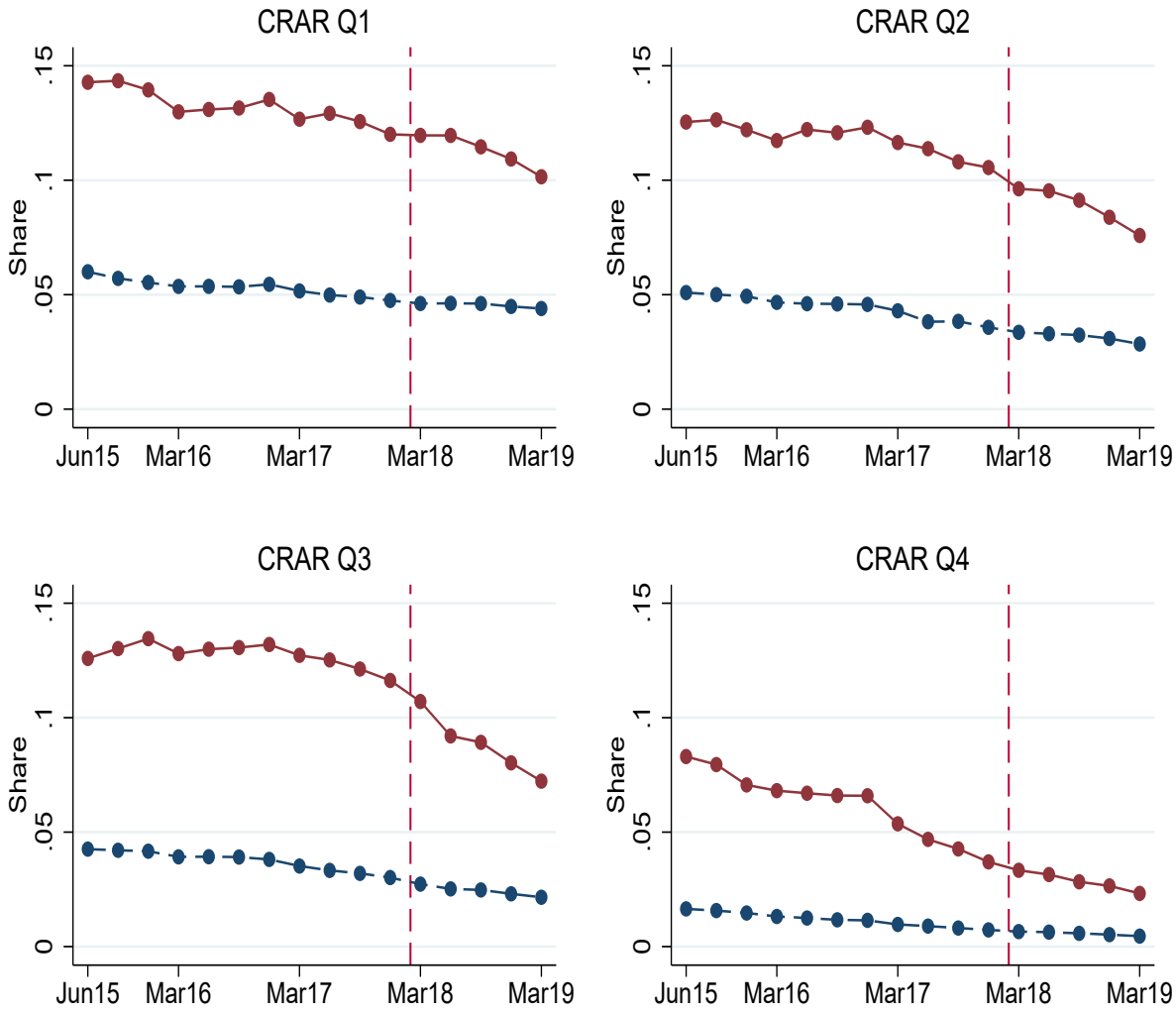
**Figure A1:** Quarterly Trends in Zombie and Non-Zombie Exposures




*Notes:* The above figures presents the quarterly trends in average zombie and non-zombie exposures. The dashed vertical line represents the month in which the February 12 circular was introduced in 2018.

**Figure A2:** Zombie Borrowers and Exposures in CRILC Database




*Notes:* The above figures presents the quarterly trends in the fraction of zombie borrowers and exposures in the CRILC database, disaggregated by bank CRAR. The dashed vertical line represents the month in which the February 12 circular was introduced in 2018. The solid line represents the fraction of exposures attributate to zombie borrowers; the dashed line represents the fraction of zombie borrowers. Banks' CRAR quartiles are calculated based on the average CRAR of banks between 2009 and 2014.

**Table A1:** Differential Treatment Effects of Regulatory Interventions and Bankruptcy Reforms on NPA Recognition for Zombie Borrowers by Exposure Threshold

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Pr(NPA = 1) | | Log(NPA Exposures) | |
| $\mathbb{1}_{1Bn<Exp<2.5Bn} * \mathbb{1}_{PostFeb12}$ | .012** | .014** | .215*** | .256*** |
| | (.006) | (.006) | (.027) | (.028) |
| $\mathbb{1}_{Exp>2.5Bn} * \mathbb{1}_{PostFeb12}$ | -.006 | -.004 | .249*** | .319*** |
| | (.007) | (.007) | (.039) | (.040) |
| $\mathbb{1}_{Zombie}$ | -.053*** | -.085*** | -.256*** | -.354*** |
| | (.010) | (.011) | (.050) | (.055) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .088*** | .121*** | .345*** | .454*** |
| | (.010) | (.012) | (.039) | (.048) |
| $\mathbb{1}_{1Bn<Exp<2.5Bn} * \mathbb{1}_{Zombie}$ | -.020** | -.001 | .161*** | .188*** |
| | (.009) | (.013) | (.046) | (.061) |
| $\mathbb{1}_{Exp>2.5Bn} * \mathbb{1}_{Zombie}$ | -.016 | .012 | .391*** | .420*** |
| | (.014) | (.018) | (.081) | (.105) |
| $\mathbb{1}_{1Bn<Exp<2.5Bn} * \mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .068*** | .049** | .368*** | .314*** |
| | (.018) | (.020) | (.083) | (.096) |
| $\mathbb{1}_{Exp>2.5Bn} * \mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .111*** | .081*** | .819*** | .756*** |
| | (.024) | (.027) | (.140) | (.155) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | .048*** | | .181*** |
| | | (.007) | | (.030) |
| $\mathbb{1}_{1Bn<Exp<2.5Bn} * \mathbb{1}_{PostIBC}$ | | .004 | | .118*** |
| | | (.004) | | (.018) |
| $\mathbb{1}_{Exp>2.5Bn} * \mathbb{1}_{PostIBC}$ | | .004 | | .169*** |
| | | (.004) | | (.025) |
| $\mathbb{1}_{1Bn<Exp<2.5Bn} * \mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | -.030** | | -.133** |
| | | (.012) | | (.058) |
| $\mathbb{1}_{Exp>2.5Bn} * \mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | | -.045*** | | -.154 |
| | | (.016) | | (.094) |
| Observations | 132392 | 132392 | 132392 | 132392 |
| $R^2$ | .79 | .79 | .77 | .77 |
| Dep Var Mean | .24 | .24 | 27.25 | 27.25 |

*Notes*: This table estimates the differential effect of the February 12 circular and IBC on NPA recognition across borrowers' exposure threshold. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(2) is a dummy equaling 1 if the borrower is a NPA in the bank; in columns (3)-(4), logged NPA exposures. All specifications include borrower, industry-time and bank fixed effects, in addition to linear time trends in borrowers' initial exposures and external credit ratings. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship.

**Table A2:** Differential Treatment Effects of Regulatory Interventions and Bankruptcy Reforms on NPA Recognition for Zombie Borrowers Across Alternate Measures of Bank Quality

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Pr(NPA = 1) | | Log(NPA Exposures) | |
| $\mathbb{1}_{Zombie}$ | -.132*** | -.132*** | -.660*** | -.661*** |
| | (.035) | (.036) | (.193) | (.199) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PSB}$ | .084** | | .473** | |
| | (.036) | | (.195) | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12}$ | .276*** | .285*** | 1.263*** | 1.309*** |
| | (.049) | (.050) | (.264) | (.274) |
| $\mathbb{1}_{PostFeb12} * \mathbb{1}_{PSB}$ | .035*** | | .187*** | |
| | (.012) | | (.068) | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{PSB}$ | -.126** | | -.499* | |
| | (.052) | | (.281) | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC}$ | .069*** | .071*** | .301** | .312** |
| | (.024) | (.025) | (.135) | (.141) |
| $\mathbb{1}_{PostIBC} * \mathbb{1}_{PSB}$ | .000 | | .005 | |
| | (.007) | | (.037) | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC} * \mathbb{1}_{PSB}$ | -.070*** | | -.354** | |
| | (.026) | | (.144) | |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{CRARQ1-3}$ | | .083** | | .467** |
| | | (.036) | | (.199) |
| $\mathbb{1}_{PostFeb12} * \mathbb{1}_{CRARQ1-3}$ | | .036*** | | .192*** |
| | | (.013) | | (.069) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostFeb12} * \mathbb{1}_{CRARQ1-3}$ | | -.135** | | -.547* |
| | | (.053) | | (.291) |
| $\mathbb{1}_{PostIBC} * \mathbb{1}_{CRARQ1-3}$ | | -.002 | | -.007 |
| | | (.007) | | (.038) |
| $\mathbb{1}_{Zombie} * \mathbb{1}_{PostIBC} * \mathbb{1}_{CRARQ1-3}$ | | -.072*** | | -.362** |
| | | (.027) | | (.150) |
| Observations | 47589 | 47589 | 47589 | 47589 |
| $R^2$ | .77 | .77 | .75 | .75 |

*Notes*: This table estimates the differential effect of the February 12 circular on NPA recognition across alternate measures of bank quality. The unit of observation is borrower-bank. The outcome of interest in columns (1)-(2) is a dummy equaling 1 if the borrower is a NPA in the bank; in columns (3)-(4), logged NPA exposures. *PSB* is a dummy equaling 1 if the bank is a public sector bank; *CRAR Q1-Q3* is a dummy equaling 1 if the bank's CRAR falls below the 75th percentile of the average pre-CRILC CRAR distribution across banks. All specifications include borrower, industry-time and bank fixed effects. Standard errors are clustered by borrower-bank. A borrower is a zombie if between June 2014 and March 2016 a) it has been classified as SMA2 at least once in the CRILC system; b) has positive growth in outstanding debt; c) has not been rated AAA or AA even once; d) has not formed any new banking relationship. The sample is restricted to borrowers who have not been referred to the bankruptcy code by the central bank and have initial exposures in excess of Rs. 1.2 billion