Costs and Benefits of Debt Moratoria: Evidence from a Natural Experiment in India *

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Abstract

We provide evidence of both the costs and benefits of debt moratoria using the Indian debt waiver program of 2008. We utilize unique loan account data on agricultural borrowers. We exploit *exogenous* variation in rainfall to separate beneficiaries into distressed and non-distressed borrowers. First, by alleviating debt-overhang problems, the waiver leads to drastic improvements in loan performance of distressed borrowers. However, consistent with moral hazard, the waiver has no effect on loan performance of non-distressed borrowers. Second, non-distressed borrowers suffer from credit rationing post the waiver. Finally, while banks' overall non-performing assets decreased post the waiver, agricultural non-performing assets increased.

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1 Introduction

During the great depression, many American states passed laws that granted moratoria on debt repayments (for example, see Rothbard (1962) and Rucker and Alston (1987)). Similarly, following the financial crisis of 2008, debt relief programs for distressed borrowers have come into the spotlight. In order to help an estimated 9 million distressed homeowners, the US administration announced $75 billion towards "Homeowners Affordable Modification Program" in 2009. The plan involved forgiving and deferring a portion of the borrower's mortgage balance.[1] These examples illustrate that governments intervene in private debt contracts to mitigate the hardships faced by distressed borrowers. Despite their popularity in tough economic times, the costs and benefits of debt moratoria have not been studied simultaneously.

Theories of debt moratoria highlight their benefits in alleviating debt overhang for distressed borrowers and opening up credit lines for future investment (see Jensen and Meckling, 1976, Myers, 1977, Banerjee and Newman, 1993, Banerjee, 2000, Mookherjee and Ray, 2003). However, debt moratoria impose economic costs even during tough economic times. First, selective debt waivers can distort expectations and induce moral hazard. For example, Guiso, Sapienza, and Zingales (2013) show that when home prices fell sharply in the U.S., even those borrowers who had the resources to fully repay their home loan obligations defaulted strategically. Second, since the recipients of the relief packages are, in most cases, delinquent borrowers, the program's efficiency depends on carefully distinguishing between genuine defaulters (cases where a debtor is affected by an adverse shock and fails to repay) and intentional defaulters (cases where a debtor chooses not to repay despite having the ability to do so). Third, debt moratoria can lead to the distorted expectation that unlawful behavior will ultimately be rewarded (through such bailout programs). A final cost stems from potential adverse selection when the lender cannot differentiate between the genuine and intentional defaulters, which may then lead to credit rationing. In this paper, we provide empirical evidence for both benefits and costs of a debt waiver by exploiting a *natural experiment* provided by one of the largest debt waiver programs in history—the debt relief program for small and marginal farmers in India in 2008.

On 29^{th} February 2008, the Indian Government announced a debt waiver program, a year before national elections.[2] In absolute terms, the debt waiver program ranks as the largest in an emerging market and as a percentage of GDP, the program ranks as the largest across the world. This program serves as a useful natural experiment for the

[1] The plan used cost sharing and other incentives to encourage lenders to reduce homeowners monthly payments to 31% of their gross monthly income.

[2] The political economic nature of the program is consistent with developing country governments using fiscal resources to serve their narrow political interests (see Nordhaus (1975), Lindbeck (1976), Cole (2009b), Khemani (2007), Khwaja and Mian (2005) and Akhmedov and Zhuravskaya (2004)).

following reasons. First, as described in Section 3, the waiver came as an unanticipated event. Second, as per the program, all farmers who were in default on their agricultural loans as on 31^{st} December 2007—two months *before* the announcement of the program—were eligible for the waiver. Third, the beneficiaries and the non-beneficiaries of the program were very similar to each other before the program. Specifically, following the "priority sector lending regulations" stipulated by the Government of India, primarily small and marginal farmers borrow agricultural loans from banks. In fact, for the administration of the priority sector lending regulations, the Reserve Bank of India defines small and marginal farmers as those with land holdings less than two hectares. Furthermore, all the farmers in our sample borrowed agricultural loans of approximately INR 25,000 for rice cultivation. Finally, the assignment of borrowers into beneficiaries and non-beneficiaries based on their default status as on 31^{st} December 2007 ensures that the assignment was exogenous to the program itself. Figure 1 illustrates our argument that the beneficiaries and the non-beneficiaries of the program were very similar to each other before the program. The figure in particular illustrates that the counterfactual trend behavior of the beneficiaries (our "treatment" group) and non-beneficiaries (our "control" group) is the same (Angrist and Pischke, 2008, pp. 165).

To examine *simultaneously* the costs and benefits of this program, we examine its effect on distressed and non-distressed borrowers separately. Because weather is a key determinant of agricultural production in a developing country such as India, a farmer who suffered from an adverse weather shock is most likely to be a genuine defaulter, as his production might not have been sufficient to repay the loan; we call such a borrower a "distressed borrower." On the other hand, a farmer who defaulted despite favorable weather conditions is likely to be a non-distressed/strategic defaulter; we call such a borrower a "non-distressed borrower." As we explain in Section 3, the lending and recovery framework for agricultural loans in India provides ample scope for strategic default by borrowers.

We use a *unique* loan level dataset of more than 12,000 borrowers compiled from the account level information provided to us by a large public sector bank in India. We have details of transactions starting from October 2005 and ending in May 2012. Since the debt waiver occurred in February 2008, our data represents a good before-after sample. We collect information about rainfall at the level of a mandal, which is equivalent to a county in the United States. We use deviation of actual rainfall from normal levels as an indicator of an adverse weather shock (Burgess, Deschenes, Donaldson, and Greenstone, 2011).

Using difference-in-difference tests, we obtain striking results. In the case of distressed borrowers, the waiver reduces by 44% the number of days taken to repay the loan and by 36% the probability of default; these effects are statistically significant at the 99% level. However, these effects are insignificant for non-distressed borrowers. Thus, while

the waiver helps distressed borrowers, it has no effect on the loan performance of non-distressed borrowers.

The absence of any effect of the loan waiver on non-distressed borrowers serves to buttress our identification strategy using non-beneficiaries as the control group. As we had seen in figure 1, the trend for the beneficiaries and the non-beneficiaries was almost identical before the waiver. When the borrowers are not distressed, the post-waiver performance of the beneficiaries and the non-beneficiaries continuous to be similar. Thus, the set of non-distressed borrowers emphasizes that the difference-in-difference estimates obtained for distressed borrowers does not result from possible placebo effects.

Strategic behavior by non-distressed borrowers, however, is costly to such borrowers: the non-distressed borrowers suffer from considerable credit rationing while the distressed borrowers are significantly more likely to receive credit. Even the amount of loan given to distressed borrowers is higher.

Finally, we examine the overall macro effect of the loan waiver scheme. By examining the annual rainfall and agricultural production leading up to the announcement of the waiver in February 2008, we conclude that non-distressed borrowers that availed the waiver may have dominated distressed borrowers that benefited from the waiver. Correspondingly, we find that non-performing assets among agricultural loans *increased* significantly post the waiver though overall non-performing assets *declined* during the same period. Because the waiver was announced when Indian agriculture was performing relatively well, most of the benefits may have been cornered by opportunistic (non-distressed) defaulters.

To the best of our knowledge, ours is the first empirical study to use a single policy experiment to establish the circumstances under which a debt waiver has a beneficial impact and those under which it fuels strategic default. Using exogenous variation in weather conditions, we disentangle genuine defaulters from the opportunistic ones and show that a waiver induces more default by the opportunistic defaulters while it improves loan performance by genuine defaulters. Even though studies have examined the possibility of strategic default post intervention ((Agarwal, Amromin, Ben-David, Chomsisengphet, Piskorski, and Seru, 2012), (Mayer, Morrison, Piskorski, and Gupta, 2011), to our knowledge the possibility of a waiver being awarded to strategic defaulters has not been considered. Other studies such as Kroszner (1999) and Kanz (2012) do not differentiate between genuine and strategic default. Ours is also the first study to show that after a debt waiver program, loan officers distinguish between distressed and non-distressed defaulters and that non-distressed defaulters face credit rationing ex-post. Earlier studies on political intervention in debt contracts (Rucker and Alston, 1987) have hinted at the possibility of credit rationing post a moratorium. However, they do not distinguish between credit rationing faced by genuine and strategic defaulters.

The paper proceeds in the following manner. Section 2 describes the existing literature

on the topic; section 3 presents the institutional background and describes the debt waiver program; Section 5 describes the data that has been used in the study; Section 6 enunciates our empirical methodology and describes the results. Section 8 concludes the paper.

2 Literature Survey

This paper touches three strands of the literature: i) political intervention in private debt contracts; ii) political capture of public resources; and iii) impact of weather on farmer distress. We briefly discuss the relevant literature in each area.

2.1 Studies of political intervention in private debt contracts

Theories of debt overhang and risk shifting (see Jensen and Meckling, 1976, Myers, 1977) view debt relief favorably. Poverty trap theories (see Banerjee and Newman, 1993, Banerjee, 2000, Mookherjee and Ray, 2003) claim that high indebtedness may not leave enough money in the hands of the households to invest in physical and human capital. Thus such households may be stuck in a low productivity equilibrium. A debt waiver will be able to pull such households out of the poverty trap and enable them to make productive investments.

Bolton and Rosenthal (2002) postulate that when bad economic shocks are highly likely, state-contingent debt moratoria always improve ex post efficiency and may also improve ex ante efficiency. Assuming no willful default, they show that enforcing the debt contract and seizing land when the weather conditions are adverse generate inefficiencies. These inefficiencies arise due to loss of production in the next period as the defaulting farmer no longer has the land and is unable to cultivate. Their set-up is such that a waiver comes in to force only if the weather conditions are adverse. They also show that if bad weather conditions are unlikely and lenders are confident that a debt waiver will come in to force only in case of a bad weather, there will not be any rationing and hence even ex-ante efficiency is enhanced.

Kroszner (1999) presents empirical evidence highlighting the overall beneficial impact of a debt waiver. He shows that when the US Government granted a large scale debt relief by making the gold indexation clauses in debt contracts unenforceable, prices of both equity and debt rose. Agarwal, Amromin, Ben-David, Chomsisengphet, Piskorski, and Seru (2012) study the Home Affordable Modification Program(HAMP) and analyze its impact on mortgage servicers, borrowers and investors. They find that the program caused a reduction in home foreclosures by a modest 0.48%. They do not find evidence of strategic default because, as they clarify, the program design had significantly reduced the possibility of strategic default. The authors also claim that the program is likely to

achieve only 1.2 million permanent modifications over its planned duration as against government expectations of 3-4 million modifications. As opposed to HAMP, the Indian debt waiver program was extended to all agricultural defaulters below a certain size. Moreover, the program provided complete waiver as opposed to a modification in the loan contract. Unlike HAMP and other debt relief programs, which were announced as a response to a general crisis, there was no widespread agrarian crisis when the Indian debt waiver program was announced. Some regions had experienced harsh weather resulting in agricultural distress while other regions did not. Our study is unique in comparing the reaction of distressed and non-distressed borrowers to a debt waiver.

However, ours is not the first study of the Indian debt waiver program of 2008. Two other contemporaneous studies examine this program. Kanz (2012) employs survey data to investigate the effects of this program on investment, productivity and future financial access. The survey covers 2897 households that received the loan waiver. He argues that a debt relief does not improve investment or productivity of beneficiary households, but shifts borrowing away from the formal sector lenders. He concludes that debt waiver programs are of limited use in addressing the problem of debt overhang. De and Tantri (2013) study the same program and show that those borrowers who miss the waiver show maximum deterioration in their loan repayment discipline. Our study differs from both these studies in examining both costs and benefits, as well as the impact of the program on overall welfare.

Overall, the empirical literature on the subject has focused exclusively either on the benefits of a debt waiver or its deficiencies. To the best of our knowledge, this is the first empirical paper to show using a natural experiment, the circumstances in which debt waiver improves borrowing culture and when it negatively impacts the same. Instead of assuming credit rationing for all defaulters, we show that the credit rationing differs across distressed and non-distressed delinquents. There have been a few survey based empirical studies on the subject. However evidence they have produced is mixed. Foote, Gerardi, and Willen (2008) show that there were very few cases of strategic default when the house prices fell during the 1990-91 recession. In contrast, Guiso, Sapienza, and Zingales (2013) show that during the recent financial crisis, when the house prices fell sharply, even those borrowers who had the ability to repay their mortgages showed willingness to walk away.

2.2 Studies of political capture of public resources

In the literature there is a political view as opposed to development view of Government ownership of banks. This view holds that Government ownership of banks results in softening budget constraints, politicization of resource allocation and lowers the economic efficiency (see Kornai, 1979, Shleifer and Vishny, 1994). Other studies including **?**, Khwaja and Mian (2005) show that there is a high possibility of state lending institu-

tions being used to serve the political purpose of the incumbent government without any regard to economic merits. Cole(2009) shows that agricultural credit in India increases during election years and the increase is higher in swing constituencies. He shows that such increased lending does not improve production and also that such loans have a very high chance of going bad. Khwaja and Mian (2005) show that politically connected firms have 40%-50% higher chance of obtaining a loan from state controlled banks and a high proportion of such loans go bad. Alok and Ayyagari (2012) document that new project announcements of public sector enterprises in India increases during elections and such increase is targeted towards the swing districts.

2.3 Studies examining impact of weather on farmer distress

Impact of weather on farm productivity has been a subject of academic enquiry for a long time. Schlenker, Hanemann, and Fisher (2005) claim that adverse weather has an unfavorable impact on agriculture. They measure the impact of abnormal temperature and precipitation on agricultural land values and show that farm land values significantly fall in response to adverse weather conditions. Mendelsohn, Nordhaus, and Shaw (1994) echo a similar view. Deschênes and Greenstone (2011), on the other hand, find that random changes in temperature and precipitation have no significant impact on agricultural production. They use agricultural production instead of land values as the dependent variable. Thus the evidence on the impact of weather on agricultural production in developed world is mixed. However there isn't much confusion about the impact of weather on agricultural productivity of developing countries. Burgess, Deschenes, Donaldson, and Greenstone (2011), based on a study on Indian weather conditions and mortality rate, show that mortality rate in rural India increases if weather during agricultural season turns adverse. The impact is limited only to rural areas. Inclement weather during non-crop season has no such impact even in rural areas. Their theoretical model identifies two channels that cause distress: (i) impact on human health because of inclement weather, and (ii) income shocks due to reduced production. Thus our claim that inclement weather causes distress among farmers in India has empirical evidence in the literature.

3 Institutional Background

3.1 Agricultural Lending in India

Three key factors—scarce collateral, state control of banking and poor legal enforcement—characterize the agricultural credit markets in emerging economies like India.

3.1.1 Scarce Collateral

A common solution to mitigate strategic default is to have the borrower post a physical asset as collateral, which can be appropriated in case of default. However, most farmers in emerging economies are too poor to post any substantial collateral other than land or the expected crop itself. Also, poorly delineated property rights over land exacerbate the problem by making it difficult for the bank to foreclose the land that has been put up as collateral for the loan. Moreover, foreclosing a farmer's land is politically sensitive as local politicians, cutting across party lines, intervene on behalf of farmers irrespective of the merits of the case.[3] In extreme cases, laws have been passed to render recovery of agricultural loans difficult; an example of this is the Andhra Pradesh Microfinance Institutions (Regulation and Moneylending) Act, 2010. Effectively, farmers in India do not face the threat of their land being taken over by their lenders, which encourages strategic default.

3.1.2 State Controlled Banking System

Government of India plays a dominant role in the banking sector: approximately 71% of the banking system (as measured by assets) is owned by the government. The government of India nationalized many private banks in 1969 and 1980 and enacted several regulations to improve access to finance to "critical" sectors and to vulnerable sections of the population. Priority sector guidelines and branch expansion norms were among the significant regulations issued (see Burgess and Pande, 2005, Burgess, Pande, and Wong, 2005, Cole, 2009a). Priority sector lending guidelines require that 18% of a bank's credit should be directed to agriculture. Government of India introduced another set of guidelines that required the banks to open branches in four unbanked locations for every branch in a banked location. This substantially increased the branch network and improved access to finance in rural areas (see Burgess and Pande, 2005).

3.1.3 Poor Enforcement

Given state control of banking and the political economy of state controlled lending (see Cole, 2009a), recovery of loans has been a major challenge in India. Though the establishment of debt recovery tribunals and the passage of "Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI)" Act have substantially improved the NPA scenario (see Visaria, 2009, Vig, 2013), neither of them apply to small agricultural loans. Thus, when it comes to agricultural loans, lenders do not have recourse to any special laws and have to rely on ordinary courts for enforcement. The

[3] In one such incident in Mysore, Karnataka, the lender was forced to return the tractor repossessed from a farmer as the farmer committed suicide. The local politicians alleged that the suicide was due to "arm twisting" tactics employed by the recovery agents of the bank. The Hindu, June 30, 2008.

slow judicial process compounds lenders' difficulties in loan recovery.[4]

3.2 India's Debt Waiver Scheme of 2008

As a part of the financial budget speech delivered on 29^{th} February 2008, the then Finance Minister of India announced an unprecedented bailout of indebted small and marginal farmers. The "Debt Waiver and Debt Relief Scheme for Small and Marginal Farmers" affected about 40 million farmers and provided subsidies worth approximately INR 715 billion (US$14.4 billion). All formal agricultural debt disbursed by commercial and co-operative banks between 1997 and 2007 came under the purview of this scheme. All agricultural loans that were either overdue or were restructured (after being overdue) as on 31^{st} December 2007 (and continued to be overdue till February 28^{th}, 2008) qualified for the debt waiver. The Government set a deadline of 30^{th} June 2008 for the implementation of the program.

The debt waiver scheme was an unanticipated event. Concerned with the dismal performance of the agricultural sector and rising farmer suicides, [5] Government of India set up a high powered committee (Radhakrishna Committee) "to look into the problems of agricultural indebtedness in its totality and to suggest measures to provide relief to farmers across the country." In its report submitted in 2007, the Committee recommended setting up a Government fund to provide loans to the farming community and special relief packages to 100 distressed districts. However, the Radhakrishana committee *did not* recommend a loan waiver. Second, the previous large scale national level debt waiver was announced about two decades back in 1990. Though five parliamentary elections were held between 1990 and 2008, no waiver was announced prior to any of these elections. Finally, media reports before the 2008 budget did not mention the debt waiver as a prominent expectation.

Crucially, note that this debt waiver program differs substantially from the modification offer made by Countrywide Financial Corporation (see (Mayer, Morrison, Piskorski, and Gupta, 2011)). In our setting, the borrowers had no opportunity to qualify for the waiver by acting strategically post the announcement date. The announcement was made on 29^{th} February 2008 but the loan status as on 31^{st} December 2007 was used to decide waiver qualification.

[4]World Bank's doing business survey 2012-2013 ranks India 132 out of 185 in terms of ease of doing business. In terms of enforcement of contracts India occupies 17th rank out of 185 countries surveyed. Also, in India it takes on an average 1420 days to enforce a contract. In comparison, in Singapore the same takes just 150 days.

[5]According to a UN report, more than 100,000 farmers have committed suicide since 1997, 87% of them after incurring an average debt of US dollar 835

4 Hypotheses

Based on the arguments laid out in the introduction, we state the following hypotheses:
HYPOTHESIS 1: *A debt waiver program improves loan performance of distressed borrowers.*
HYPOTHESIS 2: *A debt waiver program does not affect the loan performance of non-distressed borrowers.*
HYPOTHESIS 3: *When compared to distressed beneficiaries, non-distressed beneficiaries of a debt waiver program are more likely to face credit rationing in the post-waiver period.*

5 Data and Proxies

We obtain loan account level information from a large government owned bank in India.[6] As a transparency measure, banks were required to publicly display the following details of the waiver beneficiaries on their branch notice boards: the name of the farmer, account number, amount of land pledged, the date of loan disbursement, the principal and interest outstanding as of December 31, 2007, and the eligible relief amount. In addition to this publicly available audited information, the bank gave us detailed transaction statements for about 12000 farmers.

We use individual account level data from the bank. This data has been collected from nine branches across four districts of the state of Andhra Pradesh—Mehboob Nagar, Khammam, Karimnagar and Medak.[7] These districts are further sub-divided into smaller administrative units knows as Mandals. All crop loans that form our sample have a tenure of 12 months.[8]

Our sample comprises account statements of about 12000 loan accounts from October 2005 through May 2012. The transaction details include account number, date, type (debit or credit), a brief description of the transaction, amount and the resulting balance (amount and type). The detailed nature of the data allows us to create a loan-level dataset with information about the amount of loan, first loan withdrawal date, the number of days the loan has been outstanding, total outstanding interest, whether the farmer has defaulted on the loan, whether the account holder received a loan waiver or not, among

[6]The bank has a long operating history of more than 70 years and wide geographical presence with more than 1500 branches spread across the the country. All the branches of the Bank are totally networked under Core Banking Solutions, offering a wide range of products to its customers. All the customers have access to the current technologies like Internet Banking, ATMs etc.

[7]Andhra Pradesh is the fourth largest state in India in terms of area and fifth largest in terms of population. As per Planning Commission of India, the state ranks fourth in terms of per capita GDP in the year 2011-2012. Andhra Pradesh is called the "rice bowl of India" with rice being more than 77% of State's agricultural output. For the year 2011-12, Andhra Pradesh accounted for 12.7% of India's total rice production.

[8]A copy of the pro-farma loan contract that specifies the various loan features is available for reference from the authors on request.

others. After filtering out accounts where data are incomplete, we are left with complete transaction records of 10,292 loan accounts.

In most of our tests, we use either the status of loan (current or default) or number of days a loan is outstanding as dependent variable. We calculate the number of days a loan is outstanding as follows: If a loan is repaid, we calculate the number of days taken to repay the loan and if a loan is not repaid then we calculate the difference between 31^{st} May 2012 (end of our coverage period) and the loan origination date.

We also collect data regarding annual crop yields in a particular district and agricultural credit disbursed in a particular district. Note that we have data regarding crop yields and agricultural credit only at the District level.

5.1 Classification into distressed and non-distressed borrowers

A variable central to our identification strategy is rainfall in a Mandal, which is equivalent to a county in the United States. We have obtained Mandal level rainfall data from Department of Economics and Statistics, Government of Andhra Pradesh. The nine branches we study, are located in nine different Mandals. For the construction of drought and adverse weather variables, we follow the Percentage of Normal (PN) method as in Pai, Sridhar, Guhathakurta, and Hatwar (2010). Here, we compare the actual (measured) rainfall in a particular Mandal with its long-term average (LTA). If the measured value is less than 80% of the LTA, the Mandal is said to be suffering from drought [9].

Since weather is the most important determinant of success in Indian agriculture (Burgess, Deschenes, Donaldson, and Greenstone, 2011), a significant portion of those who default despite facing no adverse weather shock are likely to be non-distressed defaulters. In developing countries like India, farming is extremely dependent on favorable rainfall even to this day as successive governments have failed to provide adequate irrigation facilities and flood prevention measures. Lack of awareness about modern methods of farming and farming technology further aggravates the problem. Therefore, weather shocks that disrupt production adversely impact farmers (Burgess, Deschenes, Donaldson, and Greenstone, 2011).

Using the weather in the Mandal in which a farmer resides, we classify the farmers into two broad categories: distressed and non-distressed borrowers. The farmers who default on their last loan despite experiencing favorable environmental conditions are labeled *non-distressed defaulters*. As argued in Section 3, the extant legal and political scenario in India creates an ideal setting for strategic default by borrowers of agricultural loans. On the other hand, the farmers who experience adverse weather and default on their loan are likely to have defaulted out of distress; we therefore label such farmers as *distressed defaulters*.

[9] Results are similar with an alternate drought definition of 75% of normal precipitation.

5.2 Descriptive Statistics

Table 1 reports the summary statistics of the main variables we use in our study. We notice that the median (average) loan amount in our sample equals INR 21801 (30590) while the median (average) landholdings in our sample equal 1.34 (2.32) hectares.[10] The small size of the loan and the landholdings indicates that the borrowers of agricultural loans in our sample are indeed the small and marginal farmers. The amount of relief provided by the loan waiver program was substantial compared to the size of the loan as the median (average) relief amount in our sample equals INR 6231 (12858). The median borrower in our sample has obtained two loans over the six year time period from 2005 to 2011 while the average borrower in our sample borrows 2.82 times during this time period. The median borrower in the sample has not defaulted on the loan though the average rate of default in our sample equals 48%. The median duration of the loan equals 357 days, which is consistent with the fact that all the loans in our sample are crop loans with a stated duration of one year; the mean duration is greater than one year (=458 days) because of the average rates of default being equal to 48% in our sample. The median (average) interest rate charged to a borrower in our sample equals 7% (12%).

5.3 Similarity between beneficiaries and non-beneficiaries

Apart from the classification into distressed and non-distressed borrowers, another key feature of our identification strategy is the comparison between beneficiaries and non-beneficiaries. As the described in the introduction, we argue that the beneficiaries and the non-beneficiaries of the program were very similar to each other before the program. Figure 1 illustrates our argument. We construct this figure as follows. First, we estimate the residuals from a regression of the log of the number of days loan is outstanding on (i) branch fixed effects, (ii) year fixed effects, (iii) the loan amount, and (iv) the interest rate charged on the loan. Next, for each year in the sample, we average these residuals separately for the beneficiaries and the non-beneficiaries. Finally, to display the value of the residuals for each year relative to the date used for classification of the borrowers into beneficiaries and non-beneficiaries, which was 31^{st} December 2007, we normalize the residuals for each group to zero as of 31^{st} December 2007. The figure clearly shows that once we control for branch-specific effects, secular time trends, the loan amount and the interest rate, the movement in the number of days a loan is outstanding is almost identical till 2007 for the beneficiary group and the non-beneficiary group. In fact, the continuation of the upward trend in the y-variable in 2008 for the group of non-beneficiaries suggests that the counterfactual trend behavior of the beneficiaries and

[10] Our control sample consists of the farmers who were not in default as of December 2007 and hence, were excluded from the debt-relief program. Unfortunately, because of the very same reason, their land-holdings were not audited and we do not have the corresponding land data for this sub-group.

non-beneficiaries is the same. Moreover, when we compare the distribution of the loan amount till 2007 for the beneficiaries and the non-beneficiaries, we find that the for beneficiaries (non-beneficiaries), the minimum, 25th percentile, median, 75th percentile, maximum and the standard deviation for the loan amount respectively equal INR 14693 (12748), 6180 (8180), 10841 (12997), 20253 (21208), 33239 (32333), 50815 (48000), 23652 (24071). Thus, the distribution of the loan amount for the beneficiaries and the non-beneficiaries before the waiver is quite similar. Thus, a key assumption for a difference in difference estimation — the counterfactual trend behavior of the "treatment" group and "control" group being the same (Angrist and Pischke, 2008, pp. 165) — is quite likely to be satisfied in our setting.

6 Results

In this section we outline our empirical strategy and present our principal findings.

6.1 Post-waiver Borrower Performance

6.1.1 Difference-in-Difference tests

As Hypothesis 1 states, we expect the bailout to have a positive impact on the ex-post loan performance of distressed borrowers. We test our hypotheses through a difference-in-difference (DID) estimation where the beneficiaries constitute the treatment group and the non-beneficiaries constitute the control group. As mentioned in the introduction and in section 5.3, the control group and the treatment group before the treatment are quite similar. Moreover, the assignment of borrowers to treatment and control groups was exogenous to the waiver program. Thus, to implement the DID, we measure the outcomes of the two groups before and after the implementation of the program. For this purpose, we estimate the following specification:

$$Y_{ibt} = \beta_1 \text{POST}_t + \beta_2 \text{WAIVER}_i + \beta_{DID} \text{POST}_t \times \text{WAIVER}_i + \mu_b + \Gamma' \mathbf{X_{ibt}} + \epsilon_{ibt}, \quad (1)$$

where Y_{ibt} represents the outcome of interest for borrower i in branch b of the bank in year t. The binary variable POST_t takes the value 1 for loans given post the waiver (i.e. for loans originated after February 29, 2008 - the day on which the agricultural loan waiver was announced) and 0 otherwise. WAIVER_i represents a dummy that equals 1 for a borrower in the treatment group and 0 if the borrower belongs to the control group. The term μ_b indicates branch fixed effects, which control for time-invariant unobserved factors that may affect loan performance in each branch. X_{ibt} is a vector of controls including loan amount, the total production in the district in the same calender year, and the amount of agricultural credit disbursed in the district. Standard errors are clustered at

account-level to control for autocorrelation in farmer performance. The causal effect of interest is β_{DID}, which measures the DID effect of the impact of the loan waiver program:

$$\beta_{DID} = (E(Y)_{\text{After}} - E(Y)_{\text{Before}})|_{\text{Beneficiary}} - E(Y)_{\text{After}} - E(Y)_{\text{Before}})|_{\text{Non-beneficiary}} \quad (2)$$

We consider two measures of borrower performance. As the first measure, we consider the natural logarithm of the total number of days the loan has been outstanding. As our second measure, we consider the probability of default.

Number of days the loan has been outstanding: Table 3 reports the results of the OLS specification for equation (1). Columns (1) and (2) report estimates of the model for mandals where the weather during the crop season prior to the waiver was bad (i.e. the mandal experience a drought) while columns (3) and (4) report the corresponding estimates for mandals where the weather was good. We find in columns (1) and (2) that the coefficient estimate for β_{DID} is negative and statistically significant at the 1% level. Thus, for the sub-sample of distressed borrowers in columns (3) and (4), we find substantial improvement in loan performance post the waiver. The coefficient estimate for β_{DID} in columns (1) and (2) show a reduction of 57% in the number of days taken to repay the loan. However, for the subsample of non-distressed borrowers in columns (3) and (4), we find that the coefficient estimate for β_{DID} is not only statistically significant. Thus, we find that non-distressed borrowers that receive loan relief do not fare any better in the post waiver period when compared to other non-distressed borrowers that did not receive loan relief.

Across columns (1) to (4), we find that the coefficient of POST, β_1, ranges from 0.28 to 0.54 implying almost 30% - 50% *increase* in the time taken to repay a given loan, which indicates a general worsening in the farmer performance in the aftermath of the waiver. It is also informative to examine the difference in the loan performance of waiver beneficiaries and non-beneficiaries. The coefficient estimate of $\beta_1 + \beta_2$ captures the difference in the loan performance for beneficiaries:

$$\beta_1 + \beta_2 = (E(Y)_{\text{After}} - E(Y)_{\text{Before}})|_{\text{Beneficiary}} \quad (3)$$

while the coefficient β_2 captures the difference in the loan performance for beneficiaries:

$$\beta_2 = (E(Y)_{\text{After}} - E(Y)_{\text{Before}})|_{\text{Non-beneficiary}} \quad (4)$$

In table 3, we also report the results of a test of the significance of $\beta_1 + \beta_2$. We notice that while in columns 1 and 2 $\beta_1 + \beta_2$ is negative and statistically significant at the 1% level, it is positive and statistically significant at 1% level in columns 3 and 4. Thus, in the case of distressed borrowers, the beneficiaries of the loan waiver exhibit improvement in loan performance while the non-beneficiaries exhibit deterioration in loan performance.

In contrast, in the case of non-distressed borrowers, both the beneficiaries and the non-beneficiaries of the loan waiver exhibit deterioration in loan performance. Therefore, the loan waiver has no effect on the loan performance of non-distressed borrowers.

The absence of any effect of the loan waiver on non-distressed borrowers serves to buttress our identification strategy using non-beneficiaries as the control group. As we had seen in figure 1, the trend for the beneficiaries and the non-beneficiaries was almost identical before the waiver. The insignificant coefficient for β_{DID} in columns 3 and 4 suggests that when the borrowers are not distressed, the post-waiver performance of the beneficiaries and the non-beneficiaries continuous to be similar. Thus, the set of non-distressed borrowers emphasizes that the DID effect obtained for distressed borrowers does not result from possible placebo effects.

Probability of default: As a second measure of borrower performance, we consider the probability of default. Here, the response is a dichotomous variable which assumes the value 1 if the farmer defaults on the current loan and 0 if the farmer repays in time. As stated before, the term of a crop loan is 12 months. Hence, a loan is in default if it is outstanding for more than 365 days. Table 4 reports the estimates of OLS regressions with this new specification.[11]

The point estimates, which are in line with those reported in the previous table, indicate substantial improvement in performance of the distressed waiver beneficiaries. The probability of default for the post-waiver loans for the treatment sample is 36% - 38% lower than the corresponding figures for the farmers in the control sample (the farmers who did not receive the loan waiver). The economic magnitude of this reduction is substantial: with a pre-waiver average probability of default of 70% for this sub-sample of farmers, this indicates approximately 50% reduction in the probability of default. The results are robust to inclusion of branch fixed-effects or additional controls. However, the effect of the waiver on non-distressed beneficiaries is weak: even though the coefficient estimate for β_{DID} is significant in column 4, it is significant in only one of the four cases (columns 3 and 4 of table 3 and columns 3 and 4 of table 4). Thus, overall the waiver does not have any effect on the loan performance of non-distressed beneficiaries.

The results presented in tables 3 and 4 confirm hypotheses 1 and 2. We demonstrate, using an analysis of post-waiver behavior of the beneficiaries, that distressed borrowers perform significantly better after being bailed out by the government while the non-distressed defaulters show no such improvement. A difference-in-difference test helps to establish the fact that the post-waiver performance is not due to some unobservable branch or district specific variables.

[11]The estimates of probit regressions are qualitatively similar and hence not reported.

6.1.2 Dynamics of the Debt-Waiver

We conclude our analysis of borrowers' loan performance by examining the dynamics of the debt-waiver program. We do this by incorporating year-specific dummies into our baseline regression specifications. In particular, we estimate the model:

$$ln(days)_{ibt} = \alpha + \beta_1 D^{-2} + \beta_2 D^{-1} + \beta_3 D^0 + \beta_4 D^{+1} + \beta_5 D^{+2} + \beta_6 D^{+3} + \mu_b + \tau_t + \epsilon_{ibt} \quad (5)$$

where D^i represents the year-specific binary variables measured with respect to the year of waiver disbursement. Here, we associate the years with the time of loan origination. Thus, D^{-1} equals 1 for the all the loans sanctioned during the year before the waiver (that is 2007), while it remains at zero for all the remaining loans. The base represents the repayment behavior of the loans originated in 2005 and we include the loans disbursed in 2008, immediately after the announcement of the waiver (estimated by the variable D^0). We include branch fixed effects, agricultural production in the district as control and cluster the standard errors at account level.

Figure 2 plots the results with 95% confidence intervals. The first panel reports the results for the beneficiary accounts while the second panel presents the corresponding results for the non-beneficiaries. Especially noteworthy is the downward (upward) trending performance curve for distressed (non-distressed) farmers who received debt relief. After detrending based on the pre-intervention performance, we do not observe discernible difference between the behavior of the farmers pre-waiver. However in the post-waiver period, the distressed beneficiaries show significant improvement in their performance (as evidenced by the decreasing trend) while that of the other group show a reverse movement.

However, a similar exercise conducted for the non-beneficiary accounts do not reveal any such difference. The confidence intervals overlap for the two groups of farmers (distressed and others) for all the years indicating insignificant statistical difference between the performance of the two sub-groups.

6.2 Ex-Post Access to Credit

A related question concerns the economic consequences of the debt moratorium. The economic argument put forth in favor of a large-scale debt relief program pertains to its ability to mitigate the disincentives to invest due to high levels of pre-existing debt and to improve investment and productivity. Hence, debt relief should improve post program access to credit. However, the loan officer, is likely to keep in mind that all the waiver beneficiaries are past defaulters. Hence, despite there being a political pressure to do so, the loan officer is unlikely to grant fresh loans to all waiver beneficiaries. The loan officer is held accountable for performance of loans granted in the post waiver period. This may

lead to credit rationing.

Specifically, we first employ the following specification:

$$y_{ibt} = \beta_1 waiver_i + \beta_2 no\_drought_{ib,t-1} + \beta_3 no\_drought_{ib,t-1} \times waiver_i + \mu_b + \Gamma' \mathbf{X_{it}} + \epsilon_{ibt} \quad (6)$$

where y_{ibt} represents the log of loan amount sanctioned to farmer i at time t, $no\_drought_{ib,t-1}$ is a binary variable which assumes a value 1 if the farmer i suffered from drought during the crop season corresponding to the previous loan, $waiver_i$ is a dummy indicating whether the farmer i was eligible for a waiver or not. Controls include the last loan amount received, whether the last loan was a default, agricultural credit disbursed in the district during time t and branch fixed effects. Because we are interested in examining credit rationing post the waiver, the sample includes loans disbursed posts the waiver.

Columns 1 and 2 of Table 4 report the results of the above regression. Column 1 presents the estimates of the regression without controlling for branch fixed effects or additional controls while column 2 presents the results for tests including grants fixed effects and agricultural credit as an additional control variable. It is interesting to note that in general the waiver beneficiaries received about 40% more credit when compared to non-beneficiaries as seen in the coefficient estimate of β_1. Similarly, we find that the borrowers experiencing good weather receive about 34% to 37% more credit than borrowers experiencing drought. However, quite interestingly, as seen in the negative coefficient estimate for β_3, non-distressed waiver beneficiaries receive almost 93% to 95% lower credit when compared to distressed waiver beneficiaries.

To examine this effect further, we first employ the following specification:

$$y_{ibt} = \beta_1 default_{ib,t-1} + \beta_2 no\_drought_{ib,t-1} + \beta_3 no\_drought_{ib,t-1} \times default_{ib,t-1} + \mu_b + \Gamma' \mathbf{X_{it}} + \epsilon_{ibt} \quad (7)$$

where y_{ibt} and $no\_drought_{ib,t-1}$ are as defined above while $default_{ib,t-1}$ captures if borrower i defaulted on his previous loan or not. Columns 3 and 4 of Table 4 report the results of the above regression. Column 3 presents the estimates of the regression without controlling for branch fixed effects or additional controls while column 4 presents the results for tests including grants fixed effects and agricultural credit as an additional control variable. In columns 3 and 4, we observe from the coefficient estimate of β_1 that a borrower that has defaulted on the previous loan gets about 6.4% to 9% lower credit than a borrower that has not defaulted on the previous loan. While the negative effect of priority for on credit seems to be low (6.4% to 9%), we must take cognizance of the regulatory requirements that necessitate credit allocation to agriculture. At least 18% of total credit provided by banks has to be credit provided to agriculture and allied activities Banerjee, Duflo, and Munshi (2003). Given this constraint, it is difficult for a loan officer to significantly ration crop loans based on the farmer's credit history. Once we control

for the effect of actual default by the borrower, the effect of previous weather becomes weak as seen in the coefficient estimate of β_2.

Crucially, non-distressed defaulters receive almost 35% lower credit when compared to distressed defaulters. This can be seen in the negative coefficient estimate for β_3 in columns 3 and 4. In columns 5 and 6, we include both the above interactions together and find that the effects estimated before remain similar.

Our findings lend support to our third hypothesis — the non-distressed beneficiaries of the waiver suffer from considerable credit rationing when compared to the distressed beneficiaries. This is not surprising and essentially resonates the findings reported in Kanz (2012) who, based on a survey of beneficiary households, finds that post-waiver, there is a substantial reduction in investment in agricultural inputs by about 11-14%, a concomitant reduction in output and productivity and a general shift towards more informal channels of credit.

A caveat, however, is noteworthy. The reduction that we find could be driven by demand or supply. Since the loans that we observe are essentially equilibrium points, we cannot comment on the off-equilibrium trajectories. For example, since we do not have at our disposal, either the loan application data or the consumption details of the concerned households, any comment on whether the reduction in loan amount is being driven by rationing by the loan officers or by a reduced demand from the farmers will not be prudent. However, in the next section we try to analyze loan officer decisions from the data that we possess.

6.3 Total Household Debt

The most potent argument set forth by the proponents of government intervention in rural credit markets is the potential improvement in the credit conditions for indebted borrowers. Thus we expect waiver beneficiaries to have lower levels of final debt as compared to the non-beneficiaries. We test this question in this section and report the results in table 5. The dependent variable in each of the regressions is the final account balance of the borrowers. Note that the final balance can be positive (credit balance indicating a surplus amount in the accounts of the borrowers) or negative (debit balance indicating the outstanding loan amount that the farmers need to repay). In each of the specifications, the base represents the sub-sample of farmers who were left out of the ambit of the debt-relief program. To separate the impact of lower of access to credit from that of better repayment track record, we include average loan size in the post-waiver period as a control. Branch fixed effects are added to control for regional unobserved effects which might affect general investments and debt-levels (and consequently account balance) in the area.

In column (1), we compare them with the defaulters in general. Thus, the average

final balance of the no-waiver sample is INR 47,615 in debit. The relief recipients, in comparison are less indebted. The difference amount of INR 13,000 is both statistically significant and economically large (considering the average loan amount of INR 31,392 this indicates a ratio of about 0.40). In column (2), we introduce a binary variable which indicates whether the farmers suffer from adverse weather during the crop season corresponding to the last loan before the relief was announced (DROUGHT). Observe the difference in sign of the variables (DROUGHT) and the interaction DROUGHT $\times$ WAIVER. After controlling for the loans during the post waiver period, this indicates that distressed borrowers who were bailed out by the relief program were considerably better-off at the end of our sample period. Since we explicitly control for the loan size, this indicates better repayment rate for these farmers and lower levels of outstanding credit. The distressed borrowers are wealthier post intervention while the non-beneficiaries continue to suffer from the woes of adverse shocks.

6.4 Robustness Tests

6.4.1 A Credit Score Model

We also test the robustness of our results by adopting a simple and intuitive Credit Scoring Model whereby we distinguish the defaulters from those who repay their loans. In this model, we provide a score for each loan extended to the borrowers during the pre-waiver period. Once the loan is granted, the state of the world is revealed which can either be adverse (A) or normal (N). Conditional on the weather/state, the borrower may repay the loan or default. The scoring system is presented in Table A.1 in the Appendix.

In this setting, the good-credit receives a higher score than the defaulters. Intuitively, the highest score(2) is awarded to the exceptional cases where farmers, despite facing bad weather, repay the loans. In the second best scenario, the weather is normal and the farmer repays the debt and receives a score of 1. However, if the state is adverse, and the borrower defaults on her obligation, she receives a neutral score of 0.[12] In the worst case, however, the borrower defaults even when the weather is favorable. It is highly probable, that this borrower is a non-distressed defaulter and we impose a punishment on her with a score of -1.

We assign scores to the sample of pre-waiver loans and generate a cumulative score (CUMCS). Since the credit scoring model has been devised to reward the good borrowers and punish the defaulters, higher cumulative score indicates better debtor quality.[13] The

[12]In case the state is revealed to be bad, the distinction between the good and the delinquents collapses, as all the borrowers find it difficult to produce at a level necessary to repay the debt.

[13]The pairwise correlations between CUMCS and mean pre-waiver number of loans, outstanding days, default rate are 0.33, -0.32 and -0.36 respectively, each of them being significant at 1% level. Thus, higher credit score corresponds to higher loans, lower durations and lower defaults. Note that this result is not surprising given the construction of the scoring model. However, number and size of loans and days outstanding do not directly enter the model. Hence, expected sign of these correlations lends credence

basic equation that we estimate is as follows:

$$Y_{ibt} = \beta_0 + \beta_1 \text{CUMCS}_i + \beta_2 Loan_{it} + \mu_b + \delta_t + \Gamma' \mathbf{X_{bt}} + \epsilon_{ibt} \tag{8}$$

where CUMCS_i represent the pre-waiver cumulative credit score of the borrower i. The equation additionally includes: Loan specific variables $Loan_{it}$, branch fixed effects α_b, year fixed effects δ_t and a vector of additional controls. The standard errors are clustered at account levels and corrected for heteroskedasticity.

Table 6 reports the estimates obtained from four specifications of the above equation. In column 1, the dependent variable is the number of days the loan is outstanding. An increase in the cumulative credit score of 1 leads to a statistically significant decrease in the outstanding period by about 15 days. In the second specification, the results of which are displayed in column 2, we estimate the effect of credit score on the probability of default in the post-waiver period. An increase in credit score by 1 lowers the default rate by 3% for the beneficiaries. The remaining two specifications use as the dependent variable the new loan amount and the probability of getting rejected. The results displayed in columns 3 and 4 show that borrowers with higher credit scores have a higher probability of getting a loan with higher amount.

6.4.2 Alternate Specifications

A detailed study by Parthasarathy and Shameem, 1998 on the farmer suicides in Andhra Pradesh highlight the importance of weather on the sustenance of the farmers in rural societies. According to them, *"...excessive rainfall during the harvesting season coupled with low rainfall during sowing seasons resulted in very low yields"*. Thus, not only drought but excessive rainfall can also lead to substantial distress and loss of livelihoods for the farmers. If that is the case, then debt-relief should prove to be beneficial for such borrowers too.

We rerun all our tests with the adverse weather dummy indicating a 20% deviation from normal precipitation levels on either direction. All the results continue to hold for this specification. However, for the sake of brevity, we do not report the results with this alternate definition of an adverse weather shock.

to our stylized scoring system.

7 Impact of the Debt Waiver on Non-performing Assets

7.1 Agricultural distress leading up to the waiver

Our analysis postulates that if a debt waiver is preceded by a draught, then it should lead to an improvement in the credit culture and if the waiver is not preceded by a draught then the credit culture should worsen. Thus in order to assess the overall impact of the debt waiver scheme of 2008, it is important to understand the weather condition at the time of the waiver.

Table 7 shows the annual rainfall in India before and after the debt relief. As we can see in above table both 2007 and 2008 were normal years in terms of rainfall. In fact, the rainfall was normal in all the years before waiver. In 2007, only 5 out of 36 meteorological divisions experienced scanty rainfall (less than 80% of normal rainfall). In 2008, only 3 meteorological sub divisions experienced scanty rainfall. From the above table we can conclude that the rainfall situation was absolutely normal at the time when the debt waiver was announced.

Even though the rainfall was normal, agricultural production could have been affected by other reasons such as rise in input costs, pests, etc. Impact of all these factors should show up in the agricultural production numbers. Therefore, in order to confirm whether a majority of the farmers were distressed at the time of waiver, we look at the annual agricultural production. It is clear from table below that there was no shock to agricultural production either during 2006-07 or during 2007-08. Year 2007-08 recorded nearly 6% growth in agricultural production. There was growth even during 2008-09.

Table 8 shows agricultural production in India before and after the waiver scheme. On the basis of numbers reported in tables 7 and 8, we conclude that there was no widespread distress when the debt waiver was announced. We showed that debt waiver granted to non-distressed borrowers has no effect on their loan performance; the non-distressed beneficiaries of the loan waiver continued to exhibit similar levels of loan performance as the non-distressed borrowers that did not receive a waiver. Though loan performance improves for the distressed borrowers, our analysis of weather and agricultural production leads us to conclude that non-distressed beneficiaries of the waiver are likely to have outnumbered distressed beneficiaries. Therefore, it is likely that overall nonperforming assets among agricultural loans would have increased in the post waiver years. We now turn to testing this hypothesis.

7.2 Agricultural NPA

Here we formally test if there has been a significant increase in defaults on agricultural loan post the waiver. We have collected data pertaining to non-performing assets (NPAs) of major banks in India from the website of the Reserve Bank of India. We have only included banks that have a national level presence and have left out banks like Ratnatkar bank, Jammu and Kashmir Bank, the subsidiaries of the State Bank of India, etc. which are present only in some states. Thus, for this part of the analysis, we include the 22 large banks with pan India presence. The list includes both public and private sector banks. We estimate the following regression:

$$LogAgriNPA_{it} = \beta_0 + \beta_1 * Post08_t + \Gamma' \mathbf{X_{bt}} + \alpha_{bank} + \epsilon_{it}$$

where $LogAgriNPA_{it}$ denotes the logarithm of the Agricultural NPAs of bank i in year t, $Post08_t$ is a dummy which takes the value of 1 for the year 2008 and after. The vector of control variables $\mathbf{X_{bt}}$ includes growth in agricultural production in year t, proportion of actual rainfall over normal rainfall during year t, and average inflation rate for year t. α_{bank} represents bank fixed affects.

The results are reported in table 9. In column (1), we do not include any control variables apart from the branch fixed effects. We find an increase in agricultural NPAs post 2008. However, the increase could be the result of other factors, most importantly production and rainfall. This becomes important because it is evident from the analysis so far that the year 2009-10 was an exceptionally bad year both in terms of precipitation and production. We control for the impact of production, rainfall and inflation in column (2). Even after controlling for other reasons that could increase NPAs, we find that the agricultural NPAs have shot up by nearly 1.7% post the waiver. This is in line with our expectations as described in section 7.1.

7.3 Comparison with non-agricultural NPAs

It could be argued that the increase in agricultural NPAs is a result of an overall decrease in NPAs across all sectors, which may have been caused by some factor other than the debt waiver. The financial crisis of 2008 could be one such factor though it is important to note that while the decline in the Indian Stock markets mirrored that in the stock markets worldwide, the Indian economy did not experience a recession in 2008. Nevertheless, if the financial crisis were a reason for the deterioration in agricultural in case, it should impact other sectors apart from agriculture. Indian Agriculture is largely driven by domestic factors with very little exposure to the global economy whereas there are many other sectors in India which are more integrated with the global economy. To test whether the deterioration in agricultural NPAs is a by-product of general deterioration in NPAs

across all sectors, we estimate the following regression:

$$LogNPA_{itj} = \alpha_t + \alpha_{bank} + \delta_1 * Post08 + \delta_2 * Agridummy_{it} + \delta_3 * Agridummy_{it} * Post08 + \Gamma' \mathbf{X_{bt}} + \epsilon_{it}$$

Each bank year has two observations: one corresponding to the agricultural NPA and the second corresponding to the total NPA across all sectors. Here the logarithm of the NPAs of bank i in year t is the dependent variable. $Post08$ is a dummy which takes the value of 1 for the year 2008 and years after that. $Agridummy$ takes a value of 1 for agricultural NPAs and 0 for total NPAs. The set of control variables include growth in agricultural production in year t over year t-1, actual rainfall over normal rainfall during year t, the average inflation rate for year t, and overall GDP growth during year t. α_{bank} represents bank fixed affects while α_t denotes year fixed affects.

Columns (3) and (4) of table 9 show that the interaction term between Post08 and Agridummy is positive and significant in all specifications. This implies that the difference between agricultural NPAs and total NPAs has increased in the post waiver period compared to pre waiver period by about 1.1%. Given that the total NPA number for the year 2008 was INR 481.06 billion, the economic magnitude of the increase could be nearly INR. 5 billion. The results hold even after controlling for agricultural production growth, overall economic growth, rainfall, inflation, bank fixed affects and year fixed affects. Despite a financial crisis affecting the overall economy and controlling for change in agricultural production and rainfall, the agricultural NPAs have increased when compared to the total NPAs. As we had argued in section 7.1, the proportion of non-distressed borrowers that availed the loan waiver is likely to have been higher than the proportion of distressed borrowers that benefited from the loan waiver. Therefore, we can conclude from the results in table 9 that the debt waiver program contributed to the spurt in agricultural NPAs.

Bolton and Rosenthal (2002) raise the concern that if the political intervention in debt contracts is not state contingent then functioning of credit markets may get hampered as the lenders, anticipating debt waiver, may resort to credit rationing. Through our analysis of a natural experiment we not only confirm this concern but also find that if the law enforcement machinery is weak, a debt waiver that is not state-contingent may also fuel default by non-distressed borrowers.

8 Conclusion

Our empirical results are consistent with the hypothesis that political intervention in debt contracts results in improvement in loan repayment behavior of distressed borrowers. However, loan moratoria extended to non-distressed borrowers have no such impact. In fact, if the distressed and non-distressed beneficiaries of a loan waiver program are

not carefully separated when administering the program, strategic default by the non-distressed borrowers is likely to impose significant costs on the program. Therefore, the success of a debt relief program crucially depends on the ability of the political executive to target the program towards distressed borrowers. In the context of the Indian debt waiver program of 2008, our empirical analysis reveals that rainfall can be used as a reasonable proxy for farmer distress. Debt relief granted to farmers who faced scanty rainfall leads to improvement in their loan repayment behavior whereas debt relief granted to farmers who experienced normal rainfall leads to strategic default by non-distressed borrowers. In line with the literature, we find ex-ante credit rationing by the loan officers. However credit rationing is restricted to only non-distressed borrowers who got the benefit of debt relief. Distressed borrowers, in fact, get more credit than before. This shows that the loan officers, with their ears firmly on the ground, are able to distinguish between genuine and non-distressed default. Since political intervention in debt contracts generates both costs and benefits, focusing only on the benefits may lead to increased moral hazard and missed opportunities in alleviating the hardships of the distressed borrowers. Our study suggests that policy makers may benefit from trying to device a credible mechanism to identify the distressed borrowers. It may not be easy in all contexts. However, a program launched without proper identification may lead to unintended consequences.

References

Agarwal, S., G. Amromin, I. Ben-David, S. Chomsisengphet, T. Piskorski, and A. Seru (2012): "Policy Intervention in Debt Renegotiation: Evidence from the Home Affordable Modification Program," Working paper, The University of Chicago Booth School of Business.

Akhmedov, A., and E. Zhuravskaya (2004): "Opportunistic Political Cycles: Test in a Young Democracy Setting," *The Quarterly Journal of Economics*, 119(4), 1301–1338.

Alok, S., and M. Ayyagari (2012): "Political Influence and Investments of Government Owned Firms.," Working paper, Indian School of Business.

Banerjee, A. V. (2000): "The Two Poverties," *Nordic Journal of Political Economy*, 26, 129 – 141.

Banerjee, A. V., E. Duflo, and K. Munshi (2003): "THE (MIS)ALLOCATION OF CAPITAL," *Journal of the European Economic Association*, 1(2-3), 484–494.

Banerjee, A. V., and A. F. Newman (1993): "Occupational choice and the process of development," *Journal of Political Economy*, pp. 274–298.

Bolton, P., and H. Rosenthal (2002): "Political intervention in debt contracts," *Journal of Political Economy*, 110(5), 1103–1134.

Burgess, R., O. Deschenes, D. Donaldson, and M. Greenstone (2011): "Weather and death in India," Working paper, London School of Economics.

Burgess, R., and R. Pande (2005): "Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment," *The American Economic Review*, 95(3), pp. 780–795.

Burgess, R., R. Pande, and G. Wong (2005): "Banking for the poor: Evidence from India," *Journal of the European Economic Association*, 3(2-3), 268–278.

Cole, S. (2009a): "Financial Development, Bank Ownership, and Growth: Or, Does Quantity Imply Quality?," *The Review of Economics and Statistics*, 91(1), 33–51.

——— (2009b): "Fixing Market Failures or Fixing Elections? Agricultural Credit in India.," *American Economic Journal: Applied Economics*, 1(1), 219–250.

De, S., and P. Tantri (2013): "Borrowing Culture and Debt Relief: Evidence from a Policy Experiment," Working paper, Indian School of Business.

Deschênes, O., and M. Greenstone (2011): "Climate change, mortality, and adaptation: evidence from annual fluctuations in weather in the US," *American Economic Journal: Applied Economics*, 3(4), 152–185.

Foote, C. L., K. Gerardi, and P. S. Willen (2008): "Negative equity and foreclosure: Theory and evidence," *Journal of Urban Economics*, 64(2), 234–245.

Guiso, L., P. Sapienza, and L. Zingales (2013): "The Determinants of Attitudes toward Strategic Default on Mortgages," *The Journal of Finance*, 68(4), 1473–1515.

Jensen, M. C., and W. H. Meckling (1976): "Theory of the firm: Managerial behavior, agency costs and ownership structure," *Journal of financial economics*, 3(4), 305–360.

Kanz, M. (2012): "What Does Debt Relief Do for Development? Evidence from Indias Bailout Program for Highly-Indebted Rural Households," *World Bank Policy Research Working Paper*, 6258.

Khemani, S. (2007): "Does delegation of fiscal policy to an independent agency make a difference? Evidence from intergovernmental transfers in India," *Journal of Development Economics*, 82(2), 464 – 484.

Khwaja, A. I., and A. Mian (2005): "Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market," *The Quarterly Journal of Economics*, 120(4), 1371–1411.

Kornai, J. (1979): "Resource-constrained versus demand-constrained systems," *Econometrica: Journal of the Econometric Society*, pp. 801–819.

Kroszner, R. (1999): *"Is it Better to Forgive Than to Receive?: Repudiation of the Gold Indexation Clause in Long-term Debt During the Great Depression"*. Citeseer.

Lindbeck, A. (1976): "Stabilization Policy in Open Economies with Endogenous Politicians," *The American Economic Review*, 66(2), 1–19.

Mayer, C., E. Morrison, T. Piskorski, and A. Gupta (2011): "Mortgage Modification and Strategic Behavior: Evidence from a Legal Settlement with Countrywide," Working paper, Columbia Business School.

Mendelsohn, R., W. D. Nordhaus, and D. Shaw (1994): "The impact of global warming on agriculture: a Ricardian analysis," *The American Economic Review*, pp. 753–771.

Mookherjee, D., and D. Ray (2003): "Persistent inequality," *The Review of Economic Studies*, 70(2), 369–393.

Myers, S. C. (1977): "Determinants of corporate borrowing," *Journal of Financial Economics*, 5(2), 147–175.

Nordhaus, W. D. (1975): "The Political Business Cycle," *The Review of Economic Studies*, 42(2), 169–190.

Pai, D., L. Sridhar, P. Guhathakurta, and H. Hatwar (2010): "Districtwise Drought Climatology of the Southwest Monsoon Season over India Based on Standardized Precipitation Index (SPI)," *National Climate Centre Research Report, India Meteorological Department*, 2/2010.

Parthasarathy, G., and Shameem (1998): "Suicides of Cotton Farmers in Andhra Pradesh-An Exploratory Study," *Economic and Political Weekly*, 33(13).

Rothbard, M. N. (1962): *"The panic of 1819: Reactions and policies"*, vol. 605. Ludwig von Mises Institute.

Rucker, R. R., and L. J. Alston (1987): "Farm failures and government intervention: A case study of the 1930's," *The American Economic Review*, 77(4), 724–730.

Schlenker, W., W. M. Hanemann, and A. C. Fisher (2005): "Will US agriculture really benefit from global warming? Accounting for irrigation in the hedonic approach," *The American Economic Review*, 95(1), 395–406.

Shleifer, A., and R. W. Vishny (1994): "Politicians and firms," *The Quarterly Journal of Economics*, 109(4), 995–1025.

Vig, V. (2013): "Access to collateral and corporate debt structure: Evidence from a natural experiment," *The Journal of Finance*, 68(3), 881–928.

Visaria, S. (2009): "Legal reform and loan repayment: The microeconomic impact of debt recovery tribunals in India," *American Economic Journal: Applied Economics*, pp. 59–81.

Table 1: Descriptive Statistics

This table reports the descriptive statistics for the sample of agricultural loans collected from a large nationalized bank in India. The sample covers all agricultural loans disbursed by the bank in 9 branches across 4 districts in Andhra Pradesh over a period of 8 years from September 2005 through May 2012. The table reports summary statistics pertaining to loan amount, relief amount, probability of default, number of days for which the loans are outstanding, land holdings, number of loans per farmer and the effective interest rate charged

Variable	Observations	Mean	S.D.	Median
Loan (In INR)	34750	30589.64	42458.78	21801
Relief (In INR)	34750	12858.22	16085.98	6231
Default Probability	34750	0.48	0.5	0
Duration (In Days)	34750	457.97	326.71	357
Land (In Hectares)	17367	2.32	18.73	1.34
Loan Count	34750	2.82	2.04	2
Interest rate	34750	0.12	0.28	0.07

Table 2: Diff-in-diff tests for the effect of loan waiver on loan repayment duration

This table presents the regression estimates of the loan repayment duration of the beneficiary and the non-beneficiary households. Each column reports the results of a separate regression where the dependent variable is the natural logarithm of the total number of days the current loan is outstanding. In Columns (1) and (2), the account-holders had unfavorable weather conditions during the last loan, while in columns (3) and (4), the weather was normal. Additional controls include Branch fixed effects, district-wise production of food-grains during the sample years and total agricultural credit disbursed in the district during the sample years. The standard errors are clustered at account level and adjusted t-statistics are reported in parentheses below the regression estimates. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	(1)	(2)	(3)	(4)
VARIABLES	logdays	l0gdays	logdays	logdays
Relief Accounts	0.703***	0.521***	0.189***	0.158***
	(7.639)	(5.666)	(12.547)	(10.159)
Post Waiver Dummy	0.297***	0.282***	0.538***	0.357***
	(3.101)	(3.005)	(8.446)	(4.330)
Post Waiver*Relief Accounts	-0.568***	-0.435***	0.052	-0.002
	(-5.805)	(-4.565)	(0.867)	(-0.040)
Log Loan Amount	0.094***	0.109***	-0.046***	-0.027***
	(6.573)	(7.904)	(-5.788)	(-2.718)
Interest Rate	0.988***	0.959***	0.556	0.577
	(8.301)	(8.291)	(1.644)	(1.621)
Constant	4.381***	4.439***	5.799***	5.236***
	(25.444)	(25.414)	(60.910)	(38.656)
Observations	9,264	9,264	25,486	25,486
R-squared	0.117	0.181	0.175	0.199
Branch Fixed Effects	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes
Joint	-0.271	-0.153	0.590	0.355
t-stat	-14.01	-5.805	39.54	10.71
p-val	0	6.77e-09	0	0

Table 3: Diff-in-diff tests for the effect of loan waiver on probability of default

This table presents the regression estimates of the probability of default for the current loan of the beneficiary and the non-beneficiary households. Each column reports the results of a separate regression where the dependent variable is a dummy indicating whether the current loan is a bad loan. We define a default condition as total outstanding days being > 365 days. In Columns (1) and (2), the account-holders had unfavorable weather conditions during the last loan, while in columns (3) and (4), the weather was normal. Additional controls include Branch fixed effects, district-wise yearly food-grain production and agricultural loan disbursed. The standard errors are clustered at account level and adjusted t-statistics are reported in parentheses below the regression estimates. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	(1)	(2)	(3)	(4)
VARIABLES	default	default	default	default
Relief Accounts	0.519***	0.480***	0.224***	0.180***
	(11.391)	(10.452)	(29.938)	(22.383)
Post Waiver Dummy	0.182***	0.060	0.338***	0.232***
	(3.841)	(1.285)	(10.663)	(5.653)
Post Waiver*Relief Accounts	-0.379***	-0.357***	-0.041	-0.107***
	(-7.707)	(-7.413)	(-1.379)	(-3.588)
Log Loan Amount	0.032***	0.038***	-0.032***	-0.018***
	(4.778)	(5.694)	(-10.750)	(-4.382)
Interest Rate	0.468***	0.465***	0.266	0.277
	(7.839)	(7.856)	(1.608)	(1.579)
Constant	-0.196**	-0.431***	0.440***	0.116*
	(-2.389)	(-5.111)	(11.665)	(1.924)
Observations	9,264	9,264	25,486	25,486
R-squared	0.101	0.193	0.200	0.240
Branch Fixed Effects	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes
Joint	-0.197	-0.297	0.297	0.125
t-stat	-16.08	-17.27	38.07	7.631
p-val	0	0	0	0

Table 4: Access to Credit

This table presents the regression estimates of the total current loan granted to the beneficiary and the non-beneficiary households. Each column reports the results of a separate regression where the dependent variable is the log of loan amount granted in the post waiver period. Waiver is a dummy that takes the value of one for waiver beneficiaries and zero otherwise. DraughtPre is a dummy that takes the value of one if the farmer concerned suffered a draught in the period corresponding to the loan immediately preceding waiver and zero otherwise. Default Previous Loan is a dummy that takes the value of one if the farmer concerned defaulted on the loan immediately preceding the loan under consideration. Previous Loan Amount stands for log of previous loan amount. Additional controls include branch and year fixed effects. The standard errors are clustered at account level and adjusted t-statistics are reported in parentheses below the regression estimates. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

VARIABLES	(1) lloan	(2) lloan	(3) lloan	(4) lloan	(5) lloan	(6) lloan
Waiver Accounts	-0.528***	-0.549***			-0.237***	-0.294***
	(-12.856)	(-13.647)			(-5.647)	(-7.158)
DroughtPre	-0.340***	-0.368***			-0.417***	-0.487***
	(-8.420)	(-9.227)			(-9.627)	(-11.608)
Waiver Accounts*DroughtPre	0.935***	0.954***			0.731***	0.775***
	(19.890)	(20.809)			(15.350)	(16.745)
Previous Loan Amount	0.356***	0.357***	0.396***	0.397***	0.392***	0.393***
	(34.884)	(34.872)	(31.287)	(31.390)	(30.321)	(30.365)
Agricultural Credit		0.157***		0.332***		0.334***
		(4.534)		(9.282)		(9.255)
Default Previous Loan			-0.468***	-0.439***	-0.400***	-0.380***
			(-15.383)	(-13.805)	(-11.404)	(-10.592)
Default Previous Loan*DroughtPre			0.411***	0.395***	0.213***	0.224***
			(12.303)	(11.603)	(4.963)	(5.263)
Constant	6.365***	5.271***	5.863***	3.517***	6.056***	3.760***
	(55.317)	(19.091)	(44.739)	(11.957)	(41.292)	(12.428)
Observations	20,638	20,638	16,131	16,131	16,131	16,131
R-squared	0.133	0.134	0.126	0.132	0.140	0.146
Branch Fixed Effects	No	Yes	No	Yes	No	Yes
Additional Controls	No	Yes	No	Yes	No	Yes

Table 5: Debt Relief and Account Balance

The following regressions investigate the effect of debt-relief on the end-of-period account balance of the borrowers. The dependent variable is the final account balance at the end of the sample period. Note that the positive(negative) sign indicates a credit(debit) balance for the borrower and signifies a net surplus(deficit). In the first column, we differentiate between beneficiaries and non-beneficiaries. In Column (2), we measure the overall impact of waiver on the wealth of the borrowers condition on the pre-waiver weather. We include the average post-relief loan amount and branch fixed effects as controls. The standard errors are clustered at account level and robust t-statistics are reported in the parentheses.

	Dependent Variable: Account Balance	
	(1)	(2)
Waiver Beneficiaries	13.055***	7.590***
	(16.460)	(4.163)
Drought Pre Waiver		-6.869***
		(-3.497)
Drought Pre Waiver × Waiver Acccounts		3.949*
		(1.681)
Constant	-47.615***	-39.792***
	(-30.639)	(-16.259)
Observations	12,077	12,077
R-squared	0.053	0.054
Branch Fixed Effects	Yes	Yes

Table 6: Pre-Waiver Credit Score and Ex-post Performance

This table reports the OLS estimates. In columns (1) and (2) the dependent variable is the number of days the current loan is outstanding; in columns (3) and (4) - the probability of default. The remaining regressions concern the response of the loan officer to new loan applications. Columns (5) and (6) present the results where the response is the amount of new loan approved to the borrower while in columns (7) and (8), we model the probability of rejection. Additional controls include Branch and year fixed effects. The standard errors are clustered at account level and adjusted t-statistics are reported in parentheses below the regression estimates. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	Total Days Outstanding	Default Prob	Log(New Loan Amount)	Loan Reject Prob
	(1)	(2)	(3)	(4)
Cumulative Credit Score Pre Waiver	-15.139***	-0.029***	3.169***	-0.012***
	(-5.411)	(-7.550)	(9.549)	(-6.115)
Loan Amount	-2.277***	-0.000		-0.002***
	(-11.004)	(-1.501)		(-9.730)
Land Holdings	-82.841***	-0.069***	19.481***	-0.016**
	(-8.674)	(-6.349)	(24.683)	(-2.295)
intrate	40.043	0.055	-2.713***	-0.035***
	(1.265)	(1.240)	(-2.922)	(-2.897)
Production	-0.539***	-0.000***	0.043***	-0.001***
	(-19.744)	(-8.877)	(13.352)	(-43.439)
Agricultural Credit	0.068	-0.000***	-0.011**	0.000***
	(1.390)	(-3.910)	(-2.221)	(18.362)
Log Previous Loan Amount			3.352***	
			(11.523)	
Constant	839.995***	1.241***	-39.055***	0.065***
	(18.972)	(16.811)	(-6.777)	(2.911)
Observations	8,112	8,112	8,111	8,112
R-squared	0.225	0.222	0.351	0.532
Branch Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes

Table 7: Annual Rainfall in India

This table presents data regarding rainfall in India. Column (1) shows the proportion (in terms of percentages) of meteorological sub divisions that faced deficient rainfall. Column (2) presents data regarding actual rainfall received as compared to normal expected rainfall in the whole country. Each row represents a year.

year	% Sub divisions with deficient rainfall	Actual rainfall as a % of normal rainfall
2005	4	99
2006	10	99
2007	5	106
2008	3	98
2009	22	78
2010	5	102
2011	3	101
2012	13	92

Table 8: Annual Agricultural Production in India

This table presents data regarding annual agricultural production in India. Column (1) shows the area under cultivation in terms of million hectares, Column (2) presents annual foodgrain production in million tonnes and Column (3). Rows represent years.

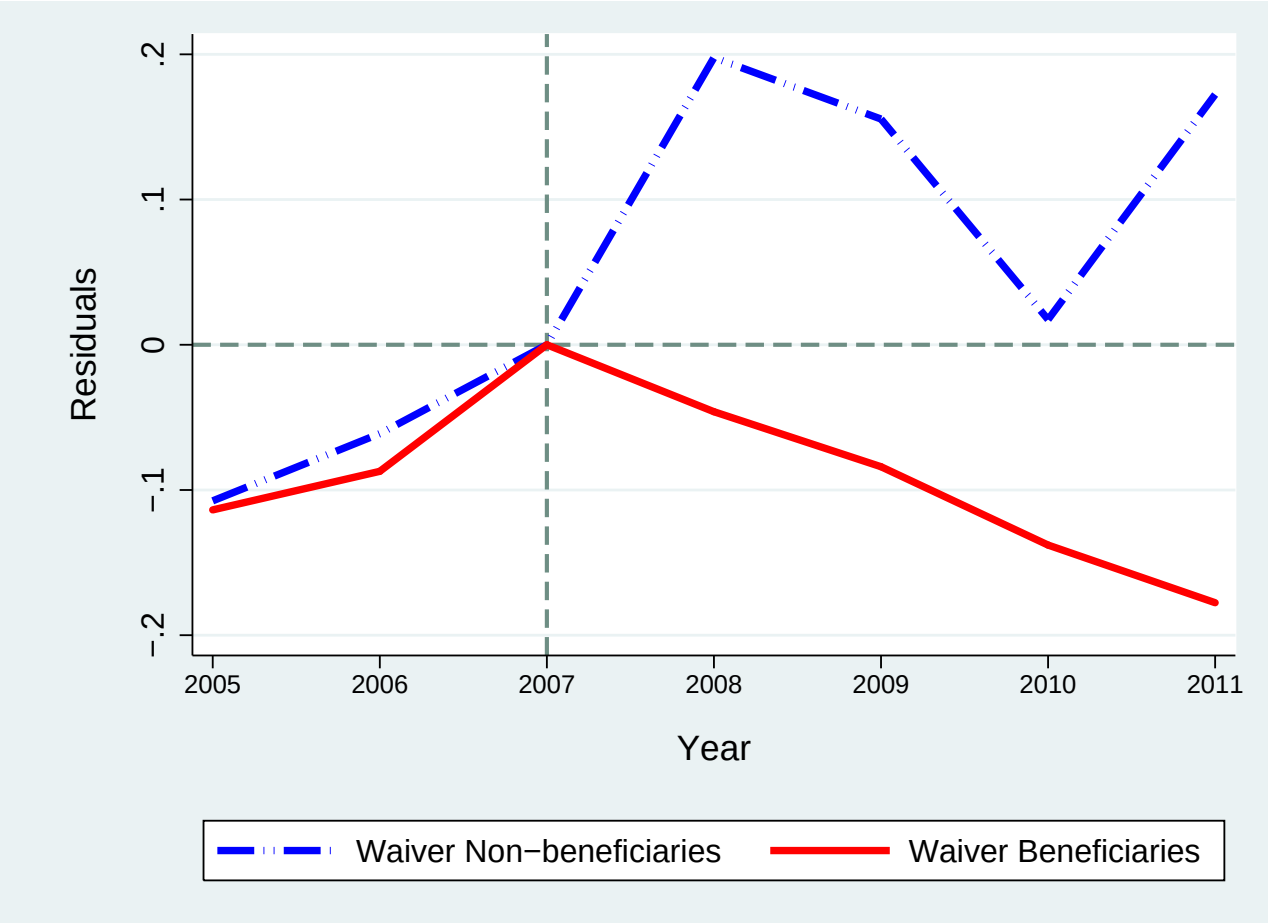
Year	**Area (In Million**	**Production (In Million Tonne)**	**Yield (Kg/ hectare.**
2005-06	121.6	208.6	1715
2006-07	123.71	217.28	1756
2007-08	124.07	230.78	1860
2008-09	122.83	234.47	1909
2009-10	121.33	218.11	1798
2010-11	126.67	244.49	1930
2011-12	125.03	257.44	2059

Table 9: Macro Impact: Non Performing Assets Pre and Post waiver

This table presents the regression estimates of the agricultural and non agricultural NPAs in India between 2005 and 2012. Column (1) and Column (2) of the table report the results of the regression equation (8).
Here the logarithm of the Agricultural NPAs of bank (i) in year (t) is the dependent variable. Post08 is a dummy which takes the value of 1 for the year 2008 and years after that. Agricultural GDP denotes growth in agricultural production in year t over year t-1. Rainfall represents proportion of actual rainfall over normal rainfall during year t. The variable Inflation represents the average inflation rate for year t. Vb represents bank fixed affects.
Column (3) and column (4) of the table report the results of the regression equation (9)
Here the logarithm of the total NPAs of bank (i) in year (t) is the dependent variable. Post08 is a dummy which takes the value of 1 for the year 2008 and years after that. Dummy for Agricultural NPAs takes a value of 1 for agricultural NPAs(j=1) and 0 for total NPAs(j=0). The independent variable GDP represents overall GDP growth during year t. Yt denotes year fixed affects. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

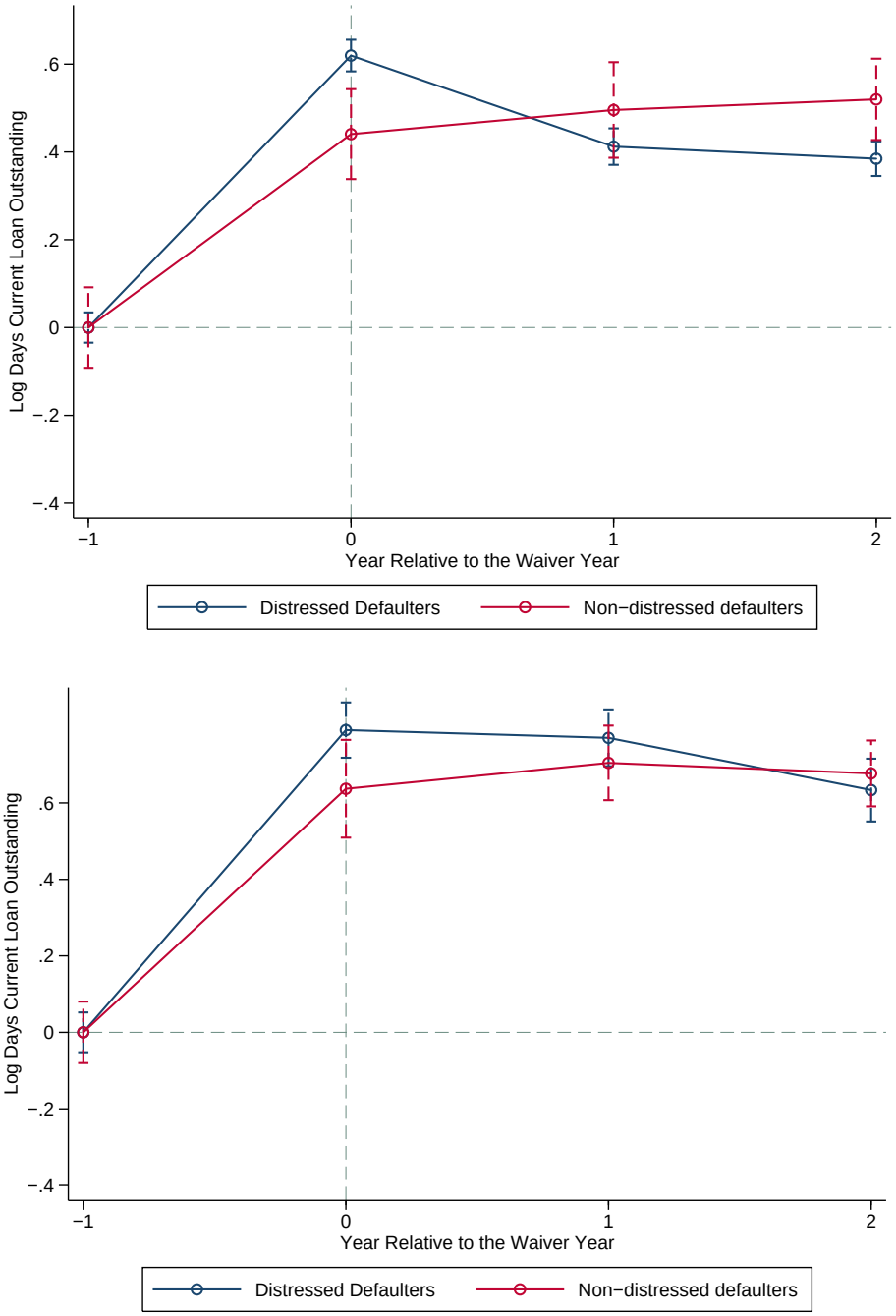
	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE	AgriNPA	AgriNPA	AllNPA	AllNPA
Post waiver	0.6***	0.89***		0.22**
	[3.40]	[5.30]		[2.09]
Dummy for Agricultural NPA			-2.19***	-2.30***
			[-11.13]	[-8.44]
Post Waiver* Dummy for Agricultural NPA			0.39***	0.81***
			[2.95]	[3.99]
GDP				34.18*
				[1.76]
Agricultural GDP		12.04***		2.68
		[4.22]		[0.35]
Rain		0.00		0.00
		[1.60]		[0.98]
Inflation				6.76
				[1.47]
Constant	5.51***	3.06***	7.27***	2.35**
	[51.18]	[2.85]	[67.33]	[2.39]
Observations	161	161	322	322
R-squarred	0.66	0.7	0.8	0.8
Year Fixed Effects	No	No	Yes	No
Bank Fixed Effects	Yes	Yes	Yes	Yes

Figure 1: Existence of parallel trend between control and treatment groups in the pre-treatment period



Note: The figure shows the existence parallel trend between the control and the treatment groups. Residuals from a regression of log of days taken to repay a loan on branch and time fixed effects, interest rate and loan amount are shown in the Y axis. The residuals are averaged for each year and normalized at zero for 2007.

Figure 2: Dynamic Impact of Loan Waiver on the Performance of Farmers



Note: The figure plots the impact of debt waiver on borrower repayment behavior. We consider a window of 7 years spanning from 3 years before the announcement and implementation of the debt relief program to 3 years post. The circles represent the regression coefficients while the dashed lines report the 95% confidence intervals, adjusted for clustering at firm level. Specifically, we report the estimates of the following regression:

$$y_{ibt} = \alpha + \beta_1 D^{-2} + \beta_2 D^{-1} + \beta_3 D^{0} + \beta_4 D^{+1} + \beta_5 D^{+2} + \beta_6 D^{+3} + \mu_b + \tau_t + \epsilon_{ibt} \quad (9)$$

where D^{-i} equals 0 except for the borrowers in the i^{th} year before the waiver while D^{+j} equals 1 for the loans extended in the jth year after the intervention. μ_b and τ_t are dummies introduced to account for branch and year fixed effects respectively.

Appendix

Table A.1: A simple Credit Scoring Model

This table presents scoring methodology used in our simple credit scoring model. Columns (1) and (2) represent adverse weather and good weather respectively. Rows represent the status of the loan. The highest score(2) is awarded to the cases where farmers, despite facing bad weather, repay the loans. In cases where the weather is normal and the farmer repays the debt the score awarded is 1. If the state is adverse, and the borrower defaults on her obligation, she receives a neutral score of 0. Finally, cases where the framer defaults despite good weather, the score awarded is -1.

		Weather Conditions	
		Adverse Weather	Good Weather
Performance	Repay	2	1
	Default	0	-1