Knowing what's good for you: Can a repayment flexibility option in microfinance contracts improve repayment rates and business outcomes?*

Giorgia Barboni† and Parul Agarwal‡

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Abstract

Repayment flexibility in microfinance contracts can enable clients to undertake higher return projects that have more irregular payment streams. But there is the risk of increased default due to time-inconsistent or excessively risky borrower behavior. How severe is this default risk and can it be mitigated simply by using contract price as a screening mechanism? To examine this we implement a randomized experiment with microfinance borrowers in Uttar Pradesh, India. In treated branches, borrowers select between the standard, rigid contract and a more expensive flexible contract. In control branches, customers are only offered the standard rigid contract. Clients in treated branches have higher repayment rates than control branches. We also find higher business sales in treatment compared to control group. Selection is an important mechanism – in treated branches, time-consistent and more financially disciplined borrowers are significantly more likely to opt for the flexible repayment schedule.

Keywords: Microfinance, Adverse Selection, Repayment Flexibility, Screening, Randomized Controlled Trial
JEL Codes: O12, O16, D03

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†*Corresponding Author*. Princeton University, gbarboni@princeton.edu
‡Centre for Microfinance, IFMR-LEAD

1 Introduction

Flexible repayment contracts not only allow borrowers to invest in more illiquid business activities, but also to manage their cash-flows better and thus to be insured against low income realizations. However such contracts can be potentially costly from the lender's perspective. Indeed, the existing empirical literature has found an adverse effect of repayment flexibility on repayment rates (Field et al., 2013).

This paper proposes an innovative way for Microfinance Institutions (MFIs) to offer repayment flexibility in microfinance contracts, which uses uses contract price as a screening mechanism. The underlying intuition is that offering repayment flexibility as a more expensive contract option than the standard rigid contract can work as a screening instrument for lenders, with borrowers selecting into the contract that best suits their characteristics. This, in turn, can mitigate default rates.
We design and set up a Randomized Controlled Trial (RCT) in Uttar Pradesh, India, to test this hypothesis: in treated branches, the lender offered a flexible repayment option along with the standard rigid contract, the former being more expensive than the latter. In control branches, only the standard, rigid contract was offered.

We find that including a flexible repayment option in microfinance contracts improves borrowers' business outcomes, at least in the short-term, but does not undermine repayment rates. We also find time-consistent borrowers, those who draft a budget for their business activity more frequently, and those who report being more worried about households' expenditures to be more likely to opt for the flexible contract.

Our work differs from prior studies, and in particular from the paper by Field et al. (2013), along two dimensions: first, it specifically focuses on the design of microfinance contracts, and in particular on the introduction of flexible repayment schedules that can be profitable for both borrowers and the lenders. Second, it studies how borrowers select into different repayment schedules, based on their sensitivity to price and behavioral characteristics (time preferences, risk aversion, financial discipline), as well as on the value they give to continuing their relationship with the lender. In order to study borrowers' selection, our experimental design does not "exogenously" assign borrowers to a flexible contract (as in Field et al., 2013), but allows them to choose between a rigid and a flexible schedule, which are provided simultaneously by the lender.

Our experiment leads to two main sets of results: first, behavioral characteristics matter for contract choice. We indeed find that time preferences, attitudes towards risk, as well as financial dis-

cipline are highly predictive of borrowers' preferences towards rigid vs. flexible contracts. Second, letting borrowers select their preferred repayment schedule represents an optimal strategy for both the lender and the borrowers, as it improves both repayment rates and business outcomes, at least in the short-term.

All in all, our study indicates that the combination of two contract features that are traditionally thought to increase default rates – i.e. higher interest rates and repayment flexibility – lead instead to better outcomes.

Our findings cast new light on how microfinance contracts should be designed and offered in a sustainable way for both lenders and borrowers. The recent evidence that microfinance loans are not able to radically transform borrowers' small-scale self-employed activities (Banerjee et al., 2015; Crépon et al., 2015; Angelucci et al., 2015) has further highlighted the inability of microfinance contracts, in their current structure, to make microfinance borrowers to grow beyond subsistence level (Field et al. (2013); Fischer (2013)). Yet, despite relaxing the stringent terms of microfinance contracts should in principle meet micro-entrepreneurs' financial needs to a better extent (Feigenberg et al., 2013; Field et al., 2013; Barboni, 2017; Gulesci et al., 2017; Czura, 2015), very few microfinance institutions (MFIs) currently offer flexible repayment schedules. One reason for MFIs' reluctance to introduce flexible contract is the potential increase in default rates. This could be exacerbated by borrowers' excessive risk-taking behavior or time-inconsistency.

Our analysis thus wants to contribute to the current debate on innovations in financial contracts by showing that repayment flexibility can be introduced in microfinance contracts without negatively affecting repayment rates.

On the other hand, our paper wants to add to the literature that studies how financial products can mitigate users' behavioral biases. Studies belonging to this stream of research have praised contract features like commitment savings devices (Ashraf et al., 2006) or rigid repayment schedules (Bauer et al., 2012) for their ability to discipline those individuals who cannot anticipate their time inconsistency. In line with these papers, our study shows that lenders can exploit borrowers? private information to design optimal contracts

The remainder of the paper is organized as follows. Section 2 describes the experiment and its target population; results from the RCT, both in terms of business performance and repayment rates are discussed in Section 3. Section 4 explores whether an effective selection has been implemented through the separating contract; Section 5 concludes.

2 The Experiment

The experiment was set up in collaboration with the Centre of Microfinance, IFMR-LEAD, which organized and carried out all the field operations. It began in January 2016, and was held in partnership with an Indian Microfinance Institution headquartered in Lucknow, Uttar Pradesh: Sonata Microfinance Pvt. Twenty-eight branches were selected in Uttar Pradesh for the RCT, either in urban or peri-urban areas, and randomly assigned to either treatment or control using a pair-matching algorithm, as shown in figure 4. Figure 3 shows the experimental design. Both in control and treatment, subjects approached the branch to get an individual loan with a rigid repayment schedule, which is offered by Sonata at an interest rate of 24% APR. Once ascertained they were eligible for the individual loan, customers in treated branches were offered the opportunity to choose between the product they asked for (i.e. the rigid contract) and a flexible contract offered at an interest rate of 26%. This flexible loan gives the customers the opportunity to benefit from a three-months repayment holiday, to be exerted any time after the third month of the loan maturity. The first three instalments of the flexible contract require a monthly repayment. During the three-months repayment holiday, borrowers still needed to repay a small fee.[1] Borrowers in control branches were only offered the standard rigid contract at 24%. All borrowers were micro-entrepreneurs who took up the loan to make an investment for their business activity.[2] A comprehensive baseline survey was administered from May 2016 to the December 2016; subjects were interviewed as they took out a loan in the local branch. A follow-up survey was then carried from May 2017 to July 2017, on average eight months apart from the baseline.

2.1 Sample and Descriptive Statistics

A total of 799 borrowers were initially involved in the study. All experimental subjects were clients of Sonata who had successfully repaid a few loans as group-lending borrowers and had just approached Sonata to get an individual loan.[3] However, these borrowers had not taken an individual loan, yet.

[1] As repayments are made by Sonata's customers through bank transfers predominantly, this fee was used by Sonata to avoid that borrowers might cancel their automatic bank transfer, and thus not resume repayments once the repayment holiday was over. The existence of this small fee during the repayment holiday month allows us to compute delays in repayments also for flexible customers.

[2] Sonata indeed collects detailed data on the loan purposes and verifies them.

[3] Most MFIs, particularly in India, have now started offering individual loans. However, in order to "screen" among borrowers, they require their customers to first borrow in group lending schemes. Conditional on a successful repayment behavior in group loans, these borrowers are then "upgraded" to individual loans, which normally are more expensive, have larger loan size, and are specifically targeted for business purposes.

This made this sample of borrowers particularly suitable for the experiment, for at least two reasons: first, subjects were entrepreneurs with business growth potential and, as such, had borrowing needs for productive purposes. Second, these individuals had never taken individual loans before, nor benefited from repayment flexibility. Therefore, their preferences for repayment flexibility are solely driven by their type, and not by any learning from previous flexible loans.

The baseline survey instrument contained questions that allowed us to detect subjects' main socio-demographic variables, as well as their business characteristics, borrowing and saving behavior, aspirations, use of time, and financial literacy. Two sets of "games" were then played to elicit both time and risk preferences.

Borrowers' attitude towards risk was measured with a standard Multiple Price List (MPL), in a similar spirit as Holt and Laury (2002). The MPL protocol consists of presenting the subjects with two different lotteries, Lottery A and Lottery B, entailing six decisions. Payouts are constant but the probabilities of success change from one decision to the other, with Lottery B being riskier than lottery A. Until round three, lottery A gives a higher expected value than lottery B. Starting from round four, Lottery B yields a higher expected value. Therefore, subjects who stay with Lottery A longer than three rounds display increasing levels of risk aversion. Conversely, subjects switching to Lottery B in the earlier rounds would display increasing levels of risk-loving behavior.

In addition, we assessed subjects' intertemporal preferences using standard list choices, in a similar spirit as Harrison et al. (2002). This protocol consisted of two lotteries. In the first one, the respondent had to choose between a Rs. 200 sum to be paid the day after the interview and an equal or larger sum (Rs. 200, 240, 260, 280, 300) to be paid one month later. The second lottery "shifted" the time horizon of the first lottery by three months. Combining the two lotteries not only allows one to estimate subjects' discount rate, but also to detect any time inconsistency. If a subject preferred Rs. 260 one month later to Rs. 200 paid tomorrow, she should have also preferred Rs. 260 paid four months in the future to Rs. 200 paid three months in the future. This behavior is defined as "time consistent". Still, preference "reversals" may emerge. For example, when a subject prefers Rs. 260 one month later to Rs. 200 paid tomorrow, but the choice is reverted for the later rewards, the subject is said to display hyperbolic discounting as shown by Mahajan and Tarozzi (2011). Conversely, when a subject prefers Rs. 260 one month later to Rs. 200 paid tomorrow, but this choice is reverted for the earlier rewards, the subject is showing anti-hyperbolic discounting.[4]

[4]Although less documented in the behavioral economics literature, anti-hyperbolic discounting has been reported in a number of contexts (see Read et al., 2013).

Primary data collected at both baseline and endline are then complemented by administrative data from Sonata on each borrower's repayment performance. Of the original 799 individuals we interviewed at baseline, we were able to re-interview 789 at endline, with an implied attrition of 1.2%.[5] Table 1 shows descriptive statistics for our sample. Households consist on average of six members, with household heads being 41 years old, on average. 97% of the household heads are male, and slightly less than half of households report owning land, at baseline. Average household income in the last twelve months is about 216,000 Rupees, and business sales reported for the last month 13,000 Rs. At baseline less than 20% of households has an outstanding loan. This because most of the subjects had already repaid their group-lending loans, and were about to borrow as individual-lending customers for the first time. Table 2 shows statistics for the main business activities held by experimental subjects. All of them are micro-entrepreneurs engaged in small business activities that predominantly entail producing and/or selling goods and services. 20% of the sample owns a grocery store/fruits & vegetables shop, while 17% owns a small business or hotel. 16% is involved in dairy farming and animal husbandry; selling and trading, as well as small manufacturing, account for other 16% and 15% of the total business activities, respectively.

2.2 Randomization and Balancing Checks

We set up a Clustered Randomized Controlled Trial where the unit of randomization is Sonata's bank branch. Before randomizing branches into treatment and control, we paired them using the Edmond algorithm for minimum distance, which allows us to maximize the power of the experiment. 389 subjects were recruited in treated branches, while 410 subjects were recruited in control branches.[6] However, because we decided to drop 12 customers who were not taking the loan for themselves, we are ultimately left with 407 and 380 subjects, respectively.

Table 3 reports balancing checks across treatment and control for the main demographic variables, as well as for wealth, income and borrowing behavior. Treatment and control group appear balanced along subjects' main socio-economic dimensions. We detect a small unbalance in terms of education of the household head: the share of individuals who completed a higher degree of education is

[5] A few months after loan disbursement, Sonata's loan officers found out that 12 borrowers (1.5% of the original sample) had actually taken a loan for somebody else. In order to avoid any potential endogeneity, we kept these subjects in the sample. However, answers for the business income sections for these subjects are missing.

[6] These figures represent the universe of customers in the branches during the time we carried out the baseline.

slightly higher in treatment vs. control (6 p.p. more in treatment, significant at 5%).[7] We also look at balancing in terms of business activities carried out by experimental subjects. There seems to be a slight un-balance in the type of business held in treatment vs. control group. Treated subjects are more likely to be small manufacturers/artisans/tailors, while control subjects are more likely to own a grocery store. Though the difference is quite small (six percentage points), we will take into account these un-balances in the main analysis.

3 Results

Our experimental design allows us to test three main sets of results. First, by comparing treatment and control group and using primary data collected by our field team, we can study the impact of providing a menu of contracts vs. the standard rigid contract on borrowers' repayment rates, business income, as well as borrowing and saving behavior. Second, by focusing on treated branches only (using baseline data), we can uncover the mechanism driving our main results. In particular, we can study which borrowers, based on their individual characteristics, are more likely to select into the flexible vs. the rigid contract - and thus assess whether the menu of contracts represents an effective screening mechanism for Sonata. Finally, by using administrative data gathered from Sonata, we can carry out a Cost-Benefit Analysis (CBA) of the respective contracts for Sonata. Data from treated branches are also used to identify the "profile" of borrowers who chose the flexible contract, both in terms of "hard" information (type of business activity, business income, business fluctuation) and more "soft" information (attitude towards risk, time preferences, financial literacy). We believe this is an essential part of our study, as our ultimate goal is to inform our partner MFI of the benefits of the new contract, thus providing recommendations on whether, and under which terms, this menu of contracts could be scaled-up.

3.1 Loan Usage

All our borrowers are small and micro-entrepreneurs who took up a loan for investing in their business. As a first step in our analysis, we therefore look at loan usage, as reported by subjects at endline. Results are shown in table 4. We ask subjects to indicate whether they used the loan from Sonata to invest in their current business; to start a new business; to repay an old debt; for household's consump-

[7] Throughout the analysis, we will therefore control for education level to take into account for this unbalance.

tion; for other expenditures (marriage, health, and education). As expected, about 90% of subjects report using their loan to invest in their current business, with no significant differences across treatment and control group. Interestingly, we find that treated borrowers are significantly more likely to report using their loan for consumption.

3.2 Repayment Rates

The analysis of repayment rates is a crucial outcome to understand whether the screening mechanism entailed by our treatment is effective. So far, studies on repayment flexibility have shown that flexible repayment schedules lead to worse repayment performances. By contrast, the model developed by Barboni (2017) predicts that by offering a menu of contract, the lender should be able to retrieve better repayment rates.

We gathered repayment data by combining two sets of data: i) monthly recall data performed by our field team; ii) administrative data from Sonata. First of all, it must be noticed that, after one year from the first baseline surveys were administered, no borrowers defaulted in the branches assigned to the experiment. This is not suprising: in general, default rates among individual-lending borrowers at Sonata are very low. One reason for this is precisely that borrowers become eligible for individual loans only after having successfully repaid a few group loans cycles.Yet, delays in repayments are still a big concern for Sonata: borrowers are charged 100 Rs every time they are late with their monthly repayments. Late repayments are quite frequent: we do find that, on average, a little more than one in four borrowers being late on at least one installment.

Therefore, in order to identify differences in terms of repayment performance across treatment and control group, we look at delays in repayment. To this end, we compute three different measures of delays based on the monthly recall data collected by our field team, which are intended to capture both the intensive and the extensive margin of borrowers' repayment performance: i) number of times the borrower has paid a penalty for being late; ii) probability of having paid the late penalty at least once; iii) probability of having paid the late penalty multiple times. Following Barboni (2017)'s prediction, we conjecture that if the pricing structure implemented in treated branches works effectively, we should observe the repayment performance in treated branches to be *at least* as good as in control branches.

We test this hypothesis by estimating the following regression equation:

$$repayment_{ib} = \alpha + \beta T_b + \epsilon_{ib} \quad (1)$$

T_b is a binary variable for the treatment assigned to the branch b - whether borrowers were only offered the standard rigid contract ($T_b = 0$) or, instead, a menu of contracts ($T_b = 1$). Our coefficient of interest is β, which measures the average causal effect of being offered a pooling vs. a separating contract. Results are displayed in table 5, without and with controls, in Panel 1 and 2, respectively.[8] Column (1) of both Panel 1 and Panel 2 shows that, compared to control branches, borrowers in treated branches pay a significantly lower amount of late penalties than control group. Similar results are found for the probability to pay the late penalty fee at least once or multiple times (in column (2) and (3), respectively), although the β coefficient in column (2) is not statistically significant. Still, results from table 5 reveal that the separating contract performs better (or at least as well as) than the pooling contract in terms of repayment rates. This is in stark contrast with the existing literature: both Field et al. (2013) and Czura (2015), for instance, find an increse in default rates among flexible customers. Findings from table 5 thus confirm **Prediction 1** of Barboni (2017)'s model: offering a menu of contracts which includes both the flexible and the rigid contract, the former being more expensive than the latter, performs better than the standard, rigid contract in terms of repayment rates.

3.3 Treatment effects on Business Income

The other set of results we are interested in concern business performance. The hypothesis we want to test here is whether the better sorting potentially generated by the contract price structure also allows borrowers in treated branches to choose the business activity that best suits their characteristics, as predicted by Barboni (2017). This, however, would depend on the use that borrowers made of the repayment holiday. Indeed, while Barboni (2017)'s model predicts that borrowers would use the repayment holiday to invest in high-return business activities, it may well be the case that borrowers used the repayment holiday to cope with unexpected shocks.[9] If the screening mechanism works effectively, again our hypothesis is that, in treatment branches, business performance should be *at*

[8] We include, as controls: household size; age and education of the head of the household; probability that the household owns land - all these evaluated at baseline; the number of months since the loan was taken out and the loan size

[9] Indeed, when the flexible contract was offered in treated branches, its purpose was not prompted to customers - they could use it to either manage risks or liquidity better, or both.

least as good as in control branches. This because those who opted for the flexible contract should have used it to either mitigate potential losses or invest in more illiquid investment projects. While analysing business performance, one *caveat* is that all borrowers in our sample use their loans for investment purposes. This is the main requirement from Sonata to access individual, business loans. Thus, it is difficult to measure an increase in investments through our data. Yet, we measure business income by looking at business sales, profits, and any diversion of loan usage from the one stated at the time of disbursal. Therefore, we estimate the following regression equation by using endline data only:

$$y_{ib} = \alpha + \beta T_b + \epsilon_{ib} \tag{2}$$

where y_{ib} is the outcome of interest for borrower i in branch b. Again, T_b is the binary variable for the treatment assigned to the branch b - whether borrowers were only offered the standard rigid contract ($T_b = 0$) or, instead, a menu of contracts ($T_b = 1$). The coefficient of interest β again measures the average causal effect of being offered a pooling *versus* a separating contract.

We first look at sales. We collected data on borrowers' business in the last week, and we also computed a measure of sales variability by taking the square difference between the weekly sales and the average weekly sales. Results are shown in Table 6. Panel 1 shows results without controls, which are instead added in Panel 2. Interestingly, we find that borrowers in treated branches are significantly more likely to report both higher weekly sales and larger variability of weekly sales, which we can interpret as clients' undertaking riskier, but also more profitable business practices.

There are two competing hypotheses that can explain this result: one the one hand, higher returns in treatment versus control group can signal that treated borrowers have been more likely to invest in higher-return business activities than control borrowers. This implies that the sorting mechanism was used by more entrepreneurial borrowers to invest more. On the other hand, higher sales in business activities may also mean that the sorting mechanism was able to mitigate losses that still happen in control branches. In this case, the repayment holiday was used to mitigate income irregularity, rather than to make investments. Of course, to understand which of the two hypotheses is the dominant, we need to explore the treatment effect on borrowers' pool composition in detail. This will be done in Section 4. In what follows, we look at other treatment effects on business characteristics, to find support for either one of the two hypotheses.

As the next step, we look at the difference between the profits in the best and the worst month,

which we consider as a proxy for business fluctuations - the larger this difference, the more "volatile" borrowers' business activity is. Results are shown in table 11. Interestingly, we find that for treated borrowers the difference in the profits between the best and the worst month of business activity is significantly lower, compared to control, when we include households' controls (Panel 2). A potential explanation for this result is that the sorting mechanism somehow mitigated business fluctuations.

3.3.1 Treatment effects on Expenditures, Borrowing and Saving

Our survey instrument contains an extensive module aiming at capturing consumption and expenditures. In particular, we asked borrowers to report expenditures on a number of items, including meat and vegetables, temptation goods[10], education and health. We therefore look at differences in total expenditures in the last 30 days across treatment and control. Results are shown in table 7. We do not find significant differences in total expenditures across treatment and control. We also look at differences in borrowing and saving behavior across treatment and control. We also compare borrowers' probability to top up the loan from Sonata some time after the loan disbursement. To some extent, repayment flexibility and loan top-ups can be seen as two sides of the same coin: loan top-ups can indeed be used by borrowers to inject more liquidity in their business activity (thus, for *investment* motives), but, at the same time, to smooth consumption in face of shocks (thus, for *risk mitigation* motives). Although treated borrowers appear less likely to top up their loan, the difference with the control is not statistically significant.

We also look at both the intensive and extensive margin of borrowing. Results are shown in table 12 in the Appendix. We find the probability to borrow from informal sources being significantly larger for treated borrowers in Panel 1 and 2, although the result disappears once we control for baseline.[11]

4 Disentangling the Screening Mechanism

The analysis so far shows that offering a menu of contracts vs. only the rigid contract leads to remarkable differences across treatment and control: those who are offered the menu of contracts (rigid + flexible, at different prices) are more likely, on average, to repay on time; they also report higher

[10] Alchool, cigarettes. Also mobile phone expenses are clubbed under this category.

[11] We do not perform the analysis for the probability of borrowing from formal sources, as this is equal to one for both treatment and control at endline, given that they all borrowed from Sonata.

sales and lower business fluctuations. At the same time, they are more likely to use their loan for consumption purposes, but also to increase inventory during festivals.

As we mentioned already, we see two main competing explanations for these results, which relate to the borrowers' pool composition and to how subjects sorted themselves into the flexible and the rigid contract, in treated branches. This is inherently linked to how borrowers perceive the utility of repayment flexibility. Indeed, on the one hand, the provision of repayment flexibility can be seen as an opportunity for more entrepreneurial borrowers to invest in higher-return business activities. If this is the case, we should then observe those who opted for the flexible repayment contract to report higher business sales. On the other hand, repayment flexibility can also be used as a form of "insurance" against business fluctuations. If this second scenario, better repayment rates should still be associated with borrowers who preferred the flexible repayment schedule, but not necessarily an improved business performance. In what follows, we look in detail at borrowers' characteristics to see which of the two explanations is the predominant one.

4.1 Take-up rates of the flexible contract

Before studying borrowers' selection into the flexible and the rigid schedule, we look at the take-up rates of the flexible schedule in treated branches. Overall, 117 individuals out of 380 took up the flexible schedule, implying a take-up rate of 31% (see table **??** in Appendix 4.2). This take-up rate is consistent with the findings from the lab-in-the field games carried out by Barboni (2017), but lower than in Field et al. (2013) and Czura (2015). One reason could be that, in our experiment, the flexible contract is more expensive than the rigid one: therefore, borrowers were less likely to take-up this contract, as it was not implicitly cheaper than the rigid one.[12] The number of loans indicated for each branch corresponds to the total number of loans sourced in each branch in the period under study.

4.2 Borrowers' selection into rigid *versus* flexible repayment schedule

As a first step, we focus on treatment branches only and look at who chose the flexible *versus* the rigid repayment schedule. To this end, we recall **Prediction 2** from Barboni (2017)'s model: by making the flexible contract more expensive, the lender should be able to reach a separating equilibrium where

[12] It must also be noted that both in Field et al. (2013) and Czura (2015) the flexible contract was exogenously given in treated group, thus representing the first and main product offered to customers - the rigid contract thus representing the "outside" option for borrowers. In our experiment, this is not the case: borrowers were first signing up for the rigid contract and then, in treated branches, offered the flexible contract. Also, loan demand was balanced across treatment and control group.

"bad" borrowers (i.e. present-biased and low-revenues individuals) stick to the rigid option while good borrowers (borrowers with $\beta \geq 1$ and high-revenues individuals) choose the flexible repayment schedule. We therefore look at borrowers' characteristics and how borrowers sorted themselves into the flexible vs. the rigid contract, based on their traits. This is done by studying borrowers' likelihood to choose the flexible vs. the rigid contract, through the following regression equation:

$$p(flex)_i = \beta X_i + \epsilon_i \tag{3}$$

where $p(flex)_i$ is the probability the borrower i in treated branches chooses the flexible contract *versus* the rigid one, and X_i is a vector of borrowers' characteristics including behavioral ones (time preferences and risk aversion). We look at different sets of variables that can predict borrowers' choice for the flexible contract. Table 8 looks at behavioral characteristics such as time preferences, risk aversion, and financial literacy. We find that time-consistent borrowers are significantly more likely to take-up the flexible contract, compared to time-inconsistent ones (Column 1). We further distinguish between present-biased and future-biased borrowers (Column 2 and 3, with and without controls, respectively), and find that both these types of borrowers are less likely to opt for the flexible repayment schedule, compared to time-consistent borrowers. Somewhat surprisingly, we do not find evidence of a predictive role of borrowers' risk aversion on their choice for the flexible contract, as column 5 and 6 of table 8 show. Instead, when we look at borrowers' financial and business literacy (Column 7), we do find that borrowers who draft a budget for their business activity on a frequent basis (daily, weekly or fortnightly) are more likely to opt for the flexible schedule than those who make the budget less frequently (monthly or less frequently than monthly). Finally, column 8 shows that borrowers who report being more worried for household expenditures are more likely to choose the flexible contract. All in all, results from table 8 corroborate the intuition that more "business-disciplined" borrowers are more likely to prefer the flexible contract. This suggests that the price structure of the two contracts offered in treated branches successfully separate borrowers according to their types. We also look at business characteristics and, in particular, business seasonality. Results are shown in Table 9. We observe that borrowers with worse profits in the best month of the year for the business are more likely to opt for the flexible repayment schedule (Column 7). At the same time, as shown in Column 8 of table 9, also borrowers with larger profit fluctuations in their business, represented here by the difference between the best and the worst month of their business, are more likely to opt for the flexible repayment schedule.

All in all, the contract structure offered by Sonata in treated branches appears successful in achieving a separating equilibrium. Indeed, there is a clear separation of borrowers across the rigid and the flexible repayment schedule. Yet, as it is always the case, results are more nuanced than what is stated in **Prediction 2**. If, on the one hand, present-biased borrowers seem more likely to stick to the rigid contract, we do not necessarily find that higher-revenues borrowers are those who opted for the flexible contract. This may thus suggest that borrowers who opted for the flexible schedule did so because they valued repayment flexibility for other reasons that increasing investment in their business - another possibility is their worry for business irregularity.

4.3 Differences across borrowers' types

4.3.1 Comparing flexible customers to similar borrowers in control group

Once ascertained that the pricing structure worked as an *effective* screening mechanism - that is, there is a clear sorting of borrowers into either one of the two repayment schedules, based on their characteristics we look at how *better* borrowers who in treated branches opted for the flexible contract did versus a comparable set of borrowers who are in the control group and have similar predictive characteristics of take-up of the flexible contract. We use as predictive characteristics the household income distribution (at baseline), as well as borrowers' likelihood to be time-consistent, as well as to draft the budget for their business activity on a frequent basis. We then randomly draw a sample of 150 borrowers who fulfilled those predictive traits and run the following regression equation:

$$y_{ib} = \alpha T_b + \beta PredictFlex_i + \gamma T_b \times PredictFlex_i + \epsilon_{ib} \tag{4}$$

Where y_{ib} indicates business outcomes like weekly sales and variability of sales. Results are shown in Table 10: it shows that the coefficient of the interaction term $T_b \times PredictFlex_i$, γ, is positive and significant. This confirms that, by choosing the flexible contract, good borrowers managed to improve their business income to a larger extent than those who would have chosen the flexible contract but were not actually offered (by default, as they were in the control group).

4.3.2 Repayment rates

In the Appendix, we also perform an additional analysis mirroring the one carried out in section 3, by distinguishing across borrowers that, within treatment, chose the flexible *versus* the rigid contract. This is in order to assess which type of borrowers are driving the main treatment effects previously identified and discussed and, in turn, to understand what repayment flexibility has been used for. We first look at whether the significantly better repayment rates detected for treated borrowers (in the form of less delays) are driven by borrowers who either opted for the rigid or the flexible repayment schedule (or both). To this end, we estimate the following regression equation:

$$y_{ib} = \alpha + \beta_1 flex_b + \beta_2 rigid_b + \epsilon_{ib} \tag{5}$$

$flex_b$ is a dummy that equals to one if the borrower in treated branches opted for the flexible contract once he was offered it, while $rigid_b$ is a dummy that equals to one if the borrower in treated branches opted for the rigid contract, instead. Again, the omitted variable is for borrowers in control group. Results for repayment rates are shown in table **??**: the lower rate of repayment delays are entirely driven by borrowers who opted for the flexible contract. On the contrary, the delays in repayment for borrowers who sticked to the rigid contract in the the treatment group are not significantly different from the control group (those who were only offered the rigid contract).

4.3.3 Business Performance

We then look at business performance, in terms of business sales and business fluctuations, across types. Recalling results in section 3, we previously found higher business sales (in particular last week's sales) in treatment branches, compared to control ones. We therefore look at whether higher business sales are driven by borrowers who opted for the flexible schedules, or by those who opted for the rigid one. If it is the former case, then this would mean that higher sales are associated with the repayment holiday - i.e., borrowers did use repayment flexibility to invest in more illiquid activities. On the contrary, if higher sales are driven by borrowers who sticked to the rigid repayment schedule, this would mean that a compositional / selection effect is taking place. We thus estimate the impact of business income both by looking at endline data (as in equation (5)), and also at changes between baseline and endline. Results for monthly and weekly sales are displayed in table **??**. We find that the higher sales documented in table 6 are driven by both types borrowers, although the effect

seems stronger for those who preferred to stick to the rigid contract. This means also that borrowers who opted for the flexible schedule managed to improve their business performance thanks to the repayment holiday.

4.4 Use of the repayment holiday: investment or risk smoothing?

So far, our analysis suggests that repayment flexibility has been predominantly used by borrowers to mitigate business fluctuations, and to a lower extent to increase business growth. This hypothesis is supported by evidence that the better repayment rates we detect in treated vs. control branches are mainly driven by flexible customers. At the same time, borrowers who preferred the rigid contract display a better business performance compared to the control group. This of course does not rule out that *some* of the borrowers who chose the flexible contract did so for investment purposes. Indeed, we still find flexible customers to be more likely the control ones to use the loan from Sonata to buy more stock during festivals. Yet, it seems clear that a big concern of flexible borrowers is precisely the seasonality of their income.

In order to validate our results, we also conducted a set of qualitative interviews with customers to understand which usage they made of the repayment holiday. Consistent with our findings, the qualitative work confirms that borrowers want to use repayment flexibility more as an insurance mechanism against irregular income rather than to increase business investment.

5 Conclusions

In this paper, we study how lenders can introduce innovative contracts without exacerbating adverse selection problems. In doing so, we look at the provision of repayment flexibility by microfinance lenders, and study whether offering a flexible contract and a standard, rigid one at different prices successfully screens out less entrepreneurial and disciplined borrowers and retains more entrepreneurial ones.

At the beginning of 2016, we partnered with an Indian Microfinance Institution, Sonata Microfinance Pvt., to introduce a flexible microfinance contract that entails a three-months repayment holiday option that the borrower can exert after having successfully repaid three monthly instalments. The flexible contract was offered at an interest rate two percentage points higher than the standard, rigid contract. The underlying intuition is that by making the flexible contract more expensive, Sonata

would be able to reach a separating equilibrium where more entrepreneurial borrowers are still attracted by the flexible option, while the less entrepreneurial ones stick to the cheaper, rigid schedule.

We test these predictions through a Randomized Controlled Trial. Twenty-eight branches were selected in Uttar Pradesh. In half of these branches, newly enrolled borrowers, signing up for an individual liability, business loan, were given the option to choose between the standard rigid contract offered by Sonata, or a more expensive, flexible one. In control branches, similar borrowers, again taking up individual business loans, were only offered the rigid contract.

We find higher business sales in treatment vs. control branches. However, in stark contrast with existing studies on repayment flexibility, we also find that providing a menu of contracts vs. only the standard, rigid contract also improves repayment rates. The random assignment of the treatment allows us to attribute these results to a better screening mechanism in place in treated branches, compared to control branches. Indeed, by looking at the selection of borrowers in treated branches, we find that borrowers' characteristics can be good predictors of the selection into the flexible contract. In particular, good borrowers (time-consistent and financial literate borrowers) were more likely to take up the flexible contract.

Results from our paper have several implications: first, they show that increasing repayment flexibility by pricing it adequately represents a win-win situation for both lenders and borrowers. Lenders can retrieve better repayment rates by innovately targeting borrowers with their most appropriate products. Borrowers, on the other hand, can choose which repayment schedule fits best their profile and that of their business activity.

Therefore, from a policy perspective, this calls for the need of better-designed financial products for the poor that would combine, for instance, insurance against shocks with flexible repayment schedules.

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A Figures and Tables

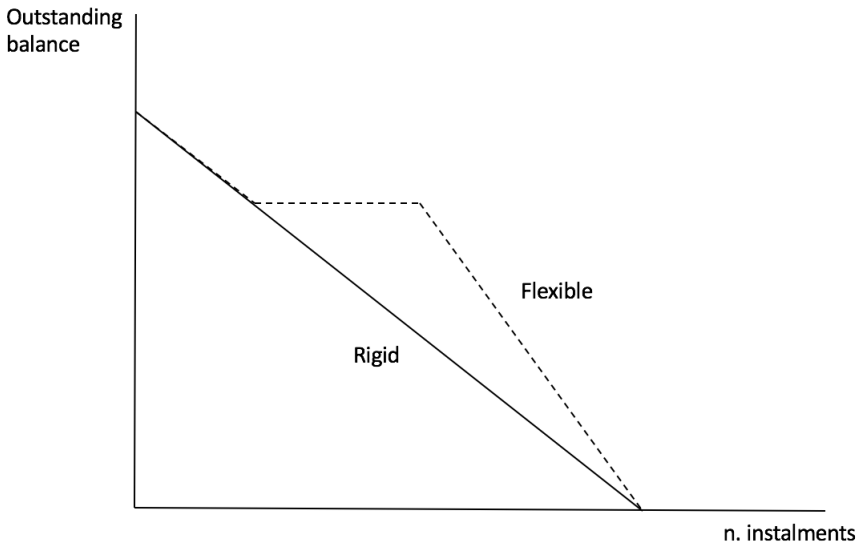

Figure 1: Flexible contract vs. rigid contract

Month #	Rigid Cash Flows	Flexible Cash Flows
0	38000	38000
1	-2009	-2047
2	-2009	-2047
3	-2009	-2047
4	-2009	-2047
5	-2009	-2047
6	-2009	-304
7	-2009	-304
8	-2009	-304
9	-2009	-2509
10	-2009	-2509
11	-2009	-2509
12	-2009	-2509
13	-2009	-2509
14	-2009	-2509
15	-2009	-304
16	-2009	-304
17	-2009	-304
18	-2009	-3695
19	-2009	-3695
20	-2009	-3695
21	-2009	-3695
22	-2009	-3695
23	-2009	-3695
24	-2009	-3695

Figure 2: Flexible contract vs. rigid contract

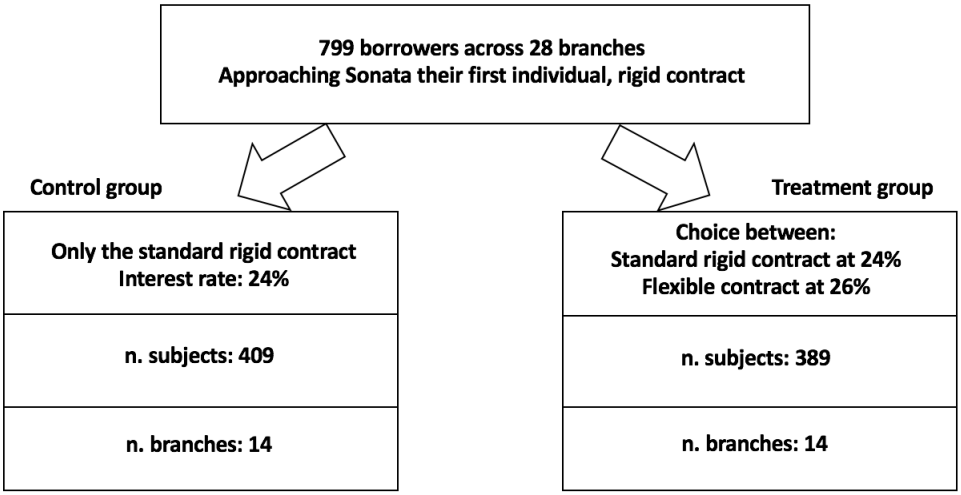

Figure 3: Experiment design

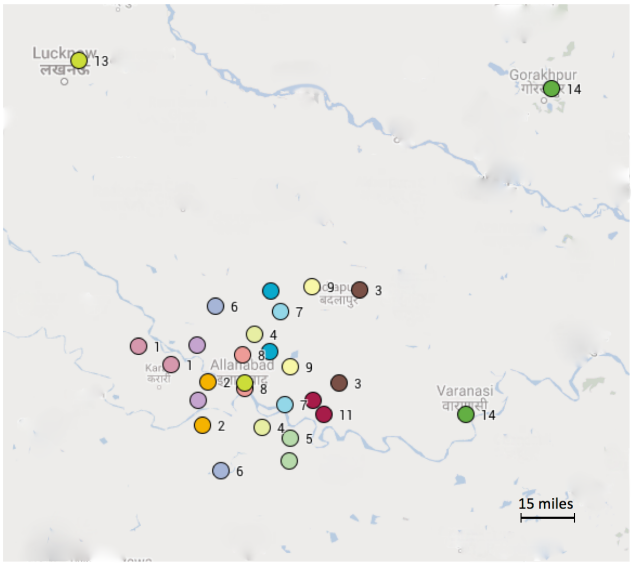

Figure 4: Randomization map

Table 1: Descriptive Statistics

Variable	mean	median	min	max
Household size	6.05	6	2	22
Age of hoh	41.36	40	20	88
Gender of hoh	0.97	1	0	1
Has at least middle school degree	0.391	0	0	1
Owns land	0.47	0	0	1
Income last 12 months, tc 3sd	215,806.4	180,000	700	796,259.80
Business sales last 30 days, tc 3sd	13,084.34	10,000	0	85,727.75
Has outstanding loans	0.17	0	0	1
Loan from Sonata	38,494.9	35,900	26,500	70,000
Number of subjects		799		

Table 2: Business Activities

Type of Business for which they asked for a loan	Freq	%
Manufacturer/Artisan/Tailor	120	15.02
Seller/Trader/Contractor	128	16.02
Dairy/Meat/Poultry	130	16.27
Grocery/Fruits & Vegetables	162	20.28
Business/Shop/Hotel	141	17.65
Transport	56	7.01
Services	47	5.88
Labour - Agri/Non Agri	11	1.38
Others	4	0.50
Number of subjects	799	

Table 3: Balancing Checks across Treatment and Control group

Variable	Control mean	Treatment mean (diff)	n. obs
Demographics			
Household size	6.061	-0.021	799
Age of hoh	41.368	-0.021	799
Has completed primary school	0.162	-0.021	789
Has completed middle school	0.217	-0.043**	789
Has completed high school	0.441	-0.011	789
Has completed higher education	0.125	0.062**	789
Has no formal schooling	0.051	0.012	789
Wealth			
Owns land	0.435	0.067	799
Income and Business performance			
Income last 12 months, tc 3sd	222,379.80	-13,501.64	799
Business sales last 30 days, tc 3sd	13,983.29	-2250.23	787
Δ profit (best/worst month)	10,339.83	-93.505	770
Borrowing and Savings			
Has Formal Loans (other than Sonata's loan)	0.130	0.062	799
Has Informal Loans	0.007	0.007	799
Total formal borrowed amount in the last 12 months (excl. Sonata loan)	10,215.33	465.43	799
Sonata loan amount	38,776.50	-990.51	787
Loan amount demanded to Sonata	38892.96	-856.48	784
Total informal borrowed amount	329.49	256.39	799
Total saved amount	14,698.80	675.50	799
# months after which borrowers have been re-interviewed	8.43	0.03	789
Business Activities			
Manufacturer/Artisan/Tailor	0.120	0.063**	799
Seller/Trader/Contractor	0.132	0.057	799
Dairy/Meat/Poultry	0.187	-0.049	799
Grocery/Fruits & Vegetables	0.231	-0.058**	799
Business/Shop/Hotel	0.185	-0.017	799
Transport	0.074	-0.008	799
Services	0.050	0.017	799
Labour - Agri/Non Agri	0.018	-0.008	799
Others	0.003	0.004	799

Pair FE are included. Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Loan Usage

Dep. Var.	buy agriculture inputs	buy other inputs	improvement works	start new business	more stock during festivals	repay old debt	consumption	other expenditures
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
treatment	-0.038	-0.014	0.039	-0.020	0.117**	0.001	0.010*	0.014
	(0.023)	(0.018)	(0.055)	(0.032)	(0.052)	(0.007)	(0.005)	(0.014)
Observations	789	789	789	789	789	789	789	789
Control Mean	0.132	0.072	0.700	0.097	0.127	0.009	0.001	0.032

Pair FE are included in all specifications. Robust standard errors in parentheses (clustered at the branch level).

Table 5: Repayment Rates

Dep. Var.	loan amount	nbpenalty	penaltybinary	multpenalty
Panel 1 - No Controls				
	(1)	(2)	(3)	(4)
treatment	378.278	-0.284**	-0.090***	-0.066**
	(538.453)	(0.112)	(0.030)	(0.028)
Observations	557	565	565	565
Panel 2 - with Controls				
	(1)	(2)	(3)	(4)
treatment	386.425	-0.271**	-0.088***	-0.058*
	(463.651)	(0.116)	(0.030)	(0.032)
Observations	557	565	565	565
Control Mean	38,185.904	1.042	0.438	0.254

Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Pair FE are included in all specifications. The dep. var. in column (1) reflects the number of months borrowers have been late in repaying. p(delay) is a dummy that equals one if borrwers have been late at least once in a monthly repayment, and zero otherwise. p(multiple delays) is a dummy that equals one if borrowers have been late more than once in the period considered, and zero otherwise. Controls included in Panel 2: household size; age and education of the head of the household; type of business (all at baseline); number of months between baseline and endline; Sonata loan size.

Table 6: Business Income

Dep. Var.	weekly sales	variability of weekly sales (ten thousands)
Panel 1 - No Controls		
	(1)	(2)
treatment	1,282.931**	3,803.977***
	(495.812)	(1,283.590)
Observations	778	778
Panel 2 - w/Controls		
	(1)	(2)
treatment	1,341.866**	3,223.451**
	(526.475)	(1,385.348)
Observations	778	778
Control Mean	5,546.437	6,150.303

Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Pair FE are included in all specifications. All the dependent variables used are top-coded (3 sd). The variability of weekly sales has been computed by taking the square difference between weekly business sales and the mean computed in column (2). Controls included in Panel 2: household size; age and education of the head of the household; type of business; number of months between baseline and endline; Sonata loan size.

Table 7: Expenditures, Borrowing and Savings

Dep. Var.	total monthly expenditures	loan top-up	total savings amount
Panel 1 - No Controls			
	(1)	(2)	(3)
treatment	5.822	-0.076*	-173.028
	(285.806)	(0.043)	(1,103.183)
Observations	789	787	789
Panel 2 - w/Controls			
	(1)	(2)	(3)
treatment	-56.223	-0.067*	188.786
	(255.475)	(0.039)	(862.296)
Observations	789	787	789
Control Mean	2,968.471	0.203	12,874.907

Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Pair FE are included in all specifications. All the dependent variables used are top-coded (3 sd). Total monthly expenditures include: meat and vegetables, temptation goods, education and health. Controls included in Panel 2: household size; age and education of the head of the household; type of business; number of months between baseline and endline; Sonata loan size.

Table 8: Behavioral variables that predict borrowers' selection

Dep. Var.	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
β_1: time consistent	0.202**	0.192***									
	(0.080)	(0.071)									
β_2: present biased			-0.156*	-0.159**							-0.154**
			(0.080)	(0.073)							(0.074)
β_3 future biased			-0.214***	-0.199***							-0.173**
			(0.077)	(0.074)							(0.077)
β_4: risk loving					0.149	0.213*					0.231**
					(0.123)	(0.117)					(0.113)
β_5: frequent budget							0.095*	0.061			0.024
							(0.051)	(0.052)			(0.046)
β_6: worried about expenses									0.177**	0.166**	0.149**
									(0.073)	(0.068)	(0.064)
Type of Business Activity		X		X		X		X		X	X
Observations	387	387	387	387	389	389	389	389	389	389	387
P-values from F-Tests											
$\beta_1 = 0$	0.032**	0.018**									
$\beta_2 = \beta_3$			0.492	0.673							
$\beta_4 = 0$					0.205	0.057*					
$\beta_5 = 0$							0.071**	0.235			
$\beta_6 = 0$									0.018**	0.014**	
Joint Test: All Coeffs. = 0											0.014**

Robust standard errors in parentheses (clustered at the branch level)
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Income variables that predict borrowers' selection

Dep. Var.	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)	p(flex)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
β_1: owns land	0.088						0.080
	(0.070)						(0.074)
β_2: log(household income)		0.016					
		(0.036)					
β_3: log(weekly sales)			0.057				
			(0.051)				
β_4: log(variability weekly sales)				-0.013			
				(0.016)			
β_5: log(profit best month)					0.047		-0.211*
					(0.030)		(0.112)
β_6: log(profit worst month)						0.025	0.066
						(0.033)	(0.041)
β_7: log(difference profit best/worst month)							0.179**
							(0.074)
Type of Business Activity	X	X	X	X	X	X	X
Observations	389	389	389	389	389	389	389
P-values from F-Tests							
$\beta_5 = \beta_7$							0.019**
Joint Test: All Coeffs. = 0							0.037**

Robust standard errors in parentheses, clustered at the branch level
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Quantifying Adverse Selection: Business Income

Dep. Var.	weekly sales	variability of weekly sales (10,000)
	(1)	(2)
treatment	521.837	-1,000.044
	(724.361)	(2,008.038)
Predict Flex	-2,139.617*	-6,731.070*
	(1,057.459)	(3,545.863)
Predict Flex × treatment	2,482.756*	13,171.765**
	(1,396.973)	(4,915.027)
Observations	778	778
Control Mean	5,410.356	4,661.049

B Appendix

Table 11: Profit Fluctuations over the year

Dep. Var.	best profit	worst profit	diff
Panel 1 - No Controls			
	(1)	(2)	(3)
treatment	-2,094.921	-350.935	-1,643.534
	(1,328.174)	(471.969)	(1,110.038)
Observations	762	763	762
Panel 2 - w/Controls			
	(1)	(2)	(3)
treatment	-2,133.916*	-254.538	-1,795.806*
	(1,183.460)	(434.323)	(979.913)
Observations	762	763	762
Panel 3 - Diff-in-diff			
	(1)	(2)	(3)
post×treatment	-1,891.087	364.882	-2,169.622
	(1,754.741)	(889.062)	(1,490.126)
Observations	1,530	1,529	1,528
Control Mean	18,524.957	6,084.876	12,503.675

Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Pair FE are included in all specifications. All the dependent variables used are top-coded (3 sd). Column (3) is computed as the difference between the best and the worst profit in the year. Controls included in Panel 2: household size; age and education of the head of the household; type of business; number of months between baseline and endline; Sonata loan size.

Table 12: Borrowing (additional variables)

Dep.Var.	log formal borrowed amount	log informal borrowed amount	p(informal)
Panel 1 - No Controls			
	(1)	(2)	(3)
treatment	0.572	0.368*	0.040**
	(0.453)	(0.180)	(0.019)
Observations	777	777	777
Panel 2 - w/Controls			
	(1)	(2)	(3)
treatment	0.544	0.355**	0.038**
	(0.409)	(0.159)	(0.017)
Observations	777	777	777
Panel 3 - Diff-in-diff			
	(1)	(2)	(3)
post×treatment	-0.093	0.251	0.027
	(0.166)	(0.211)	(0.022)
Observations	1,561	1,559	1,553
Control Mean	1.477	0.016	0.002

Robust standard errors in parentheses (clustered at the branch level).
*** p<0.01, ** p<0.05, * p<0.1

Pair FE are included in all specifications. All the dependent variables used are top-coded (3 sd). Column (3) is computed as the difference between the best and the worst profit in the year. Controls included in Panel 2: household size; age and education of the head of the household; type of business; number of months between baseline and endline; Sonata loan size.