DO INTEREST RATES MATTER?

CREDIT DEMAND IN THE DHAKA SLUMS*

Preliminary draft

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Abstract

Current thinking among microfinance experts is that poor customers are not very sensitive to interest rates. The assumption implies that microlenders should be free to pursue profitability without fearing losing customers or changing the composition of who is being served. Despite the importance of the assumption, we know of no previous estimates of interest rate elasticities within the context of microlending. We provide estimates of the interest elasticity of borrowing using data from *Safe*Save, an innovative microfinance institution operating in the slums of Dhaka, Bangladesh. We focus on a change that occurred in February 2000 in which *Safe*Save raised their interest rates on loans from 2 percent per month to 3 percent per month in two branches, but not in a third. This allows us to use a differences-in-differences estimation strategy. Our analysis suggests that borrowers are highly sensitive to interest rates. After controlling for generally upward trends in loans, the implied elasticities of loan demand with respect to changes in the interest rate are in the range -0.73 to -0.86, with estimates as low as -1.04. We also find that less wealthy households (as measured by initial savings balances) were particularly sensitive to the interest rate increase (an elasticity of -0.86). The response of wealthier households was less than a third the size. The rate increase was important in helping *Safe*Save improve its financial position and continue its work over time, but in the short-term it shifted the relative composition of SafeSave's loan portfolio away from its least wealthy clients.

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1. Introduction

The advent of microfinance lending in the last two decades has been hailed as one of the key developments in the fight against poverty.[2] Since the poorest households are shut out of formal credit markets, their only sources of credit – if any – are informal channels that often come at an exorbitant price tag. By lending at interest rates that are low relative to informal credit but high compared to formal credit markets, microfinance institutions are able to provide the poorest households with the opportunity to borrow and seek the productive opportunities that come with credit. Implicit in this argument is a key – and untested – assumption. It has been claimed that poor households of the kind that take advantage of microfinance are not very responsive to changes in interest rates. Accordingly, it is argued that microfinance institutions can offer credit at a sufficiently high interest rate to cover their operating costs and at the same time not merely cream skim the most eligible borrowers. In this paper, we test this something-for-nothing view by examining whether, in fact, poor households reduce their borrowing when faced with interest rate increases.

Thirty years ago, many economists believed that most poor households lived so close to subsistence levels that surpluses were stretched thin when servicing debt. Demand for loans, accordingly, was thought to be highly sensitive to interest rates. At the same time, it was recognized that the poor often pay exorbitant interest rates to

[2] The *New York Times* (1997) editorial page, for example, has promoted microfinance as "a much-needed revolution" and "the world's hot idea for reducing poverty, " and the United Nations General Assembly recognized the trend by marking 2005 as the International Year of Microfinance.

moneylenders when left with no alternative—which suggests that, in contrast, at other times the poor may not in fact be very sensitive to interest rates at all.

Given this pair of beliefs, commercial banks saw little prospect for profit in poor areas, unless they were to get into the business of what is now termed "predatory lending"—taking advantage of customers desperate for financial services. Under normal conditions, raising prices to levels that would cover costs would surely mean losing much business (and would likely exacerbate incentive problems). Moreover, usury laws that capped interest rates at low levels meant that commercial banks could not provide high-cost emergency loans at the times when borrowers would willingly accept high prices. State-supported development banks were thus created to provide loans in poor areas at low interest rates. But, fed with steady subsidies and manipulated by politicians, the state banks have mainly been inefficient and ineffective at serving their target markets.

Microfinance has brought a revolution in opportunities for poor households, brought in part by a pendulum swing in assumptions about interest elasticities. It is now thought by most microfinance policy experts that the demand for loans by the poor is in fact highly *in*sensitive to interest rates, even in normal circumstances. This is a function of an upward shift in focus toward customers just below national poverty lines or just above them, reinforced by the experience of microlenders who charge real interest rates of 20 percent-60 percent but which still maintain a steady core of low-income customers.

While the sensitivity of loan demand to interest rates has been a key part of development discourse (and a key part of microfinance policymaking), we know of no previous econometric estimates of interest elasticities for customers in the microfinance market.[3] In this paper, we provide estimates of interest elasticities using data from *Safe*Save, an innovative microfinance institution operating in the slums of Dhaka, Bangladesh since 1996.

At the time of our study, *Safe*Save operated three urban branches, with slightly different products and prices in one of the branches. By comparing times at which product rules changed in two locations but not in the third, we have an unusual opportunity to be able to make inferences about the sensitivity of customer behavior to interest rates. As described below, *Safe*Save staff members meet with each customer on a daily basis, and *Safe*Save has provided us with the daily saving and borrowing records of each customer. This totals over 7 million client-day observations. In the present study, we analyze the data aggregated to the account-month level.

Our particular focus is on a change that occurred in February 2000, at which time *Safe*Save raised their interest rates from 2 percent per month to 3 percent per month in two branches (i.e., from 24 percent to 36 percent per year); a third branch had started with interest rates already at 3 percent per month, so no subsequent adjustments were made there during in the period we study. During this period, urban inflation was low, and the inflation-adjusted interest rate increase was from about 21 percent to 34 percent per year.[4]

[3] Gross and Souleles (2002) provide estimates of the sensitivity of credit card customers in the United States to interest rate changes. Their findings are in the same range as ours. They find that the long-run (at the end of one year) elasticity of debt to the interest rate is -1.3, which is greater (in absolute value) than our estimates, but they find a smaller (in absolute value) elasticity for interest rate increases than decreases. Under half of their elasticity is comes from shifting balances between accounts and the balance is reduction in total debt.

[4] Monthly urban price data collected by the Bangladesh Bureau of statistics indicates that inflation in cities was running at 2.8 percent over the year before the change (February 1999 to February 2000) and at 1.8 percent during the following year. Below we show that the actual effective interest rate hike faced by customers was affected by the specific terms of *Safe*Save's loan contracts; once those details are taken into account, the overall increase is still on the order of about 50 percent.

We use a differences-in-differences strategy to control analyze the interest rate hike in the first two branches (using the third branch to control for counterfactual time trends). Our results suggest that borrowers are in fact highly sensitive to interest rate changes. After controlling for generally upward trends in loan demand, the implied elasticities of loan demand with respect to changes in the interest rate tend to be in the range -0.73 to -0.86, with estimates as low as -1.04. We also find that less wealthy households (as measured by initial savings balances) were particularly sensitive to the interest rate increase (an elasticity of -0.86). The response of wealthier households was a third the size (an elasticity of -0.26).

Taking the results together, we find that the interest rate increase improved the financial position of *Safe*Save, but in the short run it diminished demand for credit among the poor, particularly for the poorest. The results imply that the composition of *Safe*Save's loan portfolio shifted toward wealthier customers, relative to the composition before the increase, and that there were financial benefits but also signs of substantial social trade-offs entailed in raising interest rates.

2. A Brief History of Microfinance and Interest Rates

Economists working on microfinance have focused mainly on innovative contracts that mitigate adverse selection and moral hazard in credit markets, both of which have proved particularly important when lending to poor households without collateral. The application of new credit contracts has led to surprisingly high loan repayment rates: most established microlenders can claim repayment rates above 95 percent.[5]

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[5] The July 2003 *Microbanking Bulletin* provides the highest quality data available on 124 leading microlenders. The average portfolio at risk greater than 30 days is 2.8 percent.

But high repayment rates are insufficient to drive the microfinance revolution. The key to the expansion of microfinance globally, it is argued, depends on the success of microfinance as a commercial phenomenon. This hinges as much (or more) on the ability to contain costs and to price products at interest rates that are high enough to generate profits. Once profitability is in hand, microlenders can expand globally with minimal external support.

The logic of this part of the microfinance revolution is built on the idea that poor households are willing and able to pay interest rates for loans that fully cover the costs of lenders. A corollary of the logic is that the poorest borrowers (who also tend to be the most expensive to serve) should pay the highest prices for capital. Figure 3 shows that this tends to be so in practice, with microlenders serving the low-end market charging higher interest rates and facing higher expenditures relative to lenders serving clients upmarket.

A frequently heard argument to support this policy is that poor households are not very sensitive to increases in interest rates. Specifically, it is argued that poor households primarily seek *access* to credit, not necessarily cheap credit. When poor households are not very sensitive to price changes, prices can be raised without fear of losing the core customer base and suffering from "mission drift." This argument has held greater force in Latin America and Africa, where microfinance interest rates have tended to be higher, than in South Asia, where fears are more often expressed that high interest rates will deter promising clients and diminish social and economic impacts on households.

This vision for microfinance constitutes a radical break from past practice. In the 1970s and 1980s, usury laws were common, and they restricted interest rates on loans to low levels. The caps were often combined with directives as to who should get subsidized loans and what for.[6] In Brazil in the early 1970s, for example, interest rates on loans for working capital were fixed at 17 percent per year while inflation rates ranged from 20 to 40 percent per year.[7] Even where interest rate caps allowed positive real interest rates, they were seldom high enough to permit banks to cover costs. As a result, lending to the poor was a heavily-subsidized business, monopolized by state-run banks driven by the belief that requiring the poor to pay more would undermine rural development. Moreover, subsidized resources too often went to non-poor households and political elites. Financial services tended to be low-quality, and scale was constrained by the size of government budgets.[8]

Microfinance advocates challenged the myths upon which the state-subsidized banks were built. Microlender after microlender showed that the poor could pay more and most microfinance interest rates now fall between 30 percent and 60 percent per year (in places where inflation runs no higher than 10 percent per year). Figure 1 shows the range of costs charged by leading microlenders, averaged by countries. The chart gives real portfolio yields (calculated as the financial revenue from the loan portfolio as a fraction of the average gross loan portfolio, adjusted for inflation). The portfolio yields thus give average effective interest rates charged on loans, together with any extra loan-related service charges. The figures range from 0 percent at the bottom (for a single lender in Yugoslavia) to over 70 percent at the top, with a median of 30 percent;

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[6] See, for example, the critical discussion in Adams, et al (1984).
[7] Page 381 of João Sayad (1983).
[8] The phenomenon is part of a broader problem of financial repression as described by Ronald McKinnon (1973).

the 25th percentile has a real interest rate of 20 percent per year while the 75th percentile has a rate of 47 percent per year.

Donors who are shaping microfinance policy have spent much effort making the argument that raising interests is unlikely, in fact, to dissuade credit-worthy borrowers. The assertion stems from two ideas. The first is that marginal returns to capital diminish with scale. If that is so, poor borrowers who are starved for capital ought to have high marginal returns to their investments—and ought to be willing to pay high interest rates as a result (CGAP, 1996).

The second idea is that poor households already pay a lot to moneylenders (often 100 percent per year or more), and suggest that if poor households can keep moneylenders in business, it should be no surprise that loans at half the moneylender rate are welcomed.

Thus, the refrain became: households need *access* to credit, not cheap credit. Influential advocates now argue that poor households are so insensitive to interest rates that the standard practice ought to be to set fees high enough that institutions generate profits, cutting donors out of the loop after a short period of start-up subsidies.[9] If this is so, microfinance can readily expand to serve the hundreds of millions of currently excluded households.

All the same, it is far from clear as a general proposition. First, the assumption of diminishing marginal returns to capital disregards non-convexities in production processes and access to non-capital inputs like managerial skills and human capital.

[9] The argument often invokes a simple version of the idea of diminishing marginal returns to capital (e.g., Consultative Group to Assist the Poorest, 1996). See Armendariz and Morduch (2005) for why the version is too simple. The idea of restricting subsidization to a short start-up period is captured in the "pink book", a document produced by a donor consortium on best practices for donors.

Moreover, raising interest rates can exacerbate moral hazard and adverse selection, worsening loan repayment rates and screening out the most reliable borrowers on whom banks depend.[10] And, while microlenders may still find a pool of customers after real interest rates are raised from 20 percent to 40 percent, 60 percent, or 80 percent per year, the customers may not be from the same pool that was willing and able to pay the lower rates. Fears like these, coupled with a strongly-felt moral imperative to keep costs as low as possible for the poor, have compelled the larger microlenders in Bangladesh to keep real interest rates below 40 percent per year, even if it means turning to subsidized resources to cover costs (e.g., Morduch, 1999). Figure 1 shows that the average fees charged by two large lenders in Bangladesh are just under 30 percent. The Grameen Bank (which is not one of the two) keeps their interest rates and fees closer to 20 percent per year (nominal) on their main lending products—and they deflect suggestions to raise rates. Figure 2 shows differences in real interest rates across continents, with South Asia at the low end.

Without careful experiments designed to measure interest rate elasticities, conversations have proceeded based on anecdotes and assertions but little hard evidence. The main difficulty is that the schedule of interest rates seldom varies within a given program, and, when does change, it does so for everyone across the board. Thus it can be hard to disentangle the effect of the interest rate change from broader changes occurring simultaneously (e.g., macroeconomic shocks). It may be possible to compare clients of different institutions who face different interest rates at any given moment, but then researchers face the question of why some customers selected one institution and why others selected another. It is also difficult to disentangle the effects of non-price

[10] The arguments are reviewed in Armendariz and Morduch (2005).

differences among programs. The SafeSave data allow a clean comparison within a single institution that maintains a uniform philosophy and operating protocol throughout.

3. The *Safe*Save Program

About one third of Dhaka's 11 million people live in slums. Most adult slum residents are poor but working, finding informal sector jobs such as being a driver, domestic help, or construction worker. Some find work in factories, particularly in the garments industry. The slums have active economies of their own, but they are poorly served by formal financial intermediaries. Instead, traditional means of saving and borrowing, like joining rotating saving and credit associations (ROSCAs) or finding a friend willing to serve as a "money guard", are common ways to manage funds.[11] There are also several microlenders, nearly all of them – but not *Safe*Save – using variants of the dominating Grameen-style group-based system.

In August 1996, Stuart Rutherford, a development practitioner who had earlier created the first urban replication of the Grameen Bank, and Rabeya Islam, a housewife who had long managed ROSCAs, launched an experiment called *Safe*Save to bring better financial intermediation to the Dhaka slums. The experiment aimed "to see if useful, frequent, reliable and flexible banking services can be successfully and sustainably delivered to very poor people." [12]

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[11] Rutherford (1997) describes a survey of informal finance in the Dhaka slums. Half of the sample collecting financial diaries described in Rutherford (2004) are from the Dhaka slums. Both studies provide rich data on a relatively small sample. In contrast, the present study takes advantage of a large sample but just a limited number of variables.

[12] Information on *Safe*Save and its products can be found at www.safesave.org. The quote is taken from the website in April 2004

*Safe*Save's mission is to offer their clients "the most convenient possible way to turn their savings into usefully large sums of money."[13] To do this, *Safe*Save clients are served by "collectors" who visit them in their homes or businesses six days a week. Each day, clients can choose to add to their savings, pay down loans, or to draw down their savings, in amounts that are variable and freely chosen. Clients must visit the branch office only to withdraw more than 500 taka in a day or to get a loan. Once clients have a loan, they can pay it back on their own schedule – in small frequent bits, in a lump sum, quickly, or stretched out over time. The only stipulation is that interest on the outstanding balance must be paid each month. The program thus combines the convenience of a ROSCA with the flexibility that a bank can offer. While borrowers are required to hold savings accounts, savers are not required to borrow (at any time, about two thirds of clients hold loans). None of the loans require assets to be pledged as collateral, although, as we describe below, a form of "financial collateral" is employed.[14]

The first branches were in western Dhaka. Apart from residence in the slum, there are no additional eligibility requirements or means tests. The first branches served were in Tikkapara and Kalyanpur, a mix of densely-populated slums where squatters live in rows of lightweight huts built on bamboo frames, with woven bamboo walls and, in better circumstances, tin roofs. The third branch was opened in Geneva slum, a community of Bihari refugees with government-provided concrete housing along a grid of narrow lanes. The analysis below compares changes in Tikkapara and Kalyanpur to ongoing conditions in Geneva.

[13] The quote is taken from www.safesave.org in April 2004.
[14] Armendariz and Morduch (2005) describe the use of financial collateral and its rationale.

4. The Data

After making their daily rounds to the homes and businesses of their customers, the records of *Safe*Save collectors are entered into database software for use by management. We use the daily data to calculate basic measures of saving and borrowing and then aggregate them to the monthly level. Much of the variation in loan balances occurs between months, rather than within, so little relevant information was sacrificed through aggregation. In addition to financial variables, we also know the customers's ages, gender, and length of time as customers.

Most of the analysis focuses on 68,037 month-customer observations between January 1999 and January 2001. They reflect data on 5147 customers, not all of whom are part of the program during the entire period. The change in the interest rate occurs midway through the sample, in February 2000.

Table 1 gives summary statistics for the sample, restricted to the dates we study. Two thirds of the clients are women (or girls), with an average age in the late twenties. The financial data (converted to January 2000 US dollars) show that in all three branches, monthly savings deposits are small, averaging about $2. In Tikkapara and Kalyanpur, which had started several years before Geneva, accumulated savings balances averaged $26, while in Geneva the average savings balance was $10. The average loan sizes are small relative to those from other microlenders (at $48 in Tikkapara and Kalyanpur and $37 in Geneva), but the loan balances (which reflect partial repayments) are similar in the branches – about $20 in Tikkapara and Kalyanpur and $22 in Geneva.

5. Estimation and Identification

Identification of the impact of the February 2000 interest rate change takes advantage of the fact that the change occurred in Tikkapara and Kalyanpur branches, but not in Geneva Branch. Geneva had already started with an interest rate of 3 percent per month when it opened in March 1999.

Identification hinges on the presumed lack of correlation of the timing of the interest rate change with other events occurring in Tikkapara and Kalyanpur. Based on interviews with the bank, the timing of the switch seems to have been both arbitrary and unexpected.[15] Contemporaneous changes that occur in all three branches will be controlled for through the inclusion of data from Geneva branch and the estimation of baseline trends using those data.

The set-up suggests the usefulness of a difference-in-difference estimator, although there is one feature that deserves particular attention here. Unlike a situation in which customers move from one equilibrium to another with little else in the environment changing but the price, here customers are steadily building up savings and the capacity to borrow. New customers are also joining up, and some older customers are beginning to depart. Because we have records for all customers, past and present, concern with attrition is limited here, but we do need to pay attention to the underlying upward trends in borrowing and saving. It is against those trends that we see a reduction of demand for borrowing. The net effect is to slow the rate of lending in the year following the interest rate increase.

[15] As Stuart Rutherford, the founder of *Safe*Save, remembers the switch: "It was fairly arbitrary. Geneva was at 3 percent from it's start, recognizing that we probably needed to charge that to cover costs. It then took us some time and courage to get round to raising the rate in [Tikkapara and Kalyanpur]. I don't think there was anything special about February 2000 - it is just that by then the pro-rise argument finally prevailed in the discussions that I had with [the senior staff]." Email correspondence, March 6, 2005.

The basic trends can be seen in Figure 4, which gives average monthly loan balances in Geneva Branch versus Tikkapara and Kalyanpur combined. Since Geneva started only in March 1999, we find a steady rise from zero upward, whereas growth in the other two branches starts at a higher level and flattens in the middle of the period. The vertical line marks January 2000, the month prior to the interest rate increase. It is notable that in the prior both groups seem to have a similar linear trend. This suggests that the simplest diffs-in-diffs assumption (of a common time trend across the two groups, up to a shift factor) is plausible. Hence, we begin with a simple difference-in-difference specification:

$$y_{\mathrm{it}} = \beta_0 + \beta_1\, Treated_i + \beta_2\, Post_t + \beta_3\, Treated_i \bullet Post_t + \varepsilon_{it} \qquad (1)$$

where y_{it} is the dependent variable (typically average monthly loan balances, but also an indicator for loans, amount loaned, repayments), $Treated_i$ takes on a value of 1 for individuals in Tikkapara and Kalyanpur and 0 for those in Geneva, and $Post_t$ refers to time periods after the interest rate increase. The data are observed for all customers i in month t. Hence, β_3 gives the impact of interest: the change in borrowing before and after the change in Tikkapara and Kalyanpur relative to the contemporaneous change in Geneva.

We refine this estimation strategy along a number of dimensions. First, we can control for borrower characteristics, including age and length of time in the program. Second, rather than simply controlling for time effects with a before-versus-after dummy, we include a full set of month-year dummies. Third, we include account fixed effects; this then controls for all non-time-varying differences between borrowers across districts. Fourth, we allow for trend differences between the treated and comparison groups, in addition to a shift in the level of borrowing. Finally, the basic set-up can be expanded to consider the heterogeneity of responses (along dimensions such as gender, wealth, and age).

An alternative specification uses knowledge of *Safe*Save's product rules to control for credit supply. In particular, we use the exact formula used by *Safe*Save to determine an individual's maximum borrowing capacity. For example, in Tikkapara and Kalyanpur, borrowers are not allowed to borrow until they have been customers for at least two months and their savings have reached 500 taka (just under $10 in January 2000).[16] At that point they can borrow their saving balance plus 1000 taka. The next time, they can increase the loan size by another 500 taka, and so forth, without limit, adding another 500 taka to their credit limit with each successive cycle. (The exact rules are in the appendix.)

This is important – and an advantage of the data we are using – because individuals might respond differently to changes in the interest rate based on their ability to borrow. For example, individuals with low (or zero) borrowing capacity are unlikely to significantly respond to changes in interest rates. Since borrowing capacity hinges in part on savings behavior, and since savings behavior is likely to be jointly determined with borrowing, there is a fear that simultaneity bias and, possibly, omitted variable bias will color the results. We thus instrument for the capacity measure using time in the program as an instrument. Time in program is a valid instrument for capacity under three assumptions, all of which seem reasonable for our data: exogeneity (since time in program increases linearly it is unlikely to be correlated with account unobservables or simultaneous shocks to borrowing and saving), relevance (the longer individuals are in

[16] On January 1, 2000, US$1 = 50.9 taka. So 500 taka was $9.83.

the program typically the more savings they accumulate), and exclusion (assuming we have correctly computed borrowing capacity, which is reasonable since we observe all the information that bank does, then the only reason that time in program should affect borrowing is through savings and in turn capacity – there should be no direct effect).

6. Results

6.1 Diffs-in-diffs and fixed effects

The first column of Table 2 gives the results of the basic difference-in-difference estimator. The coefficient on the indicator variable that captures the net impact of the interest rate hike yields a 92.7 taka reduction in loan demand. The impact is small (the implied elasticity is –0.17) but, given the large sample size, statistically significant. The overall fit of the equation is weak, however, with an R-squared of 0.02.

The fit improves (to an R-squared of 0.12) and the interest rate elasticity falls (to –0.29) once customer age and their time in the program are included in the second column. The third column increases the flexibility of the specification by allowing for a full set of month-year dummy variables. The ability to better control for underlying trends lowers the interest rate elasticity further, to –0.39.

Few controls for heterogeneity in customer tastes and constraints are available in the data, but the long time series dimension of the panel allows precise estimates of account-level fixed effects. Adding controls for account fixed effects in column 4 raises the R-squared to 0.69 and reduces the interest rate elasticity to –0.73. The next two columns show that the estimated elasticities are in a similar range when Tikkapara (–

[18] These rules were written by Stuart Rutherford. Kalyanpur was originally served by the Tikkapara branch and became it's own branch in September 1998. The product rules were unchanged during the switch.

0.86) and Kalyanpur (–0.70) are considered separately. The seventh column of Table 2 allows the estimated impacts to vary by month, showing that in the very short run interest rate elasticities are not as great as they become later over a year, with a range from –0.25 to –1.18. The eighth column allows for differing time trends in Tikkapara and Kalyanpur versus Geneva, allowing trends in Tikkapara and Kalyanpur to differ from Geneva's base trend both before and after the interest rate change (we retain the differential intercepts of the standard diffs-in-diffs model, in addition to account fixed effects). The treatment effect in this model is both the shift in the intercept and the differential trend associated with being in Tikkapara or Kalyanpur in the months after the interest rate hike. The average elasticity associated based on this treatment is -0.72, which is again in the same range as the previously estimated elasticities.

The panel used above is not balanced: customers enter the program at different points and some exit before January 2001. One concern is that the changing mix of customers over time affects the results. So, in the final column we restrict attention to a balanced panel made up of customers who are in the panel for at least six months prior to the February 2000 interest rate increase. These estimates from the balanced panel yield similar results to the parallel specification in column 4; the estimated interest rate elasticity is -0.79.

6.2 Controlling for borrowing capacity

Table 2 presented a range of estimates of loan balances to changes in the interest rate. Though these estimates account for time trends, time effects more flexibly, and observable and unobserved individual level characteristics, the estimates did not account for variation in borrowing capacity. In particular, individuals with low borrowing capacity are less able to respond to changes in interest rate than individuals with higher capacity (this is most transparent for individuals with zero borrowing capacity). In Table 3 we address this by taking advantage of our knowledge of the rules used by *Safe*Save to determine the maximum loan capacity of borrowers (the rules are detailed in the appendix).

The first column includes only customers for whom borrowing capacity is positive, with a similar overall fit and interest rate elasticity as found in the parallel specifications in Table 2. In column 2 we instead include all individuals, but control for borrowing capacity. The estimated elasticity becomes larger in absolute value, going from -0.75 to -0.88.

Measurement error, simultaneity, and omitted variable bias with respect to the capacity measure are serious concerns. Though in principle we measure borrowing capacity precisely, there is always scope for some variation in the branch loan decision. There is also a serious concern of simultaneity. A common shock could drive both savings (which is the most important component of capacity) and borrowing. In particular, the presumption is that a negative shock would decrease savings and increase the demand for loans, potentially biasing our results downward. Finally, borrowing capacity is determined mostly by savings, which could affect the demand for loans for reasons other than borrowing capacity.

We address all of these concerns by instrumenting for loan capacity using a measure of the length of time the individual has been in the program. As discussed in Section 5, time in program plausibly satisfies the key requirements for a valid instrumental variable. Results are presented in column 3. We note that that F-statistic of the instrument in the first stage is reasonably high (10.75). The estimated effect of interest rates on borrowing increases in absolute value. The implied interest rate elasticity is now -1.04, the lowest elasticity that we find in any specification.

6.3 Further results

The results above may be driven by reductions in the probability of taking loans, reductions in the size of those loans, increased speed in repaying the loans, or some combination. In Table 4 we examine each of these outcomes using our base specification.

In column 1 we begin by considering a linear probability model where the dependent variable is a dummy variable for whether the borrower takes a loan in a given month. We find a five percentage point increase in the probability of taking a loan. If borrowers are taking more loans, but average loan balances are decreasing, it would suggest either that the size of loans is decreasing or that repayment rates are accelerating. Columns 2 and 3 show that both of these are the case. We find that the amount borrowed decreases by about 17 percent relative to the typical loan size. For the amount repaid, we find an increase of approximately 100 takka , or 60 percent relative to the typical monthly repayment. The fourth column shows that saving increase with the increase in the cost of borrowing, a result that counters expectations that self-finance would replace borrowing (and thus result in less saving rather than more).

The final three columns investigate how wealth affects the impact on loan balances. Without a complete measure of wealth, we turn to data on average saving balances. In column 5, the sample is restricted to households who had not saved at least 100 taka during one of the months between June 1999 and August 1999. The sample is further restricted to beginning two months later, in October 1999. Column 6 considers households who saved over 100 taka during any month in the June to August period. The estimates show that the "low-saving" group exhibited a greater interest elasticity than the high-saving group. The elasticity is -0.86 for the low-saving group, while for the "high-saving" group it is -0.26. These findings lead us to conclude that the composition of *Safe*Save's loan portfolio shifted toward wealthier customers (as measured by initial savings balances), relative to the composition before the increase.

We examine this effect directly in column 7 where estimate the effect of the interest rate change on size of loans taken by poor borrowers. We use a triple-differences framework: we are comparing the growth after the interest rate increase in the amount loaned to the poor relative to the rich in Tikkapara and Kalyanpur, subtracting out the same difference from Geneva to control for the time trend. We find that there was a 250 takka decrease in the typical size of loan taken by poor borrowers because of the interest rate change, a decrease of 12 percent relative to the mean. Note that the decrease in amount loaned is relative to Geneva. In absolute terms, the amount loaned to the poor relative to the rich decreased in Tikkapara and Kalyanpur by 624 takka, compared to a decrease of 373 in Geneva over the same period.

We also explored possible differences in responsiveness by male and female borrowers (in specifications not reported here). We do not find substantial differences, with similar estimated elasticities for both groups.

7. Conclusions

The goal of reaching as many unbanked customers as possible has pushed microlenders to pursue profitability. Once profitable, microlenders can expand as far as the market will allow, without concern for the availability of funds from donors. The natural fear, though, is that raising interest rates too high will erode surpluses generated by customers and reduce the demand for financial services, undermining the original intention of the global push for microfinance. This concern has, however, been largely ignored, with the argument that poor customers are apt to be insensitive to interest rates and have ample surpluses with which to pay cost-covering fees. There is, though, little careful evidence on which to base this claim, and estimating interest elasticities is made difficult by the lack of plausibly exogenous price variation.

We examine this tradeoff in the context of *Safe*Save, a microfinance organization operating within the slums of Dhaka. *Safe*Save's balance sheets show that the interest rate increase was important in putting *Safe*Save on a stronger financial footing. Prior to the rate change, *Safe*Save was running losses, and subsequently managed to break even, at least in terms of accounting profit and self-sustainability. At the same time, our estimates show considerable sensitivity to the interest rate increase among borrowers. We estimate elasticities in the range of approximately -0.73 to -1.04, with our preferred estimate being at the upper end of this range.

The overall trends in the areas we study have been positive, with increases in lending each year, and many poor households are currently served by *Safe*Save. But our results suggest that their loan portfolio shifted toward wealthier (but still poor) customers in the year after the interest rate hike—as compared to the expected composition of the portfolio without an interest rate change. The results support those who argue that raising rates can improve the financial stability of microfinance organizations, but the results also support those who argue that the poor, and particularly the poorest, do take prices into account—and reduce loan demand accordingly. Because of this, financial gains were accompanied by social trade-offs during the period we study.

Appendix:

*Safe*Save product rules[18]

Product P2
Offered in Tikkapara and Kalyanpur branches as of November 1997. Not changed (except for the February 2000 interest rate rise on loans) until August 2003.

Eligibility: Anyone in the slum including children (children allowed to borrow); multiple accounts per person allowed and per household allowed.

Account Fees: no account opening nor closing nor monthly fees.

Savings: Deposit any sum any time; withdraw any sum any time unless a loan is held in which case no withdrawal allowed; interest paid in two ways (a) if account held for 5 years, then 25 percent of final balance paid at the end of the term (provided certain safeguards against 'end loading' were satisfied) (b) if account closed before 5 years interest paid retrospectively at closure at 1 percent a month for accounts that attained and maintained 1000 balance.

Loans: Account must be 2 months old and savings must have reached 500 before first loan; first loan = savings balance + 1000, subsequent loans savings balance + 1500, then savings balance + 2000, etc, no limit; disbursement fee of 100 for loans up to 5000, 200 taka for bigger ones; interest charged monthly at 2 percent per month on outstanding balance at end of previous month; no fixed repayment schedule and no fixed term but a 'renewal fee' equal to the disbursement fee payable each 6 months.

In February 2000, the interest rate on loans was raised from 2 percent to 3 percent per month; renewal fees set at 3 percent of outstanding balance (rather than as a set figure).

Insurance: None.

Product P3
Only offered in Geneva branch. Introduced in March 1999 and not changed until August 2003.

Eligibility: Anyone in the slum including children (children allowed to borrow); multiple accounts per person allowed and per household allowed.

Account Fees: no account opening or closing fees, 10 taka monthly service fee.

Savings: Two products: current and long-term, both optional.

Current Savings: deposit any sum any time; withdraw any sum any time; no linkage with loans; interest paid on balances of 500 or more at 1 percent a month but no interest in months when withdrawals are made.

Long-term savings: a 60-month accumulating savings device, monthly deposits 50 or a multiple of 50; if terminated prematurely no interest is paid; after 60 months the client stops saving and interest is added at the same monthly deposit rate, so the longer the client holds the savings the more s/he receives and the higher the effective rate.

Loans: Client must have held and paid into a long-term savings account for 2 months before a loan can be taken, and must be up-to-date with long-term savings to borrow; first loan value 1000 then rises in 1000 steps; maximum value cannot exceed the monthly long-term deposit x 100. Repay any time, any schedule; charge of 3 percent of loan when it is disbursed; interest paid monthly at 3 percent of previous month-end balance.

Insurance: None.

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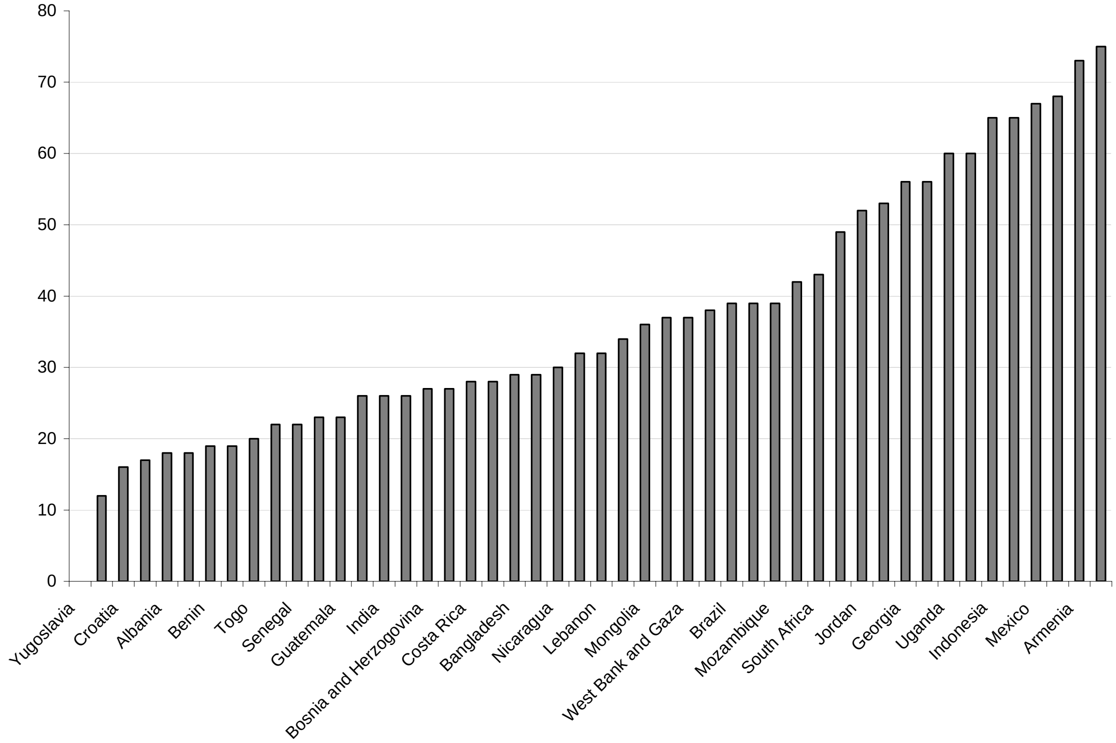


Figure 1: Real Yields on Gross Portfolio, Country averages
***MicroBanking Bulletin*, July 2003 (n = 124)**

Figure 2: Real Yields on Gross Portfolio, Region averages and maximums
***MicroBanking Bulletin*, July 2003 (n = 124)**

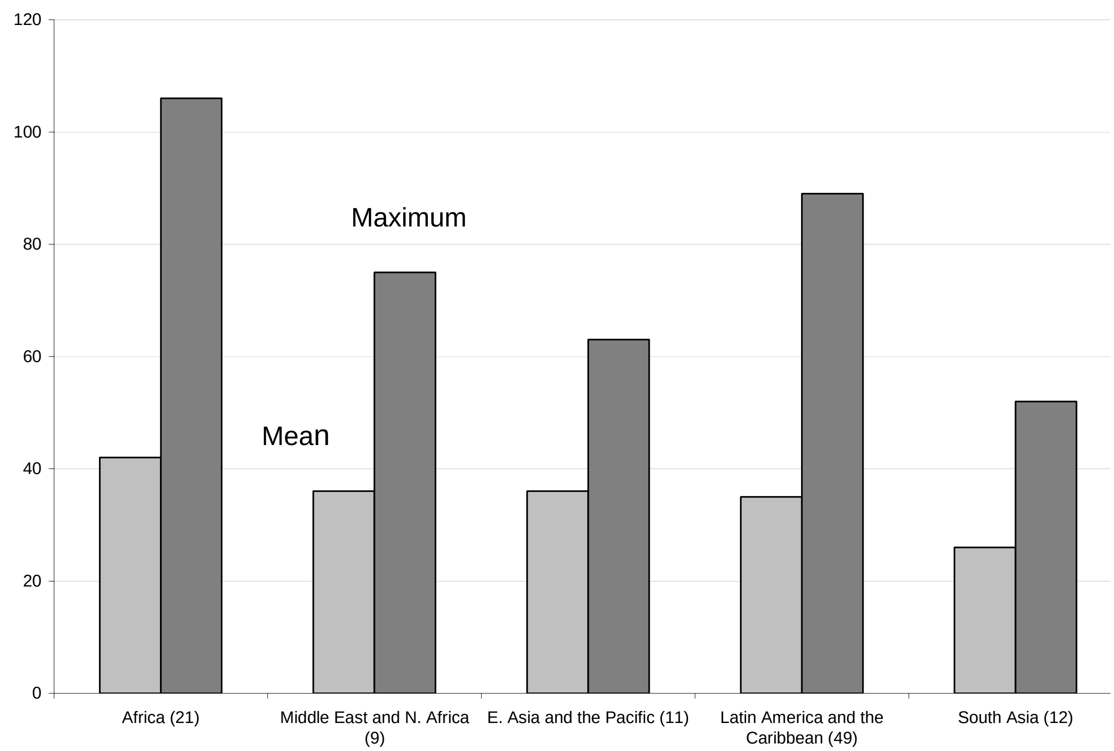
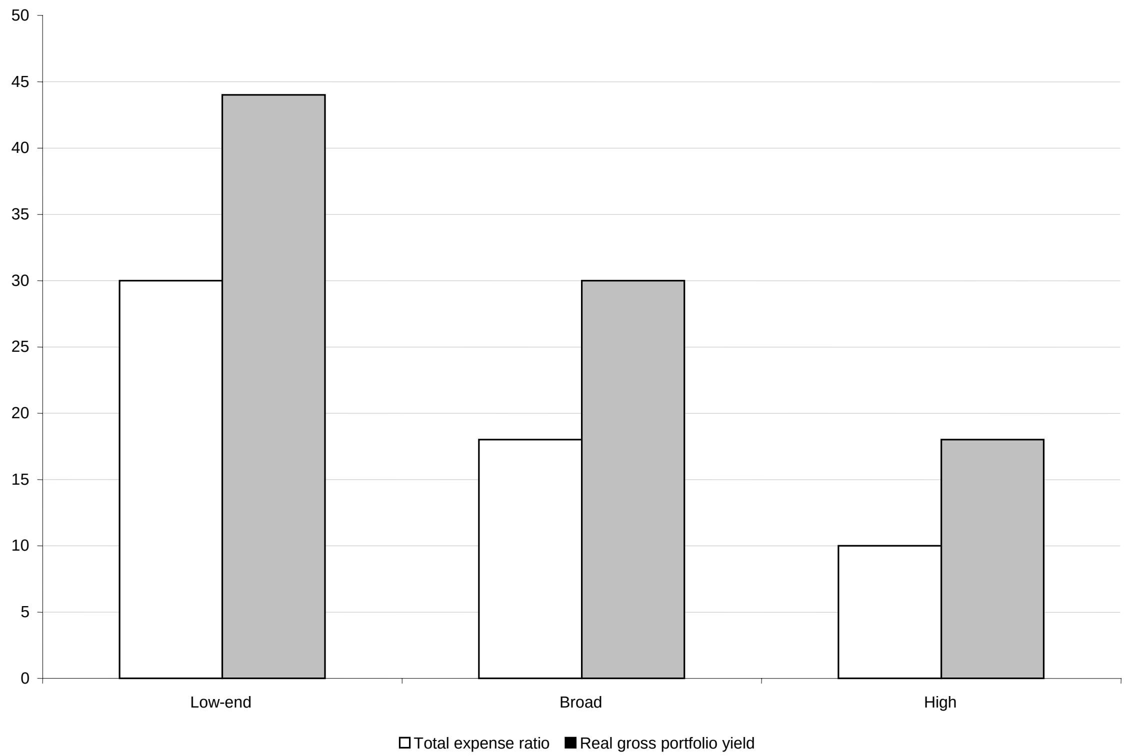


Figure 3: Total expense ratio and real gross portfolio yield, by target group
***MicroBanking Bulletin*, July 2003 (n=124)**



Notes: "Low-end" institutions include those with a ratio of average loan size to GNP per capita below 20 percent (or an average loan size under US$150). For "broad" institutions, the ratio is between 20 percent and 149 percent, and for "high-end" institutions, it is between 150 percent and 249 percent. The total expense ratio is the ratio of total expenses to assets.

Figure 4: Average loan balances, *Safe*Save

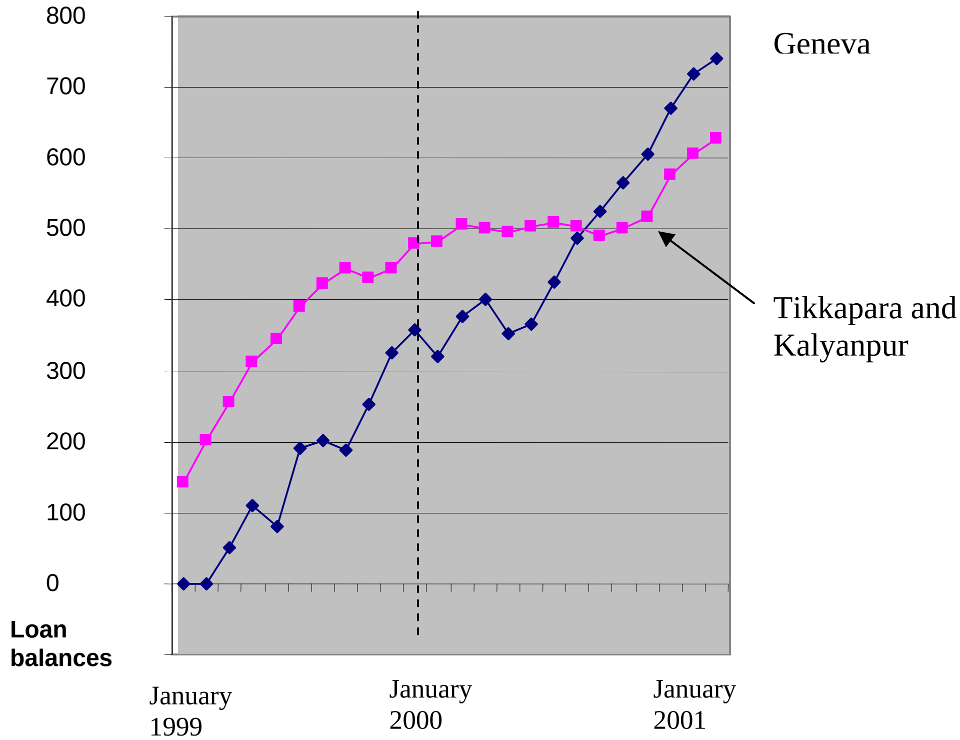

800
700
600
500
400
300
200
100
0
Loan balances
January 1999
January 2000
January 2001
Geneva
Tikkapara and Kalyanpur

Table 1: Descriptive Statistics

Monthly averages, January 1999 – January 2001

	Observations	Mean	Standard deviation	Minimum	Maximum
Tikkapara and Kalyanpur					
Female	54,522	0.64	0.48	0	1
Age	54,522	26.9	10.7	4	94
Saving deposit	54,522	43.2	128	0	11675
Saving balance	54,522	579	978	0	30347
Long-term saving deposit	54,522	0	0	0	0
Long-term saving balance	54,522	0	0	0	0
Loan balances	54,522	434	665	0	6500
Positive loan balances	22,523	1051	650	0.22	6501
Geneva					
Female	13,515	0.67	0.47	0	1
Age	13,515	27.5	10.7	2	94
Saving deposit	13,515	44.1	76.8	0	1880
Saving balance	13,515	217	409	0	13803
Long-term saving deposit	13,515	23.3	17.6	0	131
Long-term saving balance	13,515	136	145	-85.8	1190
Loan balances	13,515	480	545	0	3360
Positive loan balances	7,956	816	481	3.16	3365

Notes: Statistics calculated from *Safe*Save customer records and converted into 1985-86 taka. The urban price level had risen to 230.14 by January 2000, at which time 50.85 taka could buy one dollar. To convert the data into January 2000 dollars, divide by 22.1. In Geneva branch, customers could have both a regular saving account (with flexible deposits and withdrawals) and a long-term savings account with restricted withdrawals and a rigid monthly deposit requirement.

Table 2: Estimated Interest Rate Effects on Loan Balances

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification	Diffs in diffs	Diffs in diffs	Diffs in diffs	Account FE	Account FE	Account FE	Account FE	Account FE	Account FE, balanced panel
Sample	TI KA GE	TI KA GE	TI KA GE	TI KA GE	TI GE	KA GE	TI KA GE	TI KA GE	TI KA GE
Time effects	Pre-post	Pre-post	Month-year dummies	Month-year dummies	Month-year dummies	Month-year dummies	Month-year dummies	Linear trends TI+KA/ GE	
Interest rate increase (TI+KA+ post 2-2000)	-92.7***	-156.7***	-209.0***	-388.5***	-461.0***	-374.4***		-207.9***	-421.6***
	(17.4)	(16.5)	(16.6)	(11.8)	(14.1)	(11.8)		(18.2)	(17.6)
Geneva	-93.6***	105.3***	41.4***						
	(15.9)	(15.3)	(15.5)						
Post- 2-2002	273.3***	196.6***							
	(16.5)	(15.6)							
Age		1.9***	1.9***						
		(0.2)	(0.2)						
Time in program		23.9***	23.0***	54.0***	59.1***	54.6***	53.3***	37.2***	52.2***
		(0.3)	(0.3)	(1.0)	(1.4)	(1.0)	(2.4)	(1.1)	(1.5)
Interest rate effects: 2-2000							-134.3***		
							(19.9)		
3-2000							-187.7***		
							(19.0)		
4-2000							-210.7***		
							(17.7)		
5-2000							-256.7***		
							(17.0)		
6-2000							-327.6***		
							(16.9)		
7-2000							-404.3***		
							(16.7)		
8-2000							-461.1***		
							(16.6)		
9-2000							-514.7***		
							(16.5)		
10-2000							-563.3***		
							(16.5)		
11-2000							-603.8***		
							(16.6)		
12-2000							-633.3***		
							(16.8)		
Time trend								6.9***	
								(2.2)	
TI +KA differential trend								-2.5	
								(2.3)	
Post differential trend								9.2***	
								(1.4)	
TI+KA+post differential trend								-28.8***	
								(1.9)	
Constant	335.1***	16.7**							
	(4.1)	(7.5)							
Interest rate elasticity of borrowing	*-0.17*	*-0.29*	*-0.39*	*-0.73*	*-0.86*	*-0.70*	(*-0.25,-1.18*)	*-0.72*	*-0.79*
Observations	68,037	68,037	68,037	68,037	24,759	56,793	68,037	68,037	43,237
R-squared	0.02	0.12	0.13	0.69	0.68	0.69	0.70	0.69	0.69

Notes: Standard errors in parentheses. ** significant at 5 percent; *** significant at 1 percent

Table 3: Estimated Interest Rate Effects on Loan Balances, Control for Borrowing Capacity

	(1)	(2)	(3)
Specification	OLS	OLS	IV[b]
Sample	Capacity>0	All	All
Interest rate increase	-400.6	-469.5	-555.7
	(14.7)	(9.9)	(13.1)
Borrowing capacity[a]		0.2	0.44
		(0.001)	(0.011)
Time in program	59.1	35.7	
	(2.1)	(0.8)	
Interest rate elasticity of borrowing	*-0.75*	*-0.88*	*-1.04*
F-stat in instrument			10.75
Observations	36,231	68,037	68,037
R-squared	0.68	0.78	0.78

Notes: Standard errors in parentheses. All coefficients are statistically significant at 1 percent.
(a) Borrowing capacity uses program rules in conjunction with savings to determine the maximum amount an individual could borrow.
(b) We instrument for borrowing capacity using time in program.

Table 4: Estimated Interest Rate Effects,
Further Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome	Takes a loan	Amount borrowed	Amount repaid	Total savings	Loan balances	Loan balances	Amount loaned to poor
Specification	Linear probability model with account FE	Account FE	Account FE	Account FE	Account FE	Account FE	Diffs in diffs[b]
Sample					Low savings[a]	High savings	TI KA vs. GE
Interest rate increase	0.049***	-202.0***	103.4***	297.2***	-331.0***	-169.6***	-250.0***
	(0.0088)	(43.1)	(15.0)	(20.8)	(12.1)	(35.5)	(129)
Time in program	0.0017**	82.7***	4.6***	45.0***	54.5***	30.9***	
	(0.0007)	(4.7)	(1.7)	(2.4)	(1.4)	(4.0)	
Interest rate elasticity of borrowing					*-0.86*	*-0.26*	
Observations	68,037	6,240	30,479	30,479	31,291	20,318	6243
R-squared	0.14	0.85	0.22	0.81	0.69	0.78	0.25

Notes: All specifications contain month-year dummies.
Standard errors in parentheses. *** significant at 1 percent; ** significant at 5 percent;
(a) Low-savings individuals are identified using savings balances between June to August 1999, and the subsequent responsiveness to the change in interest rate is measured using data from October 1999 on.
(b) This is a triple-differences specification, looking at the change in Tikkapara and Kalyanpur in amount loaned to poor individuals after the interest rate change compared to before the interest rate change, relative to the same difference for rich individuals in Tikkapara and Kalyanpur, subtracting out the before-after rich-poor difference from Geneva.