

Do Risky Microfinance Borrowers Really Invest in Risky Projects? Experimental Evidence from Bolivia

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ABSTRACT *This paper reports the results of an experiment testing a fundamental assumption in Stiglitz and Weiss' (1981) model of credit rationing: that defaulting borrowers are associated with investment in risky projects. Through an artefactual field experiment with 200 Bolivian microfinance borrowers, we observe that subjects from real-world delinquent borrowing groups do not prefer risky projects to safer ones significantly more than subjects from repaying groups. Instead, our results support more recent behavioural theories of credit market failure. Implications are that defaulting microfinance borrowers may be those who take too little investment risk rather than those who take too much.*

‘Poor people are not credit worthy [...] they will not be able to pay back [...] no matter how much money you give, they will eat and the money will be over, they can't pay you back’. Muhammad Yunus (2006), on how banks justify denying credit to the poor.

1. Introduction

In one of the most celebrated papers in economics, Stiglitz and Weiss (1981) develop a model of credit markets that demonstrates how adverse selections and moral hazards emerge under asymmetric information to create incentives for borrowers to invest in risky projects. This incentive to undertake risky projects forms the basis for a credit rationing equilibrium in which many borrowers who desire to take loans at the market interest rate are denied. The model has been applied extensively as a basis for understanding the nature of microfinance markets in developing countries, and even as a motivation for microfinance itself; indeed, a recent search in Google scholar showed 1,070 papers that discuss the Stiglitz and Weiss model in the context of microfinance.

The question of whether or not the Stiglitz and Weiss model holds for microfinance has important policy implications for development economics as well as development practice. Fundamentally, it affects the way we think about delinquency in microfinance: Are risky microfinance borrowers those who take too much risk, or, as more recent behavioural economics research suggests, are risky

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microfinance borrowers those who favour the safety of consumption over investment and thus in some sense take on too little risk?

In this paper we report the results of an artefactual field experiment designed to investigate the characteristics of borrowers that a microfinance institution would consider 'risky', borrowers who are members of delinquent groups that failed to repay in time. In particular, we are interested in testing Stiglitz and Weiss' (1981) assumption underlying credit market failure: that risky borrowers are those who invest in risky projects. We proceed by testing whether there is any correlation between borrowers that a bank considers risky and their choices of riskier versus safer projects (moral hazard), consumption versus investment (cheating moral hazard), or home-grown preference towards risk (adverse selection).

We carried out an artefactual field experiment among 200 Bolivian microfinance borrowers from PORVENIR S.A., a microfinance institute in El Alto, Bolivia. The sample of subjects was purposely stratified to include a large number of real-world delinquent borrowers: three-fifths of our subjects were members of small borrowing groups who had experienced significant problems with timely loan repayment. The remaining subjects, whom we will refer to as 'safe borrowers', came from borrowing groups without any difficulties in loan repayment.

The experiment was framed as a microfinance loan assigned to each subject. Each subject participated in two distinct treatments administered in a random order.¹ In a first treatment, individual borrowers were asked to choose between investing in either: a risky project with a low probability of a high return; or a safer investment project with a high probability of a lower return. In a second treatment (carried out in a random order with the other treatments to prevent learning order-effects), the same borrowers were presented with a choice between: investing the loan in the safer investment project; or not investing the loan but rather using it for 'consumption' (a certain payoff that involved delinquency).

Our results reveal no evidence that real-world risky borrowers (subjects from delinquent borrowing groups) have a tendency to prefer risky choices or to be endowed with risk tolerance preferences higher than the rest. On the contrary, we find that they prefer safer choices and, when faced with the 'consumption' versus a relatively safe investment option, they prefer to consume their loans at a rate nearly double that of the safe borrowers (30% versus 18%, $p = 0.06$). In short, our results find no empirical support for the assumptions that underpin the Stiglitz and Weiss credit model. Instead, our results offer some evidence that the fundamental source of moral hazard in credit markets appears to lie in diverting loans from investment to consumption, consistent with some more recent models of behaviour in credit markets (for example Ashraf, Karlan, & Yin, 2006; Banerjee & Mullainathan, 2010; Bertrand, Karlin, Mullainathan, Shafir, & Zinman, 2005; Gugerty, 2007). According to these newer models, moral hazard in credit transactions is not related to the temptation to invest in risky projects, but rather in the temptation to consume borrowed capital instead of investing it productively.

Whether the behaviour underlying the traditional model or the newer behavioural-economics-based models is better able to explain the origin of default has important implications for microfinance policy. If the basis of microfinance default lies in the temptation to use loans for present consumption rather than undertaking risky projects, then training loan officers to dissuade microfinance borrowers from investing in risky projects will have little impact on default. On the contrary, our experimental results suggest that, to reduce microfinance default, practitioners should encourage borrowers to engage in the normal risks associated with entrepreneurial investment rather giving in to the temptation to use loans for household consumption.

2. Related Literature

The Stiglitz and Weiss (1981) model of credit market failure presents a type of moral hazard in which borrowers, due to a convex payoff function over returns, have an incentive to invest in risky projects over safer ones. This incentive is at odds with the interests of lenders, who, given their concave payoff function over borrower returns, would prefer borrowers to invest in safer projects to increase the probability of loan repayment. In their model, riskier borrowers are willing to pay higher interest rates because they realise higher rates of return in the good states of nature, but are insulated from losses under joint liability

in the bad state of nature. Credit rationing occurs because lenders have an incentive to keep interest rates at sub-market-clearing levels in order to bring safer projects back into the pool.

This ‘risky-versus-safe project’ framework has had a powerful influence on the development economics literature and has become a theoretical starting point in textbook chapters on credit markets for leading undergraduate and graduate texts in development economics (for example Bardhan & Udry, 1999; Ray, 1997) and microfinance (Armendáriz & Morduch, 2005, 2010). This ‘risky-versus-safe project’ framework has given birth to theories regarding the ability of group lending to mitigate problems of adverse selection and moral hazard. Stiglitz (1990) argues that the peer monitoring advantages inherent in group lending dissuade borrowers from undertaking investments in risky projects. The same framework underlies the foundation of Banerjee, Ghatak, and Guinnane’s (1994) model of peer monitoring in early German credit cooperatives. Adverse-selection-based group lending models developed by Ghatak (1999, 2000), Van Tassel (1999), Ghatak and Guinnane (2001), and Armendáriz de Aghion and Gollier (2000) all adopt the risky-versus-safe projects framework to demonstrate the potentially advantageous self-selection properties of group lending and its ability to screen borrowers with risky projects from a lender’s portfolio. Early empirical works on group lending, such as Wenner (1995) and Wydick (1999), implicitly adopt the Stiglitz and Weiss framework to ascertain whether group lending is able to improve borrower repayment by way of selection and internal enforcement mechanisms. The model has also formed the basis of experimental design in recent experimental works in microfinance, such as Giné, Jakiela, Karlan, and Morduch (2010).

In contrast, the real fear of many practitioners in developing countries doesn’t appear to be that borrowers would take too *much* investment risk with borrowed capital, but rather too *little* risk. One of the main reasons given by formal lenders for not lending to the poor is the fear that these borrowers who lack collateral would not invest the loan but instead direct it for consumption needs. According to Yunus (2006), the traditional fear among formal lenders has been that the poor lack the self-discipline to abstain from consumption when in possession of a large sum of money intended for productive investment. While these views tend to be reported more anecdotally than in the academic literature, they are pervasive enough to warrant investigation.

The idea that consumption-based moral hazards might constitute a greater source of moral hazard than the fear of investment in projects that are too risky makes economic sense in many contexts involving lending, such as, but not limited to, microfinance. First of all, the type of activity in which microfinance borrowers invest is more often than not an exogenous choice, determined by a rather fixed set of skills and identity: A baker will invest in an oven; a vendor selling pants will buy boxes of pants. Second, since the type of business operated by the borrower is known by the loan officer, the type of project in which a borrower invests is one of the more salient components of a credit transaction. On the contrary, much more susceptible to hidden action is the diversion of all or part of the loan from the investment activity toward household consumption.

This kind of consumption-based moral hazard is cited by both practitioners and many recent theories about saving and borrowing, such as Ashraf et al. (2006), Bertrand et al. (2005), and Banerjee and Mullainathan (2010). This research tends to view the problem of saving, borrowing, and investment as a self-control issue. Microfinance loans are seen as commitment devices to keep resources directed toward capital, with payoffs in the future and away from consumption goods, especially ‘temptation goods’ that have a payoff only in the present. From this perspective, microfinance contracts may function as a device that commits borrowers to a series of formal payments to finance a productive capital investment. For example, one of the principal advantages of non-profit microfinance, which often places an emphasis on building entrepreneurial capacities, may be that the *esprit de corps* of training sessions create a collective reference point around successful entrepreneurialism and loan repayment. Another advantage of group lending (even without joint liability) may be the recurrent ‘nudge’ by the other members to focus one another on timely repayment and away from the temptation of using current liquidity for current consumption. Seen in this light, borrowing may just be another form of saving, but embodied in a stronger commitment device.

This temptation to divert credit granted for business investment to household consumption has empirical support. For example, in a sample of 1,672 microfinance households in Guatemala, India, and Ghana, McIntosh, Villaran, and Wydick (2011) find that among borrowers who had taken loans officially for business investment, the probability of a television set purchase rose 1.7 percentage points (over a baseline probability of only 4.3 percentage points) in the first year that a microfinance loan was taken.

3. Experimental Design

3.1. Sample

The data reported in this paper come from an artefactual field experiment and survey carried out in Bolivia during July and August 2009. Our subject pool consists of 200 borrowers from PORVENIR S.A., a medium-sized Bolivian microfinance institution located in El Alto, a north-eastern suburb of La Paz, specialising in group lending. PORVENIR's borrowers typically receive a six-month loan at a 3 per cent interest rate, with payments every two weeks. Loan size varies from 1,000 to 4,000 Bolivianos (USD143 to USD571), with larger sizes depending on borrowers' previous performance. Table 1 reports summary statistics of subject characteristics. Our sample was 87 per cent female, with an average age of 37 years.

Table 1. Summary statistics

Variables	Mean (Std. Dev.)	Risky borrowers (61%)	Safe borrowers (39%)	<i>t</i> -test <i>p</i> -value (two-tailed)
Risky Borrower (from a delinquent group)	0.610 (0.489)			
Female	0.870 (0.337)	0.869 (0.339)	0.872 (0.336)	0.952
Age	37.270 (12.713)	37.115 (12.625)	37.513 (12.928)	0.830
Married	0.650 (0.478)	0.648 (0.480)	0.654 (0.479)	0.928
House owner	0.560 (0.498)	0.525 (0.501)	0.615 (0.490)	0.209
Persons per room	2.886 (1.751)	2.863 (1.886)	2.923 (1.527)	0.814
Subject owns business	0.535 (0.500)	0.590 (0.494)	0.449 (0.501)	0.051*
Income proxy (expenditures - Bolivianos)	1350.047 (1546.523)	1302.451 (1389.762)	1424.492 (1771.134)	0.588
Years of education	8.505 (4.128)	8.025 (4.079)	9.256 (4.120)	0.039**
<i>Experimental Results</i>				
Risk aversion (experimental elicitation)	4.830 (1.690)	4.877 (1.756)	4.756 (1.589)	0.624
Consume versus safer project	0.250 (0.434)	0.295 (0.458)	0.179 (0.386)	0.066*
Riskier vs. Safer project	0.312 (0.464)	0.298 (0.459)	0.333 (0.474)	0.597

Standard deviations in parentheses.

*** Significant at 1% level.

** Significant at 5% level.

* Significant at 10% level.

About 65 per cent of our subjects were married, 56 per cent owned the house in which they lived, had an average of 8.5 years of formal education, and earned a household income of USD193 per month. Within our sample, 122 out of 200 subjects were borrowers from delinquent groups in arrears with loan repayments.

Our data contain default information at the borrowing group level. Because information about internal repayment problems are often held within borrowing groups, PORVENIR was not able to give us information about the culpability of each individual borrower in a delinquent group. However, there are several reasons why group defaults capture important individual variations within the borrowing pool. First, research such as Ghatak (1999) and Van Tassel (1999) have demonstrated that an important feature of joint liability is that under self-selection, groups should form homogeneously with respect to individual default risk under an assortative matching process; high-risk borrowers will match with other high-risk borrowers, and low-risk to match with low-risk.² While this formation process, in practice, is certainly imperfect, we should expect borrowers within a given self-selected group to exhibit similar levels of default risk in a matching equilibrium. Second, group lending involves an agreement over a joint-liability contract in which individual borrowers make an a priori commitment to repay the entire debt of the group. That a group under joint liability is in default implies that *no* individual borrower within the group is willing to contribute sufficient funds to fully honour each borrower's joint-liability commitment. So while the behaviour of these borrowers who fail to cover for partners' loans is arguably not the *primary* cause of the group default, it is inarguably the *secondary* cause of the group default and constitutes the breach of a loan contract. Moreover, in the typical joint-liability contract, an individual refusal to honour joint liability often occurs even in the face of substantial peer pressure from other group members. Third, group borrowers face the same penalty for group default as individual borrowers, forfeiting access to future microloans, so that not only should they be similar in a priori default risk, but borrowers within a defaulting group also would indicate a shared preference for present consumption while foregoing the future advantages of access to microcredit. Thus it is reasonable to assume that each member of a delinquent borrowing group embodies a greater average risk to a microfinance lender than members of borrowing groups who have never experienced repayment problems.

Therefore, in our analysis we consider a borrowing group member belonging to a borrowing group with a microfinance loan in arrears as a borrower with an elevated default risk. The non-risky subjects came from groups with no history of repayment problems. While any measure of borrower riskiness is imperfect, we have reason to believe ours is a good approximation, capable of capturing important variations within the borrowing pool.

Sample recruitment was carried out by PORVENIR's loan officers among their active borrowers, from either repaying or delinquent groups. Our sample does not contain members of completely defaulting groups, since these were no longer clients of the institution, but we cannot exclude the possibility that some of these delinquent groups might have become defaulting groups at a later date. PORVENIR officers were only involved in the recruitment phase of the experiment. They did not take any part in the data collection process, and they were not present during any of the sessions and were not informed about individual experimental outcomes. The subjects were informed several times throughout the experiment that their choices would remain anonymous.

We carried out 17 sessions in total, with each session comprising of either 10 or 15 subjects. Depending on the outcome of the experiments, subjects earned payouts of up to 73 bolivianos (USD10.50), more than one day's minimum salary, where the monthly minimum wage was USD92.5 in 2009. The sessions were held at the group's regular meeting place, typically the house of one of the group members.

3.2. Experimental Treatments

The complete experimental design was comprised of seven different loan experimental treatments and a final risk aversion task. The experimental treatments were administered in a random order and without revealing to the subject the results until the very end of the entire experiment, to prevent

wealth effects and correlation across treatments. Throughout the experiment the instructions were framed in the context of a microfinance loan (see the Online Appendix to this paper). Under all of the loan treatments, each subject began the task with 500 bolivianos to be used as collateral for the securing of an experimental 'loan' equal to 1,000 bolivianos at 20 per cent interest.

Safer versus riskier investment project treatment. For the safer versus riskier project treatment, each subject had to choose between investing a loan in a safer project or into a riskier one. The safer project, if successful, would return a gross payoff of 3,000 bolivianos. The probability of success was 5/6, implemented by tossing a six-faced die in front of the subject if this task was the one randomly selected for payment at the end of the session. If the project failed (with 1/6 probability), the return was zero. In contrast, the riskier project returned a gross payoff of 5,000 bolivianos or zero, each with probability 1/2. Again, the toss of the die (three faces were considered success, the other three failures) would occur in the presence of the subjects if selected for payment. Under either project, only in the case of success would the subject be able to repay the principal of 1,000 bolivianos plus the 200 bolivianos in interest. Net profit would be 1,800 bolivianos, plus the 500 collateral, for a total of 2,300 bolivianos, in the case that the subject was successful and chose the safer project, or 4,300 bolivianos (3,800 bolivianos plus the 500 collateral) if she chose the riskier one. In cases of project failure, subjects would lose their 500 bolivianos collateral, and therefore would have earnings of zero. For more detailed explanations of the payoffs, refer to the Online Appendix, in which we provide a complete summary of our experimental protocol and instructions.

Consumption versus safer investment project. For the consumption versus safer investment project, each subject had to choose between allocating her experimental loan either into a zero-risk project, which we framed in terms of 'consumption', or 'investment' in the safer project. The instructions specified that if a subject chose the low-payoff, zero-risk option (that is, to consume the loan rather than investing it), she would keep the 1,000 bolivianos principal but would default on the loan and lose the 500 collateral. If a subject chose to invest, she would earn a gross payoff of 3,000 bolivianos (less the 1,200 principal and interest payments) with 5/6 probability or zero with 1/6 probability. Net profit would then be 2,300 in case of success (3,000 minus principal and interest, plus the collateral back), and zero otherwise.

Our experimental tasks are very simple and, as such, are not intended to capture all aspects of lending dynamics. Repaid microfinance loans are typically rewarded with subsequent loans, and this may represent one of the most important motives for borrowers to repay a loan. We leave the dynamics out of our framework and develop a framework primarily designed to test the assumption that borrowers who present a default risk to a microfinance lender are associated with risky projects, not to directly assess the empirical validity of a particular behavioural-based credit theory. We believe this simplicity is a virtue, even as we acknowledge its shortcomings. For example, the choice to consume rather than invest could be due to extreme risk aversion (for which we control with the risk task), present bias, or a combination of the two. In a subsequent experiment one could introduce a time gap between the choice to consume and the one to invest, or a time elicitation component to the experiment, to account for the differences between extreme risk aversion and/or impatience. Here we implemented a static game with subject decisions made at a single point in time, where our experiment was designed in this way so that dynamic incentives, monitoring, and the other aspects of microfinance that are important in the real world are held constant and identical between treatments.

Risk task. To investigate the role that individual attitudes towards risk might have in being a risky or safe borrower, our experiment included a risk task to elicit an estimate of individual risk aversion. While it is still open to debate whether risk attitudes change in systematic ways in the aftermath of different life events or are a more permanent feature of an individual's personality,³ we could foresee the possibility that being part of a defaulting group could cause individual risk preferences to shift. If this were the case, a borrower's preference for 'consumption' could be due to increased risk aversion instead of the other way round. Since we did not have any data on pre-delinquency risk attitudes, we

cannot make any statement here about causality. We use our elicited estimates of risk aversion at the time of the experiment as a control, aware that the causality could theoretically move in the opposite direction. Nevertheless, an uncontrolled *t*-test of risk aversion between borrowers from delinquent and non-delinquent groups shows no statistical difference between these groups (4.9 versus 4.8, respectively; $p = 0.62$), and when being in a delinquent group is regressed on the controls plus elicited risk aversion, parameters furthermore display non-significant results. Thus *ex post*, after being already in a delinquent group, we see no difference in risk aversion between the two groups, but we cannot say anything about their *ex ante* preferences.

From a procedural perspective, the risk task was administered at the end of the session, before any of the actual outcomes of the previous experimental games were revealed to the subjects, in order to prevent correlation between games. The protocol was based on the MPL (multiple price list) procedure of Holt and Laury (2002). The MPL protocol consists of presenting subjects with a series of choices between two distinct lotteries, lottery A and lottery B. The two payoffs of each lottery (one for the good outcome, one for the bad outcome) are constant, but the probabilities of success (good outcome) change from one round to the next. In our experiment, lottery A offered the subjects an opportunity to gain either 2000 (experimental) bolivianos or 1600 bolivianos.⁴ Lottery B offered a higher gain of 3,850 bolivianos in its high state, but only a 100 boliviano gain in its low state. Subjects had to decide which one of the two lotteries they preferred, one choice for each one of 10 rounds, in which the probability of the good outcome increased in increments of 10 per cent from 0 to 100 per cent. Because probability is an abstract concept, lottery probabilities were explained to subjects in terms of frequencies with the help of coloured balls as visual aids. Depending on the round in which a subject switched from lottery A to lottery B, we can infer individual risk preferences. (The later the round in which the subjects selected lottery B, the higher is her estimated risk aversion.) In case a subject switched back to lottery A after having switched to lottery B, we use the first time she switched to B as measure of her risk aversion,⁵ a common solution to this puzzling choice when using the MPL procedure (see Harrison & Rutström, 2008).

At the end of all the experimental tasks, subjects filled out a questionnaire covering age, gender, civil status, education, main occupation, income, expenditures, family size, assets, business activity, and home ownership.

4. Experimental Results

An uncontrolled *t*-test between 'risky' borrowers and 'safe' borrowers over their mean choice proportion between the riskier and safer investment projects reveals no significant difference between real-world delinquent and non-delinquent borrowers. Borrowers from delinquent groups chose the riskier project 29.8 per cent of the time, while those from good borrowing groups chose it 33.3 per cent of the time (p -value = 0.597). If anything, the raw difference in outcomes contradicts the hypothesis that delinquent group borrowers risk too much: they chose the riskier project less frequently and displayed more aversion (both differences insignificant, however, from an inferential perspective). However, in our second treatment, when the choice is between the zero-risk alternative (framed as consumption) and investment in a modestly risky project, borrowers from delinquent groups chose the first option at nearly twice the rate, 29.5 per cent versus 17.9 per cent of the time, of members of good borrowing groups (p -value = 0.066). One possibility we considered was that this difference could be due to subjects in the delinquent group not understanding the game as well as subjects from solvent groups; the consumption option in some respects was a more simple choice. However, if this was the cause, we would have found similar systematic group differences in the other treatments, especially in the risk task, but this is not the case. Furthermore, the result holds even after controlling for education, a variable likely to capture subjects' understanding of the respective experimental treatments.

Tables 2 and 3 report the regression results for the experimental treatment outcomes. Table 2 displays the estimates for the riskier versus safer project treatment. Both the logit and linear probability

Table 2. Results of riskier versus saver investment treatment

Dependent Variable: 1 = Subject chooses riskier over safer project (mean 0.312, std. dev. 0.464)						
Variables	Logit estimations (marginal effects)			Linear probabilities Model		
Risky borrower (from a delinquent group)	-0.036 (0.068)	-0.032 (0.071)	-0.029 (0.071)	-0.036 (0.068)	-0.032 (0.071)	-0.028 (0.071)
Female		-0.078 (0.107)	-0.066 (0.106)		-0.077 (0.103)	-0.065 (0.103)
Age		0.003 (0.003)	0.002 (0.003)		0.003 (0.003)	0.002 (0.003)
Married		0.000 (0.072)	0.017 (0.073)		0.000 (0.073)	0.017 (0.073)
House owner		0.062 (0.068)	0.073 (0.068)		0.063 (0.069)	0.073 (0.069)
Persons per room		0.009 (0.019)	0.007 (0.019)		0.010 (0.020)	0.007 (0.020)
Subject owns business		0.037 (0.071)	0.042 (0.071)		0.036 (0.072)	0.043 (0.071)
Income proxy (expenditures - Bolivianos)		-0.022 (0.027)	-0.024 (0.027)		-0.022 (0.028)	-0.024 (0.028)
Years of education		0.006 (0.010)	0.006 (0.010)		0.006 (0.010)	0.006 (0.010)
Risk aversion (experimental elicitation)			-0.0354* (0.020)			-0.0365* (0.020)
Constant				0.333*** (0.053)	0.288 (0.288)	0.494 (0.308)
Observations	199	199	199	199	199	199
Pseudo R2	0.001	0.896	0.030			
R-Squared				0.001	0.021	0.038
Adj R-Squared				-0.004	-0.025	-0.013

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.01$.

*** Significant at 1% level.

** Significant at 5% level.

* Significant at 10% level.

estimations⁶ reveal that none of the independent variables display significant explanatory power, except for risk aversion. Subjects who demonstrated a higher degree of risk aversion during the risk elicitation task were also less likely to choose the riskier project over the safer one: a one standard deviation increase in risk aversion decreases the probability of undertaking the riskier investment by about 6.2 percentage points, significant at the 90 per cent confidence level. Thus when subjects are faced with choices that involve differing levels of implicit risk, individual risk preferences do matter and, as expected, more risk-averse subjects prefer the safer option. However, being a real-world borrower from a delinquent group appears to have no significant effect on a subject's project choice.

Table 3 displays the results of the consumption versus safer project investment treatment. On average, 25 per cent of subjects preferred to consume rather than to invest. Importantly, those who might be outwardly identified as more reliable borrowers showed a stronger tendency toward investment than consumption. Subjects who owned a business were 22 percentage points more likely to choose to invest than those with only informal economic activity (p -value < 0.01). Every year of additional education reduced the probability of choosing consumption by about 2 percentage points (p -value < 0.05).

The most important result from this analysis is that real-world delinquent borrowers were significantly more likely to choose the consumption option over investment. The point estimate is large (12.8 percentage points more likely, relative to a mean of 25 per cent) and statistically significant

Table 3. Results of consumption versus investment treatment

Dependent Variable: 1 = Subject chooses consumption versus safer project (mean 0.25, std. dev. 0.434)						
Variables	Logit estimations (marginal effects)			Linear probabilities Model		
Risky borrower (from a delinquent group)	0.116*	0.128**	0.127**	0.116*	0.129**	0.128**
	(0.060)	(0.059)	(0.059)	(0.063)	(0.062)	(0.062)
Female		0.079	0.078		0.072	0.070
		(0.088)	(0.089)		(0.090)	(0.090)
Age		0.003	0.003		0.003	0.003
		(0.003)	(0.003)		(0.003)	(0.003)
Married		0.013	0.011		0.013	0.010
		(0.065)	(0.066)		(0.063)	(0.064)
House owner		-0.024	-0.025		-0.013	-0.015
		(0.062)	(0.063)		(0.060)	(0.060)
Persons per room		-0.004	-0.003		-0.003	-0.002
		(0.018)	(0.018)		(0.017)	(0.017)
Subject owns business		-0.227***	-0.227***		-0.223***	-0.224***
		(0.067)	(0.067)		(0.062)	(0.062)
Income proxy (expenditures - Bolivianos)		0.019	0.019		0.021	0.021
		(0.026)	(0.026)		(0.024)	(0.024)
Years of education		-0.0168*	-0.0167*		-0.0192**	-0.0192**
		(0.009)	(0.009)		(0.009)	(0.009)
Risk aversion (experimental elicitation)			0.003			0.006
			(0.018)			(0.018)
Constant				0.179***	0.140	0.105
				(0.049)	(0.248)	(0.267)
Observations	200	200	200	200	200	200
Pseudo R2	0.016	0.143	0.143			
R-Squared				0.017	0.156	0.156
Adj R-Squared				0.012	0.1156	0.112

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.01$.

*** Significant at 1% level.

** Significant at 5% level.

* Significant at 10% level.

(p -value < 0.05). Interestingly, the point estimates are essentially unchanged when we control for risk aversion, which becomes insignificant. This result casts doubt on the hypothesis that it is mainly risk aversion that induces delinquent borrowers to consume rather than to invest, in favour of alternative hypotheses (like present bias) that are beyond the scope of the current experiment.

One possible objection to our estimations is that they do not include session fixed effects. The reason they are not employed is that sessions were either comprised of borrowers from solvent groups or of borrowers from delinquent groups, because recruiting was done at the group level, not at the individual level. Thus each session is homogeneous in borrowers' type. Including a session fixed effect would have implied mixing groups, which would have compromised what we believe was a vital part of the design of the experiment. Careful repetition of experimental protocol should allow for minimal differences in this respect.

To summarize, our experimental results suggest that risky microfinance borrowers, those from delinquent borrowing groups, are not borrowers who invest in risky projects, but rather borrowers who are in some sense the opposite: they significantly prefer to consume loans instead of investing, even in a relatively safe project. Furthermore, our results show this may be partially due to some factor besides an unwillingness to take on enough of the risks associated with entrepreneurial activities. Leading possibilities are impatience or present bias, and we leave the further exploration of this hypothesis for future work.

5. Conclusion

That the risky-project-based framework has enhanced our understanding of credit market failure and credit rationing does not necessarily render it a good framework for building applied models of credit markets in developing countries. Based on our experimental research, this may particularly hold for microfinance. Here, we provide experimental evidence that theories of credit markets centred in a risky-project-based framework are likely to be built on behavioural foundations that lack empirical support. Although there are important facets of microfinance borrowing that are not captured in our simple experimental design (especially dynamic incentives), the simple choices and the frame we adopt in our protocol allows us to capture important differences in real borrower characteristics.

If the implications of the traditional moral hazard models of credit rationing were to transfer to microfinance borrowers, we would expect to find real-world delinquent borrowers to prefer riskier projects over the safer ones. But this is not supported by our data. Controlling for risk aversion, when faced with the experimental choice between a riskier project and a safer project, real-world borrowers from delinquent groups are no more likely to expose themselves to risky projects than safe borrowers. In addition, again after controlling for risk aversion, we find that these same borrowers are instead significantly more likely to choose the certainty of ‘consuming’ a unit of capital over the small risk involved with choosing a relatively safe investment.

The assumptions behind models like Stiglitz and Weiss’ appear to be rooted in what an economic theorist can successfully argue *should* be a major source of moral hazard in credit markets. Yet our experimental research cannot confirm any relationship between the desire of borrowers to invest in projects with greater risk and actual problems in borrower repayment.

The traditional risk-based model has been widely used as a theoretical framework for understanding credit markets in developing countries and for economic analyses of microfinance. Here we propose an alternative explanation for moral hazard which has important policy implications for development practitioners. These differences, which we summarise in Table 4, are not benign. If the source of moral hazard we describe here more accurately reflects its true manifestation in credit markets, a persistent focus on ‘risky-versus-safe projects’ by microfinance institutions is likely to have little effect on addressing problems in poorly performing loan portfolios or under-performing credit institutions. For example, if the main problem facing a lender is the temptation for borrowers to divert borrowed capital

Table 4. Policy implications consequences

Concern	Policy implications of traditional model	Policy implications of present bias model	Consequences of incorrect policy
Borrower selection	Screening should occur over borrower projects	Screening should occur over borrower entrepreneurialism	Emphasis on decreasing risk dissuades entrepreneurship
Borrower behavior	Repayment will be higher if borrowers have low risk projects	Repayment high if borrower fully invest in projects	Safe projects will not guarantee loan repayment
Borrower training	Borrowers should be dissuaded from undertaking risky projects	Borrowers should be encouraged to invest boldly and productively	Consumption-based moral hazard not addressed
Credit officer training	Train credit officers to screen risky borrower projects from portfolio	Train credit officers to encourage clients’ productive investment	Lender stifles entrepreneurial development among clients
Savings mobilization	No particular emphasis on savings versus household consumption	Encourage the self-discipline of regular savings by clients	Borrowers aren’t supported in developing savings discipline
Overall theme	Discourage risk-taking	Promote investment	Higher default rates

away from productive investment toward present consumption, an emphasis on ensuring that projects are 'safe' (say, in terms of variance in their gross returns) will be of little use in curtailing default.

Much of the more recent literature investigating credit market issues in developing countries and microfinance has explored self-control issues, nudges, and reference points as lying at the heart of savings and borrowing behaviour (Ashraf et al., 2006; Bertrand et al., 2005; Gugerty, 2007). Our experiment offers modest support to the newer behavioural-economics-based theories of borrower behaviour, although an experiment designed to test these theories directly would better incorporate the dynamics and time lag involved in the consumption versus investment decision.

Preliminary work from a separate experiment offers measured support for the idea that microfinance default may be associated with present bias. In a small study carried out among microfinance borrowers in Jordan, Start (2013) examines measures of riskiness and impatience and their relationship to microfinance default. In part of this study, borrowers were asked the question 'If you had two *Kanafeh* [a traditional Arab pastry soaked in a sweet syrup], would you eat both today, or eat one today and save the other for later?'. Microfinance borrowers with poor repayment records indicated they would eat the second *Kanafeh* today 41.7 per cent of the time, while borrowers with excellent repayment records indicated they would eat the second *Kanafeh* today only 23.3 per cent of the time. Although a regression on an aggregated index of impatience indicators is statistically insignificant, the result provides an encouraging avenue for future research.

While the implications of the Stiglitz and Weiss model for credit rationing and market failure would generally not be considered neo-classical, their model assumes a quality of borrower rationality to which much of the behavioural economics literature has offered strong empirical challenges. Further work that incorporates behavioural economics into its research methodology will lead to the development of more robust models that not only allow us to understand the nature of borrower behaviour in microfinance markets, but can be used to guide important policy questions faced by development practitioners.

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Notes

1. The complete experiment consisted of several other treatments designed to investigate other aspects of moral hazard and self-selection in group settings. These treatments and results are described in a companion paper (Barboni, Cassar, Rodriguez, & Wydick, forthcoming).
2. In practice, assortative matching by default risk may be adjusted, of course, for heterogeneities that might allow for risk sharing, as in Sadoulet (1999).
3. For example, see Cassar, Healy, and von Kessler (2010).
4. Payoffs from the experiments were given in experimental bolivianos at a conversion rate of 100 experimental bolivianos per actual boliviano. This was so experimenters could use integer numbers to make it easier for subjects. Subjects were informed about this conversion rate at the beginning and reminded throughout the session.
5. Using either first switch time or an average does make a significant difference on our results.
6. Given the relative low ratio of experimental sessions to subjects, it would be inappropriate to use clustered standard errors.

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