Microequity for Microenterprises: Evidence from an Artefactual Field Experiment and Survey

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Abstract

Access to finance is often listed as one of the most important constraints on the expansion of small firms in low-income countries. However, several recent studies reveal that most microcredit-funded businesses rarely grow beyond subsistence-level entrepreneurship. Other evidence shows that cash and capital grants have delivered high returns to some microenterprises, and that small changes to contract structure can have a long-term effect on investment and profits. In this paper, I investigate the potential of 'microequity' contracts, which can be viewed as lying at some point on a spectrum between credit and grants, and provide a more flexible form of capital with performance-contingent repayments and a greater sharing of risk and reward. I present results from work with two of the largest microfinance institutions in Pakistan to investigate the effects of microequity contracts on microenterprises. In the first part of the paper, I describe an artefactual field experiment, designed using a simple model of investment choice under different financial contracts. This is tested with microenterprise owners who are part of a related field experiment that provides them with shared-ownership financing to expand their business. Results reveal that equity-financed microenterprise owners chose investment options with a greater expected profit than those under debt financing, with heterogeneity analysis suggesting a larger effect for more risk-averse individuals. Given the potential benefits, in the second part of the paper I present results from a field survey to provide insights on the reasons why most microfinance institutions do not actually offer microequity products. Results reveal the practical implementation challenges related to costly state verification, adverse selection into income-sharing contracts and moral hazard caused by inappropriately-tailored profit-sharing ratios. In the final section of the paper, I discuss a number of projects that have been developed based on the insights from this paper, and which explore the implementation of equity-like contracts while taking into consideration the observability of performance, the unique agency problems inherent in offering performance-contingent contracts and the required institutional structure of the financing institution offering such contracts.

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1 Introduction

Access to finance is often listed as one of the most important constraints on the expansion of informal micro, small and medium enterprises in many low-income countries.[1] Many existing studies focus on the role of microcredit as a source of capital; other work complements this by considering the potential effect of microsavings and microinsurance. In this paper, I consider a different approach: 'microequity'. Microequity contracts, which involve performance-contingent repayments, have the potential to provide a more flexible form of capital that could more effectively stimulate growth for *some* microenterprise in developing countries. Microequity contracts may, relative to microcredit contracts, encourage higher risk and higher return investments, by providing a form of implicit insurance to microenterprises that automatically reduces repayment requirements when business conditions are challenging. This is in comparison to microcredit and microsavings products, which often have strict payment schedules (and, in the case of microcredit, relatively high interest rates). The effects could be particularly strong for microenterprise owners whose behavioural characteristics lead them to under-invest in profitable opportunities, such as those with higher levels of risk aversion. Such individuals may be more willing to choose riskier but higher expected-return investments when provided with the implicit insurance of microequity contracts, which mitigate the risk of losing their own wealth, compared to non-performance-contingent, fixed-repayment debt contracts. Microequity contracts also have the potential to serve hundreds of millions of low-income microentrepreneurs from the world's population of 1.6 billion Muslims, many of whom remain unbanked both by microcredit and microsavings products because of the religious prohibition on interest.

Initially, it was believed that microcredit would be an effective tool for encouraging entrepreneurship and growth of microenterprises. However, several recent studies have suggested that microloans have not had large benefits for most entrepreneurs and that microcredit-funded businesses rarely grow beyond a subsistence level of entrepreneurship. Banerjee, Karlan, and Zinman (2015) report on seven randomised evaluations of microcredit, using a variety of sampling, data collection, experimental design, and econometric strategies to identify causal effects of expanded access to microcredit on borrowers or communities.[2] They consistently find no transformative impact from microcredit. In particular, take-up rates were unexpectedly low, investments rarely resulted in increased profits, and none of the studies found a significant impact on average household income. Among several recommendations, Banerjee, Karlan, and Zinman (2015) identify the following key challenges for the next generation of microfinance studies: (i) investigating how innovations to microfinance contract structure can improve take-up rates and effectiveness; (ii) addressing the limited

[1] See Ayyagari, Beck, and Demirguc-Kunt (2007); Beck, Demirgüç-Kunt, and Martinez Peria (2008); Stein, Ardic, and Hommes (2013).

[2] See Augsburg, De Haas, Harmgart, and Meghir (2015); Tarozzi, Desai, and K. Johnson (2015); Duflo, Banerjee, Glennerster, and Kinnan (2013); Angelucci, Karlan, and Zinman (2015); Attanasio, Augsburg, De Haas, Fitzsimons, and Harmgart (2015); Crépon, Devoto, Duflo, and Parienté (2015); Karlan and Zinman (2011). Meager (2018) jointly estimates the average effect and the heterogeneity in effects across these seven studies using a Bayesian hierarchial model, and finds support for the conclusion that the average effect on household outcomes is close to zero, while there is some evidence of a positive effect for households with previous business experience.

evidence on repeat borrowers; and (iii) broadening our understanding of non-credit microfinance activities. In this paper, I aim to contribute to these objectives by investigating the viability of microequity contracts, which provide a more flexible form of capital with performance-contingent repayments and a greater sharing of risk and reward, using an artefactual field experiment and a field survey with two of the largest microfinance institutions in Pakistan.

Standard microcredit contracts are often characterised by high interest rates and immediate repayment requirements. While the majority of the results from the literature on microcredit have showed little effect from standard microcredit products on the growth of microenterprises, recent evidence reveals that small changes to contract structure, such as repayment grace periods, can have a long-term effect on profits and facilitation of lumpy investment.[3] Further, cash and capital grants have delivered high and sustained returns to at least some kinds of microenterprise.[4] Microequity contracts can be viewed as lying at some point on a spectrum between credit and grants, sharing characteristics of both, by providing capital with performance-contingent repayments.

This paper draws on the work of Fischer (2013), who uses theory and a 'lab-in-field' experiment to investigate the possibility that the structure of many existing microfinance contracts discourages risky but high-expected-return investments, with a particular focus on the difference between individual- and joint-liability microcredit contracts on risk-sharing and informal transfers between pairs of individuals who have been issued a loan. He also investigates the effect of a quasi-equity contract, in which partners who are given a loan also have profit- and loss-sharing enforced on them, and finds that this contract led to increased risk-taking and expected returns relative to all other contracts (both individual- and joint-liability debt contracts), and actually produced the lowest default rates.[5]

There are over 1.6 billion Muslims in the world, representing nearly a quarter of the global population. The religious prohibition on usury (*'riba'*) means that many Muslim microentrepreneurs remain unbanked both by microcredit and microsaving products.[6] An equity-based product, though not restricted to any one particular religion or group, has the potential to meet the demands of hundreds of millions of poor Muslims, many of whom reject conventional loan products on religious grounds.[7] Research from the Islamic Development Bank reports that in the six countries with the largest Muslim populations (Indonesia, India, Pakistan, Bangladesh,

[3] See Field, Pande, Papp, and Rigol (2013); Battaglia, Gulesci, and Madestam (2017); Barboni (2017).
[4] See De Mel, McKenzie, and Woodruff (2008); Fafchamps, McKenzie, Quinn, and Woodruff (2014).
[5] The major differences between this paper and Fischer (2013) are that Fischer's equity-like contract is itself a hybrid of a debt and equity contract that was implemented with participants in pairs, with the primary aim of studying informal risk sharing and transfers between these pairs of individuals. Other major differences include the characteristics of the sample: Fischer uses only females with relatively low incomes, and it is not clear how many of them were managing a business. In my context, all participants were growth-oriented microenterprise owners who had successfully graduated from previous loan cycles, reaching the upper limit of borrowing of $450, and had entered into an experiment that provided them with financing up to the value of $1,800 to expand their business with the purchase of a fixed asset using a shared-ownership contract.
[6] See El-Gamal, El-Komi, Karlan, and Osman (2014).
[7] See Nimrah, Michael, and Xavier (2008).

Egypt and Nigeria) the number of people living on less than $2 per day far exceeds half a billion.[8] Financial exclusion rates in India are as high as 80% for Muslims, compared to 20% for non-Muslims.[9] Recent reports by the World Bank and IMF discuss the benefits of risk-sharing products and call for innovations in equity-based contracts for micro-, small- and medium-sized enterprises.[10]

In the first part of the paper, I test a microequity contract using an artefactual field experiment, with microenterprise owners who were part of a broader field experiment, two-thirds of whom were randomly offered a relatively large amount of financing to purchase an asset for their business (using an 'equity-like', shared-ownership contract). The sample consists of growth-oriented microenterprise owners who had successfully graduated from previous loan cycles, reaching the upper limit of borrowing of $450 from Akhuwat, one of the largest microfinance institutions in Pakistan, and who had expressed an interest in expanding their business by purchasing a fixed asset up to the value of $1,800. As such, this experiment has greater external validity compared to most 'lab-in-the-field' studies because all participants are actual microenterprise owners making an important investment decision for their business. The experiment was designed based on a simple theoretical model, in which a utility-maximising agent makes investment decisions in discrete time. Financial contracts are then introduced to investigate investment behaviour under equity and debt. The model predicts that agents are more likely to choose higher-risk, higher expected-return investment options when financed with performance-contingent-repayment equity contracts, compared to investment decisions taken under a fixed-repayment debt contract. This prediction is stronger for more risk-averse agents. I demonstrate the robustness of these predictions to changes in the parameters of the model, which is then tested using the artefactual field experiment with microenterprise owners. Results from the experiment reveal that equity-financed microentrepreneurs chose investment options with a higher expected return than under debt financing, with an effect size of 0.40 standard deviations. Heterogeneity analysis with pre-specified variables reveals a treatment effect that is approximately 50% larger for the most risk-averse microenterprise owners, using a survey-based measure of risk aversion. Such individuals may under-invest in profitable opportunities due to their aversion to risk and losses; microequity contracts have the potential to stimulate profitable but more risky investment choices for this group of individuals through the implicit insurance inherent in performance-contingent repayments. However, while the welfare effects on this population of individuals could be significant, from a policy perspective microfinance institutions may not wish to provide such financing if those individuals who take the most risk under equity financing also tend to be those with the worst business management practices, education or cognitive ability. The results presented in the second part of the heterogeneity analysis help to mitigate such concerns: I find no evidence that microenterprise owners with lower business management practices, education or cognitive ability are those for whom equity contracts incentivise the greatest risk-taking relative to debt.

[8] See Obaidullah and Khan (2008).
[9] See El-Komi and Croson (2013).
[10] See World Bank (2012); Kammer, Norat, Pinon, Prasad, Towe, and Zeidane (2015).

Following on from the positive results in the artefactual field experiment, the second part of the paper provides some insights for why large microfinance institutions (MFIs) do not typically offer microequity contracts alongside other products in their portfolios. Given the stated objectives of many microfinance institutions to consider borrower welfare as well as profits, it seems surprising that no large microfinance institution appears to be implementing microequity contracts, given the potential benefits, in particular for individuals whose risk aversion may lead them to under-invest, and given the evidence that those individuals are not characterised by the lowest levels of business management practices, education or cognitive ability. To investigate this, I report on an attempt by the National Rural Support Program (NRSP), another one of the largest microfinance institutions in Pakistan, to implement microequity contracts with microenterprise owners in the field. Results from a detailed client survey and a post-survey focus group with senior management reveal the significant challenges of implementing equity-based contracts within a conventional microcredit organisation. I find that, while contracts were initially implemented with profit- and loss-sharing, gradually clients and loan officers abandoned the performance-contingent payment features and converged back to a model of fixed-repayment debt contracts. Interviews with senior management and loan officers uncover key reasons for this convergence, which echo results from theoretical work that has investigated the difficulties in implementing performance-contingent contracts, such as equity or sharecropping, due to costly state verification, adverse selection and moral hazard.[11]

The second part of this paper reveals two major insights. First, from the supply-side, the main challenge of implementing equity-like contracts was related to the organisational structure of a conventional microfinance institution: specifically, how loan officers are incentivised. Loan officers in the study reported that they were familiar with disbursing a relatively high volume of loans and focusing the majority of their efforts on maximising the repayment rate of their loan portfolio, based on which they are paid a bonus.[12] Loan officers did not have much incentive to finance higher-return, higher-risk microentrepreneurs by providing them with a product that contained possible loss-sharing, especially because the loan officer would not themselves benefit from the upside portion of the entrepreneur's payment. Further, loan officers reported that it took much added effort to monitor microenterprises and their profits and losses, on which they had to calculate shared payments. These results provide some support for the theoretical result of Townsend (1979), who shows that under costly state verification the optimal financing mechanism is a standard debt contract, rather than performance-linked contracts that require the capital provider to monitor the microenterprise.

The second major insight relates to the incentives of microfinance clients themselves in the implementation of profit-sharing contracts. Results from the survey and interviews illustrate that many microenterprise owners had serious objections to the profit-sharing rule used in the contracts when they were originally implemented. A common sharing rule of 20-80 was applied by the MFI – where the microenterprise shared 20% of its

[11] See Townsend (1979); Stiglitz and Weiss (1981).

[12] Note that this could also lead to an incentive to re-finance the loan of a client who is performing poorly, rather than investigating whether their business is worthy of being re-financed.

monthly profits – but this led to the most profitable microentrepreneurs having to share too much of their profits and thus the equity product, ironically, appeared to them to be very 'inequitable'. Once again, it was beyond the remit and incentives of loan officers to spend a large amount of time auditing the accounts of the microenterprise and carefully tailoring the sharing ratio based on expected profits and losses of the business after the capital injection. Over time, loan officers and clients mutually agreed to remove the performance-contingent aspect of the contracts, which converged to a fixed repayment schedule. Had NRSP maintained performance-contingent contracts alongside fixed-repayment contracts, a serious problem of adverse selection may have developed, with the most profitable microenterprises deciding to re-negotiate to a debt contract, and the least profitable ones remaining on performance-contingent contracts. Hence, the decision taken by NRSP management to revert all contracts back to a standard fixed repayment schedule appears to have been appropriate. This decision to move back to debt-like contracts also appears prudent in light of the potential adverse consequences of moral hazard. Since a 20-80 sharing ratio was considered inappropriate by some of the more profitable businesses, in that they were obliged to share too much of their profits, had NRSP not renegotiated the contract then it could have created negative incentives for those microenterprises stuck on 'unfair' sharing ratios. This may have encouraged them either to exert less effort – for instance if they equated their marginal disutility of effort with their share of their marginal product rather than total marginal product – or to simply understate their profits, which would be difficult to detect due to costly state verification.

Intriguingly, NRSP branch managers also observed that, even though the contracts originally maintained a 'downside option' that did allow for loss-sharing ex-ante, in practice no entrepreneurs ever exercised this loss-sharing option. This was due to a fear that if they did not meet their expected payment every month, it would adversely affect their standing with the bank, which may hinder their ability to borrow in the future. Therefore, fears regarding reputation and dynamic incentives actually led to microenterprise owners not exercising their loss-sharing option, even when NRSP had explicitly allowed it. In summary, these findings from the survey of NRSP clients suggest that it is very challenging to implement equity-based contracts within a conventional microcredit organisation. The major constraints relate to the incentives of microcredit loan officers and those of clients, as discussed in earlier theoretical work on optimal financial contracts in the presence of asymmetric information and costly state verification. These are compounded by the related problems of adverse selection (the most profitable microenterprises selecting out of equity contracts) and moral hazard (distortionary effects caused by inappropriately chosen income-sharing ratios).

Nevertheless, given the positive results from the artefactual field experiment, and the eagerness of some of the largest microfinance institutions in the world such as NRSP and Akhuwat to implement microequity contracts, there appears to be some potential for establishing alternative 'venture capital-like' funding models. Insights from this paper suggest that these would need to be operated separately from the conventional operations of a microcredit institution, with the aim of providing risk-sharing capital for promising growth-oriented microentrepreneurs. In Sections 6 and 7, I discuss the potential design of such a financing model, links to the broader literature on entrepreneurial finance and venture capital, and some examples of recents attempts to

innovate in this direction.

The remainder of the paper proceeds as follows. In Section 2, I outline the simple model that was used to design the artefactual field experiment, which is described in Section 3, and for which results are presented in Section 4. Section 5 presents results from the field survey of NRSP clients, Section 6 discusses some recent attempts to implement innovative equity-based contracts in the field, based on the insights from this paper, and Section 7 concludes.

2 A simple model of contract structure and investment choice

2.1 General setup

In this section, I outline a simple model in which an agent makes a series of investment decisions in discrete time. I describe the general setup of the model, how financial contracts are introduced (debt and equity), and the model's predictions for the behaviour of agents under the financial contract 'treatments'. The model forecasts that agents are more likely to choose investment options with a higher expected return (and higher risk) when financed with the equity contract, compared to the debt contract. This prediction is stronger for more risk-averse agents. I demonstrate the robustness of these predictions to changes in the structure of the model. This model is then used to design the experiment that is outlined in Section 3, which is implemented with microenterprise owners who are part of a large field experiment, in order to test the effect of financial contracts on investment choice.

In the model, the agent begins the game with initial wealth w_1, and makes an investment choice in each decision round. There are T decision rounds; in each round the agent chooses from a set of j investment options, with each investment option having: (i) a good outcome g_j; and (ii) a bad outcome b_j. The bad outcome always has a payoff of zero ($b_j = 0$), while the good outcome has some positive payoff ($g_j > 0$). Each outcome is equally likely. I define a payoff matrix with each row corresponding to one of the j investment options pairs (b_j, g_j). Each of the j investment options also has an associated cost, c_j. The agent chooses investment options that maximise their expected utility, subject to the constraint that their current wealth is sufficient to pay for the chosen investment option. The agent is assumed to have a constant relative risk aversion (CRRA) utility function over wealth w_t:

$$u(w_T) = \frac{w_T^{1-r} - 1}{1 - r} \tag{1}$$

where r is the coefficient of relative risk aversion (CRRA) (and $u(w_t) = \ln w_t$ if $r = 1$). Backward induction

is used to solve the model for the optimal decisions of the agent. I begin by defining a 'wealth grid' at the terminal period T, with $[w_{T,1}, w_{T,2}, ..., w_{T,MAX}]$ representing gradually increasing values on the discretised state space for wealth, and $w_{T,MAX}$ the maximum possible wealth at T.[13] Similarly, wealth grids are created for all periods $t = 1, 2, ..., T-1$. A 'value grid' is then created for each period t, where each point on the value grid represents the utility from the corresponding point on the wealth grid at time t, based on the utility function in equation 1: $[u(w_{t,1}), u(w_{t,2}), ..., u(w_{t,max})]$. This therefore represents a discrete choice dynamic programming problem with wealth w_t as the state variable and the investment decision as the choice variable. The objective is to fill in each of these value grids, starting from the last period, and working back one period at a time. The model is solved by backward induction; in the final period T, the agent chooses the investment option that maximises their expected utility. This optimal choice of investment option is computed for every possible starting wealth level on the $T-1$ wealth grid, which leads to a vector of optimal investment choices, for each possible wealth level w_{T-1}. This is then repeated for the $T-2$ wealth grid, and so on, until period $t = 1$. This provides an optimal solution grid for each agent, based on their CRRA parameter r. Having solved the model backwards, it is then possible to 'simulate forwards' in order to generate predictions for investment choices made by agents with different levels of risk aversion, which is outlined in Sections 2.3 and 2.4.

2.2 Adding financial contracts

Each game is played under a different financial contract environment, described below, which affects the amount of capital with which the agent begins and the terminal payoffs at the end of the game. These different environments correspond to the 'treatment arms' in the experiment described in Section 3:

Control Treatment (CT): The control treatment is the baseline scenario, upon which different financial contract treatments are added. In the general setup, an agent begins period $t = 1$ with initial capital w_1. The agent can then choose any of the affordable j investment options; in period $t = 1$, they can afford any investment option with cost $c_j \leq w_1$. The agent selects the optimal investment option and pays the cost. The outcome of the investment option is then realised, with the agent carrying forward to the next round their initial wealth w_1, minus the cost of the investment option that they chose c_j, plus the payoff from the investment option that they chose (b_j or g_j, with equal likelihood). The game proceeds in the same manner for T rounds, after which it ends and the agent keeps whatever wealth is remaining.

Debt Treatment (DT): In the debt dreatment, the agent begins with the same initial capital w_1 as in the control treatment, but they also receive an additional amount of capital k in the form of a zero-interest loan (the debt contract with which the microenterprise owners in the experiment are most familiar).[14] At the end

[13] Calculated as the number of previous rounds ($T-1$) multiplied by the maximum payoff from the set of j investment options (g_j).
[14] The MFI partner in this artefactual field experiment and the larger field experiment, Akhuwat, predominantly lends at zero interest.

of the T rounds, the loan of k must be repaid in full. The main purpose of the debt treatment is that it mimics 'external financing' that is required by the agent to invest in higher expected-return investment options, which also cost more, and which the agent cannot afford when their initial wealth level is w_1 (as in the control treatment).

Equity Treatment, 50-50 Sharing (ET1): In the first equity treatment, the agent also begins with w_1 and an additional amount of capital k. However, the additional capital k is now given in the form of equity-based financing. The equity capital does not have a fixed repayment obligation at the end of the game, which is the requirement of the loan in debt treatment. Instead, there is a requirement to share all the wealth that is left at the end of the game in a 50-50 ratio (the agent keeps 50% of the remaining wealth, and shares 50%; this includes the initial wealth w_1 that they were given as starting capital).

Equity Treatment, 75-25 Sharing (ET2): The second equity treatment is identical to ET1, except that the sharing ratio at the end of the game is 75-25 (the agent keeps 75% and shares 25%).

For the financial contract treatments, an adjustment to the terminal wealth is made at the end of the game to meet all payment requirements (repaying the loan for the debt treatment, or sharing the required amount for the equity treatments). Equation 2 nests the different financial contracts:

$$Y_{T+1} = W_{T+1} - \delta.k - \alpha.\gamma.W_{T+1} \tag{2}$$

where Y_{T+1} is the total final payoff for the agent, $\delta \in \{0, 1\}$ is an indicator variable for the debt contract DT, $\gamma \in \{0, 1\}$ is an indicator variable for the equity contract ET and $\alpha \in \{0.5, 0.25\}$ controls the sharing ratio for ET. For example, when $\delta = 0$, $\gamma = 1$ and $\alpha = 0.25$ the 75-25 sharing equity contract (ET2) is activated.

2.3 Model predictions

To summarise the setup of the model, the objective for agents is to select investment options to maximise their expected utility from wealth, subject to the constraint that they must have sufficient wealth to choose the investment options (with the additional financial contract treatments relaxing the budget constraint by providing external capital at the start of the game). Agents are assumed to know the full structure of the game, including the fixed number of rounds and investment options, that each investment option is equally likely, and the terms of the debt and equity contracts. In terms of heterogeneity of preferences, all agents are assumed to be expected utility maximisers, but they vary in their coefficient of relative risk aversion. The solution method is backward induction.

Thus far, the model has been outlined in general terms. Section 2.2 describes results from simulations that demonstrate the robustness of the final model predictions to a changing of the values of the key model parameters. The result of the analysis, and extensive testing of the game in the field, is a final preferred structure for the game, which is used in the design and implementation of the final experiment described in Section 3:

(i) Two rounds in the game;

(ii) Initial capital w_1 of 200 and external capital k of 500;

(iii) Five investment options (monotonically increasing in risk-return, as illustrated in Figure 1).

Figure 1: INVESTMENT OPTIONS

Investment Option	Cost	Bad Payoff	Good Payoff	Expected Payoff	Net Expected Return
1	0	0	100	50	50
2	100	0	400	200	100
3	200	0	700	350	150
4	300	0	1000	500	200
5	400	0	1300	650	250

Note: Each row represents one of the five possible investment options, along with the cost of each option and the payoff in each of the two possible states. The expected payoff and the expected payoff net of cost are also displayed, but were not shown to the participant in the final activity.

The final model predictions can be summarised as:

Hypothesis 1 *In general, agents take more risk under equity financing.*

Hypothesis 2 *More risk-averse agents take more risk under equity financing.*

Figure 2 illustrates the optimal solution grid for the model under the preferred game structure. Each row represents the optimal investment choice, as solved for in the model, for different values of the CRRA parameter of the agent. CT, DT, ET1 and ET2 refer to the four different treatments. Each entry is a number between 1 and 5, representing the choice between the five investment options listed in Figure 1. For each treatment, there are three columns, which represent:

(i) The optimal investment choice in round 1;

(ii) The optimal investment choice in round 2, if the *bad* outcome occurred in round 1;

(iii) The optimal investment choice in round 2, if the *good* outcome occurred in round 1.

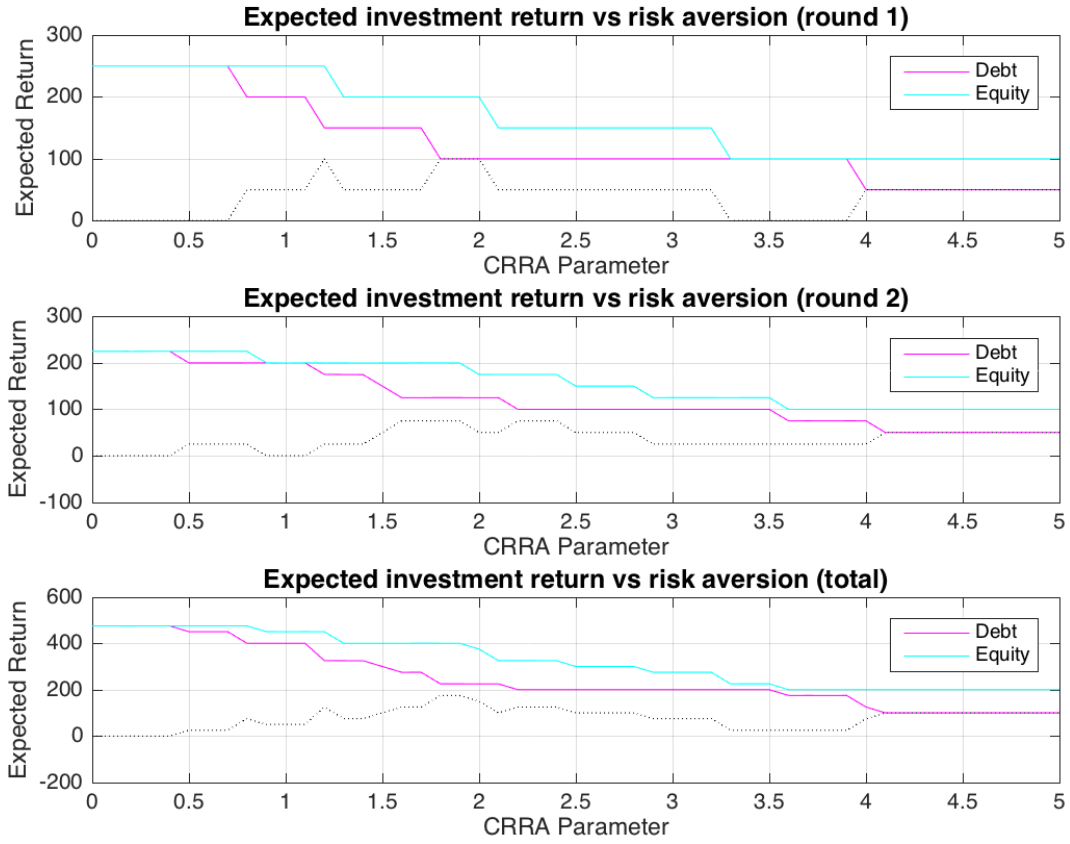
Figure 2: MODEL SOLUTION GRID

	CT	CT	CT	DT	DT	DT	ET1	ET1	ET1	ET2	ET2	ET2
CRRA	1	2_b	2_g	1	2_b	2_g	1	2_b	2_g	1	2_b	2_g
0.0	3	1	5	5	4	5	5	4	5	5	4	5
0.1	3	1	5	5	4	5	5	4	5	5	4	5
0.2	3	1	5	5	4	5	5	4	5	5	4	5
0.3	3	1	5	5	4	5	5	4	5	5	4	5
0.4	3	1	5	5	4	5	5	4	5	5	4	5
0.5	3	1	5	5	4	5	5	4	5	5	4	5
0.6	3	1	5	5	4	5	5	4	5	5	4	5
0.7	3	1	5	5	4	5	5	4	5	5	4	5
0.8	3	1	5	4	4	5	5	4	5	5	4	5
0.9	3	1	5	4	3	5	5	4	5	5	4	5
1.0	3	1	5	4	3	5	5	4	5	5	4	5
1.1	2	2	4	4	3	5	5	4	5	5	4	5
1.2	2	2	4	3	3	4	5	4	5	5	4	5
1.3	2	2	4	3	3	4	5	4	5	5	4	5
1.4	2	2	3	3	2	4	5	4	5	4	4	5
1.5	2	2	3	3	2	4	5	4	5	4	4	5
1.7	2	2	3	3	2	4	5	4	5	4	3	5
2.0	2	2	3	2	2	3	4	4	5	3	3	4
2.5	2	2	2	2	2	2	3	3	4	3	2	3
3.0	2	2	2	2	2	2	3	3	3	2	2	3
3.5	2	2	2	2	1	2	3	2	3	2	2	2
4.0	1	1	1	1	1	1	2	2	2	2	2	2

Note: Each number represents the optimal investment choice for an agent with a given coefficient of relative risk aversion (CRRA) and under a given treatment environment.

As can be seen in Figure 2, the optimal solution implies greater risk-taking in the equity treatments, ET1 and ET2, than the debt treatment DT. This is reflected in Figure 3, which illustrates results from simulations of the model, pooling together the two equity treatments. Each point represents the coefficient from a regression of the expected return of the investment options chosen by an agent with a given CRRA parameter on treatment indicator variables (an OLS regression without a constant). The top two panels illustrate simulated results for the investment decisions made in the first round and second round respectively, with the bottom panel displaying the sum of the two decision rounds. In each round, it can be observed that a risk-neutral agent takes the same amount of risk under both debt and equity contracts, but for agents with CRRA parameters above 0.5 there is relatively less risk-taking under debt contracts. The gap between risk-taking under equity and debt is largest in the intermediate range of illustrated CRRA parameters, while the effect for the most risk-averse people is relatively smaller but still positive in the direction of greater risk-taking under equity.

Figure 3: SIMULATED RESULTS



Note: The grey dotted line plots the risk-taking under equity minus risk-taking under debt. Simulations were done in MATLAB with a simulated sample of size 300 and 300 simulations, with regressions being run for each simulated dataset. Results are also stable and similar for a lower number of simulations and smaller sample size.

2.4 Robustness simulations

Tables 15 - 19 of the appendix illustrate results from a number of simulations, which reveal the robustness of the model's predictions to changes in key parameters. Each simulation is done with results compared to the 'baseline' specification that was implemented in the final experiment: two decision rounds, five investment options to choose from each round, starting capital of 200 and additional capital of 500 for the financing contracts.

Number of decision rounds: Table 15 presents simulated results when the number of decision rounds in the game is changed from two to three, five, seven and ten. Results are qualitatively the same, and based on logistical reasons and a desire not to over-burden participants, the final design included only two rounds.

Number of investment options: Table 16 illustrates results using three, seven and ten investment options respectively. Again, predictions do not qualitatively change. Based on piloting, it was decided that five investment options provided the optimal trade-off between client comprehension and offering sufficient variation in choices.

Initial wealth level: In Table 17, the initial level of starting capital w_1 was sequentially increased. While results reveal the same pattern of equity-financed agents taking more risk than debt-financed agents, with the effect positive for more risk-averse agents (before tailing off for the most risk-averse agents), the CRRA region in which the effect is largest shifts to the right as the initial wealth level is increased. This is an intuitive result, given that the assumed utility function exhibits constant relative risk aversion (CRRA), which implies decreasing absolute risk aversion (DARA), such that an agent who experienced an increase in wealth should increase their absolute level of risk-taking. Although not illustrated in Table 17, when comparing risk-taking for each of the two treatment contracts relative to the control group, who do not get access to the additional capital of 500, it can be seen that the effect is smaller as the initial wealth level is increased. Again, this is quite an intuitive result, as less 'value' is added by the external capital treatments when the agent begins in a wealthier state. Nonetheless, the overall effect of greater risk-taking under equity than debt persists, with the difference increasing in risk aversion up to a certain CRRA coefficient where it begins to decrease but remains positive.

Amount of external capital: Table 18 illustrates simulated results for different values of the external capital amount k. Results remain qualitatively similar, although the effect size when the external capital amount is smallest decreases, as would be expected. It should be noted that there are potentially large differences in the welfare implications of the two financial contracts. For example, if the external capital amount is very low, the equity contracts begin to look rather 'unequal', since agents are provided with very little capital yet they are required to share a large amount of the firm's value at the end of the game.

Finally, Table 19 presents simulations of the terminal wealth at the end of the game for the two treatments. Results show that the equity contracts are not unambiguously 'better' than the debt contracts in terms of expected terminal wealth; in particular, for risk-neutral agents and those with a CRRA coefficient up to 0.5, expected terminal wealth is the same under both debt and equity contracts. For higher levels of risk aversion, equity-financed entrepreneurs do end with higher terminal wealth, as would be expected given the observed greater risk-taking.

3 Experimental implementation

In this section, I describe the setup of the artefactual field experiment, which was designed to test the predictions of the model set out in Section 2, and to coincide with a broader field experiment conducted with

growth-oriented clients from one of the fastest growing microfinance institutions in Pakistan to help them finance business expansion. Akhuwat is based in Lahore and operates in 775 branches across Pakistan, with over 930,000 active borrowers and an outstanding loan portfolio of PKR 15.6 billion (approximately USD 135 million).[15] The sample consisted of microenterprise owners who had successfully completed at least one loan cycle with Akhuwat, and who had expressed an interest in expanding their business by purchasing a fixed asset. Individuals were invited to a half-day workshop, where a baseline survey was conducted and the new shared-ownership microfinance contract was explained to them (after this session, two-thirds of participants were randomly offered this new contract to finance an asset for their business, up to the value of $1,800). During the workshop, and after the baseline survey, enumerators conducted a detailed session of behavioural games, with the microequity game, based on the model in Section 2, as the main activity.

3.1 Summary statistics for microenterprise owners

Table 1 presents summary statistics for the microenterprise owners who participated in the study. 90% were male, with an average age of 38 and seven years of formal education. 84% were married, and the average household size was six, of which two people were typically earning some form of income. 62% of participants were themselves the head of the household, with a further 22% as the son or daughter of the household head, and 8% as the husband or wife of the head. In terms of business characteristics, the mean number of businesses in the household was 1.2, with a median of 1. The average number of years of experience in that business was 9.6. The mean number of employees was 1.1, with a median of 0. Average monthly business profits were approximately US$ 253, with a median of $217, and average total fixed assets were $1,175 (median $395). Average monthly household income from all sources was $560 (median $350), and average monthly household expenditure was $218 (median $185). The most popular business sector was rickshaw driving (20%), followed by clothing and footwear production (10%), food and drink sales (8%), and retail trade in the form of fabric and garment sales (6%). As a comparison to two of the most prominent studies on microenterprises, average microenterprise profits in De Mel, McKenzie, and Woodruff (2008) were 3,850 Sri Lankan Rupees (approximately $25 at current market rates) and 125 Ghanaian Cedis ($27) in Fafchamps, McKenzie, Quinn, and Woodruff (2014). The average microenterprise owner in this current study is larger in terms of business profits than the two most prominent microenterprise-focused studies, which is unsurprising given that the wider field experiment targets growth-oriented microenterprise owners who had successfully completed previous loans and were looking to finance an asset for business expansion up to the value of $1,800. The seven microcredit field experiments summarised in Banerjee, Karlan, and Zinman (2015) contained a mixture of microenterprise-targeted products and ones with no restrictions. The most relevant comparisons would be Tarozzi, Desai, and K. Johnson (2015), who worked with a microenterprise-targeted loan product in Ethiopia with an approximate value of $500, Karlan and Zinman (2011), who offered approximately $220 to microenterprises in the Philippines, and Angelucci,

[15] Information is correct as of 03 April 2018.

Table 1: AKHUWAT SAMPLE: SUMMARY STATISTICS

	Mean	SD	10th Pctile	Median	90th Pctile	Obs.
Gender	0.1	0.3	0.0	0.0	0.0	718
Age	38.0	10.3	26.0	37.0	52.0	718
Education	7.4	3.7	0.0	8.0	12.0	718
Married	0.8	0.4	0.0	1.0	1.0	718
Household size	6.3	2.8	4.0	6.0	9.0	718
Household earners	2.0	1.2	1.0	2.0	4.0	718
Number of businesses	1.2	0.6	1.0	1.0	2.0	718
Business experience	9.6	8.1	2.0	7.0	20.0	718
Number of employees	1.1	3.1	0.0	0.0	3.0	718
Monthly profits	25,327.7	18,005.6	7,500.0	21,666.7	48,333.3	718
Total fixed assets	117,513.5	310,687.7	0.0	39,500.0	250,000.0	718
Household Income	55,967.2	73,649.0	0.0	35,000.0	120,000.0	718
Household Expenditure	21,785.4	17,266.5	9,500.0	18,450.0	36,000.0	718

Karlan, and Zinman (2015), who offered approximately $450 to Mexican microenterprises.

3.2 Eliciting risk preferences and loss aversion

Microenterprise owners who had expressed an interest in expanding their business with a fixed asset were invited to a half-day workshop, where a baseline survey was conducted. Prior to the microequity game, behavioural games were conducted to measure risk preferences and loss aversion, in order to provide measures for the analysis of heterogeneous treatment effects.

The first measure of risk aversion was survey-based, in which each respondent was asked the following four questions:[16]

(i) *"How would you rate your willingness to take risks in financial matters?"*;

(ii) *"How would you rate your willingness to take risks in your occupation?"*;

(iii) *"How would you rate your willingness to take risks when it comes to having faith in other people?"*;

(iv) *"How do you see yourself? Are you generally a person who is fully willing to take risks or do you try to avoid taking risks?"*.

The questions were adapted from Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner (2011), who used a large sample to show that responses to the survey-based measure were a reliable predictor of actual risky behaviour in incentivised risk preference elicitation activities. The authors argue that relatively simple

[16] Responses were given on a scale of 1 to 10, with 0 representing 'risk-averse' and 10 for 'fully prepared to take risks'.

survey-based measures, compared to often quite complex paid lottery experiments, are easy to use, cheap to administer, and deliver a behaviourally valid measure of risk attitudes, which maps onto actual choices in risk preference elicitation activities with real monetary consequences.

I complemented the survey-based measure of risk aversion with an incentive-compatible measure, using a method that provided the best trade-off between comprehension and quality of data for this population of microenterprise owners, as discovered through extensive piloting.[17] The final incentivised risk preference elicitation activity can be characterised as a 'certainty-equivalent method'.[18] Respondents were posed a series of 30 questions, where they were required to choose between a certain amount of money or an uncertain investment option, which had two possible outcomes: (i) a 'bad' outcome, with a payoff of zero; or (ii) a 'good' outcome, with a payoff of PKR 1,000 ($9).

In the risk preference elicitation activity, there were three sets of ten questions. Each of the three sets had a different probability of a good outcome and bad outcome, which was illustrated using four coloured balls. In the first set of 10 questions, participants were shown a bowl that contained four balls: one green and three white. This reflected a probability of the good outcome of 25% (winning PKR 1,000) and 75% for the bad outcome (receiving nothing). Participants were also shown a sheet to graphically illustrate the possible outcomes for the uncertain option. Participants were asked to choose between the uncertain investment option (which had an expected value of PKR 250, although no mention of expected values was made to participants) and a certain payment of money. For example, in the first question, they were presented with a certain payment of zero versus the uncertain option.[19] In the second question, participants were offered a certain payment of PKR 100 or the uncertain option. The response recorded by enumerators, who explained the activities carefully and conducted a number of practice rounds with participants to test understanding, was either a '1' (if the participant selected the certain payment for that question) or a '0' (if the participant took the risk of the uncertain investment option). As such, for this first set of 10 questions, each participant finished with a score between 0 and 10, with a higher number indicating a higher level of risk aversion (choosing the certain payment more often). Most participants would be expected to initially choose the

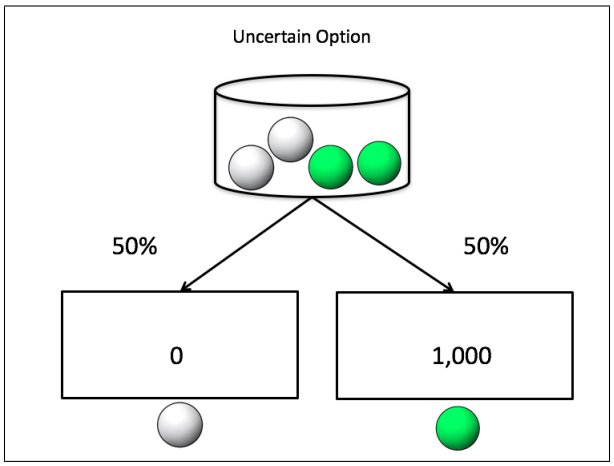
[17] I previously tested the well-known Ordered Lottery Selection design, which was developed by Binswanger (1981) and used by many authors, such as Fischer (2013), but decided against it for two main reasons that are explained in more depth in Harrison and Elisabet Rutström (2008): (i) probabilities are restricted to 0.5, which does not allow one to make inferences about probability weighting, which plays a major role in alternatives to Expected Utility Theory, such as rank-dependent utility models; and (ii) the use of a certain amount for the first investment choice may frame the investment choices in a way that makes them 'sign-dependent', such that the certain payment provides a clear reference point from which participants may identify gains and losses. I also tested other more sophisticated risk preference elicitation methods, such as the well-known Multiple Price List (MPL) design of Holt and Laury (2002), where subjects were presented with a choice between two binary lotteries, and the probabilities on each lottery were varied for different decisions. Based on piloting, I considered this risk elicitation method to be too complicated for the population at hand, which would have resulted in a large portion of the data needing to be discarded due to a lack of participant comprehension.

[18] I adapted the measures used by Barr and Packard (2002) and Vieider, Lefebvre, Bouchouicha, Chmura, Hakimov, Krawczyk, and Martinsson (2015).

[19] This was essentially a test of comprehension, since no-one was expected to accept a certain payment of zero versus an uncertain option with a non-zero expected value and a minimum payoff of zero.

uncertain investment option (compared to a certain payment of zero) but, at the point of a sufficiently high certain payment being offered, would switch to choosing the certain investment option. After switching, they would then be expected to accept all greater amounts for the certain payment rather than the uncertain investment option. While participants were in principle allowed to make 'multiple switches', which means switching back to preferring the uncertain option compared to a greater certain payment, this would be a clear sign of lack of comprehension of the activity.[20]

Figure 4: DEMONSTRATING THE UNCERTAIN INVESTMENT OPTION



In the second set of 10 questions, the mix of balls was changed to two green and two white, reflecting an equal probability of the good or bad outcome. The same set of 10 questions was then asked: *"Do you prefer x for certain or the uncertain investment option?"*, where x increased from 0 to 1,000 in increments of 100, with real money being used for display purposes. In the third set of 10 questions, the mix of balls became three green balls and one white ball, reflecting a probability of the good outcome of 75%. At the end of the activity, it was possible to construct a risk aversion index with a number between 0 and 30 for each respondent, with higher numbers reflecting greater risk aversion.[21] Before the activities were conducted, some non-inentivised questions to check the cognitive ability of participants were also asked.[22]

Having elicited risk preferences using two separate measures, the final activity elicited possible loss aver-

[20] Collected data reveal that there was relatively little multiple switching (less than 3%), which likely reflects many practice rounds and careful explanation, as well as the participants knowing that their inputted data was being monitored on a regular basis. Sessions were conducted in a large hall in and under the monitoring of up to three research assistants and one of the principal investigators on the project. The data was collected using tablets and uploaded to SurveyCTO immediately after each survey. A project manager was then able to download and check the data to monitor collection and detect errors, which addressed by directly contacting the responsible enumerator.

[21] The purpose of varying the probability of a good outcome was to allow for testing of non-linear probability weighting in future work.

[22] These included number recall exercises, simple calculations and questions to test understanding of probabilities when drawing balls from a bag, which was the format used to explain probabilities throughout the activities.

sion.[23] Individuals were presented with a series of investment decisions, which they could either accept or reject. Each was a binary equal-probability lottery, with the 'good' payoff being a positive value of PKR 1,000, and the bad payoff being some negative number x. x started at a low number (- PKR 100) and the individual had to decide whether they would accept or reject a binary lottery that either paid PKR 1,000 or led to a loss of PKR 100. If a loss was incurred in the activity, then the amount of loss would be taken from the individual's participation fee of PKR 1,000; as such, it was a 'real' loss that was being considered. The next question required the participant to accept or reject a binary lottery that either paid PKR 1,000 or led to a loss of PKR 200. A rejection was coded as '1' and an acceptance as '0'. 10 such questions were asked, with the loss amount increasing by PKR 100 each time. In the end, each individual had a score between 0 and 10, which indicated how many of the 10 investment options they rejected, and provided an incentive-compatible measure of loss aversion for the microenterprise owner.

Before conducting all activities, participants were informed that, at the end of the behavioural games session, one of the incentivised activities would be selected for payment by physically drawing a ball from a bag. Within the selected activity, balls would be drawn to select the one final question that would be used for payment. As such, participants were required to answer all questions attentively, because any question could have been selected. This method also allowed the use of payment amounts that were relatively large, with the average payment being approximately three times as large as median daily business profits for microenterprises in the sample. From a methodological perspective, Charness, Gneezy, and Halladay (2016) show that paying for only a (randomly selected) subset of all activities is at least as effective as paying for all of them, and can actually be more effective in terms of helping to avoid wealth effects and hedging within the behavioural games session. Further, compared to most other 'lab experiments', which have been criticised as not accurately reflecting behaviour in the field for a number of reasons including 'small stakes' and unrepresentative student samples,[24] the experiment in this paper uses a highly relevant population. These individuals were all growth-oriented microenterprise owners who were taking part in a large field experiment that randomly offered two-thirds of them a large amount of financing for a fixed asset; therefore, concerns about attentiveness are significantly reduced and payment amounts are relatively large.[25]

3.3 Basic structure of the microequity game

Following the risk preference elicitation activity, the microequity game was conducted. Before learning the structure of the game, participants were carefully introduced to the concept of the game using a vignette. This described the story of an entrepreneur who was starting a new business, which would then be closed after a period of two years due to their need to migrate to another city. The entrepreneur in this vignette began with some amount of wealth, and had the possibility of obtaining additional financing through external capital,

[23] I adapted the measure used by Bartling, Fehr, and Herz (2014).
[24] See Levitt and List (2007).
[25] The average payment amount was approximately $20.

either in the form of: (i) a zero-interest loan, to be paid at the end of the two years; or (ii) equity capital, which required a 50-50 or 25-75 sharing of all that was left in the business at the end of the two years. A number of example scenarios for the value of the firm at the end of the two years were described, as well as an illustration and calculation of the required payments under the different financial contracts. Finally, participants were tested on their understanding of the contracts, using similar examples but with different numbers for the value of the firm at the end of the two years (specifically, one scenario where the firm was very profitable, and one scenario where it was not profitable); participants were then asked to calculate the required payment under the different contracts.

Following the introduction to the concept of raising external capital in the form of debt or equity, and how one calculated the terminal payoffs at the liquidation of the firm (which was analogous to the terminal payment at the end of the proceeding microequity game), participants were introduced to the final microequity game activity. As mentioned, the microequity game was designed to match the structure of the model described in Section 2:

(i) Two decision rounds: in each round, one of the five different investment options had to be chosen, conditional on it being affordable; participants were only allowed to use money provided to them in the game;[26]

(ii) Starting capital of 200 for the control treatment (CT);

(iii) Additional capital of 500 for the debt treatment (DT), to be repaid at the end of the second round;

(iv) Additional capital of 500 for the equity treatment (ET), which required sharing of all money remaining at the end of the second round using a 50-50 or 25-75 split.

3.4 Strategy method

I used a strategy method to elicit second-round investment decisions, rather than having participants choose an investment option for round 1 and then actually drawing a ball from a bag to determine the outcome (after which they would have had to make their second round decision). As well as providing twice as much second-round information,[27] the strategy method mitigated undesirable behaviour whereby a person who chose a number that led to a good outcome would perceive something 'lucky' about that number and continue

[26] The microequity game, as well as all behavioural games, used real monetary notes for both demonstration purposes and the final decisions. Piloting suggested that the use of paper tokens reduced the seriousness with which participants viewed the activity. Further, all numerical values corresponded to actual amounts in Pakistani Rupees (PKR), to avoid confusion mapping from game units to real units. As mentioned, the procedure of only paying out for one activity at the end of the workshop allows for the use of relatively large payment amounts for each activity.

[27] If one used the actual realisation of first-round outcomes to frame the second-round decision, one counterfactual second round decision would never be observed.

to choose it in the second round, regardless of their underlying preference over the risk and return of the different options.[28] Participants were initially asked to make their choice of investment in round one from one of the five investment options illustrated in Figure 5. Participants were informed that each investment option had a cost, and once that cost had been paid, each investment had an equally-likely good or bad outcome, as demonstrated using Figure 6. Participants were then asked the following two questions:

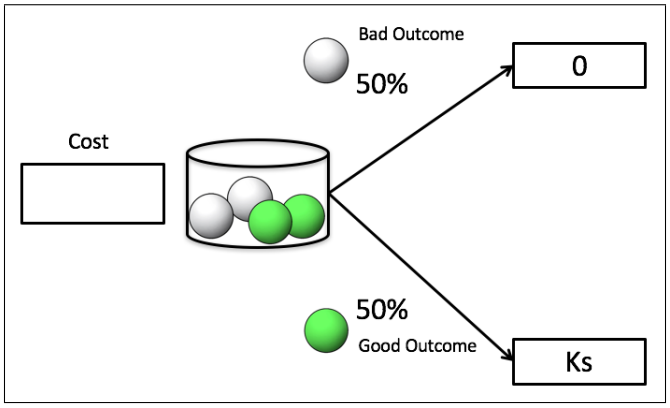
(i) *"If the bad outcome occurs from the investment choice you just chose for the first round, which investment option would you then choose in the second round?"*;

(ii) *"What about if the good outcome occurs from the investment choice you just chose for the first round; which investment option would you then choose in the second round?"*.

Figure 5: SET OF INVESTMENT OPTIONS

			
Investment Option	Cost	Bad Outcome	Good Outcome
1	0	0	100
2	-100	0	400
3	-200	0	700
4	-300	0	1000
5	-400	0	1300

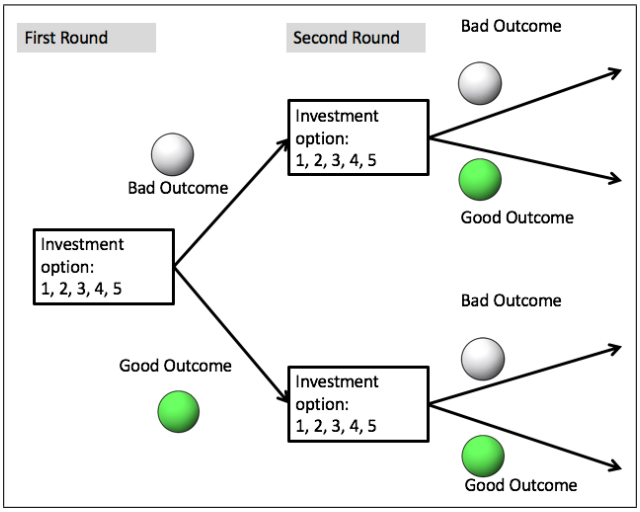
Figure 6: OUTCOME OF AN INVESTMENT OPTION



Enumerators spent a considerable amount of time explaining the structure of the game to participants, and a number of practice rounds were conducted to test understanding before the final decisions. Figure 7 illustrates the tree diagram that was used to explain the structure of the entire game to participants.

[28] Such behaviour was indeed observed among some participants during piloting.

Figure 7: GAME STRUCTURE



3.5 Randomisation of financial contract treatments

After completing a demonstration round with participants, where they practised the game under each treatment, the final activity was conducted. To mitigate learning effects, the order in which the participants played the three financial contract treatments was randomised.[29] It is important to note that, when communicating with participants, the word 'treatment' was never used, nor were the words 'debt' or 'equity'; instead the more neutral words 'loan contract' and 'sharing contract' were used (in the local language). The purpose of the experiment was to study the effect of the contractual structure on investment behaviour, rather than any effect driven by using those possibly emotive terms. However, all participants had previously taken a loan from Akhuwat and successfully repaid it, and therefore it is much less likely that they would have had an aversion to debt contracts.

4 Experimental results

In this section, I present results from the artefactual field experiment, which took place between December 2016 and February 2018. The main outcome variable, empirical specifications, and variables for heterogeneity analysis were pre-specified at the American Economic Association's RCT Registry.[30] The sample consists of 2,872 observations from 718 unique microenterprise owners, representing one decision per respondent for each of the four treatment groups (CT, DT, ET1, ET2). Decisions under the two equity contracts are pooled into one treatment indicator (ET) in the subsequent analysis.

[29] In order to reduce confusion from switching from equity to debt and then back to equity, the two equity treatments always appeared next to each other, although the order in which the two equity treatments appeared was also randomised.

[30] See https://www.socialscienceregistry.org/trials/2224.

4.1 Main result: Greater risk-taking under equity contract

Table 2 presents results using the following simple specification:

$$y_i = \beta_0 + \beta_1 DT_i + \beta_2 ET_i + \varepsilon_i \tag{3}$$

where y_i is the expected return of the investment options chosen by individual i in round 1, DT_i is an indicator variable that equals one for all investment decisions made under the debt treatment, and ET_i is the equivalent indicator variable for the equity treatments. Standard errors are clustered at the individual level. β_0 represents the average expected return of investments chosen by individuals in the control group, whilst β_1 and β_2 represent the additional risk taken by debt-financed and equity-financed individuals relative to the control group, respectively. The main hypothesis I test is $H_0 : \beta_1 = \beta_2$. Table 2 presents the main result of the experiment. Equity-financed microenterprise owners chose investment options with an expected return of 185, compared to an expected return of 173 under the debt contract. This represents an effect size of 0.40 standard deviations of the control group's distribution of investment choices, where the average expected return was 109, and is statistically significant at the 1% level. In Section 4.4, I present evidence that this overall result is robust to a number of alternative specifications, including using the outcomes of second-round decisions. Further, in Tables 3 - 9, where heterogeneous treatment analysis using a set of pre-specified variables is presented, the average expected return under equity is greater than under debt in every sub-group.[31] Heterogeneity analysis is conducted by estimating equation 3 separately for each quantile of the particular heterogeneity variable, as well as estimating the combined specification:

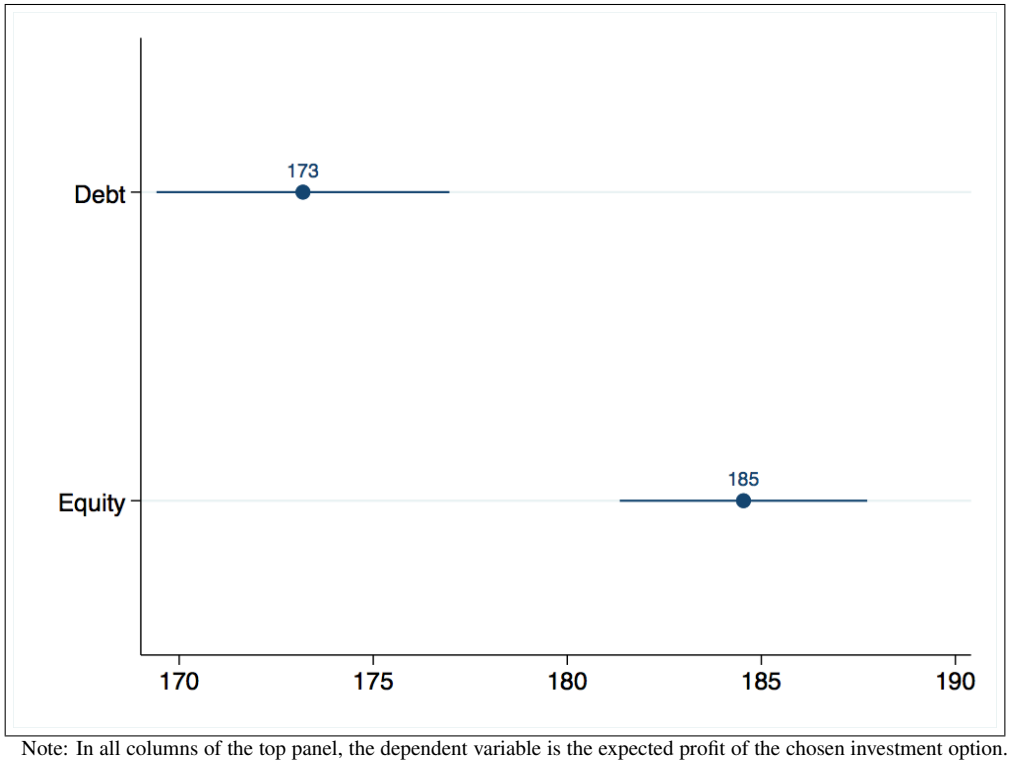
$$y_i = \beta_0 + \beta_1 DT_i + \beta_2 ET_i + \beta_3 HighX_i + \beta_4 DT_i * HighX_i + \beta_5 ET_i * HighX_i + \varepsilon_i \tag{4}$$

where $HighX_i$ indicates whether the individual has a higher value of the particular heterogeneity variable being considered (X_i), using both a median split as well as terciles. A test for the equivalence of β_4 and β_5 indicates whether individuals with higher values of X_i are differentially affected by the equity and debt treatments.

[31] While all variables used in the heterogeneity analysis were pre-specified, the fact that they were trichotomised was not specified. In each of Tables 3 - 9, I provide results using both a median split and terciles for the heterogeneity variable.

Table 2: OVERALL EFFECTS

	(1) Expected return	(2) Expected return	(3) Expected return
ET	76***	76***	76***
	(2.00)	(2.00)	(2.00)
DT	64***	64***	64***
	(2.32)	(2.32)	(2.32)
Order effect			2
			(2.96)
Constant	109***	109***	108***
	(1.07)	(1.44)	(1.83)
Observations	2872	2872	2872
R-squared	0.26	0.46	0.26
ET vs DT (Percent)	6.6	6.6	6.6
ET vs DT (Standard deviation)	0.40	0.40	0.40
Test: ET = DT (p-value)	0.00	0.00	0.00



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. DT and ET represent indicator variables for the debt and equity contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the result graphically, with each point representing the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

4.2 Heterogeneous treatment effects: Risk aversion and loss aversion

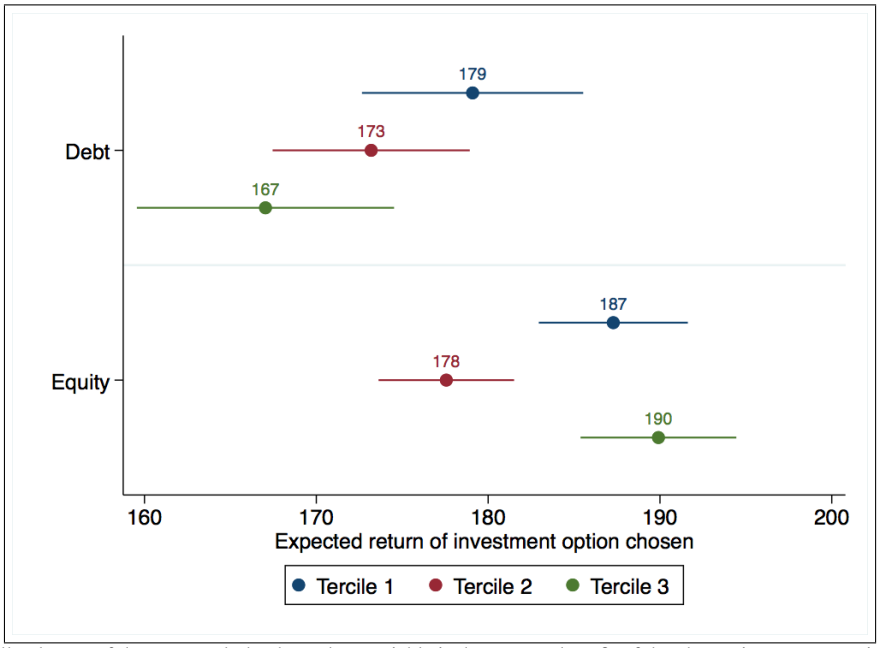
The purpose of the first section of heterogeneity analysis, presented in Tables 3 - 5, is to investigate potential mechanisms through which the structure of contracts may affect investment behaviour. In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the respective heterogeneity variable, while columns (5) and (6) present results from the sub-sample with below- and above-median values respectively. Columns (4) and (7) present results from the combined specification. DT and ET are indicator variables for the debt and equity contracts respectively, with the reported coefficient estimate indicating the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). In the bottom panel of each table, results are presented graphically, with each point illustrating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

4.2.1 Risk aversion

Entrepreneurs who are more risk-averse may take relatively greater risk when financed with an equity contract, where there is an insurance-like element through the explicit sharing of losses, compared to when they are financed with a fixed-repayment debt contract. Tables 3 and 4 display regressions and graphical analysis using the two different measures of risk aversion. Column (1) of Table 3 presents results for the least risk-averse entrepreneurs (the most 'risk-tolerant'), with column (2) showing results for those with an intermediate level of risk aversion, and column (3) for the most risk-averse, using the survey-based measure. In all three specifications, the expected return of investment options chosen under equity is greater than that under debt, mirroring the overall results described in Section 4.1. The magnitude of the difference between risk-taking under equity compared to debt increases for the most risk-averse microenterprise owners. Specifically, for the most risk-averse tercile, risk taken under equity is 0.80 standard deviations greater than risk taken under debt, with the effect statistically significant at the 1% level. This compares to a difference of 0.29 and 0.15 standard deviations for the first two terciles of risk aversion respectively, using this survey-based measure. A similar result can be seen in the median split analysis of columns (4) and (5), with an effect size of 0.29 standard deviations for those with below-median risk aversion and 0.51 standard deviations

Table 3: HETEROGENEITY ANALYSIS: RISK PREFERENCES (SURVEY-BASED MEASURE)

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	74***	68***	87***	74***	70***	82***	70***
	(3.60)	(3.12)	(3.61)	(3.60)	(2.83)	(2.78)	(2.83)
DT	66***	64***	64***	66***	62***	67***	62***
	(4.11)	(3.55)	(4.45)	(4.11)	(3.18)	(3.37)	(3.18)
Tercile 2				-4			
				(2.44)			
ET * Tercile 2				-6			
				(4.76)			
DT * Tercile 2				-2			
				(5.43)			
Tercile 3				-10***			
				(2.71)			
ET * Tercile 3				13**			
				(5.10)			
DT * Tercile 3				-2			
				(6.06)			
Median							-8***
							(2.13)
ET * Median							12***
							(3.97)
DT * Median							6
							(4.64)
Constant	113***	110***	103***	113***	113***	105***	113***
	(1.74)	(1.71)	(2.07)	(1.74)	(1.40)	(1.60)	(1.40)
Observations	928	1052	892	2872	1500	1372	2872
R-squared	0.26	0.25	0.29	0.27	0.24	0.29	0.27
ETvsDT (Percent)	4.6	2.5	13.7		4.8	8.5	
ETvsDT (Standard deviation)	0.29	0.15	0.80		0.29	0.51	
Test: ET=DT (p-value)	0.005	0.117	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.347			
Test: ET*Terc3=DT*Terc3 (p-value)				0.003			
Test: ET*Med=DT*Med (p-value)							0.103



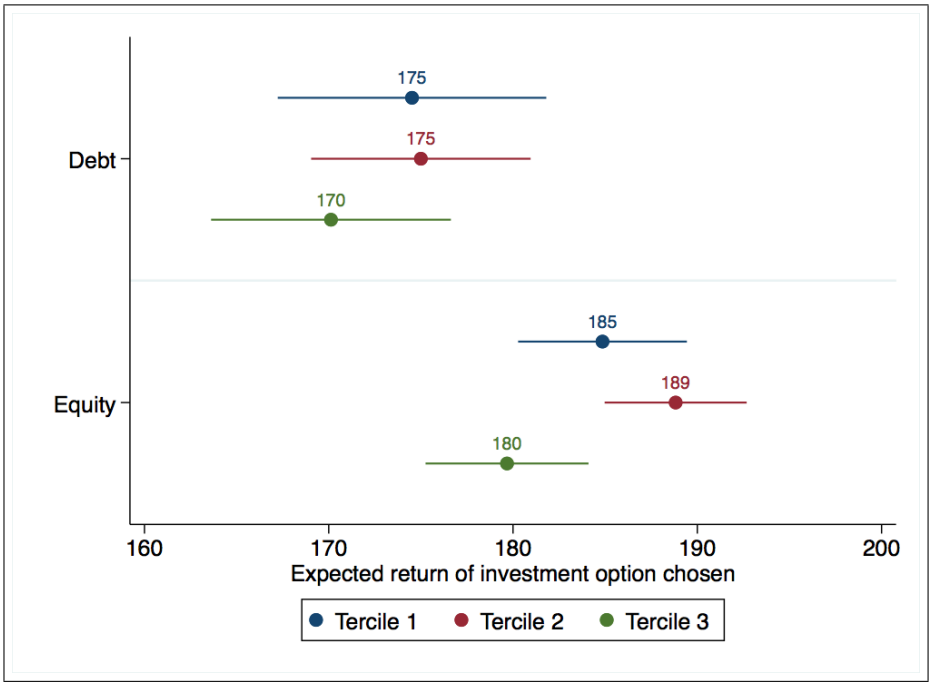
Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

for those with above-median risk aversion (both statistically significant at the 1% level). The joint specification in column (4), which includes all individuals, confirms that the equity treatment differentially affected the most risk-averse individuals ($p-$value for the test of equivalence between $ET_i * Tercile3$ and $DT_i * Tercile3$ is 0.003). The joint specification in column (7), using the median split, reveals a marginally insignificant differential effect ($p-$value of 0.103).

Turning to the incentivised measure of risk aversion, Table 4 reveals that the most risk-tolerant tercile took on average 0.37 standard deviations more risk under equity compared to debt, and that this magnitude increases for those with intermediate risk aversion, with an effect size of 0.49 standard deviations. For those who were most risk-averse in the incentivised risk aversion activity, the effect size decreases back down to 0.33 standard deviations. The median-split analysis of columns (4) and (5) reveals an effect size of 0.36 standard deviations for those with below-median risk aversion and 0.43 standard deviations for those with above-median risk aversion (both statistically significant at the 1% level). One possible reason that the largest effect size is seen with the top tercile of risk aversion for the survey-based measure, whereas for the incentivised measure it was seen for those with an intermediate level of risk aversion, is that those who are defined as 'most risk-averse' using the incentivised measure are displaying quite an 'extreme' form of risk aversion, compared to those who are self-reporting as risk-averse in the survey-based measure. The two measures of risk aversion are significantly correlated, but the correlation coefficient is 0.267 for the raw measure and only 0.222 for the trichotomised measure (both statistically significant at the 1% level), and thus the 'most risk-averse' group defined by the two different measures could be quite distinct. Investigating the choices made by those in the top tercile of the incentivised measure confirms the rather extreme level of risk aversion; the average person in the top tercile of risk aversion rejected all 30 offers of the risky investment option, even when the certain payment offered was only PKR 100 (compared to an average expected return of the risky investment option of PKR 500, and even when the expected return of the risky option was increased to PKR 750). As a comparison, the most risk-tolerant tercile on average only rejected 11 of the risky investment options, and accepted 19 of them. It could be argued that this result for the most risk-averse tercile may be due to a cultural 'gambling aversion', given the Pakistani conservative Muslim context, yet all these participants who displayed extreme risk aversion were willing to make risky decisions in the microequity game. There were also no reports of any of the microenterprise owners refusing

Table 4: HETEROGENEITY ANALYSIS: RISK PREFERENCES (INCENTIVISED MEASURE)

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	67***	84***	77***	67***	69***	82***	69***
	(3.47)	(3.30)	(3.51)	(3.47)	(2.81)	(2.80)	(2.81)
DT	56***	70***	67***	56***	59***	70***	59***
	(4.15)	(3.97)	(3.85)	(4.15)	(3.34)	(3.19)	(3.34)
Tercile 2				-6**			
				(2.52)			
ET * Tercile 2				18***			
				(4.78)			
DT * Tercile 2				14**			
				(5.75)			
Tercile 3				-12***			
				(2.61)			
ET * Tercile 3				10**			
				(4.93)			
DT * Tercile 3				12**			
				(5.66)			
Median							-10***
							(2.10)
ET * Median							13***
							(3.97)
DT * Median							11**
							(4.62)
Constant	115***	109***	103***	115***	114***	104***	114***
	(1.81)	(1.76)	(1.89)	(1.81)	(1.43)	(1.54)	(1.43)
Observations	972	916	984	2872	1396	1476	2872
R-squared	0.21	0.33	0.26	0.27	0.24	0.29	0.27
ETvsDT (Percent)	6.2	7.9	5.6		5.9	7.1	
ETvsDT (Standard deviation)	0.37	0.49	0.33		0.36	0.43	
Test: ET=DT (p-value)	0.001	0.000	0.002		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.463			
Test: ET*Terc3=DT*Terc3 (p-value)				0.812			
Test: ET*Med=DT*Med (p-value)							0.565



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

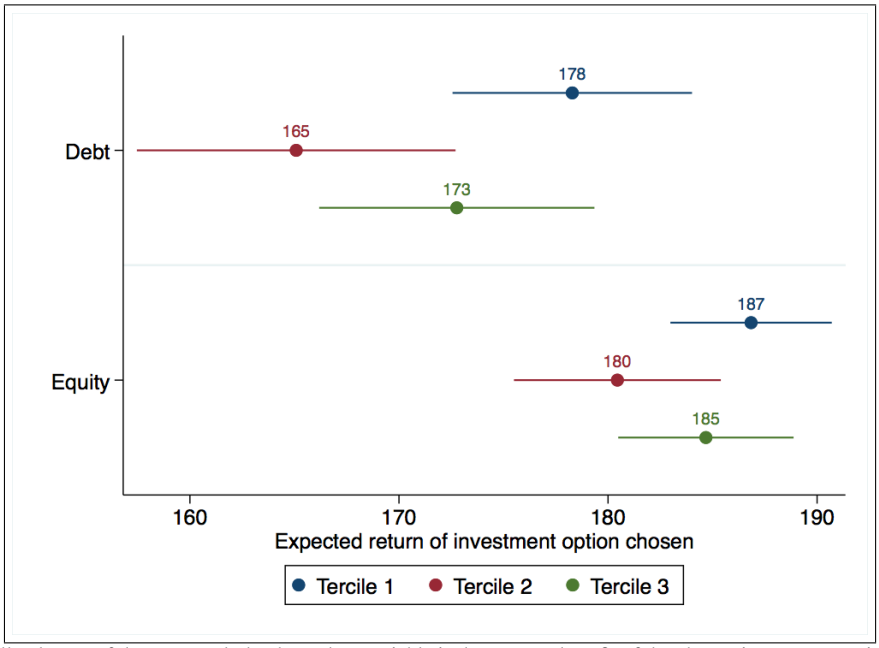
to participate, so it appears that this behaviour does in fact reflect an extreme form of risk aversion. Referring back to the model predictions in Section 2, the effect of equity contracts on risk-taking was expected to be most significant for those with greater risk aversion, while tailing off for those who were most risk-averse, and results in this section are broadly consistent with that prediction. However, the combined specifications in columns (4) and (7) do not reveal a significant differential effect of equity and debt when testing for equality of the interaction terms, using either terciles or the median split.

4.2.2 Loss aversion

Entrepreneurs who are more loss-averse may take relatively less risk when financed by the debt contract, compared to the equity contract, because of the prospect of defaulting on their debt contract and having money deducted from the fixed participation fee that they are guaranteed for attending the workshop. Loss-averse agents may be more willing to choose a higher expected return but riskier investment option when provided with the implicit insurance of the equity contract, which mitigates the risk that they would lose some of their own wealth, compared to the unlimited-liability debt contract. Table 5 presents regression and graphical analysis of results using the incentivised measure of loss aversion. Column (1) presents results for the least loss-averse entrepreneurs, with column (2) containing results for those with an intermediate level of loss aversion, and column (3) for the most loss-averse. In all specifications, the expected return of investment options chosen under equity is greater than that under debt. For the least loss-averse group, risk taken under equity is 0.30 standard deviations greater than risk taken under debt, with the difference statistically significant at the 1% level. For those with an intermediate level of loss aversion, risk taken under equity is 0.54 standard deviations greater than risk taken under debt, and significant at the 1% level. Finally, for the most loss-averse group, the effect size is smaller, at 0.42 standard deviations, significant at the 1% level, and mirroring the results for the incentivised risk aversion measure in Table 4. The median split analysis of columns (4) and (5) reveals an effect size of 0.32 standard deviations for those with below-median loss aversion and 0.49 standard deviations for those with above-median loss aversion. However, none of the differential effects are significant when analysing the equality of the interacted terms in the combined specification in columns (4) and (7).

Table 5: HETEROGENEITY ANALYSIS: LOSS AVERSION

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	73***	72***	82***	73***	72***	81***	72***
	(3.24)	(3.69)	(3.40)	(3.24)	(2.72)	(2.93)	(2.72)
DT	64***	57***	70***	64***	63***	66***	63***
	(3.66)	(4.46)	(3.97)	(3.66)	(3.13)	(3.45)	(3.13)
Tercile 2				-6**			
				(2.66)			
ET * Tercile 2				-1			
				(4.91)			
DT * Tercile 2				-7			
				(5.78)			
Tercile 3				-11***			
				(2.46)			
ET * Tercile 3				9*			
				(4.70)			
DT * Tercile 3				6			
				(5.40)			
Median							-9***
							(2.14)
ET * Median							9**
							(3.99)
DT * Median							4
							(4.65)
Constant	114***	108***	103***	114***	113***	103***	113***
	(1.58)	(2.13)	(1.88)	(1.58)	(1.38)	(1.63)	(1.38)
Observations	1216	716	940	2872	1604	1268	2872
R-squared	0.25	0.24	0.30	0.27	0.25	0.28	0.27
ETvsDT (Percent)	4.8	9.3	6.9		5.2	8.3	
ETvsDT (Standard deviation)	0.30	0.54	0.42		0.32	0.49	
Test: ET=DT (p-value)	0.001	0.000	0.001		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.141			
Test: ET*Terc3=DT*Terc3 (p-value)				0.448			
Test: ET*Med=DT*Med (p-value)							0.196



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Analysing the behaviour of the most loss-averse microenterprise owners (the top tercile of loss aversion) sheds light on why the effect is smaller relative to those with an intermediate amount of loss aversion, as was clear in the analysis of the most risk-averse tercile in the incentivised risk measure. Individuals in the most loss-averse tercile made an average of 9 rejection decisions, meaning that they rejected investment options that involved either winning PKR 1,000 with probability 0.5 or losing PKR 200 with probability 0.5 (an expected value of 400), and 8 other similar investment options that led to winning PKR 1,000 or losing amounts greater than PKR 200 (in increments of PKR 100). As a comparison, the least loss-averse individuals only rejected 4 of the 10 investment options. Therefore, those in the most loss-averse tercile could be considered to have quite an 'extreme' amount of loss aversion, as was the case with those in the top tercile of the incentivised risk aversion activity; in fact, the correlation between responses in the incentivised loss aversion activity and the incentivised risk preference elicitation activity is actually higher than that between the two risk preference activities (a correlation of 0.302 in the raw data, and 0.319 for the trichotomised measure, both statistically significant at the 1% level). However, as mentioned, the differential effects are insignificant when comparing the interacted terms in the combined models for both the incentivised risk measure and loss aversion, so results are interpreted with caution.

4.3 Heterogeneous effects: Management practices and education

The purpose of the first section of heterogeneity analysis was to explore heterogeneous treatment effects by variables that illustrate potential mechanisms through which the structure of contracts may affect investment behaviour. Results in Section 4.2 provide suggestive evidence that more risk-averse individuals chose investment options with a greater expected return under equity financing than under debt financing, using the survey-based measure of risk aversion. While there could be positive welfare effects in stimulating profitable investments for individuals whose behavioural characteristics lead them to relatively under-invest, from a policy perspective MFIs may not wish to provide such financing if those individuals have the worst business management practices, and the lowest education and cognitive ability. In this section I conduct a similar heterogeneity analysis for those variables, and confirm that such a concern is unfounded; there is no evidence that the microenterprise owners with the lowest business management practices, education or cognitive ability are those for whom equity contracts are incentivising the greatest risk-taking relative to debt.

4.3.1 Management practices

From a policy perspective, it is important to understand what the treatment effect is for microenterprise owners with better management practices, for example record-keeping and a clear separation of business and household finances. Equity financing, which requires accurate reporting of performance for the purposes of profit- and loss-sharing, is less viable for individuals who do not keep records of their assets, incomes and expenses, or who frequently combine business and household accounts. If individuals with better management practices take more risk under equity financing, this provides promising evidence for the potential impact of an equity-based product in the field. A recent literature has highlighted the importance of business management

practices for the performance of firms in developed countries (Bloom and Van Reenen, 2010). McKenzie and Woodruff (2016) develop a set of questions that have been adapted for microenterprises in a developing country setting, which I used to measure business management practices for the participants in my sample. The questions covered the following areas:

(i) Marketing (whether the firm advertises, attempts to attract customers with a special offer, and if it solicits customer feedback on what other products they would like it to sell);

(ii) Record-keeping (whether the firm records its sales and purchases, if it has calculated the cost and profit margin of its main products, and whether it has a written budget);

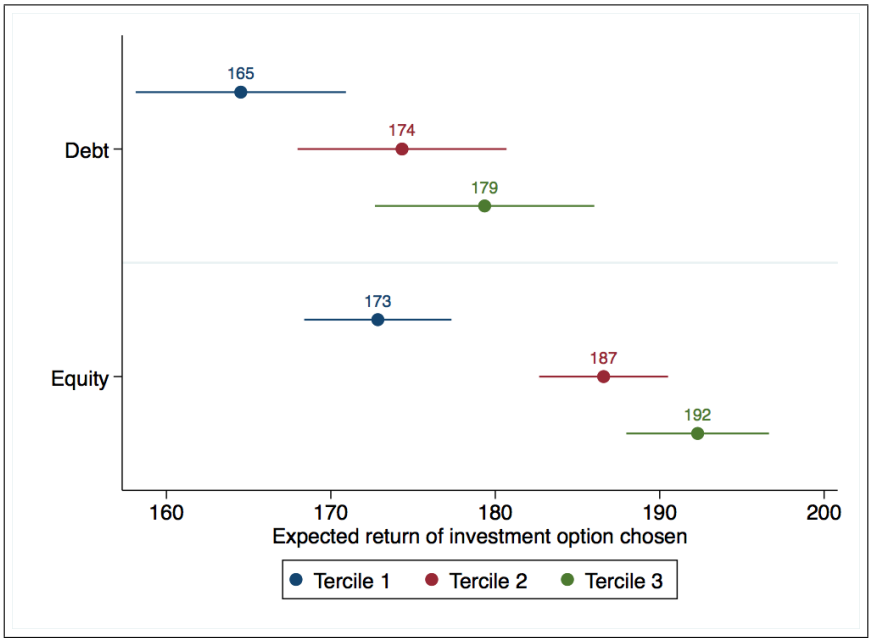
(iii) Financial planning (whether the firm has a sales target, and if it keeps a balance sheet and profit and loss statement);

(iv) Buying and stock control (whether it frequently runs out of stock, and if it attempts to negotiate with suppliers).

I aggregated all positive responses into a business management practices index. Results in Table 6 reveal that, as with all previous specifications, average risk-taking is greater under equity than debt for each sub-group. It can also be observed that the size of the effect is greater for those with higher management practices; those in the lowest tercile of management practices take 0.29 standard deviations greater risk under equity (significant at the 5% level), with an effect size of 0.43 standard deviations for those with intermediate management practices and 0.45 standard deviations for the highest management practices group (both significant at the 1% level). A similar result is reflected in the median-split analysis (0.33 and 0.46 standard

Table 6: HETEROGENEITY ANALYSIS: BUSINESS MANAGEMENT PRACTICES

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	62***	79***	84***	62***	70***	81***	70***
	(3.70)	(3.18)	(3.41)	(3.70)	(2.87)	(2.76)	(2.87)
DT	54***	66***	71***	54***	61***	68***	61***
	(4.00)	(3.74)	(4.19)	(4.00)	(3.14)	(3.39)	(3.14)
Tercile 2				-3			
				(2.71)			
ET * Tercile 2				17***			
				(4.88)			
DT * Tercile 2				13**			
				(5.48)			
Tercile 3				-3			
				(2.69)			
ET * Tercile 3				22***			
				(5.03)			
DT * Tercile 3				17***			
				(5.80)			
Median							-3
							(2.14)
ET * Median							11***
							(3.98)
DT * Median							7
							(4.62)
Constant	111***	108***	108***	111***	110***	108***	110***
	(2.04)	(1.78)	(1.76)	(2.04)	(1.54)	(1.48)	(1.54)
Observations	840	1044	988	2872	1412	1460	2872
R-squared	0.21	0.29	0.29	0.27	0.25	0.28	0.27
ETvsDT (Percent)	5.1	7.0	7.2		5.6	7.5	
ETvsDT (Standard deviation)	0.29	0.43	0.45		0.33	0.46	
Test: ET=DT (p-value)	0.010	0.000	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.395			
Test: ET*Terc3=DT*Terc3 (p-value)				0.305			
Test: ET*Med=DT*Med (p-value)							0.329



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

deviation effect sizes for those with below-median and above-median management practices respectively, with both effects significant at the 1% level). However, the differential effects are insignificant when comparing the interacted terms in the combined model in columns (4) and (7).

4.3.2 Education and cognitive ability

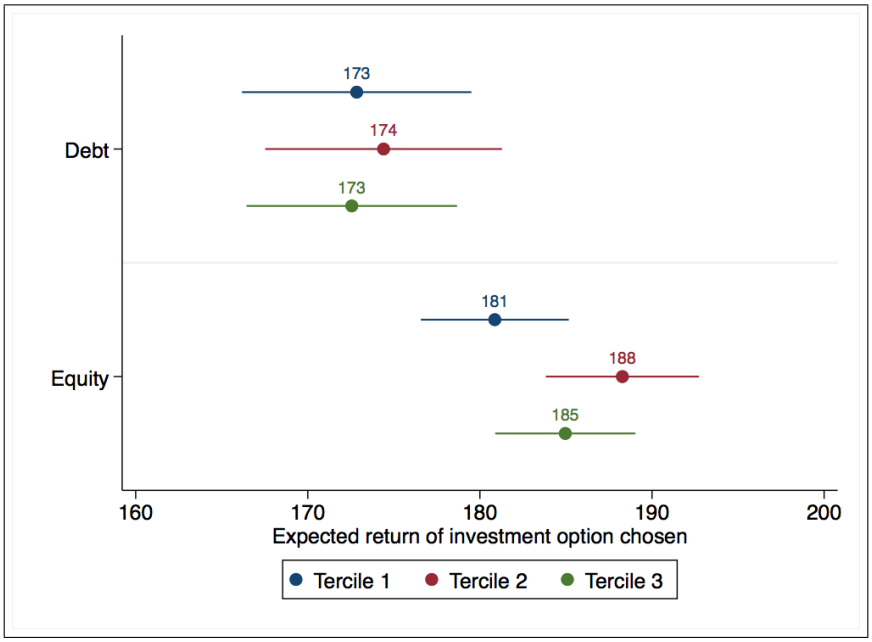
Equity contracts may be relatively unfamiliar to many participants and need more cognitive processing than simple fixed-repayment debt contracts, since they require individuals to calculate income-sharing payments of 25%, 50% and 75%. Individuals with lower cognitive ability may struggle with such calculations. While the education variable was simply measured as the highest completed level of formal education, cognitive ability was measured using a set of number recall activities and addition, subtraction and division questions, with scores aggregated into an index.

Tables 7 and 8 suggest that the largest effect of equity financing was amongst those with the highest education and cognitive ability respectively. Individuals in the lowest tercile of education took 0.28 standard deviations greater risk under equity, with an effect size of 0.48 and 0.43 standard deviations for those with intermediate and the highest levels of education respectively. Similar evidence is provided using scores from a mathematical test that was administered with all participants during the workshop, with an effect size of 0.30 standard deviations for the lowest tercile of maths score, and 0.45 and 0.42 standard deviations for those with intermediate and the highest maths scores respectively, with the effects statistically significant in all specifications. However, as with the management practices score, the differential effects are insignificant when comparing the interacted terms in the combined model in columns (4) and (7).

Overall, results from this section of heterogeneity analysis are encouraging from a policy perspective since there is no evidence that the overall result of greater risk raking under equity is being driven by microenterprise owners with the lowest business management practices, education or cognitive ability, particularly because these are the individuals who an MFI would be least likely to offer equity-based contracts (which require clear record keeping, a separation of household and business accounts, and making non-standard calculations for profit shares).

Table 7: HETEROGENEITY ANALYSIS: YEARS OF EDUCATION

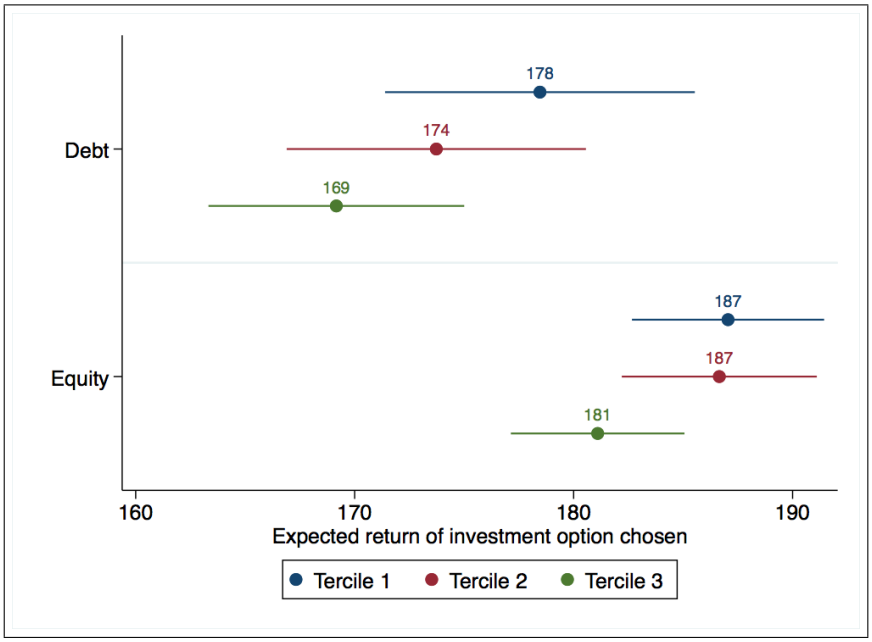
	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	72***	80***	76***	72***	76***	76***	76***
	(3.41)	(3.49)	(3.44)	(3.41)	(2.55)	(3.19)	(2.55)
DT	64***	66***	63***	64***	65***	63***	65***
	(3.95)	(4.18)	(3.90)	(3.95)	(2.98)	(3.67)	(2.98)
Tercile 2				-1			
				(2.60)			
ET * Tercile 2				8			
				(4.88)			
DT * Tercile 2				2			
				(5.76)			
Tercile 3				1			
				(2.61)			
ET * Tercile 3				3			
				(4.84)			
DT * Tercile 3				-1			
				(5.56)			
Median							0
							(2.18)
ET * Median							-0
							(4.08)
DT * Median							-2
							(4.72)
Constant	109***	108***	109***	109***	109***	109***	109***
	(1.85)	(1.83)	(1.85)	(1.85)	(1.38)	(1.69)	(1.38)
Observations	972	836	1064	2872	1628	1244	2872
R-squared	0.24	0.30	0.26	0.26	0.27	0.26	0.26
ETvsDT (Percent)	4.6	8.0	7.2		6.0	7.3	
ETvsDT (Standard deviation)	0.28	0.48	0.43		0.36	0.44	
Test: ET=DT (p-value)	0.015	0.000	0.000		0.000	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.206			
Test: ET*Terc3=DT*Terc3 (p-value)				0.338			
Test: ET*Med=DT*Med (p-value)							0.581



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Table 8: HETEROGENEITY ANALYSIS: MATHEMATICAL CALCULATIONS EXERCISE

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	82***	79***	69***	82***	79***	73***	79***
	(3.48)	(3.48)	(3.31)	(3.48)	(2.93)	(2.72)	(2.93)
DT	73***	66***	57***	73***	69***	61***	69***
	(4.26)	(4.11)	(3.66)	(4.26)	(3.44)	(3.12)	(3.44)
Tercile 2				2			
				(2.65)			
ET * Tercile 2				-2			
				(4.92)			
DT * Tercile 2				-7			
				(5.92)			
Tercile 3				7***			
				(2.62)			
ET * Tercile 3				-13***			
				(4.80)			
DT * Tercile 3				-16***			
				(5.62)			
Median							4*
							(2.15)
ET * Median							-6
							(4.00)
DT * Median							-8*
							(4.65)
Constant	105***	107***	112***	105***	106***	111***	106***
	(1.93)	(1.82)	(1.77)	(1.93)	(1.61)	(1.43)	(1.61)
Observations	780	944	1148	2872	1268	1604	2872
R-squared	0.32	0.27	0.22	0.27	0.28	0.25	0.26
ETvsDT (Percent)	4.8	7.4	7.1		5.8	7.2	
ETvsDT (Standard deviation)	0.30	0.45	0.42		0.35	0.43	
Test: ET=DT (p-value)	0.028	0.000	0.000		0.001	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.401			
Test: ET*Terc3=DT*Terc3 (p-value)				0.481			
Test: ET*Med=DT*Med (p-value)							0.582



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

4.3.3 Trust

The final pre-specified variable for heterogeneity analysis is trust. Trust is potentially quite important in the comparison between equity contracts, which involve sharing of profits and losses, and fixed-repayment debt contracts. Since individuals who are less trusting may be less inclined to choose equity financing in the field, understanding the treatment effect for more trusting individuals is important from a policy perspective. Trust was measured using a series of questions from the General Social Survey (GSS).[32] Table 9, as with all previous tables, shows greater risk-taking under equity compared to debt, for all terciles. The magnitude of the effect is 0.27 standard deviations for the least trusting, 0.42 standard deviations for those with an intermediate level of trust, and 0.52 standard deviations for the most trusting, however the differential effects are marginally insignificant when comparing the interacted terms in the combined model.

4.4 Robustness checks

As seen in Table 2 and the subsequent heterogeneity analysis of Tables 3-9, risk-taking under equity was greater than that under debt, with the effect evident in every sub-group used in the heterogeneity analysis. While this provides strong evidence for the effects, in this section I present further robustness checks by investigating second-round decisions and order effects.

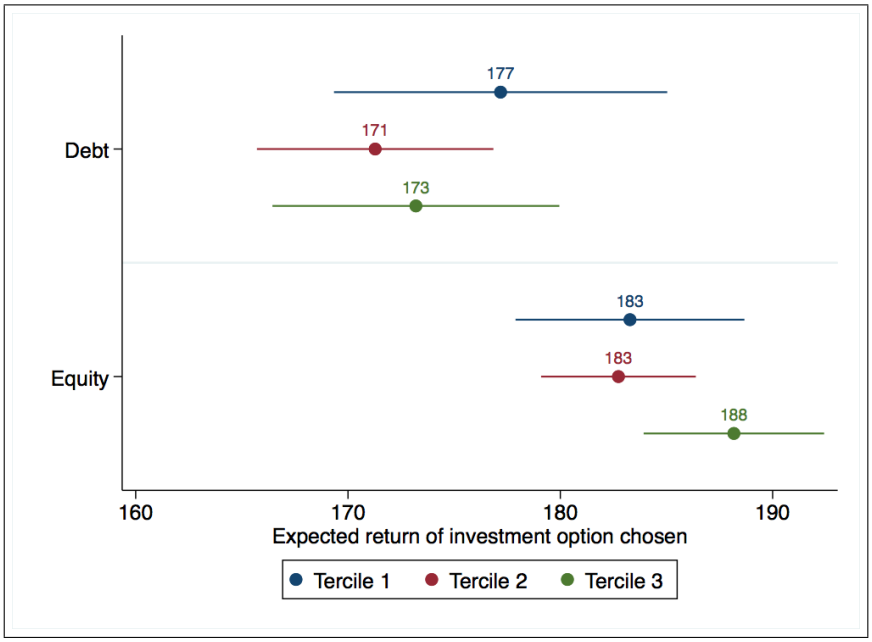
4.4.1 Second-round decisions

Table 10 illustrates results for the investment options chosen in the second decision round, using the strategy method described in Section 3.4. In columns (1) and (2) the analysis is done for second-round decisions conditional on a bad outcome occurring in the first round, and in columns (3) and (4) the analysis is done conditional on a good outcome having occurred in the first round. Columns (1) and (3) present results from specifications with simple treatment dummies and a dummy for basic order effects, while columns (2) and (4) include dummies that fully control for the endogeneity that is inherent in columns (1) and (3). Decisions in the second round are endogenous to the previous investment decision made by participants, which in this setting can be fully controlled for by including dummies for the decision made in the first round.

[32] As used by Giné, Jakiela, Karlan, and Morduch (2010).

Table 9: HETEROGENEITY ANALYSIS: TRUST

	(1) Tercile 1	(2) Tercile 2	(3) Tercile 3	(4) All	(5) Below-median	(6) Above-median	(7) All
ET	77***	72***	78***	77***	75***	76***	75***
	(3.33)	(3.53)	(3.52)	(3.33)	(2.94)	(2.73)	(2.94)
DT	70***	60***	63***	70***	67***	62***	67***
	(3.69)	(4.28)	(4.06)	(3.69)	(3.32)	(3.23)	(3.32)
Tercile 2				6**			
				(2.53)			
ET * Tercile 2				-5			
				(4.85)			
DT * Tercile 2				-10*			
				(5.65)			
Tercile 3				5*			
				(2.65)			
ET * Tercile 3				1			
				(4.85)			
DT * Tercile 3				-7			
				(5.49)			
Median							5**
							(2.14)
ET * Median							1
							(4.01)
DT * Median							-5
							(4.63)
Constant	105***	111***	110***	105***	106***	111***	106***
	(1.78)	(1.80)	(1.96)	(1.78)	(1.56)	(1.46)	(1.56)
Observations	1036	948	888	2872	1336	1536	2872
R-squared	0.28	0.23	0.28	0.26	0.27	0.26	0.27
ETvsDT (Percent)	4.4	7.0	8.6		4.9	8.0	
ETvsDT (Standard deviation)	0.27	0.42	0.52		0.30	0.48	
Test: ET=DT (p-value)	0.007	0.000	0.000		0.001	0.000	
Test: ET*Terc2=DT*Terc2 (p-value)				0.320			
Test: ET*Terc3=DT*Terc3 (p-value)				0.104			
Test: ET*Med=DT*Med (p-value)							0.157



Note: In all columns of the top panel, the dependent variable is the expected profit of the chosen investment option. Columns (1), (2) and (3) present results for the bottom, middle, and top terciles of the heterogeneity variable respectively. Columns (4) and (5) present results from the sub-sample with below- and above-median values respectively. ET and DT represent indicator variables for the equity and debt contracts respectively, with the reported coefficient estimate representing the average expected profit of investment options chosen under each treatment, relative to the control group (represented by the coefficient on the constant). Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10. The bottom panel presents the results from the heterogeneity analysis graphically, with each point indicating the *total* risk taken under each treatment contract, with 90% confidence intervals shown around each point estimate.

Column (1) reveals that in the second round, conditional on a bad outcome occurring in the first round, risk-taking under equity was 0.40 standard deviations greater than risk-taking under debt, with the difference statistically significant at the 1% level. Inclusion of dummies for endogenous selection does not significantly change the outcome; column (2) shows that equity-financed microenterprise owners took 0.29 standard deviations greater risk than those who were debt-financed, with the effect still statistically significant at the 1% level.

Table 10: SECOND-ROUND DECISIONS

	(1)	(2)	(3)	(4)
	R2|R1bad	R2|R1bad	R2|R1good	R2|R1good
Constant	77***	44***	176***	110***
	(1.51)	(4.89)	(2.80)	(6.17)
DT	65***	52***	24***	-14***
	(2.00)	(2.57)	(2.27)	(3.09)
ET	75***	59***	32***	-13***
	(1.81)	(2.56)	(1.99)	(3.08)
Order	0	0	1	-1
	(2.31)	(2.03)	(3.70)	(2.62)
R1:Inv2		37***		65***
		(5.04)		(6.47)
R1:Inv3		37***		94***
		(5.18)		(6.82)
R1:Inv4		64***		125***
		(5.59)		(6.93)
R1:Inv5		60***		148***
		(5.46)		(6.50)
Observations	2872	2872	2872	2872
R-squared	0.34	0.41	0.05	0.37
ET vs DT (Percent)	7.2	7.7	3.9	0.6
ET vs DT (Standard deviation)	0.40	0.29	0.14	0.01
Test: ET = DT (p-value)	0.00	0.00	0.00	0.71

Note: The dependent variable is the expected profit of the chosen investment option in the second round, conditional on the outcome of the first-round choice. Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

While column (3) also reveals greater risk-taking under equity in the second decision round conditional on a good outcome occurring in the first round, with an effect size of 0.14 standard deviations (significant at the 1% level), inclusion of dummies for first-round decisions leads to this effect almost completely disappearing (to 0.01 standard deviations, statistically indistinguishable from zero). In fact, inclusion of the first-round dummies reveals that the coefficients on the debt and equity treatments are actually negative and of similar magnitude, implying less risk-taking relative to the control group. This could indicate an income effect, whereby entrepreneurs who were externally financed, by either debt or equity, are implicitly being taxed

on their gains, with some portion being returned either as a loan repayment or an equity sharing amount, whereas the control group accrue the full additional benefits of the positive investment outcomes.

4.4.2 Order effects

As described in Section 3, the experiment used a within-subject design, where each microenterprise owner made investment decisions under all treatments, with the order of the financing treatments randomised. Column (1) of Table 11 presents regression analysis with the same simple controls for order effects as in previous regressions, as well as the addition of interaction terms between the order and treatments, where 'Order' is an indicator variable for whether debt (randomly) appeared as the first treatment. Column (2) illustrates the analysis for only those observations where debt was randomly revealed first, and column (3) displays results when equity appeared first. Risk-taking under equity is significantly greater than risk-taking under debt, regardless of whether debt or equity appear first, although there is some difference in magnitude. Column (3) reveals that when equity appeared first, risk-taking under equity was greater by 0.53 standard deviations, significant at the 1% level. The effect decreases to 0.25 standard deviations greater risk-taking under equity when debt appears first, but is still highly significant (p-value 0.010). As can be seen in columns (2) and (3), risk-taking under equity is at approximately the same level regardless of whether debt or equity appear first in the order, however risk-taking under debt is lower when it appears after equity. One possible interpretation is that, having experienced the risk-sharing contract, individuals are subsequently less likely to take risk under debt as they have learned about the insurance-like benefits of the equity contract, which are absent from a fixed-repayment loan contract. Nonetheless, as mentioned, risk-taking under equity is still significantly greater than risk-taking under debt, even when debt appears first.

Table 11: ORDER EFFECTS

	(1) ExpRet	(2) ExpRet	(3) ExpRet
Constant	109***	108***	109***
	(1.49)	(1.54)	(1.49)
DT	59***	70***	59***
	(3.16)	(3.38)	(3.17)
ET	75***	77***	75***
	(2.78)	(2.89)	(2.78)
Order	-1		
	(2.14)		
DT:Ord1	10**		
	(4.63)		
ET:Ord1	2		
	(4.01)		
Observations	2872	1412	1460
R-squared	0.27	0.28	0.25
ET vs DT (Percent)		4.1	9.1
ET vs DT (Standard deviation)		0.25	0.53
Test: ET = DT (p-value)		0.0101	0.0000

Note: The dependent variable is the expected profit of the chosen investment option. Standard errors are clustered at the individual level and are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

4.4.3 Robustness: Predicting risk-taking with a simple machine learning algorithm

In this section, I use a simple machine learning technique as a robustness check for the heterogeneity analysis of Sections 4.2 and 4.3. Specifically, the Least Absolute Shrinkage and Selection Operator (LASSO) is employed (Belloni, Chernozhukov, and Hansen, 2014). The LASSO estimator (and other high-dimensional model selection methods) can be a useful forecasting tool when there are a large number of potentially informative covariates. For a simple model:

$$y_i = \sum_{j=1}^{p} \beta_j x_{ij} + u_i$$

LASSO coefficients are chosen to minimise the sum of squared residuals plus a penalty term that penalises the size of the model through the sum of absolute values of the coefficients:

$$\widehat{\beta} = \arg\min_{b} \sum_{i=1}^{n} \left(y_i - \sum_{j=1}^{p} x_{ij} b_j \right)^2 + \lambda \sum_{j=1}^{p} |b_j| \gamma_j$$

where λ is a penalty parameter and γ_j are penalty loadings. One issue with this estimator is that non-zero coefficients that are part of the solution to the LASSO problem tend to be biased towards zero. The Post-LASSO estimator first applies LASSO to determine which variables can be dropped from the standpoint of prediction, and then estimates coefficients on the remaining variables using ordinary least squares. Table 12 presents results from LASSO estimation. In column (1), all variables that were used for the purposes of heterogeneity analysis in Sections 4.2 and 4.3 are included in their trichotomised form. Column (2) includes a number of other potentially important business and household characteristics: respondent literacy, household net income (total household income minus total expenditure), net wealth (value of all assets plus savings minus loans), business profits, and business assets (fixed assets plus current assets).

Unsurprisingly, LASSO estimation identifies the two most important variables for predicting the outcome variable of expected return of investment chosen as the debt and equity treatment indicator variables, DT and ET. Column (1) also identifies risk aversion and loss aversion as important variables for predicting risk-taking, independently of their interaction with the treatment variables. Both coefficients are negative, indicating that more risk- and more loss-averse microenterprise owners chose investment options with a lower expected return and risk, on average. Results also confirm the findings of Section 4.2: more risk-averse individuals chose investment options with a higher expected return when financed with the equity contract, as indicated by the selection of the interaction between ET and the two different measures of risk aversion in the LASSO estimation (specifically, the third tercile of risk aversion for the survey-based measure, and the second tercile of risk aversion for the incentivised measure). In contrast, LASSO dropped the interaction between DT and both risk aversion measures. Further, in column (1), the LASSO specification also selected the interaction between ET and the top two terciles of management practices, as well as the top tercile of the trust measure, with a positive coefficient indicating greatest risk-taking when individuals with the highest management practices and the highest level of trust are equity-financed. The only debt-interacted variable selected is the interaction between DT and the top tercile of management practices.

Table 12: LASSO ANALYSIS

	(1) ExpRet	(2) ExpRet
ET	59.05***	52.44***
	(3.548)	(3.901)
DT	61.09***	58.93***
	(3.080)	(3.253)
Risk (incentivised) tericle 3	-7.68***	-8.52***
	(2.245)	(2.240)
Loss aversion tericle 2	-6.80***	
	(2.252)	
ET * Risk (incentivised) tercile 2	1.57	-0.07
	(3.130)	(3.111)
ET * Risk (survey-based) tercile 3	8.73***	8.64***
	(3.009)	(3.005)
ET * Management practices tercile 2	13.71***	11.84***
	(3.436)	(3.438)
ET * Management practices tercile 3	19.25***	12.48***
	(3.484)	(3.681)
DT * Management practices tercile 3	9.67**	6.42
	(4.083)	(4.160)
ET * Trust tercile 3	5.89**	5.82**
	(2.973)	(2.958)
Household net income tercile 3		-8.38***
		(2.091)
DT * total household wealth tercile 3		9.85**
		(4.195)
ET * total household wealth tercile 2		9.03***
		(3.360)
ET * total household wealth tercile 3		11.72***
		(3.516)
ET * total business assets tercile 3		10.09***
		(3.133)
Constant	113.10***	114.45***
	(2.160)	(2.204)
Observations	2872	2872
R-squared	0.28	0.29

Note: Column (1) presents results from a Post-LASSO estimation using all variables that were used for heterogeneity analysis in Sections 4.2 and 4.3, in their trichotomised form. The dependent variable is the expected profit of the chosen investment option. Column (2) includes respondent literacy, household net income, household net wealth (total savings minus total loans), business profits and business assets. The LASSO code was taken from Belloni, Chernozhukov, and Hansen (2014), with the following inputs: `lassoShooting Takeup 'variables', lasiter(0)`, where `'variables'` represents all explanatory variables entered into the analysis. Standard errors from a simple OLS regression using the set of variables identified by the LASSO estimation are reported in parentheses below each coefficient estimate. *** p<0.001, ** p<0.05, * p<0.10.

Results in column (2), when including a number of other business and household characteristics, reveal the robustness of the findings in the top panel; the LASSO estimator continues to select the interaction between equity financing and risk aversion, management practices and trust as important variables in predicting the outcome variable. Further, a number of other variables that capture business size and household net wealth are also found to be important determinants of risk-taking when interacted with both treatment variables (with the majority of the selected variables being those interacted with the equity financing indicator). As discussed by Mullainathan and Spiess (2017), the purpose of LASSO and other machine learning algorithms is prediction and not parameter estimation, so one should be cautious in providing too much interpretation to these results. The purpose of this section was to provide an additional robustness check, which confirms the importance of risk aversion and business management practices when interacted with equity financing. However, the fact that loss aversion was dropped by the LASSO estimator does not indicate that loss aversion is not an important factor; it could simply be that risk aversion is more accurately measured than loss aversion in the behavioural games activities, which would not be surprising, given that there were many more questions dedicated to measuring risk preferences.

5 Implementing microequity contracts in the field

Results in Section 4 reveal that equity contracts led to greater risk-taking compared to debt-based contracts, with suggestive evidence that the effect was stronger for more risk-averse entrepreneurs, who might ordinarily under-invest. Further, the second part of the heterogeneity analysis provides evidence that mitigates adverse-selection-type concerns that those microenterprise owners who are most encouraged to take more risk with equity financing might be those with the worst business management practices, education and cognitive ability, which has important implications for the viability of implementing equity contracts in the field. Given the positive results, it is important to investigate why we do not typically observe MFIs implementing microequity contracts in the field. The majority of microcredit contracts have a very rigid structure, and – although there are recent researcher-led efforts to introduce more flexible microcredit contracts – to my knowledge there is no organisation that is implementing performance-contingent-repayment contracts with microenterprises on any meaningfully large scale. Theoretical work suggests that equity contracts are non-optimal relative to debt due to costly state verification (Townsend, 1979) and moral hazard (Stiglitz and Weiss, 1981), although those results only hold for a risk-neutral agent and a fixed-repayment contract may be sub-optimal for a risk-averse agent. Given many MFIs' stated objectives to prioritise borrower welfare as well as profits, it is peculiar that no large MFI is implementing microequity contracts, given the potential benefits discussed in the artefactual field experiment in this paper, in particular for individuals whose behavioural characteristics such as risk aversion may lead them to under-invest. In this section, I provide some evidence that sheds light on some of the most important constraints to implementing microequity contracts in the field, using a survey that I designed to investigate a microequity program that had been initiated by one of the largest microfinance

institutions in Pakistan, the National Rural Support Programme (NRSP).[33]

NRSP is the largest rural support programme in Pakistan, with a presence in 64 districts across all four provinces, and currently working with 3 million poor households. In September 2014, NRSP launched a microequity program that aimed to help skilled apprentices start their own business by providing them with equity-like capital. As of August 2015, 1,250 individuals had been provided with financing as part of this program, in five major districts across Punjab and Islamabad.[34] I generated a stratified random sample from the population of 1,250 clients, based on the following variables: (i) gender; (ii) business type (trade, manufacturing or services); (iii) district; and (iv) age of entrepreneur (using a median-split). This generated 60 distinct blocks, from which a random sample of 248 individuals was drawn.[35]

5.1 Summary statistics

Tables 13 and 14 present summary statistics. 90% of clients were male, with a mean age of 33. The average years of education was eight, and 95% of clients could read Urdu. 73% of clients were married, and the average household size was approximately seven. 96% of respondents were managing a business, with 88% of them only running one business (79% owned that business themselves). On average, they had seven years of experience in the sector to which their business related (either managing a business, or as an apprentice). 81% of businesses were initially set up by the respondent. 61% of businesses had no other employees, with 20% having one additional employee and 12% having two additional employees. Only 2% of respondents had any other form of wage employment.

Table 13: NRSP SAMPLE: SUMMARY STATISTICS

	count	mean	sd	min	max
Gender	248	0.10	0.31	0.00	1.00
Age	248	33.09	9.10	19.00	70.00
Education	248	8.16	3.19	0.00	14.00
Reads Urdu	248	0.95	0.42	0.00	2.00
Married	248	0.73	0.44	0.00	1.00
HH Size	248	6.88	3.37	2.00	32.00

In terms of sectoral composition, the most common business sectors were: (i) trade and retail shops; (ii) hairdressers and beauty parlours; (iii) tailors; (iv) food outlets; and (v) vehicle repair shops. Figure 11 in the appendix illustrates business performance. The average microenterprise had mean monthly sales of PKR

[33] I learned about this program in the course of fieldwork for the artefactual field experiment; the program had started before my activities with Akhuwat and I was invited by the CEO of NRSP to conduct a survey to evaluate the implementation of these microequity contracts in the field.

[34] In Attock, Chakwal, ICT, Jhelum, and Mandi Bahauddin.

[35] All surveys were then conducted by enumerators at the microenterprise's location of business.

Table 14: NRSP SAMPLE: BUSINESS ACTIVITIES

	count	mean	sd	min	max
Manage a business?	248	0.96	0.19	0.00	1.00
Numbers of businesses managed	239	1.15	0.42	1.00	3.00
Own the business?	248	0.79	0.41	0.00	1.00
Number of years of experience (in sector)	239	6.57	6.70	0.00	50.00
Started the business from scratch?	248	0.81	0.39	0.00	1.00
Number of employees in the business	238	0.70	1.11	0.00	6.00
Own the land on which the business operates?	239	0.26	0.44	0.00	1.00
Have any form of other wage employment?	248	0.02	0.15	0.00	1.00

81,000 (approximately $810) over the previous three months, with a median of $360, and mean monthly profits of $178 (median $136), which is not too dissimilar to the microenterprise clients of Akhuwat who took part in the artefactual field experiment.

Figure 12 in the appendix shows that 68% of microenterprise owners were previously apprentices, which is unsurprising given that the program specifically aimed to help skilled but capital-constrained apprentices start a business. The mean number of years of experience as an apprentice was three. In terms of reasons for taking the financing product, approximately half of microentrepreneurs stated the purchase of assets or equipment for the business as one of the reasons, with 40% stating the purchase of raw materials. The amount of financing received as part of the program was $500 in 97% of cases, which is the first indication that the product, as it was implemented, appeared very similar to that of a conventional microcredit portfolio. Given the heterogeneity in business sector and business performance observed in Figure 11, some variation in financing amount might have been expected.

5.2 NRSP contract structure

The main purpose of the survey was to investigate the structure of the contracts that were intended to be implemented as 'microequity', as described by clients who were provided with financing. Figures 8, 9 and 10 illustrate the results. It is clear that NRSP had started implementing the product as an equity-based contract, for which there was a pre-agreed profit- and loss-sharing ratio of 20-80 (with the entrepreneur sharing 20% of their monthly profits with NRSP, and keeping 80% for themselves). As observed in Figure 8, when asked what the 'profit-sharing ratio' was between them and NRSP, 50% of respondents answered "80-20", which reflects the actual profit- and loss-sharing ratio with which the program started. Over 30% of respondents, however, stated that they did not know the profit-sharing ratio; post-survey follow-up conversations with enumerators suggested a lack of comprehension of this question. In hindsight, this reflects many entrepreneurs' inability to understand a question about sharing ratios when the way in which the product was being implemented at the time of the survey very much resembled a conventional fixed-repayment debt product. The next graph in Figure 8 again provides evidence that the way the contracts were being implemented in the field at the

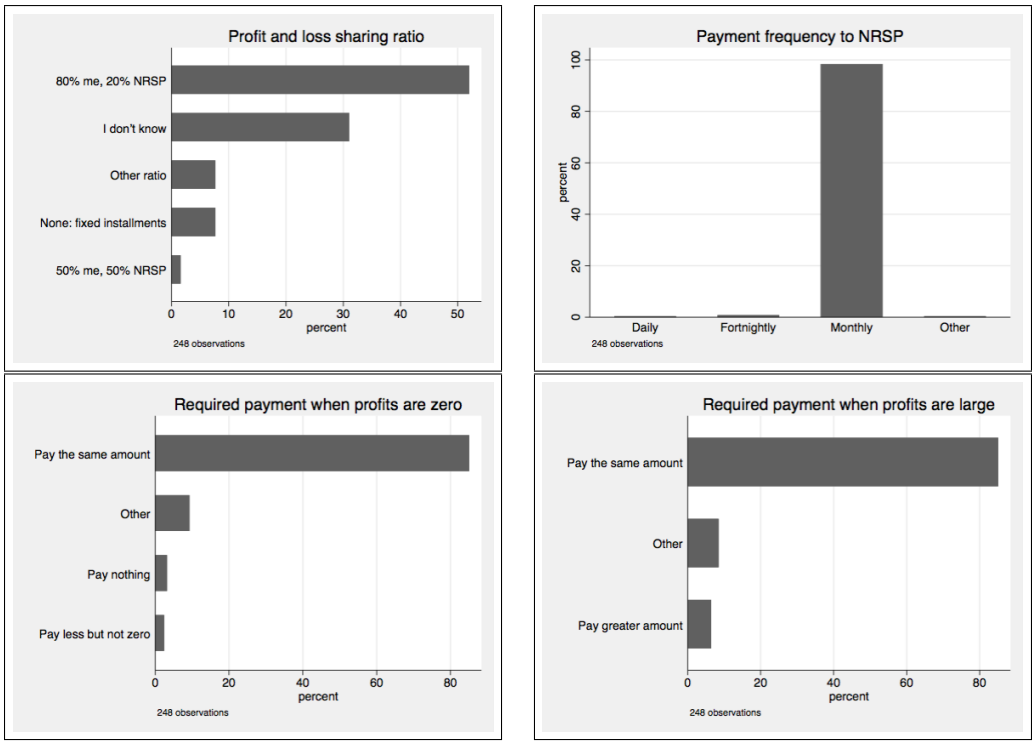
time of the survey mirrored a conventional debt contract with one set of standard terms and conditions implemented by all NRSP field staff. Here, it is clear that the repayment payment frequency was monthly for all entrepreneurs. While this is not sufficient evidence in itself that the product being offered was not equity-like, *some* variation in payment frequency might have been expected if a true equity-like product was being implemented.

The next two questions were the most significant in the survey; if what was being implemented was truly an equity-like product with performance-contingent payments, then one would expect some correlation between microenterprise business outcomes and actual payments made to NRSP. The following questions were asked:

(i) *"Think about the current contract that you have with NRSP. If you have zero profits in a given period that you usually make payments, how much do you have to pay to NRSP?"*;

(ii) *"Think about the current contract that you have with NRSP. If you have very big profits in a given period, how much do you have to pay to NRSP?"*.

Figure 8: CONTRACT STRUCTURE QUESTIONS 1

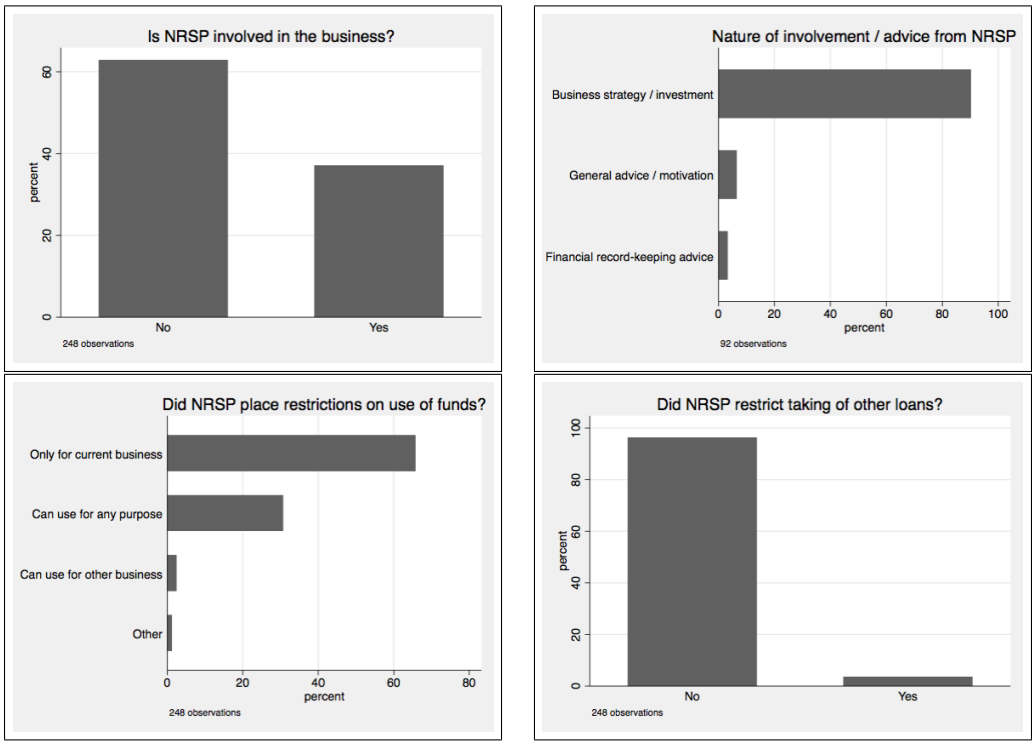


The results, illustrated in the third and fourth graphs in Figure 8, are very clear; in 85% of cases, the respondent stated that there was no profit- or loss-sharing involved in their relationship with NRSP: when their business profits were low, their repayments stayed the same, and when their business profits were high, their

repayments again remained constant. This provides conclusive evidence that what was being implemented in the field was not equity-like in the sense of containing performance-contingent repayments.

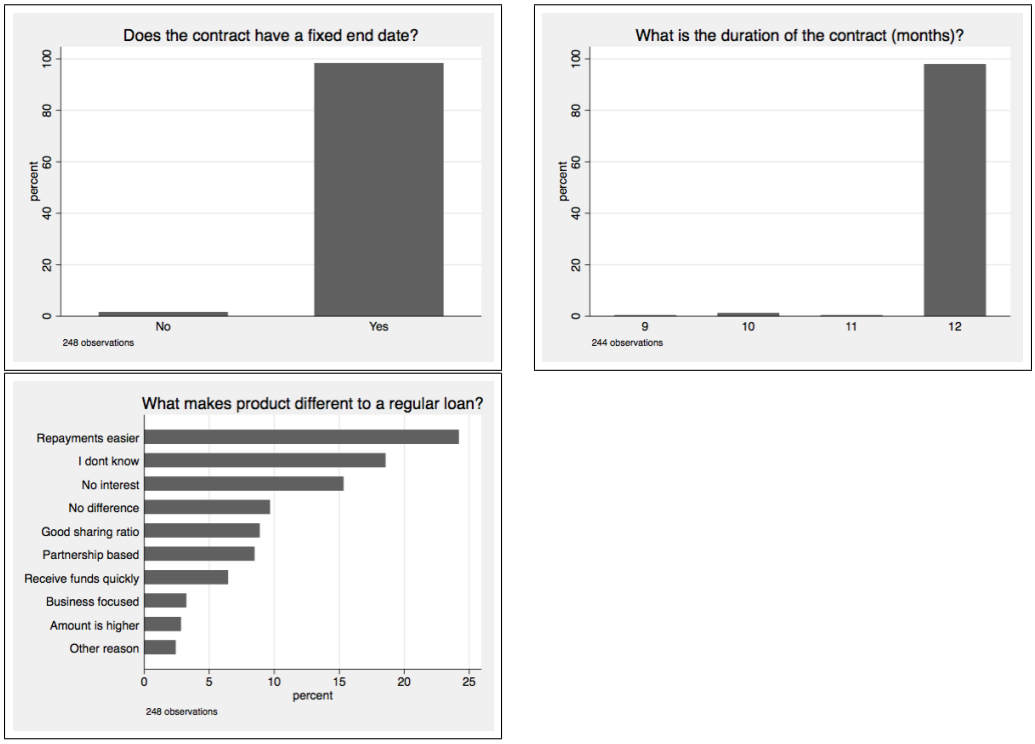
Another common feature of equity contracts is active involvement by the capital provider in the business. The first and second panels in Figure 9 illustrate that 37% of microenterprise owners said that NRSP was involved in their business, with most people citing some sort of 'business / investment strategy' as the form of advice. To further explore the extent of the involvement of NRSP, the next two questions were posed: *"Does the financing place any restrictions on the type of business for which you can use the money?"*, and *"Does the financing place any restrictions on you taking other loans in your business?"*. As can be seen in the third and fourth panels of Figure 9, 65% of respondents stated that they *were* restricted to using the money for their current business, while 31% asserted that they could spend the money for any other uses (which is rather surprising, given that the program was solely intended for business financing). 96% of respondents stated that NRSP did not place any restrictions on them taking other loans in their business. This is likely to be a standard practice with conventional loans, but it may be a cause for concern when providing actual equity-like financing. Specifically, if providing a loss-sharing product, the hierarchy of claims on the cash-flows of the firm is important (with debt typically having seniority and equity representing the residual claimant), so an MFI offering equity-like financing might be advised to place restrictions on the amount of debt that the microentrepreneur takes on.

Figure 9: CONTRACT STRUCTURE QUESTIONS 2



Finally, the first and second panels in Figure 10 illustrate that almost all contracts were implemented with a fixed end date of 12 months, much like the conventional NRSP loan product. The third panel illustrates the response to the question, *"In what ways is this product different from a normal loan?"*. There were many positive reasons given; approximately 30% stated that the payment terms were preferable, and nearly 10% thought that it was more 'partnership-based'. 15% said that it was unique because it was not interest-based; this is a surprising result, since the product very much resembled a conventional interest-based product, which is NRSP's standard product. This response may reflect that the program did in fact start with an equity-based product, and initially used Islamic legal terms such as '*Musharakah*', which means joint participation in Arabic and is commonly used to describe equity financing. This likely also reflects the desire of many clients to use non-interest-based products. In summary, this section of questions provides conclusive evidence that the contracts, as they were being implemented in the field, did not contain any loss-sharing or profit-sharing features, and that NRSP was not exercising any control rights in the operational or financial management of the firm.

Figure 10: CONTRACT STRUCTURE QUESTIONS 3



5.3 Discussion: NRSP's experience implementing equity contracts

Results from Section 5.2 reveal that, at the time of the survey, the contracts were not implemented in any meaningfully distinct way from a conventional fixed-repayment, fixed-duration, microcredit contract. Presentation of results and a detailed focus group with senior managers and field officers revealed interesting reasons for which these contracts, which had in fact started with performance-contingent repayments, converged to a standard debt structure. Results relate to many of the themes that arise in earlier theoretical work on sharecropping and income-sharing contracts, which suggest the optimality of a standard debt contract in the presence of information asymmetries and costly state verification.[36]

I presented results from the survey to NRSP's CEO, senior management and regional managers, with a detailed focus-group-style discussion taking place over the course of three hours. There are two major insights arising out of post-survey reflections and accounts from managers and field officers. First, from the supply side, one valuable lesson is the difficulty in implementing equity-like contracts within the structure of a conventional microcredit organisation. Loan officers did not have much incentive to finance higher-return, higher-risk microenterprise owners by providing them with an unfamiliar product that required greater monitoring effort and contained loss-sharing, especially because the loan officer would not themselves benefit from the upside portion of the profit- and loss-sharing arrangement (i.e. they had no 'skin in the game'). Further, loan officers reported that it was very time-consuming to calculate profit- and loss-sharing amounts, since many microenterprises did not keep adequate income statements, thereby requiring the loan officer to essentially create these. Even when records were kept, they were often paper-based and took much time to process for calculating performance-contingent payments, which reinforces the idea that in a world of costly state verification, a non-performance-contingent contract may be optimal.

The second key lesson arising out of post-survey interviews was from the perspective of clients. Results indicate that many clients had serious objections to the sharing rule used in the contracts when they were originally implemented with profit- and loss-sharing. A common sharing rule led to the most profitable entrepreneurs having to share too much of their profits and thus the equity product, ironically, appearing to be very 'inequitable' to them. The post-survey focus group with NRSP management revealed that gradually this led to loan officers and clients mutually agreeing to remove the performance-contingent aspect of the contracts, which eventually converged to a fixed-repayment structure, albeit on much more lenient terms than a conventional microcredit contract. Had NRSP maintained performance-contingent contracts alongside fixed-repayment contracts, adverse selection may have become a serious issue, with the most profitable microenterprises deciding to re-negotiate to a debt contract, and the least profitable ones remaining on performance-contingent contracts. Hence, the decision taken by NRSP management to revert all contracts back to a standard fixed repayment schedule appears to have been appropriate. This decision to move back to debt-like contracts also appears prudent in light of the potential adverse consequences of moral hazard.

[36] See Townsend (1979); Stiglitz and Weiss (1981).

Since a 20-80 sharing ratio was considered inappropriate by some of the more profitable businesses, in that they were obliged to share too much of their profits, had NRSP not renegotiated the contract then it could have created negative incentives for those microenterprises stuck on 'unfair' sharing ratios. This may have encouraged them either to exert less effort – for instance if they equated their marginal disutility of effort with their share of their marginal product rather than total marginal product – or to simply understate their profits, which would be difficult to detect due to costly state verification.

Intriguingly, NRSP branch managers also observed that, even though the contracts originally maintained a 'downside option' that did allow for loss-sharing ex-ante, in practice no entrepreneurs ever exercised this loss-sharing option. This was due to a fear that if they did not meet their expected payment every month, it would adversely affect their standing with the bank, which may hinder their ability to borrow in the future. Therefore, fears regarding reputation and dynamic incentives actually led to microenterprise owners not exercising their loss-sharing option, even when NRSP had explicitly allowed it. In summary, these findings from the survey of NRSP clients suggest that it is very challenging to implement equity-based contracts within a conventional microcredit organisation. The major constraints relate to the incentives of microcredit loan officers and those of clients, as discussed in earlier theoretical work on optimal financial contracts in the presence of asymmetric information and costly state verification. These are compounded by the related problems of adverse selection (the most profitable microenterprises selecting out of equity contracts) and moral hazard (distortionary effects caused by inappropriately chosen profit-sharing ratios).

6 Discussion: Avenues for future research on equity-based microfinance

The results from the artefactual field experiment with Akhuwat clients provide promising evidence for the potential of equity-based microfinance contracts to stimulate the growth of microenterprises in developing countries. However, NRSP's experience reveals the challenges arising from costly state verification and moral hazard, and the need to carefully investigate specific innovations in microfinance contract structure that test one particular feature of equity financing, rather than the assortment of features inherent in traditional equity contracts (shared ownership, performance-contingent payments, and business advice and mentorship). This is particularly important in environments characterised by high information asymmetries. In this section, I briefly describe three separate projects that have recently emerged out of the insights in this paper and which provide interesting avenues for future research.

6.1 Implementing performance-contingent contracts

One of the most important market failures that inhibit the implementation of performance-contingent contracts is costly state verification, which is a particularly significant problem in low-income countries, where most small businesses do not keep formal records of assets and income and there is often a mixing of business

and household accounts. In an ongoing project that is joint work with Marcel Fafchamps (Stanford), Franco Cordaro (Mars), and Colin Mayer, Simon Quinn and Kate Roll from the University of Oxford, we operate in a setting where we are able to observe a proxy for the performance of microentrepreneurs, which allows us to design contracts with performance-contingent repayments. We collaborate with one of the largest companies in the world, Mars Corporation, who own Wrigley Kenya. Our sample consists of micro-distributors, many of whom sell their retail products on foot, and who would like to finance the purchase of a bicycle to expand their micro-distribution activities. This setting is common to many 'route-to-market' distribution programs run by large multinational corporations around the world. This project is part of Mars Corporation's 'Mutuality in Business' research program, in collaboration with Said Business School. The project was initiated by Mars' research department, who approached us to design a more 'mutual' contract with its micro-distributors. The concept of mutuality is closely aligned with the idea of risk-sharing in equity contracts, and so we collaborated with Mars to design a number of different microfinance contracts that would help their micro-distributors finance the purchase of a bicycle, with the contracts varying in the extent to which they contain features that are 'debt-like', 'equity-like', and 'insurance-like'.

Our setting consists of microentrepreneurs who are part of Wrigley Kenya's route-to-market program. These micro-distributors purchase chewing gum from stock points that function as small warehouses. Stock points receive deliveries of Wrigley chewing gum, which they sell, alongside various non-Wrigley products. Micro-distributors purchase chewing gum as well as other products from stock points, before selling it to retailers, who are often small kiosks. Many micro-distributors do their work by foot; some have bicycles, with a much smaller number using motorcycles. There are currently approximately 700 active micro-distributors in Wrigley's program across Kenya.

Qualitative work with these microentrepreneurs revealed the two major constraints on their business to be 'materials and equipment', which can be interpreted as working capital and assets. Our sample consists of micro-distributors who expressed an interest in expanding their business by purchasing a bicycle. Bicycles can lead to significantly greater sales due to an expansion of territory and extra storage capacity; further, many microentrepreneurs, particularly women, have complained of back problems from carrying large bags for their distribution work, so bicycles can also be beneficial from a health perspective. However, bicycles are often prohibitively expensive, costing approximately KES 10,000 ($100) for a mid-market model. The mean monthly profit from selling Wrigley products is approximately $400, but micro-distributors typically sell a number of other products to generate income, with the sale of chewing gum constituting around 50% of their portfolio on average.

In the project, we randomly offer a subset of these micro-distributors financing for a bicycle, using five types of contract, which vary in their 'equity-like' and 'debt-like' characteristics, and are labelled with (politically-neutral) colours to facilitate explanation:

(i) **Grey contract**: a 12-month, fixed-repayment debt contract, based on a 15% mark-up of the financed amount;

(ii) **White contract**: a 12-month, fixed-repayment debt contract, based on a 15% mark-up of the financed amount, and including an early repayment option: micro-distributors can pay more than the required monthly payment in any given month, with the duration of the contract adjusting accordingly;

(iii) **Blue contract**: a hybrid between a debt and equity contract; this contract has a flexible duration, and ends when the cumulative payments reach the amount that is due under the aforementioned debt contracts. However, repayments are 'equity-like': they are based on a percentage of profits earned by micro-distributors, which we can credibly estimate given that we observe their stock purchases and know the expected profit margin on all products they sell;

(iv) **Pink contract**: A profit-sharing contract with the same repayment structure as the blue contract, which ends after a fixed time period (12 months);

(v) **Yellow contract**: An index insurance contract that has a similar structure to the pink contract, but where the profit-sharing is based on an index of regional profits rather than the micro-distributors' own profits (we are able to construct this index because we have full access to the profit data for all micro-distributors in Wrigley's programme).

Understanding of the contracts by micro-distributors has been good, and we have successfully implemented them with our MFI partner in the field. The motivation for adding the index insurance contract is related to our original hypothesis that 'equity-like' contracts, through performance-contingent payments, have the potential to benefit microentrepreneurs through the provision of implicit insurance, by automatically reducing repayment requirements when business conditions are challenging. We confirmed the potential importance of such a mechanism by analysis of variance of administrative data on incomes of all micro-distributors in the Wrigley program, which reveal the importance of both within-micro-distributor as well as between-micro-distributor variation. However, this value of performance-contingent payments could also in principle be achieved by an index insurance contract, which would not directly tax an micro-distributor's income. Index insurance may also be preferred to our 'equity-based' contracts, if common shocks are the primary concern for micro-distributors. Therefore, to provide a sharper test of the value of our 'equity-like' contracts, we added an index insurance contract.

As mentioned, the project is ongoing, but so far micro-distributors have shown interest in all of the contracts, and demonstrated a high level of understanding of the structure of contracts, which are being successfully implemented in the field. In future analysis, we hope to investigate the preferences of entrepreneurs for each of our contracts (we have detailed incentivised measures for each micro-distributor on their preference for each of the contracts), and investigate how such preferences are related to baseline measures of risk and loss aversion, impatience, business profitability and household wealth. With progress in financial

technology (we currently use mobile banking via MPesa to implement all payments in this project) and greater data availability on performance, such as in this current route-to-market programme operated by Mars (which can be found in many other situations with multinational corporations around the world), there is an exciting potential to implement equity-like contracts that provide implicit insurance to entrepreneurs through performance-contingent payments.

6.2 Designing a 'venture-capital-like' model for microenterprises

NRSP's experience, as described in Section 5, revealed the difficulties of implementing equity-like contracts within a conventional microcredit institution, where loan officers typically disburse a large number of standardised loans with an identical repayment structure, and are not required to expend significant effort monitoring the performance of the businesses that they finance.[37] Renumeration structures in microcredit institutions usually directly incentivise the minimisation of loan portfolio default rates, which can conflict with the policy objective of seeking to stimulate local economies by financing higher-risk, higher-potential-return entrepreneurs, many of whom would be expected to fail, with a few succeeding and generating overall benefits.

One of the insights from NRSP's experience described is that it may be necessary to operate such a model outside of the usual structure of a microcredit organisation, and by hiring staff who are dedicated to such activities. In the spirit of such financing models, Allianz, the largest insurance company in the world, recently launched a microequity project called 'Equitree' that aims to establish such a 'venture-capital-like' investment fund for microenterprises in Indonesia. As part of an ongoing project, we recently completed a post-hoc survey with clients of their program, in collaboration with Simon Quinn (University of Oxford), Russell Toth (University of Sydney), and the Abdul Latif Jameel Poverty Action Lab (JPAL), as part of an exploratory grant funded by the Australian Government's Department of Foreign Affairs and Trade (DFAT) to investigate the viability of such an equity-based model.

The model being implemented by Allianz involves an initial selection phase of microentrepreneurs, who are given six-month uncollateralised zero-interest loans of up to $150 and are encouraged to share some of their business profits from using the loans. Indonesia has a population of approximately 225 million Muslims, many of whom lack access to financial services due to their aversion to borrowing with interest, so the provision of zero-interest loans is intended to provide financing to a large number of potentially unbanked microentrepreneurs. The loans are used as a screening mechanism; microentrepreneurs who demonstrate good repayment behaviour and share some of their profits are given larger loans, after which they become eligible to graduate to the mentoring phase. This is similar to 'capital staging' that is done by 'business angel' groups and venture capital firms in developed countries. In the mentoring phase, microenterprises are matched with a business mentor and provided with a larger amount of financing. Some microenterprises are then expected to move into the business professionalisation phase, where Allianz proposes to formally register

[37] In fact, there is no necessity for them to ensure that the loans are used for business investment purposes.

the business and take an equity share, with a view to exiting the investment by selling their stake in the final phase, for example to a social impact investor. The Equitree model has been designed in a venture capital-like manner, with the aim of filtering out all but the most promising entrepreneurs. Thus far, over 150 investments have been made since 2016, with a number of microenterprises progressing to the mentoring phase of the program. Microenterprises are classified into four categories, based on their repayment behaviour:

(i) 'Baddies' are those who do not return their zero-interest loan on time;

(ii) 'Goodies' return their loan on time, and also share some of their profits (up to 10% of the loan amount);

(iii) 'Stars' return their loan on time and share profits greater than 10% of the loan amount;

(iv) 'Superstars' are those who have been classified as stars for two consecutive loans.

Despite some reservations about the classification system that Allianz had implemented, in particular the potential for 'gaming' of the system by claiming that returned funds were from profits in order to obtain a larger loan, in December 2017 we agreed to conduct surveys with some of Equitree's clients for the purpose of a post-hoc analysis and to advise Allianz on the design of their program. The objective of our analysis was to test clients' understanding of the structure of the Equitree graduation model, and to investigate which particular aspect of the model was the most influential in their decision to join the program. Finally, we wanted to explore which business and household variables correlated most strongly with administrative data on repayment behaviour, using a simple variable selection algorithm, in order to shed light on whether it was possible to identify microenterprises with the highest growth potential. In general, the characteristics of the sample were not too dissimilar to those described for Akhuwat and NRSP's clients in Sections 3 and 5; mean monthly business sales were $600 and mean profits were $150.

When testing respondents on their understanding of the Equitree model and its various stages, we found that understanding was much lower than we had anticipated. While around half of clients knew that the phase after the loan was mentorship, around three quarters stated that they would have still taken a loan even if the Equitree program did not contain a mentorship element, which was the first sign that the initial zero-interest loan may have been the main motivation for many people joining the program.

We asked respondents about their main reasons for joining the program as opposed to taking finance from a conventional source; the most popular response was the zero-interest nature of the loan, which was cited by three quarters of respondents. We then used a simple machine learning (LASSO) method to investigate what variables were the best predictors of the feature of the Equitree program identified by the clients as the most important for them, by regressing a binary variable for which feature was preferred on a large selection of household and business characteristics. We find that households containing a higher number of businesses and those with better business management practices are *less* likely to have reported the initial loan as the most influential reason for their decision to join the program. Consistent with this, we find that households

with a greater number of businesses and better business management practices are *more* likely to report the mentorship phase as the most important reason for their joining.

Finally, we combined the survey data with administrative data on total loans taken by clients and their repayment behaviour. We again employed LASSO to identify the strongest predictors of repayment behaviour, using a large set of household and business characteristics. We start with the administrative data based on which clients were classified as 'baddie', owing to their failure to repay their loans on time. Results reveal a strong correlation with microenterprises that have fewer employees, those reporting themselves as being satisfied with their business, and those stating the reason for taking the loan as the lack of interest.

Turning to clients who were classified as 'goodie', LASSO fails to identify any key variables that are good predictors, which is consistent with a large literature that documents the challenges in predicting the best-performing microentrepreneurs.[38] That literature also finds that it is often easier to predict the far-right tail of the microenterprise growth distribution, and our next result is also consistent with this. When exploring which variables predict whether a microenterprise is categorised as a 'star', we find that clients who are more concerned about the religious aspect of the product are *less* likely to be 'stars', while those who have remained in the same business as when they joined the Equitree program and those who report that they would like to continue or expand their existing business are more likely to be classified as 'stars' (which likely reflects reverse causality).

Organisations inspired by the investment strategies and incentive structures put in place by 'business angel' groups and venture capital firms in developed countries have the potential to provide an alternative to the current financing options for growth-oriented microenterprises in low-income countries. They may be more effective at fostering the selection and growth of potentially transformational entrepreneurs than a standard microcredit institution, using a separate dedicated organisational structure that adopts a more portfolio-based view of investments. However, the insights described here from Allianz's experimental model of institutional structure indicate the difficulty in predicting which microenterprises will be the most successful, which is consistent with the existing literature.

In this specific Indonesian context, we have found that the program being implemented by Allianz has succeeded in providing low-cost and easily-accessible financing of smaller amounts to microenterprises that may have been financially constrained due to religious reasons. It appears that such individuals have benefitted from the Equitree program, but that these same people are much less likely to perform well in their repayments, or to expand their business. We are currently collaborating with Allianz to re-design the program, with a focus on improving the identification stage. Nonetheless, using small-scale staged loans certainly seems to be an effective negative screening method, by identifying which clients would *not* be good

[38] See McKenzie and Sansone (2017).

candidates for equity-like financing.

6.3 'Skin in the game': Microequity and mentorship

Another common feature of equity-based financing, which follows naturally from the previous section's discussion on integrating mentorship in a microequity model, is the role of 'active' equity investors who provide business advice as well as capital. A combination of mentorship and equity financing could lead to significant benefits for microenterprises, given that many business training programs have yielded limited and short-term benefits for most microentrepreneurs, with little impact on sales or profits (McKenzie and Woodruff, 2013). There is recent evidence that tailored and intensive programs can have a positive impact, with particularly promising results for personalised mentorship, although impacts were again only short-term (Brooks, Donovan, and T. Johnson, 2016). We hypothesise that entrepreneurial mentorship could be more effective when mentors are incentivised directly by the productivity of their mentees, or, in other words, when they have 'skin in the game'. Mentors can help the microentrepreneurs reap the benefits of better management practices, which may lead to more sustained gains, given the alignment of incentives induced by equity financing.

In this project, which is joint work with Mehrab Bakhtiar (University of Maryland), Abu Shonchoy (Florida International University), and Simon Quinn (University of Oxford), we work with an IT company in rural Bangladesh to help train college graduates to become online freelancers. Online freelancing work includes basic data entry as well as more sophisticated activities such as website development, search engine optimisation and social media marketing. Average income for mature online freelancers can be significant, but it takes approximately three to six months of full-time training to get to a basic level, and training programs often have a relatively high up-front cost (approximately $120).

We therefore seek to alleviate both financial and human capital constraints, by providing promising potential freelancers with financing for the program cost, intensive training and mentorship. We use a field experiment to randomly vary the form in which capital is provided; specifically, we offer a fixed-repayment debt contract, as well as 'equity-based' contracts that involve performance-contingent payments, which are feasible because freelancing activities are conducted on an observable online platform. We also hope to monitor the effort entrepreneurs exert in the online marketplace, the reputation they build on the platform, and any shirking from work. This allows us to test another key prediction from the theoretical literature: that income-sharing arrangements may be inefficient relative to debt contracts because entrepreneurs will exert less effort, since they equate their marginal disutility of effort with their share of their marginal product rather than the total marginal product.

After the intensive training program, a number of students enter an "on the job" internship program, where

they have access to a computer facility where they can conduct their business operations, and where a mentor helps them to navigate the online market place and start interacting with clients and earning income. We are also experimenting with offering students a percentage of their earnings on the platform, compared to a fixed repayment, and the interaction between this and repayments on their initial financing for the up-front cost of the program. Early results results reveal a strong demand for the online freelancing program, with students very sensitive to the price of the program and many struggling to raise the required costs of the program. We intend to investigate preferences over contracts and how these vary by student and household characteristics, as well as the impact of the different contracts on freelancing behaviour. We plan to collect high-frequency data on: (i) participant income, effort levels and activities on the platform, including sales strategies and other activities to boost their online reputation; (ii) the use of any additional training materials; and (iii) shirking such as using the work terminals to access social media. We are also actively seeking to increase the number of female participants in the program. Online freelancing training programs have a great potential to benefit females in rural areas, who often have few job opportunities and face patriarchal social norms, *'purdhah'* restrictions and family obligations that hinder active labour force participation. An online freelancing platform can enable many women to enter entrepreneurship, with the freedom to work from home and access global clients to earn a competitive wage. There is also substantial policy interest in online freelancing from the Bangladeshi government.

7 Conclusion

Access to finance is frequently listed as one of the most important constraints on the expansion of small firms in low-income countries. Many existing studies focus on the role of microcredit as a source of capital; other work complements this by considering the potential effect of microsavings and microinsurance. In this paper, I investigate the effect of 'microequity' contracts, which provide capital using a performance-contingent repayment schedule that allows a greater sharing of risk and reward between capital provider and microenterprise. In the first part of the paper, I describe the implementation of an artefactual field experiment, designed using a simple model of investment choice under different financial contracts, and tested with microenterprise owners who are part of a large field experiment that provides them with a graduated loan to expand their business with a fixed asset. Results reveal that equity-financed microentrepreneurs chose investment options with a greater expected return and risk than under debt financing, with heterogeneity analysis providing suggestive evidence of a larger effect for more risk-averse microenterprise owners. In the second part of the paper, I explore the question of why microequity contracts do not appear to be part of the current portfolio of products offered by most microfinance institutions, considering the significant potential benefits identified in the first part of the paper. To shed some light on this question, I report on an attempt by one of the largest microfinance institutions in Pakistan to implement equity-based microfinance contracts with microenterprise owners in the field. Results from a detailed client survey and a post-survey focus group with senior management point to the significant challenges of implementing equity-based contracts

within a conventional microcredit organisation, with the major challenges relating both to the incentives for microcredit loan officers as well as costly state verification, adverse selection and moral hazard.

Nevertheless, given the positive results in the first part of the paper, and the willingness of some large MFIs such as Akhuwat and NRSP to implement microequity contracts, there appears to be some potential for establishing alternative 'venture capital-like' funding models. Insights from this paper suggest that this would need to be operated separately from the conventional operations of a microcredit institution, with the aim of providing risk-sharing capital for promising growth-oriented microentrepreneurs. In the entrepreneurial finance literature, it is well-established that venture capital firms can add value beyond that of traditional financial intermediaries, including monitoring, support, control, and the professionalisation of firms.[39] One of the key insights from NRSP's experiment with a microequity product was that the common sharing ratio that was applied to all entrepreneurs was inappropriate, and led to some entrepreneurs sharing a very large amount of profit; if such income-sharing contracts are to be provided, then there is clearly a need for more specialised investment officers who understand the dynamics of the firms and industries being financed and what a reasonable sharing ratio would be, given the typical margins and income volatility in that sector. Venture capital firms are also able to diversify risk simultaneously in a number of firms, whereas a conventional loan-based organisation typically does not operate with such a 'portfolio perspective' and rather seeks to prevent default on each individual loan disbursed, which is unrealistic if one seeks to finance higher-risk, higher-return entrepreneurs. As a way of screening high-potential firms through a graduated finance model, venture capital firms often 'stage' their investment expenditure in each enterprise, initially giving smaller amounts of finance and increasing this based on the attainment of certain targets, which has a number of benefits such as the reduction of agency risks induced by one-sided asymmetric information.[40] While one concern with attempting to implement such a venture-capital-type model in developing countries is the lack of exit option via a liquid stock market, Hellmann (2006) reports that there are actually more venture capital exits by acquisition than by initial public offering (IPO), and in many developing countries there may be the potential for a future exit by selling to various possible buyers, include social investment funds.

An important issue to consider when attempting to address the lack of growth of many microenterprises in developing countries is the identification of growth-oriented entrepreneurs. A useful distinction to make is between 'subsistence entrepreneurs' and 'transformational entrepreneurs', who vary in their economic objectives, skills, and role in the economy. Subsistence entrepreneurs become entrepreneurs as a means of providing subsistence income, whereas transformational entrepreneurs aim to grow their firms and provide jobs and income for others. Most of the financial infrastructure built to reach the poor in developing countries is based on MFIs, like Akhuwat and NRSP, who have succeeded in rapidly expanding and effectively managing the operational challenges with a 'retail-like' approach of providing a high volume of standardised loan products with relatively rigid repayment terms. Although there is now strong evidence that such products have

[39] See Hellmann and Puri (2002); Bottazzi, Da Rin, and Hellmann (2008).
[40] See Sahlman (1990); Gompers (1995); Neher (1999).

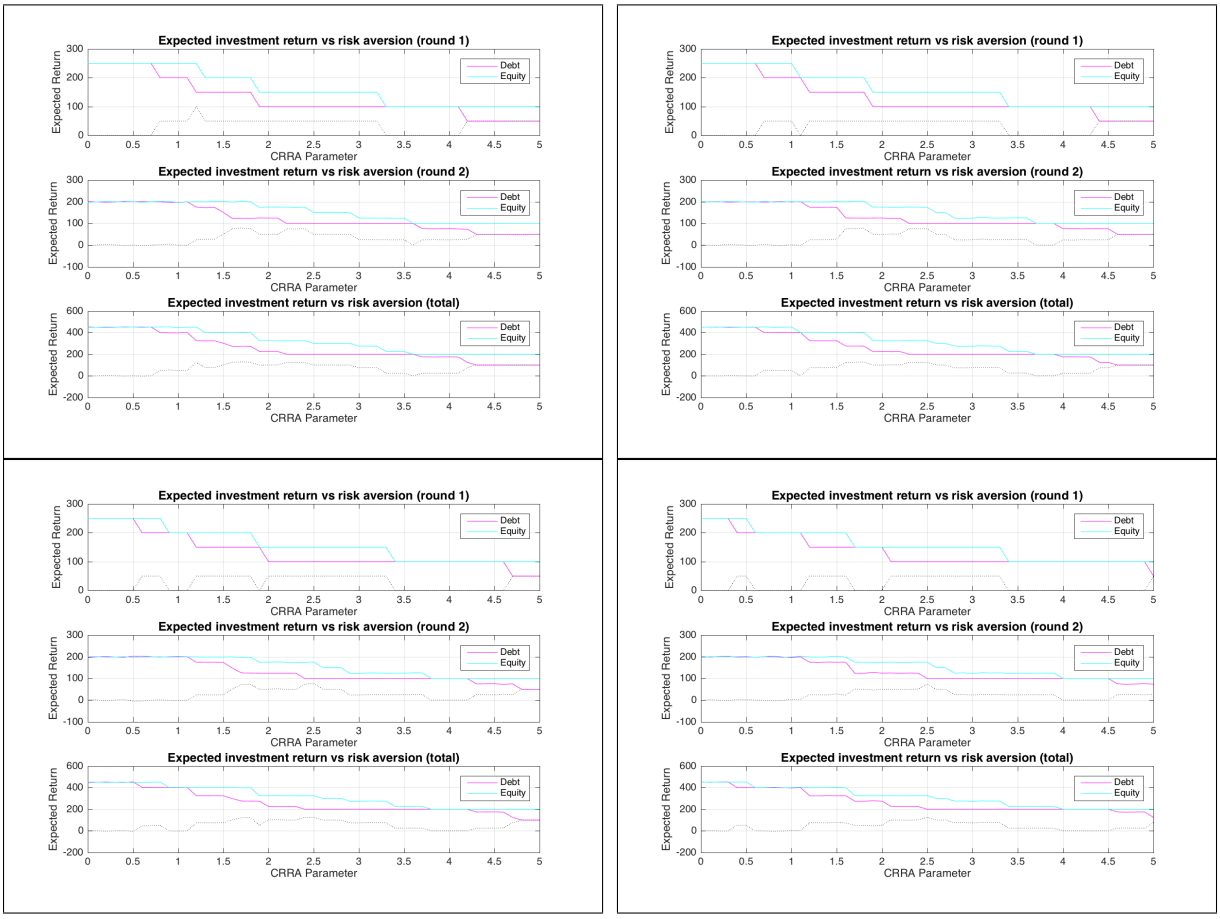
not led to large effects on the growth of entrepreneurs or household income, they have proven to be important tools that help poor individuals manage negative income shocks and smooth consumption. Nonetheless, it is clear that MFIs are not best-placed to support growth-oriented transformational entrepreneurs. Schoar (2010) argues that to achieve a more effective flow of capital to transformational entrepreneurs in developing countries, there is a requirement for organisations that effectively foster the selection and financing of such entrepreneurs. She discusses emerging markets such as Brazil, India, and China, where there has been a rapid emergence of venture capital funds that support the top end of entrepreneurs. However, most small firms still rely on bank lending, so innovations to provide more risk-sharing products are much-needed.

Apart from organisational structure and microenterprise selection methods, one of the major remaining challenges in providing equity-like financing is that of costly state verification. Progress in financial technology, such as electronic point-of-sale systems and mobile banking, may help mitigate the cost of monitoring business performance, and permit innovative models with performance-contingent repayments. Revenue-sharing models may be a particularly fruitful avenue to investigate such contracts, as they avoid the often complicated process of identifying business expenses in order to calculate profits. It is conceivable that costly state verification can be dramatically reduced for firm revenues, whereas it may remain difficult to verify microenterprise profits due to the challenge of measuring and monitoring business expenses directly attributable to sales in a particular period (for the purpose of calculating that period's profits), especially given that many microenterprises face highly volatile incomes, do not keep good business records, and mix business and household finances. While it may be possible that technological advances can also help monitor expenses, for example using radio frequency identification (RFID) tags for inventory management to measure flow of inventories, recent work highlights the significant challenges in implementing the currently available 'off-the-shelf' inventory management devices with microenterprises.[41] For example, the financial technology firm iZettle, which is one of the fastest growing fintech companies in Europe, provides payments systems and point of sales terminals for small businesses to record, manage and analyse sales. iZettle recently introduced a financing product with performance-contingent repayments that are taken directly taken out of the business' sales.[42] A revenue-based financing model avoids the complication of accurately attributing expenses, and it is relatively straightforward to monitor sales using an electronic point-of-sale system. [43] Such innovations in contract structure merit further empirical and theoretical research.

[41] See De Mel, Herath, McKenzie, and Pathak (2016).
[42] iZettle processes their sales through its card payments system. www.mobiletransaction.org/loans-small-businesses-izettle-advance/.
[43] Of course, one needs to design mechanisms that consider the incentives to hide sales from such systems, if repayments are only linked to sales registered on the system.

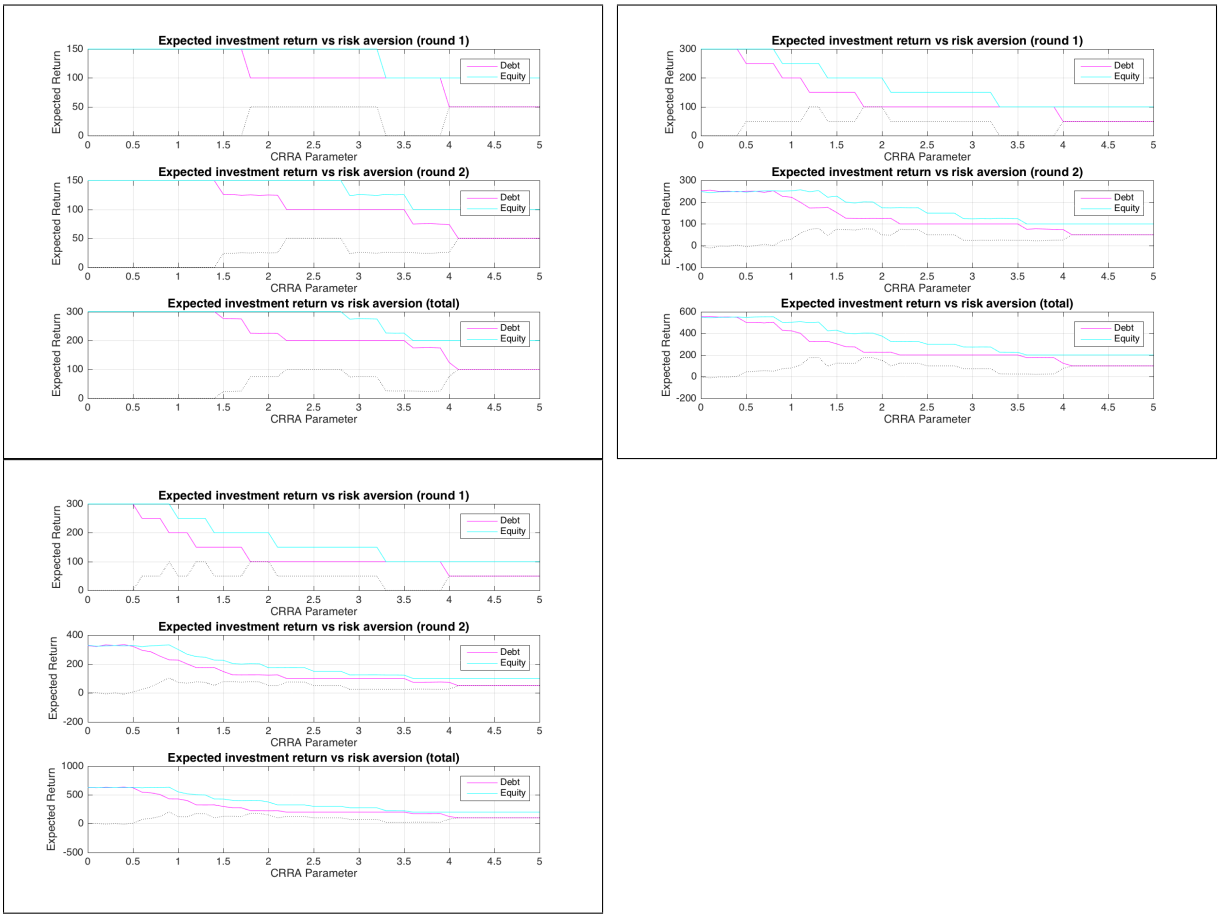
8 Appendix

Table 15: SIMULATIONS: CHANGING THE NUMBER OF GAME ROUNDS



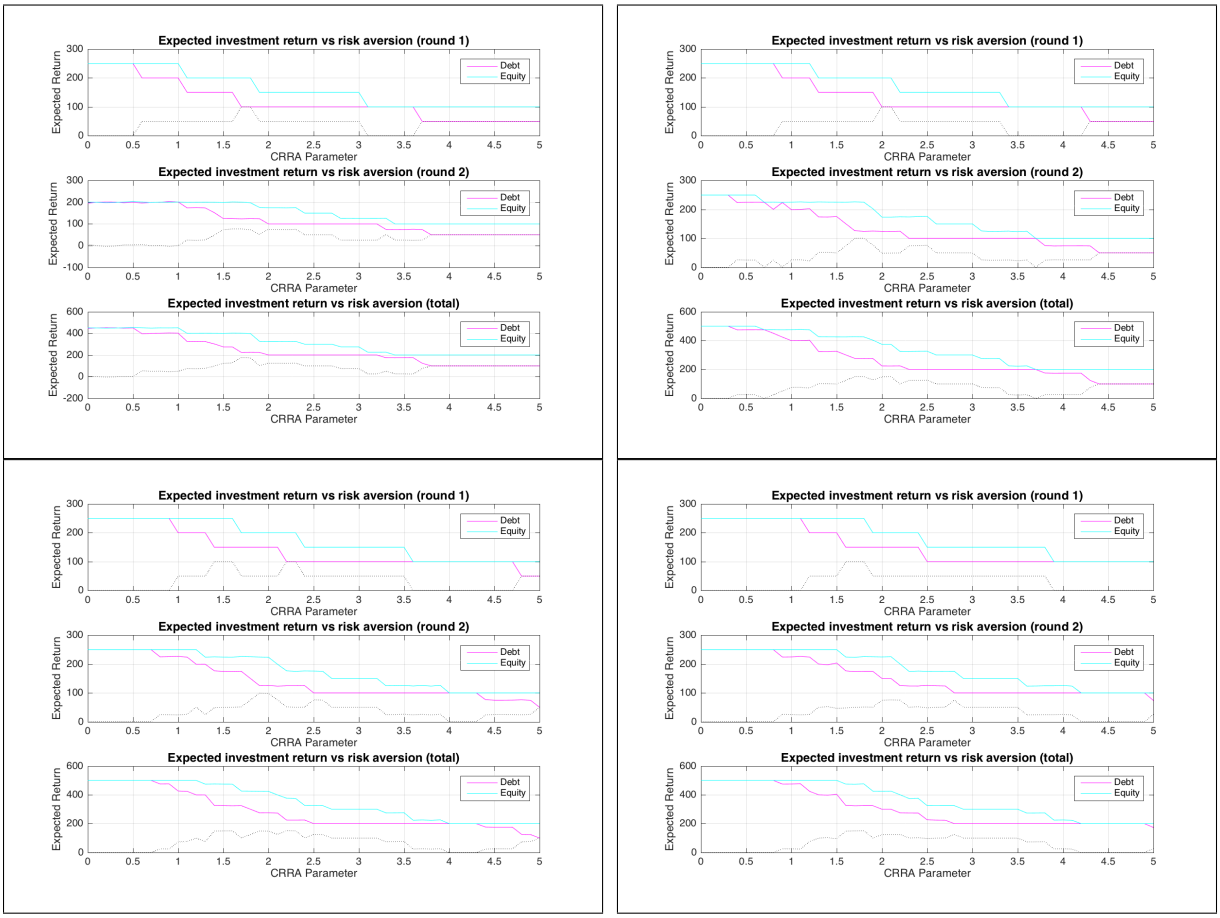
This figure presents results from simulations with a different number of investment rounds in the game: (beginning in the top-left panel, going clockwise): 3, 5, 7 and 10 rounds.

Table 16: SIMULATIONS: CHANGING THE NUMBER OF INVESTMENT OPTIONS



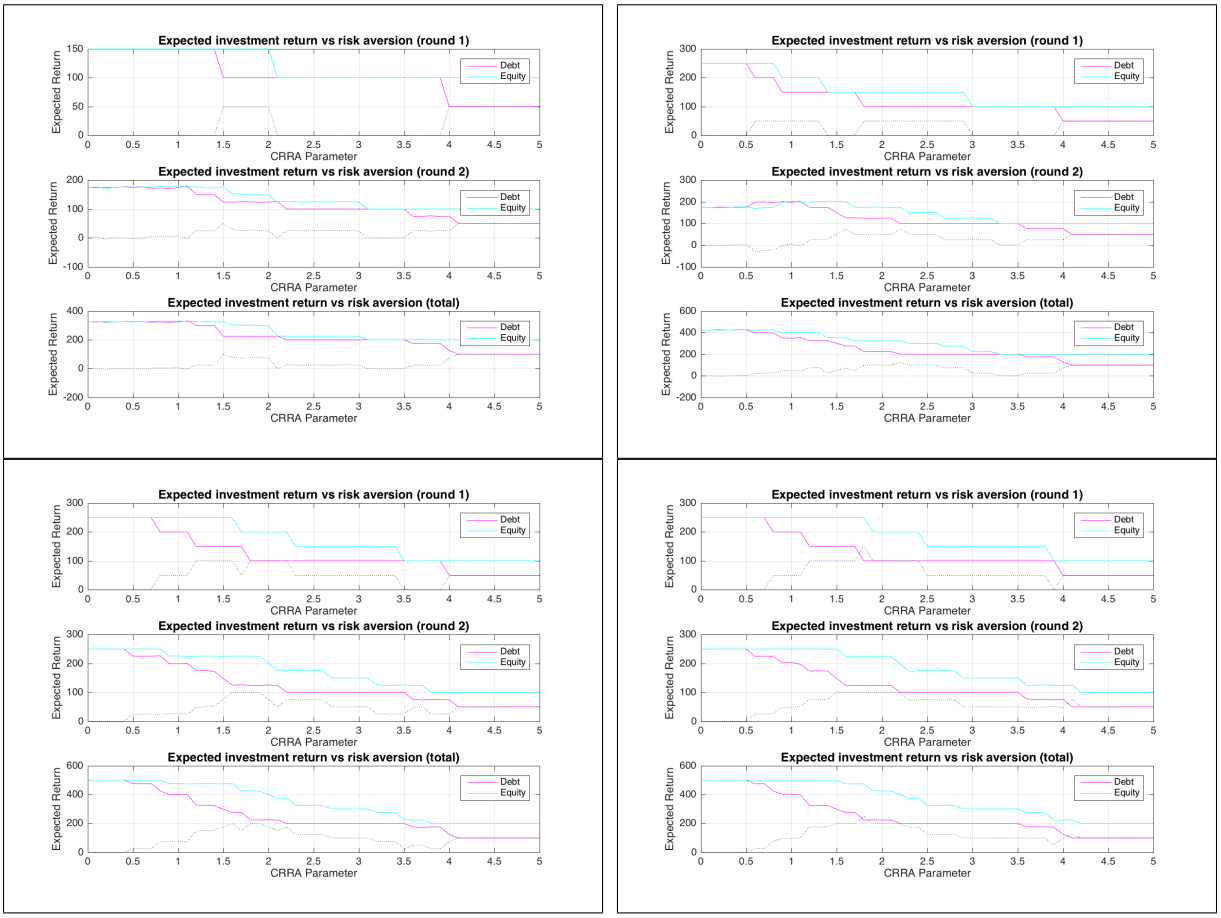
This figure presents results from simulations with a different number of investment options per round: (beginning in the top-left panel, going clockwise): 3, 7 and 10 investment options.

Table 17: SIMULATIONS: CHANGING THE INITIAL WEALTH LEVEL IN THE GAME



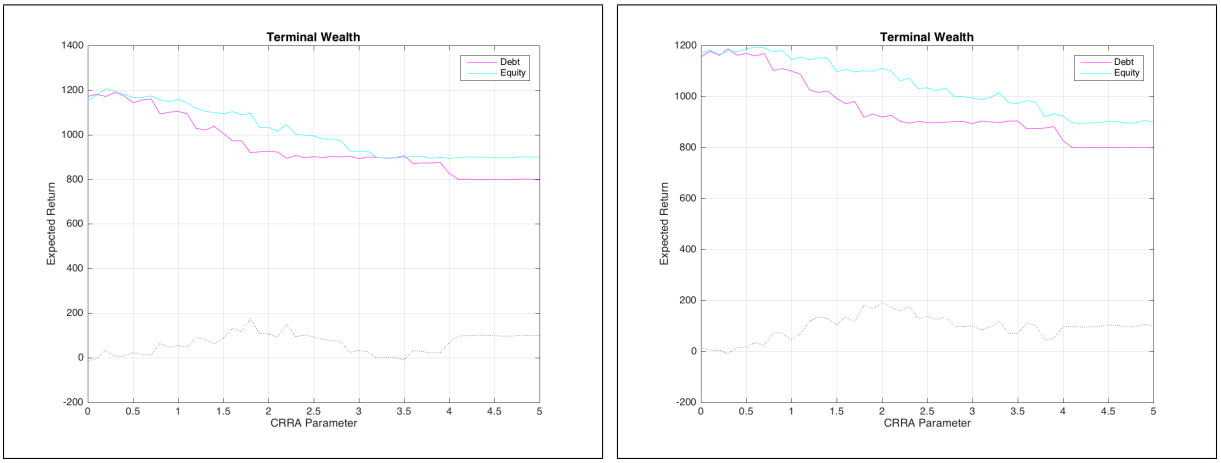
This figure presents results from simulations with a different starting amount of investment wealth in the first round of the game: (beginning in the top-left panel, going clockwise): 100, 300, 500, and 700.

Table 18: SIMULATIONS: CHANGING THE FINANCING AMOUNT



This figure presents results from simulations with a different capital amount for the financing contracts: (beginning in the top-left panel, going clockwise): 100, 300, 700, and 1,000.

Table 19: SIMULATION: TERMINAL WEALTH AT THE END OF THE GAME.



This figure presents results for the terminal wealth for agents at the end of the game. The left panel represents the 50-50 equity contract, and the right panel the 25-75 equity contract.

Figure 11: BUSINESS PERFORMANCE METRICS

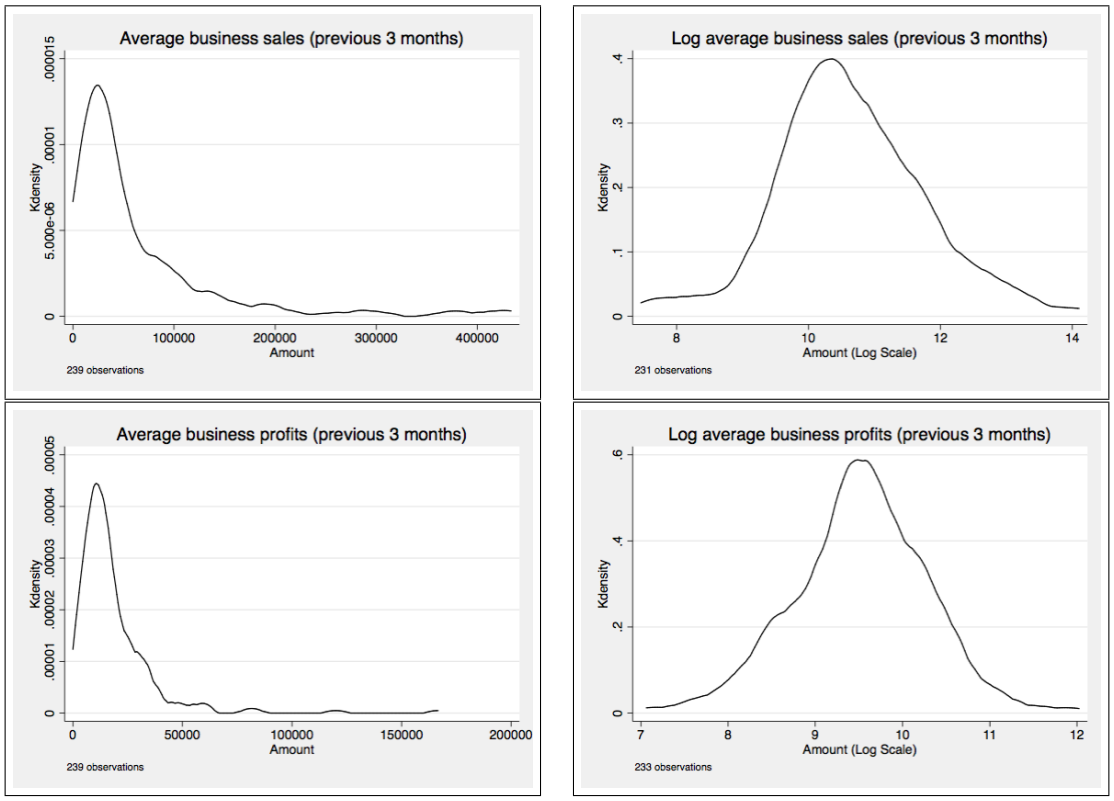


Figure 12: BACKGROUND OF APPRENTICES AND HOW THE FUNDS WERE USED