Too Vulnerable for Microfinance?: Risk and Vulnerability as Determinants of Microfinance Selection

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Abstract: Microfinance has become a popular part of poverty reduction agendas since its inception roughly 30 years ago. Despite dramatic growth, however, many microfinance institutions face low penetration rates. It turns out many potential borrowers choose not to participate. Current explanations for this phenomenon largely focus on skill, arguing that high skill entrepreneurs generate expected returns above the borrowing rate and select microfinance while low skill entrepreneurs do not and stay away. In this paper I contend these explanations are insufficient because they ignore risk altogether, a fundamental driver of poor household's behavior. I propose consideration of vulnerability, defined as the inability to smooth consumption across negative income shocks, as an additional factor driving microfinance selection. I outline a model in which the risk level of projects and a household's ability to manage risk help determine whether or not a household can "afford" microfinance. Using data from ACP, a large, profit-oriented microfinance institution in Peru, I find positive evidence that vulnerability is significant in determining microfinance participation. These results suggest risk and vulnerability should be incorporated into subsequent analyses of the effectiveness of microfinance as a poverty alleviation tool.

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I. Introduction

Roughly 30 years after its inception microfinance has become an increasingly popular part of poverty reduction agendas of multilateral organizations, national policy makers, and NGOs. An industry that began with the premise of providing working capital loans to poor entrepreneurs unable to obtain formal credit elsewhere continues to capture attention and garner proponents. The industry also draws increasing amounts of donor funding, thanks in part to theories about how credit access improves welfare, (Eswaran and Kotwal 1990, Morduch 1994, Banerjee 2004), limited empirical evidence that expansion of credit reduces poverty (Burgess and Pande 2005, Khandker 2003), and a large body of anecdotal evidence[2] that microfinance in particular has helped some households navigate the road out of poverty. With the help of significant enthusiasm and billions of dollars in donor support the microfinance model has spread around the world, and an estimated 3100 microfinance institutions (MFIs) currently operate in countries as diverse as Indonesia, Bosnia, Peru and the U.S. Collectively these institutions serve over 92 million clients worldwide, and the numbers continue to grow as many MFIs migrate into new services such as savings accounts, remittance management, housing finance and microinsurance[3].

Despite dramatic growth, however, there is an infrequently cited puzzle about microfinance which is that many institutions face low penetration rates. It turns out a significant number of potential borrowers never seek out microfinance loans[4]. In the case of Peru, the country of focus of this analysis, it is estimated that only 5% of all microentrepreneurs access credit from MFIs (Berger 2003)[5]. This is a curious phenomenon, because if microfinance fills an important void in the lives of the poor, as is argued by MFI's numerous proponents, why are so many households not availing themselves of a service that would potentially make them better off? Candidate explanations such as a limited supply of

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[2] Despite much anecdotal evidence of positive impacts of microcredit, there is little undisputed empirical evidence, mostly due to lack of data that can appropriately address the problem of selection bias. See Armendariz and Morduch (2005) for an overview of the debate over impact studies.

[3] Figures as of Dec. 31, 2004. Microcredit Summit Campaign Report 2005 (*www.microcreditsummit.org*)

[4] Studies of Kenya and Tanzania estimate penetration rates of 1% (CGAP 2000), while studies in Brazil estimate penetration rates of 2% (BNDES 2002). In Bolivia, the most penetrated microfinance market in Latin America, it is estimated only 28% of potential borrowers are reached (IDB 2004).

[5] In 1997 ACP had roughly 30,000 clients. It is estimated there were 600,000 microentrepreneurs in Lima at the time, meaning ACP reached only 5% of the Lima market (Campion, Dunn and Arbuckle 2001). Although this estimate, along with others, overstates the extent of underpenetration by classifying all microentrepreneurs as potential clients, the client base is sufficiently low relative to the universe of micro-entrepreneurs to indicate a substantial number of households remain untouched by the "microfinance revolution".

microfinance funds, limited demand due the availability of other funding options, or limited need for working capital finance generally fall flat when put to the data. Something else must help explain the extent of non participation behavior.

The standard argument is that differential endowments of entrepreneurial skill explain the puzzle of microfinance selection. High skill entrepreneurs generate sufficient returns on entrepreneurial projects to service microfinance loans and therefore seek out this credit, while low skill entrepreneurs generate insufficient returns and decide to stay away. While skill likely plays a role, the flaw in this argument is that it ignores risk altogether, a fundamental driver of poor households' behavior. Only if the level of risk is constant across projects and tolerance for risk constant across entrepreneurs can skill represent the only barrier to high yield projects and microfinance. It is highly unlikely, however, that high and low yield projects have the same level of risk or that tolerance for risk is constant given different levels of wealth and access to credit and insurance. Risk is so significant a consideration for many poor households, in fact, that even after removing the skill barrier many entrepreneurs likely would continue to avoid high yield projects and microfinance. Perhaps, then, the something else driving microfinance selection is the ability to manage risk.

This paper argues the above point, that vulnerability, defined as the inability to smooth consumption across adverse income shocks, is an additional, critical factor that drives microfinance selection and explains the puzzle of low participation rates[6]. Households with greater ability to manage higher risk might choose to engage in higher yield projects and to seek microfinance credit, while those less able to manage higher levels of risk opt out of both. The idea that vulnerability to risk is linked to income choice is not novel, as there is a large body of theoretical and empirical literature on the relationship between vulnerability and crop choice amongst rural households (Dercon 2005, Fafchamps 2003, Heltberg and Tarp 2001, Lopez, Nash and Stanton 1995, Morduch 1990, McKloskey 1991, Wright 1978). The extension of this rationale to an urban setting and exploration of the implications for microfinance programs, however, is unique. Both of these extensions are important given the increasing recognition of the size of the urban, microenterprise sector in

[6] Other definitions of vulnerability include: the "the likelihood that a shock will result in a decline in well-being" (2000/2001 World Development Report); or "the existence and extent of a threat of poverty and destitution" (Dercon 2005). See Dercon 2005 for further discussion of vulnerability.

generating employment and income in the developing world[7], and new questions about whether or not access to credit, particularly microfinance, is sufficient to achieve poverty reduction goals. By examining potential links between vulnerability, project choice and microfinance it might be possible to better understand how urban households successfully exit poverty and the importance of microfinance, and formal credit in general, in this process.

The paper provides a theoretical and empirical investigation into the impact of vulnerability on microfinance selection. I first explore the theoretical dimension, developing a model in which entrepreneurs choose between a high yield/high risk enterprise and microfinance and a low yield/low risk enterprise and no microfinance. The model finds that even after controlling for skill and wealth, at higher levels of vulnerability entrepreneurs reject the high yield enterprise and microfinance for the low yield, safe option. The model also predicts that while vulnerability is a key determinant of microfinance selection, it matters less for high skill and high wealth entrepreneurs.

I then test the empirical relationship between vulnerability and microfinance selection using data on microentrepreneurs in Lima, Peru. Data was collected in two years, 1997 and 1999, on clients of ACP, a large, profit-driven microfinance institution in Lima and on a group of entrepreneurs with similar observable characteristics but no microfinance. After defining proxy measures for vulnerability and skill I find positive evidence that vulnerability negatively impacts microfinance selection. More vulnerable entrepreneurs are found to be anywhere from 8% to 45% less likely than their less vulnerable counterparts to select into microfinance programs. I also find that vulnerability weighs less heavily in the probability of microfinance selection for high skill and high wealth entrepreneurs. Overall these findings suggest vulnerability to risk is an important determinant of behavior for potential microfinance borrowers and may explain low participation rates.

The paper proceeds as follows. Section 2 develops a theoretical model that predicts vulnerability negatively impacts microfinance selection. Section 3 describes the data, including information on ACP, the loans offered by this institution, and alternative sources of financing. Section 4 outlines measures of vulnerability and skill. Section 5 estimates the determinants of microfinance selection using the full sample of households from the first

[7] According to a 1996 INEI (statistical agency in Peru) survey 66% of the economically active population in urban areas in Peru is involved in some form of microenterprise. See Pearlman (2006) for further discussion.

survey round (1997). Section 6 estimates the determinants of microfinance selection using the balanced panel (1997 and 1999 data). Section 7 concludes

2. Theoretical Model

This section develops a model of microfinance selection amongst microentrepreneurs. The theory shows that even after controlling for skill and wealth, entrepreneurs who have less ability to smooth consumption across negative income shocks do not select into microfinance programs. It also shows that vulnerability is less of a concern for microfinance selection at higher levels of entrepreneurial skill and wealth.

2.1 Setup

Consider a two period model in which risk-averse entrepreneurial households (referred to as entrepreneurs) make decisions to maximize expected lifetime utility. Entrepreneurs begin period 1 with an exogenous skill endowment which can take one of two values: T_H =high skill, or T_L =low skill. Entrepreneurs also being period 1 with an exogenous endowment of liquid wealth, which is randomly drawn from a uniform distribution over the range $[\underline{W}, \overline{W}]$. Liquid wealth can be thought of as household durables or low yielding savings, such as cash stashed at home. All values earn zero interest. It is important to include wealth in the model to distinguish between risk preferences and vulnerability as drivers of behavior. For example, the willingness to take on risky projects is negatively related to a household's level of risk aversion, which, depending on the utility function, declines in wealth. Vulnerability, however, encompasses more than risk aversion; it encompasses a household's ability to manage risk. Wealth plays a role in this, but so do other factors like access to consumption credit and insurance. Households with equal levels of wealth and risk aversion might make very different choices if their ability to manage negative income shocks varies greatly[8].

Entrepreneurs can choose to engage in one of two entrepreneurial projects; a risky enterprise (*RE*) and a safe enterprise (*SE*). The risky enterprise requires working capital to operate, which must come from borrowing since liquid wealth is insufficient to meet these needs. Microfinance is the only source of external working finance in the model, such that entrepreneurs who wish to engage in the risky enterprise must take out a microfinance loan. The microfinance institution (MFI), on the other hand, cannot view skill and distinguish entrepreneurial types and therefore lends the same amount, MF , and charges the same

[8] See Dercon (2005) for a more detailed discussion of risk preferences and vulnerability.

interest rate, b, to all borrowers who meet the collateral requirement equal to $\underline{W}$. All entrepreneurs in the model meet the collateral requirements for microfinance loans, making supply concerns irrelevant to the model. This assumption is necessary because the goal is to explain why entrepreneurs who qualify for loans choose not to take out microfinance, not why access might differ across entrepreneurs.

Entrepreneurs make decisions about the type of enterprise at the beginning of the first period. For the risky enterprise gross returns are uncertain and depend upon the state of nature, which is realized immediately after the choice of enterprise is made. For simplicity there are only two possible outcomes, a good state and a bad state, and the probability of each depends on skill. The probability a high skill entrepreneur receives a good state is p_H while the probability a low skill entrepreneur receives a good state is p_L, where $p_H > p_L$. Gross returns are as follows:

$$\begin{aligned} &= R_{RE}^{G} \quad \text{w/probability} = p_T \\ &= R_{RE}^{B} \quad \text{w/probability} = (1 - p_T) \\ &= R_{SE}^{G} \quad \text{w/ probability} = 1 \end{aligned} \tag{1}$$

The expected return from the risky enterprise is: $E(R_{RE}) = p_T R_{RE}^{G} + (1 - p_T) R_{RE}^{B}$; high skill entrepreneurs have a greater expected return from the risky enterprise than low skill entrepreneurs. Meanwhile gross returns for the safe enterprise are constant across entrepreneurial types and state realizations. The risky enterprise has a higher return than the safe enterprise in a good state but a lower return in a bad state: $R_{RE}^{G} > R_{SE} > R_{RE}^{B}$. It is assumed p_T and the risky enterprise realizations are such that the expected return of the risky enterprise is greater for both skill types than the return from the safe enterprise. It follows that the variance is greater as well.

$$E(R_{RE}^{HighSkill}) > E(R_{RE}^{LowSkill}) > R_{SE} \tag{3}$$

To ensure households find it optimal to engage in entrepreneurial activity rather than to live off of their wealth, I assume the safe enterprise return is greater than all levels of liquid wealth: $R_{SE} > \overline{W} > \underline{W}$ (4)

After gross returns from each enterprise are realized entrepreneurs engaged in the risky enterprise make decisions about loan repayment. The microfinance institution offers no repayment flexibility and if a borrower does not repay $(1 + b)MF$ at the end of the first period, two things occur. First, the borrower is barred from any future loans from the

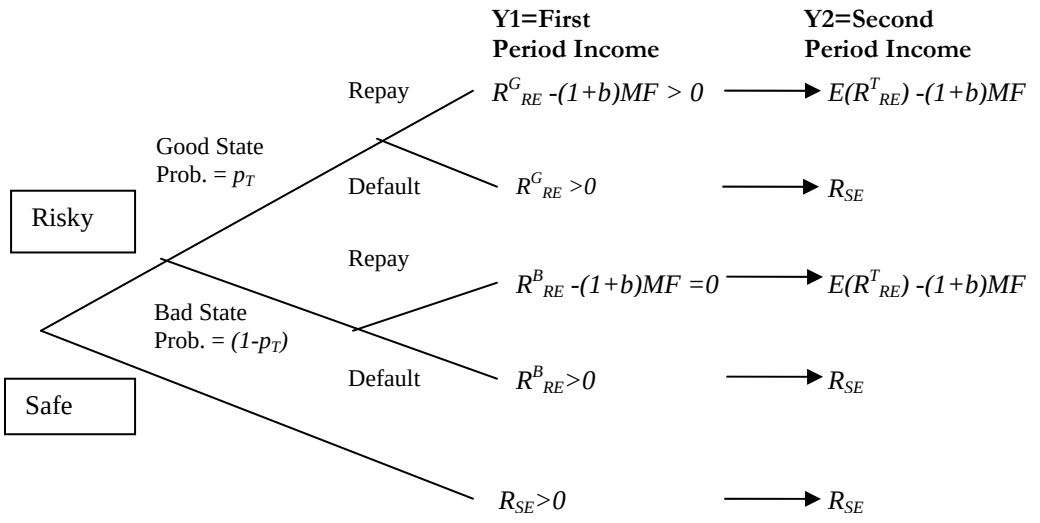
microfinance institution, which means he/she must abandon the risky enterprise in the second period. Second, the microfinance institution seizes liquid wealth ($\underline{W}$) placed as collateral. Although collateral seizure is not standard practice for many microfinance institutions, with only two periods it is difficult to generate the dynamic incentives that usually ensure no strategic default (Armendariz and Morduch 2005, Alexander 2006).

Net returns from the risky enterprise at the end of the first period depend on repayment decisions. If a good state is realized the net return from the risky enterprise is positive. If a bad state is realized the net return from the risky enterprise is zero.

$$\begin{aligned} R_{RE}^{G} - (1+b)MF > 0 \quad & \text{w/ prob } p_T \\ R_{RE}^{B} - (1+b)MF = 0 \quad & \text{w/ prob } (1-p_T) \end{aligned} \tag{5}$$

At the beginning of the second period entrepreneurs again choose projects. Similar to several models of vulnerability and crop choice I assume second period income from both enterprises is certain (Eswaran and Kotwal 1989, Morduch 1994). In the case of the risky enterprise, the certain second period return equals the expected first period return. This assumption generates the incentive for entrepreneurs to continue with the risky enterprise even if a bad state is realized in the first period, as it leads to higher certain second period income than the safe option. Finally, it is assumed an entrepreneur cannot take out a microfinance loan in the second period if she did not do so in the first period.

Following Van Tassel (2004), I use a tree to outline net income under different scenarios.



where $E(R_{RE}^{H}) - (1+b)MF > E(R_{RE}^{L}) - (1+b)MF > R_{SE} > 0.5[E(R_{RE}^{T}) - (1+b)MF]$ (6)

(6) says that certain second period income from the risky enterprise is greater for high skill entrepreneurs than for low skill entrepreneurs, and both are greater than income from the safe enterprise. It also says the difference between second period income from the safe and risky enterprises is such that the return from the safe enterprise is greater than half of the return from the risky enterprise. The final inequality in (6) is to ensure the difference between the safe and risky enterprise is not too large.

Finally, interest and return realizations are such that the difference between net income of the risky and safe enterprise is greater than the difference between loan repayment and the value of seized collateral. This generates a no-default equilibrium and is necessary due to the inability to generate dynamic repayment incentives over a two period time horizon.

$$(E(R_{RE}^{T}) - (1+b)MF) - R_{SE} > (1+b)MF - \underline{W} \tag{7}$$

2.2 Vulnerability, Consumption Credit and No Default

Up until this point entrepreneurs have no direct source of consumption credit in the case of a bad state realization. This is due to the fact that the microfinance loan cannot be used to cover consumption needs, as diversion of loan funds to consumption leaves entrepreneurs with insufficient working capital to operate the risky enterprise and zero income. Explicitly outlining consumption credit is an important addition to the model because if a bad state is realized and an entrepreneur engaged in the risky enterprise repays the microfinance loan, she will not have any income in the first period. Without consumption credit the entrepreneur must use liquid wealth to cover first period consumption. While this is a realistic scenario, it yields the unsatisfactory conclusion that the ability to smooth consumption across an adverse income shock depends only on wealth. In reality, however, the ability to smooth consumption also depends on access to consumption credit and insurance, both of which may be uncorrelated with wealth. For example, access to informal credit and insurance networks may result from marital status, how long an entrepreneur has lived in Lima, and the number of family members living nearby, all of which could be unrelated to wealth[9]. To further our understanding of how vulnerability impacts microfinance selection I assume no correlation between access to consumption credit and wealth.

[9] There of course could be a positive correlation between all of these factors and wealth if entrepreneurs who are married, have lived for a longer time in Lima or have larger family networks are somehow more wealthy than entrepreneurs without strong informal networks. But this does not necessarily have to be the case. In the Peruvian data martial status and Time lived in Lima are not strongly correlated with wealth or income.

Consumption credit is defined as: $\gamma(E(R_{RE}^{T}) - (1+b)MF)$, where $\gamma \in [0,1]$ (8)

It comes from informal sources, such as a spouse or partner, family and friends, or moneylenders, and carries no interest[10]. γ therefore measures vulnerability, as it dictates the portion of certain second period income an entrepreneur can borrow from these informal sources in the first period. Higher values of γ mean an entrepreneur has greater ability to smooth consumption and is less vulnerable. Lower values of γ mean an entrepreneur has less ability to smooth consumption and is more vulnerable.

At the beginning of each period risk-averse entrepreneurs make decisions on enterprise type. After income from the enterprise is received, entrepreneurs choose consumption to maximize expected lifetime utility, which is additively separable in each component, and expressed as: $EU = Eu(c_1) + \delta Eu(c_2)$ (9)

Atemporal utility is increasing and strictly concave in that period's consumption and δ is the degree time preference. To abstract from concerns about differing degrees of time preference I assume all entrepreneurs weigh first and second period consumption equally, and thus that the degree of time preference equals one.

No Default Condition[11]

Prior to assessing the optimal enterprise and financing choices for different entrepreneurs, it is necessary to establish that default in the first period is never optimal. Given the assumption of no interest and discount rates equal to one, we can compare intertemporal budget constraints (IBC) to assess the optimality of first period default.

I start by comparing scenarios under a good state realization. If an entrepreneur does not default, the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = (R_{RE}^{G} + E(R_{RE}^{T}) - 2(1+b)MF) + W \quad (10)$$

If an entrepreneur defaults wealth placed as collateral is seized and the entrepreneur cannot engage in the risky enterprise in the second period. The intertemporal budget constraint is:

$$c_{1G} + c_{2G} = R_{RE}^{G} + R_{SE} + W - \underline{W} \quad (11)$$

[10] In practice we usually observe zero interest rates on loans from family, friends and ROSCAs. The implicit costs usually come from the expectation of reciprocal lending in the future (Dunn and Arbuckle 2001).

[11] There is no penalty beyond collateral seizure for default in the second period, and thus many microfinance borrowers might find second period default optimal. To avoid this it is possible to introduce an additional sanction, such as profit seizure. However, since second period default does not changes the dynamics of the model, introducing additional assumptions to ensure it doesn't happen is not necessary.

No default prevails if $(E(R_{RE}^{T}) - (1+b)MF) - R_{SE} + \underline{W} > (1+b)MF$ (12)

which will always hold according to assumption (7). Since second period income from the risky enterprise is sufficiently greater than that from the safe enterprise, defaulting is always suboptimal.

If a bad state is realized first period income equals zero. If the entrepreneur does not default the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = (R_{RE}^{B} + E(R_{RE}^{T}) - 2(1+b)MF) + W \quad (13)$$

In the case of default, the optimization problem becomes:

$$c_{1G} + c_{2G} = R_{RE}^{B} + R_{SE} + W - \underline{W} \quad (14)$$

No-default prevails if $(E(R_{RE}^{T}) - (1+b)MF) - R_{SE} + \underline{W} > (1+b)MF$ (15)

which is the same inequality as in the good state scenario and holds because of assumption (7). In all cases entrepreneurs who have chosen the risky enterprise in the first period prefer to do so in the second period, making default suboptimal.

2.3 Entrepreneur's Decisions

Now that it is established first period default will never prevail, we can assess the optimality of enterprise and financing choices for an entrepreneur. This choice reduces to choosing either the safe or the risky enterprise in the first period, since first period choices carry over into the second period. By comparing lifetime utility under both choices the model shows that for sufficiently low γ households obtain higher expected lifetime utility by engaging in the safe enterprise and eschewing microfinance.

I start by analyzing utility under the safe enterprise. If an entrepreneur selects the safe enterprise, she chooses consumption in each period to maximize the problem:

$$\begin{aligned} &\max_{c} EU = u(c_1) + u(c_2) \quad (16)\\ &\text{st. } c_1 \le R_{SE} + W \\ &\quad c_2 \le R_{SE} + (W - c_1 + R_{SE}) \end{aligned}$$

It is easy to show that $c_1 = c_2 = R_{SE} + 0.5W$ solves the problem and that total lifetime utility equals $2u(R_{SE} + 0.5W)$. This is a key comparison value. (17)

Total lifetime utility under the risky enterprise is more complicated and, unlike the safe enterprise, depends on skill (T) and vulnerability (γ). I start by considering utility under the risky enterprise if a bad state is realized and consider the case of a "non-vulnerable" entrepreneur; that is, an entrepreneur whose γ=1. This entrepreneur can borrow all of

second period income and can perfectly smooth consumption across a negative income shock. In this case the household maximizes the problem:

$$\max_c EU = u(c_1) + u(c_2) \tag{18}$$
$$\text{st. } c_1 \le W - \underline{W} + \gamma(E(R_{RE}^T) - (1+b)MF), \quad \text{where } \gamma = 1$$
$$c_2 \le (1-\gamma)(E(R_{RE}^T) - (1+b)MF) + W - c_1, \quad \text{where } \gamma = 1$$

It is easy to show lifetime utility equals $2u(0.5(E(R_{RE}^T - (1+b)MF) + 0.5W)$ (19)

From assumption (8) this is lower than lifetime utility under the safe enterprise (17). If a bad state is realized lifetime utility is lower under the risky enterprise than under the safe enterprise. Since this is the case for a non-vulnerable entrepreneur, it will also be true of vulnerable entrepreneurs as lifetime utility under the bad state declines further as γ falls below 1. In a bad state all households, regardless of their level of vulnerability, wealth or skill are better off under the safe enterprise than under the risky enterprise.

If a good state is realized the opposite is true. Households face higher lifetime income under the risky enterprise and all entrepreneurs, regardless of vulnerability, wealth or skill, will prefer the risky enterprise over the safe one.

$$\max_c EU = u(c_1) + u(c_2) \tag{20}$$
$$\text{st. } c_1 \le (R_{RE}^G - (1+b)MF) + W$$
$$c_2 \le (E(R_{RE}^T) - (1+b)MF) + (W - c_1 + (R_{RE}^G - (1+b)MF))$$

Lifetime utility in this case equals $2u(0.5(E(R_{RE}^T) + R_{RE}^G - 2(1+b)MF) + 0.5W)$ (21)

It is easy to confirm that (21) is greater than lifetime utility under the safe enterprise (17).

To establish the connection between vulnerability and microfinance selection (entrepreneurs only select microfinance if they choose the risky enterprise) I compare expected lifetime utility under the risky option for non-vulnerable and vulnerable entrepreneurs. Under the risky enterprise entrepreneurs solve:

$$\max_c EU = p_T[u(c_{1G}) + u(c_{2G})] + (1-p_T)[u(c_{1B}) + u(c_{2B})] \tag{22}$$
$$\text{s.t. } c_{2G} \le (E(R_{RE}^T) - (1+b)MF) + (W - c_{1G} + (R_{RE}^G - (1+b)MF))$$
$$c_{1B} \le W - \underline{W} + \gamma[E(R_{RE}^T - (1+b)MF]$$
$$c_{2B} \le (E(R_{RE}^T) - (1+b)MF) + W - c_{1B}$$

For non-vulnerable entrepreneurs, γ is sufficiently high such that the borrowing constraint does not bind. For these entrepreneurs expected lifetime utility under the risky enterprise is:

$$p_T[2u(0.5(E(R_{RE}^T)+R_{RE}^G-2(1+b)MF+W)] \\ +(1-p_T)[2u(0.5(E(R_{RE}^T)-(1+b)MF+W)] \quad (23)$$

Non-vulnerable entrepreneurs are indifferent between the safe and risky enterprise when (23) equals (17). The probability of a good state, $p_T = \hat{p}_T$, that solves this indifference equation equals:

$$\hat{p}_T = \frac{u(R_{SE}+0.5W)-u(0.5(E(R_{RE}^T)-(1+b)MF+W))}{u(0.5(E(R_{RE}^T)+R_{\mathrm{Re}}^G-2(1+b)MF+W))-u(0.5(E(R_{RE}^T)-(1+b)MF+W))} \quad (24)$$

$$\Rightarrow \hat{p}_T = \frac{u(safe)-u(risky_{bad})}{u(risky_{good})-u(risky_{bad})}$$

(24) says that non-vulnerable entrepreneurs are indifferent between the safe and risky enterprises when the probability of a good state equals the ratio of the difference between utility under the safe and the risky enterprise in a bad state and the difference between utility under the risky enterprise in a good and bad state. The value of $\hat{p}_T$ depends on the degree of curvature in the utility function, but for any strictly concave function $\hat{p}_T \in (0,1)$. While it is not necessary to solve for an explicit p_T value, it is necessary to establish an acceptable range, because for any $p_T < \hat{p}_T$, all entrepreneurs, regardless of their vulnerability status, prefer the safe enterprise and no microfinance loans. In order for the model to generate any predictions about the impact of vulnerability on microfinance selection we must assume $p_T > \hat{p}_T$. This simply says that for any entrepreneur to choose the risky enterprise, the probability of a good state must be sufficiently high.

In the case of vulnerable entrepreneurs γ is low enough such that the borrowing constraint binds. These entrepreneurs are unable to borrow enough in the first period to perfectly smooth consumption across a bad shock. Lifetime expected utility for the risky option for these entrepreneurs is:

$$p_T[2u(0.5(E(R_{RE}^T)+R_{RE}^G-2(1+b)MF+W)] \\ +(1-p_T)[u(\gamma E(R_{RE}^T)-(1+b)MF+W)+u((1-\gamma)E(R_{RE}^T)-(1+b)MF] \quad (25)$$

By assuming a value for $p_T > \hat{p}_T$ it is possible to solve for the level of vulnerability, $\gamma = \hat{\gamma}$, at which a vulnerable entrepreneur is indifferent between the safe and risky enterprise. $\hat{\gamma}$ solves:

$$(1-p_T)[u(\hat{\gamma}(E(R_{RE}^T)-(1+b)MF)+W)+u((1-\hat{\gamma})(E(R_{RE}^T)-(1+b)MF))= \\ 2u(R_{SE}+0.5W)-p_T[2u(0.5(E(R_{RE}^T)+R_{\mathrm{Re}}^G-2(1+b)MF+W))] \quad (26)$$

To show that vulnerability negatively impacts microfinance selection it is sufficient to show that $\hat{\gamma}$ exists and lies between zero and one. This is simple given the assumptions about p_T and the differences between income from the safe and risky enterprises. $\hat{\gamma}$ determines the critical level of vulnerability below which entrepreneurs are better off choosing the safe enterprise and no microfinance. If entrepreneurs have $\gamma < \hat{\gamma}$ they are too vulnerable to manage the risky enterprise and do not select microfinance. If entrepreneurs have $\gamma \geq \hat{\gamma}$ they are better able to manage the risky enterprise and select microfinance. This produces the key result of the model: Even after controlling for skill and wealth, vulnerability negatively impacts the probability an entrepreneur selects microfinance.

Equation (26) also has important implications for the relationship between vulnerability, skill and wealth. For skill, since the probability of a good state is greater for high skill entrepreneurs than for low skill entrepreneurs ($p_H > p_L$) the threshold level of vulnerability, $\hat{\gamma}$, will be lower for high skill entrepreneurs than for low skill entrepreneurs ($\hat{\gamma}_{T=H} < \hat{\gamma}_{T=L}$). This means that for an equal level of vulnerability, high skill entrepreneurs will be more likely to select microfinance than low skill entrepreneurs. This is the second key result of the model: While vulnerability matters for all skill types, it matters more for low skill entrepreneurs than for high skill entrepreneurs.

For wealth, we can totally differentiate (26) to see how the threshold level of vulnerability changes in wealth.

$$\frac{d\hat{\gamma}}{dW} = \frac{p_T u'(c_{RE,G}) + (1-p_T)u'(c_{RE,B}^1) + u'(c_{SE})}{(1-p_T)(E(R_{RE}^T)-(1+b)MF)[u'(c_{RE,B}^1)-u'(c_{RE,B}^2)]} \quad (28)$$

The sign of (28) depends only on the last term, $[u'(c_{RE,B}^1)-u'(c_{RE,B}^2)]$, since all of the other terms are positive. If households are vulnerable they cannot smooth consumption across a negative income shock, which means first period consumption is greater than second period consumption ($c_{RE,B}^1 > c_{RE,B}^2$). Given concave utility this implies $u'(c_{RE,B}^1) < u'(c_{RE,B}^2)$, which means $\frac{d\hat{\gamma}}{dW} < 0$. This is the third key result of the model: While vulnerability matters for all wealth types, it matters less for high wealth entrepreneurs than for low wealth entrepreneurs.

For equal levels of vulnerability more wealthy entrepreneurs are more likely to select microfinance than less wealthy entrepreneurs. It is important to note, however, that even entrepreneurs with the highest level of wealth, $\overline{W}$, will reject the risky enterprise and microfinance if their vulnerability is sufficiently high.

In sum the model predicts the following: 1) Even after controlling for skill and wealth, if vulnerability is sufficiently high entrepreneurs do not choose microfinance loans; 2) Vulnerability plays less of a role in microfinance selection as entrepreneurial skill increases; and 3) Vulnerability plays less of a role in microfinance selection as wealth increases. I test these predictions in the subsequent sections.

3. Description of the Data

The data used in this paper comes from an impact evaluation of a Peruvian microfinance enterprise that was part of USAID's Assessing the Impact of Microfinance Services Project (AIMS)[12]. The Peruvian portion of the project was carried out with Accion Comunitaria del Peru (ACP, which became MiBanco in 1998[13]), a large, profit-oriented microfinance institution with operations exclusively in Lima, Peru's capital and largest city[14]. Data on clients of ACP and a comparison group was collected in two periods, August of 1997 and again in July/August of 1999, producing a panel data set. The 1997 survey round includes 401 clients and 300 non clients. Due to attrition, by 1999 the original 701 respondents are whittled down to 520 respondents; 306 clients and 214 non clients. Elizabeth Dunn, Assistant Professor of Agricultural Economics at the University of Missouri-Columbia, was the primary researcher.

An important feature of the data set is the way the comparison group was collected. A pool of non-clients was randomly selected from a sample of 4,000 microentrepreneurs in the same neighborhoods and with similar enterprise and household characteristics as their microfinance counterparts. Two prerequisites for the comparison sample were made: 1) no member of the household could have microfinance credit from any source and 2) at least one of the enterprises of the household must have been in operation for at least six months.

[12] The goal of the AIMS Project was to gather more quantitative and qualitative information on the impact of microfinance services at the household, enterprise and individual level and to promote the institutionalization of impact studies among practitioners.

[13] For discussion of the transformation of ACP to Mibanco see Campion, Dunn and Arbuckle (2001)

[14] In 2000 Mibanco opened its first office outside of Lima, in Chincha

The latter prerequisite ensures the comparison group qualifies as potential clients, as ACP requires that the enterprise on which the loan is taken out have at least six months of operating history. Thus on paper all of the non-clients meet eligibility requirements for ACP loans.

Given this paper focuses on a particular type of credit offered to poor entrepreneurs, it is critical to understand the terms of microfinance loans and how they vary from other forms of credit. At the time of the survey the principal product offered by ACP was a working capital loan, with typical loan lengths ranging from 6 weeks to 6 months. Average loan size in 1997 was 1,021 soles (approximately $384) and loans were usually paid back over short term intervals, typically on a bi-weekly or monthly basis[15]. Loans were granted either to a group or to an individual, the requirement for the latter being home ownership or a guarantor with proof of home ownership[16]. Loans could be taken out by only one household member and for the purpose of only one existing microenterprise[17]. To meet the requirement of a 6 month minimum operating history, borrowers must provide proof of enterprise duration, including electricity or telephone bills, receipts from suppliers, or registration certificates with the municipality or tax authority. (Dunn and Arbuckle 2001)

While loan use is not monitored by the MFI and a great deal of fungibility has been documented[18], the short maturity lengths of the loans combined with frequent payback intervals generally mean microfinance loans are directed to short-term business needs[19]. ACP client interviews confirm this. When asked about loan use, one respondent replied:

> "I don't know what we bought (with the last loan), but it has always been inventory, you know? Because you can't spend it on your house or you can't take it and go spend it on furniture… You have to make the money produce, because they are going to charge interest too, you know?" (Dunn and Arbuckle 2001)

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[15] For ACP clients in the sample 30% re-paid loans on a bi-weekly basis while 58% re-paid on a monthly basis.
[16] For group loans at least one group member must own their home. In 1997 incidence of home ownership amongst group loan borrowers is 84%, while incidence amongst individual borrowers with a guarantor is 81%. ANOVA estimates show no significant difference in home ownership, savings incidence or marital status across different microfinance loan types in 1997.
[17] By 1999 80% of entrepreneurs without microfinance have heard not just of microfinance, but of ACP.
[18] Fungibility is the use of loan funds for purposes other than those laid out in the loan contract, such as for consumption or household investment purposes. See Gaile and Foster (1996) for evidence of fungibility.
[19] Armendariz and Morduch (2005) explain that this type of payback structure can improve loan repayment as the timing of payments better matches that of income flows into the household. This matching can be important if borrowers have difficulty saving, due to household demands, pilfering of funds by other household members (women keeping funds away from their husbands) or the absence of saving vehicles.

Microfinance is not the only source of working capital finance for entrepreneurs in the sample[20]. The other options, outlined it table 2, include other formal lenders, such as commercial banks, credit unions, credit cooperatives, construction banks, as well as informal lenders, such as suppliers, friends, family, moneylenders, and ROSCAS[21]. The most frequently cited sources are suppliers and family and friends, both of which are informal. To understand the demand for microfinance loans it is necessary to compare the interest rates and repayment terms of these loans to those of other credit options.

In the case of interest rates, ACP's rates do not differ significantly from those charged by most other credit providers. Dissimilar to many other microfinance institutions, ACP's interest rates are unsubsidized and market determined. At the time of the survey nominal, annual rates were close to 50%, which translates into estimated real interest rates of 42.5% in 1997 and 47.5% in 1999.[22] According to Dunn and Arbuckle (2001) ACP's interest rates are comparable to those charged by other formal sources engaged in microlending[23] such as banks, credit unions and other microfinance institutions, lower than those charged by moneylenders and pawnshops, and higher than those charged by family and friends and ROSCAs[24]. Although there is no information on the costs of supplier credit, the most cited source of external finance, data from small firms in several developed countries suggest ACP's rates equal or lie below those charged by suppliers. For example, Cuñat (2006), finds supplier credit rates in the range of 44% for small firms in the U.S. and U.K.

One concern may be that real rates above 40% are exorbitant and fully explain why many entrepreneurs do not seek microfinance loans. It turns out, however, that ACP's interest rates are consistent with those charged for similar types of short-term, working

[20]The definition of working capital is the difference between current assets and current liabilities and this difference can be negative if a firm has a gap between when they receive payments for goods and when they must make payments on inputs. A germane example is a small grocer who must purchase inventory. If working capital is negative the firm can finance the difference internally, in the form of retained profits, or externally, in the form of loans, either informal or formal. Although internal finance carries fewer explicit costs, dependence on retained profits to finance working capital limits everyday operations and restricts enterprise growth, leading many businesses to seek external finance.

[21] Rotation Savings and Credit Associations. See Armendariz and Morduch (2005) and Besley, Coate and Loury (1993). The latter note that ROSCAS are predominantly used to save for large, indivisible durable goods, rather than to finance ongoing business expenses.

[22] According to the Central Bank of Peru, annual inflation was 8.5% in 1997, and 3.5% in 1999.

[23] "Microloans' refer to loans that are significantly smaller in size than those typically lent by banks and extended to borrowers with collateral that is insufficient to qualify for standard bank loans.

[24] Interest rates tend to be extremely low and in some instances zero for loans from family and friends and ROSCAS, although in both cases implicit costs partially mitigate the low rates. Loans from family and friends often carry the expectation of reciprocation while loans from ROSCAs depend on the order given and the timing of the distribution might not coincide with business needs (Dunn and Arbuckle 2001).

capital loans within Peru[25] and within some developed countries[26]. They are also consistent with the returns these microentrepreneurs likely generate from capital[27]. As a result, high interest rates probably explain very little of non participation behavior.

In the case of repayment terms ACP is much more restrictive than the other sources, principally informal ones. Similar to most microfinance institutions ACP has very strict repayment terms for both group and individual loans. If a borrower is delinquent on a payment they are charged a daily fee and if a borrower defaults they are barred forever from any future loans from the institution. Not only is there no option for late repayment, there is a severe penalty for doing so[28]. This compares to terms that likely are more flexible for supplier credit and loans from family and friends, the two most cited credit sources[29].

Despite market interest rates and more restrictive terms, microfinance loans have two key advantages over other credit sources, principally informal ones. The first advantage is that MFIs can provide larger and more frequent loans than informal sources. As with any financial intermediary the pool of loanable funds is greater for an MFI than for informal lenders such as suppliers, moneylenders, and family or friends. The information presented in table 2 confirms this: median loan sizes for ACP surpass those from all other sources except other financial intermediaries. Additionally, in interviews several clients cite larger loan size as an advantage of borrowing from ACP, while dropouts mention the difficulty in

[25] According to the Central Bank of Peru (BCRP) nominal short-term rates for the general banking sector averaged 31.1% in 1997 and 27.6% in 1999. Unlike the banks included in these averages, microfinance institutions lend to borrowers with zero or very little collateral and extend loans of significantly smaller size. As a result they tend to charge much higher interest rates (CGAP 2002, Armendariz and Morduch 2005).

[26] Research on the use of supplier credit, a popular form of working capital finance, in the U.S. and U.K. (Cuñat 2006) finds the implicit costs of standard contracts for manufacturers in these countries are close to 44% a year, and in some cases are as high as 358%. This is quite expensive for countries with deep and well functioning financial markets. Yet supplier credit continues to be a popular financing source for small and medium sized firms in the U.S. and U.K, despite access to other types of credit.

[27] Using data on urban microentrepreneurs in Mexico, McKenzie and Woodruff (2006) find real monthly returns that range from 10-15% for small to medium size investments and 2-3% for larger investments. Meanwhile, Udry and Anagol (2006) estimate returns to capital for the informal sector in Ghana and find real rates in the order of 60%.

[28] Most MFIs eternally bar borrowers from any future loans in the case of default. Alexander (2006) argues this severe penalty is unnecessary to create the dynamic incentives that are thought to contribute to high repayment rates. She presents a model in which the punishment phase for default can be less than infinity and still produce repayment rates that allow microfinance institutions to break even.

[29] Although there is no information on the terms of either, in the case of loans from family and friends it is likely repayment terms are more flexible. In the case of supplier credit, information from standard contracts in the U.S. (Cuñat 2006) suggests these contracts also have more flexible repayment terms. In a representative survey of small U.S. firms, 46% report paying back suppliers after the due date and 43% report no penalties for late payment. These firms also report more inflexible repayment terms for banks loans. Translating this to the ACP sample, the option of late payment may explain the high incidence of supplier finance for entrepreneurs, even amongst those with multiple sources of bank and microfinance credit.

cobbling together the same quantity of funds from other sources. The second advantage is the guarantee of continual access to credit as long as outstanding debts are serviced on time. Many microfinance institutions have renewable loan contracts, and in the case of ACP the client can receive a new loan on the same day the previous loan is repaid.[30] Furthermore, with prompt repayment many MFIs grant borrowers access to an increasing pool of funds. This guarantee of access to continual and increasing credit likely is not replicated by informal lenders due to limited and perhaps more variable sources of funds.

3.1 Microfinance and Project Choice

As a result of larger loans and more continual access, microfinance may be able to finance projects, particularly those with larger working capital requirements, which other credit sources cannot. The theoretical model takes this a step further and assumes projects with larger working capital requirements have higher returns and risk than those with lower working capital requirements. Several ACP client interviews justify this last assumption. For the microentrepreneurs in this sample, high yield/ high risk projects oftentimes translate into larger, more expensive inventory items that have higher expected return but also more risk. A former ACP client provides an example:

> "When Pepa was receiving loans… she would use them primarily to invest in high margin clothing for sale. She saw the loans as a separate credit for her mobile clothing business, and used them only for her (other home based retail business during peak sales seasons)… Credit helped Pepa invest in clothing, which while requiring larger investments, provided higher returns." (Dunn and Arbuckle 2001)

Pepa is later forced to dropout of microfinance programs due to her husband's payment delinquency. After loosing access to the larger loans provided by ACP she must abandon her high quality clothing business due to an inability to procure the same quantity of funds from other sources. (Dunn and Arbuckle 2001). Another ACP client provides a similar story. She comments:

> "With loans you can buy other things that take longer to move, but which leave you with more profit." (Dunn and Arbuckle 2001)

These quotes illustrate how microfinance, as a result of larger loan size, can be used to fund high risk, high return projects. The specific example of high bulk inventory also reveals why

[30] Armendariz and Morduch (2005), in summarizing their own and others' work, explain that this automatic roll over generates the dynamic incentives that help explain high payback for many MFIs despite little or no collateral. When funding is automatically extended and sometimes increased, the cost of defaulting rises for the borrower. Alexander (2006) also presents a model of dynamic incentives in individual loan contracts.

microfinance borrowers might be limited to entrepreneurs with sufficient support to cover both loan repayments and consumption needs if an adverse shock, such as robbery or an unanticipated sales decline, occurs.

In a related paper (Pearlman 2006) I explicitly investigate the relationship between vulnerability and enterprise choice amongst urban micro-entrepreneurs. I develop a theoretical model that predicts a negative relationship between vulnerability and the portion of resources a household dedicates to a high yield/high risk enterprise over a low yield/low risk alternative. I test this prediction using the ACP data and find positive evidence that more vulnerable households dedicate fewer resources to high yield/high risk enterprises than their less vulnerable counterparts. I also find that households with microfinance are more heavily invested in high yield/high risk enterprises than those without microfinance. Table 3 provides a summary of these last comparisons. Mean and standard deviation values of microenterprise income per adult equivalent are used to capture the return and risk profiles of households' enterprise portfolios. It is easy to see that entrepreneurs with microfinance have enterprise portfolios with significantly higher returns and risk than those without microfinance, implying greater investment in high yield/high risk enterprises.

3.2 Alternative Hypotheses for Microfinance Selection: Supply

This paper focuses on a demand side explanation for why some entrepreneurs don't seek out microfinance and in so doing it implicitly assumes limited supply of microfinance loans is not behind limited outreach. This assumption may be problematic if microfinance institutions have limited sources of funds and are at full capacity in terms of loan extension and if the entrepreneurs who don't participate are lower quality borrowers and would likely be rejected if they applied for a loan. In both cases the assumption that entrepreneurs without microfinance would be granted a loan if they applied, breaks down, jeopardizing the vulnerability hypothesis. Additional information on ACP/Mibanco addresses both concerns. In the case of the supply of loanable funds, in the year 2000, one year after the final survey round, Mibanco reports using only 65% of an approved credit line and states this is an improvement over previous years[31]. This clearly shows the institution has excess lending capacity and that limited supply of funds is not driving low penetration rates.

[31] Information from Mibanco's annual reports, available on www.themix.org. Conversations with practitioners reveal excess capacity is not an exclusive domain of ACP/Mibanco and that other large, microfinance institutions oftentimes have access to more funds than they can lend.

The case of high rejection rates is more difficult to address since we do not know if entrepreneurs without microfinance would be accepted for a loan if they applied. Anecdotal evidence suggests they would be. On paper all meet the requirements for ACP loans and the institution, similar to most microfinance institutions, has fairly low rejection rates[32]. Researchers involved with data collection believe most of the entrepreneurs without microfinance would be approved for a loan if they applied. Furthermore, comparisons of entrepreneurs who join microfinance programs by the second panel period to entrepreneurs who never join reveal few observable differences between the two. In logit analyses only 1999 values for other property and informality status are significant in predicting which entrepreneurs join microfinance programs. None of the other 1999 or 1997 variables are significant. While these results mean we have little information about factors that lead one group to join microfinance programs, they support the contention that demand partially explains microfinance status. Based on the same factors observable to the lender, entrepreneurs without microfinance look very similar to entrepreneurs who join microfinance between the panel periods. This suggests that while rejection rates are a concern, they probably are not the major cause of low microfinance participation.

4. Measuring Vulnerability and Skill

This section outlines proxy measures for two key variables of interest, vulnerability and skill.

4.1 Measuring Vulnerability

In this paper vulnerability is defined as the ability to smooth consumption across adverse shocks to income. In the theoretical model vulnerability was defined by γ, the amount of consumption credit a household can access in a bad state. In practice, however, a comprehensive vulnerability measure should also include liquid assets and access to insurance, both of which may be critical to a household's ability to cover income shortfalls. Directly measuring vulnerability, however, is impossible since the researcher does not observe households' access to credit and insurance, particularly informal versions of each. Indirect "ex-post" measures derived from examining the response of consumption to

[32] See The Microfinance Gateway for discussion of rejection rates

income changes are also impossible given the limitations of a two period panel[33]. I therefore rely on "ex-ante" vulnerability measures that proxy for access to external and internal funds.

Access to internal funds is straightforward as the ACP data contains information on household assets, in the form of durable goods and vehicles, as well as information on whether or not a household has savings. Although other authors (Zeldes 1989) restrict measures of liquidity constraints to the ratio of financial assets to income, for the poor microentrepreneurs in the ACP sample durable goods and vehicles may also constitute measures of liquid wealth. Due to the paucity of savings instruments, many poor households save in the form of low yielding but liquid physical assets like consumer durables, and exclusion of these assets likely overestimates liquidity constraints. Interviewees' references to pawnshops and secondary markets attest to households' ability to convert these assets into cash in times of need.

Access to external funds proves more difficult, especially given heavy reliance on informal sources. Savings and durable goods capture some access to credit, as households with greater liquid wealth are generally deemed better borrowers. This is particularly true of durable goods, as these are typically the collateral demanded by formal and informal lenders (including ACP[34]), perhaps due to difficulties in repossessing other assets. To further capture credit access I also use information on whether or not a household has legal title to its home[35] and whether or not a household has another residential property. Given the

[33] Several authors (Deaton 1997, Paxson 1992, 1993, Zeldes 1989) note the difficulty in measuring vulnerability given the unobservable nature of credit constraints. The standard approach is to examine changes in temporary income and deem vulnerable households whose consumption responds. Kamanou and Morduch (2002) argue this approach is problematic with a two period panel. The first concern is the inability to identify temporary from permanent changes in income. Failure to disentangle the two can lead to false identification of vulnerable households if changes assumed to be temporary are permanent. The second concern is the limited number of states of the world observed in a short panel. Households facing the same distribution of shocks will have different draws over a short time frame and only a limited portion will face the test of trying to smooth consumption across adverse shocks. Households with "good" shock draws might be incorrectly labeled as not vulnerable, although they may be equally or more vulnerable than households whose consumption smoothing ability was tested by a negative shock. Also see Dercon (2005) for discussion of recent work attempting to measure vulnerability.

[34] ACP/Mibanco requires durable goods to be placed as collateral. As part of the loan application, applicants submit a list of electrical appliances to be used as collateral. Mibanco credit agents then verify the status and value of these appliances before approving the loan. (Dunn and Arbuckle 2001)

[35] Few households report being informal residents (exactly 17 out of 518 in 1997 and 8 out of 518 in 1999 report their homes are occupied through invasion). The high incidence of formal property rights may stem from the massive urban titling program that began in Lima in 1992. Initially under the direction of an NGO and later under the auspices of the Peruvian government, this program, over a period of approximately 10 years, granted home titles to over 1.2 million previously informal dwellers. See Field (2003) for details.

requirement by some lenders that borrowers own their home, home title and additional property likely translate into a wider range of credit options.

Liquid wealth and property ownership still may leave out access to informal credit and insurance networks, which is a key component of vulnerability status. Capturing these networks is important given the large dependence on credit from family and friends by entrepreneurs in the sample. For example, family and friends are cited as the second most popular source of credit (see Table 2), and of households that report borrowing funds to manage negative shocks, over 60% say these funds came from family or friends. Liquid assets and property may fail to pick up this key component of vulnerability if an entrepreneur's network of friends and family is unrelated to wealth, which is quite plausible[36]. To estimate the extent of entrepreneur's informal networks I rely upon information on whether or not an entrepreneur is married or cohabitates with a partner and how long an entrepreneur has lived in Lima. These two variables are used in the absence of information about the number of family and friends living nearby. For this reason I define marital status loosely (not single, widowed, divorced or separated), as the goal is to gauge the extent of informal credit and insurance networks, and partners may provide the same benefits in this respect as spouses[37]. Finally, to ensure marital status is not just picking up the effect of having another adult in the household I include the total number of working age household members.

In sum, savings status, home ownership status, ownership of additional property, marital status, and the time an entrepreneur has lived in Lima, as measured by years, are used to measure vulnerability. I also include wealth in the form of durable goods and vehicles to both capture additional elements of vulnerability and to potentially control for risk preferences. Tables 4 and 7 present average values.

One concern about the validity of savings, home ownership, and other property as vulnerability measures is that these are all bi-products of microfinance participation and

[36] Correlation between measures of informal networks and wealth is low. The correlation between marital status and net HH assets is 0.09 (1997) and 0.15 (1999), while the correlation with total income is -0.01 (1997) and 0.10 (1999). The correlation between TimeInLima and net HH assets is 0.20 (1997) and 0.12 (1999), while the correlation with annual income is 0.12 (1997) and 0.02 (1999).

[37] Single, widowed, separated or divorced status may be an indication that an entrepreneur is more vulnerable because they have less access to other income in the case a bad state is realized. Van Tassel (2004) presents a model of microfinance and household bargaining in which a male spouse decides whether or not to use his income to repay a portion of his wife's microfinance loan if a negative shock is realized.

therefore endogenous[38]. If this is true, reverse causality bias would cloud any information about the impact of vulnerability on microfinance selection. In the case of ACP the institution's limited product offerings during the survey period quell these concerns. In 1997 and 1999 ACP only offered short-term, working capital loans. It did not offer any type of savings product nor did it offer mortgage loans or any type of long term, high principal loan that would be needed to buy property. Furthermore, in the case of savings, entrepreneur's responses to questions on saving behavior reveal very few save in the form of demand deposits with financial intermediaries. The majority save by stashing money in their house or through ROSCAs. Therefore it is unlikely savings status, home ownership, and other property are simply weak proxies for microfinance status and that reverse causality bias is significant[39].

4.2 Measuring Skill

The most viable alternative theory to the one offered by this paper is that entrepreneurial skill fully drives selection into microfinance programs. While it is impossible to prove or disprove this theory given that entrepreneurial skill is unobservable to the researcher and perhaps even to the entrepreneur (Jovanovic 1982)[40], it is necessary to attempt to control for skill. Without doing so it is difficult to contend that the vulnerability variables are uncorrelated with the error term and that coefficient estimates are unbiased. Given the likely correlation between skill and selection and skill and the vulnerability variables, generating a usable measure of this unobservable trait is essential in deriving clean statements about vulnerability as a factor in microfinance selection.

The most standard observable proxy measures used for skill are education and experience (Paulson, Townsend and Karaivanov 2006, Gine and Townsend 2004). For education I use dummy variables for three categories of educational attainment by the entrepreneur; primary school or less[41], between primary and secondary school, and anything higher than secondary school. For experience I use the maximum amount of time, in years,

[38] Savings status is a particular concern since many microfinance programs not only offer savings products but require borrowers to maintain positive savings with the institution during the duration of the loan (see Armendariz and Morduch 2005). ACP, however, does not a have forced savings component to its loans.
[39] There is potential bias in liquid wealth measure, but the importance of including this is to control for wealth to ensure that savings, marital status, home ownership are not just picking up wealth
[40] Jovanovic (1982) presents a model in which individual entrepreneurs do not know their actual skill endowment and receive noisy signals of their skill endowment based on the cost of operating the enterprise.
[41] This is the left out group

any enterprise owned by the household has been in operation as of the first survey round. Average values for all skill measures are presented in tables 4 and 8.

5. Empirical Model of Microfinance Selection, Full Sample

Initially I analyze the determinants of microfinance selection using the full 1997 sample, which includes 701 households. One benefit of exclusively considering the first survey round is a larger sample, as attrition whittles the original 701 households down to 520 by the second round in 1999. A related benefit is an amelioration of concerns that attrition bias compromises the external validity of results from the balanced panel. The cost, however, is that the second survey round does provide additional information on the entrepreneurs in the sample. This information may prove helpful to understanding microfinance selection, and therefore I follow the analysis using the full sample with a similar analysis using the balanced panel (Section 6).

Following the theoretical model I use a random utility framework to estimate the probability an entrepreneur has microfinance in 1997. As of 1997 entrepreneurs have two choices; to select microfinance prior to 1997 (denoted as *j*) or to not select microfinance prior to 1997 (denoted as *k*). The probability an entrepreneur chooses *j* over *k* is the probability *j* yields higher utility than *k*. If utility from a given choice is a linear function of observable factors (X_i) and unobservable factors (ε_i), this probability (ie. the probability an entrepreneur has microfinance in 1997) is:

$$\Pr(Microfinance_{i,1997} = j) = \Pr(X_i\beta_j + \varepsilon_{ij} > X_i\beta_k + \varepsilon_{ik}) \quad (1)$$

If the random utility components follow a generalized extreme value distribution the estimation of (1) is:

$\Pr(Microfinance_{i,1997} = j) = \frac{e^{X_i\beta}}{1+e^{X_i\beta}}$, which is the simple logit model of binary choice.

Observable components hypothesized to impact the utility of taking out a microfinance loan include household characteristics, enterprise characteristics, vulnerability and skill. These characteristics are captured in the vector X_i. Average values are presented in tables 4 and 8 and are outlined below.

1) Household characteristics (*HC*) include: a dummy variable if the entrepreneur is a woman; the entrepreneur's age; the dependency ratio (number of children under 18 to

total household members); the total number of working age adults in the household; and whether or not the entrepreneur was hit with a shock at the household or enterprise level in the past two years[42].

2) Enterprise characteristics (*EC*) include: the number of enterprises; a dummy variable if all the enterprises of the household are informal[43]; and the type of enterprises households have, as defined by eight dummy variables that equal one if a household has an enterprise in a certain category.

3) Vulnerability Measures include: household assets; whether or not and entrepreneur has savings; whether or not an entrepreneur owns their home; and whether or not a household has control over another property[44]; a dummy variable if the entrepreneur is married or cohabitating with someone; and how long the entrepreneur has lived in Lima

4) Skill Measures include: dummies if the entrepreneur has secondary or above secondary education and experience, as measured by the maximum amount of time any enterprise under the household's direction has been in operation.

Results of logit estimations of the probability an entrepreneur has microfinance in 1997 based on these observable characteristics are presented in Table 5. Column (1) presents results that include only vulnerability and skill variables, column (2) presents results including wealth (as measured by net HH assets, scaled down by 1000), and columns (3), (4), and (5) include results with interaction terms. The necessity for the inclusion of different variables in the estimation is outlined below. For comparison purposes results of a linear probability model are presented in columns six (6) and seven (7). All reported coefficients are average marginal effects.

The most important theoretical prediction is that vulnerability negatively impacts the probability an entrepreneur seeks out microfinance, and the results from the logit estimation using 1997 data support this prediction. Four of the vulnerability measures, home ownership, savings, marital status and time in Lima, are significant predictors of microfinance status in 1997. According to the estimation results, home ownership increases

[42] A shock is defined as "any unexpected or unforeseen event that that occurred in the previous 2 years and that had significant negative economic or financial repercussions for the household." (Dunn and Arbuckle)
[43] I consider two measures of informality. The first dummy variable takes a positive value if all of the enterprises of a household are informal. The second is less stringent and takes a positive value if at least one enterprise of the household is informal. The second is considered for robustness in the subsequent analysis.
[44] Respondents are asked if they or another household member have another residence in or near Lima.

the probability an entrepreneur has microfinance in 1997 by 19%-27%, savings increases the probability by 8%-13%, having a spouse or partner increases the probability by 10-14%, and one more year of residence in Lima increases the probability an entrepreneur has microfinance in 1997 by 0.3%, while 5 more years increase the probability by 1.8%. Taking the first three combined, if an entrepreneur goes from zero to positive values for savings, home ownership and marital status, the probability she has microfinance in 1997 increases by 45%. For marital status the results are robust to controlling for the number of working age household members, implying the importance of marriage or partnership goes beyond having another adult in the household[45]. Finally, for Time in Lima, although the effect is not large, since I control for age and the amount of time any business has been in operation the significance implies tenure in Lima impacts microfinance selection through some other channel.

To ensure that the positive and significant coefficients on home ownership, savings and marital status are not simply statements about wealth and risk aversion, rather than vulnerability, I estimate the logit model with and without household wealth (columns (1) and (2)). If wealth fully drives the relationships between savings, home ownership, marital status and microfinance selection, the results for the vulnerability measures should vary when wealth is included. Comparison of the results in columns 1 (wealth excluded) and 2 (wealth included) show this is not the case. While the estimated marginal effects of home ownership, savings and marital status slightly decline, the reduction in the coefficients is small and all three remain significant. Therefore it is unlikely the significance of several vulnerability measures is simply a statement about wealth's influence on microfinance selection.

I also test the theoretical predictions that vulnerability has less of an impact on microfinance selection for high wealth and high skill entrepreneurs by including two sets of interaction terms. The first set interacts household wealth with the four main vulnerability measures, home ownership, savings, marital status and Time in Lima. The second set interacts education, the most robust skill measure, with home ownership, savings, marital status and Time in Lima[46]. If the theoretical prediction holds, the signs in these terms

[45] In almost all cases the coefficient on marital status declines if it is defined more restrictively (cohabitation not included), implying the benefits indeed stem from partnership.
[46] Given the small sample size I have an interest in limiting the number of interaction terms. I choose only one skill variable to interact and choose education because it seems a stronger proxy measure than experience.

should be negative: each vulnerability measure plays less of a role in determining microfinance status when wealth and skill are high. Column (3) contains estimation results when only wealth interaction terms are included, column (4) presents results when only skill interaction terms are included, and column (5) contains results when all interaction terms are included. The reported coefficients for the interaction terms are average interaction effects, rather than average marginal effects of the interaction terms[47].

The empirical results provide weak evidence in support of the second and third theoretical predictions. Consistent with the theory the signs on all of the interaction terms except one are negative. This implies wealth and skill reduce the impact of vulnerability on microfinance selection. However, in all cases the coefficients are insignificant, and for wealth the coefficients on all of the interaction terms are extremely small. This implies that the influence of wealth and skill on the impact of vulnerability is indistinguishable from zero. This result could simply stem from the limited sample size of the ACP data, and a larger data set would likely yield more conclusive results about the relationship between wealth, skill and vulnerability.

In sum, estimation of microfinance selection using the full sample finds that four of the vulnerability measures, home ownership, savings, marital status and time in Lima, have significant power in predicting microfinance participation in 1997. Just considering the first three measures, according to the estimates improving savings, home ownership and marital status simultaneously increases the chance an entrepreneur has microfinance in 1997 by 45%. To the degree I have managed to control for skill these results provide strong evidence that vulnerability negatively impacts microfinance selection.

Section 6: Empirical Model of Microfinance Selection, Balanced Panel

The ACP data set is a panel and includes additional information from the second survey round for the 520 households that do not drop out of the original sample. Although the balanced panel sample is smaller and may differ from the original due to attrition bias, incorporating this additional information provides a more comprehensive analysis of microfinance selection. This section and the appendix are devoted to investigating the determinants of microfinance selection using the 1999 data.

[47] See Ai and Norton (2003) for discussion of why the interaction effect differs from the marginal effect of the interaction term, and appropriate calculation of the former.

I will first address concerns that the results from the full 1997 sample are driven by observations that drop out of the sample, in which case their external validity is compromised. To do this I re-estimate the logit model of microfinance in 1997 on the sub-sample of households that appear in the 1999 estimation (this is less than 520 households due to non-response on some 1999 enterprise level variables). The results are presented in columns (4), (5) and (6) of table 11, and essentially match those from the estimation using the full sample. Marital status, home ownership and savings remain positive and significant in predicting microfinance status in 1997 and the size of the marginal effects is relatively unchanged. The only substantive difference to the results from the full sample is that all but one of the wealth interaction terms becomes significant. Given that the wealth variable is scaled down by 1000, however, the small value of the coefficients implies the influence of wealth on determining vulnerability's impact on selection is minor. Overall this check confirms that the results from the full sample are robust to exclusion of households that drop out of the sample.

6.1 Empirical Analysis of Microfinance Selection, 1999

The inclusion of the 1999 data yields a more complex breakdown of households based on microfinance status as several microfinance clients drop out and several non-microfinance clients become clients of either Mibanco or another microfinance institution by 1999. The groups of entrepreneurs expands from two; those with and without microfinance, to four; those who have microcredit in 1997 and in 1999 (Still Have), those who had microcredit in 1997 but do not in 1999 (Dropouts[48]), those who did not have microcredit in 1997 but do in 1999 (Join MFI) and those who do not have microcredit in either 1997 or 1999 (Never Join).

Table 1. Breakdown of Balanced Sample

	Have Microcredit in '99	Do Not Have Microcredit in '99
Have Microcredit in '97	219 HHs (Still Have)	87 HHs (Dropouts)
Do Not Have Microcredit in '97	64 HHs (Join MFI)	150 HHs (Never Join)

With the sequential nature of the decision making process outlined in the panel data a nested logit becomes the natural model to estimate microfinance selection in both periods. The difficulty with the nested logit, however, is the small size of the Dropout and Join MFI groups. This is problematic because after dividing entrepreneurs into nests based on their

[48] Dropouts defined as entrepreneurs that have not taken out any microfinance loans since 1997; that is, in almost two years

1997 microfinance status, within each nest there may be insufficient observations to discern the differences between the group that has microfinance in 1999 and the group that does not. As a result the nested logit yields little information about the determinants of 1999 microfinance status. For interested readers, details of the set-up and results of the nested logit estimation are provided in the appendix.

To overcome the problem of limited sample size I turn to a simple logit estimation of microfinance status in 1999. I use the same observables as in the 1997 estimation, but employ 1999 values. This slightly reduces the sample size from 520 as several households do not respond to all of the enterprise level questions in 1999. Results of this estimation are presented in table 8. Column (1) presents results without household wealth, column (2) presents results with household wealth and column (3) presents results with interaction terms. Finally, because the Still Have (those with microfinance in both periods) and Never Join (those without microfinance in both periods) groups present the starkest contrasts regarding microfinance choice (and have more observations), I estimate a logit model of microfinance selection using these two groups. Results of this estimation are presented in table 9. Columns (1), (2) and (3) contain results using 1997 variables and columns (4), (5) and (6) contain results using 1999 variables.

The most striking feature of the estimations of microfinance status using 1999 data is that the results are less conclusive those using 1997 data. In both sets of analyses 1999 values of the observables have significantly less power than their 1997 equivalents in predicting microfinance participation. This is specifically true of the vulnerability measures. In the balanced panel only 1999 marital status remains positive and significant. Home ownership, savings and time in Lima, which were strong predictors of microfinance status in 1997, fail to remain so in 1999. In the Still Have and Never Join comparison the same pattern is observed. 1997 values of home ownership, savings, marital status and time in Lima are all significant in predicting which entrepreneurs have microfinance in both periods (Still Have) and which do not (Never Join). When 1999 values of the same variables are used, however, only marital status remains significant in all cases. The limited power of the 1999 vulnerability measures to predict microfinance status is curious, given strong evidence in the 1997 data to the contrary. Defending the findings in the 1997 data therefore requires an explanation of why several of the vulnerability measures cease to be good predictors of microfinance selection in 1999.

6.2 Environment in 1999 vs. 1997

The difficulty with the vulnerability variables employed is that they are ex-ante measures; they largely capture a household's ability to smooth consumption prior to being hit with a shock. The ability of these measures to capture vulnerability may change, however, after a household is hit with a negative shock. When using panel data this distinction proves important if the two survey periods portray very different moments in the lives of the sample households, in which case the information captured by the vulnerability measures might change. For example, if realizations of negative shocks increase between 1999 and 1997, the incidence of savings and home ownership might decline if households liquidate these assets to manage negative shocks. As a result savings and home ownership may cease to be strong predictors of microfinance selection in 1999, despite the fact that the relationship between vulnerability and microfinance selection remains the same if households' ability to take out consumption loans, should they face another adverse shock, stays in tact. The explanation perhaps is that several variables cease to fully capture vulnerability after a household is hit with a shock. The question becomes whether or not this explanation is viable, and this appears to be the case.

The Peruvian economy entered into recession in 1998 following the adverse shocks of El Niño, the Asian crisis and Russia's default and only began to emerge from it in the fourth quarter of 1999, after the second survey round in the ACP data[49]. According to the Central Bank of Peru (BCRP), from the third quarter of 1997, when the first survey was conducted, to the third quarter of 1999, when the second survey was conducted, real GDP fell by 0.2%. This compares to an 8.7% increase in real GDP from the third quarter of 1995 to the third quarter of 1997, the two year period leading up to the first survey round. The brunt of this contraction came from real internal demand, a measure which better captures the situation of the urban micro-entrepreneurs in the sample since few, if any, are engaged in export industries. Between the first and second rounds of the ACP survey real internal demand fell by 6.4%. This compares to an 8.6% increase in real internal demand over the two years leading up to the first survey round. These indicators clearly show the entrepreneurs in the sample faced a better economic environment in the two years leading up to the first survey round than in the two years that followed.

[49]See BCRP Annual Reports for 1998 and 1999 and Dunn and Arbuckle (2001) for details on the recession, particularly further explanation on the impact of the Asian and Russian crises on Peruvian internal demand.

Responses to survey questions confirm that this deteriorating economic environment translated into increased realizations of negative shocks for ACP entrepreneurs. In the balanced panel the percent of entrepreneurs that report being hit with a negative shock increases by 13%, from 44% in 1997 to 57% in 1999. Meanwhile the percent of households living below the poverty line increases by almost 10%[50]. In addition, as shown in table 10, the ranking of most severe shocks changes over the two year period. In 1997 only 17% of households report loss or reduction of income as the most severe shock. By 1999 this increases twofold, to 35%, further indicating the recession had a direct impact on the entrepreneurs in the sample. There also is evidence many households liquidated savings to manage these shocks. In every group except Join MFI, savings incidence declines from 1997 to 1999, with the most severe decline registered by the Still Have group, the set of entrepreneurs that have microfinance in both periods.

The data corroborate the theory that 1999 vulnerability measures cease to predict microfinance selection in 1999 due to an increase in the realization of negative shocks and the use of savings, in particular, to manage these shocks. It is quite compelling, then, that one vulnerability measure that would be less likely to change following a negative shock, marital status, is the only measure that is significant in all cases. This variable, which perhaps best captures the unobservable characteristic that is a household's ability to manage adverse income shocks, proves to be the most robust predictors of microfinance selection. As such, despite the fact that home ownership and savings cease to be significant in determining microfinance status in 1999, overall the empirical evidence supports the contention that vulnerability is a key determinant of microfinance selection.

7. Conclusion

This paper argues that vulnerability, defined as the inability to smooth consumption across adverse income shocks, is a key determinant of whether or not poor entrepreneurs seek microfinance loans and a potential explanation for low microfinance participation rates. In a simple theoretical model vulnerability is found to drive some entrepreneurs to reject high yield/high risk enterprises and microfinance, even after accounting for skill and wealth. Vulnerability is also predicted to weigh less heavily in microfinance decisions for high skill

[50]Defined if a household's consumption per adult equivalent falls below a $2 measure, which is determined by the Peruvian statistical agency (INEI).

and high wealth entrepreneurs. Using data from ACP, a large microfinance institution in Lima, Peru, I find empirical support for the theory that vulnerability drives microfinance decisions. More vulnerable entrepreneurs are significantly less likely to seek microfinance than their less vulnerable counterparts. I also find weak evidence that skill and wealth reduce the impact of vulnerability on microfinance selection.

The vulnerability theory outlined in this paper would benefit from further investigation using more expansive data sets. While the ACP data set is one of the few panel data sets on urban microentrepreneurs, it is imperfect due to the small sample size and limited number of panel periods. In order to make more conclusive statements about the importance of vulnerability it would be helpful to acquire further evidence from larger or longer (in the sense of panel periods) data sets. At present only the former is possible, and I have started to investigate the importance of vulnerability using new, cross-sectional data on urban microentrepreneurs in Ecuador. This representative survey includes over 17,000 urban microentrepreneurs and although it is only cross-sectional, it may yield further insight into the role vulnerability plays in determining the behavior of poor, urban households.

Finally, the results of this paper have important implications for microfinance institutions and general efforts to expand credit access for the poor. Despite enthusiasm surrounding these efforts, credit expansion has not proved a magic solution to poverty. Contrary to the claims of many microfinance proponents, most poor households do not appear to be one or two loans away from crossing the poverty line. Given the credit constraints many poor household face and the likely link between these constraints and poverty, it is curious that credit outreach programs have had less of an impact than anticipated. Vulnerability may be one important explanation for this phenomenon. From a policy perspective this suggests that efforts to improve risk management strategies should play a larger role in poverty reduction policies. Specifically, promotion of consumption credit and microinsurance, both of which would reduce vulnerability, should be more thoroughly integrated into credit expansion programs, particularly microfinance.

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Table 2: Types of Credit Other than Microfinance, 1997

Use of Other Types of Credit (% of 1997 full sample respondents)	Have Microfinance in 1997	Do Not Have Microfinance in 1997	Median Amount Outstanding (1997 soles)
Family/Friend	8.9%	10.1%	500
Moneylenders	2.3%	5.8%	225
Pawnshop	0.6%	0.4%	200
Suppliers	54.1%	50.0%	200
Companies/Credit Unions	2.0%	1.4%	715
Banks	7.2%	3.3%	2,171
EDPYMEs[51]	1.1%	0.4%	700
Cooperatives	0.3%	0.7%	2,000
ROSCAs	6.3%	4.7%	200
Government	1.7%	1.8%	115
Construction Banks	7.2%	2.5%	2,510
Other	4.9%	5.1%	364
None	33.5%	39.1%	
ACP (for 1997 borrowers)			1,300
N respondents[52]	349	276	
% non-respondents	13.0%	8.0%	
Average # non MFI debt sources	0.97	0.86	
Mean debt outstanding, non ACP	1.229.7	698.9	

Use of Other Types of Credit (% Balanced Sample respondents)	Still Have	Dropout	Join MFI	Never Join
Family/Friend	10.3%	8.6%	10.3%	11.8%
Moneylenders	1.5%	5.7%	3.4%	5.1%
Pawnshop	0.5%	1.4%	0.0%	0.7%
Suppliers	49.0%	42.9%	48.3%	44.1%
Companies/Credit Unions	2.1%	2.8%	1.7%	1.5%
Banks	5.1%	8.6%	8.6%	0.0%
EDPYMEs	1.0%	2.8%	0.0%	0.0%
Cooperatives	0.5%	0.0%	0.0%	0.7%
ROSCAs	3.1%	7.1%	8.6%	2.2%
Government	0.5%	0.0%	3.4%	0.7%
Construction Banks	6.2%	11.4%	6.9%	1.5%
Other	4.6%	5.7%	1.7%	5.1%
None	34.0%	34.2%	34.5%	39.0%
N respondents[53]	194	70	58	136
% non-respondent	34.0%	34.3%	34.5%	39.0%
Average # non MFI debt sources	0.94	1.07	1.07	0.82
Mean debt outstanding, non ACP	1030.5	1269.0	1242.3	501.1
Mean debt outstanding ACP (1997 soles)	1,680.0	1,191.4		

[51] *Entidades de Desarrollo para la Pequena y Microempresa.* These are MFIs that are regulated financial institutions, unlike most NGOs that are unregulated.

[52] 79 HHs do not respond to these questions in the 1997 survey. I leave them as non-responses

[53] 62 HHs in balanced sample do not respond to these questions. I leave them as non-responses

Table 3: Enterprise Portfolios, Summary Statistics

FULL SAMPLE	**Micro-finance 1997**	**No Micro-finance 1997**			**ANOVA (p value)**
Expected Return Measures					
Microenterprise Income per Adult Equivalent 1997	4529.2	3084.6			0.002**
Microenterprise Income per Adult Equivalent 1999	4275.6	3143.3			0.007**
Distribution of Average Microenterprise Income					
Mean	4410.0	3113.6			0.000**
Standard Deviation[54]	4303.1	3663.1			0.020*
Variance Measures					
Distribution of Standard Deviation of Microenterprise Income					
Mean	1731.1	1036.3			0.001**
Standard Deviation[55]	2572.9	2010.6			0.003**
Return/Risk Relationship					**TOTAL**
Correlation bet. Mean & Standard Deviation of Microenterprise Income per Adult Equivalent	0.816	0.708			0.786
Observations	302	212			514
BALANCED SAMPLE	**Still Have**	**Dropouts**	**Join MFI**	**Never Join**	**ANOVA (p value)**
Expected Return Measures					
Microenterprise Income per Adult Equivalent 1997	4,639	4,255	3,496	2,910	0.001**
Microenterprise Income per Adult Equivalent 1999	4,607	3,448	4,187	2,705	0.013*
Distribution of Average Microenterprise Income					
Mean	4635.8	3851.8	3841.7	2805.8	0.000**
Standard Deviation	4576.9	3498.7	5734.0	2244.0	
Variance Measures					
Distribution of Standard Deviation of Microenterprise Income					
Mean	1810.6	1534.6	1192.5	970.3	0.008**
Standard Deviation	2653.1	2366.3	2946.0	1453.7	
Return/Risk Relationship					**TOTAL**
Correlation bet. Mean and Standard Deviation of Microenterprise Income per Adult Equivalent	0.84	0.73	0.73	0.67	0.79
Observations (N)	215	87	63	149	520

[54] Test statistic from Levene's test for the equality of variance used

[55] Test statistic from Levene's test for the equality of variance used

Table 4: Summary Statistics, Full Sample 1997

All Values as of 1997	Have Microfinance in 1997	Don't Have Microfinance in 1997	ANOVA (p value)
Household Characteristics			
Total Income	24,667	16,180	0.000**
Wealth (net household assets)	11,121	6,840	0.000**
% Entrepreneurs that are women	62.2%	59.8%	0.001**
Age of Microentrepreneur	41.2	40.8	0.103
Dependency Ratio	30.4%	30.2%	0.903
Working Age HH Members	3.5	3.1	0.003**
Hit by Shock in past two years	48.2%	39.2%	0.017*
Enterprise Characteristics			
Enterprise Number	1.60	1.37	0.000**
Informality			
All enterprises informal	47.3%	59.1%	0.002**
At least one enterprise informal	70.1%	71.4%	0.710
Have Enterprise in Category			
Food and Clothing	9.11%	5.78%	0.105
Manufacturing	4.8%	6.1%	0.450
Construction	3.8%	2.4%	0.296
Auto Repair/ Auto Parts Sales	3.5%	0.7%	0.013*
Minor Retail and Wholesale	80.7%	86.7%	0.037*
Hospitality[56]	11.1%	6.8%	0.052
Transport	13.9%	5.1%	0.001**
Services	6.6%	6.1%	0.807
Employees & Capital			
Total employees, all enterprises	1.62	1.17	0.003**
Employees per Enterprise	1.10	0.86	0.007**
Net Enterprise Assets	9.187.1	3,983.6	0.000**
Vulnerability			
Have Savings	62.2%	50.8%	0.002**
Own Home	86.0%	70.0%	0.000**
Other Properties	15.2%	10.6%	0.074
Married or Equivalent	82.7%	71.8%	0.511
Time in Lima	29.8 years	25.8 years	0.000**
Wealth (net household assets)	11,121	6,840	0.000**
NetHH Assets/ Income	54.6%	50.1%	0.264
Skill			
Education & Experience			
Education			
Primary & Below	29.2%	36.2%	
Secondary	49.3%	43.9%	0.157
More Than Secondary	21.5%	19.9%	0.614
Experience (years in operation)	8.93 years	7.12 years	0.009**
Observations (N)	400	301	

*Difference in means significant at the 5% level; ** Difference in means significant at the 1% level

[56] 'Hospitality' includes hotels and restaurants. This is predominantly some form of food service.

Table 5: Logit Estimation of 1997 Microfinance Status, Full Sample

1997 Microfinance Status			**LOGIT**			LINEAR PROB.	
Average Marginal Effects	(1)	(2)	(3)	(4)	(5)	(5)	(6)
Vulnerability Measures							
Own Home	0.215	0.196	0.211	0.257	0.277	0.199	0.265
	(4.56)***	(4.14)***	(2.97)***	(3.98)***	(3.26)***	(4.16)***	(3.14)***
Have other property	0.085	0.078	0.082	0.079	0.082	0.078	0.082
	(1.63)	(1.49)	(1.57)	(1.52)	(1.59)	(1.46)	(1.54)
Have savings	0.100	0.083	0.084	0.131	0.133	0.084	0.138
	(2.75)***	(2.27)**	(1.66)*	(2.38)**	(2.04)**	(2.27)**	(2.14)**
Entrepreneur Married or	0.115	0.108	0.127	0.127	0.148	0.111	0.155
Equivalent[57]	(2.55)**	(2.40)**	(2.16)**	(1.99)**	(1.93)*	(2.44)**	(2.09)**
Time in Lima	0.004	0.003	0.005	0.002	0.003	0.003	0.004
	(2.06)**	(1.65)*	(2.20)**	(0.66)	(1.26)	(1.62)	(1.46)
Wealth (*Net HH Assets/1000)*		0.007	0.007	0.018	0.018	0.006	0.020
		(2.83)***	(2.84)***	(1.80)*	(1.79)*	(2.67)***	(2.24)**
Skill Measures							
Secondary Education	0.101	0.087	0.235	0.084	0.236	0.092	0.235
	(2.39)**	(2.06)**	(1.97)**	(1.96)**	(1.99)**	(2.08)**	(1.73)*
Above Secondary	0.079	0.045	0.050	0.043	0.049	0.056	0.051
Education	(1.49)	(0.82)	(0.88)	(0.78)	(0.87)	(0.98)	(0.86)
Maximum Time in	0.003	0.003	0.003	0.003	0.003	0.004	0.003
Operation	(1.21)	(1.18)	(1.11)	(1.15)	(1.08)	(1.28)	(1.17)
Interaction Terms[58]							
Wealth*Home				-0.008	-0.008		-0.009
				(1.19)	(1.08)		(1.49)
Wealth*Savings				-0.006	-0.006		-0.006
				(1.14)	(1.10)		(1.32)
Wealth*Married				-0.003	-0.003		-0.004
				(0.55)	(0.51)		(0.70)
Wealth*TimeinLima				0.000	0.000		0.000
				(0.40)	(0.28)		(0.40)
SecEd*Home			-0.014		-0.019		-0.001
			(0.12)		(0.12)		(0.01)
SecEd*Savings			-0.008		-0.014		-0.001
			(0.16)		(0.21)		(0.01)
SecEd*Married			-0.040		-0.045		-0.039
			(0.81)		(0.86)		(0.44)
SecEd*TimeinLima			-0.004		-0.004		-0.004
			(1.39)		(1.28)		(1.38)
Controls[59]							
All enterprises informal[60]	-0.062	-0.043	-0.041	-0.040	-0.039	-0.042	-0.038
	(1.63)	(1.12)	(1.08)	(1.13)	(1.02)	(1.10)	(0.97)
Observations (N)	686	686	686	686	686	686	686
Pseudo R2	.121	.129	.132	.134	.136	.130	0.130

Absolute value of z statistics in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

[57] In all cases redefining marital status more restrictively (cohabitation not included) slightly reduces the size of the coefficients, but all remain significant at the 10% level.

[58] Coefficients equal average Interaction Effects, not the average marginal effect of interaction term.

[59] Other controls include whether or not entrepreneur is a woman, the entrepreneur's age, the household's dependency ratio, the number of working age HH members, whether or not HH hit with a shock in the past 2 years (significant at 10%), the number of enterprises (significant at 5%), and dummy variables for the type of enterprise across 8 categories.

[60] When informality counted as at least one enterprise of household is informal, this dummy variables also does not show up as significant at the 10% level. None of the other results change when the alternative measure is used

Table 6: Summary Statistics, Household and Enterprise Characteristics, Balanced Panel

Mean Values	Still Have	Dropouts	Join MFI	Never Join	ANOVA test (p value)
Household Characteristics					
Entrepreneur a Woman 1997	58.7%	74.7%	55.6%	55.3%	0.019*
Age of Entrepreneur 1997	44.0	43.2	41.9	42.4	0.391
Dependency Ratio					
1997	0.288	0.328	0.312	0.288	0.419
1999	0.261	0.301	0.292	0.263	0.381
Working Age HH Members					
1997	3.57	3.31	3.33	3.11	0.069
1999	3.45	3.55	3.44	3.21	0.389
Hit by a Shock in past 2 years					
1997	45.2%	60.9%	37.5%	36.7%	0.002**
1999	57.3%	58.6%	58.6%	55.3%	0.951
Income Per Adult Equivalent					
1997	6,720 soles	6,439soles	5,049 soles	4,170 soles	0.000**
1999	6,728 soles	6,066 soles	5,591 soles	4,200 soles	0.000**
Enterprise Characteristics					
Enterprise Number					
1997	1.61	1.59	1.50	1.40	0.033*
1999	1.61	1.49	1.38	1.45	0.033*
All Enterprises Informal					
1997	20.5%	28.7%	25.4%	34.2%	0.031*
1999	26.8%	46.2%	27.9%	39.9%	0.004**
Have Enterprise in Category					
Food and Clothing					
1997	10.7%	6.9%	6.3%	6.0%	0.364
1999	11.5%	10.2%	6.5%	9.8%	0.733
Manufacturing					
1997	6.0%	3.4%	6.3%	7.4%	0.681
1999	6.7%	3.8%	6.5%	6.3%	0.838
Construction					
1997	1.9%	6.9%	1.6%	2.0%	0.075
1999	1.9%	6.4%	3.3%	2.1%	0.208
Auto Repair & Parts Sales					
1997	3.2%	2.3%	1.6%	0.6%	0.407
1999	4.3%	3.8%	0.0%	2.8%	0.400
Minor Retail and Wholesale					
1997	80.9%	78.2%	92.1%	85.9%	0.082
1999	77.0%	60.2%	82.0%	76.9%	0.010**
Hospitality[61]					
1997	9.8%	16.1%	6.3%	6.7%	0.091
1999	14.8%	12.8%	4.9%	4.9%	0.010**
Transport					
1997	12.5%	14.9%	6.3%	2.0%	0.001**
1999	18.2%	21.8%	6.5%	8.4%	0.005**
Services					
1997	3.2%	4.6%	6.3%	4.7%	0.732
1999	6.7%	7.7%	6.5%	6.3%	0.984

*Difference in means significant at the 5% level; **Difference in means significant at the 1% level

[61] 'Hospitality' includes hotels and restaurants. This is predominantly some form of food service.

Table 7: Summary Statistics, Vulnerability and Skill Measures, Balanced Panel

(values in 1997 nuevo soles)	**Still Have**	**Dropout**	**Join MFI**	**Never Join**	**ANOVA p-value**
Vulnerability					
Have Savings					
1997	63.9%	57.5%	42.2%	48.7%	0.003**
1999	50.7%	49.4%	47.6%	40.0%	0.241
Own Home					
1997	87.2%	87.4%	76.2%	70.0%	0.000**
1999	83.9%	88.5%	80.9%	74.0%	0.025*
Other Properties					
1997	15.6%	18.4%	11.1%	8.7%	0.117
1999	19.3%	14.9%	6.4%	12.0%	0.048*
Married or Equivalent					
1997	85.4%	81.6%	78.1%	71.3%	0.534
1999	82.2%	74.7%	76.6%	70.0%	0.534
Time in Lima 1997	30.2 years	30.4 years	26.2 years	25.5 years	0.001**
Wealth (Net HH Assets)					
1997	11,195 soles	9,687 soles	7,182 soles	6,171 soles	0.000**
1999	10,664.6 soles	10,394 soles	9,067 soles	7,138 soles	0.002**
NetHH Assets/ Income					
1997	56.2%	50.3%	54.1%	48.6%	0.597
1999	60.6%	54.0%	52.7%	49.2%	0.338
Skill					
Education 1997					
Primary & Below	31.6%	25.3%	36.5%	35.3%	
Secondary	47.7%	54.0%	42.9%	48.0%	0.590
More Than Secondary	20.7%	20.7%	20.6%	16.7%	0.784
Experience 1997 (max years in operation of any enterprise)	8.78 years	8.64 years	7.40 years	6.98 years	0.092
Enterprise Resources					
Employees[62]					
Total employees all enterprises					
1997	2.19	1.84	1.76	1.49	0.006**
1999	1.70	0.97	1.45	0.87	0.000**
Employees per Enterprise					
1997	1.41	1.15	1.08	0.99	0.013*
1999	1.13	0.66	1.06	0.61	0.000**
% Enterprises with Employees					
1997	75.9%	70.1%	69.3%	60.6%	0.006**
1999					
Capital					
Net Enterprise Assets					
1997	10,420.3	6,943.6	5,398.8	3,684.4	0.000**
1999	12,082.1	7.115.3	9,858.8	6,034.8	0.019*
Enterprise Investment					
1997	3,250.7	2,890.5	2,932.4	1,315.4	0.092
1999	2,599.4	1,962.3	1,052.9	1,502.4	0.372

*****Difference in means significant at 5% level;**Difference in means significant at 1% level

[62] Employees do not include the entrepreneur

Table 8: Logit Estimation of Microfinance Status, Balanced Panel

Average Marginal Effects	1999 Microfinance Status			1997 Microfinance Status		
	(1)	(2)	(3)	(4)	(5)	(6)
Vulnerability Measures						
Own Home	0.046	0.042	-0.088	0.181	0.165	0.315
	(0.76)	(0.68)	(0.83)	(3.06)***	(2.78)***	(2.78)***
Other property	0.012	0.008	0.013	0.111	0.100	0.087
	(0.19)	(0.12)	(0.20)	(1.83)	(1.63)	(1.43)
Have Savings	0.034	0.029	0.089	0.131	0.117	0.097
	(0.73)	(0.63)	(1.10)	(3.05)***	(2.72)***	(1.25)
Entrepreneur married[63]	0.144	0.139	0.198	0.151	0.134	0.298
	(2.52)**	(2.41)**	(2.13)**	(2.69)***	(2.37)**	(3.08)***
Time Lived in Lima (1997)	0.002	0.001	0.001	0.005	0.005	0.002
	(0.71)	(0.66)	(0.39)	(2.81)***	(2.58)***	(0.73)
Wealth (*Net HH Assets/1000)*		0.018	0.028		0.007	0.034
		(0.65)	(1.71)*		(2.27)**	(2.16)**
Skill Measures						
Secondary Education	0.014	0.010	-0.239	0.075	0.061	0.228
	(0.24)	(0.17)	(1.78)*	(1.53)	(1.24)	(1.53)
Above Secondary Education	-0.029	-0.035	-0.070	0.087	0.054	0.041
	(0.39)	(0.48)	(0.95)	(1.43)	(0.68)	(0.62)
Maximum Time in Operation	0.002	0.003	0.002	0.005	0.005	0.004
	(0.72)	(0.71)	(0.58)	(1.52)	(1.42)	(1.34)
Interaction Terms[64]						
Wealth*Home			-0.004			-0.022
			(0.37)			(1.44)
Wealth*Savings			-0.002			0.001
			(0.43)			(0.11)
Wealth*Married			-0.006			-0.018
			(0.81)			(1.28)
Wealth*TimeinLima			-0.000			0.001
			(1.00)			(0.48)
SecEd*Home			0.276			0.053
			(2.16)**			(0.47)
SecEd*Savings			-0.086			-0.040
			(0.99)			(0.46)
SecEd*Married			-0.043			-0.077
			(0.42)			(0.48)
SecEd*TimeinLima			0.004			-0.004
			(1.17)			(1.08)
Controls[65]						
Hit with shock in past two years	-0.031	-0.032	-0.032	0.087	0.078	0.090
	(0.68)	(0.70)	(0.70)	(2.04)**	(1.84)*	(2.13)**
All enterprises of HH informal[66]	-0.178	-0.171	-0.163	-0.051	-0.031	-0.035
	(3.53)***	(3.32)***	(3.18)**	(1.00)	(0.61)	(0.70)
Observations (N)	469	469	469	467	467	467
Pseudo R2	0.065	0.065	0.084	0.157	0.165	0.196

Absolute value of z statistics in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

[63] In all but column (1) defining marital status more restrictively (taking out cohabitation) slightly reduces the size of the marital status coefficients, but all remain significant at the 5% level.

[64] Coefficients equal average Interaction Effects, not the average marginal effect of interaction term.

[65] Other controls include whether or not entrepreneur is a woman, the entrepreneur's age, the household's dependency ratio, the number of working age HH members, whether or not HH hit with a shock in the past 2 years (significant at 10%), the number of enterprises (significant at 5%), and dummy variables for the type of enterprise across 8 categories.

[66] Informality is insignificant if it is measured as household has at least one informal enterprise.

Table 9: Logit Estimation of Microfinance Status, Still Have vs. Never Join

Average Marginal Effects	1997 Variables			1999 Variables		
	(1)	(2)	(3)	(4)	(5)	(6)
Vulnerability Measures						
Own Home	0.169	0.153	0.278	0.122	0.117	-0.080
	(2.32)**	(2.13)**	(1.82)*	(1.78)*	(1.70)*	(0.72)
Household has other property	0.137	0.115	0.101	0.061	0.049	0.025
	(1.92)*	(1.56)	(1.41)	(0.86)	(0.67)	(0.34)
Have savings	0.107	0.090	0.165	0.064	0.058	0.156
	(2.05)**	(1.73)*	(1.81)*	(1.25)	(1.13)	(1.82)*
Entrepreneur married[67]	0.169	0.148	0.320	0.175	0.162	0.452
	(2.46)**	(2.14)**	(2.72)***	(2.69)***	(2.45)**	(5.24)***
Time Lived in Lima	0.006	0.005	0.005	0.005	0.005	0.002
	(2.37)**	(2.05)**	(1.29)	(2.00)**	(1.88)*	(0.44)
Wealth (*Net HH Assets/1000*)		0.009	0.048		0.004	0.048
		(2.09)**	(2.40)**		(1.06)	(2.37)**
Skill Measures						
Secondary Education	0.031	0.017	0.190	0.084	0.077	-0.074
	(0.51)	(0.27)	(1.01)	(1.34)	(1.22)	(0.38)
Above Secondary Education	0.076	0.039	-0.005	0.041	0.030	-0.027
	(1.02)	(0.50)	(0.06)	(0.50)	(0.37)	(0.32)
Maximum Time in Operation	0.006	0.006	0.004	0.008	0.008	0.007
	(1.42)	(1.31)	(1.12)	(1.99)**	(1.94)*	(1.70)*
Interaction Terms[68]						
Wealth*Home			-0.023			0.005
			(1.03)			(0.30)
Wealth*Savings			-0.005			-0.008
			(0.27)			(0.62)
Wealth*Married			-0.017			-0.042
			(0.78)			(1.88)*
Wealth*TimeinLima			-0.001			-0.000
			(0.12)			(0.02)
SecEd*Home			0.136			0.269
			(0.89)			(1.64)
SecEd*Savings			-0.160			-0.138
			(1.30)			(1.15)
SecEd*Married			-0.064			-0.071
			(0.31)			(0.46)
SecEd*TimeinLima			-0.006			0.002
			(1.17)			(0.44)
Controls [69]						
Hit with shock in past two years	0.030	0.026	0.039	-0.034	-0.035	-0.035
	(0.59)	(0.52)	(0.79)	(0.66)	(0.68)	(0.69)
All enterprises of HH informal	-0.085	-0.058	-0.063	-0.147	-0.129	-0.110
	(1.35)	(0.94)	(1.03)	(2.47)**	(2.12)**	(1.81)*
Observations (N)	330	330	330	332	332	332
Pseudo R2	0.159	0.169	0.209	0.138	0.141	0.186

Absolute value of z statistics in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%

[67] In all but column (5) redefining marital status slightly reduces the size of the marital status coefficients, but all remain significant at the 10% level.

[68] Coefficients equal average Interaction Effects, not the average marginal effect of interaction term.

[69] Other controls include whether or not entrepreneur is a woman, the entrepreneur's age, the household's dependency ratio, the number of working age HH members, whether or not HH hit with a shock in the past 2 years (significant at 10%), the number of enterprises (significant at 5%), and dummy variables for the type of enterprise across 8 categories.

Table 10: Shocks, Incidence and Management

All Values	Have Microfinance in 1997	Don't Have Microfinance in 1997	Total	ANOVA test (p value)
Macroeconomic Indicators				
Real GDP				
ΔQ3 1995- Q3 1997			8.72%	
ΔQ3 1997- Q3 1999			-0.2%	
Internal Demand				
ΔQ3 1995- Q3 1997			8.6%	
ΔQ3 1997- Q3 1999			-6.4%	
1997 Shocks				
Hit by Shock in past two years	49.7%	36.9%	44.4%	0.004**
Most Severe Shock[70]				
Robbery	35.5%	27.8%	32.9%	0.007**
Severe Illness	27.6%	26.6%	27.3%	0.200
Loss or Reduction in Income	15.8%	19.0%	16.9%	0.695
Death of Income Earner	0.7%	5.1%	2.2%	0.163
Job Loss	6.6%	6.3%	6.5%	0.896
1999 Shocks				
Hit by Shock in past two years	57.7%	56.6%	57.2%	0.757
Most Severe Shock				
Loss of Reduction of Income	36.2%	34.2%	35.4%	0.720
Robbery	21.8%	21.7%	21.8%	0.972
Severe Illness	17.8%	20.0%	18.7%	0.638
Death of Income Earner	1.7%	2.5%	2.0%	0.645
Job Loss	4.0%	6.7%	5.1%	0.313
% Below Poverty Line[71]				
1997	22.0%	31.5%	25.9%	0.000***
1999	27.1%	44.4%	34.2%	0.015**
Observations (N)	206	214	520	
Way of Managing Negative Shock (1999)[72]				
Use Savings	19.9%	21.7%	20.6%	
Borrow at all	25.6%	23.3%	24.7%	
o/w Borrow from family/friends	13.1%	15.8%	14.2%	
Observations (N)	176	120	296	

*Difference in means significant at the 5% level; **Difference in means significant at the 1% level.

[70] Shock listed as most severe for those who reported being hit with a shock over the past two years. Distribution across most severe shock similar for full 1997 sample.

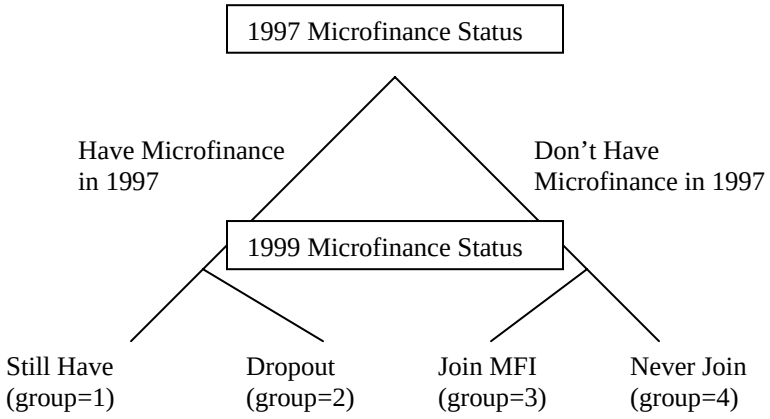
[71] Poverty line calculated by INEI (Peruvian statistical agency) using a $2/day measure. Household classified as below the poverty line if consumption per adult equivalent falls below $2 day measure.

[72] Households who were hit with a shock were asked up to three ways of managing the adverse event.

Appendix 1: Nested Logit estimation of Microfinance Selection

For robustness I estimate microfinance selection in the balanced panel using a nested logit model. I choose a nested logit over a simple non-nested multinomial logit model because the choices under consideration stem from a sequential decision process, making it highly probable the independence of irrelevant alternatives assumption[73] (IIA) is violated and that a multinomial logit yields inconsistent estimates. The nested logit is more appropriate in this context because it allows for unobserved similarities between groups within a defined subset, or nest. This is a valuable feature as it is likely entrepreneurs with microfinance in 1997 (Still Have and Dropout groups) have more in common with each other, regardless of their 1999 microfinance status, than with entrepreneurs without microfinance in 1997 (Never Join or Join MFI group).

The nested logit model[74] allows for unobserved similarities across certain groups by creating a hierarchical structure. The choice set is divided into S mutually exclusive subsets, or nests, and the probability an entrepreneur belongs to a particular group is the probability she chooses a certain nest *s* over all other nests multiplied by the probability she chooses a specific group *j* from within nest *s*. In the ACP data I divide the four groups into two nests. The first nest contains the two groups with microfinance in 1997 (the Still Have and Dropout groups) and the second nest contains the two groups without microfinance in 1997 (the Join MFI and Never Join groups). Each nest thus contains one group with microfinance in 1999 and one group without microfinance in 1999.



The probability an entrepreneur belongs to one of the four groups (P_{js}) is the probability she selects microfinance prior to 1997 (probability of choosing nest s= P_s) multiplied by the probability she

[73] This assumption states the relative probabilities of two choices are not impacted by the inclusion of another choice. For example, the probability an entrepreneur is a 'Still Have' relative to the probability she is a 'Never Join' will not be impacted by the possibility she is a 'Join MFI'. It is likely this assumption holds. I did run a MNL model and Small-Hsiao tests confirmed that in all cases the IIA assumption did not hold.

[74] The discussion of the nested logit model follows that of Greene (2003), Stancill (2000) and Hensher (1986).

selects microfinance between 1997 and 1999 (probability of choosing a specific choice within a nest= $P_{j|s}$). Estimating these marginal and conditional probabilities reveals the determinants of microfinance status in both periods.

The nested logit follows a random utility framework, such that the probability an entrepreneur falls into a specific group is the probability this group yields higher expected utility than every other group. If utility from a given group *j* in nest *s* is a linear function of observable attributes that vary across nests (Z_s), observable attributes that vary across groups ($X_{j|s}$), and unobservable factors (ε_{js}) ($U_{jsi} = X_{j|s}'\beta + Z_s'\xi + \varepsilon_{js}$) and if the unobservable utility components (ε_{js}) are distributed according to a generalized extreme value distribution (GEV)[75] it can be shown the probability an entrepreneur falls into a specific group (P_{js}) can be written as:

$$P_{js} = P_s * P_{j|s} = \frac{\exp(Z_s'\xi + \varrho_s I_s)}{\sum_{r=1}^{S}\exp(Z_r'\xi + \varrho_r I_r)} * \frac{\exp(X_{j|s}'\beta/\varrho_s)}{\exp(I_s)} \quad (2)$$

Where ϱ_s measures the degree of correlation of the error terms for the elements of set *s*. The *inclusive value* for set *s*, (I_s), is defined as:

$$I_s = \ln\left(\sum_{j=1}^{Js}\exp(X_{j|s}'\beta/\varrho_s)\right) \quad (3)$$

The inclusive value is an index of the expected maximum utility from the choices in a particular set and captures the degree of complementarity amongst elements of a particular nest. In order for a nested logit model to be consistent with utility maximization estimated inclusive values must lie within the unit interval[76]. If inclusive value estimates lie outside this range, the nested logit likely is inappropriate over other models of multinomial choice.

I estimate the parameters of the nested logit model using a full information maximum likelihood model, as this yields consistent and efficient estimates[77]. For observable factors that impact 1997

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[75] Under this distribution the random components of choices within a specific nest are allowed to be correlated while random components of choices across sets are assumed to be independent:

$$F(\varepsilon_i) = \exp[-\sum_{r=1}^{S}\left(\sum_{js=1}^{Js}-\exp(\varepsilon_{js}/\varrho_s)\right)^{\varrho_s}$$

Where $\varrho_s \in [0,1]$ and $(1-\varrho_s)$ measures the degree of correlation between the error terms of the two choices in the set. McFadden (1981) shows the Independence of Irrelevant Alternatives assumption (IIA) holds within nests but not across nests under this distribution. When ϱ_s=1 the choices in the nest are independent and the nested logit collapses to the standard multinomial logit model.

[76] If the inclusive value for a nest equals 0 the model degenerates since no utility will come from any other nest. Alternatively, if the inclusive values for nests equal 1 there is no complementarity amongst the elements in the nests and the nested structure is unnecessary. In this case a multinomial logit model is more appropriate.

[77] Implicit is the assumption that in both periods households have the option of choosing microfinance.

microfinance status (Z_i) I use the same household and enterprise characteristics, vulnerability and skill measures used in the logit analysis. For observable factors that impact 1999 microfinance status ($X_{j|s}$) I use the variables outlined below. Average values across groups are also provided in table 11.
1) Household characteristics ($HC_{j|s}$) include: changes in the dependency ratio; changes in the number of working age household members; whether or not the entrepreneur was hit with a shock in the past two years; and household wealth. The age and gender of an entrepreneur also likely impact the utility from microfinance, but since these values do not change across periods, I use 1997 values.
2) Enterprise characteristics ($EC_{j|s}$) include: changes in the number of enterprises; whether on not a household closed the primary enterprise between 1997 and 1999[78]; changes in the formality status of enterprises run by the household (if the household had more or less informal enterprises in 1999 than in 1997); and changes in the types of enterprises run by the household[79].
3) Vulnerability Measures include: changes in the ratio of assets to income; changes in savings, changes in home ownership; and changes in other property[80], changes in marital status, and an entrepreneur's tenure in Lima as of 1997.
4) Skill Measures include: Education and experience, but since these variables do not extensively change over the two year period I use 1997 values in the estimation.

Results of the full maximum likelihood estimation of the nested logit model are presented in table 12. Coefficients in the top half of the table report the impact of the observables on the probability an entrepreneur does not have microfinance in 1997 ($P(Y_{si}=2)$ =*Upper Nest=2*) over the probability an entrepreneur has microfinance in 1997 (($P(Y_{si}=1)$ =*Upper Nest=1*). Coefficients in the bottom half report the impact of the observables on the probability an entrepreneur has microfinance in 1999 over the probability an entrepreneur does not. The first column contains estimated impacts of explanatory variables on the probability an entrepreneur is in the Dropout group over the Still Have group ($P(Y_{ji|1}=2)$). The second column contains estimated impacts of these variables on the probability an entrepreneur is in the Never Join group over the Join MFI join ($P(Y_{ji|2}=4)$). All reported coefficients are average marginal effects.

The results are very similar to those from the simple logit model. Estimation of the upper branches finds three vulnerability measures, savings, home ownership and marital status, are all

[78] Households were asked if the enterprise they listed as primary in 1997 still exists in 1999. "No' responses were coded as primary business closure. In many cases household opened new enterprises, so the net change in enterprises is zero or even positive.
[79] I create a dummy variable that takes on the value of 1 if the categories of the businesses run by the household differ in 1999 relative to 1997. For example, if in 1997 the household had one enterprise in the retail sector and one enterprise in the construction section and in 1999 the household had two enterprises in the retail sector, the household would have a value of 1 for this dummy variable.
[80] I also used 1999 levels of vulnerability measures, but results do not differ from those when changes are used.

significant in predicting microfinance status in 1997. In all cases positive values increase the probability an entrepreneur has microfinance in 1997. Meanwhile, although higher educational attainment increase the probability an entrepreneur has microfinance in 1997, the impact is not significant. Experience is also found to have no impact, suggesting skill plays less of a role in microfinance selection.

Similar to the logit analysis, estimation of the lower branches finds the determinants of microfinance status in 1999 are less conclusive. Within the first nest only the closure of the primary enterprise and a positive change in the number of working age members of the household are significant in distinguishing the Dropout and Still Have groups. This means that amongst households that selected into microfinance programs by 1997, entrepreneurs that closed the primary enterprise between 1997 and 1999 and entrepreneurs that had an increase in the number of working age members of the household were more likely to drop out of microfinance programs. Within the second nest only a positive change in marital status and a change in the categories of businesses run by the household are significant in distinguishing the Join MFI and the Never Join groups. Amongst entrepreneurs that do not have microfinance in 1997, those that marry or begin to cohabitate and those that change the composition of their businesses have a higher propensity of not joining microfinance programs by 1999. The results for changes in marital status are perplexing, but given that a negative change in marital status also reduces the probability of selecting microfinance in 1999, I do not put strong weight on these results.

Table 12 also includes estimated inclusive values for each branch. We can reject the hypothesis that the inclusive values equal 1, given the chi squared of the likelihood ratio test is over 200. This finding confirms the existence of unobserved similarities between the groups within each nest, supporting the choice of a nested logit model over a multinomial logit model. Inconsistent with utility maximization, the inclusive value for the Join MFI and Never Join branch is greater than 1. However neither inclusive value is significantly different from zero. This result could stem from the small sample size of each group and the lack of large variation between the groups within each nest. Finally Table 11 presents percent correct predictions for each group. The percentages show the nested logit does a good job of predicting the Still Have group, a decent job of predicting the Never Join groups, and a poor job of predicting the Dropout and Join MFI groups. The lack of predictive power for the Dropout and Join MFI groups also may result from the small sample size of each group. For example, the Dropout group contains only 87 households and the Join MFI group only 64, and the actual numbers of each group included in the estimation are even lower since several households do not respond to all of the enterprise level questions. As a result there may simply be insufficient information to distinguish within each branch the group that takes out microfinance loans between 1997 and 1999 and the group that does not.

Table 11: Additional Explanatory Variables for Lower Branch Estimation, Nested Logit (*Xi/j*)

Mean Values	Still Have	Dropout	Join MFI	Never Join	ANOVA p-value
Vulnerability					
Change in net HH assets	-50.1 soles	70.7 soles	180.8 soles	92.7 soles	0.096*
Change in property (home ownership or other property)[81]					
Positive	14.6%	12.6%	14.1%	17.3%	0.781
Negative	13.7%	14.9%	12.5%	11.3%	0.860
Change in savings					
Positive (now have)	18.3%	18.4%	18.8%	18.0%	0.999
Negative (no longer have)	31.5%	26.4%	14.1%	26.7%	0.053*
Change in Marital Status					
Positive	3.6%	4.6%	1.6%	7.3%	0.229
Negative	6.8%	11.5%	3.1%	8.9%	0.255
Household Characteristics					
Entrepreneur a Woman (1997)	58.7%	74.7%	55.6%	55.3%	0.019**
Age of Entrepreneur (1997)	44.0	43.2	41.9	42.4	0.391
Change in Dependency Ratio	-0.08	-0.03	-0.02	-0.02	0.982
Change in Working Age HH members	-0.11	0.24	0.11	0.10	0.161
Hit with Shock between 1997 and 1999	57.3%	58.6%	58.7%	55.3%	0.952
Enterprise Characteristics					
Change in Formality Status					
Positive	19.4%	15.4%	23.0%	14.1%	0.374
Negative	29.6%	37.2%	24.6%	25.4%	0.255
Change in Enterprise Number					
Positive	27.4%	34.6%	29.7%	35.3%	0.337
Negative	21.5%	27.6%	17.2%	17.3%	0.252
Change in Composition of Enterprises (business categories)	47.5%	59.8%	29.7%	41.3%	0.002***
Close Primary Enterprise between 1997 and 1999	14.6%	34.5%	18.8%	13.3%	0.002***
Predictive Power Nested Logit					
% correct percent predictions from nested logit	78.4%	15.4%	6.5%	54.3%	

*****Difference in means significant at 5% level **Difference in means significant at 1% level

[81] I merged the home ownership and other property dummy variables, since the positive and negative changes for each one are minimal. Thus the property variable registers a positive change if either home ownership or other property changes in the positive or negative direction.

Table 12: Nested Logit Estimation

UPPER NEST= Microfinance Status in 1997	**Do Not Have Microfinance 1997 vs. Have 1997 Microfinance**	
Vulnerability & Skill Measures		
Own Home 1997	-0.282***	
Other Property 1997	-0.026	
Have Savings 1997	-0.133**	
Married or Equivalent 1997	-0.229**	
Time in Lima	0.000**	
Secondary Education 1997	-0.047	
Above Secondary Education 1997	-0.033	
Experience (max time in operation)	0.000	
Household & Enterprise Controls[82]		
Dependency Ratio 1997	-0.000	
Working Age Household Members 1997	0.000	
Hit with Shock in Past 2 years, 1997	-0.086**	
Net HH Assets 1997 (Wealth)	-0.000**	
Number of Enterprises 1997	0.000	
All Enterprises Informal 1997	0.018	
LOWER BRANCHES= Microfinance Status in 1999	**Dropout vs. Still Have**	**Never Have vs. Join MFI**
Vulnerability & Skill Measures		
Change in Property Status (home & other)		
Positive	-0.003	-0.003
Negative	0.001	-0.010
Change in Savings		
Positive	-0.011	0.025
Negative	-0.021	0.037
Change in Marital Status		
Positive	-0.000	0.016*
Negative	0.012*	0.020
Time in Lima 1997	0.000	0.000
Secondary Education 1997	-0.178	-0.185
Above Secondary Education 1997	-0.185	-0.254
Experience (max time in operation)	-0.004	-0.007
Household & Enterprise Controls[83]		
Change in Working Age HH Members	0.000*	0.000
Hit with Shock in Past 2 years, 1999	0.006	-0.017
Change in Net HH Assets 1999 (Wealth)	0.000	0.000
Change in Informality Status		
Positive	-0.015	-0.018
Negative	-0.001	0.000
Change in Business Categories	0.000	-0.000*
End Primary Enterprise from 1997	0.026**	-0.012
Inclusive Value Estimates (*Is*)	0.33	1.33
Chi Squared	259.4	
Observations (N)	481	

*significant at 10% level; **significant at 5% level; ***significant at 10% level

[82] Other controls include age, whether or not entrepreneur is a woman, the dependency ratio and business category dummy variables

[83] Other controls include age, whether or not entrepreneur is a woman, change in the dependency ratio and change in the number of enterprises