

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 evidence² 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 microinsurance³.

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 loans⁴. 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

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 factor that drives microfinance selection and partially explains low participation rates⁶. Households with greater ability to manage risk might choose to engage in higher yield projects and to seek microfinance credit, while those less able to manage 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, Eswaran & Kotwal 1990, 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 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 world⁷, 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. It first develops a simple 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 predicts that even after controlling for skill and wealth, at higher levels of vulnerability entrepreneurs reject the high yield enterprise and microfinance for the safe option. The model also predicts that vulnerability weighs less heavily in the selection decision for high skill and high wealth entrepreneurs.

The paper then tests the theoretical predictions using data on microentrepreneurs in Lima, Peru. Data was collected in 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 measures for vulnerability and skill I find positive evidence that vulnerability negatively impacts microfinance selection. More vulnerable entrepreneurs are found to be anywhere from 7% to 35% less likely than their less vulnerable counterparts to select into microfinance programs. These findings suggest vulnerability is an important determinant of behavior for potential microfinance borrowers and may help 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 participation using the full sample of households from the first survey round (1997). Section 6 estimates the determinants of microfinance selection using the balanced panel. Section 7 concludes.

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 (2007) for further discussion.

2. Theoretical Model

This section develops a model of microfinance selection that shows that even after controlling for skill and wealth, entrepreneurs with less ability to smooth consumption across negative income shocks do not select microfinance credit. It also shows that vulnerability is less of a concern for selection at higher levels of 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 that can take one of two values: T_H =high skill, or T_L =low skill. They also begin 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. 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, meanwhile, encompasses the ability to manage risk and is distinct from risk aversion. Wealth plays a role in vulnerability, but so do other factors like access to consumption credit and insurance. As such, households with equal levels of wealth and risk aversion might make very different choices if their ability to manage negative income shocks varies⁸.

Entrepreneurs can choose 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 capital finance in the model, such that entrepreneurs who 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} . Since all entrepreneurs meet this requirement supply concerns are irrelevant to the model⁹.

Entrepreneurs choose an enterprise at the beginning of period 1. For the safe enterprise returns are constant across skill and state realizations. For the risky enterprise returns are uncertain and depend on the state of nature, realized immediately after the enterprise is chosen. There are two possible state realizations, a good state and a bad state, and the probability of each depends on skill. The probability of a good state is p_H for a high skill entrepreneur and p_L for a low skill entrepreneur, where $p_H > p_L$. Gross returns are:

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

The risky enterprise has a higher return than the safe enterprise in a good state but a lower return in a bad state: $R_{RE}^G > R_{SE} > R_{RE}^B \cdot p_T$ and the returns are such that the expected return of the risky enterprise is greater than that for the safe enterprise for both skill types.

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

To ensure households find it optimal to engage in entrepreneurial activity rather than to live off of wealth I assume the safe enterprise return is greater than all levels of liquid wealth:

$$R_{SE} > \overline{W} > \underline{W} \quad (4)$$

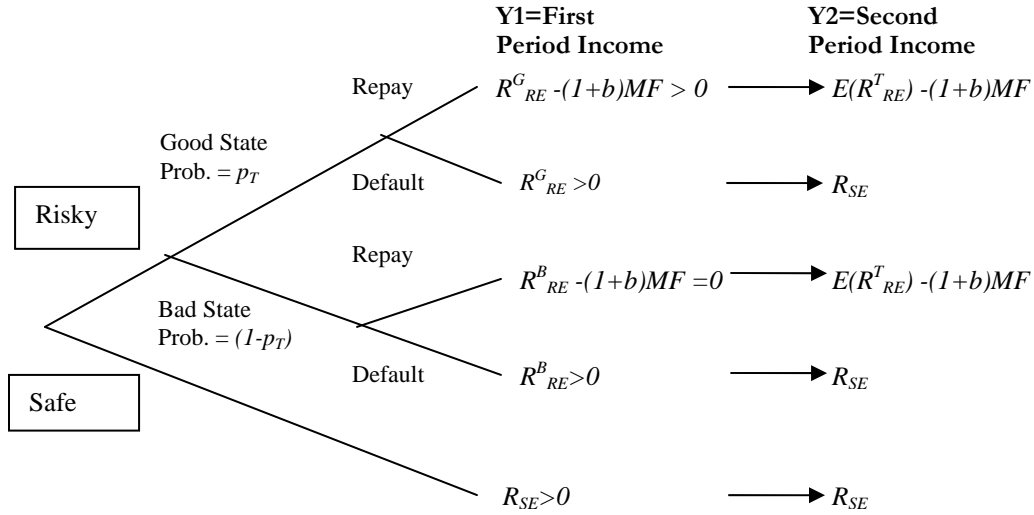
After gross enterprise returns are realized entrepreneurs make decisions about loan repayment. The microfinance institution offers no repayment flexibility and if a borrower fails to repay $(1 + b)MF$ at the end of the first period, two things occur. First, the borrower is barred from any future loans from the microfinance institution, which means 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).

⁹ This assumption is necessary because the goal is to explain why entrepreneurs who qualify for loans choose not to participate, not why access might differ.

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.

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

At the beginning of the second period entrepreneurs again choose projects. Similar to several models of vulnerability and crop choice I assume certain second period income from both enterprises (Eswaran and Kotwal 1989, Morduch 1994). For the risky enterprise certain second period income equals expected first period income. This generates the incentive for entrepreneurs to continue with the risky enterprise even if a bad state is realized, as it leads to higher, certain second period income. Finally, an entrepreneur cannot take out a microfinance loan in the second period if she did not do so in the first period. This assumption allows us to focus on only one period of decision making. Net income under different scenarios is outlined in the following tree:



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. Both are greater than income from the safe enterprise. It also says the difference between second period safe and risky income is such that the return from the safe enterprise is greater than half the return from the risky enterprise. This ensures the difference between the safe and risky enterprise is not overly

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 two periods.

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

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 because the microfinance loan cannot be used to cover consumption, 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 important 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, which may be uncorrelated with wealth. For example, informal credit and insurance networks may be a function of the number of family and friends nearby, which may be unrelated to wealth¹⁰. To further our understanding of vulnerability's impact on microfinance selection I assume no correlation between access to consumption credit and wealth.

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

γ comes from informal sources, such as a spouse or partner, family and friends, or moneylenders, and carries no interest¹¹. γ is the measure of vulnerability, as it dictates the portion of certain second period income an entrepreneur can borrow 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.

¹⁰ In the data informal networks are the principal source of consumption credit. Also, the correlation between measures of informal networks and household wealth are very low, supporting the theoretical prediction of no correlation.

¹¹ 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).

Prior to assessing optimal enterprise and financing choices it is necessary to establish that default¹² never prevails in the first period, which is done by comparing intertemporal budget constraints. In a good state realization, if an entrepreneur does not default, the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = (R_{RE}^G + E(R_{RE}^T) - 2(1+b)MF) + W \quad (9)$$

If an entrepreneur defaults the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = R_{RE}^G + R_{SE} + W - \underline{W} \quad (10)$$

$$\text{No default prevails if } (E(R_{RE}^T) - (1+b)MF) - R_{SE} + \underline{W} > (1+b)MF \quad (11)$$

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

In the case of a bad state realization first period income equals zero. If the entrepreneur does not default, the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = (R_{RE}^B + E(R_{RE}^T) - 2(1+b)MF) + W \quad (12)$$

If the entrepreneur defaults, the intertemporal budget constraint is:

$$c_{1G} + c_{2G} = R_{RE}^B + R_{SE} + W - \underline{W} \quad (13)$$

$$\text{No-default prevails if } (E(R_{RE}^T) - (1+b)MF) - R_{SE} + \underline{W} > (1+b)MF \quad (14)$$

which again holds because of (7). In all cases entrepreneurs who choose the risky enterprise in the first period prefer to do so in the second period, making default suboptimal.

2.3 Entrepreneur's Decisions

We now can analyze optimal enterprise and financing choices for entrepreneurs. In each period, after enterprise income is received, entrepreneurs choose consumption to maximize expected lifetime utility, which is additively separable in each component:

$$EU = E\mu(c_1) + \delta E\mu(c_2) \quad (15)$$

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

¹² There is no penalty beyond collateral seizure for default in the second period, which means 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 change the dynamics of the model, introducing additional assumptions to ensure it doesn't happen is not necessary.

Comparing ex-post utility under each enterprise it is easy to show that for all skill, wealth and vulnerability levels lifetime utility from the safe enterprise is higher than lifetime utility from the risky enterprise if a bad state is realized, but lower than lifetime utility from the risky enterprise if a good state is realized. In a good state all entrepreneurs are better off under the risky enterprise. In a bad state all entrepreneurs are better off under the safe enterprise. Entrepreneurs know this when deciding whether or not to choose the risky enterprise in the first period.

To establish the connection between vulnerability and microfinance selection (entrepreneurs 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:

$$\begin{aligned}
\max_c EU &= p_T[u(c_{1G}) + u(c_{2G})] + (1 - p_T)[u(c_{1B}) + u(c_{2B})] \\
\text{s.t. } c_{2G} &\leq (E(R_{RE}^T) - (1 + b)MF) + (W - c_{1G} + (R_{RE}^G - (1 + b)MF)) \\
c_{1B} &\leq W - \underline{W} + \gamma[E(R_{RE}^T) - (1 + b)MF] \\
c_{2B} &\leq (E(R_{RE}^T) - (1 + b)MF) + W - c_{1B}
\end{aligned} \tag{16}$$

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:

$$\begin{aligned}
&p_T[2u(0.5(E(R_{RE}^T) + R_{RE}^G) - 2(1 + b)MF + W)] + (1 - p_T)[2u(0.5(E(R_{RE}^T) - (1 + b)MF + W))] \\
&\text{Non-vulnerable entrepreneurs are indifferent between the safe and risky enterprise when the} \\
&\text{expected utility from both is the same. The probability of a good state, } p_T = \hat{p}_T, \text{ that solves} \\
&\text{indifference equals:}
\end{aligned}$$

$$\begin{aligned}
\hat{p}_T &= \frac{u(R_{SE} + 0.5W) - u(0.5(E(R_{RE}^T) - (1 + b)MF + W))}{u(0.5(E(R_{RE}^T) + R_{RE}^G) - 2(1 + b)MF + W) - u(0.5(E(R_{RE}^T) - (1 + b)MF + W))} \\
\Rightarrow \hat{p}_T &= \frac{u(\text{safe}) - u(\text{risky}_{bad})}{u(\text{risky}_{good}) - u(\text{risky}_{bad})}
\end{aligned} \tag{18}$$

(18) 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 value, it is necessary to establish an acceptable range

because for $p_T < \hat{p}_T$, all entrepreneurs, regardless of their vulnerability, prefer the safe enterprise and no microfinance. In order for the model to generate any predictions about vulnerability and microfinance selection, $p_T > \hat{p}_T$. Essentially, for any entrepreneur to choose the risky enterprise, the probability of a good state must be sufficiently high.

For 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 under the risky option is:

$$\begin{aligned} & p_T [2u(0.5(E(R_{RE}^T) + R_{RE}^G) - 2(1+b)MF + W)] \\ & + (1 - p_T) [u(\gamma E(R_{RE}^T) - (1+b)MF + W) + u((1-\gamma)E(R_{RE}^T) - (1+b)MF)] \end{aligned} \quad (19)$$

By assuming a value $p_T > \hat{p}_T$ 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:

$$\begin{aligned} & (1 - p_T) [u(\hat{\gamma}(E(R_{RE}^T) - (1+b)MF) + W) + u((1-\hat{\gamma})(E(R_{RE}^T) - (1+b)MF))] = \\ & 2u(R_{SE} + 0.5W) - p_T [2u(0.5(E(R_{RE}^T) + R_{RE}^G) - 2(1+b)MF + W)] \end{aligned} \quad (20)$$

To show vulnerability negatively impacts microfinance selection it is sufficient to show $\hat{\gamma}$ exists and lies between zero and one. This is simple given the assumptions about p_T and the differences between safe and risky enterprise income. $\hat{\gamma}$ determines the critical level of vulnerability below which entrepreneurs are better off with safe enterprise and no microfinance. Entrepreneurs with $\gamma < \hat{\gamma}$ are too vulnerable to manage the risky enterprise and do not select microfinance. Entrepreneurs with $\gamma \geq \hat{\gamma}$ 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 (20) 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 ($p_H > p_L$) the threshold level of vulnerability is lower for high skill entrepreneurs as well ($\hat{\gamma}_{T=H} < \hat{\gamma}_{T=L}$). For an equal level of vulnerability high skill entrepreneurs are more likely to select microfinance than low skill entrepreneurs. This is the second result of the model: Vulnerability weighs less heavily in the microfinance selection decision for low skill entrepreneurs than for high skill entrepreneurs.

Finally, total differentiation of (20) illustrates how the threshold level of vulnerability changes in wealth.

$$\frac{d\hat{y}}{dW} = \frac{p_T u'(c_{RE,G}) + (1-p_T)u'(c_{RE,B}^1) + u'(c_{SE})}{(1-p_T)(E(R_{RE}^T) - (1+b)MF)[u'(c_{RE,B}^1) - u'(c_{RE,B}^2)]} \quad (21)$$

The sign of (21) depends only on the last term, $[u'(c_{RE,B}^1) - u'(c_{RE,B}^2)]$, as all of the other terms are positive. If households are vulnerable they cannot smooth consumption across a negative income shock, and 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 $\frac{d\hat{y}}{dW} < 0$. 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. However, even entrepreneurs with the highest level of wealth, \bar{W} , will reject the risky enterprise and microfinance if their vulnerability is sufficiently high.

In sum the model predicts: 1) Even after controlling for skill and wealth, if vulnerability is sufficiently high entrepreneurs do not choose microfinance loans; 2) Vulnerability weighs less heavily in microfinance selection as entrepreneurial skill increases; and 3) Vulnerability weighs less heavily in microfinance selection as wealth increases. Empirical tests of these predictions follow in the subsequent sections.

3. Description of the Data

The data used in this paper come from an impact evaluation of a Peruvian microfinance enterprise that was part of USAID's Assessing the Impact of Microfinance Services Project (AIMS)¹³. The Peruvian portion of the project was carried out with Accion Comunitaria del Peru (ACP, which became MiBanco in 1998¹⁴), a large, profit-oriented microfinance institution with operations exclusively in Lima, Peru's capital and largest city¹⁵. Data on clients of ACP and a comparison group was collected in two periods, August of 1997 and

¹³ 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. Elizabeth Dunn was the primary researcher.

¹⁴ For discussion of the transformation of ACP to Mibanco see Campion, Dunn and Arbuckle (2001)

¹⁵ In 2000 Mibanco opened its first office outside of Lima, in Chincha

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; 306 clients and 214 non clients.

An important feature of the data set is the way the comparison group was collected. A group of non-clients was randomly drawn from a sample of microentrepreneurs in the same neighborhoods 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. 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 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 ACP loans and how they vary from other types of credit. Looking first at ACP loans; at the time of the survey the principal product offered by ACP is a working capital loan, with typical loan lengths ranging from 6 weeks to 6 months. Average loan size in 1997 is 1,021 soles (approximately \$384) and loans are paid back over short term intervals, typically on a bi-weekly or monthly basis¹⁶. Loans are granted either to a group or to an individual, the requirement for the latter being home ownership or a guarantor with proof of home ownership¹⁷. Loans could be taken out by only one household member and for the purpose of only one existing microenterprise¹⁸. 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 documented¹⁹, the short maturity lengths combined with frequent payback intervals

¹⁶ For ACP clients in the sample 30% re-paid loans on a bi-weekly basis while 58% re-paid on a monthly basis.

¹⁷ 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.

¹⁸ By 1999 80% of entrepreneurs without microfinance have heard not just of microfinance, but of ACP.

¹⁹ 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.

generally mean microfinance loans are directed to short-term business needs²⁰. 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)

Microfinance is not the only source of credit for entrepreneurs in the sample²¹. The other sources, outlined in table 2, include formal lenders, such as commercial banks, credit unions, credit cooperatives, and construction banks, as well as informal lenders, such as suppliers, friends, family, moneylenders, and ROSCAs²². The most frequently cited sources are suppliers and family and friends. A comparison of interest rates, repayment terms and loan size for ACP loans and these other types of credit follows, and is important to understand the demand for microfinance loans.

In the case of interest rates, ACP, dissimilar to many microfinance institutions, charges unsubsidized and market determined interest rates. 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 1999.²³ According to Dunn and Arbuckle (2001) ACP’s interest rates are comparable to those charged by other financial institutions engaged in microlending²⁴ such as banks, credit unions and other microfinance institutions, lower than those charged by moneylenders and pawnshops, and higher than those charged by family, friends and ROSCAs²⁵. Although there is no information on the costs of supplier credit, the

²⁰ 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.

²¹ The most important type of credit for entrepreneurs is working capital finance. Working capital is defined as the difference between current assets and liabilities and this difference is negative if a firm has a gap between payments for goods produced and payments on inputs. A germane example is a small grocer who must purchase inventory in advance of sale. If working capital is negative the firm can finance the difference internally, with retained profits, or externally, with formal or informal loans. Although retained profits carries fewer explicit costs, dependence on this to finance working capital limits everyday operations and restricts enterprise growth, leading many businesses to seek external finance.

²² Rotation Savings and Credit Associations. See Armendariz and Morduch (2005) and Besley, Coate and Louny (1993). The latter note that ROSCAs are predominantly used to save for large, indivisible durable goods, rather than to finance ongoing business expenses.

²³ According to the Central Bank of Peru, annual inflation was 8.5% in 1997, and 3.5% in 1999.

²⁴ “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.

²⁵ Interest rates tend to be extremely low and in some instances zero for loans from family and friends and ROSCAs, although for both implicit costs partially mitigate the low rates. Loans from family and friends often

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 capital loans within Peru²⁶ and within some developed countries²⁷. They are also consistent with the returns several microentrepreneurs likely generate from capital²⁸. As a result, high interest rates probably explain only a small portion 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 they are charged a daily fee, and if a borrower defaults they are barred forever from future loans from the institution. Not only is there no option for late repayment, there is a severe penalty for doing so²⁹. This compares to terms that likely are more flexible for supplier credit and loans from family and friends, the two most cited credit sources³⁰.

Despite market interest rates and more restrictive terms, microfinance loans have two key advantages over other credit sources, principally informal ones. The first is the

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).

²⁶ 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 generally charge much higher interest rates (CGAP 2002, Armendariz and Morduch 2005).

²⁷ Research on the use of supplier credit in the U.S. and U.K. (Cuñat 2006) finds the implicit costs of standard contracts 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.

²⁸ Using data on urban microentrepreneurs in Mexico, McKenzie and Woodruff (2006) find real monthly returns that range from 10-15% for small to medium investments and 2-3% for larger investments. Udry and Anagol (2006) estimate returns to capital for the informal sector in Ghana and find real rates around 60%.

²⁹ 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.

³⁰ 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. The same firms 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.

ability to 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. This is confirmed in table 2: 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 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 the same day a previous loan is repaid.³¹ Furthermore, with prompt repayment many MFIs grant borrowers access to an increasing pool of funds. The guarantee of access to continual and increasing credit likely is not replicated by informal lenders due to limited and more variable sources of funds.

3.1 Microfinance and Project Choice

As a result of larger loans and more continual access, microfinance can finance projects, particularly those with larger working capital requirements, which other credit sources cannot. The theoretical model further assumes that projects with larger working capital requirements have higher returns and risk than those with lower working capital requirements. Several client interviews justify this 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 ACP due to her husband’s payment delinquency. After losing access to the larger microfinance loans she must abandon her high quality clothing

³¹ 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.

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

3.2 Alternative Hypotheses for Microfinance Selection: Supply

This paper focuses on a demand side explanation for non participation in microfinance programs and in so doing it implicitly assumes limited supply of microfinance loans is not behind limited outreach. This assumption is problematic if microfinance institutions have limited sources of funds and are at full capacity in terms of loan extension or if the entrepreneurs who don't participate are lower quality borrowers and would likely be rejected if they applied. In both cases the assumption that entrepreneurs without microfinance have access to this credit breaks down, jeopardizing the vulnerability hypothesis. Additional information on ACP/Mibanco addresses these 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 years³². This clearly shows the institution has excess lending capacity and that limited supply of funds is not driving low penetration rates.

The case of high rejection rates is more difficult to address since we cannot be sure 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 rates³³.

Researchers involved with data collection believe most of the entrepreneurs without microfinance would be approved for a loan. Furthermore, comparisons of entrepreneurs who join microfinance programs by the second panel period to entrepreneurs who never

³² 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.

³³ See The Microfinance Gateway for discussion of rejection rates.

join reveal few observable differences between the two. In logit analyses only other property and informality status in 1999 are significant in predicting which entrepreneurs join microfinance programs. While this means we have little information about factors that lead one group to join microfinance programs, it also indicates that based on the same factors observable to the lender, entrepreneurs without microfinance are fairly indistinguishable from counterparts who join microfinance programs. 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 inability to smooth consumption across adverse shocks to income. In the theoretical model γ , the amount of consumption credit a household can access in a bad state, determined vulnerability. In practice, however, vulnerability also is determined by liquid assets and access to insurance. The difficulty with vulnerability, however, is that direct, empirical measures are impossible since the researcher does not observe households' access to credit and insurance, particularly informal versions of each. In lieu of this a standard strategy is to use indirect "ex-post" measures derived from examining the response of consumption to unexpected changes in income (Zeldes 1989, Deaton 1997, Paxson 1992, 1993). This strategy, though, is plagued with problems when using a short panel, such as the ACP data³⁴. As a result I employ indirect "ex-ante" measures; variables that gauge access to internal and external funds that can be used to smooth consumption before a negative shock is realized.

I first consider liquid wealth, which captures the ability to smooth consumption using internal funds. The ACP data provide information on two forms of liquid wealth; household assets and savings. The former is measured by the net value durable goods and vehicles. The latter is measured by a dummy variable that equals one if the household has

³⁴ Kamanou and Morduch (2002) argue the "ex-post" 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. Attempting to guess outcomes for households that did not receive negative shocks is inadvisable since it would lead to incorrect labeling of vulnerability status. Any viable analysis is thus restricted to HHs hit with negative shocks.

savings, either formal or informal³⁵. Although other authors (Zeldes 1989) restrict liquid wealth to financial assets, for the poor microentrepreneurs in the ACP data durable goods and vehicles also constitute important measures. Due to the paucity of savings instruments many poor households save in the form of low yielding but liquid physical assets, like consumer durables. Interviewees' references to pawnshops and secondary markets attest to the ability to convert these assets into cash in times of need. Finally, of the two measures the net value of durables and vehicles best captures household wealth due to the fact that actual values are available rather than a binary indicator, as is the case with savings. Thus in subsequent analysis the net value of durables and vehicles is used as the measure of household wealth.

Liquid wealth also may capture a degree of access to external funds in the form of consumption credit, if households with savings and more durable goods are deemed better borrowers³⁶. Liquid wealth is probably not the only determinant of consumption credit access, however, and I also consider wealth in the form of property³⁷. In the ACP data property wealth is measured by a dummy variable if a household has legal title to its home³⁸ and a dummy variable if a household has another residential property. Since households were not asked to assess the value of their property, only binary indicators are available.

Finally, to capture access to consumption credit it is crucial to consider the extent of informal networks, which are the main source of consumption credit for households in the ACP sample. For example, family and friends are cited as the second most used 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. Overall households list loans from family and friends as the second most important mechanism for managing negative

³⁵ Households were asked if they had savings and the form in which it was held. The majority report cash at home as the principal savings vehicle. Unfortunately households were not asked the value of savings, so a binary indicator is the best measure available. Meanwhile for durables and vehicles households were asked the current value of the asset, as well as the value of remaining debts incurred to purchase the asset.

³⁶ This is particularly true of durable goods, as these are the standard collateral required by formal and informal lenders. This includes ACP, which requires loan applicants to submit a list of electrical appliances to be used as collateral. ACP credit agents verify the status and value of these appliances before approving the loan (Dunn and Arbuckle 2001). Durable goods' use as collateral may stem from difficulties in repossessing other assets.

³⁷ Property wealth, particularly home title, is a common collateral requirement of lenders and may indicate broader credit access.

³⁸ 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.

shocks (see Table 8). Liquid assets and property may not capture this key component of vulnerability if an entrepreneur's network of friends and family is unrelated to wealth, which is quite plausible³⁹. This means a more direct measure is required. To measure informal networks it would be ideal to have information on the quantity (number of family and friends living nearby) and quality (ability of these contacts to help in times of need) of social contacts, but this information is not available in the data. In its absence I rely upon two variables; marital status, as measured by a dummy variable that equals one if an entrepreneur has a spouse or partner, and tenure in Lima, as measured in years; which are related to the extent of informal networks. In the case of marital status, a spouse or partner may provide access to a wider network of family and friends⁴⁰. In the case of tenure in Lima a longer tenure means the entrepreneur has had greater opportunity to develop informal networks. Going forward I use marital status, Time in Lima, durable goods and vehicles, savings status, home ownership, and ownership of additional property, to measure vulnerability. Positive values for the binary variables and higher values for the continuous variables indicate lower vulnerability. Tables 3 and 6 present average values for each.

The vulnerability measures outlined above are imperfect, but in the absence of better alternatives I will try to address obvious concerns about their viability. The first is that household wealth, savings, home ownership, and other property are bi-products of microfinance participation and therefore endogenous⁴¹. If this is true reverse causality bias clouds any information about the impact of vulnerability on microfinance selection. In the case of savings, home ownership and other property, ACP's limited product offerings during the survey period quell most endogeneity concerns. In 1997 and 1999 ACP only offered short-term, working capital loans. It did not offer a savings product, mortgage loans or any type of long term, high principal loan that would be needed to buy property. Furthermore, questions on saving behavior reveal that few entrepreneurs save through demand deposits with financial intermediaries. The majority save by stashing money in their house or through

³⁹ 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).

⁴⁰ A spouse or partner may also provide income that can be used in times of need. For example, 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.

⁴¹ 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 have a forced savings component to its loans.

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.

Unfortunately the same cannot be said of durables and vehicles, as microfinance loans frequently are used to finance these purchases. This means microfinance participation likely governs asset values and that endogeneity concerns are quite valid. Instrumenting for household wealth using would eliminate the reverse causality bias, but a valid instrument does not emerge from the data. As a result, household wealth should be viewed as a control rather than an independent vulnerability measure. In particular its inclusion may control for differences in risk preferences, which also dictate project choice and microfinance selection. *Ceteris paribus*, more risk averse households achieve lower expected utility under the risky enterprise and microfinance than their less risk averse counterparts. Knowing risk preferences is impossible, but to the extent that risk aversion is a function of wealth the inclusion of wealth may partially control for disparate risk preferences as determinants of microfinance selection.

The second concern is that the informal network measures proxy for household characteristics besides vulnerability that impact microfinance selection. Marital status, for example, may simply capture the effect of having another working adult in the household. To control for this I include the number of household members that currently work. Meanwhile, tenure in Lima may only capture entrepreneurial experience and/or increased knowledge of better projects rather than reduced vulnerability. To control for these concerns I use age and entrepreneurial experience, as measured by the longest tenure of the household's microenterprises, and measures of entrepreneurial skill, outlined below.

The final concern involves the potential for the informal network measures to actually reduce the probability of microfinance selection if loans from family and friends serve as substitutes for credit from microfinance institutions. Given the large reliance on credit from family and friends, it is possible entrepreneurs with greater informal networks can finance their working capital needs via these channels, eliminating the need for microfinance credit. If the importance of informal networks lies more in providing substitutes for microfinance than in reducing vulnerability, we may see a negative relationship between the informal network measures and microfinance participation. Thus there is potential for the empirical estimation to yield signs on marital status and Time in Lima opposite those predicted by the theory.

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. It is impossible to prove or disprove this claim given the unobservable nature of entrepreneurial skill, but attempting to control for skill is necessary to ameliorate concerns about bias due to spurious correlation. Given the likely correlation between skill and selection and skill and the vulnerability variables, controlling for skill is essential in deriving clean statements about vulnerability as a factor in microfinance selection. To control for skill I use the standard measures of 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 less⁴², between primary and secondary school, and higher than secondary school. For experience I use the maximum amount of time, in years, any enterprise owned by the household has been in operation as of 1997. Average values are presented in tables 3 and 6.

5. Empirical Model of Microfinance Selection, Complete Sample

I first analyze the determinants of microfinance selection using the complete 1997 sample. One benefit of exclusively considering the first survey round is a larger sample, as attrition whittles down the original households by 1999. The cost, however, is under-utilization of the additional information provided in the second survey round. Therefore I follow this section with a similar analysis using the balanced panel (Section 6).

To estimate the probability an entrepreneur has microfinance in 1997 I use a random utility framework. As of 1997 entrepreneurs have two choices; to select microfinance prior to 1997 (denoted as j) or not to 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 is:

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

If the random components follow a generalized extreme value distribution, the estimation of

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

⁴² This is the left out group

The four types of observable components used in the estimation are outlined below. Mean values are presented in table 3.

- 1) Household characteristics include: the entrepreneur's gender, the entrepreneur's age, as measured by four age bin dummy variables⁴³; the dependency ratio (number of children under 16 to total household members); the total number of working 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 years⁴⁴.
- 2) Enterprise characteristics include: the number of enterprises run by the household; a dummy variable if all enterprises of the household are informal⁴⁵; and enterprise categories, defined by eight dummy variables for having an enterprise in a particular category.
- 3) Vulnerability Measures include: household wealth; a dummy variable for savings; a dummy variable for home ownership; a dummy for control over other property⁴⁶; a dummy variable if the entrepreneur is married or has a partner; and tenure in Lima.
- 4) Skill Measures include: dummy variables for secondary or above secondary education and the maximum duration of any enterprise of the household.

Results of logit estimation of microfinance status in 1997 are presented in Table 4. Column (1) presents results including all vulnerability measures except wealth and column (2) presents results including wealth. Column (3) includes results with interaction terms. Reported coefficients on all terms are average marginal effects, with the exception of the interaction terms, in which case average interaction effects are reported⁴⁷.

The results from logit estimations using 1997 data support the key theoretical prediction that vulnerability reduces the probability an entrepreneur seeks out microfinance. Four vulnerability measures, home ownership, savings, marital status and time in Lima, are significant predictors of microfinance status in 1997. Home ownership increases the

⁴³ Age bins are less than 25, between 40 and 60 and above 60. The left out comparison group is age between 25 and 40. The goal is to see if younger and older entrepreneurs behave differently than "middle age" ones.

⁴⁴ 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)

⁴⁵ 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 analysis.

⁴⁶ Respondents are asked if they or another household member have another residence in or near Lima.

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.

probability an entrepreneur has microfinance in 1997 by 19%-25%; savings increases the probability by 7%-12%, having a spouse or partner increases the probability by 9-12%, and one more year of residence in Lima increases the probability 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 35%. For marital status the results are robust to controlling for the number of working household members, implying the importance of marriage or partnership goes beyond having another adult in the household⁴⁸. For Time in Lima, the results are robust to controlling for age and experience, implying tenure impacts microfinance selection through some other channel. Finally, the coefficients on the informal network measures are positive despite potential downward bias stemming from the substitution of loans from family and friends for microfinance credit. This further suggests the link between these variables and microfinance selection may lie in vulnerability.

To ensure 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 coefficients on these variables should change 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 slightly decline following the inclusion of wealth, the reduction is small and all three variables remain significant at the 10% level. Therefore it is unlikely the significance of these measures simply shows wealth's influence on microfinance selection.

To test the second and third theoretical predictions that vulnerability's role in selection declines in wealth and skill, I include 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 skill, as measured by the secondary education dummy, with the same variables⁴⁹. If the theoretical prediction holds the signs on these terms should be negative. Column (3) contains the estimation results,

⁴⁸ 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.

⁴⁹ 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.

which overall provide weak evidence supporting the second and third theoretical predictions. Consistent with the theory the signs on three of the four wealth and skill interaction terms are negative. This implies wealth and skill reduce the impact of each vulnerability measure on microfinance selection. In all cases, however, the coefficients are insignificant, implying that the influence of wealth and skill on the impact of vulnerability is indistinguishable from zero. The lack of significance could stem from the small sample size of the ACP data, and a larger sample would likely yield more conclusive results about the second order effects of skill and wealth.

In sum, in estimation using the full sample home ownership, savings, marital status and time in Lima, have significant power in predicting microfinance participation in 1997. While I have tried to control for potential sources of bias, it is still possible there are unobservable factors, such as the portion of skill not picked up by education and experience, that jointly determine the vulnerability measures and microfinance participation. In the absence of sufficient panel periods to use individual fixed effects to better capture these unobserved factors, it is only possible to control for bias stemming from observable characteristics. To the degree the observables employed control for the confounding effects of skill, the logit results provide strong evidence that vulnerability negatively impacts microfinance selection.

Section 6: Empirical Model of Microfinance Selection, Balanced Panel

Although the balanced panel sample is smaller and may differ from the original due to attrition, incorporating the information from the second survey round provides a more comprehensive analysis of microfinance selection. This section and the appendix are devoted to investigating the determinants of microfinance selection using the balanced panel.

I first address concerns that the results from the full sample are driven by observations that drop out of the sample. I re-estimate the logit model of microfinance in 1997 on the sub-sample of households that appear in the 1999 estimation⁵⁰. The results, presented in columns (4), (5) and (6) of table 4, essentially match those from the estimation using the full sample, confirming that they are robust to exclusion of households that exit the sample.

6.1 Empirical Analysis of Microfinance Selection, 1999

The inclusion of 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 Mibanco or another microfinance institution by 1999. The groups

⁵⁰ This is less than 520 households due to non-response on some 1999 enterprise level variables

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 (Dropouts⁵¹), 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. 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 1997 microfinance status, within each nest there is insufficient variation 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. 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. Results are presented in Table 7. 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 and Never Join groups present the starkest contrasts regarding microfinance choice, I estimate a logit model of microfinance selection using these two groups. Results of this estimation are also presented in table 7. Columns (4) and (5) contain results using 1997 variables and columns (6) and (7) 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 have significantly less power than their 1997 equivalents in predicting microfinance participation. This is specifically true of the vulnerability measures, of which only marital status remains positive and significant in all cases. Home ownership, savings and time in

⁵¹ Dropouts are defined as entrepreneurs that have not taken out any microfinance loans since 1997; that is, in almost two years

Lima, which were strong predictors of microfinance status in 1997, fail to remain so in 1999. The same pattern is observed in the Still Have and Never Join comparison. 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 are used, however, only marital status remains significant in all cases. The limited power of 1999 vulnerability measures to predict microfinance status is curious, given strong evidence in the 1997 data to the contrary. Further investigation into the differences across the panel periods reveals a possible explanation for this change.

6.2 Increased Realization of Negative Shocks: The Environment in 1999 vs. 1997

An important feature of the vulnerability variables is that many are ex-ante measures; they largely capture the ability to smooth consumption prior to being hit with a shock. The degree to which the same variables capture vulnerability after a negative shock is realized, however, is unclear. For example, households list savings as the principal mechanism for managing adverse events (see Table 8), which means many likely drain their savings in the wake of a negative shock. Based on savings alone all of these households look more vulnerable ex-post than ex-ante. Some households, however, will have unchanged vulnerability status if they maintain the ability to take out consumption loans and thereby smooth consumption across a subsequent shock. So while a decline in savings likely indicates increased vulnerability, the extent to which this happens varies across households and remains unknown.

The difference between ex-ante and ex-post measures turns out to be a concern because the 1999 survey round portrays a significantly worse moment in the lives of the ACP households than the 1997 survey round. In 1998 the Peruvian economy entered into recession following 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 round⁵². According to the Central Bank of Peru, from the third quarter of 1997 to the third quarter of 1999 real GDP fell by 0.2%. This compares to an 8.7% increase in real GDP during the two year period leading up to September 1997. The brunt of this contraction came from real internal demand, a measure that better captures the situation of urban micro-entrepreneurs since few are engaged in export industries. Between the first and second survey rounds real internal

⁵²See 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.

demand fell by 6.4%, which compares to an 8.6% increase over the two years leading up to the first survey round.

Survey questions confirm that the deteriorating macroeconomic environment translated into increased negative shocks for ACP entrepreneurs. The percent of entrepreneurs in the balanced panel that report a negative shock increases by 13%, from 44% in 1997 to 57% in 1999, while the percent living below the poverty line increases by almost 10%⁵³. In addition, as shown in table 8, the ranking of most severe shocks changes. In 1997 only 17% of households report loss or reduction of income as the most severe shock. By 1999 this increases twofold, further indicating the recession had a direct impact on the ACP entrepreneurs. There also is evidence that many households liquidated savings in the face of adverse events. In 1999 savings is listed as the main mechanism for managing a negative shock, and every group except Join MFI registers a decline in savings incidence over the two year period. The most severe decline occurs in the Still Have group, which largely explains why savings ceases to be a significant predictor of microfinance status in 1999. A similar channel to insignificance may be at work for home ownership, although there is weaker evidence for this in the data.

In light of the inherent difficulties of ex-ante vulnerability measures, it is compelling that marital status, one of the measures less likely to change following a negative shock, is the variable that remains significant in all cases. Marital status proves the most robust predictor of microfinance status, an interesting result given that I control for working household members and the weak correlation with both income and wealth. This implies having a spouse or partner influences microfinance selection through some other channel, potentially informal networks. Indeed, of the vulnerability measures, marital status likely best captures the unobservable characteristic that is a household's access to informal consumption credit. As such, despite the fact that home ownership and savings cease to be significant predictors of microfinance status in 1999, the empirical evidence still supports the contention that vulnerability determines 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 poor entrepreneurs' decision to seek

⁵³Defined if a household's consumption per adult equivalent falls below a \$2 measure, which is determined by the Peruvian statistical agency (INEI).

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. Using data from ACP, a large microfinance institution in Lima, Peru, I find empirical corroboration of the theoretical results. More vulnerable entrepreneurs are found to be significantly less likely to seek microfinance than their less vulnerable counterparts.

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 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 despite being 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 credit that can better be used for consumption smoothing (longer maturity lengths combined with longer repayment periods) 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 ⁵⁴	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 ⁵⁵	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 ⁵⁶	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		

⁵⁴ *Entidades de Desarrollo para la Pequeña y Microempresa*. These are MFIs that are regulated financial institutions, unlike most NGOs that are unregulated.

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

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

Table 3: Summary Statistics, Full Sample 1997

All Values as of 1997	Have Microfinance in 1997	Don't Have Microfinance in 1997	ANOVA (p value)
<u>Household Characteristics</u>			
Total Income	24,667	16,180	0.000**
% Entrepreneurs that are women	62.2%	59.8%	0.001**
Age of Microentrepreneur (mean)	41.2	40.8	0.103
Age Distribution			
Less than or equal 25	2.8%	8.0%	0.002**
Between 25 and 40	44.5%	46.2%	0.659
Between 40 and 60	49.0%	39.5%	0.013*
Above 60	3.8%	6.3%	0.118
Dependency Ratio	30.4%	29.6%	0.642
# Working Members of HH	3.29	2.78	0.000**
Hit by Shock in past two years	48.2%	39.2%	0.017*
<u>Enterprise Characteristics</u>			
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	6.6%	7.8%	0.531
Minor Retail and Wholesale	79.0%	80.6%	0.600
Hospitality ⁵⁷	11.1%	6.8%	0.052
Transport	13.9%	5.1%	0.001**
Services	6.6%	6.1%	0.807
<u>Employees & Capital</u>			
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**
<u>Vulnerability</u>			
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
<u>Skill</u>			
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

⁵⁷ 'Hospitality' includes hotels and restaurants. This is predominantly some form of food service.

Table 4: Logit Estimation of 1997 Microfinance Status

1997 Microfinance Status	Full Sample			Balanced Panel		
	(1)	(2)	(3)	(4)	(5)	(6)
Coef=average marginal effects						
Vulnerability Measures⁵⁸						
Own Home	0.207 (4.37)***	0.189 (3.96)***	0.255 (2.96)***	0.176 (2.98)***	0.153 (2.58)***	0.291 (2.51)**
Have other property	0.083 (1.58)	0.076 (1.45)	0.082 (1.59)	0.116 (1.90)*	0.104 (1.70)*	0.094 (1.56)
Have savings	0.088 (2.44)**	0.072 (1.98)**	0.119 (1.84)*	0.128 (2.97)***	0.112 (2.63)***	0.081 (1.05)
Entrepreneur Married or Equivalent ⁵⁹	0.095 (2.09)**	0.089 (1.96)**	0.123 (1.60)	0.129 (2.25)**	0.107 (1.87)*	0.281 (2.77)***
Time in Lima	0.004 (2.43)**	0.003 (1.95)*	0.004 (1.42)	0.006 (2.93)***	0.005 (2.62)***	0.003 (0.85)
Wealth (<i>Net HH Assets/1000</i>)		0.007 (2.80)***	0.015 (1.50)		0.008 (2.58)***	0.032 (2.05)**
Skill Measures						
Secondary Education	0.092 (2.24)**	0.082 (1.98)**	0.245 (2.14)**	0.082 (1.70)*	0.068 (1.40)	0.251 (1.87)*
Above Secondary Education	0.067 (1.28)	0.038 (0.70)	0.041 (0.74)	0.110 (1.87)*	0.076 (1.23)	0.063 (0.98)
Maximum Time in Operation	0.004 (1.34)	0.004 (1.32)	0.003 (1.18)	0.005 (1.40)	0.004 (1.33)	0.004 (1.17)
Interaction Terms						
Wealth*Home			-0.008 (1.21)			-0.022 (1.44)
Wealth*Savings			-0.006 (1.12)			0.001 (0.11)
Wealth*Married			-0.001 (0.22)			-0.018 (1.28)
Wealth*TimeinLima			0.000 (0.43)			0.001 (0.48)
SecEd*Home			0.011 (0.17)			0.053 (0.47)
SecEd*Savings			-0.005 (0.10)			-0.040 (0.45)
SecEd*Married			-0.070 (1.34)			-0.077 (0.48)
SecEd*TimeinLima			-0.005 (1.60)			-0.004 (1.08)
Observations (N)	685	685	685	466	466	466
Pseudo R2	.123	.132	.141	0.156	0.167	0.202

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

⁵⁸ Other variables include whether or not entrepreneur is a woman, the entrepreneur's age, the household's dependency ratio, the # of working 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%), the informality status of enterprises, and dummy variables for the type of enterprise across 8 categories.

⁵⁹ 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.

Table 5: 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 Distribution					
Less than 25	1.4%	2.3%	3.1%	6.0%	0.087
Between 25 and 40	35.2%	41.4%	46.9%	46.0%	0.133
Between 40 and 60	59.3%	47.1%	43.7%	39.3%	0.001**
Above 60	4.1%	9.2%	6.3%	8.7%	0.238
Dependency Ratio					
1997	28.8%	32.9%	31.1%	28.7%	0.419
1999	26.5%	30.1%	29.8%	26.4%	0.443
# Working Members of HH					
1997	3.39	3.21	2.97	2.77	0.001**
1999	2.87	2.82	2.78	2.51	0.101
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	6,439 soles	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%	4.8%	7.4%	0.681
1999	6.7%	3.8%	6.5%	6.3%	0.838
Construction					
1997	1.9%	6.9%	3.2%	2.0%	0.075
1999	1.9%	6.4%	3.3%	2.1%	0.208
Auto, Other Repair & Parts					
1997	6.0%	4.6%	6.3%	8.7%	0.407
1999	7.2%	6.4%	4.9%	9.1%	0.400
Minor Retail and Wholesale					
1997	79.1%	77.0%	88.9%	79.1%	0.082
1999	74.6%	60.2%	78.7%	72.0%	0.010**
Hospitality ⁶⁰					
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%	19.5%	7.9%	3.3%	0.001**
1999	18.2%	21.8%	6.5%	8.4%	0.005**
Services					
1997	6.0%	6.9%	9.5%	5.4%	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

⁶⁰ 'Hospitality' includes hotels and restaurants. This is predominantly some form of food service.

Table 6: Summary Statistics, Vulnerability and Skill Measures, Balanced Panel

<i>(values in 1997 nuevo soles)</i>	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**
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					
Employees⁶¹					
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

⁶¹ Employees do not include the entrepreneur

Table 7: Logit Estimation of Microfinance Status, Balanced Panel

coef=avg. marginal effects	All Balanced Panel 1999 Microfinance Status, 1999 Variables ⁶²			Still Have vs. Never Join Sub-Sample 1997 Variables 1999 Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vulnerability Measures⁶³							
Own Home	0.050 (0.84)	0.045 (0.75)	-0.050 (0.46)	0.165 (2.34)**	0.255 (1.71)*	0.123 (1.84)*	0.017 (0.14)
Other property	0.004 (0.06)	-0.001 (0.01)	0.006 (0.10)	0.121 (1.65)*	0.117 (1.65)*	0.036 (0.49)	0.019 (0.27)
Have Savings	0.034 (0.76)	0.030 (0.66)	0.086 (1.07)	0.091 (1.77)*	0.140 (1.56)	0.056 (1.10)	0.172 (2.10)**
Entrepreneur married ⁶⁴	0.119 (2.07)**	0.114 (1.96)**	0.190 (2.02)**	0.110 (1.57)	0.329 (2.71)***	0.131 (1.99)**	0.464 (5.67)***
Time Lived in Lima (1997)	0.002 (0.82)	0.002 (0.76)	0.002 (0.73)	0.005 (2.21)**	0.007 (1.82)*	0.005 (2.16)**	0.005 (1.23)
Wealth (<i>Net HH Assets/1000</i>)		0.002 (0.60)	0.024 (1.81)*	0.010 (2.47)**	0.045 (2.33)**	0.003 (0.89)	0.055 (2.76)***
Interaction Terms							
Wealth*Home			-0.004 (0.37)		-0.023 (1.03)		0.005 (0.30)
Wealth*Savings			-0.002 (0.43)		-0.005 (0.27)		-0.008 (0.62)
Wealth*Married			-0.006 (0.81)		-0.017 (0.78)		-0.042 (1.87)*
Wealth*TimeinLima			-0.000 (1.00)		-0.001 (0.12)		-0.000 (0.02)
SecEd*Home			0.276 (2.16)**		0.136 (0.89)		0.269 (1.64)
SecEd*Savings			-0.086 (0.99)		-0.160 (1.30)		-0.138 (1.15)
SecEd*Married			-0.043 (0.42)		-0.064 (0.32)		-0.071 (0.46)
SecEd*TimeinLima			0.004 (1.17)		-0.006 (1.17)		0.002 (0.44)
Observations (N)	468	468	468	329	329	331	331
Pseudo R2	0.077	0.078	0.092	0.187	0.233	0.168	0.214

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

⁶² When 1997 values of all right hand side variables are used only net household assets shows up as significant at the 10% level. Thus 1997 vulnerability measures also do a poor job of predicting 1999 microfinance status.

⁶³ Other variables include whether or not entrepreneur is a woman, the entrepreneur's age, the household's dependency ratio, the # of working members of the HH, whether or not HH hit with a shock in the past 2 years (significant at 10%), the number of enterprises (significant at 5%), whether or not all of the enterprises are informal (negative and significant at the 1% level in 1999, insignificant in 1997), dummy variables for the type of enterprise across 8 categories, and three skill measures

⁶⁴ 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.

Table 8: 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%	
Shock Incidence				
1997 Shocks				
Hit by Shock in past two years	49.7%	36.9%	44.4%	0.004**
Most Severe Shock ⁶⁵				
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 Line⁶⁶				
1997	22.0%	31.5%	25.9%	0.000***
1999	27.1%	44.4%	34.2%	0.015**
Observations (N)	206	214	520	
Managing Negative Shocks⁶⁷				
1997				
Use Savings	30.0%	28.0%	29.3%	
Borrow at all	26.4%	22.0%	24.8%	
o/w Borrow from family/friends	20.2%	14.4%	18.0%	
Observations (N)	193	118	311	
1999				
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.

⁶⁵ 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.

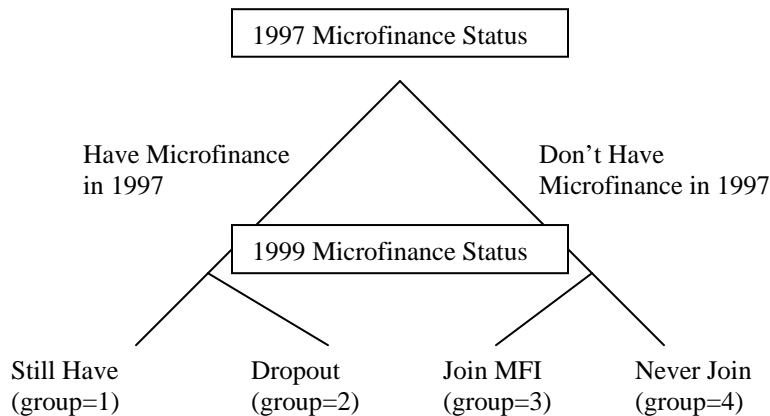
⁶⁶ Poverty line calculated by INEI (Peruvian statistical agency) using a \$2/day measure. Household classified as below the poverty line if consumption per adult equivalent falls below \$2 day measure.

⁶⁷ Households who were hit with a shock were asked the primary way of managing the adverse event.

Appendix 1: Nested Logit estimation of Microfinance Selection

For robustness I estimate microfinance selection 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 assumption⁶⁸ (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 model⁶⁹ 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_{jk}) is the probability she selects microfinance prior to 1997 (probability of choosing nest $s = P_s$) multiplied by the probability she

⁶⁸ 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.

⁶⁹ 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}) ($U_{j|s} = X_{j|s}'\beta + Z_s'\xi + \varepsilon_{js}$) and if the unobservable utility components (ε_{js}) are distributed according to a generalized extreme value distribution (GEV)⁷⁰ it can be shown the probability an entrepreneur falls into a specific group (P_{js}) can be written as:

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

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

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

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 interval⁷¹. 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 estimates⁷². For observable factors that impact 1997

⁷⁰ 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:

$$F(\varepsilon_i) = \exp \left[- \sum_{r=1}^S \left(\sum_{j=1}^{J_s} - \exp(\varepsilon_{js} / \rho_s) \right)^{\rho_s} \right]$$

Where $\rho_s \in [0,1]$ and $(1 - \rho_s)$ 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 $\rho_s=1$ the choices in the nest are independent and the nested logit collapses to the standard multinomial logit model.

⁷¹ 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.

⁷² Implicit is the assumption that in both periods households have the option of choosing microfinance.

microfinance status (Z_i) I use the same variables used in the logit analysis. For factors that impact 1999 microfinance status ($X_{j|i}$) I use the variables outlined below. Average values across groups are provided in table 9.

- 1) Household characteristics ($HC_{j|i}$) include: changes in the dependency ratio; changes in the number of working household members; whether or not the entrepreneur was hit with a shock in the past two years; and the age and gender of an entrepreneur as of 1997.
- 2) Enterprise characteristics ($EC_{j|i}$) include: changes in the number of enterprises; whether or not a household closed the primary enterprise between 1997 and 1999⁷³; 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 categories of enterprises run by the household⁷⁴.
- 3) Vulnerability Measures include: changes in net household assets, savings, home ownership, other property⁷⁵, and marital status. Also included is the 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 full maximum likelihood estimation of the nested logit model are presented in table 10. 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 does not have microfinance in 1999 over the probability an entrepreneur does. The first column contains estimated impacts on the probability an entrepreneur is in the Dropout group over the Still Have group ($P(Y_{j|1} = 2)$). The second column contains estimated impacts on the probability an entrepreneur is in the Never Join group over the Join MFI join ($P(Y_{j|2} = 4)$). 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 savings, home ownership and marital status are all significant in predicting microfinance status in 1997. Savings decreases the probability an entrepreneur does not have microfinance in 1997 by 14.7%. Home ownership decreases the probability by 25%, and marital

⁷³ 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.

⁷⁴ 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.

⁷⁵ I also used 1999 levels of vulnerability measures, but results do not differ from those when changes are used.

status decreases the probability by 23.4%. While net household assets are also found to significantly decrease the probability of falling into the no-microfinance in 1997 branch, the estimated marginal effect is zero, implying the importance of wealth is quite low. Thus the nested logit finds that in 1997 lower vulnerability increases the probability an entrepreneur has microfinance.

For 1999 microfinance status, similar to the logit analysis, estimation of the lower branches finds less conclusive determinants of microfinance selection. Within the first nest (Dropout vs. Still Have) a negative change in marital status, a positive change in the number of working household members, the closure of the primary enterprise, and an increase in the degree of informality are significant in distinguishing the Dropout group. In all cases positive values increase the probability an entrepreneur drops out of the microfinance program instead of staying. For marital status, the significance of a negative change in determining dropout behavior supports the vulnerability hypothesis of the paper. Entrepreneurs that become more vulnerable through the loss a spouse or partner are more likely to leave microfinance programs. This result is particularly compelling given that marital status is likely the strongest measure of vulnerability in the data and proves to be the most robust predictor of microfinance status in the logit analyses.

Within the second nest only a positive change in marital status is 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 have a higher propensity of not joining microfinance programs by 1999. These results are perplexing and go against the vulnerability hypothesis of this paper. However, for this branch it is clear there is little variation across the two groups, making it difficult to determine the factors that drive one group to join microfinance programs.

Table 10 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 the bottom portion of Table 9 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 may result from the small sample size of each group. 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 9: Additional Explanatory Variables for Lower Branch Estimation, Nested Logit (X_i/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) ⁷⁶					
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%	19.0%	18.0%	0.998
Negative (no longer have)	31.8%	26.4%	14.3%	26.7%	0.054*
Change in Marital Status					
Positive	3.6%	4.6%	1.6%	7.3%	0.115
Negative	6.4%	11.5%	1.6%	8.7%	0.236
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	-0.02	-0.03	-0.01	-0.02	0.965
Change in Working HH members	-0.51	-0.39	-0.19	-0.25	0.278
Hit with Shock between 1997 and 1999	57.3%	58.6%	58.7%	55.3%	0.952
Enterprise Characteristics					
Change in Formality Status					
Positive	14.8%	14.1%	16.3%	9.8%	0.482
Negative	21.9%	21.8%	14.1%	17.3%	0.433
Change in Enterprise Number					
Positive	21.5%	23.0%	14.1%	24.7%	0.384
Negative	21.5%	31.0%	25.0%	17.3%	0.097*
Change in Composition of Enterprises (business categories)	45.9%	56.4%	29.5%	42.6%	0.015**
Close Primary Enterprise between 1997 and 1999	14.6%	34.5%	18.8%	13.3%	0.002***
Predictive Power Nested Logit					
Observations in Nested Logit estimation	203	78	61	138	480
% correct percent predictions	76.8%	11.5%	6.5%	55.8%	

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

⁷⁶ 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 10: Nested Logit Estimation

UPPER NEST= Microfinance Status in 1997 (average marginal effects reported)	Do Not Have Microfinance 1997 vs. Have 1997 Microfinance	
<u>Vulnerability Measures</u>		
Own Home 1997	-0.250***	
Other Property 1997	-0.029	
Have Savings 1997	-0.147**	
Married or Equivalent 1997	-0.234*	
Time in Lima	0.000	
Net HH Assets 1997 (Wealth)	-0.000**	
<u>Household & Enterprise Controls⁷⁷</u>		
Working Household Members 1997	0.000	
Hit with Shock in Past 2 years, 1997	-0.083**	
All Enterprises Informal 1997	0.010	
LOWER BRANCHES= Microfinance Status in 1999	Dropout vs. Still Have	Never Have vs. Join MFI
<u>Vulnerability Measures</u>		
Change in Property Status (home & other)		
Positive	0.000	-0.003
Negative	-0.001	-0.010
Change in Savings		
Positive	-0.017	0.025
Negative	-0.007	0.044
Change in Marital Status		
Positive	0.016	0.016*
Negative	0.022*	0.020
Time in Lima 1997	0.000	0.000
Change in Net HH Assets (Wealth)	-0.000	-0.000
<u>Household & Enterprise Controls⁷⁸</u>		
Change in Working HH Members	0.000*	0.000
Hit with Shock in Past 2 years, 1999	0.001	-0.027
Change in Informality Status		
Positive	-0.008	0.003
Negative	-0.025*	0.012
End Primary Enterprise from 1997	0.019**	0.000
Inclusive Value Estimates (<i>I</i> _{<i>i</i>})	0.37	1.34
Chi Squared	273.8	
Observations (<i>N</i>)	480	

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

⁷⁷ Other controls include age, as measured by bins, whether or not entrepreneur is a woman, the dependency ratio, business category dummy variables and skill as measured by dummy variables for secondary education, above secondary education, and experience.

⁷⁸ Other controls include age, whether or not entrepreneur is a woman, change in the dependency ratio, a change in the number of enterprises, and skill as measured by dummy variables for secondary education in 1997, above secondary education in 1997 and experience in 1997.