Vulnerability as a Determinant of Entrepreneurial Choice: Evidence from Poor Microentrepreneurs in Peru

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Abstract: Microenteprises are increasingly recognized as major generators of income and employment in the developing world. Recent surveys suggest, however, that the sector is plagued by low productivity, leading some to claim that reducing impediments to microenterprise productivity is necessary to reduce urban poverty. Given mixed evidence that the only impediments are lack of credit and entrepreneurial skill, I propose vulnerability, defined as the inability to smooth consumption across negative shocks, as an additional barrier to highly productive enterprises. Since high yield projects likely carry more risk than low yield projects, I argue households choose high yield enterprises over low yield alternatives only if they are able to manage higher levels of risk. I define a simple theoretical model showing that vulnerability leads households to dedicate fewer resources to high yield/high risk enterprises. Using data on urban microentrepreneurs in Lima, Peru I find empirical corroboration of this prediction, suggesting that vulnerability helps drive enterprise choice and may explain a portion of low productivity in the microenterprise sector. Finally I show that households with microfinance dedicate more resources to high yield/high risk projects, implying there may be a link between enterprise choice and microfinance use.

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I. Introduction

Microenteprises, non-crop enterprises with 10 or fewer employees[1], are increasingly recognized as major generators of income and employment in the developing world[2]. In Latin America, the region of focus of this paper, microenteprises are estimated to account for 20% of GDP and anywhere from 30%-50% of total urban employment[3]. Furthermore, recent work suggests the size of the sector is due to demand (enterprises offer higher income than other options) rather than supply (lack of other income options, principally wage labor) factors[4][5]. For example, in a representative survey in Ecuador the majority of microentrepreneurs report entering the sector voluntarily and considering themselves better off than under previous engagements. Despite the enthusiasm for self-employment, however, another observed phenomenon of the microenterprise sector is low productivity. The majority of microenterprises do not hire employees, do not make new investments, and generally do not grow. This stagnation has led some researchers and development practitioners to argue that reducing urban poverty may depend on eliminating impediments to microenterprise productivity (Fajnzylber, Maloney, Rojas 2006).

Despite research on determinants of selection into entrepreneurship[6] and differences in the size and productivity of microenterprises[7], no definitive answer has emerged as to the impediments to microenterprise productivity. The most commonly cited barriers are lack of enterprise credit and lack of entrepreneurial skill (Lloyd-Ellis and Bernhardt 2000, Jovanovic 1982, Townsend and Paulson 2004, Gine and Townsend 2004, Banerjee and Newman 1993,

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[1] The most common definition of microenterprises is enterprises with 10 or fewer employees (USAID, IADB, ADB). The definition in the text comes from a 1997 ADB report. Frequently these enterprises are informal and employ only the entrepreneur and unremunerated household members.

[2] The Asian Development Bank (1997) estimates microenterprises account for 60% of all enterprises and 50% of all employment in developing Asia. Liedholm and Mead (1999) estimate microenterprises account for between 17-27% of total employment in 7 African countries. In Peru, a 1996 household survey estimates the micro-enterprise sector employs 75% of the economically active population and accounts for 40% of GDP (Peruvian Ministry of Labor)

[3] IADB 2003, Fajnzylber, Maloney, Rojas 2006, Maloney 2004

[4] Papers arguing the informal, self-employment is involuntary and inferior and papers arguing the opposite, that these enterprises are voluntary and first-best are described by Maloney (2004). There are also papers "in between", arguing that labor intensive, low entry barrier enterprises can serve to absorb surplus labor while capital intensive, high entry barrier enterprises likely pull workers from other sources. (Daniels (2003))

[5] SALTO Ecuador Project, 2004, Mexican Survey of Microentrepreneurs, multiple years. Both ask entrepreneurs what type of work they had prior to opening their enterprises and reasons for switching. Very few list inability to find renumerated work as the primary reason. In the case of Ecuador primary reasons listed are desire for independence (37%) and opportunity to earn more money (36%).

[6] Paulson, Townsend and Karaivanov 2006, Jovanovic 1982, McKenzie and Woodruff 2006

[7] Liedholm and Mead 1999, ADB 1997, Shaw 2004, Cunningham and Maloney 2001

Karlan and Valdivia 2006)[8], but there is mixed evidence that these factors, either together or in isolation, are the only deterrents to increased productivity. In the case of credit, empirical studies find conflicting evidence on the degree to which credit constraints bind and prevent entrepreneurs from high yield activities[9]. In particular, a recent study focused on urban microentrepreneurs (McKenzie and Woodruff 2006) finds no evidence of binding constraints, and finds that returns to capital are highest for entrepreneurs with the lowest level of enterprise assets. In the case of entrepreneurial skill, while recent work finds that 1-2 years of business training in conjunction with microfinance credit leads to higher enterprise sales (Karlan and Valdivia 2006), many practitioner surveys of credit-with-training programs find muted results. One survey in particular finds that benefits are highly correlated with wealth (Shaw 2004), a curious result since wealth does not determine access for participants. Most importantly, experiments in the expansion of credit to poor entrepreneurs, principally microfinance, have yielded limited empirical corroboration of positive impacts on enterprise incomes and assets[10]. While lack of appropriate data for impact assessment is partly to blame, the absence of compelling results suggests factors beyond credit and skill may also play important roles in enterprise choice.

In this paper I propose vulnerability, defined as the inability to smooth consumption across negative income shocks, as one such additional factor that drives enterprise choice and inhibits microenterprise productivity[11]. Given that high yield projects likely carry a higher level of risk than low yield projects, and that tolerance for risk likely varies due to different levels of wealth and access to credit and insurance, it is probable that only households better able to manage the higher risk associated with higher yield enterprises

[8] Lack of credit would preclude poor households from high productivity activities if they have high entry costs (Banerjee and Newman 1993), or if lack of credit leads to underinvestment, despite access to profitable, high return projects (Lloyd-Ellis & Bernhardt 2000). Lack of skill can serve as a barrier if it is direct input into more productive enterprises, or as an indirect barrier, if it is linked to credit access

[9] Banerjee and Duflo (2002) and Gine and Townsend (2004) find positive evidence of binding credit constraints for entrepreneurs in India and Thailand, respectively. McKenzie and Woodruff, however, (2006) find no evidence of entry costs amongst microentrepreneurs in Mexico, implying that credit constraints should not serve as a barrier to entry.

[10] See Armendariz and Morduch (2005) for discussion of state owned development banks and the provision of subsidized credit, and mixed impact results for microfinance programs. Also see Shaw (2004) and ADB (1997) for brief discussions of the observed positive link between wealth and microfinance outcomes. Less wealthy households are less likely to seek out microfinance loans and are less likely to have positive impacts on income post treatment than their wealthier counterparts, a curious result if credit access is the only barrier in place.

[11] Enterprise credit alone is insufficient to render a household not vulnerable, since many can only be used for working capital needs, rather than for consumption purposes. While loan use generally is not tracked and some degree of fungibility exists, the short maturity lengths and frequent repayments generally mean they are restricted to covering short-term business needs.

choose these projects. Those less able to manage higher levels of risk choose lower yielding alternatives. Under this scenario vulnerability, in combination with or in lieu of skill and credit barriers, drives selection into entrepreneurial projects. The idea that vulnerability drives income choice is not novel, for there is a large body of theoretical and empirical literature on the relationship between vulnerability and income choice amongst rural households (Lopez, Nash and Stanton 1995, Heltberg and Tarp 2001, Rosenzweig and Binswanger 1993, Fafchamps 2003, Morduch 1990, Wright 1978, Walker and Ryan 1990, McKloskey 1991). The extension of this rationale to an urban setting, however, is unique. Poor, urban households face different choice sets and constraints than their rural counterparts and there is limited work examining their income decisions and how these relate to risk management strategies. As such, this paper forms part of a growing literature not just on microenterprises, but on income choice under uncertainty for poor, urban households[12].

In the paper I first establish a theoretical link between vulnerability and enterprise choice, outlining a model of income portfolio choice under uncertainty that follows similar models of credit and insurance (Eswaran and Kotwal 1989) and income smoothing (Morduch 1994). Risk-averse households decide how to divide resources between a high yield/high risk enterprise and to a low yield/low risk enterprise, and the model shows that after controlling for entrepreneurial skill, households that are more vulnerable dedicate a lower portion of resources to the high yield/high risk option. Finally, the expected income and variance of income of the enterprise portfolio are shown to be good, observable proxy measures of income choice. The testable prediction is that more vulnerable households exhibit lower average enterprise income and lower variance of income than their less vulnerable counterparts.

I then test the theoretical predictions using panel data on urban microentrepreneurs in Lima, Peru. After outlining measures for the portion of resources dedicated to high yield/high risk enterprises, vulnerability and skill, I find positive evidence of a negative relationship between vulnerability and investment in a risky enterprise. More vulnerable entrepreneurs dedicate fewer resources to high yield/high risk enterprises, supporting the

[12] Field (2003) discusses how previous research on the impact of property rights reform has focused on agricultural households and largely ignored their urban counterparts.

contention that inability to manage risk creates an additional barrier to entry into high return projects.

Finally, I explore the implications of enterprise choice for the use of microfinance, the only type of formal credit available to many microentrepreneurs and one that many potential borrowers actually eschew[13]. If project choice determines whether or not an entrepreneur has the capacity to service microfinance loans, the determinants of enterprise choice, such as vulnerability, play a role in microfinance selection. Using the ACP data I find that households with microfinance invest more in high yield/high risk enterprise than those without microfinance. This suggests a link exists between enterprise choice and microfinance use.

The paper proceeds as follows. Section 2 provides a theoretical framework for income choice under uncertainty, predicting an inverse relationship between the amount invested in a risky enterprise and vulnerability. Section 3 provides a description of the data. The section also outlines measures for the amount invested in the risky enterprise and vulnerability. Section 4 uses these measures to test the predictions of relationships between vulnerability and the amount invested in the risky enterprise. Section 5 discusses the implications of these findings for selection into microfinance programs and test if enterprise choice differs across households with and without microfinance. Section 6 concludes.

2. Theoretical Model

This section provides a model of household income portfolio choice under uncertainty for entrepreneurial households. The theory formalizes the intuition that even after controlling for skill, vulnerability governs the decision of how many resources poor entrepreneurs devote to a risky enterprise. In the model I employ elements of other models of income choice under uncertainty, such as Morduch's 1994 model of income smoothing and Eswaran and Kotwal's 1989 model of credit as insurance. The agent of focus is modified to a microentrepreneur and the central decision is modified to the choice of an entrepreneurial portfolio. By ignoring all other income sources, such as wage labor, the construction of an optimal enterprise portfolio translates into the construction of an optimal income portfolio.

Consider a two period model in which risk-averse households decide how to allocate resources across different enterprises at the beginning of the first period. Households begin period 1 with an exogenous skill endowment (T) and an exogenous endowment of labor (L).

[13]See Pearlman (2007) for more details on the low penetration rates faced by many microfinance institutions.

For simplicity I assume labor is the only input of microenterprises, making it the only resource households must allocate. The skill endowment varies and can take one of two values, T_H or T_L, where T_H =high skill and T_L =low skill. The labor endowment is the same for all households. Both endowments stay constant in the second period.

After receiving initial endowments entrepreneurial households choose how to allocate labor across two income sources: a safe enterprise (SE), that has a low return and zero risk, and a risky enterprise (RE), that has a high return and positive risk. The portion of labor devoted to the risky enterprise is denoted by θ, where $\theta \in [0,1]$, with the remaining portion, (1-θ), allocated to the safe enterprise (SE). θ is the variable of interest in the model and to focus on one decision I assume θ cannot change in the second period. The fixed nature of θ makes sense if there are costs to households changing enterprise portfolios, which may occur if there is an initial investment of labor required to learn how to run a particular business.

Income from both types of enterprises is realized at the end of period 1 and is a simple, linear function of the only input, labor. In the case of the safe enterprise, income is certain across states and independent of skill. In the case of the risky enterprise income is uncertain, depends on the state of nature and on entrepreneurial skill. For the state of nature, realizations occur immediately after households choose θ and can take two possible values, good (G) or bad (B). The probability of a good state equals p and the probability of a bad state equals $(1-p)$. For entrepreneurial skill, greater skill allows households to generate higher profits from the risky enterprise in good and bad states. This is captured by the variables G_T and B_T, where $G_{TH} > G_{TL}$ and $B_{TH} > B_{TL}$. These variables, along with θ and labor, L, determine first period income from each enterprise as follows:

$$SafeEnterpriseIncome_1 = Y^1_{SE} = (1-\theta)LS \quad w/\ probability = 1 \tag{1}$$

$$RiskyEnterpriseIncome_1 = Y^1_{RE} = \theta L G^1_T \quad w/\ probability = p \tag{2}$$

$$RiskyEnterpriseIncome_1 = Y^1_{RE} = \theta L B^1_T \quad w/probability = (1-p)$$

$$\text{where } T = T_H \text{ or } T_L \text{ and } G^1_H > G^1_L > S > B^1_H > B^1_L \tag{3}$$

The inequalities in (3) capture the fact that for equal labor allocation high skill households generate greater income from the risky enterprise in both states than low skill households.

In order for any household in the model to have $\theta > 0$ the probability of a good state must be sufficiently high to ensure that, for equal labor allocation, expected risky enterprise

income is greater than safe enterprise income. If this does not hold, there is no risk premium attached to the risky choice and no risk-averse household will devote resources to it. To avoid this outcome the probability of a good state, p, must lie above the value at which expected risky and safe income are equal. This value is defined as $\bar{p}$ and equals:

$$\bar{p}\theta LG_T^1 + (1-\bar{p})\theta LB_T^1 = \theta LS \Rightarrow \bar{p} = \frac{S - B_T^1}{G_T^1 - B_T^1} \tag{4}$$

The actual value of p must lie above $\bar{p}$, which means $pG_T^1 + (1-p)B_T^1 > S$ (5)

The strict inequality of (5) ensures that expected income from the risky enterprise surpasses certain income from the safe enterprise, allowing for the possibility of positive θ values.

Total first period income generated from the enterprise portfolio[14] can take one of two values; income in a good state (Y_{1G}) and income in a bad state (Y_{1B}). Combining (1) and (2):

$$Y_{1G} = (1-\theta)LS + \theta LG_T^1 \quad \textit{with probability=}p \tag{6}$$
$$Y_{1B} = (1-\theta)LS + \theta LB_T^1 \quad \textit{with probability= (1-}p\textit{)} \quad \text{where } T=T_H \text{ or } T_L$$

In the second period the enterprise portfolio remains the same, since θ is fixed from the first period. Safe enterprise income is certain and assumes the same value as in the first period. Risky enterprise income, however, changes in the second period. It becomes certain and equals expected first period income: $Y_{RE}^2 = E(Y_{RE}^1)$. Given (1) and (2) this means:

$$Y_{RE}^2 = p\theta LG_T^1 + (1-p)\theta LB_T^1 \tag{7}$$

Thus second period income depends on the portion of resources dedicated to the risky enterprise in the first period. This creates an added incentive for households to engage in the risky enterprise in the first period, despite increased risk, as it leads to higher second period income. The assumption of certain second period income follows other models of income choice under uncertainty (Morduch 1994, Eswaran & Kotwal 1989) and is necessary to simplify the analysis and focus on one decision for households. It also allows for a simple introduction of vulnerability, discussed in more detail below. Intuitively the assumption of

[14] In the Peruvian data used in this paper most households operate more than one microenterprise, which is why it is instructive to think of income choice in terms of an enterprise portfolio. Beyond this, one can think of enterprises as business models, which can co-exist within the same location. Entrepreneurs may then combine risky and safe products or services within the same enterprise.

certain second period income can be explained by better management of enterprises after the initial period, which may constitute a trial period for operation[15].

Combining the safe and risky enterprises, total certain second period income is:

$$Y_2 = E(Y_1) = p\theta LG_T^1 + (1-p)\theta LB_T^1 + (1-\theta)LS \quad (8)$$

It is now possible to introduce vulnerability, defined as the inability to smooth consumption across negative income shocks. Empirically vulnerability is determined by liquid wealth, access to insurance and access to consumption credit, but for simplicity I model it purely as a function of access to consumption credit. This assumption appears strong, but it matches evidence from the ACP data, where households list borrowing as the most important mechanism for managing negative shocks[16]. Consumption credit, in turn, largely depends on informal networks of family and friends. For example, of households that list borrowing money to manage a shock, almost 60% say the funds came from family and friends. Due to the large dependence on informal networks I assume consumption credit access is unrelated to skill. This assumption is plausible since a household's number of family and friends may be delinked from entrepreneurial skill. The assumption also is necessary to separate the impact of skill from the impact of vulnerability on income choice.

Access to consumption credit is modeled as an idiosyncratic borrowing constraint faced in the first period. The constraint, denoted by φ (where $\varphi \in [0,1]$), dictates the portion of certain second period income households can borrow in the first period to smooth consumption. Thus φ is the measure of vulnerability in the model. Higher values denote greater ability to smooth consumption and lower vulnerability, while lower values denote less ability to smooth consumption and greater vulnerability. The constraint φ is revealed to households at the beginning of Period 1, such that households know their vulnerability status prior to choosing θ. Since borrowing and saving in this context is largely informal[17], interest rates over the one year period are assumed to be zero ($r = 0$).

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[15] Eswaran and Kotwal adopt a similar explanation in reference to technological adoption amongst farmers, claiming that reduced uncertainty over second period returns from the new technology stems from improved knowledge and ability in its utilization.

[16] Households who were hit with a negative shock were asked the main mechanism for managing the shock. 23.5% list borrowing, while 17.5% list savings use.

[17] For credit, family and friends are listed as the second most important source of credit, behind suppliers, by households in the sample. Interest rates on these loans are typically zero (Dunn and Arbuckle 2001). For saving, most households report saving in the form of cash stashed in the house or through ROSCAS. Both of these savings vehicles pay no interest.

We can now outline the household's problem. After choosing θ, the state of nature is realized and income from each enterprise is received. Households then choose consumption to maximize utility in each period, which is an increasing and strictly concave function of instantaneous consumption. The consumption path across the two periods depends on the state of nature, with a good state leading to a higher consumption path than a bad state. To recognize this instantaneous consumption in both periods is expressed as a function of the state realization.

In the first period households choose θ to maximize expected lifetime utility. Households do this after receiving skill and labor endowments and after viewing their idiosyncratic borrowing constraint[18]. To abstract from concerns about differing degrees of time preference I assume households weigh first and second period consumption equally, and that the coefficient of time preference, β, equals one. Incorporating this and rewriting Y_1 and Y_2, the household's problem is:

$$\max_{\theta} EU = p*[u(c_{1G}) + \beta u(c_{2G})] + (1-p)*[u(c_{1B}) + \beta u(c_{2B})] \tag{10}$$

$$\text{s.t. } c_{2G} \le [(1-\theta)LS + \theta LG_T^1 - c_{1G}] + [p\theta LG_T^1 + (1-p)\theta LB_T^1 + (1-\theta)LS]$$

$$c_{1B} \le [(1-\theta)LS + \theta LB_T^1 + \varphi[p\theta LG_T^1 + (1-p)\theta LB_T^1 + (1-\theta)LS]]$$

$$c_{2B} \le [(1-\theta)LS + \theta LB_T^1 - c_{1B}] + [p\theta LG_T^1 + (1-p)\theta LB_T^1 + (1-\theta)LS]$$

The optimal allocation, θ^*, solves the following first order condition:

$$\frac{\partial EU}{\partial \theta} = pu'(c_{2G})[G_T^1 - S + Z] + (1-p)u'(c_{2B})[B_T^1 - S + Z] + \pi[B_T^1 - S + \varphi Z] = 0$$

$$\text{Where } Z = pG_T^1 + (1-p)B_T^1 - S > 0 \quad \text{(from (5))} \tag{11}$$

π is the shadow price on the first period borrowing constraint and its value varies across households depending on their level of vulnerability. For non vulnerable households the borrowing constraint does not bind and $\pi = 0$. These households can perfectly smooth consumption in a bad state and c_{1B} is at its optimal level. For vulnerable households the borrowing constraint binds and $\pi > 0$. These households cannot smooth consumption in a bad state and c_{1B} is below its optimum.

To assess how vulnerability impacts enterprise choice I compare the optimal allocation for non-vulnerable and vulnerable households. For non-vulnerable households $\theta^*_{\pi=0}$ solves:

[18] If a good state is realized the borrowing constraint never binds since first period income is higher than second period income, so that households have no need to bring a portion of second period income forward through borrowing. Thus a constraint for first period consumption in a good state is not included.

$$p u'(c_{2G})[(G_T^1 - S + Z] = (1-p)u'(c_{2B})[S - B_T^1 - Z] \quad (12)$$

For vulnerable households, $\theta^*_{\pi>0}$ solves:

$$p u'(c_{2G})[G_T^1 - S + Z] = (1-p)u'(c_{2B})[S - B_T^1 - Z] + \pi[S - B_T^1 - \varphi Z] \quad (13)$$

By comparing (12) and (13) it is clear $\theta^*_{\pi=0} \neq \theta^*_{\pi>0}$; the same allocation cannot solve both first order conditions. This comparison also indicates that the allocation to the risky enterprise must be less for vulnerable entrepreneurs than for non vulnerable entrepreneurs ($\theta^*_{\pi>0} < \theta^*_{\pi=0}$). Consider $\theta^*_{\pi=0}$ as a solution for (13). Under this scenario the left hand side of (13) is too low and we have disequilibrium. The only factors that can change to regain equilibrium are $u'(c_{2G})$ and $u'(c_{2B})$, which are functions of θ. Thus for the left hand side to rise, $u'(c_{2G})$ must rise. Given concave utility this means c_{2G} must fall, which can only occur if total lifetime income declines. Meanwhile, the only w ay for lifetime utility to decline is if θ *declines*. Lower θ also yields higher income in a bad state, leading to higher c_{2B}, and lower $u'(c_{2B})$, further pushing (13) into equilibrium. Thus the value of $\theta = \theta_{\pi>0}$ that solves (13) must be lower than the value of $\theta = \theta_{\pi=0}$ that solves (12); the optimal allocation to the risky enterprise must be lower for vulnerable households.

Performing comparative statics on $\theta^*_{\pi>0}$ (13) further illustrates how the optimal allocation of resources is impacted by vulnerability. Total differentiation of the FOC yields equation (14), which tells us how θ^* changes with φ, the inverse of vulnerability:

$$\frac{d\theta^*}{d\varphi} = \frac{-\pi Z}{p u''(c_{2G})[(G_T^1 - S + Z)]^2 L + (1-p)u''(c_{2B})[B_T^1 - S + Z)]^2 L} \quad (14)$$

It is possible to sign the right hand side of equation (14). From strict concavity and the fact that L>0 it is easily determined that the denominator is negative. From (5), which says that Z>0, it is determined that the numerator is negative. The result is the key conclusion of the model: $\frac{d\theta^*}{d\varphi} > 0$ (15)

This is the key prediction of the model; the portion of resources dedicated to the risky project increases as the level of vulnerability of the household decreases. Due to restricted ability to smooth consumption in a bad state, more vulnerable households are less willing to engage in the high yield/high risk enterprise and devote more resources to the safe choice.

2.2 Testable Predictions

There is a difficulty in empirically testing the prediction that θ decreases in vulnerability, which is that θ is unobservable. As the next section outlines, it is impossible to identify "risky" and "safe" enterprises, eliminating the option of directly discerning the allocation of resources. It is possible, however, to derive testable implications by looking at the consequences of θ for certain observables, the most salient of which are the expected income and variance of income of the enterprise portfolio. The logic of the link stems from basic financial portfolio theory, which demonstrates that the expected return and variance of returns of a portfolio increases when the weight in a risky security rises relative to the weight in a safe security[19]. The explicit relationship between θ and the expected income and variance of income of the enterprise portfolio is described below.

Total lifetime expected income and actual income of the enterprise portfolio are:

$$E(Income_P) = 2[p\theta LG_T^1 + (1-p)\theta LB_T^1 + (1-\theta)LS] \tag{16}$$

$$ActualIncome = \begin{Bmatrix} \theta LG_T^1 + p\theta LG_T^1 + (1-p)\theta LB_T^1 + 2(1-\theta)LS \rightarrow ifState = G \\ \theta LB_T^1 + p\theta LG_T^1 + (1-p)\theta LB_T^1 + 2(1-\theta)LS \rightarrow ifState = B \end{Bmatrix} \tag{17}$$

The variance is thus:

$$\sigma_P^2 = p[(1-p)\theta LG_T^1 - (1-p)\theta LB_T^1]^2 + (1-p)[p\theta LB_T^1 - p\theta LG_T^1]^2 \tag{18}$$

First derivatives reveal how the expected income and variance change with θ.

$$\frac{dE(Income_P)}{d\theta} = 2L(pG_T^1 + (1-p)B_T^1 - S) > 0 \tag{19}$$

From (5) it is determined that (21)>0.

$$\frac{d\sigma_P^2}{d\theta} = 2p\theta[(1-p)LG_T^1 - (1-p)LB_T^1]^2 + 2(1-p)\theta[pLB_T^1 - pLG_T^1]^2 > 0 \tag{20}$$

From positive p and θ values it is determined that (20) >0. In line with standard financial portfolio theory the expected income and variance of households' enterprise portfolios increase with θ. The following equations guide the empirical analysis:

$$\frac{dE(Inc_p)}{d\theta} * \frac{\partial\theta}{\partial\varphi} \Rightarrow \text{Expected income predicted to decrease in vulnerability}$$

$$\frac{d\sigma_p}{d\theta} * \frac{\partial\theta}{\partial\varphi} \Rightarrow \text{Standard deviation predicted to decrease in vulnerability}$$

[19] Bodie, Kane and Marcus 2006

The theory predicts that more vulnerable entrepreneurs have enterprise portfolios with lower expected income and lower standard deviation than their less vulnerable counterparts. I now turn to the data for an empirical test of this theoretical prediction.

3. Description of the Data

The data set used in this paper comes from an impact evaluation of a Peruvian microfinance institution that was part of USAID's Assessing the Impact of Microfinance Services Project (AIMS)[20]. The Peruvian portion of the project was carried out with Accion Comunitaria del Peru (ACP, which became MiBanco in 1998), a large, profit-oriented microfinance institution with operations in Lima[21], Peru's capital and largest city. Data on clients of ACP and a comparison group, microentrepreneurs in the same neighborhoods and with similar observable enterprise and household characteristics but with no microfinance credit, was collected in two periods, August of 1997 and again in July/August of 1999. The 1997 survey includes 701 households. Due to attrition by 1999 the original respondents are whittled down to 520 respondents. In the subsequent analysis I focus on the balanced panel.

Although this paper does not address the impact of microfinance, the ACP data set is useful because it is one of the few that provides panel information on urban microentrepreneurs. The data also allow for moderate control for access to credit as 71% of the entrepreneurs in the sample have microfinance loans at some point in the two year survey period (not necessarily from ACP) and the remaining 29% meet the qualifications for ACP loans[22]. In addition to microfinance credit, 54% of the sample report having loans from other formal and informal sources in 1997[23]. While the existence of outstanding loans does not imply an absence of credit constraints, the fact that only 12% of the balanced sample utilizes no credit whatsoever implies that these households have at least some access.

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[20] 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.

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

[22] During the survey period ACP offered group and individual loans. For individual loans the borrower must have title to their home or a guarantor with title to their home. For group loans anywhere between 2-5 individuals can jointly take out the loan, with the requirement that at least one group member have title to their home. For both loan types ACP requires the enterprises on which the loan is taken to have at least 6 months of operating history and allows only one loan per household. ACP also requires borrowers to put up household durables, usually appliances, as collateral. (Dunn and Arbuckle 2001). Whether or not the group without microfinance would be approved for a loan from ACP is unknowable, since they never apply. Based on observable information, however, they would be approved.

[23] Unfortunately 60 households did not respond to this portion of the 1997 questionnaire and the questions for non microfinance credit were not repeated in the 1999 round. Comparisons of the non-respondents to those who respond are presented below table 1.

Table 1 provides a comprehensive list of credit sources and the number of households reporting using them.

The ACP data are also useful because enterprise choice has important implications for microfinance selection. If the expected returns on projects have a direct impact on households' ability to repay microfinance loans[24], project choice will determine whether or not households can "afford" microfinance. Entrepreneurs who choose low yield/low risk projects might generate insufficient surpluses to repay microfinance loans and avoid this credit. This scenario could explain one of the less publicized puzzles about microfinance, which is that many microfinance institutions (MFIs) face low penetration rates. Despite significant expansion of microfinance services in the past few decades, a significant number of potential borrowers never seek out these loans[25]. Low penetration threatens MFIs' mandate to expand credit access and improve the well-being of poor households. If the seeds lie in enterprise choice, exploring the determinants of these decisions will help explain why so many households don't avail themselves of a service that would potentially make them better off.

3.1 Measuring Allocation to the Risky Enterprise

In 1997 there were a total of 786 enterprises (for 520 households) and in 1999 there were 759 enterprises (for 491 households)[26]. Of these, 612 enterprises can be positively identified as showing up in both periods. The difference is comprised of enterprises that close (estimated to be at least 94), new enterprises (estimated at 162), and misclassified enterprises that actually exist in both periods. Table 3 presents enterprise level information, including mean values for the number of enterprises, formality status, sales, employees, net assets, and category of business. Graph 1 shows the breakdown of enterprises across 9 broad categories in both years. The information demonstrates that despite some churn, the characteristics of the sector do not change dramatically from 1997 to 1999.

To discern θ, the allocation of resources to high yield/high risk projects, it would be optimal to know which enterprises are "risky" and which are "safe" and then assess how much of each entrepreneur's portfolio is comprised of each type. Unfortunately dividing

[24] ACP loans are unsubsidized and at the time of the survey charged market interest rates of 50% annually. These rates are on par with other sources of formal finance such as banks, but higher than explicit rates for many informal sources, such as supplier credit, loans from family and friends and ROSCAS. (Dunn and Arbuckle 2001)

[25] CGAP (2000), Berger (2003)

[26] 29 households in the balanced panel to not report enterprise level information in 1999

urban entrepreneurial activities into risk/return categories is not straightforward and there is limited guidance in either the academic or practitioner literature on appropriate assignment[27]. The first problem is that broad enterprise categories, as defined by four digit codes in the ACP data[28], do not reveal much about risk and return characteristics. For example, it is likely that some enterprise categories, such as car repair or carpentry, require higher levels of entrepreneurial skill than others, such as house cleaning or a corner kiosk. It is unclear, however, if these skill requirements, once established, map into different return and risk profiles. From the current level of understanding it cannot be conclusively stated that carpentry shops have greater return and risk than corner kiosks. Additionally, in the ACP data there are insufficient observations in either category to establish one as more risky than another[29]. A secondary concern is that the division between "safe" and "risky" enterprises likely exists within categories as well. For example, the largest category in the ACP dataset is retail trade in a market location[30]. The four digit code for this category bundles together retailers that sell vegetables, retailers that sell toys, and retailers that sell appliances, among other options, and it is plausible that risk/return profiles vary across each subcategory. Unfortunately more detailed information on products sold is not provided, further complicating assignment. In sum, given the limited sample size, limited level of detail, and limited understanding of microenterprise types, it is impossible to divide microenterprises into "safe" or "risky" categories and thus directly view the allocation of resources to the risky enterprise.

It therefore is necessary to obtain indirect, observable measures of θ. The theoretical model established the expected income and variance of income of the enterprise portfolio as appropriate proxy variables. These too are unobservable due to the lack of numerous panel periods needed to estimate a probability distribution for different states of the world and associated outcomes. The ACP data only provide two realizations of income, one in 1997

[27] ADB (1997) and Shaw (2004) do define some enterprise categories as "survival" or "safe" and others as "entrepreneurial" or "risky", but their samples are either rural or semi-rural and the assignments do not translate well to the ACP data.
[28] In 1997 there were 786 enterprises in 58 different four digit categories.
[29] To attempt to categorize enterprises I analyzed the mean income and standard deviation of income across businesses based on four digit codes. However, the observations in some categories are so small (in many cases there is only one enterprise under a particular code) that it is impossible to discern which categories are more or less risky from the data.
[30] 197 out of 786 enterprises in 1997, or 25%, are in the category of retail in a market location

and in 1999. Thus the best approximation of expected income is the average value across the two periods[31], where each year's outcome is assigned equal probability.

$$ExpectedIncome = \frac{EnterpriseIncome_{1997} + EnterpriseIncome_{1999}}{2}$$

The best approximation of the variance of the enterprise portfolio is the standard deviation of microenterprise income around the mean. For the purpose of this analysis the standard deviation is preferable to measures of dispersion that control for scale, such as the coefficient of variation[32]. One concern over the standard deviation is that distributions with greater means may exhibit greater standard deviations simply because the range over which the distribution lies is higher. Thus some portion of standard deviation values may reflect differences in the range rather than differences in dispersion. The problem with correcting for this by using the coefficient of variation, however, is that the ratio of the standard deviation to the mean may not capture the proposed positive correlation between the two variables. According to the theory higher means are associated with higher standard deviations, but the coefficient of variation does not necessarily reflect this relationship. For example, a distribution with a high mean and high standard deviation (risky enterprise returns) and a distribution with a low mean and low standard deviation (safe enterprise returns) can have the same coefficient of variation. Furthermore, for poor households making income choices, the absolute fluctuation in income matters more than the relative fluctuation. This makes the standard deviation a superior measure. Mean and median values for both θ measures are presented in table 5.

For robustness I also consider monthly sales from the primary enterprise as an additional measure of θ. The primary enterprise is the one listed as the most important by each household, and in most cases it is the longest running and most stable enterprise in the income portfolio. For ACP borrowers it is the enterprise on which the loan is taken. One nice feature of primary enterprises is that they are possible to track across the two periods, which is not always true of other enterprises listed by households[33]. 421 primary enterprises survive through both periods. I use average month sales across 1997 and 1999 and the standard deviation of month sales for these 421 primary enterprises as additional measures

[31] 1997 income is inflated to 1999 prices
[32] The coefficient of variation= standard deviation/mean.
[33] While households were asked about up to three microenterprises in the enterprise questionnaire, and due to reporting error, the only ones that can be effectively linked in 1997 and 1999 are the primary enterprises.

of θ. Overall primary enterprise month sales provide weaker measures of θ than microenterprise income. This is because households are predicted to make decisions about risk/return tradeoffs at the level of the enterprise portfolio rather than at the level individual enterprises. Thus primary enterprises do not provide as complete of a picture of enterprise choice. Nevertheless, considering primary enterprise sales as a secondary θ measure enhances the analysis. Average values are presented in table 5.

3.2 Measuring Vulnerability

To measure vulnerability it is necessary to find a proxy for φ, the degree of credit constraints a household faces in the theoretical model. Portions of the consumption literature (Deaton 1997, Paxson 1992, 1993, Zeldes 1989) note the elusive nature of such a measure given that credit constraints are unobservable. A standard second best approach is to derive "ex-post" measures by comparing changes in consumption to unexpected changes in income and deeming vulnerable households that register a response. In a two period panel, however, this strategy is fraught with problems and largely unusable[34]. I therefore rely on "ex-ante" vulnerability measures; variables that gauge a household's ability to access funds, mostly consumption credit, in times of needs[35].

I start with measures of wealth, both financial and non-financial, as these indicate an ability to internally manage negative shocks as well as a degree of credit access if wealthier households are deemed better borrowers. The ACP data provide information on four types of wealth. For liquid wealth we know if a household has savings and the net value of household durables and vehicles[36]. For property wealth we know if a household has title to

[34] The first concern is the inability to identify temporary from permanent changes in income in a short panel. Failure to disentangle the two can lead to false identification of vulnerable households. The second concern is the limited number of states of the world observed in a short panel. Kamanou and Morduch (2002) point out that households facing the same distribution of shocks will have different draws over a short time frame. Only a limited portion of the sample will receive bad draws and thus be tested on their ability to smooth consumption across adverse shocks. The remaining households could be equally or more vulnerable as those hit with negative shocks but simply won't appear so in this snapshot. These households will thus be falsely labeled as not vulnerable, biasing any further analysis.

[35] Analyzing which household fell into poverty over the period, faces the same problems. This is broadly referred to as vulnerability to becoming poor, and movements across the poverty line in both directions have been examined by Jalan and Ravallion (2000), Dercon and Krishnan (2000), and Kamanou and Morduch (2002). In this sample, over the two year period 17.4% of households became poor while 8.9% escaped poverty. Poverty lines based on a $2/day measure.

[36] The majority of households held savings as cash at home (over 50%) or with ROSCAS. Relatively few households held savings in the form of demand deposits with banks or cooperatives (less than 12%).

their home and if they have any other property beyond the primary residence[37]. Combined, these measures likely capture some ability of households to smooth consumption via internal or external funds. Considering credit access specifically, while the extent of this is unobservable, it is likely that households with savings, with higher liquid wealth and with home title are deemed better borrowers and therefore have more options. Of the four wealth measures, net durable goods and vehicles might best capture credit access for households in the ACP sample. Perhaps due to difficulties in repossessing other assets, durable goods are typically the collateral offered by households for many informal and formal loans. Microfinance institutions are no exception, and ACP requires durable goods to be placed as collateral for loans[38].

Finally, it is crucial to consider the extent of informal networks, which are the main source of consumption credit for households in the 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 shocks. Liquid assets and property may fail to capture this key component of vulnerability if an entrepreneur's network of friends and family is unrelated to wealth, which is quite plausible[39]. This means a more direct measure is required. To capture 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 ACP data. In its absence I rely upon two variables related to the extent of informal networks; 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. In the case of marital status a

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[37] Households were asked if they had homes or residential locations in addition to the principal residence. Due to lack of formal savings options many households save in the form of real estate, even in invasion communities with informal property rights. In 1997, 70 households, or 14% of the sample, reported having additional properties. These were used as rental properties, for a business, or to receive family members or guests. Of these 70 HHs, 23.5% are below the poverty line, indicating that additional property is not limited to the better off portion of the sample.

[38] As part of the loan application, applicants submit a list of electrical appliances to be used as collateral. Mibanco credit agents verify the status and value of these appliances before approval. (Dunn and Arbuckle 2001)

[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).

spouse or partner may provide access to a wider network of family and friends[40]. In the case of tenure in Lima a longer tenure means the household has had greater opportunity to develop informal networks.

There are some concerns that the informal network measures proxy for household characteristics besides vulnerability that impact enterprise choice. For marital status the concern is that the variable simply captures the effect of having another working adult in the household. To control for this I include the total number of household members that currently work. The concerns for tenure in Lima are that it captures entrepreneurial experience and/or increased knowledge of better projects rather than reduced vulnerability. To control for the first concern I use age and entrepreneurial experience, as measured by the longest tenure in operation any of the household's microenterprises. To control for better knowledge of good projects I use measures of entrepreneurial skill, outlined below.

Finally, it is important to note that including wealth in the estimation may control for differences in risk preferences, which play a role in the determination of project choice. *Ceteris paribus,* more risk averse households achieve lower expected utility under the risky enterprise 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 levels of risk aversion and thereby help distinguish between risk preferences and vulnerability as drivers of behavior.

In sum, in the empirical estimation marital status and Time in Lima, the net value of durable goods and vehicles, savings status, home ownership, and ownership of additional property, are used to measure vulnerability. Positive values for the binary variables and higher values for the continuous variables indicate lower vulnerability. Table 3 presents average values.

3.3 Measuring Skill

The most viable alternative theory to the one offered by this paper is that entrepreneurial skill drives selection into high yield/ high risk projects. According to this hypothesis, after holding credit access constant, entrepreneurs engage less in the high yield/ high risk project because they are less skilled. It is difficult to prove or disprove this claim given that

[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.

entrepreneurial skill is unobservable to the researcher and perhaps even to the entrepreneur (Jovanovic 1982)[41]. Nonetheless, without controlling for skill and attempting to extract this component of the error term, it is difficult to claim the vulnerability variables are uncorrelated with the error term and that their coefficients are unbiased. Given the likely correlation between skill and enterprise choice and skill and several vulnerability measures, controlling for skill is essential to derive clean statements about vulnerability as a factor in entrepreneurial choice.

The most standard observable proxy measures for skill are education and experience (Paulson, Townsend and Karaivanov 2006, Gine and Townsend 2004). For education I use dummy variables for three categories of educational attainment by the entrepreneur in 1997; primary school or less[42], between primary and secondary school, and anything 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 education and experience values are presented in table 3.

4. Determinants of Project Choice

I now use the ACP data to test the theoretical prediction of a negative relationship between the amount of resources dedicated to the risky enterprise (θ) and vulnerability (φ).

4.1 Microenterprise Income

Average microenterprise income and the standard deviation of microenterprise income are the main measures of θ, and both are estimated as linear functions of household characteristics, enterprise characteristics, skill and vulnerability, which are outlined below. Average values are presented in table 3.

1) Household controls (*HC*) include: a dummy variable if informant is a woman, the age of the key informant, as measured in bins[43], the dependency ratio, the total number of working adults in the household, and whether or not the entrepreneur was hit with a shock in the past two years[44].

[41] Jovanovic (1982) presents a model in which individual entrepreneurs do not know their actual skill endowment and receive noisy signals of their skill endowment based on the cost of operating the enterprise.
[42] This is the left out group
[43] Entrepreneurs were divided into four age categories: less than 25, between 25 and 40, between 40 and 60, and older than 60. The 25-40 group is the left out category, as the goal is to see if younger and older cohorts behave differently than entrepreneurs in the "middle age" category.
[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) Shocks include robbery, death or severe illness, job loss, and reduction or loss of income.

2) Enterprise controls (*EC*) include: the number of enterprises operated by the household, a dummy if any enterprise is informal, and the type of enterprises based on nine different categories, measured by dummy variables if a household has an enterprise in a certain category.
3) Vulnerability measures include: a dummy variable if the household has title to their home, a dummy if the household has property in addition to the main residence, a dummy for savings, a dummy if the household is occupied by a married or cohabitating couple, and the tenure of the main entrepreneur in Lima.
4) Skill measures include: a dummy variable if the entrepreneur has secondary education, a dummy variable if the entrepreneur has beyond a secondary education[45], and the maximum number of years any enterprise of the household has been in operation.

The first θ measure, average enterprise income, is estimated as a linear function of the variables outlined above:

$$AverageEnterpriseIncome_i = a + \beta_1 EC_{ti} + \beta_2 HC_{ti} + \beta_3 Vu\ln erability_{ti} + \beta_4 Skill_{ti} + \varepsilon_i \quad (1)$$

where t=1997 or 1999.

Results of OLS estimation of (1) are presented in the first two columns of table 6. Column (1) contains results using 1997 values of the explanatory variables, while column (2) contains results using 1999 values of the explanatory variables, with the exception of age, education and experience, which do not change meaningfully over the two year period. Of the two sets of explanatory variables the 1997 values are preferable because they may better control for endogeneity stemming from reverse causality (enterprise income may impact vulnerability and skill measures). While the 1997 values do not eliminate all endogeneity problems, they are preferable to the 1999 values. In the estimations 1999 values are presented for comparison purposes only.

Estimation of (1) using the 1997 values finds, in line with the theoretical predication, a negative relationship between vulnerability and average microenterprise income. All of estimated coefficients for the vulnerability measures are positive, meaning that households that are less vulnerable, because they have savings, home ownership, other property, a spouse or partner, more time in Lima and higher wealth, have higher average enterprise

[45] Having a primary education or less is the left out group

income. Of these measures, other property and savings have the highest estimated coefficients, associated with a 3,347 soles and 1,947 soles increase, respectively, in enterprise income. Two vulnerability measures, other property and net household wealth, are significant at the 5% level. It is important to note that while I attempt to control for skill using observable measures, it is still possible the coefficients on the vulnerability measures are upwardly biased due to unobservable factors, principally the portion of skill not picked up by education and experience. However, to the extent the observables capture skill and the vulnerability measures capture vulnerability over other factors, the results provide positive evidence that lower vulnerability is associated with higher average microenterprise income.

For robustness I re-estimate (1) using only 1999 enterprise income as the dependent variable. This is done to address concerns that 1997 income might have a causal impact on or be jointly determined with many of the right hand side variables, principally several of the vulnerability measures. If this is the case removing 1997 income from the left hand side might eliminate some of the endogeneity bias.

$$EnterpriseIncome_{i,1999} = a + \beta_1 EC_{1997,i} + \beta_2 HC_{1997,i} + \beta_3 Vu\ln erability_{1997,i} + \beta_4 Skill_{1997,i} + \varepsilon_i \qquad (2)$$

Results of OLS estimation are presented in columns (3) and (4) of table 6. Column (3) corresponds to 1997 values of the explanatory variables and column (4) corresponds to 1999 values.

The general results do not change significantly when 1999 enterprise income is used instead of the average value over 1997 and 1999. The coefficients on all of the vulnerability measures expect Time in Lima remain positive, and wealth remains significant at the 1% level. In most cases the size of the coefficients on the vulnerability measures increases, suggesting that simultaneity bias, if anything runs in the opposite direction. The key differences are that the coefficient on Time in Lima becomes negative and other property ceases to be significant at the 10% level. After trying to control for potential reverse causality bias by using 1999 income as the dependent variable, we still find a positive relationship between all but one of the vulnerability measures and enterprise income, and in most cases, the estimated coefficients increase. Overall these results are weaker, but to the extent I've controlled for the confounding effects of skill, they still support the hypothesis a positive link between vulnerability and enterprise choice.

The second proxy of θ, the standard deviation of microenterprise income, is also estimated as a linear function of the observable characteristics outlined above.

$$S\tan dardDeviationEntIncome_i = a + \beta_1 EC_{ti} + \beta_2 HC_{ti} + \beta_3 Vu\ln erability_{ti} + \beta_4 Skill_{ti} + \varepsilon_i \quad (3)$$

Results of OLS estimation are presented in columns (5) and (6) of table 6. Column (5) corresponds to estimation using 1997 values of the explanatory variables, while column (6) corresponds to estimation using 1999 values.

The estimation results are less strong that those for average enterprise income. The predictive power, as evidenced by adjusted R^2 values, declines and the coefficients on only three of the vulnerability measures, other property, savings, and net wealth, remain positive. Of the vulnerability measures only net wealth remains significant at the 5% level. The negative coefficients on home ownership and marital status are interesting given that both were positively correlated with enterprise income. The negative correlation with standard deviation may stem from greater income diversification, if households occupied by a couple or with home title have more diversified income portfolios[46]. With efficient income diversification households can increase expected income while decreasing the variance, explaining the changed signs. Overall, the estimation of the standard deviation of enterprise income provides only weak evidence supporting the prediction of a negative relationship between vulnerability and θ. Only half of the vulnerability measures have positive estimated coefficients and only one, net wealth, is significant at the 10% level.

In sum, estimation of the two principle proxy measures of θ, average microenterprise income and the standard deviation of enterprise income, yields weak support of the theoretical prediction of a negative relationship between vulnerability and the portion of resources households dedicate to the risky enterprise. It is probable the lack of more compelling results stems from weakness in the proxy measures of θ. The expected income and standard deviation of the enterprise portfolio are excellent, intuitive proxies of the unobservable θ variable given basic portfolio theory. The calculation of these measures, however, is less than perfect when using only two periods of information across the wide expanse of two years. More robust measures of the enterprise portfolio would be derived from longer panel data, and such measures may yield more conclusive evidence on the

[46] A positive link between home ownership and income diversification follows empirical evidence from Field (2003), who finds that the titling program in Peru enabled household members to move into the workforce outside the home.

determinants of enterprise choice. Until such data become available, however, the ACP data provide some evidence of a relationship between vulnerability and enterprise choice.

4.2 Primary Enterprise Sales

For completeness I repeat the above analysis using average monthly sales and the standard deviation of monthy sales for the primary enterprise as alternative measures of θ. I estimate both as linear functions of the same observables outlined above. Results of OLS estimation are presented in table 7. Columns (1) and (2) contain results for average monthly sales. Columns (3) and (4) contain results for the standard deviation of monthly sales.

One notable difference is the reduction in explanatory power when considering monthly primary enterprise sales. The adjusted R^2 falls to the range of 0.04, as opposed to 0.17 for average microenterprise income. Beyond this the results are similar to and more supportive of the theoretical predictions than those from microenterprise income. For average month sales all of the 1997 vulnerability measures have positive coefficients and other property remains significant at the 1% level. For the standard deviation of month sales, all of the estimated coefficients for the 1997 vulnerability measures are positive and other property is significant at the 5% level. If I have effectively controlled for entrepreneurial skill, the results mean lower vulnerability is positively associated with higher average sales and variance of sales for the primary enterprise. If monthly sales of the primary enterprise provide good proxy measures for θ, these results provide some evidence of a negative relationship between vulnerability and the allocation to a risky enterprise.

5. Implications for Microfinance

The results on the determinants of enterprise choice have strong implications for microfinance selection, if the choice of low yield/low risk projects means entrepreneurs generate insufficient surpluses to repay microfinance loans. In this case the determinants of enterprise choice are also the determinants of microfinance selection, and can help explain why many microfinance institutions face low penetration rates, especially amongst poorer households[47]. The prevailing assumption is that entrepreneurial skill drives microfinance selection[48]; only talented entrepreneurs apply for and are approved for microfinance loans. However vulnerability also may be an important factor in enterprise choice and of microfinance selection. If entrepreneurs choose lower yield projects because they cannot

[47] Shaw 2004, CGAP 2000

[48] Armendariz and Morduch 2005

take on the risk associated with higher yield projects, vulnerability may be an important determinant of non-participation in microfinance programs.

I explore this possibility by comparing the enterprise profiles of groups in the ACP data based on their microfinance status. Four groups emerge over the two year panel; those who have microcredit in 1997 and in 1999 (Still Have), those who had microcredit in 1997 but do not in 1999 (Dropouts), 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 1999 Sample into Four Groups

	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)

From the standpoint of selection the most interesting group is the Never Join; entrepreneurs who qualify for ACP loans but who choose not to seek out these loans[49]. In the subsequent analysis I focus on comparisons between the Still Have and the Never Join groups, the most extreme groups in the sample. Not only are these groups larger, they also should demonstrate the greatest differences in behavior. Additionally, by restricting the comparison to households whose microfinance status does not change, we eliminate the potential confounding effects of acquiring or losing microfinance credit over the two year period.

5.1 Differences in Microenterprise Income

To discern if enterprise choice varies across households with and without microfinance I compare the principal proxy measures for θ; average microenterprise income and the standard deviation of microenterprise income. If enterprise choice varies we should find significant differences in both measures across the Still Have and Never Join groups.

I start with simple mean comparisons of average enterprise income and standard deviation of enterprise income, presented in table 8. Mean values for both are noticeably higher for the Still Have group, and robust t-tests[50] (p-values for which are shown in table 9) reveal the difference to be significant at the 1% level. This suggests significant differences in enterprise choice exist. To take the analysis further I compare the distributions of the θ measures for each group. While mean comparisons are useful and necessary, they only tell

[49] Lack of knowledge about microfinance or ACP is not the driver of no-show behavior as 80% of the Never Join group says they are familiar with ACP specifically.

[50] Robust t-test used because variance of the distributions of microenterprise income differs across the two groups.

us about one moment of the distribution. More conclusive statements can be derived by tests of the entire distribution of θ measures across the two groups. The first step is to determine if the distributions significantly differ from one another, which is done using the Kolmogorov Smirnov test. The Kolmogorov Smirnov test constructs a statistic based on the largest vertical difference between the cumulative density functions of the two distributions, which is then used to test the null hypothesis of no difference in the distributions. P-values for Kolmogorov Smirnov tests of average enterprise income and the standard deviation of enterprise income are in table 9. In all cases the null hypothesis of equality can be rejected at the 1% level. The distributions of both θ measures differ significantly across the Still Have and Never Join groups.

The final step is to assess if the distribution of the θ measures for the Still Have group first order dominates the distribution for the Never Join group. A distribution A is said to first order dominate a distribution B if the cumulative density function for A (G_A) is less than the cumulative density function for B (G_B) at every point along the support [0, b]. That is, $G_A(x) \leq G_B(x)$ for $\forall x \in [0, b]$. Graphically this means the CDF for A always lies to the right of the CDF for B; at every x the percentage of distribution A that lies below value x is lower than the percentage of distribution B. If the Still Have distribution exhibits first order stochastic dominance over the Never Join distribution, at every possible θ a lower percentage of the Still Have group has an actual θ less than or equal to that amount than the Never Join group. For example, if the Still Have distribution of average income first order dominates that of the Never Join group, a larger percentage of the Never Join group has average incomes below a given threshold than the Still Have group, for every possible threshold. This means the distribution of average income for the Still Have group is shifted to the right and that θ values are significantly higher not just at the mean or the median, but along the entire range. First order stochastic dominance thus provides the strongest evidence of differences in enterprise choice across groups.

Comparisons of cumulative density functions for the Still Have and Never Join groups are shown in Graph 2a. The left hand panel shows CDFs for average enterprise income and the right hand panel shows CDFs for the standard deviation of enterprise income. For both there is clear evidence of first order stochastic dominance. The distribution for the Still Have group lies below that for the Never Join group at every point along the support. This result clearly indicates average and standard deviation of microenterprise income is

significantly lower for the Never Join group, which implies these entrepreneurs dedicate fewer resources to risky entrepreneurial activities than their counterparts with microfinance.

5.2 Differences in Month Sales for the Primary Enterprise

To complete the analysis I repeat the exercises above using month sales for the primary enterprise as the basis for θ. Results of robust t-test for mean equality and Kolmogorov Smirnov test for equality of the distribution are shown in the lower half of table 9. Graphic tests of first order stochastic dominance are shown in graph 2b.

The results using month sales for the primary enterprise are not as strong as those from total microenterprise income. For average month sales both the mean and the entire distribution are significantly different at the 1% level across the Still Have and Never Join groups. For the standard deviation of month sales, however, mean values do not significantly differ at any level. Furthermore there is no evidence of first order stochastic dominance for either average month sales or the standard deviation of month sales. The CDFs for the Still Have and Never Join group cross at points, making it impossible for one distribution to first order dominate the other. The Still Have distributions may exhibit second order dominance, but this is a weaker condition that provides less compelling evidence of significant differences in enterprise choice. Overall, there is less evidence that primary enterprise month sales differ across groups with and without microfinance. Given that enterprise choice likely occurs at the level of the enterprise portfolio as a whole, however, these results do not refute claims that enterprise choice varies across households based on their microfinance status.

It is important to note that comparison of the θ measures only attempts to show that enterprise choice differs across groups with and without microfinance. The analysis does not attempt to ascribe differences to a particular factor, such as credit access, skill or vulnerability. Given the difficulties in disentangling these effects and appropriately addressing endogeneity concerns, doing so is outside the scope of this paper. Nevertheless, establishing differences in enterprise choice is an important step in understanding the use of microfinance by poor microentrepreneurs. The differences in enterprise choice between the Still Have and Never Join group may be a function of factors other than the credit itself, in which case identifying these factors are pivotal in understanding credit use, or lack thereof.

6. Conclusion

This paper proposes consideration of vulnerability as a critical determinant of enterprise choice for poor, urban households. It argues that lack of entrepreneurial skill and credit may be insufficient to explain low productivity of many microenterprises because neither factor incorporates risk, a key consideration for poor households. Using a simple theoretical model I show that even after controlling for entrepreneurial skill, more vulnerable households are less willing to devote resources to high yield, high risk enterprises over low yield, safe alternatives. Using data from ACP, a large microfinance institution in Peru, I also find empirical evidence that more vulnerable households engage in lower yield and lower risk projects than their less vulnerable counterparts. The paper also argues that vulnerability may play an important role in determining who seeks out microfinance loans and who does not. Comparisons of enterprise choice across groups with and without microfinance find significant differences, in particular that households with microfinance engage more in high yield, high risk enterprises than households without microfinance. Given the link between vulnerability and enterprise choice, this implies vulnerability also may play a role in microfinance selection.

From a policy perspective distinguishing between drivers of enterprise choice is important if adoption of different enterprises determines where a household lies relative to the poverty line. If the path out of poverty lies in adopting high yield projects, it is crucial to understand why some households are unable to engage in opportunities that would increase expected income. Identification of the main barrier to high yield projects also helps guide an appropriate use for poverty reduction funds, with policy recommendations varying greatly across candidate explanations. Under a skill based model of enterprise choice the best use of funds is business development services, aimed at improving microentrepreneurs' business acumen. Under a vulnerability based model of enterprise choice the best use of funds is projects that improve households' ability to smooth consumption across adverse income shocks, through increased provision of consumption credit and insurance. Improved understanding of the barriers to entry into high yield projects is important for development practitioners and policy makers searching for the best way integrate credit access and skill training programs into poverty reduction agendas.

Within the literature on poor, urban households this paper represents an important first step in better understanding the determinants of enterprise choice. The analysis, however, is hindered by the limitations of the ACP data, specifically the small number of panel periods.

More observations across time are needed to better estimate the expected income and standard deviation of households' enterprise portfolios, the variables used to reveal enterprise choice in the absence of information on "safe" and "risky" projects. The measures from the ACP sample are decidedly imperfect and more comprehensive data would bolster the analysis of links between vulnerability and enterprise choice. Unfortunately long panel data on urban microentrepreneurs are not currently available, but in their absence the ACP data provide evidence that vulnerability plays an important role in enterprise choice.

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Table 2: Types of Credit Other Than Microfinance[51]

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[52]	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[53]	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[54]	194	70	58	136
% non-respondent	34.0%	34.3%	34.5%	39.0%
Average # non MFI debt sources	0.94	1.07	1.07	0.82
Mean debt outstanding, non ACP	1030.5	1269.0	1242.3	501.1
Mean debt outstanding ACP (1997 soles)	1,680.0	1,191.4		

[51] Question on sources other than microfinance not repeated in 1999 survey

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

[53] 79 HHs do not respond to these questions in the 1997 survey. I leave them as non-responses

[54] 62 HHs in balanced sample do not respond to these questions. I leave them as non-responses

Table 3: Summary Statistics

Mean Values	1997 Values[55]	1999 Values
Enterprise Characteristics, household level		
Average number of enterprises per HH	1.53	1.52
Informality		
All enterprises are informal	26.5%	33.8%
At least one enterprise is informal	48.4%	54.6%
Household Characteristics		
Hit by Shock in past two years	44.4%	57.1%
Age of Respondent	41.7 years	43.1 years
% Respondents that are women	60.8%	60.1%
Working Members of HH	3.36	3.40
Dependency Ratio	0.30	0.27
Vulnerability Measures		
Net Household Assets	8,996.7 Soles	9,416.7 soles
Have Savings	55.8%	46.9%
Own Home	80.8%	81.5%
HH has Other Property	13.5%	14.9%
Respondent married or equivalent	79.8%	76.7%
Time in Lima	28.4 years	30.4 years
Skill Measures		
Education of entrepreneur (% in each category)		
Primary & Below (left out group)	32.2%	30.0%
Secondary	48.3%	51.5%
More Than Secondary	19.5%	18.5%
Experience (max years of any enterprise)	8.06 years	9.50 years
Observations (N households)	520	520
Enterprise Characteristics, enterprise level		
Monthly Sales	3,861.5 soles	3,375.2 soles
Estimated Annual Sales	44,257.1 soles	41,773.4 soles
Time in operation	6.47 years	7.53 years
Net Enterprise Assets (by enterprise)	4,873.1 soles	6,325.0 soles
Total Enterprise Investment	2,593.0 soles	1,986.6 soles
Total employees per enterprise[56]	1.87	1.32
% enterprises with employees (not including entrepreneur)	72.3%	48.0%
Business Categories (% total enterprises)		
Food and Clothing	5.5%	6.7%
Manufacturing	3.9%	4.1%
Construction	2.2%	1.8%
Auto Repair/ Auto Parts Sales	5.2%	2.2%
Minor Retail and Wholesale	62.5%	60.5%
Hospitality	6.7%	7.5%
Transport	7.3%	9.9%
Services	4.5%	4.7%
Other	2.3%	2.5%
Enterprises in Sample (N)	786	759

[55] 1997 values inflated to 1999 prices. For 1997 and 1999, 3.36 soles= 1USD (Banco Central de Reserva del Peru)

[56] Employees do not include the entrepreneur. Workers=Employees + Entrepreneur

Table 4: Other Summary Statistics

Mean Value	1997 Values[57]	1999 Values
Income and Consumption		
Total Income	22.777.1 soles	22,775.4 soles
Total Microenterprise Income	13,310.6 soles	14,620.6 soles
Percent of Total	64.5%	65.4%
Income Per Adult Equivalent	5,731.1 soles	5,745.0 soles
Microenterprise income per adult equivalent	3,934.5 soles	3,809.1 soles
Essential Consumption per Adult Equivalent	4,702.6 soles	4,879.4 soles
Observations	518	518

Table 5: Proxy Measures for θ

	Mean	Median
Total Microenterprise Income		
Average Microenterprise Income	14,647.1	11,224.8
Standard Deviation of Microenterprise Income	5,218.5	2,511.4
Observations (N)	514	514
Sales, Primary Enterprise		
Month Sales of Primary Enterprise, 1997	4,944.3	1,981.5
Month Sales of Primary Enterprise, 1999	4,574.8	1,820.0
Average Month Sales of Primary Enterprise	4,602.1	2,183.3
Standard Deviation of Monthly Sales	1,953.1	554.8
Observations (N)	418	418

All values in 1999 Nuevo Soles

[57] 1997 values are inflated to 1999 prices. For 1997 and 1999 values 3.36 soles= 1USD (source, Banco Central de Reserva del Peru)

Graph 1: Breakdown of Enterprises by Category

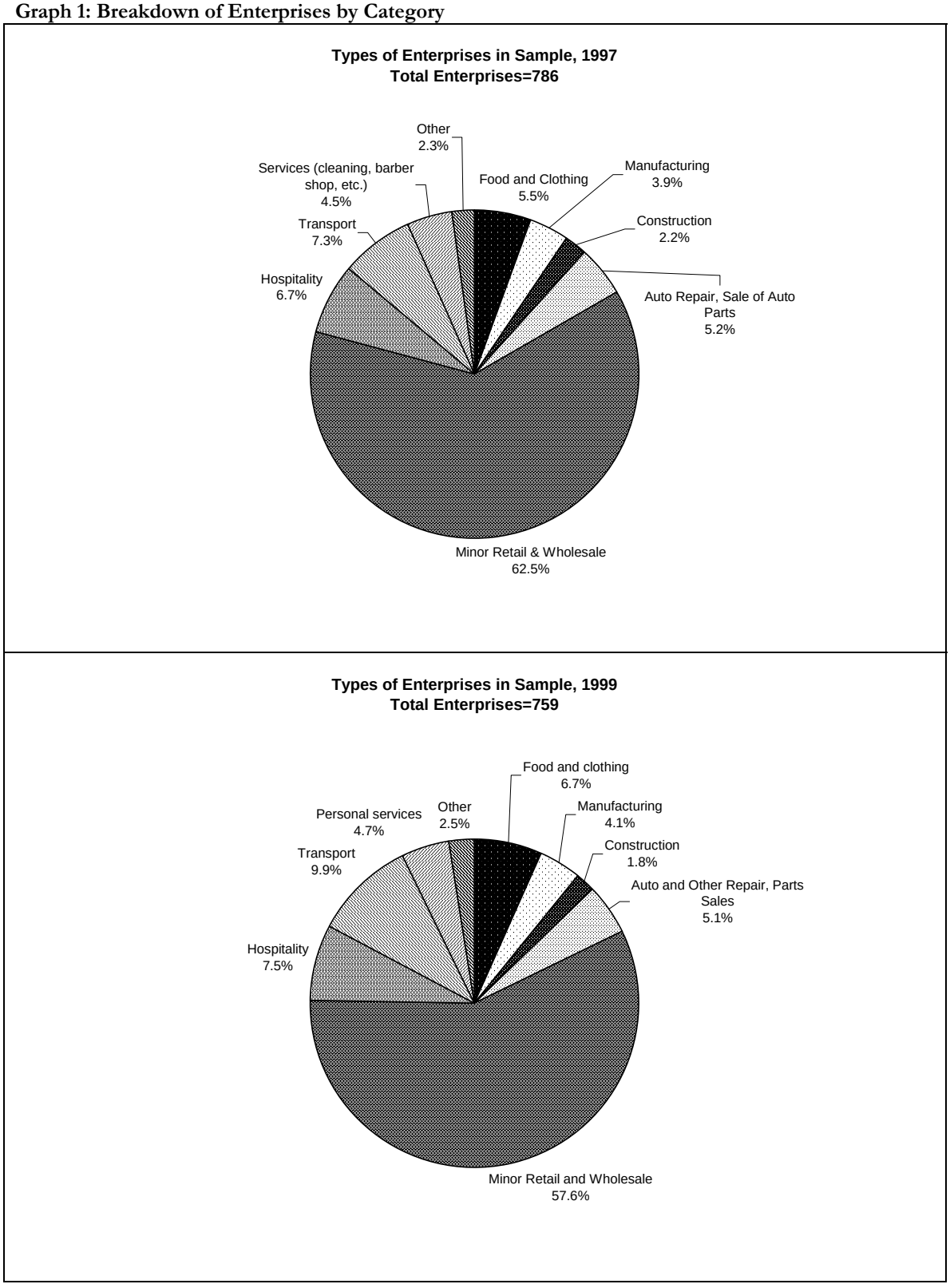


Table 6: Microenterprise Income

Dependent Variable=	Average Microenterprise Income		1999 Microenterprise Income		Standard Deviation of Microenterprise Income	
Values of Regressors:	1997	1999	1997	1999	1997	1999
	(1)	(2)	(3)	(4)	(5)	(6)
Vulnerability						
Own Home	154.4	-376.7	774.5	-970.6	-194.1	98.7
	(0.10)	(0.24)	(0.33)	(0.45)	(0.19)	(0.10)
Other Property	3346.6	-575.1	3347.1	-1696.1	1062.5	-857.2
	(1.99)**	(0.35)	(1.37)	(0.75)	(0.99)	(0.80)
Have Savings	1947.4	2807.0	924.9	4109.1	613.5	305.0
	(1.63)	(2.38)**	(0.53)	(2.52)**	(0.80)	(0.40)
Married or Equivalent	46.0	206.7	429.1	-196.5	-1248.7	-1277.1
	(0.03)	(0.14)	(0.19)	(0.10)	(1.25)	(1.36)
Time in Lima	9.1	20.2	-12.4	-34.2	-17.6	-35.3
	(0.17)	(0.38)	(0.16)	(0.47)	(0.51)	(1.03)
Wealth (Net HH Assets/1000)	428.9	390.7	555.7	558.3	234.5	190.0
	(5.44)***	(5.48)***	(4.84)***	(5.68)***	(4.64)***	(4.13)***
Skill						
Secondary Education 1997	836.8	446.4	-879.5	-2360.2	-3.14	-19.8
	(0.60)	(0.32)	(0.44)	(1.24)	(0.00)	(0.02)
Above Secondary Education 1997	274.0	844.9	-2312.5	-2516.9	-109.1	305.4
	(0.15)	(0.48)	(0.89)	(1.03)	(0.18)	(0.27)
Experience 1997	10.7	98.7	-56.8	-12.4	17.4	62.1
	(0.12)	(1.15)	(0.43)	(0.10)	(0.30)	(1.12)
HH & Enterprise Controls[58]						
Informant a woman	-3397.5	-3044.1	-4805.9	-4713.2	-1315.2	-978.6
	(2.60)***	(2.31)**	(2.53)**	(2.60)***	(1.57)	(1.15)
Informal Enterprise	-3245.4	-3435.1	-2647.1	-3201.7	-1289.4	-1342.0
	(2.31)**	(2.61)***	(1.30)	(1.78)*	(1.43)	(1.58)
Constant	9456.9	6703.7	9662.2	4094.8	3422.9	4872.9
N	477	479	480	482	477	479
Adjusted R^2	0.179	0.190	0.090	0.188	0.066	0.066

Absolute value of t statistics in brackets **significant at 5%; ** significant at 1%*

[58] Other controls include gender, age as captured by three dummy variables (less than 25, between 40 and 60 and above 60), dependency ratio, whether or not a household was hit with a negative shock in the past two years, the number of enterprises (significant at 5%), the informality status of enterprises, and dummy variables for the type of enterprise across 8 categories

Table 7: Month Sales of Primary Enterprise

Dependent Variable=	**Mean Monthly Sales**		**Standard Deviation Month Sales**	
Values of Regressors:	1997	1999	1997	1999
	(1)	(2)	(3)	(4)
Vulnerability				
Own Home	407.7	905.4	257.2	507.5
	(0.36)	(0.83)	(0.37)	(0.74)
Have Other Property	3970.5	295.9	1838.9	863.2
	(3.32)***	(0.25)	(2.45)**	(1.17)
Have Savings	953.5	352.0	261.1	100.6
	(1.16)	(0.43)	(0.51)	(0.20)
Married or Equivalent	247.6	-720.3	215.2	-626.0
	(0.23)	(0.71)	(0.32)	(1.00)
Time In Lima	54.2	31.3	37.7	31.3
	(1.45)	(0.83)	(1.61)	(1.34)
Wealth (Net HH Assets/1000)	80.9	124.0	34.6	59.1
	(1.53)	(2.50)**	(1.05)	(1.91)*
Skill				
Secondary Education in 1997	1058.4	779.8	649.1	537.5
	(1.10)	(0.80)	(1.08)	(0.89)
Above Secondary Education in 1997	1165.2	1291.8	173.8	274.8
	(0.92)	(1.02)	(0.22)	(0.35)
Experience of Entrepreneur in 1997			-49.7	
			(1.16)	
HH & Enterprise Controls[59]				
Entrepreneur a woman	-3282.5	-2779.2	-1628.0	-1474.1
	(3.50)***	(2.88)***	(2.76)***	(2.46)**
Informal Enterprise	-1414.4	-1854.0	-659.5	-651.5
	(1.55)	(2.01)**	(1.15)	(1.14)
Constant	6636.7	1305.6	3669.3	740.3
N	412	413	412	413
Adjusted R^2	0.074	0.058	0.036	0.034

Absolute value of t statistics in brackets **significant at 5%; ** significant at 1%*

[59] Other controls include: age as captured by three dummy variables (less than 25, between 40 and 60 and above 60), dependency ratio, whether or not a household was hit with a negative shock in the past two years, the number of working household members, the number of enterprises (significant at 5%), the informality status of enterprises, and dummy variables for the type of enterprise across 8 categories

Table 8: θ Measures for Groups Based on Microfinance Status

(mean values reported)	Still Have	Dropout	Join MFI	Never Join	ANOVA p- value
Microenterprise Income					
Microenterprise Income 1997	17,579.9	16,221.9	12,641.0	10.344.0	0.000***
Microenterprise Income 1999	18,216.1	13,145.4	15.975.2	9,705.9	0.002***
Average Microenterprise Income	17,920.1	14,683.7	14,308.1	10.046.5	0.000***
Standard Deviation of Microenterprise Income	6,523.1	5,527.0	4,538.5	3,443.3	0.004***
N	216	87	63	149	515
Primary Enterprise					
Monthly Sales 1997[60]	5764.3	6307.0	6046.3	3533.9	0.237
Monthly Sales 1999	4855.2	4245.6	5050.6	2268.2	0.038**
Mean Monthly Sales	5309.4	5312.5	5548.4	2901.0	0.045**
Standard Deviation Mean Monthly Sales	1925.5	2741.4	2696.6	1351.7	0.227
N	183	55	52	128	418

*difference significant at 10% level; **difference significant at 5% level; ***difference significant at 1% level

Table 9: Tests of Equality of Distributions of *θ* Measures

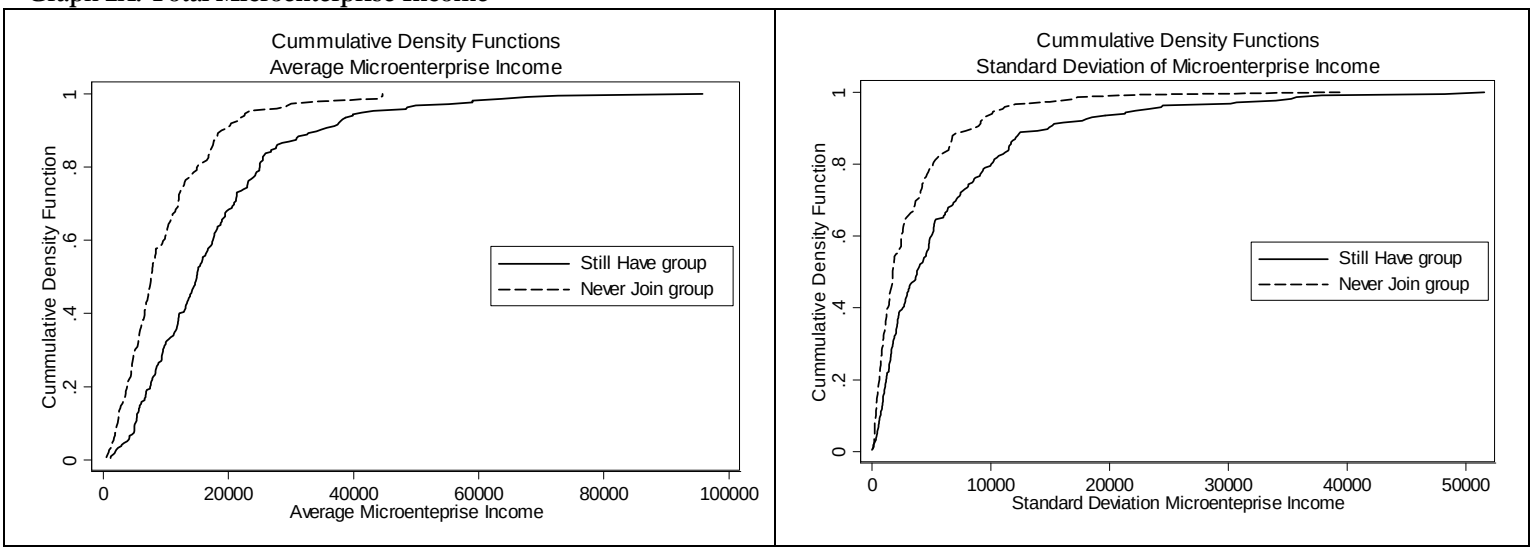
Comparison Group	θ Measure	Test	P-value of test statistic
<u>Microenterprise Income</u>			
Still Have vs. Never Join	Average Microenterprise Income	t-test for equality of means	0.000***
Still Have vs. Never Join	Standard Deviation of Microenterprise Income	t-test for equality of means	0.000***
Still Have vs. Never Join	Average Microenterprise Income	Kolmogorov Smirnov test for equality of distributions	0.000***
Still Have vs. Never Join	Standard Deviation of Microenterprise Income	Kolmogorov Smirnov test for equality of distributions	0.000***
<u>Month Sales of Primary Enterprise</u>			
Still Have vs. Never Join	Average Month Sales	t-test for equality of means	0.008***
Still Have vs. Never Join	Standard Deviation Month Sales	t-test for equality of means	0.250
Still Have vs. Never Join	Average Month Sales	Kolmogorov Smirnov test for equality of distributions	0.000***
Still Have vs. Never Join	Standard Deviation Month Sales	Kolmogorov Smirnov test for equality of distributions	0.000***

***Can reject null of equality at 1% level

[60] Adjusted to 1999 soles

Graph 2: Tests of First Order Stochastic Dominance for θ Measures

Graph 2A: Total Microenterprise Income



Graph 2B: Month Sales for Primary Enterprise