Can Low Returns to Capital Explain Low Formal Credit Use? Evidence from Microentrepreneurs in Ecuador.

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Abstract: Increasing evidence shows the use of formal credit, including microfinance, is very low amongst poor entrepreneurs. One explanation for this is the existence of production nonconvexities; poor entrepreneurs with low levels of capital generate returns to capital that are insufficient to cover borrowing costs. I test this theory using new, cross-sectional data on urban microentrepreneurs in Ecuador which asks specific questions about demand for credit at prevailing interest rates. Using semiparametric techniques I estimate returns to capital and find that entrepreneurs with low levels of capital generate monthly returns between 6.56% and 13.78%, while entrepreneurs at higher levels of capital generate returns between 1.03% to 4.25%. While I cannot rule out production noncovexities altogether, these results provide little evidence of their existence at low levels of capital. I also find that of the large number of entrepreneurs who say they have no demand for a loan with a 20%, a majority generate returns higher than the borrowing rate. This suggests the inability to afford prevailing interest rates is likely not a primary driver of low credit demand.

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Microenteprises, non-crop enterprises with 10 or fewer employees, are increasingly recognized as major generators of income and employment in the developing world. 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[2]. Recent surveys also reveal that the use of formal credit by microenterprises is very low. For example, in a 2004 survey of microentrepreneurs in Ecuador, less than 5.6% report using formal credit to start their enterprises and less than 2% report using formal credit for on-going operations. In many cases low formal credit use exists despite efforts to increase access, particularly in the form of microfinance. Indeed, many microentrepreneurs remain unserved by microfinance institutions despite rapid expansion of the industry. For example, in Kenya and Tanzania it is estimated that only 1% of all microentrepreneurs have any type of microcredit (CGAP, 2000). In Peru, the estimate is 5% (Berger, 2003), in Brazil the estimate is 2% (BNDES, 2002), and in Bolivia, one of most penetrated microfinance markets in Latin America, the estimate is only 28% (IDB, 2004).

One explanation for low credit use is that poor entrepreneurs generate returns to capital that are lower than the cost of borrowing. They simply can't afford formal credit at prevailing interest rates. This explanation corresponds with the existence of nonconvex production technologies, in which returns to capital are low at low levels of capital and increase only after capital rises above a certain threshold. Entry costs for certain types of enterprises, for example, are one cause of nonconvexities[3]. In the presence of nonconvexities poor entrepreneurs can be shut out of credit markets as they lack the capital to meet collateral requirements and the returns to cover borrowing costs. Several theoretical papers have shown that in the presence of production nonconvexities credit constraints prevent households from engaging in high yield enterprises (Banerjee and Newman 1993, Lloyd-Ellis & Bernhardt 2000). The result is a poverty trap as poor entrepreneurs lack the means to either borrow or save their way into higher levels of capital and thus higher earnings.

While there is some empirical evidence that financial constraints prevent entry into entrepreneurship and some enterprises from reaching an efficient scale (Paulson and Townsend, 2005), recent work on returns to capital for poor entrepreneurs finds little evidence of production nonconvexities at low levels of capital. For example, McKenzie and Woodruff (2006), using survey data on microentrepreneurs in Mexico, find returns to capital in the order of 15% per month for

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

[3] For example, nonconvexities would arise if it were necessary to acquire certain types of machines, vehicles, or bulky inventory to generate high returns.

capital levels below $200. Udry and Sanagol (2006) find returns in the informal sector in Ghana that range from 30% to 250% a year, depending on the technology. Finally, Woodruff, McKenzie and del Mel (2007), using experimental data from Sri Lanka find real returns in the order of 5.7% a month for low levels of invested capital. This suggests that many poor entrepreneurs generate returns to capital that are well above formal borrowing costs and would be able to either borrow or save their way into higher levels of wealth and income.

This paper contributes to the debate over the existence of production nonconvexities and their role in formal credit use using new cross-sectional survey data on microentrepreneurs in Ecuador. The data, a product of the SALTO Ecuador project, can contribute uniquely to the debate for two reasons. The first is that they are representative of all urban microentrepreneurs in Ecuador, reducing some concerns about external validity that arise with experimental data and allowing for more general statements about credit behavior. The second is that because the SALTO Ecuador project's main goals were to understand microentrepreneurs' access to and use of formal financial services as well as constraints facing the microfinance industry, the survey includes extensive questions on the use of and demand for formal credit. In particular, the survey asks entrepreneurs if they would be interested in a hypothetical loan at prevailing interest rates, a question that helps gauge demand. These responses, when linked with information about formal credit use and returns to capital, can shed more light on the role production nonconvexities play in determining formal credit use.

I estimate returns to capital for Ecuadorian microentrepreneurs using semiparametric techniques and find results are very similar to the works cited above. For entrepreneurs with capital between $0 and $1000, I find monthly returns between 6.6% and 13.8%. This translates into annual returns, on a uncompounded basis, between 78.7% and 165.4%. For the poorest entrepreneurs, those with capital of $100 of less, I find average monthly returns of 13.5%, approximately 162.0% annually. I also find more moderate returns at higher levels of capital. Estimated, monthly returns for entrepreneurs with capital between $1000 and $6000 range from 1.0% to 4.3%. While I cannot rule out production nonconvexities altogether, these results provide little evidence of them at low levels of capital.

The results also show that many entrepreneurs generate returns that are well above standard microfinance borrowing rates. I compare the estimated returns to capital to a threshold amount (1.667%) needed to generate a 20% annual return, close to the median interest rate charged by microfinance institutions in the sample, and find that all of the entrepreneurs with capital between

$0 and $1000 and 94% of entrepreneurs with capital between $1000 and $8000 generate returns above the threshold. Although we don't know how returns vary month to month and thus cannot construct risk adjusted returns, the estimates suggest that a large number of entrepreneurs in the sample likely can afford available microfinance credit.

Despite the high estimated returns to capital, however, almost half of the sample has no demand for a hypothetical loan at a 20% annual interest rate. The majority say that the main reason they don't want the loan is that the 20% interest rate is too high. While lack of demand could reflect availability of other external and internal funding sources, responses to other survey questions suggest this is not always the case. For example, close to one-fifth of entrepreneurs with no demand for the hypothetical loan cite lack of working capital finance as the major problem facing their firm, and about 45% of these list no other sources of credit. 34% of entrepreneurs with no demand for the loan have never had a formal loan, have no supplier credit and have no savings. While this is not sufficient to rule out credit constraints, the responses suggest that for many of the entrepreneurs a need for short-term credit exists, even if the demand for the hypothetical loan is not there.

In terms of the ability to "afford" microfinance credit, I find that a majority of entrepreneurs with no demand for the 20% loan and a majority of those who say they don't want it because the interest rate is too high, likely generate returns above the borrowing rate. Although these returns are not adjusted for risk and while I cannot rule out cases where entrepreneurs exit formal credit markets because they feel they will be rejected due to unobservable traits, like entrepreneurial skill, the lack of demand for microloans by many microentrepreneurs who seemingly can afford them indicates a degree of voluntary exclusion. Indeed, one of the conclusions of the authors of the SALTO survey is that "perhaps the most important challenge to MFIs in Ecuador is to overcome the microentrepreneur's resistance to using credit." (Magill and Meyer 2005) The results indicate that low returns to capital probably are not a significant cause of low formal credit use and that efforts to increase use amongst poor entrepreneurs may require more than making loanable funds available.

The paper proceeds as follows. Section II describes the data. Section III describes the semiparametric and parametric techniques used to estimate returns to capital and presents estimates for the entire sample. Section IV further investigates the reasons for low demand for formal credit. Section V includes robustness checks for the general estimates. Section VI concludes.

Section II: The Data

The data used in this paper come from the SALTO Ecuador project[4], a cross-sectional survey of Ecuadorian urban microentrepreneurs conducted from March to August 2004. The survey is nationally representative of all urban microentrepreneurs in Ecuador and contains over 17,000 individuals, an estimated 3.8% of urban microentrepreneurs in the country. The purpose of the study was to provide information about the characteristics of the microenterprise sector, particularly use of formal financial services. The main goals were "to understand the extent to which microentrepreneurs have access to and use financial services, identify constraints microentrepreneurs face in accessing formal sector financial services, and provide a framework through which donors and microfinance institutions could plan more effective programs and expand outreach." (Magill and Meyer 2005) As such the survey contains extensive questions about knowledge of formal lenders, use of these institutions, and demand for loans at prevailing interest rates. This makes the dataset useful for drawing general conclusions about formal credit use amongst poor entrepreneurs and how use might be linked to returns to capital.

In the analysis I restrict attention to microentrepreneurs between the ages of 18 and 65. I also trim the data to remove firms whose profits and/or capital stock were more than 2 standard deviations away from the mean were removed. This left a sample of 12,036 microenterprises[5]. Of these, 49.4% were owned by women and 66.0% were informal. 21.0% have full time employees and 10.9% part time employees[6]. Approximately 68% of these employees are family members. The majority of enterprises are in the retail sector and likely have high working capital needs in the form of inventory. The median business duration is 5.8 years and roughly one-fifth of the enterprises are new, with durations of 2 years or less. Of entrepreneurs with new businesses, only 23% say they operated another enterprise prior to the current one. The majority moved into entrepreneurship from wage labor or unremunerated household work, reflecting a high level of entry into the microenterprise sector.

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[4]See www.salto-ecuador.com for the data, documentation, and details of the survey. SALTO stands for Strengthening Access to Microfinance and Economic Liberalization.

[5] Considering only entrepreneurs age 18-65 removes 1,172 observations. Removing enterprises with monthly profits more than 2 standard deviations away from the mean removes 2,774 observations. Removing enterprises with enterprise assets more than 2 standard deviations away from the mean removes another 521 observations. Another 763 are removed because they have enterprise assets greater than $8,000. Missing observations on the regressors removes an additional 486 observations.

[6] This includes paid and unpaid part-time and full-time employees. Unfortunately the SALTO survey does not ask respondents to outline which employees are paid and which are unpaid, nor how many hours employees spend at the enterprise each week.

The key variables of interest for the analysis are profits and capital[7]. For profits entrepreneurs are asked to report the monthly income the household receives from the enterprise in question. Summary statistics, cited in US dollars, are presented in table 1. The median monthly profit is $160, approximately $1,920 a year, while the average monthly profit is $222.2, approximately $2,666 a year. For reference, the World Bank estimated that average per capita income in Ecuador in 2003 was $1,790, slightly below that of the median urban microentrepreneur[8].

For capital entrepreneurs are asked to give the approximate dollar value they have invested in four categories: vehicles and machinery; equipment and tools; merchandise or inventory; and furniture, installations, other adaptations. Total capital is the sum of these four categories[9]. Entrepreneurs are asked only to list assets used in the enterprise, although given that many entrepreneurs operate in their homes, some mixing of household and enterprise assets likely occurs. While entrepreneurs were also asked the value of land, given the urban nature of the sample (only 5% of entrepreneurs report land values), the greater chance of misvaluation given shallow land markets, and greater potential for mixing of household and business uses, I do not include land in the total values for capital. In general the SALTO data provide less detail on capital than other surveys, principally the Mexican National Survey of Microenterprises (ENAMIN). Dissimilar to the ENAMIN survey, entrepreneurs are not asked about the ownership status of the assets, making it impossible to distinguish between owned and rented capital. They are also not asked to report the current resale value of each asset, leading to greater concerns about measurement error in the capital values. The trade-off, however, is more information about formal credit use. The concern about measurement error with capital stock values is addressed in Section V.

Information on the distribution of capital stock values and the values as a percentage of monthly earnings is provided in table 1. The overall median capital stock is $500. This is 3.12 times general median monthly profits, implying that an entrepreneur generating a median level of monthly profits would be able to finance a capital purchase of $500 in 3.12 months. Table 1 also illustrates large differences across industries. For example, the median capital stock in the transportation industry is more than ten times that in the hospitality industry (restaurants, food stalls, lodging) and

[7] By the time of the survey Ecuador had dollarized, so all values are quoted in USD.
[8] In 2001 the World Bank estimated that average monthly labor income in the informal sector was $147.8 for independent workers and $122.80 for employees (Magill and Meyer). If we account for inflation of 10%, this means that the average microentrepreneurs is likely slightly better off than the average wage laborer.
[9] While the SALTO survey does not explicitly separate owned and rented capital, given the way the question is asked, it is doubtful entrepreneurs included rented capital in the total value.

almost five times that in the retail industry[10]. Capital for transportation also takes much longer to finance. It takes an entrepreneur earning the median amount in transportation more than a year to self finance the median amount of capital. This compares to 1.10 months for an entrepreneur in the hospitality industry and 2.5 months for an entrepreneur in retail. On the whole, however, capital stocks are not a large percentage of monthly earnings. For most industries entrepreneurs in the 10th earnings percentile could self-finance capital stock purchases in the 25th percentile in less than half a year. While these calculations do not account for household uses of microenterprise profits and potential difficulties in saving, it implies that barriers to entry for most types of enterprises are low.

Table 1: Capital Stock Distribution

							10th Percentile Earnings		Median Earnings	
		Percentiles of Owned Capital Stock (US$)					Capital Stock Percentile		Capital Stock Percentile	
Industry	N	10th	25th	Median	75th	90th	10th	25th	25th	50th
Construction	147	40	100	600	1,500	4,000	0.33	0.83	0.33	2.00
Manufacturing	759	115	500	1,500	3,000	5,500	1.44	6.25	2.08	6.25
Personal Services	473	7	70	400	1,750	3,744	0.25	2.50	0.58	3.33
Professional Services	1,425	15	150	400	1,100	3,000	0.68	6.82	1.25	3.33
Repair	632	100	400	1,000	2,500	4,800	1.25	5.00	2.00	5.00
Hospitality	1,357	10	45	220	800	2,500	0.20	0.90	0.23	1.10
Retail and Wholesale	6,572	30	100	400	1,210	3,000	0.75	2.50	0.63	2.50
Transportation	671	20	200	2,510	5,000	7,000	0.25	2.50	1.00	12.75
All Industries	12,036	20	120	500	1,600	4,000	0.50	3.00	0.75	3.12

[10] This includes small kiosks, market stalls, and street vendors selling things other than food, among others.

II.B: Formal Credit Markets and Formal Credit Use

The SALTO project was designed to gather information about the use of microfinance services, mainly credit, and examine challenges facing the industry in Ecuador. At the time of the survey there were 36 regulated institutions in Ecuador that offered microloans[11], including public sector development banks, private sector banks with microfinance programs, financieras[12], credit unions, and non-governmental organizations, which include smaller MFIs. One of the institutions, Banco Solidario, is one of the largest MFIs in Latin America and, at the time of the survey, had over 100,000 clients[13].

Entrepreneurs in the sample who received microloans in the past year from these institutions provide information about the structure of typical loans. Terms ranged from one month to 96 months, with the majority of loans having a term of one year or less. 75% of the repayment schedules were monthly, while 20% were either weekly or biweekly. Thus similar to most microfinance loans, the credit offered is largely short term and requires frequent repayment. Most of the microloans are individual rather than group loans, reflecting a trend in the microfinance industry towards the latter. Annual interest rates ranged from 10% to 70%, with the median interest rate equal to 17%. Median loan size was $1000, which is twice the size of the median capital stock for the entire sample, but only half the size of the median capital stock for entrepreneurs who have ever used microcredit[14].

What quickly emerges from the data is that the use of formal credit by microentrepreneurs is very low. Only 5.6% of entrepreneurs in the trimmed sample report using formal loans to start their business and only 1.9% list formal credit as a major source of current enterprise financing. Microentrepreneurs report largely relying on personal savings and retained earnings to finance their businesses. Overall 27.5% of entrepreneurs have ever had a formal loan. In the past 12 months only 15.5% of entrepreneurs applied for a loan, with over 80% applying to only one institution[15]. Of

[11] Microcredit is defined by the Ecuadorian Bank Superintendence as a small loan not backed by regular income like a salary.

[12] "Regulated financial intermediaries that have lower capital requirements and lack some of the powers of commercial banks" (Magill and Meyer, pg. 87)

[13] Client information for Banco Solidario and other Latin American MFIs as of year-end 2004 (www.themix.org).

[14] Unsurprisingly those who have had a formal loan are wealthier than those who never have. The median capital stock for the 3,817 entrepreneurs who have ever had a formal loan is $1900. The median amount for the 9,984 entrepreneurs who have never had a formal loan is $400; a significant difference.

[15] Of those who applied for a loan in the past year approximately 21% did not receive the full amount they requested. 0.01% were rejected outright, receiving $0. The rejection rate could be higher, however, as 17 individuals who applied for a loan last year did not answer questions about the amount requested and the amount received. We also don't know if other entrepreneurs who applied and were rejected elected not to provide this information to interviewers.

those who have ever had a formal loan, 56% report applying for one in the past 12 months, showing that formal credit is not an ongoing part of operations for many firms[16]. The most common reasons given for not having applied for a loan in the past year are: a lack of need; desire to not become indebted; and interest rates that were too high. The low use of formal credit led the survey authors to conclude that "in spite of the large expansion of the Ecuadorian microfinance industry in recent years, it has had little impact on most microenterprises." (Magill and Meyer 2005)

The survey also attempts to gauge demand for microcredit by asking entrepreneurs if they would be interested in a loan at a 20% annual interest rate, close to prevailing rates. 55% of the sample said "yes". 45% of the sample said "no". Over half of the entrepreneurs who have no demand for the loan say the main reason is that the 20% annual interest rate is too high. This is followed by not wanting to indebt oneself (30.3%) and, at a distant third, no need (7.9%). The order of responses suggests that some entrepreneurs feel they cannot "afford" the loan. The goal of this paper is to assess whether or not inability to afford formal credit explains the low level of use.

Section III: Estimating Returns to Capital

III.A. Estimation Strategy

To estimate returns to capital it is necessary to model the relationship between profits and capital. Let π_i = the monthly earnings of microenterprise *i*, K_i = the level of capital used by microenterprise *i*, and X_i = a vector of other factors that influence enterprise earnings, including characteristics of the entrepreneur and the enterprise. To allow returns to vary across the capital stock I leave the functional form of capital unspecified, letting profits take the following partial linear form[17]:

$$\pi_i = X_i'\beta + f(K_i) + \varepsilon_i \quad (1)$$

Estimation of the first derivative of the capital function, $\hat{f}'(K_i)$, provides estimated marginal return to capital.

There are two ways to proceed. The first is to leave the functional form of $f(K_i)$ unspecified and estimate (1) using semiparametric techniques. The advantage of this strategy is that we can remain agnostic about what returns to capital look like. By allowing $f(K_i)$ to assume any form (with minor restrictions), we can see if and how the marginal return to capital

[16] This is interesting given that surveyed entrepreneurs say the main use for formal loans is working capital, which cannot always be financed via internal funds or informal credit, requiring external finance from formal sources.

[17] Note that if capital enters the equation linearly, returns to capital will be constant at all levels of capital since f'(K) is just the constant β_K.

changes over the capital stock. The cost of increased flexibility, however, is precision as allowing the data to determine the functional form generates estimates with greater variance. As a result, it is useful to assume a functional form for $f(K_i)$, usually a higher order polynomial, and compare these estimates to the semiparametric ones. Specification tests can give guidance as to the appropriateness of one model relative to the other.

I start with the semiparametric model and estimate it using the two step differencing method of Yatchew (1997, 2003). The first step is to estimate the parametric component. This is done by sorting the data in increasing order by the variable that enters the model nonparametrically (capital), differencing the data by order *m,* and weighting the differences with weights $d_0, d_1, ..., d_m$.[18] Optimal differencing weights satisfy conditions that ensure that the nonparametric component of the model is differenced out as the sample size increases and that the transformed residual has variance σ_ε^2.[19] Following the differencing, equation (1) becomes:

$$\sum_{j=0}^{m} d_j \pi_{i-j} = \sum_{j=0}^{m} d_j \beta_1 x_{1,i-j} + \sum_{j=0}^{m} d_j \beta_2 x_{2,i-j} + \ldots + \sum_{j=0}^{m} d_j \beta_{W,i-j} + \sum_{j=0}^{m} d_j \varepsilon_{i-j} \qquad (2)$$

Where $x = 1,2,,,W$ are the *W* components of *X*. OLS estimation of (2) yields parameter estimates $\hat{\beta}_{diff}$. I use a differencing order of 4 and Yatchew's optimal differencing weights. This yields $\hat{\beta}_{diff}$ that achieve 88.9% efficiency relative to non differenced OLS estimates (Yatchew 2003).

Equation (1) is now rewritten using $\hat{\beta}_{diff}$ and estimated using nonparametric techniques[20].

$$\pi_i - X_i' \hat{\beta}_{diff} = f(K_i) + u_i \qquad (3)$$

I estimate (3) using the locally weighted linear regression method outlined by Fan. This estimates the unknown function's value at a given $K = K_0$ by running a weighted linear regression in an area around K_0. The weights are determined by a kernel while the area, and thus the number of

[18] There is also the restriction that the first derivative of nonparametric component be bounded by a constant, *L*. This ensures that for sequential Ks, the functional values are sufficiently "close".

[19] The differencing weights satisfy the following conditions: $\sum_{j=0}^{m} d_j = 0 \; ; \sum_{j=0}^{m} d_j^2 = 1.$ The first condition ensures that the nonparametric term is differenced out, given the restriction that the first derivative is bounded. The second condition normalizes the differenced error terms such that the variance equals that of the error term itself.

[20] The consistency of differenced parameter estimates allows for this transformation

observations in any given local regression, is determined by the bandwidth. Fan shows that locally weighted linear regressions are preferable to kernel smoothers due to boundary concerns.

To understand how local linear regression yields estimates of the function and its first derivative, consider some K_i in a neighborhood of K_0 [21]. A first order Taylor expansion of K_i around K_0 yields[22]:

$$f(K_i) \approx f(K_0) + f'(K_0) * (K_i - K_0) \tag{4}$$

Letting $f(K_0)$ and $f'(K_0)$ equal coefficients allows (4) to be written as:

$$f(K_i) \approx \beta_0 + \beta_i (K_i - K_0) \tag{5}$$

Let $\tilde{\pi}_i = \pi_i - X_i' \hat{\beta}_{diff}$ (the left hand side of (3)). Regressing $\tilde{\pi}_i$ on $f(K_i)$ yields estimates of the coefficients β_0 and β_1. The local nature of the regression comes from only using observations located within the bandwidth *h*. The kernel, *KER*, assigns each observation K_i within bandwidth *h* a weight depending on its distance from K_0. $\hat{\beta}_0 = \hat{f}(K_0)$ and $\hat{\beta}_1 = \hat{f}'(K_0)$ are thus the solutions to a local minimum problem, and the setup is weighted least squares.

$$\sum_{i=1}^{n} \left\{ \tilde{\pi}_i - [\beta_0 + \beta_1 (K_i - K_0)] \right\}^2 * KER_h (K_i - K_0) \tag{6}$$

To estimate (6) I use an Epanechnikov kernel. Optimal bandwidth is chosen using cross-validation (Yatchew 1998)[23]. Overall the local polynomial smoother is convenient because it yields direct estimates of $\hat{f}'(K_0)$ =the marginal returns to capital. Other smoothers that calculate local means necessitate finding the first derivative numerically, which generally produces noisier estimates.

For comparison I also estimate a parametric model, assuming a fourth order polynomial as the functional form for $f(K_i)$. Results are presented with those from the semiparametric estimation. A fourth order polynomial was chosen over fifth and third order polynomials because it

[21] This discussion follows Gutierrez et. al closely. The estimates are done using the locpoly command in Stata.
[22] Higher order local polynomials lead to higher order Taylor expansions. This also generates estimates of higher order derivatives of the function in question, f(K).
[23] Optimal bandwidth is critical in nonparametric estimation due to the inherent tradeoff between bias and variance in the estimators. Smaller bandwidths follow the data more closely, yielding less biased but more variable estimates. Larger bandwidths incorporate more observations in each estimate, providing less variable but more biased estimates.

performed better in specification tests[24]. This indicates that the fourth order polynomial fits the data better than the other polynomials.

III.B. Covariates

Before discussing estimation results it is necessary to outline the components of *X*, the variables that enter the model linearly. These are factors other than capital that influence enterprise profits and include characteristics of the entrepreneur and of the enterprise. For characteristics of the entrepreneur the difficulty is that the most important characteristic, entrepreneurial skill, is unobservable. Furthermore, given the cross sectional nature of the data and lack of good instruments, the most viable strategy is to control for skill using observable proxy measures. I start with education and experience, which are frequently used to measure skill (Paulson and Townsend 2005, Gine and Townsend 2004, McKenzie and Woodruff 2006). Education is measured by dummy variables for four categories of educational attainment by the entrepreneur; less than primary education, primary education, secondary education, and college education. Experience is measured by the amount of time the enterprise has been in operation and its square, along with the age of the entrepreneur and age squared. Finally, I include controls for marital status and for gender, as both may play a role in determining profits[25].

In addition to entrepreneur characteristics, I include labor used by the firm, measured by the total number of family and non-family full-time and part-time employees. The labor variables serve multiple purposes. The first is the need to control for labor in estimating profits, so as not to inflate returns to capital if there are complementarities between labor and capital. The second is that due to the high percentage of total employees who are family members (around 68%) and the fact that many family employees likely are unpaid, it is necessary to control for the returns to unpaid labor that may accrue to the entrepreneur in the form of profits. The third, which stems from literature on the size distribution of firms, is that total labor may measure entrepreneurial or managerial skill. For example, both Lucas (1978) and Jovanovic (1982) present models in which resources are allocated across enterprises according to managerial ability. In these models firms with more skilled entrepreneurs grow in size while those with less skilled entrepreneurs do not, driving the prediction

[24] The specification tests the following: under the null that the parametric model is the "true" model, the test statistic $V = (mn)^{1/2}(s^2_{res} - s^2_{diff})/s^2_{diff}$ follows a standard normal distribution. s^2_{res} = restricted estimator of the residual variance (parametric estimation). s^2_{diff} = differenced estimator of the residual variance (semiparametric estimation).

[25] McKenzie and Woodruff (2006) point out that marital status may pick up entrepreneurial skill, as research has shown that married male workers earn more, after controlling for other characteristics, than unmarried workers.

of a positive link between skill and firm size[26]. To measure returns to managerial ability other papers use total hours worked by paid employees (McKenzie and Woodruff (2006)). The SALTO data do not include information on whether or not employees are paid. I assume that all part time and full time employees who are not family members are paid and that these variables capture returns to managerial skill.

Finally, I control for the type of business, based on 8 categories, and for the province in which the enterprise is located. The baseline model (Model 1) includes all of the controls listed. Due to potential concerns that the controls for skill are insufficient I also consider two additional skill variables. These variables are based on the reasons entrepreneurs give for starting their businesses (McKenzie and Woodruff (2006)). One of the variables equals one if an entrepreneur says he/she entered entrepreneurship because of family tradition or because he/she can earn more than in wage employment. These responses likely indicate greater entrepreneurial skill. The other variable equals one if an entrepreneur says he/she entered entrepreneurship because there was nothing else available. This response likely indicates lower levels of entrepreneurial skill. The second model, Model 2, adds these additional skill measures to those in the baseline model.

III.C. General Estimation Results

I estimate returns to capital semiparametrically and parametrically, using a fourth order polynomial. Given that optimal bandwidth will vary depending on the sample size, I split the sample into a "low capital" group (capital between $0 and $1000) and a "high capital" group (capital values between $500 and $8000) and estimate returns separately for each. This allows greater focus on poor entrepreneurs with low levels of capital. The cutoff for the low capital group lies slightly below the average capital stock, which is $1238 for the trimmed sample. The cutoff for the high capital group lies at the median, which is $500.

The parameter estimates and standard errors for the covariates in X are shown in table 2. The standard errors for the semiparametric estimates are adjusted to account for differencing (Yatchew 2003) [27] and are greater than those from the parametric estimation. The parameter estimates, however, are similar across all of the models and generally follow intuition. For example, women have lower profits, on average, than men. Older, married and more educated entrepreneurs

[26] Lucas and Jovanovic present unconstrained models. Relevant barriers to the allocation of resources such as credit constraints or an urban equivalent to a harvest labor constraint do not apply.

[27] Standard errors are multiplied by $(1+1/2m)^{0.5}$ to account for the reduced efficiency of the differenced estimates (Yatchew 2003).

have higher profits than younger, unmarried and less educated entrepreneurs. Enterprises with more time in operation and more full time employees and part time employees who are not family members have higher profits. The estimated coefficients on employees and duration support the story that more profitable businesses are the ones that remain in operation and are the ones that grow over time. The additional skill controls have little impact on the values of the estimates.

Table 2: Parameter Estimates for the Linear Portion of the Model [28]

	Parametric Estimates				Semi-Parametric Estimates			
	Low Capital ($0-$1400)		High Capital($500-$8500)		Low Capital ($0-$1000)		High Capital($500-$8000)	
Noncapital variables[29]	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Owner a woman	-71.453	-73.265	-80.361	-80.761	-70.413	-78.772	-78.772	-79.185
	(3.680)	(3.689)	(5.886)	(5.883)	(3.903)	(3.917)	(6.256)	(6.255)
Owner has primary	11.879	12.156	15.007	15.113	9.911	10.282	22.935	22.688
education[30]	(8.400)	(8.387)	(20.731)	(20.715)	(8.789)	(8.781)	(22.142)	(22.129)
Owner has secondary	33.064	33.506	46.007	46.161	26.837	27.504	50.411	50.389
education	(8.679)	(8.669)	(20.862)	(20.847)	(9.110)	(9.104)	(22.294)	(22.280)
Owner has college	39.303	39.199	36.653	36.348	33.640	34.035	37.722	37.202
education	(10.058)	(10.043)	(21.632)	(21.615)	(10.610)	(10.601)	(23.085)	(23.071)
Duration of business	8.034	8.098	6.034	6.069	7.307	7.382	5.567	5.636
	(0.606)	(0.605)	(0.968)	(0.968)	(0.642)	(0.641)	(1.026)	(1.026)
Full time employees,	35.406	35.071	36.787	36.497	32.349	32.121	37.802	37.537
family	(3.089)	(3.084)	(3.888)	(3.889)	(3.362)	(3.359)	(4.124)	(4.123)
Full time employees,	58.726	58.360	46.621	46.700	58.291	57.898	46.264	46.457
nonfamily	(4.374)	(4.364)	(3.975)	(3.973)	(4.839)	(4.834)	(4.194)	(4.129)
Part time employees,	0.802	0.694	0.079	0.180	-1.753	-1.966	0.141	0.141
family	(3.948)	(3.941)	(4.793)	(4.800)	(4.374)	(4.370)	(5.077)	(5.074)
Part time employees,	30.861	30.227	20.707	20.262	26.550	25.852	22.904	22.410
nonfamily	(5.675)	(5.649)	(5.732)	(5.730)	(6.136)	(6.133)	(6.037)	(6.036)
Entered business to increase income/family	No	Yes	No	Yes	No	Yes	No	Yes
Entered business due to lack of better options	No	Yes	No	Yes	No	Yes	No	Yes
No. observations	8692	8692	6163	6136	8216	8216	6145	6145

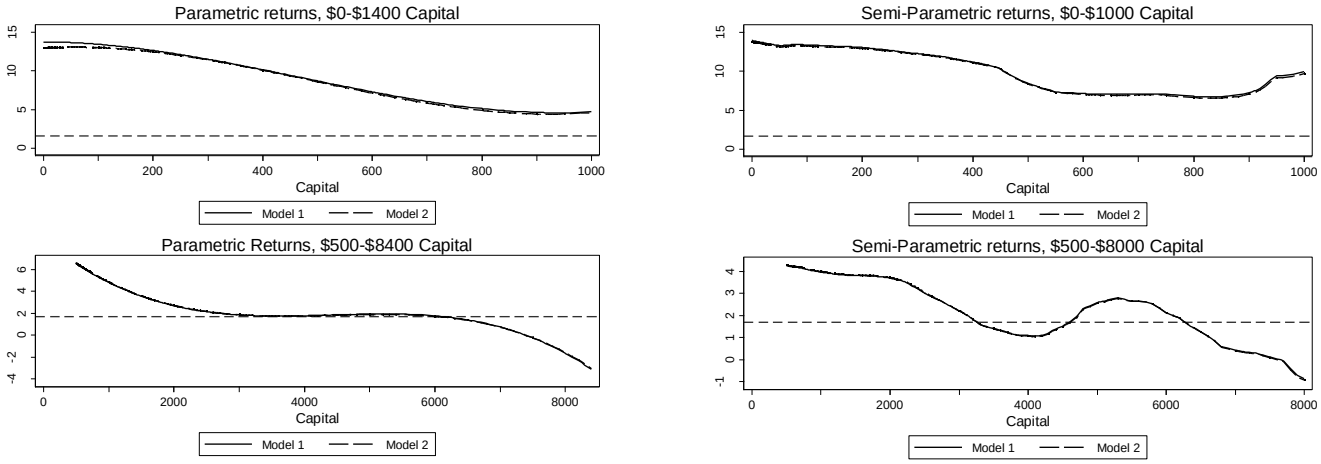
[28] Standard errors show in parenthesis. Estimators from the semi-parametric differenced equation are scaled by $(1+1/2m)^{0.5}$, as the standard errors are larger due to the differencing.

[29] Other covariates include marital status, age, age squared, age of business squared, business category fixed effects and province fixed effects.

[30] In differenced equation there is no constant, which means the left out group, no education, has a separate dummy variable. This group is absorbed in the constant term in the parametric, non-differenced estimation.

The estimated returns to capital from the parametric and semiparametric models are displayed in figure 1. A solid horizontal line is set at 1.667%, the monthly amount needed to generate an annual return of 20%, assuming no compounding[31]. This line distinguishes entrepreneurs who probably can afford a 20% interest rate and those who probably cannot. The nonparametric estimates are less smooth than the parametric ones, but the results generally lie within the same range and follow similar patterns. This implies that the fourth order polynomial is a decent approximation of the functional form for capital.

Figure 1: Estimated Returns to Capital



Several conclusions arise from the results. The first is that returns to capital are quite high for entrepreneurs with low levels of capital. For entrepreneurs with capital between $0 and $1000, semi-parametric estimates of model 2 find monthly returns that range from 6.56% to 13.78%. This implies approximate annual returns between 78.7% and 165.4%, assuming no compounding. Considering only the poorest group, entrepreneurs with capital of $100 or less, the average monthly return is 13.5%. These results are similar to those found by McKenzie & Woodruff (2006), Udry and Anagol (2006), and Woodruff, McKenzie and del Mel (2007) and provide further evidence that some poor entrepreneurs generate very high returns to capital.

The second conclusion is that returns are more moderate for higher levels of capital. For capital values between $500 and $8000, semiparametric estimates of model 2 find monthly returns

[31] Compounding would assume that entrepreneurs re-invest all monthly profits into the business. However, over 70% of entrepreneurs say that the first use of enterprise profits is for household expenses, and only 47% of entrepreneurs list re-investment as one of the three main uses of profits. Thus an appropriate benchmark for monthly interest rates would be one not based on compounded.

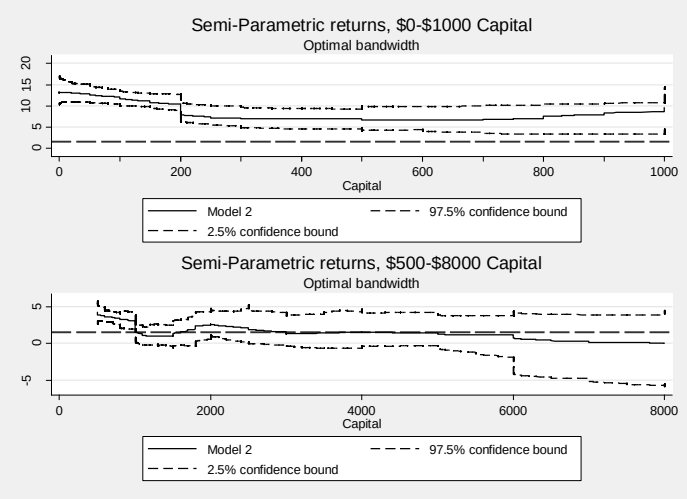
that range from -0.93% to 4.25%. This translates into approximate annual returns of 51.0% for the upper bound. Considering the group with capital between $1000 and $5000, monthly returns range from 1.03% to 4.25%. This translates into approximate annual returns between 12.4% and 51.0%. It is important to note, however, that the results do not provide evidence of diminishing returns to capital, as returns fall in certain ranges ($300-$500) and rise in others ($600-$1000). I can only say that returns are generally lower for the high capital group than the low capital one.

The third conclusion is that there is little evidence that production nonconvexities exist at low levels of capital. The highest estimated returns in the sample come from entrepreneurs who have capital of $100 or less, while the lowest returns come from entrepreneurs who have capital over $7000. Nonconvexities may still exist over certain ranges. For example, marginal returns are constant in the range of $500 to $900 and rise at $900, suggesting potential threshold effects. However, there is little evidence of their existence at low levels of capital. Many poor entrepreneurs generate returns that are well above borrowing rates, which means they should be able to either borrow or save their way into higher levels of capital. This provides little evidence that low marginal returns are a major cause of poverty traps for many poor entrepreneurs (although I cannot rule out the case of poverty traps caused by other factors).

The final conclusion is that a high portion of microentrepreneurs generate returns to capital above standard microfinance borrowing rates. All of the entrepreneurs in the low capital group and 94% of the entrepreneurs in the high capital group have estimated monthly returns above standard borrowing rates. This suggests that inability to afford formal credit is not a major driver of low formal credit use. I explore this issue more deeply in section IV.

Given the high variance associated with nonparametric estimates, it is useful to show the estimated returns to capital with confidence intervals. To do this I carry out 100 bootstrap replications of the semiparametric estimation of Model 2 and plot the 95% pointwise confidence interval with the original estimates. This is done separately for the low capital and the high capital samples and the results are shown in figure 2. The range for the estimates using the optimal bandwidth is wide, reflecting the high variance associated with nonparametric estimates. For the low capital group, however, the lower bound of the confidence interval lies above 1.667% for all of the observations. This provides further evidence that low returns to capital are not a dominant explanation for low formal credit use.

Figure 2: Estimated Returns with Confidence Intervals



Section IV: Demand for Formal Credit

This section examines links between returns to capital and formal credit use in more detail. The SALTO data are apt for exploring the links for two reasons. The first is that the data are representative of all urban microentrepreneurs in Ecuador, reducing some concerns about external validity that arise with experimental data. The second is that the survey includes questions about demand for formal credit at prevailing interest rates, allowing for some separation of supply and demand as determinants of credit use. This is important because oftentimes the researcher only sees the incidence of formal credit and does not know if low credit use is due to lack of supply (involuntary exclusion from credit markets), lack of demand (voluntary exclusion) or both (mutual exclusion). Voluntary exclusion is often ignored as a potential explanation for low credit use, but recent evidence shows that non-trivial numbers of potential microfinance borrowers sometimes have little interest in the loans (Johnston and Morduch, 2007), suggesting it should be considered. The information on demand for a hypothetical loan at prevailing interest rates can shed some light on voluntary exclusion from formal credit markets amongst Ecuadorian microentrepreneurs.

The SALTO survey attempts to gauge demand for formal credit by asking entrepreneurs if they are interested in a formal loan with a 20% annual interest rate, close to prevailing interest rates. If entrepreneurs say 'yes' they are asked how much they would want to borrow. If they say 'no' they are asked the reasons why. Almost half of the entrepreneurs (45%) say they are not interested in the loan. 54% of these entrepreneurs say the main reason is because the 20% annual interest rate is too high. This is followed by not wanting to indebt oneself (30.3%) and, a distant third, no need (7.9%).

The high percentage of entrepreneurs with no demand for the hypothetical loan is surprising given the assumption that many are credit constrained. Perhaps, however, many entrepreneurs are not, in fact, credit constrained and have no need for additional credit. Responses to other questions regarding financing sources and business needs, however, suggest this is not a compelling explanation. For example, 18% of those with no interest in the loan cite working capital constraints as a major problem facing the firm. 45% of these, in turn, have never had a formal loan, have no supplier credit, and have no savings. These entrepreneurs clearly appear credit constrained and we would expect greater demand for the hypothetical loan. Another example is that 34% of those with no interest in the loan have never used formal credit, do not have supplier credit and do not have savings. While this is not a comprehensive picture of credit available to these entrepreneurs (SALTO does not have information on loans from moneylenders, family and friends or ROSCAs), it is sufficient to suggest limited access to external or internal finance.

Table 3 provides more information on funding sources and working capital constraints for the group with no interest in the loan. I only consider the sample of entrepreneurs in the return to capital estimates. The SALTO survey does not have comprehensive questions of firm finance, but we do know if an entrepreneur has ever used formal credit, currently uses supplier credit (a major source of informal finance) and has savings, either formal or informal. These responses give an idea of the availability of external and internal finance and hint at whether or not credit constraints are binding. Since there may be differences across poorer and wealthier entrepreneurs, I divide the sample into two groups; those with capital below $500 and those with capital above $500. I also show separate results for retail enterprises, which need continual supplies of inventory and likely have a greater need for working capital finance than other types of firms.

Table 3: Entrepreneurs who do not demand hypothetical loan

	All Enterprises Capital		Retail Enterprises Capital	
	Below $500	Above $500	Below $500	Above $500
No Demand for 20% Interest Rate Loan				
Percent of total group (observations)	44.2% (2,855)	46.5% (2,599)	42.5% (1,631)	45.7% (1,315)
Of which:				
List lack of working capital finance as main problem facing firm	19.3% (552)	17.5% (454)	23.5% (384)	19.6% (258)
Have never had a formal loan	81.4% (2,138)	56.7% (1,432)	80.6% (1,195)	57.5% (727)
Did not apply for a formal loan last year	90.3% (2,579)	76.1% (1,978)	89.4% (1,459)	75.7% (996)
Do not have supplier credit	70.3% (2,008)	56.8% (1,476)	60.9% (993)	41.5% (546)
Do not have savings, formal or informal	78.3% (2,235)	50.9% (1,324)	77.9% (1,270)	52.3% (688)
Have never had a formal loan, do not have supplier credit or savings	46.1% (1,317)	21.5% (558)	38.5% (629)	16.3% (214)
Of those who cite lack of working capital as a major problem facing the firm				
% with no cited external or internal finance	44.4% (245)	20.9% (95)	40.1% (154)	15.5% (40)

The first thing to note is that while demand for the hypothetical loan is higher amongst poorer entrepreneurs than amongst wealthier ones, the difference is slight. 55.8% of the low capital group demands the hypothetical loan, as compared with 53.5% of the high capital group. Indeed, demand for the hypothetical loan differs very little across entrepreneurs at different levels of capital. For example, 52.7% of entrepreneurs with capital of $100 or less demand the loan, as compared with 50.3% of entrepreneurs with capital of $2000 or more, and 45% of entrepreneurs with capital of $5000 or more.

The second thing to note is that a surprisingly high percentage of entrepreneurs appear to have limited sources of funding. 46% of entrepreneurs with capital less than $500 and 23% of entrepreneurs with capital above $500 have neither formal credit, supplier credit nor savings. While these entrepreneurs could have financing from other informal sources, like family and friends, moneylenders, or retained earnings, the numbers suggest that ample financing sources do not explain low formal credit demand. This is particularly true for the entrepreneurs who cite a lack of working capital finance as the major problem facing the firm. 19.3% of entrepreneurs with low levels of capital and 17.5% of entrepreneurs with high levels of capital say lack of working capital finance is a major problem. Of these, 44% and 21%, respectively, do not have formal credit, supplier credit or savings. Why then, do these entrepreneurs have no interest in the hypothetical loan?

The most common reason given for lack of demand in the hypothetical loan is that the interest rates are too high; some entrepreneurs feel they cannot "afford" a loan with a 20% annual interest rate. Table 4 examines the issue of affordability. It shows median estimated returns to capital for entrepreneurs who demand the hypothetical loan and for those who do not. The samples are again divided into low and high capital groups and separate results for retail enterprises are shown. I also show estimated returns to capital for those who say that the 20% annual interest rate is too high. The last row shows the percentage of this group estimated to have monthly returns to capital above this borrowing rate (1.667% monthly).

Table 4: Affordability

	All Enterprises Capital		Retail Enterprises Capital	
Median Values shown	Below $500	Above $500	Below $500	Above $500
Demand for 20% Interest Rate Loan (n)	(3,599)	(2,983)	(2,205)	(1,565)
Estimated monthly return to capital	13.11%	3.80%	13.11%	3.78%
No Demand for 20% Interest Rate Loan				
Estimated monthly return to capital	13.16%	3.70%	13.11%	3.82%
Entrepreneurs who cite interest rate being too high as reason for not wanting the loan	46.3% (1,321)	63.5% (1,651)	46.7% (761)	60.4% (794)
Estimated monthly return to capital	13.11%	3.70%	13.06%	3.70%
Percent who have estimated returns to capital above 20% a year	100%	90.7%	100%	99.1%

Surprisingly, for the low capital group, the median estimated return to capital is higher for the group that does not demand the loan than for the group that does. For entrepreneurs who demand the hypothetical loan and have capital below $500, the median monthly return is 13.11%. For entrepreneurs who do not demand the hypothetical loan, the median monthly return is 13.16%. Furthermore, the median estimated monthly return for entrepreneurs in the low capital group who say the interest rate is too high is 13.11%, the same as the group that demands the loan. Indeed, 100% of the low capital group that says a 20% annual interest rate is too high has estimated returns to capital above this borrowing rate. This falls to 90.7% for the high capital group, reflecting a decline in estimated monthly returns at higher levels of capital. Overall the results show that a majority of entrepreneurs, even those who do not want the loan and say the interest rate is too high, likely can afford prevailing interest rates.

One caveat is that the estimates of annual returns assume constant monthly returns and do not account for fluctuations across months. Some entrepreneurs may have variable returns, in

which case one month of high returns may not mean that they could cover a 20% interest rate over the year. Indeed, high returns could represent compensation for higher risk, in which case a monthly return does not tell us about ability to make regular loan payments throughout the year. Risk is likely an important part of this story, but given the cross-sectional nature of the SALTO data it is difficult to learn much about the variance of monthly returns. Panel data would allow for greater exploration of variance, as well as greater control of skill, but I am unaware of any nationally representative panel data sets on microentrepreneurs.

Another caveat is that I cannot rule out cases where entrepreneurs exit formal credit markets because they lack collateral or feel they will be rejected due to unobservable traits, like entrepreneurial skill[32]. However, the lack of demand for microloans by many microentrepreneurs who seemingly can afford them indicates a degree of voluntary exclusion. There are potentially a large number of poor entrepreneurs who actively choose not to participate in formal credit markets. The authors of the SALTO survey conclude that "perhaps the most important challenge to MFIs in Ecuador is to overcome the microentrepreneur's resistance to using credit." (Magill and Meyer, 2005). They also conclude that while "it is often assumed that there is large unsatisfied demand for credit by microentrepreneurs, several findings in the survey-especially regarding the low frequency of loan applications and the high success rate in getting loans- cast doubt on this assumption." (Magill and Meyer 2005). My findings are in line with these conclusions, as it seems that an inability to "afford" microfinance loans probably is not the main explanation for low formal credit use exhibited by many poor microentrepreneurs. It is unclear if this is due to lack of understanding about how interest rates work, a lack of good measurement of profits, variability of profits and differences in risk aversion or a desire not to become indebted, among other factors. The overall implications, however, is that low formal credit use cannot be fully explained by a lack of available credit for poor entrepreneurs.

Section V: Robustness Checks

There are two main concerns about the validity of estimates of returns to capital presented in section III. The first is that measurement error in the capital stock leads to biased estimates of the returns.

[32] For entrepreneurs who applied for formal credit last year, median capital was $1300 while the 25th percentile value of capital was $400. The minimum amount was $0. While the median and 25th percentile values are higher than for entrepreneurs who did not apply for a formal loan last year, there are many entrepreneurs without formal credit with capital values in these ranges or higher. It is unclear, however, if they collateral would be deemed sufficient by lenders.

The second is that unobservable individual characteristics, mainly entrepreneurial skill, remain in the error term biasing the estimated returns to capital. I will address each issue in turn.

Measurement error is of concern in the SALTO Ecuador data because the capital values in the survey are approximations and not based on entrepreneurs' assessments of the current resale value of their assets. As a result, there is room for entrepreneurs to under or over estimate the value of their capital stocks. To check this I see how sensitive the estimates of returns to capital are to dropping the bottom 10% and 25% of the capital stock. I do this by re-estimating Model 2 using semiparametric techniques in the low capital sample only. Results are show in table 5. Overall the results do not change significantly when the data are further trimmed at the lower end of the distribution. The estimates vary most for capital ranges between $0 and $200, which is to be expected as this is the block most affected by the trimming. The values, however, are still quite high and well above standard microfinance borrowing rates.

Measurement error is also a concern given the low number of entrepreneurs who keep accounts for their businesses. Only 19% of entrepreneurs in the sample say they keep business accounts. To address this concern I separately estimate returns to capital using semiparametric estimation of Model 2 on the subsample of 2,305 entrepreneurs who keep business accounts. Results are also shown in table 5. The estimated returns are higher than with the full sample, particularly at higher levels of capital. This suggests the high estimated returns to capital are not fully a result of measurement error.

Table 5: Robustness of estimates to measurement error

Semiparametric estimates	Capital Stock Range			
Median values for each group	$0-$200	$200-$400	$400-$600	$600-$1000
Model 2 (original estimates)	13.27%	12.19%	8.37%	6.99%
Dropping bottom 10% of capital	18.65%	13.53%	8.33%	7.13%
Dropping bottom 25% of capital	7.32%	8.61%	7.49%	6.91%
Sample that keeps business accounts	13.27%	12.19%	8.37%	7.02%

The second concern is that entrepreneurial skill is not fully controlled for, leading to biased estimates of returns to capital if skill simultaneously determines capital and profits. The problem is that it is impossible to fully control for skill given the cross-sectional nature of the data and the lack of a good instrument. Thus we can never be completely certain that the returns to capital are not a

partial reflection of returns to skill. I can reduce the bias concerns, however, by including additional controls for skill in the estimation. I consider three additional controls. The first is whether or not the enterprise has made any improvements over the past year, such as moving to a better location, improving the existing location, or buying new equipment. Entrepreneurs who have made improvements likely are more successful and skilled. The second variable measures whether or not an entrepreneur says he/she either has problems finding clients or with sales. Entrepreneurs who say they face these problems are probably less skilled. The third variable measures an entrepreneur's perception of the intensity of competition. Entrepreneurs who feel competition is very intense, as opposed to not very intense or non-existent, are likely less skilled. Statistics on the additional skill measures are provided in table 6.

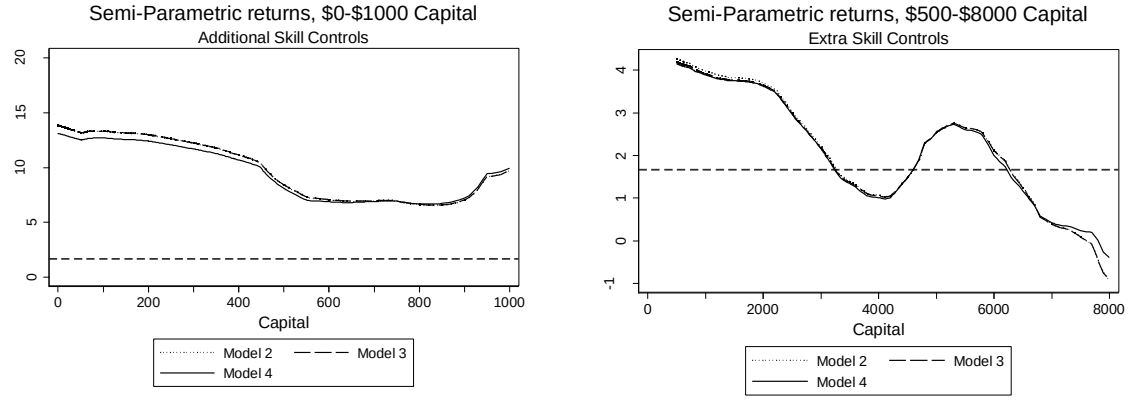
Table 6: Additional Skill Measures

Variable	Percent (%)	Observations (n)
Entrepreneur has made improvements to enterprise in the past 12 months	11.31%	1,361
Entrepreneur says he/she has problems finding clients or with sales	32.64%	3,929
Entrepreneur says competition is very intense	62.70%	7,546

I include the additional skill controls to the model and re-estimate returns to capital semiparametrically. The parameter estimates are shown in table 7. The nonparametric estimates of returns to capital are shown in figure 5. For comparison I include the results from model 2, which includes the reasons for entering entrepreneurship. Model 3 also includes the dummy variable for improvements in the past 12 months. Model 4 includes the variables in Model 3 plus the dummy variable for problems with clients or sales and the dummy variable for intensity of competition.

The additional controls for skill do not significantly change either the parameter estimates or the returns to capital estimates. For the returns to capital, the added controls seem to slightly lower the return to capital for capital levels between $0 and $400, and to slightly raise the returns for capital levels above $6000. Beyond that, the estimates from Models 2, 3 and 4 are close to indistinguishable over most ranges. This means the estimates of returns to capital are robust to the inclusion of these additional skill controls.

Figure 5: Semiparametric Estimates of Returns to Capital: Added Skill Controls



For the parameters, comparisons of Model 2 with Models 3 and 4 show little difference in the estimate values. Most of the additional skill measures have the expected signs. Entering business because of higher income or family tradition is associated with higher profits, while entering because of a lack of other options is associated with lower profits. Entrepreneurs who have problems findings clients or with sales generally have lower profits, as do those who say that the competition they face is very intense. The one exception is making improvements to the business in the past 12 months, which has mixed signs; negative in the low capital group and positive in the high capital group. This could be due to the low number of positive responses in the low capital group. Of the 1,374 entrepreneurs who made improvements last year, only 294 are in the low capital group. This group could be anomalous, driving the unexpected negative sign. In total, however, the estimates are robust to the inclusion of the additional skill measures.

Table 7: Semiparametric Estimation with Additional Skill Controls [33]

	Low			High		
Noncapital variables[34]	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Owner a woman	-78.772	-73.931	-71.883	-79.185	-79.457	-79.966
	(3.917)	(3.917)	(3.902)	(6.255)	(6.256)	(6.223)
Owner has primary education[35]	10.282	10.313	9.681	22.688	22.471	24.010
	(8.781)	(8.782)	(8.739)	(22.129)	(22.126)	(22.007)
Owner has secondary education	27.504	27.562	25.335	50.389	50.022	50.216
	(9.104)	(9.106)	(9.067)	(22.280)	(22.278)	(22.158)
Owner has college education	34.035	34.116	31.372	37.202	36.814	36.491
	(10.601)	(10.604)	(10.556)	(23.071)	(23.069)	(22.945)
Duration of business	7.382	7.386	7.453	5.636	5.615	5.819
	(0.641)	(0.642)	(0.639)	(1.026)	(1.026)	(1.022)
Full time employees, family	32.121	32.157	32.151	37.537	37.313	37.795
members	(3.359)	(3.359)	(3.342)	(4.123)	(4.124)	(4.103)
Full time employees, non family	57.898	57.874	56.768	46.457	46.200	46.150
members	(4.834)	(4.835)	(4.811)	(4.129)	(4.195)	(4.173)
Entered business to increase	10.805	10.788	11.482	14.742	14.678	15.070
Income	(3.701)	(3.701)	(3.682)	(5.539)	(5.538)	(5.510)
Entered business due to lack of	-11.451	-11.484	-9.482	-7.172	-7.098	-4.625
better options	(5.869)	(5.870)	(5.843)	(10.966)	(10.964)	(10.910)
Has made improvements in past		-2.622	-2.547		11.478	11.663
12 months		(7.020)	(6.983)		(7.036)	(7.002)
Has problems finding clients or			-33.216			-42.107
with sales			(3.909)			(6.052)
Says competition is very intense			-0.467			-9.376
			(3.753)			(5.735)
No. observations	8212	8212	8212	6145	6145	6145

[33] Standard errors show in parenthesis. Estimators from the semi-parametric differenced equation are scaled by $(1+1/2m)^{0.5}$, as the standard errors are larger due to the differencing.

[34] Other covariates are age of owner, age squared, age of business squared, number of part time employees who are family members, number of part time employees who are not family members dummy variables for business category and dummy variables for province

[35] In differenced equation there is no constant, which means the left out group, no education, has a separate dummy variables. This group is absorbed in the constant term in the parametric, non-differenced estimation.

Section VI: Conclusion

This paper contributes to the growing empirical literature on production nonconvexities and credit use by estimating returns to capital using new, cross-sectional, nationally representative data on microentrepreneurs in Ecuador. Using semiparametric techniques I find returns to capital in the range of 6.56% to 13.78% for entrepreneurs with capital between $0 and $1000, and returns in the range of -0.93% to 4.25% for entrepreneurs with capital between $500-$8000. While I cannot rule out the existence of production nonconvexities in certain ranges of capital, I can rule out their existence at low levels of capital. I find that very poor entrepreneurs generate returns that are higher, on average, than their wealthier counterparts and that are well above standard microfinance borrowing rates.

Regarding demand for formal loans, I find that a majority of entrepreneurs who do not want a loan with a 20% interest rate actually generate returns above the interest rate. Although I cannot rule out cases where entrepreneurs exit formal credit markets because they lack collateral or feel they will be rejected due to unobservable traits, like entrepreneurial skill, the lack of demand for microloans by many microentrepreneurs who seemingly can afford them indicates a degree of voluntary exclusion. In many cases, it appears that low returns to capital probably are not a significant cause of low formal credit use.

The caveat to these results is that due to the difficulty in controlling for entrepreneurial skill in cross-sectional data, the estimates of returns to capital may still be biased, providing a stronger reflection of returns to skill than returns to capital. Unfortunately, there is no way to control for this concern in the SALTO data beyond the measures I have taken. However, the fact that the estimates are in ranges similar to those generated by experimental data, which can control for skill bias, is comforting. Furthermore, the evidence on returns to capital for microentrepreneurs, particularly urban ones, is still so sparse that these estimates do further our understanding of the microenterprise sector and the use of formal credit, including microfinance, by microentrepreneurs.

Overall the absence of non-convexities is perplexing because it does not coincide with other observed characteristics of microenterprises. For example, many microenterprises appear to be stagnant. They do not register increasing sales, increasing investment or increasing employees. Indeed, the main business threat cited by the SALTO entrepreneurs is too much competition from businesses that are just like theirs. If there are small fixed costs that microenterprises have to finance to generate high returns, why aren't microenterprises growing? If returns are so high, why do we see that the sector is largely stagnant? Why don't more productive microenterprises take over

less productive ones, creating fewer, but larger firms? There are a number of potential factors, including entrepreneurial skill and the benefits of informality, which may be important to answering these questions. These issues lie beyond the scope of this paper, but the inconsistencies clearly highlight the need for further research in this area.

Finally, this paper raises questions about the reasons for low formal credit use. If entrepreneurs can afford microfinance loans, why don't we see greater use of formal credit? One potential answer is that supply of formal credit to poor entrepreneurs is still restricted, despite the increase in funds flowing to microfinance institutions from various sources (including private debt and equity markets). Thus the 55% of the sample who express a desire for a loan with a 20% interest rate may be unable to access these loans from any formal lender. Another potential explanation is entrepreneurs' lack of understanding about loan terms, including interest rates. Given the self-amortizing nature of many microfinance loans, entrepreneurs may be confused about how interest is charged and may mistakenly feel they cannot afford the loan. This, along with the large numbers of entrepreneurs who express reluctance to indebt themselves, indicates that financial education may be a necessary part of efforts to increase formal credit use.

Table 7: Summary Statistics

Characteristic	Percent (%)	Observations
Entrepreneur Characteristics		
Entrepreneur a woman	49.4%	5,945
Entrepreneur married	76.9%	9,251
Average Age	40.2 years	
Education		
Less than Primary Education	3.22%	388
Primary Education	43.08%	5,185
Secondary Education	42.97%	5,172
College Education	10.73%	1,291
Median business Duration	5.8 years	
Informal	66.0%	7,942
Has full time employees	21.1%	2,540
Has part time employees	10.9%	1,318
Business Category		
Construction	1.2%	147
Manufacturing	6.3%	759
Production of Food & Clothing	11.8%	1,425
Repair	5.2%	632
Retail and Wholesale	54.6%	6,572
Hospitality	11.3%	1,357
Transportation	5.6%	671
Personal Services	3.9%	473
Profits		
Average	$222.2	
25th percentile	$80	
50th percentile	$160	
75th percentile	$300	
Capital		
Average	$1,238.9	
25th percentile	$120	
50th percentile	$500	
75th percentile	$1,600	

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