Entrepreneurship and liquidity constraints in deprived areas: Evidence from the slums of Rio de Janeiro

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Abstract

Several economic models have described the theoretical causes and consequences of 'credit rationing' and 'under-investment'; one string of this literature shows the long-run effects of initial wealth distribution and entrepreneurial ability on the process of occupational choice and performance, and its consequences on inequality. Surprisingly, there is very little micro-level evidence on the existence and effects of 'credit rationing' in the context of developing countries. This is the contribution of the current paper. Using a survey of 4,553 entrepreneurs in 51 slums in Rio de Janeiro, this paper uses mean and quantile regression estimates to shows the effects of the type of initial capital, credit constraints, and human capital factors on entrepreneurs' performance. The main findings of the the paper are that entrepreneurs that were able to self-finance their business start-up presented earnings 16% greater than entrepreneurs that had to borrow their initial capital. In addition, entrepreneurs that explicitly claimed to be credit constrained performed substantially worse than their observationally identical counterparts, even if they were credit worthy. Both, initial source of funding and liquidity constraint presented greater effects on the highest quantiles. In terms of human capital, the current study shows positive and statistically significant returns for both years of schooling and experience, with higher returns on the lowest quantiles, indicating the potential role of these factors on inequality reduction.

Resumo

Diversos modelos econômicos analisam os efeitos de longo prazo da distribuição inicial da riqueza e da habilidade empreededora sobre o processo de escolha ocupacional e performance, bem como suas consequências sobre a desigualdade. Surpreendentemente, existem poucas evidências empíricas a respeito da existência e dos efeitos do 'racionamento de crédito' no contexto de países em desenvolvimento. Na tentativa de preencher esta lacuna, o presente artigo, baseado numa amostra de 4553 empreendedores em 51 favelas do Rio de Janeiro, realiza estimações de quantil e OLS para mostrar os efeitos de fatores referentes ao tipo de capital inicial, restrição de crédito, e capital humano sobre a performance das empresas. Os resultados obtidos indicam que empreendedores que foram capazes de auto-financiar o início de seus negócios apresentaram ganhos 16% superiores aos ganhos daqueles que obtiveram empréstimos. Além disso, empreendedores que, explicitamente, alegaram possuir restrição de crédito - mesmo estando habilitados, pela instituição financeira, a receber crédito - obtiveram performance substancialmente pior do que o seu 'grupo de controle' determinado através de características observáveis. Os fatores referentes à fonte inicial de financiamento e à restrição de crédito apresentaram grandes efeitos nos quartis mais elevados. Em termos de capital humano, o trabalho identificou retornos estatisticamente significativos tanto para a variável 'anos de escolaridade' quanto para a variável 'experiência', com retornos maiores para os quantis menores, indicando o papel potencial desses fatores na redução da desigualdade.

1 Introduction

Several models have described the theoretical causes and consequences of 'credit rationing' and 'imperfect capital markets' in the economic literature. More importantly, growth theory have recently incorporate this trait to generate models that explain economic growth at the expense of increasing inequality [1]. We use mean and quantile regression estimates to address the relation between entrepreneurs characteristics and earnings inequality using micro-level data from urban slums that have experienced per capita income growth with increasing inequality in the recent years[2].

The structure of this paper draws from the recent work of Paulson and Townsend (2002) who empirically distinguished the micro-economic foundations of two models of growth with increasing inequality using household data from Thailand. As Paulson and Townsend, we will focus in two streams of the financial constraints literature, namely, limited commitment and moral hazard models, explored, respectively, in the work of Banerjee and Newman (1993) and Aghion and Bolton (1997).

The work of Banerjee and Newman (1993) has been one the seminal contributions to this debate. These authors have shown the long-run effects of initial wealth distribution on the process of occupational choice and subsequent sustained growth with inequality. The paper shows that in an economy with imperfect credit markets, in which only individuals with previously accumulated wealth are able to borrow, economic growth will happen at the expense of increasing wealth inequality, and individuals might fall into poverty traps.

An alternative model was developed by Aghion and Bolton (1997). According to these authors, financial constraints arise from moral hazard problems. Given that effort is unobserved and repayment is conditioned to the project success, poor borrowers will face little incentive to be diligent, increasing the likelihood of project failure and default. Hence, according to this model, low-wealth entrepreneurs who do succeed in getting loans will be subject to a binding incentive compatibility constraint that ensures that they exert the appropriate level of effort, and this limits credit for investment, increasingly so as wealth diminishes.

As Paulson and Townsend (2002) explain, both models share many predictions. Entrepreneurship will be positively associated with pre-existing wealth. The long-run impact of financial constraint may be alleviated through savings and growth. Moreover, both models allow for poverty traps, and even when poverty traps are avoided, both models imply that economic growth will be accompanied by increasing inequality.

Why slums?

According to the 2000 Census, there are around 500 slums or 'favelas' in city of Rio de Janeiro with a total population of over 1 million inhabitants, or 19% of the total population of the city of Rio de Janeiro. Moreover, the population living on these communities have grown at an average rate of 2.4% per year for the past 10 years, while the average citywide growth is around 0.38% (IBGE, 2000). This facts illustrate the growing importance of this communities on the social tissue of the city of Rio de Janeiro.

Unfortunately, such phenomena is by no means exclusive to the city of Rio de Janeiro. According to a recent report from the United Nations Human Settlements Program, at least 1 billion people worldwide currently live in urban slums (UN-HABITAT, 2003). Within 30 years, if current trends continue, one out of every three people on the planet will live in such conditions.

Such trends only provide further evidences to the the urbanization of poverty, which is already a fact in Latin America. Although poverty rates in the region are higher in rural areas than in urban areas (55% vs. 39%), in absolute terms there are more than twice as many urban poor than rural poor - 68 million rural poor compared with 138 million urban poor (Cira, 2002).

In spite of the long tradition of well motivated micro-level studies on non-farming entrepreneurial activities in rural areas of developing countries (Bardhan, 1982; Pitt and Khandker, 1998; Eswaran and Kotwal, 1989; Wydick, 1999; Ferreira and Lanjouw, 2001)[3], the entrepreneurial activities in deprived urban areas of the same countries are often neglected.

Moreover, most of the very recent empirical literature on the relationship between wealth and entry into entrepreneurship in developing countries have used national household surveys (Tejerina, 2003; Mesnard

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[1]see Aghion et al. (1999) for a review of this literature.

[2]A feature also shared by Brazil (IBGE, 2003), and the metropolitan area of Rio de Janeiro (Pero et al., 2004). Using micro-level data from the census of 1991 and 2000, Pero et al. (2004) have shown that while the per capita income from the city of Rio de Janeiro has grown 31% in this period, inequality, as measure by the Gini coefficient has increased from 0.60 to 0.62, given the high initial value and the relative small variability of this index, this is a considerable change.

[3]Other authors that have discussed this this topic are GrazianodaSilva and Del Grossi (2001); Ruben and van den Berg (2001); Corral and Reardon (2001); Yunez-Naude and Taylor (2001); Reardon et al. (2001); Escobal (2001); Lanjouw (2001).

and Ravallion, 2003, 2001) or specially designed surveys that focus on rural and semi-rural areas (Paulson and Townsend, 2002), which subsequently are not able to capture the specificities of slum residents given that those surveys often do not contain enough observations of households located in these communities. In addition, most household surveys only collect information on the residence location, leaving the researcher with no information on the business location of the entrepreneur. Moreover, most of these survey instrument were not specifically designed to sample entrepreneurs, thus do not collect any information of costs and revenues from the enterprise.

This paper adds to this literature by providing micro-level evidence of the effects of the source of startup funding and 'credit constraints' on the earnings inequality of poor entrepreneurs in deprived urban areas. This work uses a unique survey with detailed information on 4,453 entrepreneurs in 51 slums in the city of Rio de Janeiro. This paper also contributes to this growing literature, by going beyond average effects, and using quantile regressions to investigate effect differentials along to conditional earnings distribution. To the best of our knowledge, this is the first paper to apply this estimation technique to this literature.

The present work is structured in six sections, including this introduction. The second section discusses the existing theoretical predictions of models with 'credit constraints', particular emphasis will be given to the role of initial capital accumulation on business start-up. The following section presents the empirical model used in the estimations of this paper. The fourth section briefly describes the data use and some of its summary characteristics of the surveyed population. The following section carries the empirical results. The sixth and last section highlights the major findings of this work.

2   Theoretical Predictions:

The structure and interpretations of the models presented in this section follows closely the recent work of Paulson and Townsend (2002).

As in the work of Paulson and Townsend, we describe the two theoretical models whose implications will provide an outline for the interpretation of the empirical estimations of this paper.

Throughout the description of these models, the same symbols are used to label variables that are common across models. For example, B always stand for wealth, k^* will denote optimum amount of capital to invest when households are unconstrained, and the parameter θ stands for entrepreneurial talent.

2.1   Description of Models

2.1.1   Limited Commitment Model

The first model that we analyze comes from Evans and Jovanovic (1989) and is closely related to Banerjee and Newman (1993). This is a static model of occupational choice where households decide whether to work in the wage sector or to become entrepreneurs. Evans and Jovanovic use this model to provide structural estimates of the choice between wage work and entrepreneurship using U.S data.

Banerjee and Newman (1993) develop a dynamic version of this model, and find that economics growth is likely to be accompanied by increases in inequality. This work was latter extended by Ghatak and Jiang (2002), who further illustrate the effects of borrowing constraints on wealth inequality, illustrating the possibility of poverty traps [4].

In this model, there no fixed start-up costs. However, the amount of capital that may be invested in entrepreneurial projects may be limited because of credit market are incomplete.

Assuming that entrepreneurs can borrow only up to a multiple $\gamma \geq 1$ of their initial assets, B, where γ is common to all individuals, the authors argue that entrepreneurs only have access to capital $k \in (0, \gamma B)$. This condition corresponds to a case of credit rationing, where banks are only willing to extend loans to those with assets, up to a given asset-determined limit, irrespective of the interest rate entrepreneurs are prepared to pay.

The amount of capital that an entrepreneurial household would like to invest k, is determined by entrepreneurial skill θ, nominal interest rate r, and a productivity parameter α. With that in mind, the entrepreneurs' incomes y is given by

$$y = \theta k^{\alpha} \tag{1}$$

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[4]Agents remain poor because they start poor.

The optimal amount of capital to invest is given by:

$$k^* = \left(\frac{\theta\alpha}{r}\right)^{1/(1-\alpha)} \tag{2}$$

Note that the optimal investment level, k^*, does depend on entrepreneurial talent, θ. As noted, households can borrow up to some fixed multiple of their total wealth, but not more. Therefore, the maximum amount that can be invested in a firm is equal to γB, and the maximum amount that can be invested in a firm is equal to $(\gamma - 1)B$. Thus, borrowing constraints are more likely to bind for higher skilled households, since business skills and capital are complements (Paulson and Townsend, 2002)[5]. It can be seen from equation (2) that for a given level of wealth B, entrepreneurs will be unconstrained only if their talent is low enough. Specifically, they will be constrained if talent satisfies:

$$\theta < \frac{r}{\alpha}(\gamma B)^{(1-\alpha)} \tag{3}$$

Figure 1 illustrates this curve and defines the boundary between constrained and unconstrained entrepreneurs as a function of wealth, B, and talent, θ. The area labeled 1a corresponds to those individuals who do not have the talent nor wealth to satisfy the condition described above, hence they became wage workers. The area labeled 1b illustrate the situation of those individuals who can became entrepreneurs and are able to borrow or have sufficient wealth, to operate their business at the optimum level of capital, given their relatively low level of talent, these are the unconstrained entrepreneurs. The area labeled 1c correspond to those entrepreneurs that can not achieve their optimal level of capital for their talent, these are the constrained entrepreneurs.
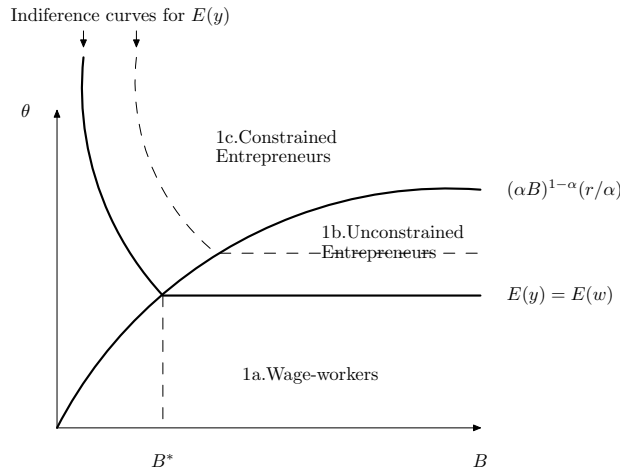

Figure 1: Nature of the selection into entrepreneurship

The two main prediction of Evans and Jovanovic (1989) model, as summarized by (Parker, 2004, pg.180), are:

1. There is a positive relationship between the probability of entering entrepreneurship and assets prior to entering entrepreneurship.
2. Wealthier entrepreneurs will operate larger enterprises, on average, than poorer ones and so will receive higher incomes.

2.1.2 Moral Hazard

The structure and implication of the moral hazard model presented in this subsection comes from Paulson and Townsend (2002), who preset an extended version of the Aghion and Bolton (1997) dynamic model of occupational choice with limited information and incentives, as in the classic moral hazard problem.

Below follows a simplified model based on Aghion and Bolton (1997) and Lehnert (1998), extended with entrepreneurial talent as a factor affecting the probability of success of the project in a similar way to that in Paulson and Townsend.

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[5]As Paulson and Townsend (2002) noted, while the demand of credit will clearly depend on entrepreneurial talent, the supply of credit will respond only to wealth.

The model consist of a continuum of risk neutral agents with wealth B and entrepreneurial talent, θ. Each one of these agents can enter a project that requires a level of investment $k = 1$ and gives a payoff according to the following functions:

$$P(k,p) = \begin{cases} r & \text{with probability } p\theta \text{ when } k = 1, \\ 0, & \text{with probability } (1 - p\theta). \end{cases} \tag{4}$$

Where $p\theta$ is the probability of success of the project. This probability if influenced by entrepreneurial talent θ and the level of effort p. Both p and θ can take values between 0 or 1. Given capital $k = 1$, if the project is not successful the payoff to the entrepreneur will be zero. Also, effort is costly according to the following function:

$$C(p) = \frac{rp^2}{2a} \tag{5}$$

where cost is increasing in the size of the payoff of the project r, the level of effort p, and a is a parameter of the function. When the agent's wealth is less than the amount needed to begin the project he will have to borrow an amount $(1 - z)$, at the equilibrium rate of interest equal to $\rho(z)$. The financial intermediary will supply credit if the borrower agrees to pay a rate of return $\rho(z)$ times the amount of money borrowed $(1 - z)$ if the project is successful and zero otherwise. Hence, the revenue function for the financial intermediary for a loan given to an individual of wealth B and talent θ will be

$$R(p) = \begin{cases} \frac{(1-z)}{\rho(z)} & \text{with probability } p\theta, \\ 0, & \text{with probability } (1 - p\theta). \end{cases} \tag{6}$$

If the project succeeds the financial intermediary will get (1-z) times the equilibrium interest rate, if the project fails it will get 0.

The agent is risk neutral and needs to choose effort p in order to maximize expected utility:

$$\max_{p} \left\{ rp\theta - \theta p(1 - z)\rho(z) - \frac{rp^2}{2a} \right\} \tag{7}$$

Expected utility will be equal to the payoff if the project is successful (r) times the probability of success $p\theta$, minus the amount to be repaid to the bank which is equal to the amount borrowed $(1 - z)$ times the probability of success $p\theta$ and times the interest rate for the given level of wealth $\rho(z)$ and minus the disutility of the effort $C(p)$

The solution for p then is

$$p = \left(1 - \frac{(1 - z)\rho(z)}{r} \right) \tag{8}$$

From this equation is possible to see that keeping $\rho(z)$ fixed, the optimal amount of effort is increasing in wealth (i.e. the more people need to borrow in order to start the project the less effort they are willing to make). The expected rate of return for the financial intermediary will be determined by the supply of funds. Wealthy people will supply the part of the funds in excess of what they need to self-finance the project the project and the poor who can not borrow and start projects will save their wealth.

Figure 2 describes who will become an entrepreneur and who will work for wages as a function of wealth and talent. The likelihood of starting a firm is zero for firms with low wealth and low talent. For high wealth, high talent households, the probability of starting a firm is virtually one. If talent if fixed at some intermediary level, the probability of entrepreneurship rises from zero to one with wealth. The intuition of Figure 2, as in Aghion and Bolton and Lehnert, is that low wealth borrowers have little incentive to work because the financial intermediary would take so much of their project returns when the project is successful. The only way the financial intermediary can make up for this is by raising the effective interest rate and at significant low wealth levels the market will clear with no borrowing at all.

In the example described in Figure 2, as in Aghion and Bolton and Lehnert, all firms are capitalized at $k = 1$, and therefore all entrepreneurs who have wealth, B, less than one must borrow. However, as wealth increases, the need for borrowed funds will decrease, and it is possible that effort will be monotonically

increasing in wealth, thus household with wealth in excess of one will invest all of the surplus funds in the market. These households who have wealth will not rely in borrowed funds at all. When there is no risk aversion, and therefore no demand for insurance, these households will experience no disincentive effect form incomplete credit markets. These high wealth households will chose their own effort level optimally and run firms that are not credit constrained. Or as Aghion and Bolton state

> "The more individuals need to borrow in order to invest, the less incentives they have to supply effort since they must share a larger fraction of the marginal returns from effort with lenders...
> The very wealthy, who do not need to borrow in order to invest in their own project, supply the first-best level of effort since they remain residual claimants on all returns from such effort."
> (Aghion and Bolton, 1997, pg.156-7)

A firm in the Aghion and Bolton and Lehnert moral hazard model and in the general moral hazard model that Paulson and Townsend developed, will be constrained by the moral hazard effect in credit markets if the incentive constraint on effort is binding. In other words, firms will be constrained if they have an incentive to shirk and this incentive in turn influences the information-constrained contract.

In this model, each household has a technology for producing output q from its own efforts z and from capital k. This technology is written $P(q|z,k)$, the probability of achieving output q given effort z and capital, $k = 1$.
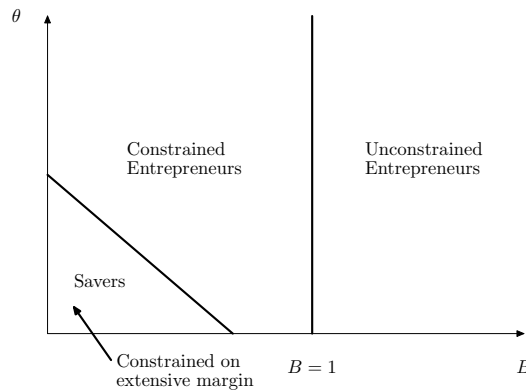

Figure 2: Restricted version of Aghion and Bolton/Lehnert Model

Policy recommendations consistent with limited commitment models will be related to reducing transaction costs and improving the quality of collateral, and policies consistent with moral hazard models will be to improve the verification of effort in projects (joint liability groups or credit bureaus).

3 Empirical estimation:

Both models in Section 2 illustrated the importance of entrepreneurial talent, wealth and liquidity constraint on entrepreneurs choice[6] and performance. In what follows, we will try to empirically investigate the effects of these factors using micro-level data from entrepreneurs in the slums of Rio.

Unfortunately, as in the case of most empirical studies, we do not have direct measures of the variables discussed in our theoretical section. Thus, a few proxy variables will have to be used.

In terms of wealth, we will be using information regarding the initial source of funding of these entrepreneurs. Regrettably, this will be a categorical variable, which will indicate if the entrepreneur has either self-financed, borrowed or did not need initial capital on their business start-up. Our assumption here is that those entrepreneurs that were able to self-finance their start-up had enough previously accumulated wealth relative to the operation needs of their business start up. Our hypothesis here, based on the models

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[6]For a discussion of the occupational choice aspect of these models please see Azevedo (2004) who uses the household module of this survey to investigate, among other things, the determinants of entrepreneurial choice for the residents of the slums of Rio de Janeiro. Household assets are proxy by house ownership and an asset index. The analysis shows a positive and statistically significant 'asset' effect on decision of becoming an entrepreneur (with increasing returns), in particular for those operating informal enterprises. As argued above, this prediction has particularly important implications for developing countries, as it reinforces inequality and makes it much harder for destituted entrepreneur to break from their poverty cycle.

presented in Section 2, is that entrepreneurs that were able self-finance their start-up will perform better, given the stronger incentives that they will have to put more effort in their enterprise, and the smaller degree of 'liquidity constraint' that they face.

Another important variable in our empirical model is a proxy for 'liquidity constraint'. To classify an entrepreneur as being constrained, we used their response to the question 'What are the the biggest difficulties faced by our enterprise?'. Those entrepreneurs that answered 'lack of funds' were classified as being constrained. This proxy is far form optimal, but it would be hard to improve without observing the production function and talent of the individual entrepreneurs. It is important to note that claims by survey respondents should be treated with great caution. As Parker (2004, pg.179) reminds us, such answers are prone to self-serving bias whereby entrepreneurs might blame banks for inherent shortcomings, and do not necessarily mean that loans were not available to these respondents (they might not be credit worthy) [7]. Another possible, and well deserved, criticism of this measure, is the fact that not all 'credit constrained' individuals are credit worthy. In order to control for this, we also included an interaction term in our model between 'having taken a loan in the past 12 months' and our proxy for being 'liquidity constrained'.

On regard to talent we included all human capital variables at our disposal, such as education, experience, training and age, which we believe are correlated to talent, and should allows us to proxy for this effect (other authors such as Paulson and Townsend (2002) and Tejerina (2003) have followed a similar route).

Another important variable in our analysis is the enterprises' level of physical assets. This variable is particularly important given the knowledge that entrepreneurs also obtain part of their returns through the remuneration of their enterprises's assets. In order to construct this variable, we combined three variables form the questionnaire, namely, the value of the building in which the enterprise is located (as reported by the entrepreneur) and the average monthly expenses of the enterprise on fuel and machinery equipment[8].

In this paper we will estimate a reduced form of earnings regression following a standard Mincer equation (Mincer, 1958, 1974), under Becker (1964) framework:

$$Y_i = \alpha + X_i\beta + D_i\mu + E_i\eta + G_i\pi + W_i\delta + L_i\kappa + C_i\omega + INT : (L_i \times C_i)\phi + INT : (I_i \times C_i)o + \varepsilon_i \quad (9)$$

where

- Y_i is the entrepreneur i earning;
- α is a constant term;
- X_i is a vector of productivity enhancing characteristics following standard human capital theory, such as: education; labour market experience; experienced squared; and, training;
- D_i is a vector of demographic characteristics such as: gender; and, age;
- E_i is a vector os enterprise specific characteristics, such as: sector; value of physical assets; value of physical assets squared; registration; physical capital expansion in the past 12 months; and, use of account controls;
- G_i is a vector of geographical factor, such as: neighborhood average income and distance to the center of the city;
- W_i is a categorical variable that indicates if the entrepreneur i had enough accumulated wealth to self-finance his business start-up, or if he had to borrow funds or if he did not need seed money[9] (this variable tries to capture the effect B in Section 2);
- L_i shows if the enterprise i has taken a loan in the past 12 months;
- Finally, C_i is a dummy variable that shows if entrepreneur i claimed to be 'credit constrained' by pointing lack of funds as one of the main difficulties of his enterprise;
- INT denotes the interaction term between liquidity constrain and credit (L_i and C_i), and credit and investment in the past 12 months (I_i and C_i);
- ε_i is an error term representing unobservables determinants of earnings;

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[7]Although these are quite plausible arguments, it must be bear in mind the 'hostile' environment in which this entrepreneurs operate. As we discussed in the previous section section only 9% of our sample took a loan to start-up their business, out of which only 0.34% did so through a formal financial institution.

[8]The assumption made here is that the monthly expenses in fuel and machinery are proportional to the level of physical capital in the enterprise.

[9]The Self-finance category is omitted and will be used as the reference criteria

- β, μ, and η are coefficient of vectors denoting the the marginal effects in monetary terms of their associated factors;

- π is a vector of coefficients that illustrate the effects neighborhood externalities on these entrepreneurs performance and proxy their transportation costs;

- δ show the effect of previously accumulated wealth on current business performance;

- ω shows performance differential of those enterprises that currently claim to be 'credit rationed';

- κ portraits the average effect of having taken a loan in the past 12 months; and,

- ϕ and o illustrate the combined effect of having taken a loan and claiming to be 'credit rationed' and having taken a loan and having invested in the past 12 months.

We estimated this model using both ordinary least squares (OLS) and quantile regression. The main difference between the two methods is that the former is based on the *mean* of the conditional distribution of the regression's dependent variable. An implicit assumption in this estimation is that possible differences of the exogenous variables along the conditional distribution are unimportant. Unlike OLS, quantile regression models allow for a full characterization of the conditional distribution of the dependent variable (Koenker and Bassett, 1978).

In our setting, the quantile regression model can be written as

$$Y_i = X_i\beta_\tau + u_{\tau i}, \text{ with } Quant_\tau(Y_i|X_i) = X_i\beta_\tau \tag{10}$$

where X_i is the vector of exogenous variables and β_τ is a vector of parameters [10]. $Quant_\tau(Y_i|X_i)$ denotes the τth conditional quantile of Y given X. The τ regression quantile, $0 < \tau < 1$, is define as a solution to the problem

$$\min_{\beta \in R^k} \left\{ \sum_{i:Y_i \geq X_i\beta} \tau \mid lnY_i - X_i\beta_\tau \mid + \sum_{i:Y_i < X_i\beta} (1-\tau) \mid Y_i - X_i\beta_\tau \mid \right\} \tag{11}$$

This is normally written as:

$$\min_{\beta \in R^k} \sum_i \rho_\tau(Y_i - X_i\beta_\tau), \tag{12}$$

where $\rho_\tau(\varepsilon)$ is the check function defined as $\rho_\tau(\varepsilon) = \tau\varepsilon$ if $\varepsilon \geq 0$ or $\rho_\tau(\varepsilon) = (\tau - 1)\varepsilon$ if $\varepsilon < 0$.

The least absolute deviation (LAD) estimator of β is a particular of this model, when $\tau = 0.5$ (the median regression). The first decile is obtained by setting $\tau = 0.1$ and so on. As τ increases from 0 to 1, we obtain the entire distribution of Y, conditional on X.

Another important characteristic of this method is its robustness to distributional assumptions. The estimates and the associated inference apparatus have an inherent distribution-free character since quantile estimations is influenced only by the local behavior of the conditional distribution of the response near the specified quantile (Koenker and Bassett, 1978, 1982).

In summary, in contrast to mean regression models, quantile regression models impose less restriction on the data, are robust to outliers in the data and provide more complete information on conditional distributions of dependent variables.

The application of quantile regression has not been fully explored by the entrepreneurship literature. In so doing, it has left unaddressed the possible impact of schooling, experience, wealth, and liquidity constraint upon inequality through its within-levels inequality component. For example, if experience earnings increment were the same across the wage distributions of wages conditional on different levels of experience would differ only on their location and not on their dispersions. However, it might be the case that these dispersion do indeed vary across experience levels, thus resulting in an impact of experience upon the wage distribution, through its within-levels channel. This is the possibility we test by using quantile regression estimates (Martins and Pereira, 2004).

Endogeniety

A potential problem that has been pointed out repeatedly in the literature (Evans and Jovanovic, 1989; Parker, 2004) is the correlation between *ex ante* wealth and entrepreneurial talent independently from the

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[10]Both of which summarize the explanatory variables and their respective coefficients described in Model (9).

future ownership of a household business. The idea is that the existence of omitted variables might bias the results, and erroneously attribute the effect of higher entrepreneurial talent on wealth to the effect of wealth on entrepreneurship. This would mean that, to the extent that entrepreneurial talent and non-business wealth are correlated, if we find a positive and significant relationship between wealth and entrepreneurship, the reason might be not that households need to save prior to starting a business but, that households that will eventually open a business will have higher returns both as wage earners and as entrepreneurs and therefore will accumulate more wealth.

Having said this, it is important to note that the empirical evidence has not found conclusive evidence that there exist a positive relationship between these two variables [11].

Before we discuss the empirical results of our model estimations, we will briefly discuss the data used as well as some of its main summary characteristics.

4   Data and Summary Statistics

The data analyzed in this study was obtained from a survey carried out by the auspices of the municipality of Rio de Janeiro between January/1998 and March/2000. The survey covered households and enterprises in 51 out of the 462 slums in the city of Rio de Janeiro at the time of survey. The survey had two modules which were carried out independently: household (PCBR-Dom) and enterprises (PCBR-Est). The data from both modules was collected through face-to-face interviews conducted by enumerators and field supervisors trained by the Brazilian National School of Statistics (ENCE) which is part of the Brazilian National Office of Statistics (IBGE). The households module followed a questionnaire similar to the World Bank LSMS[12] and covered a sample of 21,704 households in 51 slums. The enterprise module is a census of all the 4,553 business establishments located in these slums. This was one the most extensive efforts to map these communities[13]. A full description of the survey is contained in Silva et al. (1998). The current study only uses the data of the enterprise module (PCBR-Est).

This study also uses two complementary data sets, namely the 2000 Census (IBGE, 2000) and the 1996 geographical boundaries of the slums and neighborhoods of the city of Rio de Janeiro (LabGeo, 1996b,a).

The 2000 Census data was used to generate average incomes for each neighborhood where the analyzed slums are located at. The goal of this variable is to capture geographical effects that might arise from slums nearby more affluent neighborhoods.

The data from the 1996 geographical boundaries of the slums and the city of Rio de Janeiro was used to generate distance measures from the centroids of each slum to downtown Rio, in order to control for transportation effects that might affect the entrepreneurs performance in each of these communities.

Most of the variables were computed directly from the replies to the survey questionnaire. Due to the time differences of the data collection, the consumer price index of the metropolitan region of Rio de Janeiro's city was used to deflate all the monetary values in the survey to prices of March of 2000.

This survey follow the ILO/UN employment categories which include employees, unpaid family helpers, employers and own account workers. An employer is a person who operates his/her own economic enterprise or engages independently in a profession/trade and hires one or more employees. An own account worker[14] is a person who operates his/her own economic enterprise or engages independently in a profession/trade

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[11]Evans and Jovanovic (1989) assume the following relationship as part of a structural model of occupational choice: $ln\theta_i = \delta_0 + \delta_1 lnz_i + \eta_i$ where θ_i is entrepreneurial talent for agent i, and z_i is the level of wealth in the beginning of the period. Using data from the PSID they find that δ_i has a negative value. Paulson and Townsend (2002) estimated the parameters of a similar model using data for Thailand and including years of education of the head of household as an independent variable, and found that the relationship between wealth and talent may be positive, though the estimate of this parameter is small and very imprecise or negative at some points of the sample. They also found a comparatively much stronger and positive relationship between the years of education of the head of the household and the entrepreneurial talent.

[12]The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by government statistical offices in developing countries. The objectives of the LSMS were to develop new methods for monitoring progress in raising levels of living, to identify the consequences for households of current and proposed government policies, and to improve communications between survey statisticians, analysts, and policymakers.

[13]The selection criteria used to include each community in the survey sample was its involvement in a housing and infrastructure program from the municipality of Rio (for more details see Riley et al. (2001) and AciolyJr. (2001)). The 1998/2000 phase of this program prioritized small and medium size slums with already some infrastructure, leaving the most challenging and destitute communities out. If anything, the existing anecdotal evidence seems to suggests that these communities are among the least problematic, and should be interpreted as an upper boundary of the reality of slums in Rio de Janeiro.

[14]Also referred as self-employed.

and hires no employees. Following the existing literature, this paper uses employers and own account as working definition of entrepreneurs (see Parker (2004) and Le (1999)).

The description of the variables used in this study are defined below (Table 4), as well as a brief discussion of the main summary statistics of the survey.

Summary statistics

Most of the enterprises in the survey were on the service sector, followed by commerce and industry. Most of the entrepreneurs were men (55%), the average age was 41 years old, with 6 years of schooling (equivalent to incomplete Primary Education). 90% of the entrepreneurs reside in the slums where their business is located.

A few interesting remarks emerge from the analyzes of the type of expenses of the enterprises. While 94% of the entrepreneurs alleged expenses with employees, only 11% of them said that they have expenses with their employees social security, suggesting that a substantial proportion of their employees are irregular wage earners with no pension's right. Moreover, less than 3% of these entrepreneurs stated that they have taxes related expenses. This figure is even smaller than the proportion of registered enterprises (7%). According to a legal definition of the informal sector, these results suggest that around 93% to 97% of the enterprises in these communities operate at the fringes of the formal economy[15].

In terms of finance, some findings should also be mentioned. First, only 55% of these enterprises have some sort of accounting controls. In addition, 82% of these enterprises self-financed their start-up[16], while 9% took a loan, and 9% did not use any sort of seed money.

On regard of credit use only 12% of these enterprises have taken a loan, most of them in the past 12 months (8.8%). A much more interesting picture emerge as we look at the sources of finance; surprisingly, almost 70% of the credit used by these entrepreneurs originated from formal financial system. If anything, this latest finding suggest two things. First, slums are not homogenous environment as one might initially imagine. Second, the depth of outreach of the Brazilian formal financial sector might be a lot greater than initially argued by other authors (Schoenberg, 2000).

A table with the discussed summary statistics and the variable descriptions can be found in the appendix.

Some of the biggest difficulties of empirical studies on entrepreneurship are associated with the definition of earnings. Consequently, this paper considers two alternative measures to assess the robustness of the comparisons made below. It useful to bear in mind that the measurement of earnings begins with the identity:

$$\text{Net Profit}_t \equiv \text{Revenues}_t - \text{Expenses}_t = \text{Draw}_t + \text{Retained earnings}_t \tag{13}$$

Equation (13) shows that the net profit generate by a business in year t, given by the difference between revenues and expenses (including depreciation), may be withdraw from the business by the entrepreneur in the form of salary (termed the draw) or reinvested in the business (termed retained earnings). Many issues arises as researchers try to compute any of these measures. Often, net profit is underreported, both for tax purposes and because its construction demands from the respondent a much stronger accountancy control of his/her business. This latter point deserves particular attention on this study, given the already mentioned fact that only 55% of the respondents have some sort of account control. Because the draw is a more direct measure of earnings, in general it suffers less from underreporting error and is regarded by the literature as a superior measure of entrepreneurs income, in comparison to net profit.

It is also known that an entrepreneur investing in his business may report a low draw (Hamilton (2000)). However, the survey used in this study did not collect any information on the variation of the business equity; thus, it is impossible to construct an equity adjusted draw.

Hence, data limitation hindered construction of two alternative measures of earnings for the entrepreneurs in this study. The draw measure is available for virtually all business owner (99%), whereas the net profit[17] variable is available for approximately 97% of the total sample.

Another important source of bias on studies on entrepreneurship arises from the failure to properly deal with negative incomes or profits (Parker, 2004, pg.13). Although there were no entrepreneurs that stated a negative draw, the same did not happen with profits, around 50% of the final sample presented net losses.

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[15]Following a more legalistic definition of formal economy, as in De Soto (1989).

[16]There is plenty of empirical evidence to suggest that this is the case even on developed countries (i.e. 60% of start-up business in Britain use self-finance (Parker, 2004, pg.137))

[17]Total Revenue - (Expenses in: Raw Material, Labor, Social Security, Rent, Machines & Equip., Fuel, Public Utilities, Taxes, and Others)

Thus, in order to be able to build a more complete picture, and given the fact that both variables were relatively normally distributed (as it can be seen in Figure 13), we chose not to apply the usual logarithmic transformation on our dependent variables.

Once all relevant variables with missing values are dropped from the analysis (age is the main variable with missing values), we obtain a final sample of 4,026 and 3,949 (for draw and net profit, respectively) or roughly 90% of original sample. After further consideration, we also choose to drop the outliers below the 1% and above the 99% percentile of both the draw and net profit distribution, this choice further reduced the sample size to 3,825, or 86% of our original sample.

As Figure 13 illustrates, the net profit ranges from a net loss of approximately R$2,000 to a net gain of a similar magnitude. On the other hand, the draw distribution only assumes positive values, suggesting that a number of entrepreneurs have used retained earnings in order to maintain their level of draw.
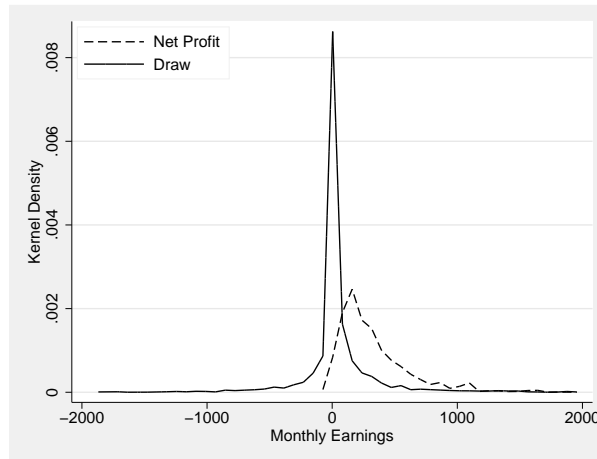

Figure 3: Empirical distributions, monthly earnings measures

5   Empirical Results

As discussed in Section 3 we estimated Model (9) through OLS and Quantile Regression, using both net profit and draw as dependent variables. The partial derivatives of the coefficients for the earning function estimates are presented in Tables 2 and 3[18]. The Tables show the OLS estimates and the quantile regression estimates for the 10th, 25th, 50th, 75th, and 90th quantiles [19] and respective robust standard errors[20]. A Wald test for the null hypothesis of equality of the coefficients across the quantiles is decisively rejected for both the net profit and the draw estimates, suggesting considerable variation in the coefficients at the different points in the earnings distribution.

In order to test of multicollinearity among the regression coefficients we calculate the variance inflation factors (VIFs) for the independent variables used in the model. Kutner et al. (1990) suggest that a VIF value greater than 10 is an indication of potential multicollinearity problems. All regressor in our model presented a VIF smaller than the above mentioned threshold [21].

One general result is that the model using draw as dependent variable fitted the data much better than the one using net profit; this was expected given the much wider dispersion of the dependent variable in the latter case. Most variables on the draw model were statistically significant at the 99% level and presented the expected sign. Moreover, all variables that were statistically significant in both models presented the

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[18]The marginal effects were numerically computed using the partial elasticity of the form $\frac{\partial \log y}{\partial x}$. Given this formula it is not possible to estimate the partial derivatives for the quantile in which the dependent variable is negative. Thus, on the net profit equation (Table 3), we are only able to present the partial derivatives for the 50th, 75th, and 90th quantile. A Table with all the original coefficients can be obtained upon request.

[19]Figures ??, ??, 4, and 5, in the appendix, provide a concise visual summary of the results of both estimations. The lightly shaded region in each panel represents a 95 pointwise confidence band for each coefficient. The OLS and respective confidence band are also plotted.

[20]Huber/White/sandiwhich for OLS estimates and quantile regression standard errors were estimated using bootstrap resampling with 200 replications.

[21]We did have an earlier specification that included a non-linear term for education, however the inclusion this this term made the VIF value of both education and education square became greater than 10, subsequently we choose not to use this specification.

same sign. In what follows, we will comment in greater detail the coefficients of the model using draw as dependent variable (Table 2). The partial derivatives of the net profit equation are presented in Table 3 and Figure 4 in the appendix.

Education and Experience

In terms of human capital, the model shows returns to years of schooling of 3.6% per year. Although these result are bellow the findings of the literature on returns to education of wage earners in Latin America [22], they are well within the boundaries of a recent survey on the entrepreneurial literature in developing countries which showed returns around 5% (Van Der Sluis et al., 2003). Moreover, this finding is very close to the latest estimation of returns to education for Brazil [23].

Experience and experience square, in this case measured as actual years of labour market experience, also showed the expected magnitudes and signs, with entrepreneurs earning around 3.4%, with decreasing returns, in the case of draw, and 7.1% in the case of net profits.

The quantile estimators for both education and experience proved to be quite revelling (Fig5a and Fig5b in the appendix). Both returns (schooling and experience) proved to be substantially higher on the lowest quintile, with each additional year of schooling yielding 4.5% on the 10th quintile versus 3.1% on the 90th quintile. For experience this difference is even greater, dropping from 7.7% on the 10th quintile versus 2.7% on the 90th quintile. In other words, low-skilled entrepreneurs (individuals who receive lower monthly earnings conditional on their characteristics) are associated with a stronger human-capital related earnings increment.

Such findings are quite important since it suggests that in the case of the entrepreneurs of the slums of Rio, both education and experience can play an important role in reducing earnings inequality.

Although these findings are in direct contrast with the quantile estimations presented by Arabsheibani et al. (2002) for Brazil using 1998 data[24], and Martins and Pereira (2004) who used data from 16 developed countries, these results are with consistent several arguments found in the the literature. We put forward a few possible explanations for this result.

If low-earnings is positively correlated with low-capital (entrepreneurs that have not being able to invest in physical capital), it is not surprising that the returns to education decreases on the higher quantiles, given that the higher we move on the earnings distribution, the more likely it is that the entrepreneur's earnings will also consist on returns to physical capital. Thus, this result might provide further evidence for the argument that returns for schooling for entrepreneurs if lower because part of its remuneration is through returns for capital. Smith and Metzger (1998) and Teilhet-Waldorf and Waldor (1983) also find higher returns to education to urban low-skilled low-paid entrepreneurs in Mexico and Thailand.

Another evidence of this line of argument is the coefficient 'expansion' which indicates if the enterprise has made or not any investment in physical capital in the past 12 months. As we can see, although this indicator was not statistically significant in the lowest quantiles, in presented a large and statistically significant effect on the highest quantiles, suggesting that entrepreneurs on the highest levels of the conditional distribution presented substantially higher returns whenever they were able to expand their physical capital.

Many authors have argued that entrepreneurs success is likely to depend on numerous factors other than formal education (Lazear, 2003; Parker, 2004, pg.20-21). Thus, if we take earnings as a measure of success, low-skill entrepreneurs might have a higher return to education because they are not 'jacks-of-all-trade', thus not presenting the 'extra' characteristics that might explain a successful entrepreneur, and which will yield a return.

An alternative explanation relies on the existence of capital market imperfections. In perfect competition, capital would flow from less productive to more productive individuals. The existence of such strong productivity differential along the earnings distribution might indicate that capital markets are not working properly. If credit is scarce and costly, low-earnings but high productivity entrepreneurs will be trapped in a vicious cycle of poverty, in spite of their high productivity.

A more standard explanation is that returns of the more scarce resource should be higher. If low-earnings is associated with low-human capital it should not came as a surprise that the rate of return of human capital

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[22]In a recent survey Psacharopoulos and Patrinos (2004) show that the average return to education for middle income countries is 8.2% and that for Latin America and the Caribbean as a whole is 12%.

[23]Arabsheibani et al. (2002) using the 1998 wave of the national household survey, found returns for years of schooling of 4.1%.

[24]In their work, the showed that returns to years of schooling increase from 1.9% on the 10th quintile versus 7.4% on the 90th quintile, and earnings for each additional year of experience increased from 4.2% on the 10th quintile to 6.7% on the 90th quintile.

if higher at the lower end of the income distribution.

A final important issue concerns the possible impact of endogeneity on the results presented. If high entrepreneurial ability individuals are over-represented in low schooling levels (because these individuals realize at a very early age that formal education would not help them [25]), then not considering ability differences would wrongly lead to an overestimate(underestimate) of the returns to schooling at lower (upper) part of the conditional distributions.

Gender and Age

In accordance with the previous literature, this paper also shows that female entrepreneurs earn substantially less than their male counterparts (around 30% less). Some of the existing empirical evidence seems to suggest that women have greater opportunities or preferences for potentially less remunerative home working, giving their often unequal responsibility for the children and for the household management (Parker, 2004, pg.127-8). In terms of quantile effects, it seems that gender discrimination decreases on the higher quintile, suggesting that this variable might play a significant role the increase of earnings inequality (Fig5e).

Age presented small and negative and statistically significant effects on entrepreneurs draw. This effect has remained relatively constant throughout the different quantiles. Alternative specifications were tested without the age and with a non linear term for age, with no substantial effects on remaining coefficients.

Business Characteristics

Current enterprise assets presented positive and statistically significant effects on entrepreneur's earnings, with diminishing returns. Both coefficients on Tables 2 and 3 have been multiplied by R$10,000 in order to simplify interpretation. For every R$10,000 in assets, the entrepreneur's earnings increase on average 14.3%. Again, the quantile estimation yield interesting results, showing that return on assets were insignificant on the 10th quantile, and positive and statistically significant returns on the remaining quantiles at a growing rate (Fig5f).

The lack of registration and account controls had a negative and statistically significant relationship on both models. One interesting factor is that this neither one of this variable presented a statistically significant effect on the 10th quantile, and presented an increasing detrimental effect as we moved the the higher quantiles of the earnings distribution (Fig5k and Fig5l).

Business Location

The neighborhood effect presented a positive and statistically significant effect. For each R$100 increase on the average neighborhood income, entrepreneurs earnings would increase by 1%.

It is important to notice that the neighborhood average income of the slums in our sample ranges from R$203 to R$1685, with a mean figure of R$562 and a standard deviation of R$313. Thus, holding everting else constant, the effect of moving an entrepreneur from a slum in the poorest neighborhood in our sample to a slum in the wealthiest neighborhood can have a net effect on earning of the magnitude of 14.8%[26]. This effect was also statistically significant for the 25th, 50th and 75th quantiles, and is twice larger for entrepreneurs on the 25th quantile (Fig5o).

Start-up funding

The coefficients of source of start-up funding suggest that the earnings of entrepreneurs that have taken a loan are on average 16% lower than those entrepreneurs that have self-financed their start-up. This figure is even lower than the earnings differential of the entrepreneurs that did not need seed money, whom presented earnings 11% smaller. Both models presented in Section 2 can help us understand this result.

If we interpret that entrepreneurs who are able to self-finance their start up as those entrepreneurs that have enough previously accumulated wealth to meet the minimum capital requirements of their business start up - as discussed in the model of Aghion and Bolton and Lehnert presented in Section 2. Then, the substantially worse performance of lenders can be explained as an effort problem, given that low wealth borrowers have little incentive to work because the financial intermediary would take so much of their project returns when the project is successful.

In addition, the superior performance of those entrepreneurs that had initial wealth can also be explained with Evans and Jovanovic model, who argue that wealthier entrepreneurs (in our case defined as those that were able to self-finance their start-up) will operate larger enterprises, on average, than poorer ones (defines that borrowers and those that did not need any seed money), and will receive higher incomes, as our data has shown.

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[25]Parker (2004, pg.20) discuss the findings of some authors that argue that formal education might be detrimental to entrepreneurial spirit.

[26]0.0001× R$1,485

One extra point is that most of these entrepreneurs have borrowed funds from family and friends, such informal sources of finance are characterized by a strong screening, monitoring and enforcing mechanisms (Robinson, 2001, Chapter 6)[27]. This qualification adds another dimension to this results, since it shows the potential of informal contracts in such communities.

Another interesting finding is that such differences on start-up funding were not statistically significant in the lowest quantiles of the earnings distribution (both coefficients were statistically insignificant on the 10th quantile), suggesting this factors only become binding as the current earnings of the entrepreneurs increase (Fig5t and Fig5u).

In Table 1 we briefly focus on the returns to human and physical capital for the individuals on these three different status. It is clear that the entrepreneurs that did not use any source of initial capital are also the ones with the highest returns to education (5.3%). Moreover, females that did not use any source of initial capital, presented much higher return to years os schooling than males, 6.7% compared to 0.8%. This results, seems to reinforce our discussion that entrepreneurs with low-capital, such as the ones that did not need any capital investment to start up their enterprises should have higher returns to years of schooling given human capital is the only assets at their possession that they are being remunerated for. It is important to acknowledge that these results might also be driven by the omission of entrepreneur talent, if talent is inversely correlated with education.

Note that experience was substantially more important for those entrepreneurs that borrowed the initial funds for their enterprise start-up, with males presenting much higher returns to experience than females, 15,5% versus 8.6%. A possible explanation of this effect is that family and friends might be using this information as the screening criteria before giving a loan. An implication, is that young individuals, naturally with less experience, would have a tougher time to obtain funds.

Another very interesting result if the return to capital. Borrowers presented strickenly higher returns to assets than the the other two groups of entrepreneurs, 77% versus 14% and 16%. More interesting, females presented an even higher return to physical assets than males. This result might suggest that the informal screening, monitoring and enforcing mechanisms used by family and friends might be operating quite well. Given that they were able to identify the entrepreneurs with the highest returns to assets.

Table 1: **Returns to Human and Physical Capital: OLS**

	Full sample			Only females			Only males		
	Self	Loan	Noneed	Self	Loan	Noneed	Self	Loan	Noneed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
educ	.034	.033	.053	.053	.041	.067	.026	.019	.008
	(.004)***	(.014)**	(.013)***	(.008)***	(.019)**	(.014)***	(.005)***	(.023)	(.024)
exp	.033	.088	.018	.035	.097	.038	.035	.138	.042
	(.005)***	(.018)***	(.019)	(.008)***	(.024)***	(.022)*	(.006)***	(.057)**	(.02)**
expsq	-.0007	-.002	0	-.0007	-.002	-.001	-.0008	-.01	-.0002
	(.0002)***	(.0007)***	(.0007)	(.0003)***	(.0009)***	(.0007)**	(.0002)***	(.005)**	(.0005)
asset	0.137	0.769	0.166	0.086	0.665	0.045	0.119	0.584	-1.988
$(\times 10,000)$	(0.024)***	(0.243)***	(0.403)	(0.058)	(0.404)*	(0.300)	(0.026)***	(0.343)*	(0.683)***
assetsq	-3.94e-7	-2.70e-5	-2.56e-6	1.71e-6	-2.27e-5	-6.82e-7	-4.59e-7	-1.61e-5	1.63e-4
	(1.48e-7)***	(8.37e-6)***	(9.50e-6)	(5.20e-7)***	(1.52e-5)	(7.79e-6)	(1.53e-7)***	(1.05e-5)	(3.50e-5)***
e(N)	3111	363	350	1266	254	263	1845	109	87
e(r2-a)	.207	.186	.162	.202	.151	.127	.158	.188	.211
e(F)	34.533	5.405	.	14.445	3.012	.	16.164	4.688	.

Standard errors in parentheses;
Significance levels::10% **:5% ***:1%.*
Note: Constant, age, female, sec2, sec3, training, registr, account, hours, days omitted
Source:PCBR-Est

Credit

The mean effect of having taken a loan in the past 12 months was positive and statistically significant, with a magnitude of almost 24%. However, this result was not persistent across the different quantiles, being much greater (and statistically significant) for those individuals at the highest quantiles of the conditional earnings distribution.

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[27]See Ghatak (1999) for a theoretical discussion of financial contracts with such characteristics

It is impossible to claim any causality out of this finding given the widely known potential sources selectivity in this context. The first source is related to the entrepreneurs behavior and their respective degrees of risk aversion. It is reasonable to assume that only those entrepreneurs who are less risk averse will self-select themselves to take credit. The second source is related to the screening mechanism which operates in virtually all lending operation (formal and informal), with the objective to screen out the borrowers with a high probability of default.

Another source of selectivity, might be hidden ability and perseverance that might be captured through this variable, given the numerus hurdles that these entrepreneurs probably managed to overcome in order to obtain such a loan. Thus, the higher returns of those entrepreneurs that have taken credit might not only capture the effect of the loan, but also reflect the higher returns associated with riskier activities, or a very effective screening mechanisms, which are only providing credit to the top of the heap, or the entrepreneurs innate abilities, or more probably, a combination of all the above.

Another interesting finding is the the interaction between credit and investment presented a negative coefficient (note that the $F-$test for the joint significance of the coefficient credit, expansion and their interaction) was statistically significant for the OLS, and the 50th, 75th and 90th quantiles (Fig5r and Fig5s). Note that this effect was also present on Table 3, which used profit as the dependent variable.

One possible explanation for this effect is again the effort problem suggested by the Aghion and Bolton and Lehnert model, given that entrepreneurs that took credit and invested performed substantially worse than those the simply self-financed their physical capital expansion in the past 12 months, the effort level of the latter group was much greater than that of the constrained entrepreneurs that had to borrow funds in order to finance their investment.

Liquidity constraint

Taking all entrepreneurs that stated that 'lack of funds' was one of their main difficulties as a group of 'credit constrained' entrepreneurs, we were able to create the variable 'lack' (this is equivalent to coefficient C_i in Equation (9)). This coefficient can be interpreted as a the explicit effect of 'credit constraint' on entrepreneurs earnings. On average these entrepreneurs presented earnings 6.5% smaller them the remaining entrepreneurs, suggesting that 'credit constraints', as defined here, had a negative and statistically significant effect on the entrepreneurs earnings.

As mentioned in Section 3 we also included in our model an interaction term between being credit constrained and having taken a long in the past 12 months. This factor should only takes into account those individuals that are credit worthy and who complain about lack of funds. This variable presented a negative and statistically significant effect on the draw, suggesting that being liquidity constraint had a particularly negative and significant on the draw of those entrepreneurs that were credit worthy (23%).

Note also that both effects presented higher effects on the 50th, 75th and 90th quantiles (Fig5v and Fig5w). This finding can be explained by Evans and Jovanovic model which predicts that liquidity constraint will be more binding as the size of the enterprise increases.

Table 2: **Earnings Equation: Draw**

	ols	quant10	quant25	quant50	quant75	quant90
	(1)	(2)	(3)	(4)	(5)	(6)
educ	.036	.045	.035	.034	.033	.031
	(.004)***	(.011)***	(.006)***	(.004)***	(.003)***	(.006)***
exp	.034	.077	.044	.037	.027	.027
	(.005)***	(.012)***	(.006)***	(.007)***	(.004)***	(.005)***
expsq	-.0007	-.001	0	-.0009	-.0006	-.0005
	(.0002)***	(.0006)***	(.0002)***	(.0003)***	(.0002)***	(.0002)***
age	-.002	-.001	-.002	-.001	-.001	-.002
	(.001)***	(.003)	(.002)	(.001)*	(.001)	(.002)**
female	-.294	-.312	-.328	-.333	-.316	-.262
	(.027)***	(.075)***	(.041)***	(.028)***	(.03)***	(.042)***
asset ($\times 10,000$)	0.143	0.082	0.116	0.183	0.163	0.174
	(0.024)***	(0.098)	(0.052)**	(0.039)***	(0.035)***	(0.042)***
assetsq	-3.94e-11	1.05e-10	1.45e-11	-5.08e-11	-6.38e-11	-7.90e-11
	(1.54e-11)**	(1.07e-10)	(7.14e-11)	(4.65e-11)	(4.21e-11)	(2.43e-11)***
renda	.0001	.0002	.0002	.0001	.0001	.0001
	(.00005)***	(.0001)	(.00005)***	(.00003)***	(.00005)**	(.00008)
cred1	.242	-.04	.151	.196	.335	.311
	(.079)***	(.201)	(.102)	(.077)**	(.072)***	(.084)***

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	ols	quant10	quant25	quant50	quant75	quant90
	(1)	(2)	(3)	(4)	(5)	(6)
-IexpXcred1-1	-.154	-.395	-.279	-.049	-.207	-.268
	(.14)	(.485)	(.188)	(.123)	(.205)	(.185)
stpf2	-.16	.004	-.082	-.099	-.102	-.123
	(.037)***	(.116)	(.049)*	(.043)**	(.033)***	(.048)***
stpf3	-.109	-.034	-.086	-.083	-.088	-.099
	(.037)***	(.084)	(.045)*	(.047)*	(.04)**	(.049)**
lack	-.065	-.109	-.02	-.035	-.046	-.07
	(.031)**	(.097)	(.043)	(.032)	(.031)	(.036)**
-IcreXlack-1	-.23	.132	-.097	-.159	-.256	-.149
	(.125)*	(.505)	(.18)	(.201)	(.143)*	(.146)
e(N)	3824	3824	3824	3824	3824	3824
e(r2-a)	.213	.	.	.	.	.
e(F)	39.498	.	.	.	.	.
$p-$value[1]	0.000	0.902	0.053	0.000	0.007	0.000
$p-$value[2]	0.001	0.454	0.605	0.096	0.000	0.033

Standard errors in parentheses;
Significance levels::10% **:5% ***:1%.*
$p-$value[1]: $p-$value of the joint significance of credit, expansion and their interaction
$p-$value[2]: $p-$value of the joint significance of credit, lack and their interaction
Note: sec2, sec3, training, registr, account, hours, days, dist and expansion omitted
Source:PCBR-Est

Table 3: **Earnings Equation: Net Profit**

	ols	quant50	quant75	quant90
	(1)	(4)	(5)	(6)
educ	.052	.036	.024	.027
	(.033)	(.018)**	(.006)***	(.009)***
exp	.071	.052	.026	.019
	(.037)*	(.028)*	(.009)***	(.007)***
expsq	-.001	0	-.0004	-.0004
	(.001)*	(.001)	(.0002)***	(.0002)**
age	-.004	.005	-.002	-.002
	(.01)	(.006)	(.002)	(.002)*
female	-.437	-.299	-.351	-.261
	(.216)**	(.141)**	(.076)***	(.055)***
asset ($\times 10,000$)	0.079	-0.346	0.160	0.308
	(0.263)	(0.551)	(0.132)	(0.130)**
assetsq	1.50e-10	8.77e-10	1.79e-10	-1.49e-10
	(1.87e-10)	(1.87e-09)	(1.95e-10)	(7.67e-11)*
renda	0	.0002	.0001	.0001
	(.0004)	(.0003)	(.0001)	(.00009)
cred1	1.317	-.084	.572	1.313
	(.804)	(.572)	(.732)	(.426)***
-IexpXcred1-1	-2.142	-1.534	-.59	-1.07
	(1.218)*	(.993)	(.997)	(.382)***
stpf2	-.439	-.332	-.16	-.122
	(.342)	(.197)*	(.057)***	(.062)**
stpf3	-.096	-.395	-.179	-.084
	(.251)	(.092)***	(.051)***	(.041)**
lack	-1.288	-.573	-.212	-.183
	(.277)***	(.145)***	(.066)***	(.052)***
-IcreXlack-1	.71	1.946	.75	-.191
	(1.317)	(1.707)	(1.099)	(.536)
e(N)	3824	3824	3824	3824
e(r2-a)	.019	.	.	.
e(F)	4.051	.	.	.
$p-$value[1]	0.028	0.053	0.000	0.000
$p-$value[2]	0.000	0.000	0.000	0.000

Standard errors in parentheses;
Significance levels::10% **:5% ***:1%.*
$p-$value[1]: $p-$value of the joint significance of credit, expansion and their interaction

... table 3 continued

	ols	quant50	quant75	quant90
	(1)	(4)	(5)	(6)

$p-value^2$: $p-value$ of the joint significance of credit, lack and their interaction
Note: sec2, sec3, training, registr, account, hours, days, dist and expansion omitted
Source:PCBR-Est

6 Conclusion:

Several economic models have described the theoretical causes and consequences of 'credit rationing' and 'under-investment'. Using micro-level data from entrepreneurs in the slums of Rio de Janeiro, we have provided some empirical evidence for such models.

Our empirical model shows that controlling for a set of observable characteristics related to human capital theory, demographics and enterprise characteristics, the entrepreneurs who were able to self-finance their business start-up with previously accumulated wealth have, on average, earnings around 16% to 11% greater those that have to borrow funds and those that did not need any seed money. It is worth mentioning that the average entrepreneur has been operating the same business for over 6 years, which for Brazilian micro enterprise standards is a quite long time, and help us to highlight the fact that we are not looking at short term effects.

Those entrepreneurs that were 'credit constrained' also presented a worse performance (an average effect of 6.5% on draw). This effect of even greater for those entrepreneurs that were credit constrained and who were credit worthy, given that the interaction term between these two factors presented a negative and statistically significant effect of 23%.

Bother factors seem to increase earnings inequality, given their more prominent effects on the higher quantiles of the conditional earnings distribution.

In terms of human capital, the work showed that education and experience can have a potentially important role on reducing earnings inequality, give their greater effects on lower quantiles.

This work provide evidence that initial wealth plays an important role on the entrepreneurs earnings, showing that those that are able to self-finance their start-up are able to operate larger enterprises thus earning more. In addition, entrepreneurs that claim to be credit constrained to perform worse than their counterparts. An important remark on this interpretation is the possible impact of omitted variable bias on the results presented. If high entrepreneurial ability individuals are over-represented in low schooling levels (because these individuals realize at a very early age that formal education would not help them, then not considering ability differences would wrongly lead to an overestimate(underestimate) of the returns to schooling at lower (upper) part of the conditional distributions.

Among other important results is a strong and statistically significant neighborhood effect on the entrepreneurs performance, with, all else constant, the average earnings varying 14% from the poorest to the wealthiest neighborhood.

As well as a strong gender discrimination, with female entrepreneurs earnings 32% less than males on the lowest quantiles of the earning distribution. The factors presented smaller, although still negative and statistically significant effects on the higher quantiles.

Both findings have important policy implications, since they highlight the imperfection of the credit market in the Brazilian economy, and demonstrate its perversive effects on increasing inequality among entrepreneurs.

An important agenda for future research is the investigation of the long-run effects of this initial wealth on business start-up. Such work is crucial in order to understand if such initial endowment inequalities increase or decrease over time. The use of continuous measures of both initial wealth and credit constraint, can also be instrumental in order to understand if such factors present decreasing or increasing effects on earnings.

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Appendix

Table 4: Variables Description

Variable	Description
profit	Net Profit
draw	Draw
asset	Enterprise Physical Assets
assetsq	Enterprise Physical Asset Squared
sec1	Industry
sec2	Commerce
sec3	Service
dexp	Dummy experience
bussadv	Business Advisor
training	Training
partner	Parnters (cat.)
resdpart	Resident Partners (cat.)
busloc	Business Location
bustate	Business State Situation
raw	expenses with Raw Materials
employee	expenses with employees
social	expenses with employees Social Security
rentsta	expenses with State Rent
rentmch	expenses with Machinery Rent

Continued on next page...

Variable	Description
fuel	expenses with Fuel
utilities	expenses with Public Utilities
taxes	expenses with Taxes
other	Other expenses
registr	Lack of Registration
account	Lack of Account Controls
labour	Number of employees
female	Female
educ	Years of Schooling
school	Schooling (categorical)
agect	Age (categorical)
age	Age
agesq	Age Squared
exp	experience
expsq	experience Squared
stupfin	Start up Finance
stpf1	stupfin==Own
stpf2	stupfin==Loan
stpf3	stupfin==Did not need
resid	Residence
credit	Took Credit
cred1	credit==Yes, in the past 12 months
cred2	credit==No
cred3	credit==Yes, more than a year
source	Credit Source
fin1	source==Friend and/or Relative
fin2	source==Commercial Banks and other Formal Financial Institutions
fin3	source==Churches, Associations and Other Organizations
fin4	source==Individuals who are not relatives
fin5	source==Other
cap	Capital as motivation
bad	Business did not performa well in the past 12 months
hours	Hours per day
days	Days per week
lack	Lack of Funding
_IcreXlack_1	(cred1==1)*lack
expansion	Expanded in the past 12 months
_IexpXcred1_1	(expansion==1)*cred1
time	Time of operation
prev	Previous occupation
prev1	prev==Employed
prev2	prev==Self-employeed
prev3	prev==Unemployed-Retired-House Wife
motiv	Motivation to Entrepreneurship
motiv1	motiv==Time and Capital
motiv2	motiv==Oportunity
motiv3	motiv==Unemployed
motiv4	motiv==Others
capital	Source of initial capital
capital1	capital==Compensation
capital2	capital==Inherence
capital3	capital==Savings
capital4	capital==Own Resources
capital5	capital==Loan Family
capital6	capital==Loan Bank
capital7	capital==Loan Friend
capital8	capital==Did not need
capital9	capital==Other

| Variable	Mean	Std. Dev.	Min.	Max.	N
profit	50.127	325.01	-1868.426	1954.473	4191
draw	327.737	288.41	0	1929.582	4191
asset	3466.783	12089.977	0	300000	4191
sec1	0.077	0.266	0	1	4168
sec2	0.328	0.47	0	1	4168
sec3	0.595	0.491	0	1	4168
dexp	0.566	0.496	0	1	4187
bussadv	0.031	0.172	0	1	4186
training	0.032	0.177	0	1	4184
partner	1.131	0.358	1	3	4150
resdpart	1.131	0.358	1	3	4150
busloc	1.628	0.717	1	4	4186
bustate	1.271	0.589	1	3	4181
raw	0.888	0.316	0	1	4191
employee	0.969	0.175	0	1	4191
social	0.107	0.31	0	1	4191
rentsta	0.117	0.322	0	1	4191
rentmch	0.04	0.196	0	1	4191
fuel	0.09	0.287	0	1	4191
utilities	0.332	0.471	0	1	4190
taxes	0.023	0.15	0	1	4191
other	0.164	0.37	0	1	4191
registr	0.952	0.214	0	1	4181
account	0.46	0.498	0	1	4176
labour	0.47	0.939	0	31	4191
female	0.458	0.498	0	1	4188
educ	6.246	3.492	0	12	4184
agect	2.979	0.78	1	4	4191
age	41.999	11.33	15	65	3956
agesq	1892.283	969.188	225	4225	3956
exp	5.69	7.402	0	60	4187
expsq	87.154	239.635	0	3600	4187
stpf1	0.816	0.388	0	1	4173
stpf2	0.092	0.289	0	1	4173
stpf3	0.092	0.29	0	1	4173
resid	0.915	0.279	0	1	4184
cred1	0.075	0.264	0	1	4191
cred2	0.884	0.321	0	1	4191
cred3	0.041	0.198	0	1	4191
fin1	0.192	0.394	0	1	484
fin2	0.690	0.463	0	1	484
fin3	0.006	0.079	0	1	484
fin4	0.072	0.259	0	1	484
fin5	0.039	0.194	0	1	484
hours	9.435	2.982	1	20	4178
days	6.352	1.184	1	7	4186
cap	0.038	0.191	0	1	4183
bad	0.023	0.148	0	1	4177
expansion	0.126	0.332	0	1	4177
_IcreXexpan_1	0.016	0.125	0	1	4177
lack	0.222	0.416	0	1	4191
_IcreXlack_1	0.019	0.138	0	1	4191
time	6.17	8.166	0	99	4191
prev1	0.351	0.477	0	1	4191
prev2	0.169	0.375	0	1	4191
prev3	0.48	0.5	0	1	4191
motiv1	0.201	0.401	0	1	4183
motiv2	0.351	0.477	0	1	4183
motiv3	0.212	0.409	0	1	4183
motiv4	0.236	0.425	0	1	4183
capital	3.726	1.889	1	9	4184
capital1	0.171	0.376	0	1	4184
capital2	0.024	0.153	0	1	4184
capital3	0.225	0.418	0	1	4184
capital4	0.392	0.488	0	1	4184
capital5	0.076	0.264	0	1	4184
capital6	0.003	0.056	0	1	4184
capital7	0.013	0.113	0	1	4184
capital8	0.092	0.289	0	1	4184
capital9	0.004	0.065	0	1	4184
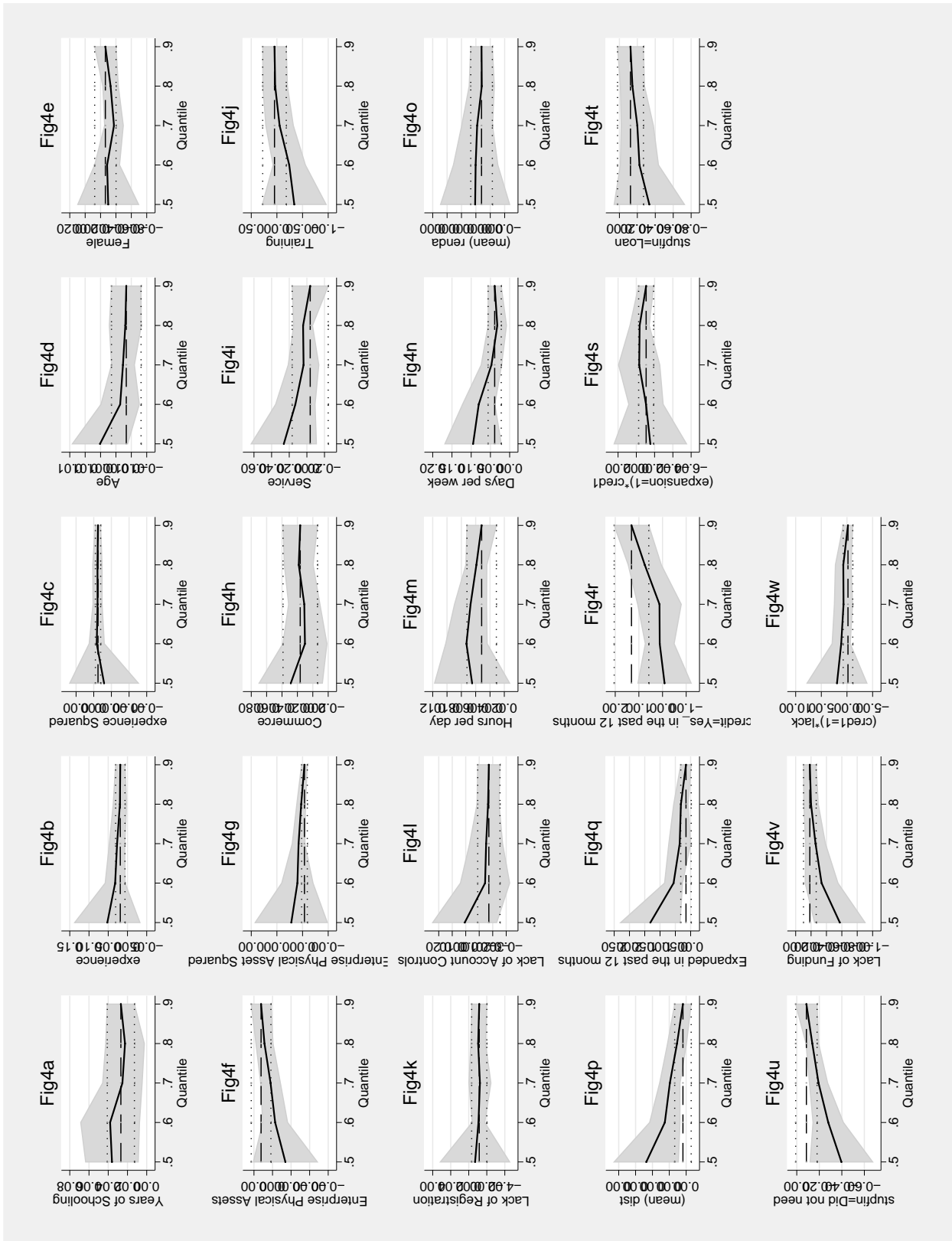
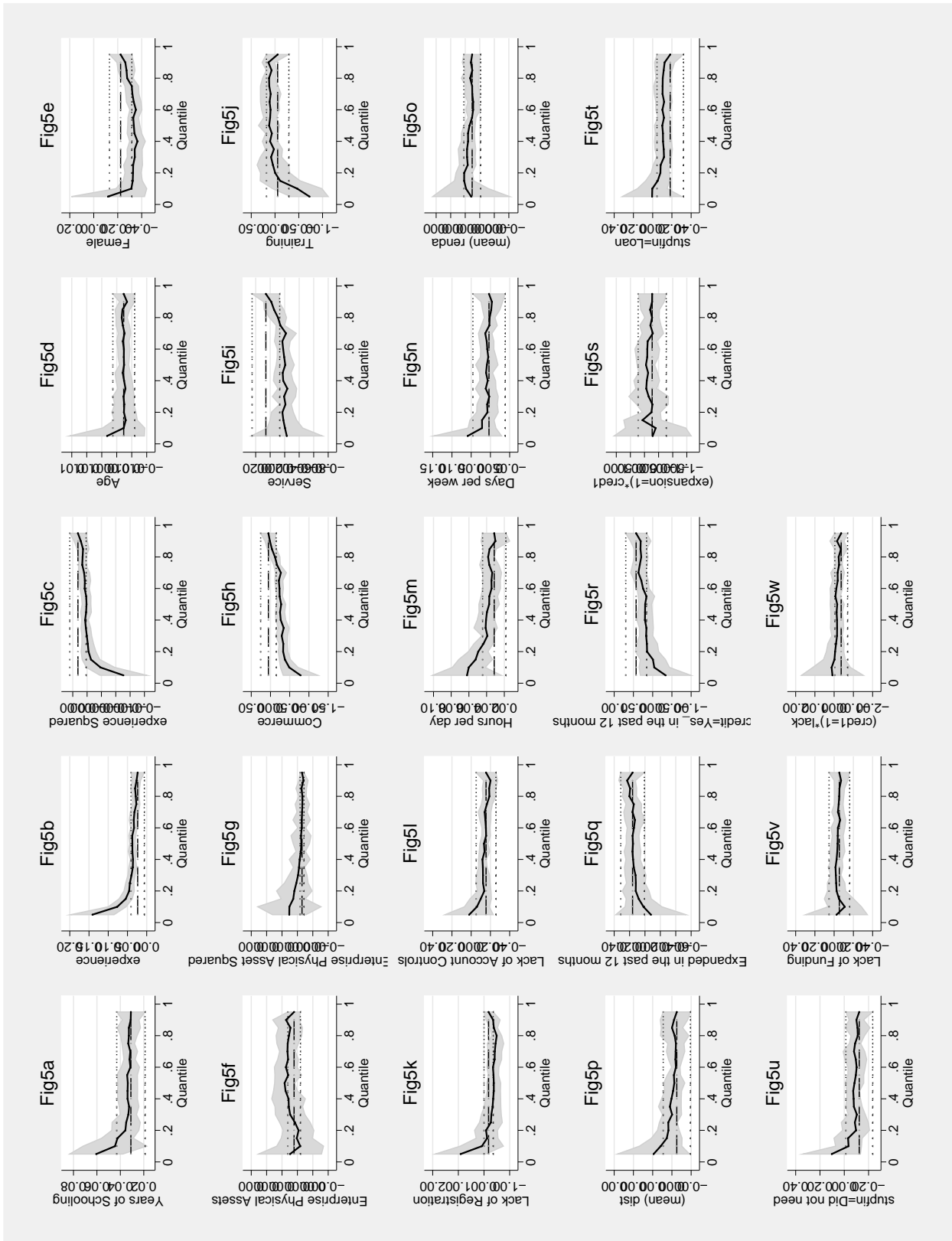Figure 4: Quantile Regressions: Profit Partial Derivative

Figure 5: Quantile Regression: Draw Partial Derivative