Social Barriers to Entrepreneurship in Africa: The Forced Mutual Help Hypothesis*

Philippe Alby[1] Emmanuelle Auriol[2] Pierre Nguimkeu[3]

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Abstract: Africa economy is characterized by a large informal sector and by an over-representation of entrepreneurs of foreign origin in the formal one. The paper argues that social arrangements prevailing in Africa partly explain these results. As formality marks economic success, local entrepreneurs in the formal sector have the social obligation to provide a job and to redistribute their wealth to the members of their extended family. Such firms are less productive than their foreign counterparts. High family taxes and reduced profit margins discourage formal entrepreneurship. The relevance of the theory is assessed with a database compiling surveys from 10,480 enterprises in 31 Sub-Saharan African countries performed between 2002 and 2007. The empirical analysis supports the theoretical analysis. Combined with the lack of credit, the labor management distortion created by the family tax takes its toll on the growth of the African formal economy. Using the estimated structural parameters, the proportion of missing African entrepreneurs varies between 5% and 8% of the overall workforce of the formal sector.

Keywords: Entrepreneurship; Family Solidarity; Informal Sector; Africa

JEL classification: H53, H55, L26, O14, O17, O55

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[1]Toulouse School of Economics (ARQADE) Toulouse, Place Anatole-France, 31042 Toulouse cedex, France, email: Philippe.Alby@univ-tlse1.fr

[2]Toulouse School of Economics (ARQADE and IDEI) Toulouse, Place Anatole-France, 31042 Toulouse cedex, France, email: emmanuelle.auriol@tse-fr.eu

[3]Georgia State University, Andrew Young School of Policy Studies, PO Box 3992, Atlanta, GA 30302-

1 Introduction

African countries are characterized by a dual economy where a small modern industrialized sector co-exists with a large informal sector.[1] The limited size of the formal sector explains that direct taxation in percentage of GDP is three time lower in Sub-Saharan Africa than in advanced economies.[2] With very low tax revenue as a proportion of GDP, African countries do not provide much public goods and even less social protection. On average, Sub-Saharan Africa countries allocate only 4.8 per cent of their gross domestic product to social security (ILO 2010). This is the lowest level of investment in social protection for a region in the world.[3] In the absence of a public safety net, Africans have developed a culture of "forced mutual help" (Firth 1951). Wealthy Africans have the social obligation to share their ressources with their needy relatives and extended family. Since becoming an entrepreneur in the formal sector marks economic success, it inevitably involves in the African context substantial family taxation. Combining theoretical and empirical analysis the paper studies how the forced mutual help constraint influences formal entrepreneurship. It distinguishes local entrepreneurs from entrepreneurs of foreign origin. The theoretical analysis shows that the forced mutual help constraint is distortive because it leads to overstaffing in local firms, which as a result are less efficient than firms managed by foreigners. Disadvantaged by the family taxation and the misallocation of labor it yields, individual of local origin becomes less often entrepreneur. Exploiting World Bank surveys from 10,480 enterprises in 31 Sub-Saharan African countries performed between 2002 and 2007, we next confront the model predictions with the available data. Since these empirical results support the theory, we finally estimate the percentage of missing local entrepreneurs in the formal sector with the help of structural estimations.

The study of barriers to entrepreneurship is not new in the literature. Since the seminal paper by Evans and Jovanovic (1989) that has shown on US data the importance of borrowing constraints in entrepreneurial choice, many papers have emphasis that the tightness of credit constraints is a major obstacle to entrepreneurship. In developing countries imperfect capital markets have hence been found to be a key determinant of informality (see for instance Straub 2005, De Mel et al. 2008, Grimm et al. 2011). Another important determinant of informality, and thus of firm growth, is the existence of entry sunk costs to the formal sector. These costs are proportionally higher in poor

3992, USA; email: nnguimkeu@gsu.edu

[1]The International Labour Organization estimates that urban informal employment absorbs 61% of the urban labor force in Africa (ILO 1999). Similarly more than 90% of new jobs created between 1990-1994 in Africa were in the informal sector (Kuchta-Helbling 2000).

[2]For international comparison of countries' tax structure and level see Tanzi and Zee (2000), Martinez-Vazquez et al. (2009) and Keen and Mansour (2010).

[3]In comparison it is 23.2% for countries of Western Europe and the world average is 10.9 % (see ILO 2010). Tanzi and Schuknecht (2000) show that the difference between OECD and developing countries' public expenditure is the OECD's expenditure on social security.

countries than in advanced economies. As a result firms in developing countries, especially small ones, remain informal, because becoming formal involves fixed costs that are beyond the reach of poor entrepreneurs (see Djankov et al 2002, Auriol and Warlters 2005). Finally, excessive or inappropriate government regulations have also been found to be a significant constraint on entrepreneurship (e.g., Botero et al. 2004 on labor market regulation).

In the African context additional barriers to entrepreneurship must exist for the local people. Indeed "small and medium enterprise (SME) are almost everywhere in Africa, mainly in the hands of non-African aliens" (Tshikuku 2001). For instance in his study on SME in Kenya and Zimbabwe, Fafchamps (2004) finds that only 32% of firms are in the hand of indigenous-African. This result is confirmed by Biggs and Shah (2006) who find that in Kenya most firms are in the hands of Asians, while in Zimbabwe they are in the hands of Europeans and to a lesser extent Asians. Biggs and Shah (2006) find that ethnic minority groups, such as the Indian in East Africa, the European in Southern Africa, the Lebanese in West Africa, dominate many of the major manufacturing activities. In this paper we study a new type of barriers to entrepreneurship, related to the forced mutual help norms prevailing in Africa, that contribute to explain this equilibrium.

There is a substantial literature, mainly anthropologic but also economic, on the possible negative impact of solidarity norms on economic development. Platteau (2006) explains that private wealth accumulation is perceived as an anti-social behavior in most traditional Africa. He quotes the anthropologist Woodburn (1998 : 52) who based on his observations of Hadza hunter-gatherers in Tanzania writes: "People who have more than they manifestly need are put under relentless pressure to share". In fact in most social networks in Africa sharing is a moral principle and accumulation is not well perceived. The impact of these social norms on economic outcome has been shown to be distortive. For instance Anderson and Baland (2002) show that women join roscas to protect their savings from their husbands and hence to save at a higher rate than they would at home. Studying credit cooperatives in Cameroon, Baland et al. (2011) find that 20% of the loans are fully collateralized by savings held by the borrowers in the same credit institutions. Yet the net interest payments represents 13% of the amount borrowed. Based on interviews with members of the cooperatives, the authors show that some individuals systematically use credit as a way to pretend that they are too poor to have available savings. By doing so, they can successfully oppose request for financial help from friends and relatives. Similarly Duflo et al. (2011) argue that Kenyan farmers do not invest in fertilizer, although it would substantially raise their yield, because it is difficult for them to protect their savings from consumption demands. Bernard et al. (2010) analyze theoretically the role of social norms in opposing economic differentiation on the emergence of market-oriented organizations and show that they tend to preclude

their emergence and distort their structure. They illustrate their results using a dataset of 646 village organizations in Burkina Faso. Finally recent experiments in Kenya and in Liberia confirm that social pressures to share with relatives create disincentives to make profitable investments. In rural Kenya within a controlled laboratory environment, Jakiela and Owen (2010) find that both women, particularly unmarried women, and men, particularly when they have recently been asked for gifts or loans by relatives, are willing to reduce their expected profits to avoid making positive income shocks observable to the community. In a similar type of experiment conducted in Liberia, Nillesen, Beekman, and Gatto (2011) combining survey and experiment data, find that individuals with strong family ties within the community tend to make lower profitable investments than individuals with weaker family ties. They are also willing to pay to hide their money. These findings support the hypothesis that kinship networks can hamper profitable investments, as people want to avoid sharing their wealth with an extensive network.

However none of these papers study how this problem mights affect the decision to become a formal entrepreneur, and thus the development of a healthy productive sector. The only paper focusing on the issue of entrepreneurship in this context is the paper by Grimm et al. (2011) and it studies the informal sector. It aims to contribute to the literature on high capital returns in small informal firms by analyzing whether social networks, more specifically those related to the family and kin, act as a constraint for informal entrepreneurs or as an asset. They use an original data set (1-2-3 surveys) covering informal entrepreneurs in seven West-African agglomerations. They find that local social networks within the city have positive effects on factor use and hence added value, presumably by easing credit and insurance markets constraints. However they also find robust negative effects associated with social networks tied to the village of origin. These effects get diluted with geographical distance, probably because with rising distance it is easier to hide the generated income and to protect it from abusive demands. The present paper is complementary to the Grimm et al. (2011) paper as it focus on the formal sector. It contributes to the new literature on the forced mutual help constraint by exploring how it impacts the decision to become a formal entrepreneur in the African context.

To guide the analysis, we model the choice of potential entrepreneurs with idiosyncratic ability and a fixed amount of capital, between becoming entrepreneur in the formal sector or becoming a wage worker/self-employed in the informal sector. We consider foreigners and local entrepreneurs. Contrary to the former, local entrepreneurs have the social obligation to subsidize their family. We show that they minimize the burden of the family tax by employing their relatives as much as they can. This strategy maximizes the entrepreneur net profit. However it is socially costly because family members do not necessarily have the right qualifications for the job. Recruiting family and relatives

rather than the best qualified people distorts productive efficiency. Everything else being equal local firms are less productive and less profitable than firms owned by foreigners. Reduced profit margins discourage entrepreneurship: with similar credit constraint and entrepreneurial ability local people becomes less often entrepreneurs than foreigners. Combined with a lack of credit this precludes Sub-Saharan formal sector from growing.

We derive from the model three main sets of predictions. First the labor force of local firms, which mainly comes from the pool of unemployed manager's relatives, is less qualified and less competent than the labor force of foreign firms. This implies that the labor force composition and also training programs offered by the local firms differ from those of foreign ones. Second the theory predicts that the local firm has a larger labor force embodied in a larger labor/capital ratio. Third the labor productivity of a local firm is lower than the labor productivity of a regular firm. Finally if the problem of forced solidarity is indeed relevant, the results should be different in countries with relatively better social protection than in countries without such social protection.

The empirical relevance of the model predictions is assessed with the help of the Enterprise Survey database maintained by the World Bank.[4] This database compiles surveys from 10,480 formal enterprises in 31 Sub-Saharan African countries performed between 2002 and 2007. The estimations reveal that African entrepreneurs are credit constrained, which is consistent with previous results in the literature. More interestingly they reveal that African entrepreneurs are also constrained in the labor market. The estimations on labor force composition, training, labor to capital ratio and labor productivity are all consistent with the model predictions.

We next use our theoretical model and data on workers of formal firms to perform a structural estimation of the model. This allows us to get an estimate of the fraction of missing African entrepreneurs, that is, the proportion of African wage-workers who would have chosen to become entrepreneurs if potential social pressure to redistribute resources didn't exist. Structural estimates are obtained by maximizing a likelihood function constructed by matching the expected probability of occupations as generated by the model to the actual occupational status observed in the data. The results show that between 5 to 8 percent of African workers are self-excluded from entrepreneurship due to social pressure.

Finally, we use the Institutional Profiles Database[5] as a complementary source of data to assess the presence of social safety nets within each surveyed country. An Institutional Solidarity Index (ISI hereafter) is computed for 21 of the 31 countries surveyed by the World Bank. We split the countries into two sub sample according to whether they are

[4]Available at http://www.enterprisesurveys.org/.

[5]http://www.cepii.fr/anglaisgraph/bdd/institutions.htm

worse or better than the median sample ISI. Regressions show that local firms located in countries with poor social protection are strongly affected by the forced solidarity constraint while it is not the case for local firms located in countries with better social protection. This suggests that social security, public retirement plans, and other public schemes aimed at protecting unemployed, sick or old people in advanced economies are not solely explained by people inner taste for solidarity and redistribution. They are also economic tools to prevent an inefficient allocation of labor in firms. The lack of such mechanisms in Sub-Sahara Africa seems very costly. By eroding the local firms productivity, forced mutual help constitutes additional barriers to formal entrepreneurship. With an atrophied formal sector, tax revenues are low. This reduces further the government ability to develop social security and insurance, reinforcing the need for family/ethnic solidarities.

The next section builds a model of entrepreneurial choice which formalizes the forced mutual help constraint for local entrepreneur and from which we derive testable predictions. Section 3 assesses the relevance of the theory on a sample of 31 African countries. Finally, section 4 offers some concluding remarks.

2 The model

The model is based on Evans and Jovanovic (1989). There is in the economy a continuum of potential entrepreneurs. They have different ability (e.g., different education level, human and social capital) captured by a parameter θ. To keep the exposition simple we present in the main text a Cobb-Douglas specification of the production function

$$Y = \theta K^{\alpha} L^{1-\alpha} \qquad \alpha \in (0,1) \tag{1}$$

where K is the stock of capital and L the quantity of labor used in the firm of entrepreneur with ability θ. However the Appendix 6.1 shows that our results are robust to a general specification of the production function (i.e., any function $f(\theta, K, L)$ increasing and concave in each of its arguments).

We assume that the maximal stock of capital available to the entrepreneur, K, is constrained. This assumption is consistent with the fact that entrepreneurs are credit constrained in Africa. The exogenous threshold may vary from one individual to the other. By contrast labor supply is plentiful. The entrepreneurs optimize freely the quantity of labor, denoted L, hired in their firms. The unit price of capital is r and the unit price of labor is w. Each individual has one unit of labor that he can use either to become an entrepreneur or to work for a wage $w > 0$ (i.e., in other people firms or as self-employed).

The optimal choice depends on the capital available to the agent and on his/her ability. We make the following assumption about ability dispersion.

A1 θ are independently distributed in $[0, \overline{\theta}]$.

The model establishes a distinction beteween local entrepreneurs, identified by l, and "foreign" entrepreneurs (i.e, foreigners, outsiders), identified by f. Local entrepreneurs face the social obligation to support their relatives. We assume that they have to pay a tax $T \geq 0$ to their family. We focus on a lump sum tax as it is a priori less distortive than a proportional tax. If productive inefficiency occurs in the local firm, it will not be related to the structure of the family tax. Moreover a lump sum tax is also less demanding in term of information acquisition. By contrast to implement a proportional tax on profit the entrepreneur's relatives need to observe the profit of the firm. The empirical evidences mentioned in the introduction show that the local entrepreneurs will do everything they can to hide this information (see Jakiela and Owen (2010), Nillesen, Beekman, and Gatto (2011), Balland et al (2012)). Nevertheless our results are robust to the introduction of a proportional tax (see the discussion below).

The entrepreneurs can pay the family tax either directly in cash or they can pay it by hiring their relatives for a wage w. Since they are chosen for their family connexion, needy relatives tend to be less efficient than regular workers chosen for their sheer ability.[6] The productivity of one unit of labor by a relative is $\beta \leq 1$, while a regular worker productivity is 1. The amount of productive labor available to a local firm is

$$L_l = L + \beta L_f \tag{2}$$

where L_f is the number of family members hired in the local firm and L the number of regular workers. By contrast a regular firm hires workers for their ability. The amount of productive labor available is simply L_f, the number of workers hired by the firm.

$$L_f = L \tag{3}$$

Finally becoming formal usually involved sunk cost in the form of entry/registration fees in developing countries. Adding such fixed costs to the formal sector entry would not change the results of the paper as both type of firms, local and foreign, would have to pay it. We thus avoid introducing new notation by assuming that it is nil. In what follows we study the benchmark case of a foreign entrepreneur.

[6]The entrepreneur is confronted with a cream-skimming problem. The most productive and educated relatives are able to find a position elsewhere or can become also entrepreneur. The people who ask for permanent help in the form of a job are the less productive.

2.1 Entrepreneur without family liability

We study the incentive an individual might have to become a formal entrepreneur. She might work for a wage w or use her time to become an entrepreneur. Entrepreneur is credit constrained so that she can borrow at most K. Without any loss of generality the price of the output is normalized to 1. Since the stock of capital that can be invested is constrained by K, the entrepreneur optimizes her profit with respect to L for any K. The objective function of the entrepreneur is

$$\max_{L} \Pi^f(L) = \theta K^{\alpha} L^{1-\alpha} - wL - rK. \tag{4}$$

The first order condition is

$$(1-\alpha)\theta K^{\alpha} L^{-\alpha} - w = 0. \tag{5}$$

It is easy to check that the profit function is concave in L. The optimal employment level is:

$$L_f = \left(\frac{(1-\alpha)\theta}{w}\right)^{\frac{1}{\alpha}} K. \tag{6}$$

Substituting L_f in (4), the profit of the foreign entrepreneur with ability θ and a stock of capital K is:

$$\Pi^f(\theta) = \left[\frac{\alpha}{1-\alpha}\left(\frac{(1-\alpha)\theta}{w^{1-\alpha}}\right)^{\frac{1}{\alpha}} - r\right] K. \tag{7}$$

$\Pi^f(\theta)$ is linear in K, which implies that the optimum is reached either for 0 or for the maximum value. We deduce that the agent with ability θ and borrowing capacity K will choose to become an entrepreneur if her profit is higher than her earning as a wage worker. That is, if $\Pi^f(\theta) \geq w$. In this case she chooses to invest the maximum possible amount K in her firm. Let $\theta^f(K)$ be the value of θ so that $\Pi^f(\theta) = w$.[7]

$$\theta^f(K) = \left(\frac{w+rK}{K}\right)^{\alpha} \frac{w^{1-\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \tag{8}$$

[7]If we add entry sunk cost to the formal sector, F, the profit is decreased by this amount so that the entry condition simply becomes $\Pi^f(\theta) \geq w + F$. One can easily generalized the paper results by substituting in what follow $F + rK$ to rK.

We deduce easily the next proposition.

Proposition 1 *An agent with access to capital K chooses to become entrepreneur if and only if $\theta \geq \theta^f(K)$.*

The more talented and wealthy people (i.e., those with ability above $\theta^f(K)$) choose to become entrepreneur. Independently of their wealth, people who are not talented enough (i.e., $\theta \leq \frac{r^\alpha w^{1-\alpha}}{\alpha^\alpha(1-\alpha)^{1-\alpha}}$), do not become entrepreneur. A greater concern is that people who are credit constrained, do not become entrepreneur, even if they are very gifted. Indeed it is straightforward to check that $\theta^f(K)$ is decreasing in K. Because of the lack of credit, talented entrepreneurs end up as wage workers or self-employed in the informal sector, while less able, but wealthier individuals become formal entrepreneur.

2.2 Local entrepreneur

We study now the incentive to become entrepreneur for local people. They aim to maximize their profit under the constraint that they pay the family tax T. They have to compute the optimal way to pay the tax. They have to spread it between wages payment (labor contract) and direct transfert to family members. They solve:

$$\max_{L,L_f,\tau} \Pi^l = \theta K^\alpha L_l^{1-\alpha} - wL - wL_r - rK - \tau T \tag{9}$$

$$\text{s.t.} \qquad L_l = L + \beta L_r$$

$$\tau T + wL_r = T$$

The first constraint is the amount of productive labor available to the firm when it hires L normal workers and L_r relatives to help them. The second constraint is the family tax that can be paid either in wages, wL_r, or in cash τT, where $\tau \in [0,1]$ is the fraction of the tax that is given directly in cash. We deduce that $L_r = \frac{1-\tau}{w}T$ and that $L_l = L + \beta\frac{1-\tau}{w}T$. Substituting L_r and L_l by their value in the objective function and simplifying yields:

$$\max_{L,\tau} \Pi^l = \theta K^\alpha \Big(L + \beta\frac{1-\tau}{w}T\Big)^{1-\alpha} - wL - rK - T. \tag{10}$$

It is straightforward to check that, for all $\beta \geq 0$, the objective function is decreasing in τ so that at the optimum $\tau^* = 0$.[8] In the limit when $\beta = 0$ the entrepreneur is indifferent

[8]The first order conditions with respect to τ yields: $\frac{\partial \Pi^l}{\partial \tau} = -(1-\alpha)\frac{\beta}{w}T\theta K^\alpha \Big(L + \beta\frac{1-\tau}{w}T\Big)^{-\alpha} \leq 0$.

between hiring her relatives or paying a cash transfer. This result is collected in the next proposition.

Proposition 2 *Independently of the value of $\beta \geq 0$ a local entrepreneur always prefers to pay the family tax by hiring his relatives in the firm.*

The result in Proposition 2 is very robust. First, as shown in Appendix 6.1, it does not depend on the specific form of the production function. Any other regular production function leads exactly to the same result. Second it does not depend on the way the family tax is computed. For instance with a proportional tax with rate t on profit, the tax constraint becomes $t\Pi^l = wL_r + \tau\Pi^l$. The amount that the entrepreneur needs to pay in cash (i.e., without any labor compensation) is $\tau\Pi^l = t\Pi^l - wL_r$. The entrepreneur then maximizes $\Pi^l(1-\tau) = \Pi^l(1-t) + wL_r$ such that $\Pi^l = \theta K^\alpha (L + \beta L_r)^{1-\alpha} - wL - wL_r - rK$. This objective function increases with L_r. The entrepreneur, who has to pay a proportional profit tax to her family, pays it preferably in wages in exchange of labor supply.

The result in Proposition 2 is not obvious economically because by hiring relatives the entrepreneur reduces the productivity of the firm, and thus its profit. This is especially true when β is very low. However it is optimal from the entrepreneur point of view. Indeed she is not interested in maximizing productive efficiency, nor the firm's profit. She is interested in maximizing her net revenue. The entrepreneur who has to pay a tax, would rather get some compensation in kind for it, rather than nothing. Family taxation is thus socially distortive because it creates an incentive to hire inefficient workers. It pushes the local firms away from the productive efficiency frontier. In practice formal entrepreneurs pay the family tax both by employing their relatives and by direct cash transfers. Indeed some of the requests they face are small and one shot (e.g., for funerals, weddings, hospital fees, medicines) while others come from people who live too far away or are too young to work (e.g. for schooling or migration costs). In these cases they cannot make them work in exchange for their financial support. They thus also give cash to people who are not employed in their firm.[9]

We next compute the optimal employment level in the local firm. It is easy to check that the objective function is concave in L. The first order condition, which is also sufficient, is:

$$\frac{\partial \Pi^l}{\partial L} = (1-\alpha)\theta K^\alpha \Big(L + \beta \frac{1-\tau}{w} T\Big)^{-\alpha} - w = 0. \tag{11}$$

[9]We are grateful to Marcel Fafchamps for pointing out this fact.

Since $\tau^* = 0$ we have $L_r^* = \frac{T}{w}$ so that equation (11) is equivalent to:

$$(1-\alpha)\theta K^{\alpha}\Big(L+\beta\frac{T}{w}\Big)^{-\alpha} = w. \tag{12}$$

The quantity of external labor that maximises the firm profit is:

$$L = \left(\frac{\theta(1-\alpha)}{w}\right)^{\frac{1}{\alpha}} K - \beta\frac{T}{w}. \tag{13}$$

Depending on the parameters values, L is not always positive. The optimal level of external hiring for a local firm is:

$$L^* = \text{Max}\left\{0, \left(\frac{\theta(1-\alpha)}{w}\right)^{\frac{1}{\alpha}} K - \beta\frac{T}{w}\right\}. \tag{14}$$

We deduce that $L^* > 0$ if and only if $\theta > \frac{w}{1-\alpha}\Big(\frac{\beta T}{wK}\Big)^{\alpha}$. In order to rule out corner solution (i.e., $L^* = 0$) in the sequel of the paper we make the following assumption.

A2 $$\alpha + \beta \leq 1.$$

We will check later that assumption A2 implies that if an individual chooses to become a formal entrepreneur then her θ is large enough so that $L^* > 0$ (i.e., $\theta > \frac{w}{1-\alpha}\Big(\frac{\beta T}{wK}\Big)^{\alpha}$).

Substituting L_r^* and L^* in the profit function (9), the entrepreneur earning is:

$$\Pi^l(\theta) = \left[\frac{\alpha}{1-\alpha}\left(\frac{(1-\alpha)\theta}{w^{1-\alpha}}\right)^{\frac{1}{\alpha}} - r\right]K - (1-\beta)T. \tag{15}$$

Let $\Delta\Pi = \Pi^f(\theta) - \Pi^l(\theta)$. Comparing (7) and (15) yields:

$$\Delta\Pi = (1-\beta)T \geq 0. \tag{16}$$

Since they have to pay a tax to their relatives, it is intuitive that local firms' profit is smaller than foreign firms' profit. However the gap is smaller than T and decreases with β. In the limit, when $\beta = 1$, the two types of firms are equally profitable. This result illuminates that local entrepreneurs have very strong incentives to help their relatives by employing them, rather than by giving direct cash transfers. By doing so they lower the burden of the family tax and are able to somehow close their revenue gap. They also have incentive to train them in order to increase β. We will check in the empirical section whether they use training in this way or not.

We next compute the threshold value θ so that a local individual is willing to become an entrepreneur. The agent with characteristic θ and K will choose to become an entrepreneur if her profit is higher than her earning as a wage worker. That is, if $\Pi^l(\theta) \geq w$. Let θ^l be the value of θ so that $\Pi^l(\theta) = w$.

$$\theta^l(K) = \left(\frac{w + rK + (1-\beta)T}{K}\right)^{\alpha} \frac{w^{1-\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \tag{17}$$

The agent chooses to become an entrepreneur in the formal sector if and only if $\theta \geq \theta^l(K)$. One can checked that $\theta^l(K) > \frac{w}{1-\alpha}\left(\frac{\beta T}{wK}\right)^{\alpha}$ is equivalent to $\frac{w+rK}{\beta T} + \frac{1-\beta}{\beta} > \frac{\alpha}{1-\alpha}$, which is always true under assumption A2. Then if an agent becomes a formal entrepreneur she necessarily chooses a strictly positive level of external labor $L^* > 0$. Comparing next equations (8) and (17) an autochtone with capital K and ability θ is at a disadvantage to become an entrepreneur compared to a foreigner: $\theta^l(K) \geq \theta^f(K)$.

Proposition 3 *Local people choose to become entrepreneur if and only if* $\theta \geq \theta^l(K) \geq \theta^f(K)$.

It is straightforward to check that $\theta^l(K)$ is decreasing and convex in K. Moreover if $w \leq 2K$, $\theta^f(K)$ is also convex in K. Figure 1 illustrates Proposition 3 under the assumption that $w \leq 2K$. The horizontal axis represents the stock of capital available to the individual, while the vertical axis represents the individual's ability. In the dashed area, below the curve $\theta^l(K)$, are the individuals who choose to work for a wage, while the region above the curve represents those who become entrepreneur.

As illustrated Figure 1 local people become less often entrepreneur in the formal sector compared to their foreign counterparts. It is interesting to check how the gap between local and regular entrepreneurs entry decision, $\Delta\theta(K) = \theta^l(K) - \theta^f(K)$, evolves when K increases. One can easily check that:

$$\frac{d\Delta\theta(K)}{dK} \leq 0. \tag{18}$$

The entrepreneurship gap is larger for countries where credit constraints are tighter. This is likely to be the case in the poorest countries. These are also countries where the social obligation to help relatives is the strongest. With small level of capital available for potential entrepreneurs the family taxes weight heavily on the growth of the formal productive sector, and thus on the economy.

It is important to stress again that although the theory developed in this section use a specific functional form for production technology, we show in the Appendix 6.1 that

our results are not driven by any specific functional form and hence the Cobb-Douglas technology used here is made for the sake of simplicity and ease of economic interpretation only.

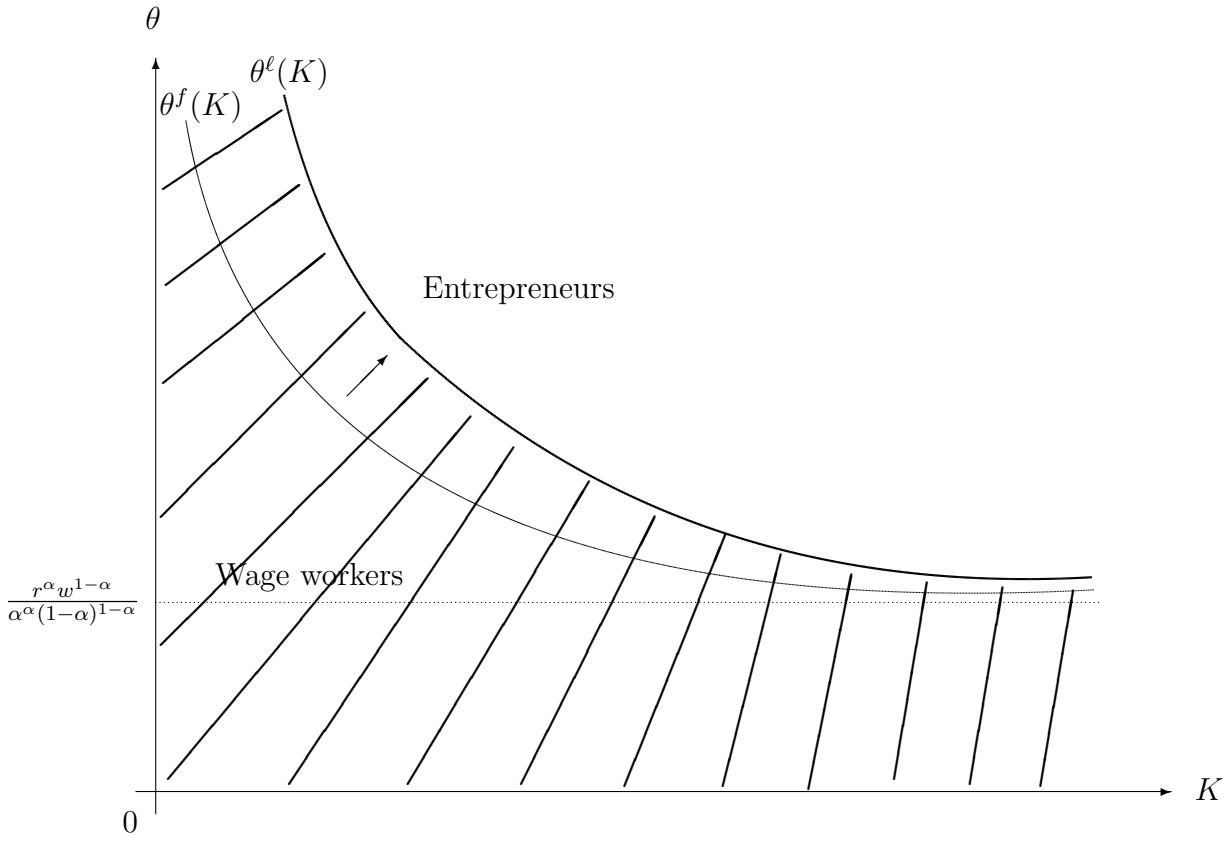

Figure 1: Entrepreneurship decision for locals and foreigners

3 Empirical Analysis

We want to assess how the forced mutual help constraint impacts entrepreneurship in Sub-Sahara Africa. The empirical analysis proceeds in two steps. In the first step we check that the data are consistent with the predictions of the model. In a second step we run structural estimations of the model to estimate the percentage of missing entrepreneurs.

3.1 Implications of the Model

The theory implies that local entrepreneurs pay the family tax preferably by hiring their relatives (Proposition 2). They should thus hire significantly more through informal

means than their foreign counterparts. Moreover if the theory is accurate the labor force of local firms is less qualified and less competent than the labor force of other type of firms. We study the labor force composition (i.e., the proportion of unqualified workers) to assess the relevance of this point. We also look at the training programs offered by the firms to their different type of employees. Indeed if workers are hired because of forced solidarity and not because of their qualifications, the local entrepreneurs might want to train them to make them more productive and hence reduce their profit gap $1-\beta$. Focusing on the level of employment, the theory predicts that, everything else being equal, a local firm has a larger labor force than a regular firm:

$$\frac{L_l}{K_l} = \left(\frac{\theta(1-\alpha)}{w}\right)^{\frac{1}{\alpha}} + (1-\beta)\frac{T}{wK_l} \geq \frac{L_f}{K_f} = \left(\frac{\theta(1-\alpha)}{w}\right)^{\frac{1}{\alpha}}. \tag{19}$$

where $L_l = L^* + L_r^*$, with L^* being defined in (14) and $L_r^* = \frac{T}{w}$, and with L_f being defined in equation (6).

Finally comparing the labor productivity of a local firm, $y_l = \frac{\theta K_l^{\alpha} L_l^{1-\alpha}}{L_l}$, with the labor productivity of a foreign firm, $y_f = \frac{\theta K_f^{\alpha} L_f^{1-\alpha}}{L_f}$, equation (19) implies that local firms are less productive than foreign ones:

$$y_l = \theta\left(\frac{K_l}{L_l}\right)^{\alpha} \leq y_f = \theta\left(\frac{K_f}{L_f}\right)^{\alpha}. \tag{20}$$

3.2 The data

To conduct our empirical analysis we use the Enterprise Survey database maintained by the World Bank.[10] This database compiles surveys from 10,480 enterprises in 31 Sub-Saharan African countries performed between 2002 and 2007.[11] Standardized survey instruments and a uniform sampling methodology were used to minimize measurement error and to yield data that are comparable across different economies. We have merged them in a unique database to conduct our analysis of formal entrepreneurship in Africa.

The surveys have been designed to be representative of the formal economy. They cover small, medium-sized and large enterprises in manufacturing and services sectors.[12]

[10] Available at http://www.enterprisesurveys.org/.

[11] The surveyed countries are Eritrea, Ethiopia and Zambia in 2002; Kenya, Lesotho, Mali, Senegal, South Africa, Tanzania and Uganda in 2003; Benin in 2004; Madagascar, Malawi, Mauritius and Niger in 2005; Angola, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, DRC, gambia, Guinea, Guinea Bissau, Mauritania, Namibia, Rwanda, Swaziland, Tanzania and Uganda in 2006; Ghana, Mozambique, Senegal and South Africa in 2007.

[12] Manufacturing and service sectors consist of 16 two-digit (ISIC) industry classifications: agro-industry, chemicals and pharmaceutics, construction, electronics, food and beverages, garments and

Sample size for the selected industries are large enough to conduct statistically robust analyses. The surveys provide information on firm performance, firm's perceptions about investment climate, and objective measures of the obstacles to firm operations and growth (see the appendix 6.2 for more details).

We also use Institutional Profiles Database[13] as a complementary set of data to assess the presence of social safety nets within each surveyed country. The Institutional Profiles Database presents a set of indicators on the institutional characteristics of 123 developed and developing countries covering 96% of the world population and 99% of world GDP. There are various institutional characteristics. For the purpose of the present analysis we focus on the institutional solidarity index available for 2001, 2006 and 2009. This particular index covers sickness, unemployment and retirement coverage for workers. For each of these coverage a score between 0 (no protection) and 4 (large protection) is attributed.[14] Using these 3 scores, an Institutional Solidarity Index (ISI hereafter) is computed for each year as the sum of the 3 scores weighted by the standard deviation (for all the countries). As the timing of both database differs and considering that institutional solidarity is less volatile than firms' performances we compute the average ISI between 2001, 2006 and 2009. Hence, we have one ISI for 21 over the 31 countries surveyed by the World Bank. This index goes from the minimum 0.00 for Namibia to 2.72 for Mauritius.

The information about entrepreneurs nationality is not available in Enterprise Surveys. However there is the ownership structure of the firms. Hence, the key variable used throughout the paper is the firm's ownership status. To proxy entrepreneurs type, between "local" and "foreign", we make the assumption that an entirely domestically owned firm is run by a local manager. Whereas a firm financed (even marginally) by foreigners cannot be classified as a local family business. In particular it can escape forced family taxation by appointing a foreign manager. We distinguish entirely domestically owned firms, labeled "private domestic firms", from others (i.e., mixed or fully foreign ownership structures) labeled "private foreign firms". As shown in table 1 in the appendix our classification works well to pin down local family businesses. Indeed in more than 98% of the cases the largest shareholder in these entirely domestically owned firms is an individual and/or a family, and in 85% of the cases this individual (or a family member) is the manager of the firm. By contrast in "private foreign firms" the largest shareholders are, in addition to individual or family members, a foreign company (i.e., in 71% of the cases). Moreover when the "private foreign firm" is own by an individual or

leather, hotels and restaurants, IT services, metals and machinery, mining and quarrying, non-metallic and plastic materials, paper, retail and wholesale trade, textiles, transport, wood and furniture.

[13] http://www.cepii.fr/anglaisgraph/bdd/institutions.htm

[14] With 0 if there is no coverage by public or private institutions for sickness, unemployment or unemployment. When such coverage exist, grade from 1 (small proportion of the population covered) to 4 (very large proportion of the population covered)

a family member this individual is significantly less often the manager of the firm than in "private domestic firms".

A first look at the data shows that foreign firms are significantly larger than domestic ones. Table 2 in the appendix shows that roughly 64 % of private domestic firms have less than 20 workers, compared with 36 % for private foreign ones. Conversely, only 9 % of private domestic firms have more than 100 employees, compared with 31 % of private foreign ones. Moreover the average workforce is systematically and significantly (at the 1 percent level) smaller in domestic firms than in foreign firms. This seems to contradict the theory above as we predict larger workforce in local firms. However the theoretical result holds true "everything else being equal". In practice the local firms might try to cope with their relatively low quality workforce by specializing in industries that do not required high skilled workers. Table 3 in the appendix shows that local firms tend to specialize in services and traditional industry such as wood and furniture or garments and leather, while foreign firms tend to specialize in more high-tech industry such as agro-industry, chemicals and pharmaceutical, or plastic material. They are also significantly more present in textile and construction. Finally local and foreign firms might face different constraints on the credit market. Statistics in table 4 on credit and financing shows that foreign firms have more often an overdraft facility or a line of credit (generally in a private commercial bank), when they contract a loan it is collateralized more often by machinery and intangible asset and less often by personal assets than in domestic firms. Domestic firms are discouraged more often than foreign ones to apply for a loan (although they claim more often to need one) by the complexity of procedures, the high interest rates, the collateral requirements, or simply because they think they will not get it.[15]

If entrepreneurs face social pressure to hire their relatives this should show in the means used by firms to find new workers. Table 5 in the appendix shows that domestic firms rely heavily on informal sources to meet their recruitment needs. In roughly 63% of the cases they use family and/or friends networks to hire new employees, in sharp contrast with private foreign firms which rely in 60% of the cases on other means than family network to hire new employees (i.e. essentially public announcements and public or private placement offices).

Our theory highlights that the social pressure which forces local entrepreneurs to hire their relatives translates into a relatively poor quality of the workforce in local firms. The descriptive statistics of the labor force composition presented in Table 6 in the appendix reveals an over representation of unqualified workers in these firms. The supervision

[15]Domestic firms also have their financial statement reviewed far less often by an external auditor than foreign ones. This might be the result of a deliberate strategy of the owner/manager to hide the true financial state of his firms to his relatives.

ratio, which is the number of non production workers over the number of production workers, is almost 14% lower in private domestic firms than in foreign ones. Moreover, not only production workers are over represented in private domestic firms, they are also significantly less educated. Indeed, the proportion of firms with an average education level of a production worker below 6 years is significantly higher (i.e., by 10 percentage point) in domestic firms.

If it is true that local entrepreneurs hire their relatives because of social obligations and not because they need them, they have to find a way to overcome their lack of qualification. Table 7 presents internal training schemes proposed by firms to their employees. The proportion of firms offering training is much lower (i.e., by 20%) for domestic firms than for foreign ones. However, when domestic firms do offer such programs, they train more their production workers (i.e., 70% of them) compared to foreign firms (58% of them). Moreover, among production workers, domestic firms tend to target more unskilled ones compared to foreign firms, although the difference is not statistically significant. Finally, the length of the training periods is significantly greater in domestic firms. In other words, when they are able to offer training programs, domestic firms train more their (unskilled) production workers than their foreign counterparts.

We might consider an alternative set of explanations that may produce similar empirical results. In particular family workers might actually be a preferred alternative for many purposes. Suppose there is a problem of adverse selection, particularly among uncredentialed workers. Family firms would then use information rents to attract less educated (but of better quality, at least per unit dollar) workers, train them more (because they will stay around longer), and need to use less supervision because they are more trustworthy. As domestic firms recruit more through family and friends, they may need to monitor less their production workers as some peer pressure may take place in these local firms. There is actually some evidence that networks play precisely this role of allocating less credentialed workers into higher skilled occupations in a different cultural context (see Munshi 2003 and 2011).[16] Another positive impact of family firms is that they might somehow ease credit and insurance markets constraints. This is at least what Grimm et al. (2011) suggest to explain that local family network within the city have positive effects on factor use and added value in their sample of informal firms.[17] This is also consistent with our data: local firms rely significantly more, although modestly, on family and friends to finance their working capital and their new investment than foreign firms (see table 4).

[16]We are grateful to Andrew Foster for suggesting this discussion.

[17]However they also find, consistently with our study, robust negative effects associated with social networks tied to the village of origin. These effects get diluted with geographical distance, probably because with rising distance it is easier to hide the generated income and to protect it from abusive demands.

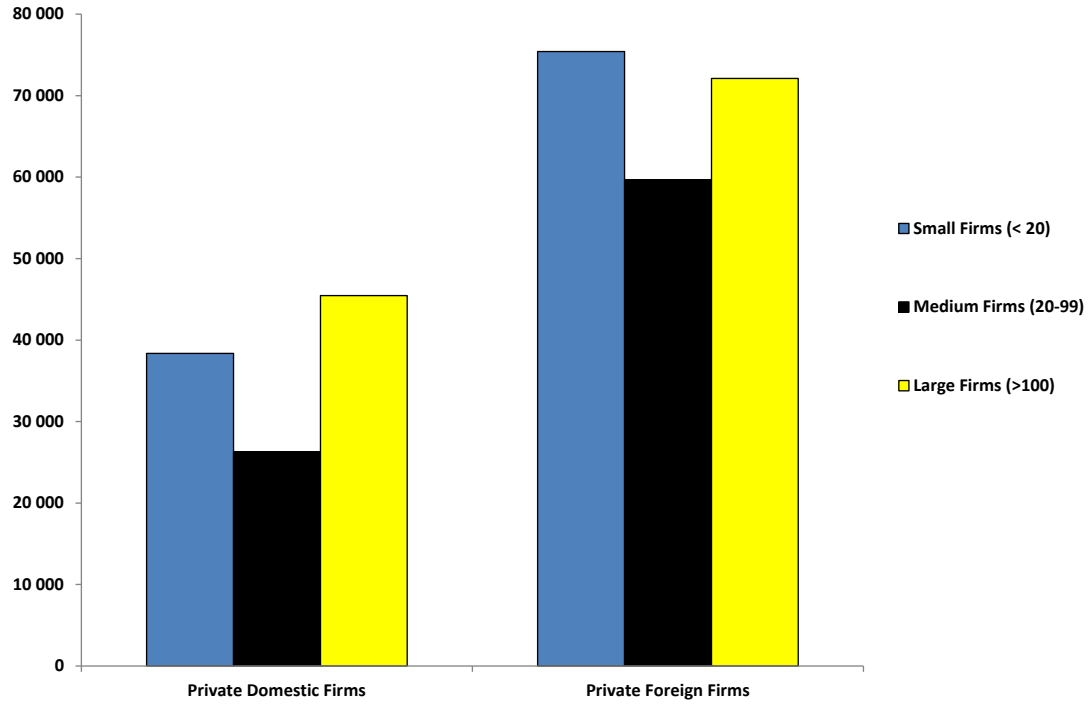

Figure 2 : Profit ($) per employee according to ownership and size.

To assess which of the positive or negative "family" effects dominate in the formal sector in Sub-Sahara Africa we need to look at firms' profitability. Our theoretical model emphasizes that domestic firms should perform poorly compared to the other firms: The social pressures born by local entrepreneurs lead to an inefficient allocation of labor which reduces local firms' productivity. By contrast if family members are the preferred alternative of the firm manager because he is able to sort them out and pick among his uneducated relatives the most able and trustworthy workers, we should observe that local firms perform better than the foreign ones. Figure 2 highlights that domestic firms are less productive than foreign ones. One could argue that this lower productivity is a consequence of the fact that small firms prevail within domestic firms. However, table 8 in the appendix shows that medium and large size domestic firms are significantly less productive than their foreign counterparts. For the small size firms the difference in productivity is large but not significant due to the large variance in this group (i.e., small firms are quite heterogeneous in term of profitability). Another piece of evidence can be found in cases studies. Henry (1996, 2003) has studied successful African firms in the

formal sector. He shows that key to these firms success is the fact that they have found ways to limit the burden of the forced mutual help constraint.[18]

Although these descriptive statistics are consistent with our theoretical results, the differences in workforce composition, training schemes or profitability can be due to other firms' characteristics. We now turn to the regression analysis to check the robustness of these preliminary results with a more complete set of controls.

3.3 Regression results

The variables used in the regressions are described in Table 9 in the Appendix. In each specification we control for the country and the year in which the survey was run, the economic sector or activity, as well as the firms' size and the average education level of the workforce.

(REGRESSION 1)

In the first set of regressions we focus on the prediction related to the workforce composition. Our dependent variable is the labor to capital ratio (in log). We regress this variable over a dummy variable controlling for the type of the firm (100 % of the firm is owned by the domestic private sector). In all the regressions our variable of interest, or its interaction term, is positive which is the expected sign and is significantly (at the 1 percent level) different from 0.

Column 1 controls for basic workforce and firms' characteristics such as age, location, stock of capital and export status. It also controls for firms' degree of modernity through an ISO certification dummy and for the presence of trade union and training programs within the firm. Young, exporting firms with an ISO certification have more capital intensive production process than the other firms. Interestingly, firms declaring that they face difficulties to find adequately educated workers are also more capital intensive. Descriptive statistics show that foreign firms are more concerned by this problem than domestic firms. As a result foreign firms might try to cope with the relative penury of educated workers by training them. Then local and foreign firms use training in a different way. Private domestic firms offer training programs to cope with the constraint of compulsory hiring of unskilled (or inadequate) workers, and thus target blue collars, while foreign firms focus on white collars.

[18]The strategy of these successful firms include recruitment by external agency and placement office to limit the burden of hiring relatives, the development of very detailed procedure books for workers, including managers, to help them oppose inappropriate requests from their extended family, the division of task so that it requires at minimum two persons to complete one task. This last strategy has proven to be very successful to collect bills in a private water company by helping the agents to oppose demand from their acquaintances to waive their bills (see Henry 1996 and 2003).

To assess the relevance of this idea we introduce in the second specification (column 2) the interaction of training programs with our variable of interest (100 percent of the firm is domestically owned). If training practices are the same in local and in foreign firms we do not expect this interaction term to be significantly different from 0. The interaction term is positive and highly significant (at the 1% level), while the variable 100 percent of the firm is domestically owned becomes insignificant. The training dummy, which is negative, becomes highly significant. Foreign firms that offer training programs have significantly lower labor to capital ratio than domestic ones. These more capital intensive firms have more complex production technology. Training programs help them to match workers' skills with technology complexity. By contrast private domestic firms that offer training programs have higher labor to capital ratio. In magnitude it cancels out the effect of having a training program suggesting that these local firms do not manage to reduce their labor to capital ratio through training.

Introducing different variables measuring firms' access to credit (overdraft or credit facilities, access or cost of financing as a major or severe constraint for firms and a dummy controlling for the fact that 100 percent of firms' working capital is financed through internal funds) in column 3, 4 and 5 do not change these basic results. However these new sets of regressions confirm that firms are credit constrained. When they have overdraft or credit facilities they adopt more capital intensive technologies.

Since domestic firms might be more credit constrained than firms owned by foreigners, controlling for the type of industry or activity, they might be obliged to specialize in more labor intensive technologies. To check the relevance of this idea we introduce in columns 4 and 5 an interaction term between having an overdraft or credit facilities and being a domestic firm. This interaction term is negative, which is the expected sign, but it is not significantly different from zero, suggesting that the credit constraint does not play differently for local and foreign firms. To further disentangle credit and labor market effects in column 5 we add the interactions between training programs and domestic firms, and between access to credit and domestic firms. The result is the same as in column 2: the excessive proportion of workers in local firms seems to be related to their inadequate skills rather than to technological choice due to credit constraints. Private domestic firms that offer training sessions display a significantly (at the 1% level) more labor intensive technology than their foreign counterparts. Firms are also credit constraint as the overdraft or credit facilities dummy is negative and highly significant. In other words, local firms face constraints both on the credit market and on the labor market, and the labor market constraint is specific to them.

In practice social pressure on domestic entrepreneurs to redistribute their wealth is related to the absence of social security. If the problem is indeed the lack of public safety net, in countries which offer more social protection local entrepreneurs should be under

less pressure to hire their relatives. To assess the relevance of this idea, we split the countries sample in two subsamples according to the ISI index described section 3.2. One sub-sample, labeled "Worse Solidarity Sample", includes the countries presenting a relatively low institutional solidarity (ISI below the countries sample median), while the other one, labeled "Better Solidarity Sample", includes the countries characterized by a higher institutional solidarity (ISI above the sampling median). There are 7 countries (Benin, Botswana, Ghana, Kenya, Mauritius, Senegal and South Africa) which are classified as having better institutional solidarity and 14 countries (Angola, Burkina Faso, Cameroon, DRC, Ethiopia, Madagascar, Mali, Mauritania, Mozambique, Namibia, Niger, Tanzania, Uganda, Zambia) which are classified as having worse institutional solidarity. Table 10 in the appendix reproduces the set of regression 1 column 2 (interaction between training programs and domestic firm) and column 5 (interaction between training programs and domestic firms, and interaction between access to credit and domestic firms) separately for the two samples. The econometric results are consistent with the theory. In the better solidarity sample the training dummy and the interaction between training programs and domestic firms loose their significance which is the expected result if the local firms face less pressure to hire their relatives and thus face similar hiring constraints than foreign ones. In contrast in the worse solidarity sample, they are highly significant. This suggests that in the worse solidarity sample domestic firms are constrained by the low quality of their workforce mainly hired from extended family and relatives. Some of them try to mitigate this problem through internal training programs as shown in the tables.

As a last robustness check we run a set of regressions with the proportion of production workers as dependant variable (see Table 11 in the appendix). The preceding result suggests that local firms are more labor intensive and use training in a different way than foreign firms (i.e., to deal with their unqualified blue collars). This result is confirmed here. Being a domestic firm increases significantly the proportion of production workers compared to a foreign firm with similar training scheme (or absence of it). Moreover the interaction term between training programs and domestic firms dummies is negative and significant (at the 1% level). It is large as well. The proportion of production workers is lower in a local firm with a training program than in a local firm without such program. Interestingly the training dummy is still significant but it becomes positive. Foreign firms that do training have a larger proportion of production workers. The two variables are thus complement for foreign firms, while there are substitute for local firms. This confirms that they do not fill the same purpose. Finally when we add the three coefficients, the total effect of being local and having a training program is positive. Local firms manage to reduce the proportion of production worker through training, however not to the point reached by foreign firms.

(REGRESSION 2)

According to the theory, labor productivity should be smaller in local firms. We test the impact of being a local firm on labor productivity in regression 2. The dependant variable is the total sales per employee.[19] We use the same specifications as in the previous regressions. The results are consistent with the predictions of the model: everything else being equal, a local firm has a significantly lower productivity of labor than a foreign one. According to our estimations the total sales per employee (in dollars) in a local firm is lower by a percentage which varies between 30% and 37%.

Exporting firms, firms having an ISO certification, firms with higher stock of capital, or firms with trade unions display significantly higher labor productivity. Surprising at first sight the last result is consistent with the fact that trade unions are not found in local private firms mainly composed of the owner relatives. Extended family members do not syndicate. In the African context the presence of trade union signals a fairly modern firm with sophisticated labor relationship. More importantly firms enjoying overdraft or credit facilities are systematically more productive. These results confirm again that firms in Africa are credit constraint. Foreign firms that offer training program are generally more productive than firms without such programs. By contrast there is no specific effect of training on the productivity of domestic firms (see columns 2 and 5). This result suggests that training programs are not very effective at alleviating the major labor productivity problem burdening local firms. In particular it does not compensate for the very strong negative impact of being 100% domestic on the total sales per employee ratio. The local firms' challenge is thus twofold: to gain a better access to the credit market and to manage their poorly qualified relatives.

In regression 12 in the appendix we conduct a robustness check by running the labor productivity regressions separately for the better and worse institutional solidarity samples. As expected, being a domestic firm affects significantly and negatively labor productivity under worse institutional solidarity sample only. Moreover exporting, having an ISO certification, a larger stock of capital, an overdraft or credit facilities are significantly correlated with a higher labor productivity. When firms do operate under better institutional solidarity, firms' location, ISO certification, capital stock and training programs are the only variable that positively correlated with labor productivity.

[19]This variable is a better measure of productivity than the profit per employee as it minimizes measurement errors and endogeneity problem. Indeed sales data is easy to collect (i.e., it is just a figure), while profits data is subjected to measurement errors because it is computed from the sales and estimation of the costs. For the sake of completeness we have nevertheless run regressions with the profit per employee and the results are similar with the results in regression 2 (computations available upon request).

4 Structural estimation

The preceding section conveyed only one part of our story which was to analyze firms and agents behavior among those who are entrepreneurs. Consistently with the experiments and the cases studies mentioned in the introduction, our descriptive statistics and regressions show that the forced mutual help constraint distorts labor management in local African firms. In this section, we thus focus on the other part of the story by taking into account those who decided not to become entrepreneurs, that is, wage-workers. The goal is to measure the impact of social pressures on individuals decision to become formal entrepreneurs. The structural estimation therefore uses data on workers employed in formal firms. One of the interesting things about the structural estimates of the model is that it allows us to estimate the proportion of missing African entrepreneurs, that is, the proportion of individuals who would have chosen to become entrepreneurs if they were not subject to potential social pressures.

4.1 Estimation procedure

Our structural estimation proceeds as follows. We start by making a parametric assumption over the distribution of talent. We then identify entrepreneurs versus wage-workers in our sample and use the distributional assumption of talent to provide estimates of our theoretical model. The estimation of missing entrepreneurs then follows by computing the gap between threshold ability levels of becoming entrepreneurs for foreign and local entrepreneurs.

Since the entrepreneurial talent θ is not observable by the econometrician we make a structural assumption over its distribution in order to estimate the model. Formally, we assume that the entrepreneurial ability is correlated with education and experience. However, we allow these correlations to differ between locals and foreigners to account for the possibly differences in the quality of education or experience across the two groups. Denote by $\mathcal{F}$ the set of foreigners and $\mathcal{L}$ the set of locals. The ability equation is given by:

$$\ln \theta_i = \begin{cases} \delta_{0f} + \delta_{1f} \ln(1 + S_i) + \delta_{2f} \ln(1 + X_i) + \epsilon_{if}, & \text{if} \quad i \in \mathcal{F} \\ \\ \delta_{0l} + \delta_{1l} \ln(1 + S_i) + \delta_{2l} \ln(1 + X_i) + \epsilon_{il}, & \text{if} \quad i \in \mathcal{L} \end{cases} \tag{21}$$

where S_i are the years of education of agent i, and X_i are years of experience of agent i.

The error terms ϵ_{if} and ϵ_{il} are assumed to be independently and normally distributed across agents, with mean 0 and variances σ_f^2 and σ_l^2, respectively. This log-linear specification of the talent distribution has also been considered by Evans & Jovanovic (1989),

and Paulson, Townsend & Karaivanov (2006). In the Appendix 6.5 we relax the normality assumption to allow for unknown distributions of ϵ_{if} and ϵ_{il} (i.e., semiparametric estimations) and hence check the validity of the normality assumption.

The allocation of agents in entrepreneurship ($E_i = 1$) and wage work ($E_i = 0$) can be modeled by $E_i = \begin{cases} \mathbb{I}\{\theta_i \geq \theta_{if}\}, & \text{if} \quad i \in \mathcal{F} \\ \mathbb{I}\{\theta_i \geq \theta_{if}\}, & \text{if} \quad i \in \mathcal{L} \end{cases}$

where $\mathbb{I}\{\cdot\}$ is the indicator function that equals 1 if its argument is true and 0 otherwise. The critical ability thresholds θ_{if} and θ_{il} that determine entrepreneurial decision for foreigners and locals are those given in Equations (8) and (17). Note that the condition $\theta \geq \theta_f$ is satisfied by both local and foreign entrepreneurs. However, because of family liability, satisfying $\theta \geq \theta_f$ does not necessarily imply that one is an entrepreneur. The probability of becoming entrepreneur (including both foreigners and locals) in our economy is given by

$$\begin{aligned} \Pr[E_i = 1] &= \Pr[E_i = 1 | i \in \mathcal{F}] \Pr(i \in \mathcal{F}) + \Pr[E_i = 1 | i \in \mathcal{L}] \Pr(i \in \mathcal{L}) \\ &= (1 - p_i) \Pr(\theta_i \geq \theta_{if} | i \in \mathcal{F}) + p_i \Pr(\theta_i \geq \theta_{il} | i \in \mathcal{L}) \end{aligned}$$

where p_i is the probability that agent i is a local (i.e., is an agent with potential family liability).

Denote by K_i the amount of capital used by the agent. Because agent i is not necessarily an entrepreneur, this variable is not observed for all individuals. We therefore need to construct a suitable measure for the agent's capital or potential capital. We use two approaches: The first one, which is presented in the main text, is to exogenously fix the capital of agent i to be the sample mean of the capital used by the firms in the country in which agent i operates.[20] Agents operating in the same country therefore face the same amount of capital. This way, estimated variations in decisions can be interpreted as due to other conditions than capital constraints. The second approach, which is presented in the appendix 6.4, is to take K_i as the actual capital of the agent if he is an entrepreneur. If agent i is a wage-worker, K_i is taken to be his total labour income (including salary, allowances and benefits) topped up with the amount he would be willing to pay for an HIV test.[21]

The vector $[1, S_i, X_i, K_i, w_i, r_i,]'$ is the vector of observable characteristics of agent i.

[20] The capital of a firm is calculated as the three-years average of the total annual investment of this firm. A better proxy would be the yearly book value of the firm, but very few firms reported this amount.

[21] A better proxy would have been their total wealth including savings and other belongings, but our data are drawn from enterprise surveys rather household surveys and therefore do not contain this information. However, since income is likely related to savings and the amount the worker is willing to pay for a HIV test likely correlated with their wealth, this variable gives information that reasonably differentiate workers in their capacity of obtaining capital for their business venture.

w_i and r_i are the average wage and the average borrowing interest rate in the commercial banks observed in the country in which agent i operates.[22]

Plugging the expression of θ_{if} given by formula (8) and of θ_{il} given by formula (17) in the above equation, we get

$$\begin{aligned}\Pr[E_i=1] = (1-p_i)\Pr\left\{\ln\theta_i \geq \alpha\ln\left(\tfrac{w^i}{K_i}+r_i\right) - \alpha\ln\alpha - (1-\alpha)\ln(1-\alpha) + (1-\alpha)\ln w_i \middle| i\in\mathcal{F}\right\} \\ + p_i\Pr\left\{\ln\theta_i \geq \alpha\ln\left(\tfrac{w_i}{K_i}+r_i+\tfrac{(1-\beta)T_i}{K_i}\right) - \alpha\ln\alpha - (1-\alpha)\ln(1-\alpha) + (1-\alpha)\ln w_i \middle| i\in\mathcal{L}\right\}.\end{aligned}$$

The data available do not contain information about the family tax T_i transferred by agent i. However, Equation (16) from the theoretical model predicts that $\Pi^f(\theta_i)-\Pi^l(\theta_i) = (1-\beta)T_i$. Therefore we can use the data to approximate $(1-\beta)T_i$ with $\Delta\bar{\Pi}^i$, the average difference of profits between foreign and local firms in the country in which agent i operates. Denote by $Z_i = [1, S_i, X_i, K_i, w_i, r_i, p_i, \Delta\bar{\Pi}_i]'$ the vector of observable data relative to agent i. Using the specification (21) we then get

$$\begin{aligned}\Pr[E_i=1|Z_i] &= (1-p_i)\Phi\left(\frac{1}{\sigma_f}\left\{\gamma_{0f}+\delta_{1f}\ln(1+S_i)+\delta_{2f}\ln(1+X_i) - \alpha\ln\left(\tfrac{w_i}{K_i}+r_i\right) - (1-\alpha)\ln w_i\right\}\right) \\ &+ p_i\Phi\left(\frac{1}{\sigma_l}\left\{\gamma_{0l}+\delta_{1l}\ln(1+S_i)+\delta_{2l}\ln(1+X_i) - \alpha\ln\left(\tfrac{w_i}{K_i}+r_i+\tfrac{\Delta\bar{\Pi}_i}{K_i}\right) - (1-\alpha)\ln w_i\right\}\right) \\ &= H(Z_i,\psi).\end{aligned} \tag{22}$$

where $\gamma_{0j} = \delta_{0j} + \alpha\ln\alpha + (1-\alpha)\ln(1-\alpha)$, $j = f, l$, and $\Phi(\cdot)$ is the cumulative density function of the standard normal. For the estimation, we take p^i as the proportion of foreigners in the sample. The vector of parameters $\psi = [\delta_{0f}, \delta_{1f}, \delta_{2f}, \sigma_f, \delta_{0l}, \delta_{1l}, \delta_{2l}, \sigma_l, \alpha]'$ is then the vector of structural parameters of the model to be estimated.

The sample log-likelihood function of the econometric model can therefore be written as:

$$L_n(\psi) = \sum_{i=1}^{n}\{E_i\ln H(Z_i,\psi) + (1-E_i)\ln(1-H(Z_i,\psi))\} \tag{23}$$

The maximum likelihood estimation is performed by numerically maximizing (23) with respect to the set of parameters $\psi = [\delta_{0f}, \delta_{1f}, \delta_{2f}, \sigma_f, \delta_{0l}, \delta_{1l}, \delta_{2l}, \sigma_l, \alpha]'$. These parameters correspond to the constant term of the ability distribution, δ_0; the interaction between education and ability, δ_1; the interaction between experience and ability, δ_2; the standard deviation of the ability distribution, σ; and the productivity of capital in the production technology, α.

We now describe a procedure to estimate the proportion of missing African entrepreneurs, that is, the proportion of talented individuals who rather chose not to be entrepreneurs because of potential social pressures. Our theoretical model predicts a local

[22]These rates are available on the countries central bank websites.

wage-worker i whose ability θ_i belongs to $[\theta_{if}, \theta_{il}]$ is a missing local entrepreneur, with probability

$$\begin{aligned} m_i &= \Pr\{\theta_{if} \leq \theta_i \leq \theta_{il} | i \in \mathcal{L}\} \Pr(i \in \mathcal{L}) \\ &= p_i \Bigg[\Phi\left(\frac{1}{\sigma_l} \left\{ \gamma_{0l} + \delta_{1l} \ln(1+S_i) + \delta_{2l} \ln(1+X_i) - \alpha \ln\left(\tfrac{w_i}{K_i} + r_i \right) - (1-\alpha) \ln w_i \right\} \right) \\ &\quad - \Phi\left(\frac{1}{\sigma_l} \left\{ \gamma_{0l} + \delta_{1l} \ln(1+S_i) + \delta_{2l} \ln(1+X_i) - \alpha \ln\left(\tfrac{w_i}{K_i} + r_i + \tfrac{\Delta \bar{\Pi}_i}{K_i} \right) - (1-\alpha) \ln w_i \right\} \right) \Bigg] \end{aligned} \tag{24}$$

The above equation allows us to estimate the proportion of missing entrepreneurs by

$$\widehat{m} = \frac{1}{n} \sum_{i=1}^{n} \widehat{m}_i \tag{25}$$

where $\widehat{m}_i$ obtained from (24) by plugging-in the parameter estimates $\widehat{\psi}$.

4.2 Estimation results

The data used to estimate our structural parameters come from the same Enterprise Survey data described in Section 3. However, we focus on data regarding Employees Questionnaires as they contain information about both employers and employees in each formal surveyed firm. The survey provides information about workers age, position in the company, experience and qualifications, education, wage/salary and allowances, opinion about the performance of the firm, etc. Because of many missing/aberrant data in the Employees Questionnaires they had to be checked and matched with each firms individually. Our final database contains six countries with exploitable data: Benin, Kenya and Senegal, whose institutional solidarity index is above the sample median (i.e., better solidarity index group) and Mali, Uganda, and Tanzania, whose institutional solidarity index is below the sample median (i.e., worse solidarity index group).

In our sample, we restrict our definition of entrepreneur to be the top manager who also is the largest shareholder of the firm. The remaining individuals are considered wage-workers. The merged data from our countries surveys is composed of 11.3% of entrepreneurs and 88.7% of wage-workers for the whole sample, while the proportions are 12.5% of entrepreneurs for the better solidarity sample, and 11% of entrepreneurs for the worse solidarity one. The interest rate faced by each individual is the average observed interest rate in the country where they operate. Borrowing rate in the sample is 15.9% with 14.8% for the better solidarity sample, and 18.4% for the worse solidarity sample. Finally foreign firms represent 18.1% (18.54% in the worse solidarity sample and 17.67% in the better solidarity one) of all firms.

We do not observe the nationality/origin of the workers. If the talent distribution were the same for foreigners and for locals, it would not matter. However the assumption of common distribution is rejected by our base case estimates, which show that people working in foreign and local firms are not drawn from the same distribution of talent. Foreigners who chose to migrate and to start a business abroad are presumably different from the local population. We thus consider that foreigner and local people are not drawn from the same distribution of talent. The problem then is to allocate individuals between "local" and "foreign". We make the assumption that the workers in a local firm are local and that the workers in a foreign firm are foreigner. This assumption is reasonable for the local firms as they recruit essentially through family network, and are thus populated with local workers. But it is less accurate for foreign firms that recruit more by formal means and have presumably on board both types of workers (i.e. foreign and local). It implies that we count as foreigner local people. Since these locals have been able to find a job in a foreign firm, they are presumably different (i.e. better) than those who need to rely on their family network for help. In particular some of them might be talented enough to become an entrepreneur, but have chosen to work as a wage worker to avoid the burden of sustaining their relatives. Our estimations neglect those individuals by treating them as wage workers of foreign origin. We hence over-estimate the talent threshold above which a foreigner becomes an entrepreneur and by the same token under-estimate the percentage of missing local entrepreneurs.[23]

Table 4.2 presents the maximum likelihood estimation results for the theoretical model parameters from our sample. We report estimates for the whole sample, for the better solidarity sample (containing Benin, Kenya and Senegal) and for the worse solidarity sample (containing Mali, Uganda, and Tanzania). We also provide P-values for the comparison of estimates between better and worse stratifications (see last column of the table). Except for the capital return parameter that has a rather relatively large standard error in the worse solidarity sample, all structural estimates produce reasonable parameter values that are significant at 1%. The constant terms of log talent δ_{0f} and δ_{0l} are estimated at 3.35 for foreigners and 3.65 for locals in our whole sample and are both lower for the better solidarity sample compared to the worse solidarity one. This parameter represents the average natural talent of individuals, that is, their minimum average talent regardless of their education and experience.

The correlation between talent and years of schooling as captured by δ_{1f} and δ_{1l} are estimated at 0.39 and 0.35 respectively. This means that each percentage increase in

[23]When we run estimations (not shown here to save space) assuming that the talent distribution is the same for foreigners and for locals, the percentage of missing entrepreneurs is indeed higher. However the assumption of common distribution is rejected by our base case estimates.

years of schooling is associated with a 0.39% increase in average talent for foreigners and a 0.35% increase of average talent for locals. The parameters that relate years of work experience to entrepreneurial talent, δ_{2f} and δ_{2l}, are also estimated to be 0.20 and 0.19 respectively, in the whole sample. This means that 1% increase in years of work experience is associated with a 0.20% increase in average entrepreneurial talent for foreigners and 0.19% for locals. These estimates show that education tends to have higher effect on entrepreneurial ability compared to professional experience. However, the relationships between education, experience and talent are not necessarily uniform across solidarity stratifications. Education and experience tend to matter for talent in countries with worse solidarity more than it does in countries with better solidarity, and the difference between estimates across these stratifications is strongly significant. In other words, everything else equal, individuals in countries with worse solidarity need to accumulate more years of education and experience to be able to compete with those from better solidarity countries.

The parameter α is estimated to be 0.019 for the whole sample. This means that a 10% increase in business investment would be associated with a 0.19% increase in profit. This estimate of α is smaller than those usually obtained for the informal economy (see Grimm et al. 2011, Kremer et al 2010, Udry and Anagol 2006). This suggests that businesses in the formal sector operate at a higher scale with low marginal returns though they face some degree of financial constraints as well. This parameter tend to be significantly higher for better solidarity countries compared to worse solidarity countries, although it is not accurately estimated for the worse solidarity sample. Finally, standard deviations for ability, σ_f and σ_l, are larger in better solidarity sample compared to worse solidarity sample. This is presumably due to the fact that a better institutional environment attracts a larger variety of talented individuals than a worse institutional environment does.

Using the estimated structural parameters, we calculated the fraction of the population that has values of θ and of other characteristics satisfying the conditions of Proposition 1 and 3, yet prefer wage-work to entrepreneurship because of the social burden that the latter occupation implies. This fraction of the population is the proportion of missing African entrepreneurs and our model predicts that they represent about 7.6% of the overall workforce in the formal sector. This proportion is even higher in countries with worse institutional solidarity environment. In particular, the difference in the loss of entrepreneurs across the two stratifications represents a significant proportion of about 3.4% of the workforce. This finding is consistent with our theoretical model and descriptive statistics and further testifies that better social safety nets may encourage

Table 4.2 : Structural Maximum Likelihood Estimates of the Model

Type	Parameter	Name	Whole sample	Better solidarity	Worse solidarity	Difference Pvalue
Foreigners	Log ability - constant	δ_{0f}	3.347 (0.0005)	2.9401 (0.0006)	3.5105 (0.0019)	0.0000
	Log ability - education	δ_{1f}	0.3981 (0.0008)	0.4784 (0.0003)	0.2886 (0.0045)	0.0000
	Log ability - experience	δ_{2f}	0.2032 (0.0172)	0.3934 (0.0002)	0.1614 (0.0037)	0.0000
	Stand. dev. for ability	σ_f	0.6392 (0.0019)	0.8913 (0.0003)	0.3796 (0.0075)	0.0000
Locals	Log ability - constant	δ_{0l}	3.6510 (0.0008)	2.4042 (0.0007)	3.9601 (0.0016)	0.0000
	Log ability - education	δ_{1l}	0.3501 (0.0004)	0.4041 (0.0002)	0.2232 (0.0037)	0.0000
	Log ability - experience	δ_{2l}	0.1948 (0.0190)	0.3015 (0.0002)	0.1084 (0.0028)	0.0000
	Stand. dev. for ability	σ_l	0.5019 (0.0012)	0.8202 (0.0005)	0.2158 (0.0082)	0.0000
All	Capital returns	α	0.0198 (0.0054)	0.0709 (0.0012)	0.0321* (0.0185)	0.0457
	Log-likelihood		-2698	-1347.1	-1238.2	
	Number of Obs.		7834	3962	3872	
	Frac. missing entrepreneurs	m	0.0760 (0.0029)	0.0538 (0.0032)	0.0877 (0.0042)	0.000

Asymptotic standard errors in parenthesis
* Not significant

entrepreneurship in Africa by relaxing social obligations. It is important to note that the 7.6% of missing entrepreneurs obtained here is an underestimated proportion of the overall missingness. In fact, it only estimates the proportion of formal wage-workers who are not willing to become entrepreneurs in spite of having good entrepreneurial abilities. It does not include, for example, possible informal entrepreneurs who have the capacity of becoming formal but are not willing to do so because they don't want to send a too strong signal of successfulness to their family and relatives.

The different robustness checks conducted are reassuringly consistent with our base case estimates. First when we assume that the talent distribution is the same for foreigners and for locals the fraction of missing entrepreneurs is estimated to be 8% for the whole sample (6.2% for the better ISI sample and 9.5% for the worse one). It is slightly

larger than in our base case, which is expected as our base case tends to under-estimate the percentage of missing entrepreneurs by assuming that all the workers in foreign firms are foreigners. To save space we do not present these results here because our results show that the ability distributions of workers in foreign firms is statistically different from that of locals. Thus, a model with common distribution (which is in fact a special case of the model with separate distributions) is necessarily restrictive and misspecified as an equality test across the coefficients from the two respective groups is rejected by the data.[24]

Second the estimation results presented in Table 4.2 are those using the first approach of measuring capital by exogenously fixing it to be the sample mean of the capital used by the firms in the country in which the individual operates. The results from the second approach, where capital is measured by the actual capital of the agent if he is an entrepreneur, and by his total labour income topped up with the amount he would be willing to pay for an HIV test if he is a wage worker, are presented in Appendix 6.4. The estimations obtained from this second approach yield a fraction of missing entrepreneurs of 5.6%. The fraction of missing entrepreneurs in the latter estimation is smaller than the former. This difference can be understood as follows: in the first case all individuals are assumed to have access to the same amount of capital which understates the level financial constraints faced by wage-workers, whereas in practice the constraints they face are twofold: capital and labor. So in the first case barriers to entrepreneurship can only be attributed to family tax, whereas in the second case additional credit constraints are taken into account. Since we do not observe the stock of capital that would be available to a wage worker if he was willing to start his own business, we proxy it by his labour income topped up with the amount he would be willing to pay for an HIV test. This amount is an under-estimation of the capital available to a worker as it does not include his borrowing capacity, nor the assets he might own and are unknown to the econometrician. By overstating the constraint the wage-workers face on the capital market this method gives us a lower bound for the fraction of missing entrepreneurs due to the forced mutual help constraint.

Third in examining the semiparametric results, presented in the Appendix 6.5, the following facts are notable. Overall, the results from the parametric and the semiparametric approaches are comparable. The signs, sizes and significance levels of both estimates are very similar. This suggests that the normal parametrization assumed earlier is not strongly at odds with the data. There however seems to be a little accuracy gain in the semiparametric estimation. Standard deviations from the semiparametric estimates tend

[24]The estimations are available upon request.

to be smaller. In particular, the capital returns that was insignificant in the parametric approach has a smaller variance in the semiparametric estimation and turns out to be significant at the 5% level, though the estimated parameter values obtained from both approaches are quite close (see table 13).

Our structural estimates are a suggestive insight of what a more refined research using more thorough information and less stringent functional forms assumptions may reveal. Yet the results obtained are very appealing. While none of parametric or semi-parametric findings presented here is definitive on its own, taken together they reinforce the predictions from the theoretical model that mutual help is a significant barrier to entrepreneurship. The fraction of missing entrepreneurs obtained in this framework represents an important amount of implied wealth and an even higher proportion of implied jobs. These missing formal enterprises represent a gap in the formal sector and in tax revenues that could be used to improve social safety nets to lower the need of mutual help.

5 Conclusion

This paper argued that the forced solidarity social norms prevailing in Sub-Sahara Africa is detrimental to the continent economic growth as it precludes many local talented people to become formal entrepreneurs. We estimate that between 5.5% and 7% of the workers in the formal sector are prevented to become entrepreneur by the forced mutual help constraint. Local entrepreneurs are hence constrained on the credit market and on the labor market, and the labor market constraint is specific to them. Foreigners have a competitive hedge as they do not suffer from the same labor distortions. This productivity gap helps to explain the over-representation of minority entrepreneurs in the region, like the Indians in East Africa and the Lebanese and Syrians in West Africa.

The analysis also helps to explain the puzzling result that very small firms in developing countries exhibit extremely high returns on capital (Banerjee and Duflo, 2004; De Mel et al 2008). The non monotonicity of capital returns according to firms size is usually explained by inefficient financial markets. In the African context the excessive returns are also the result of additional labor market constraints: talented entrepreneurs are stuck with small informal firms because they are afraid, if they become formal, to face the social obligation of hiring and subsidizing their extended network of relatives. Combined with tight credit constraints it helps to explain the excessive returns on their small firms.

Finally, the analysis sheds a new light on social protection. If it is so widespread in rich countries, and currently being developed in emerging economies (see Barrientos 2013),[25] it is because it leads to economic benefits. Social security, public retirement plans, and other public schemes aimed at protecting the unemployed, the sick, the children or the old are not solely explained by advanced economies aspiration for solidarity and redistribution. They are economic tools to prevent inefficient allocation of resources. They allow individuals and firms to disconnect their decisions of recruitment, investment and savings from family protection. Africa is the region of the world with the lowest level of public social protection (see ILO 2010). Moving from this equilibrium of laissez-faire to an equilibrium with a minimum protection is yet possible. The ILO has estimated that (in a sample of sub-Saharan African countries) a universal basic child benefit scheme would cost between 1.7% and 3.4% of GDP, a universal basic old age pension scheme would cost between 0.7% and 1.3% of GDP, and an employment guarantee scheme covering 10% of the working age population would cost between 0.4% and 0.7% of GDP.

[25]Barientos (2013) shows that there has been a staggering growth of anti-poverty transfer programmes in developing countries since the middle of the 1990s. According to the author computations a conservative estimate of their reach indicates that between 0.75 and 1 billion people in developing countries are currently receiving such social transfers.

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6 Appendix

6.1 Model Implications with a general production technology

In this section, we show that our theoretical predictions can be obtained with any production technology that satisfies basic reasonable assumptions. Let assume that the production function of an entrepreneur with ability θ is

$$Y = f(\theta, K, L) \tag{26}$$

where K is the stock of capital and L the quantity of labor used in the firm. The function $f(\theta, K, L)$ is assumed to be continuously differentiable, strictly increasing and concave in each of its argument. Moreover, $f_K(\theta, K, L)$ is increasing in θ (i.e. the marginal productivity of capital increases with entrepreneurial ability).

6.1.1 Entrepreneur without family liability

The objective function of the foreign entrepreneur is

$$\max_L \Pi^f(L) = f(\theta, K, L) - wL - rK. \tag{27}$$

The optimal employment level in a firm run by an entrepreneur with ability θ and a stock of capital K is then $L_f = L_f(\theta, K)$ where L_f satisfies the first-order condition

$$f_L(\theta, K, L) = w \tag{28}$$

Substituting L_f in (27), the profit of the entrepreneur with ability θ and a stock of capital K is:

$$\Pi^f(\theta, K) = f(\theta, K, L_f(\theta, K)) - wL_f(\theta, K) - rK. \tag{29}$$

Let $\theta^f(K)$ be the value of θ for which $\Pi^f(\theta, K) = w$.

Proposition 6.1 *An agent with access to capital K chooses to become entrepreneur if and only if $\theta \geq \theta^f(K)$.*

Proof. An agent with access to capital K chooses to become entrepreneur if and only $\Pi^f(\theta, K) \geq w$. Since $\Pi^f(\theta, K)$ is a strictly increasing function of θ this is equivalent to $\theta \geq \theta^f(K)$. ■

6.1.2 Local entrepreneur

The local entrepreneur solves the following problem

$$\max_{L,L_r,\tau} \Pi^l = f(\theta, K, L + \beta L_r) - wL - wL_r - rK - \tau T \tag{30}$$

$$\tau T + wL_r = T$$

where τ is the fraction of the tax that is given directly in cash and $\beta \leq 1$ is the productivity of one unit of labor by a relative. Note that the local entrepreneur hires $L + L_r$ units of labor whereas the amount of productive labor is only $L + \beta L_r$. Substituting L_r by its value in the objective function yields:

$$\max_{L,\tau} \Pi^l = f\Big(\theta, K, L + \beta \frac{1-\tau}{w} T\Big) - wL - rK - T. \tag{31}$$

The first order conditions with respect to τ yields:

$$\frac{\partial \Pi^l}{\partial \tau} = -\frac{\beta}{w} f_L\Big(\theta, K, L + \beta \frac{1-\tau}{w} T\Big) \leq 0. \tag{32}$$

For all $\beta \geq 0$ the objective function is decreasing in τ so that at the optimum $\tau^* = 0$. In the limit when $\beta = 0$ the entrepreneur is indifferent between hiring her relatives or paying a cash transfer. This result is collected in the next proposition.

Proposition 6.2 *Independently of the value of $\beta \geq 0$ a local entrepreneur always pays the family tax by hiring relatives in the firm.*

We next characterize the optimal employment level in the local firm. The first order condition, which is also sufficient, is:

$$\frac{\partial \Pi^l}{\partial L} = f_L\Big(\theta, K, L + \beta \frac{1-\tau}{w} T\Big) - w = 0. \tag{33}$$

Since $\tau^* = 0$ we have $L_r^* = \frac{T}{w}$ so that the condition that characterizes the optimal quantity of external labor $L_l = L_l(\theta, K)$ is given by:

$$f_L\Big(\theta, K, L_l + \frac{\beta}{w} T\Big) = w. \tag{34}$$

Substituting L_r^* and $L_l(\theta, K)$ in the profit function (30), the entrepreneur earning is:

$$\Pi^l(\theta, K) = f\Big(\theta, K, L_l(\theta, K) + \frac{\beta}{w} T\Big) - wL_l(\theta, K) - rK - T \tag{35}$$

Proposition 6.3 *For an ability level θ and an amount of capital K:*
(i) local firms' profit is smaller than regular firms' profit:

$$\Delta\Pi = \Pi^f(\theta, K) - \Pi^l(\theta, K) \geq (1-\beta)T \geq 0;$$

(ii) the profit gap increases with family tax T, and decreases with family productivity β:

$$\frac{\partial \Delta\Pi}{\partial T} = 1 - \beta > 0, \qquad \frac{\partial \Delta\Pi}{\partial \beta} = -T < 0.$$

Proof. (i) $\Pi^f(\theta, K) - \Pi^l(\theta, K) = f(\theta, K, L_f) - f(\theta, K, L_l + \frac{\beta}{w}T) - w(L_f - L_l) + T$.
By the concavity of $f(\theta, K, L)$ with respect to its argument L, it must be the case that $f(\theta, K, Lr) - f(\theta, K, L_l + \frac{\beta}{w}T) \geq (Lr - L_l - \frac{\beta}{w}T) f_L(\theta, K, Lr)$. Therefore, $\Pi^f(\theta, K) - \Pi^l(\theta, K) \geq (Lr - L_l - \frac{\beta}{w}T) f_L(\theta, K, Lr) - w(L_f - L_l) + T$. Using the first-order condition (5), we get $\Pi^f(\theta, K) - \Pi^l(\theta, K) \geq w\big(Lr - L_l - \frac{\beta}{w}T\big) - w(L_f - L_l) + T$.
That is, $\Pi^f(\theta, K) - \Pi^l(\theta, K) \geq (1-\beta)T \geq 0$.
(ii) Taking the derivative of $\Delta\Pi$ with respect to T yields

$$\frac{\partial \Delta\Pi}{\partial T} = -\frac{\beta}{w} f_L(\theta, K, L_l + \frac{\beta}{w}T) + 1.$$

Using the first-order condition (34), we get $\frac{\partial \Delta\Pi}{\partial T} = -\beta + 1$.
Taking the derivative of $\Delta\Pi$ with respect to β yields $\frac{\partial \Delta\Pi}{\partial \beta} = -\frac{T}{w} f_L(\theta, K, L_l + \frac{\beta}{w}T)$.
Using the first-order condition (34), we get $\frac{\partial \Delta\Pi}{\partial \beta} = -T$ ■

Note that in the case of a production technology with constant returns to scale, we have the equality $\Pi^f(\theta) - \Pi^l(\theta) = (1-\beta)T$. We next characterize the threshold value θ so that a local individual is willing to become entrepreneur. Let θ^l be the value of θ so that $\Pi^l(\theta, K) = w$.

Proposition 6.4 *(i) Local people choose to become entrepreneur if and only if $\theta \geq \theta^l(K)$.*
(ii)An autochtone with capital K and ability θ is at a disadvantage to become an entrepreneur compared to a foreigner: $\theta^l(K) \geq \theta^f(K)$.
(iii) The decision to become entrepreneur increases with increasing values of the available capital: $\dfrac{d\theta^j(K)}{dK} \leq 0, \quad j \in \{f, l\}$.
(iv) The gap between local and regular entrepreneurs entry decision, $\Delta\theta(K) = \theta^l(K) - \theta^f(K)$, decreases with increasing values of capital K:

$$\frac{d\Delta\theta(K)}{dK} \leq 0. \tag{36}$$

Proof.
(i) Similar to Proposition 1.

(ii) By Proposition 6.3(i), we have $\Pi^f(\theta^l, K) \geq \Pi^l(\theta^l, K)$.
But $\Pi^l(\theta^l, K) = w = \Pi^f(\theta^f, K)$. Hence, $\Pi^f(\theta^l, K) \geq \Pi^f(\theta^f, K)$, which by the strict monotonicity of $\Pi^f(\theta, K)$ with respect to θ, implies $\theta^l > \theta^f$

(iii) If we differentiate the equation $\Pi^f(\theta^f, K) = w$ characterizing θ^f with respect to K, we get

$$\frac{\partial \Pi^f(\theta^f, K)}{\partial \theta}\frac{d\theta^f(K)}{dK} + \frac{\partial \Pi(\theta^f, K)}{\partial K} = 0.$$

That is, $f_\theta(\theta^f, K, L_f)\dfrac{d\theta^f(K)}{dK} = r - f_K(\theta^f, K, L_f) = f_K(\theta^f, K_f, L_f) - f_K(\theta^f, K, L_f)$. where K_f is the optimal capital obtained from the first-order conditions of the entrepreneur's problem. Since we assumed that the maximum capital available to the entrepreneur K is constrained, we obviously have $K_f > K$. Because $f(\theta, \cdot, L)$ is strictly concave, $f_K(\theta, \cdot, L)$ must be strictly decreasing, so that $K_f > K$ implies $f_K(\theta^f, K_f, L_f) < f_K(\theta^f, K, L_f)$. It follows that $f_\theta(\theta^f, K, L_f)\dfrac{d\theta^f(K)}{dK} < 0$ and therefore $\dfrac{d\theta^f(K)}{dK} < 0$. The same argument applies to show that $\dfrac{d\theta^l(K)}{dK} < 0$.

(iv) First, let's observe that since the function $f_L(\theta, K, \cdot)$ is strictly decreasing (by the strict concavity of $f(\theta, K, \cdot)$), it follows the first-order conditions characterizing L_f and L_l, $f_L(\theta^f, K, L_f) = w = f_L(\theta^f, K, L_l + \dfrac{\beta}{w}T)$, imply that we must have

$$L_f = L_l + \frac{\beta}{w}T = \bar{L} \tag{37}$$

If we totally differentiate the equality $\Pi^l(\theta^l, K) = \Pi^f(\theta^f, K)$ with respect to K, we get: $f_\theta(\theta^l, K, \bar{L})\dfrac{d\theta^l(K)}{dK} + f_K(\theta^l, K, \bar{L}) - r = f_\theta(\theta^f, K, \bar{L})\dfrac{d\theta^f(K)}{dK} + f_K(\theta^f, K, \bar{L}) - r$, which is equivalent to: $f_\theta(\theta^l)\dfrac{d\Delta\theta(K)}{dK} = \big(f_\theta(\theta^f) - f_\theta(\theta^l)\big)\dfrac{d\theta^f(K)}{dK} + \big(f_K(\theta^f) - f_K(\theta^l)\big)$ We know from (iii) above that we have: $\dfrac{d\theta^f(K)}{dK} < 0$. Since $f_\theta(\cdot, K, L))$ is decreasing and $\theta^l \geq \theta^f$, we must have $f_\theta(\theta^l) \leq f_\theta(\theta^f)$, that is $f_\theta(\theta^f) - f_\theta(\theta^l) \geq 0$. Likewise, because $f_K(\cdot, K, L))$ is increasing and $\theta^l \geq \theta^f$, we must have $f_K(\theta^l) \geq f_K(\theta^f)$, that is, $f_K(\theta^f) - f_K(\theta^l) \leq 0$.
It then follows that $f_\theta(\theta^l)\dfrac{d\Delta\theta(K)}{dK} \leq 0$, so that, $\dfrac{d\Delta\theta(K)}{dK} \leq 0$. ■

Denote by $L_l^* = L_l + L_r^*$ the total quantity of labor hired by the local entrepreneur. We have the following results

Proposition 6.5 *(i) Everything else being equal local firms have larger labor to capital ratio than foreign firms:* $\frac{L_l^*}{K_l} \geq \frac{L_f}{K_f}$,
(ii)Everything else being equal (i.e., for the same θ *and the same* K*), the labor productivity of local firms is smaller than that of regular ones:* $y_l = \dfrac{Y_l}{L_l^*} \leq y_f = \dfrac{Y_f}{L_f}$.

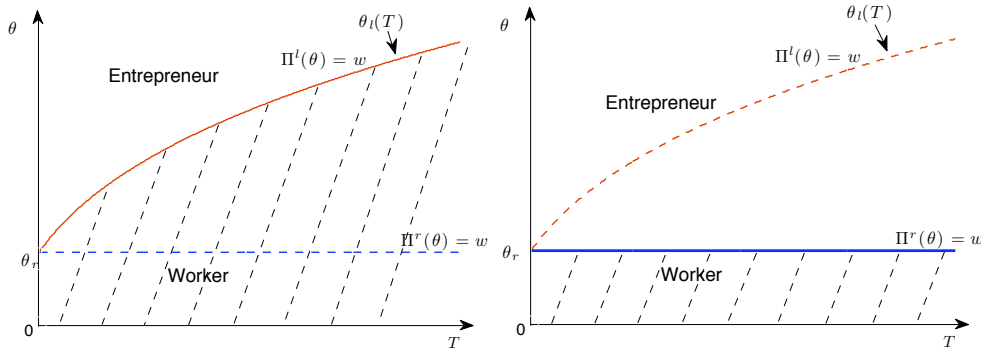
Proof.
(i) We know that $L_r^* = \dfrac{1}{w}T$, and that by Equation (37), $L_l = L_f - \dfrac{\beta}{w}T$. Hence, $L_l^* = L_f + (1-\beta)\dfrac{T}{w} \geq L_f$. Then $\frac{L_l^*}{K} \geq \frac{L_f}{K}$.
(ii) Recall that $L_f = L_l + \dfrac{\beta}{w}T$. Then,

$$y_l = \frac{Y_l}{L_l^*} = \frac{f(\theta, K, L_l + \frac{\beta}{w}T)}{L_l^*} \leq \frac{f(\theta, K, L_l + \frac{\beta}{w}T)}{L_f} = \frac{f(\theta, K, L_f)}{L_f} = y_f.$$

■

The nature of the selection to different sectors of the economy, as implied by our the theoretical model, can be summarized by Figure 3.

Figure 3: Entrepreneurship decision



(a) Locals (b) Foreigners

6.2 Data and descriptive statistics

The data used in the empirical analysis come from two sources:

- The Enterprise Survey database maintained by the World Bank is available at: http://www.enterprisesurveys.org/.

- The Institutional Profiles Database is available at:
  http://www.cepii.fr/anglaisgraph/bdd/institutions.htm

The standard Enterprise Survey questionnaire is comprised of three parts:

1. The first part of the questionnaire deals with the internal structure of businesses and the investment climate within which these businesses operate, including bureaucratic obstacles and infrastructure constraints;

2. The second part deals with finances, production and markets and provides information on business performance which can be correlated to business characteristics and investment climate obtained in the first part of the questionnaire. The detailed accounting data allows for comparison of the competitiveness of industries across African countries;

3. The third part of the questionnaire, which is particularly relevant for the present study, deals with human resources and labor market issues, including the effects of government labor regulations on the cost of doing business and the structure, as well as the cost and quality of the workforce.

In what follows we present the descriptive statistics used in the main text.

Table 1: Main shareholders of the firm

Description of the largest shareholder or owner in your firm (multiple answers acceptable)	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Individual or Family	98,02%	81,34%	-16,67% ***
Domestic company	34,77%	15,76%	-19,00% ***
Foreign company	0,00%	71,01%	71,00% ***
Bank or Investment fund	1,35%	3,23%	1,90%
Other (Employees, Government…)	14,00%	12,62%	-1,38%
Average Pct of firm owned by the largest shareholder or owner	83,73%	71,35%	12,38% ***
If the largest shareholder or owner is an individual or family member,is he also the manager/director?			
Yes	85,11%	72,76%	-12,35% ***
is he male?			
Yes	88,33%	87,46%	-0,87%

Table 2: Sample of firms according to ownership and size

% of Firms	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Small Firms (< 20)	63,70%	35,69%	-28,01% ***
Medium Firms (20-99)	27,13%	33,00%	5,87% ***
Large Firms (>100)	9,16%	31,31%	22,15% ***

Average Workforce	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Small Firms (< 20)	8,7	9,7	1 ***
Medium Firms (20-99)	39	43	4 ***
Large Firms (>100)	362	570	208 ***

Table 3: Repartition of firms by industry according to ownership

Repartition of firms by industry (in percentage)				
Industries	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic	Average Number of employee per firms
Retail and wholesale trade	14,82%	15,14%	0,32%	21
Food & Beverages	10,86%	11,42%	0,56%	153
Wood and furniture	11,68%	5,87%	-5,81% ***	51
Other manufacturing	9,26%	8,17%	-1,08%	61
Metals and machinery	9,00%	8,12%	-0,88%	99
Garments & Leather	8,21%	6,65%	-1,56% **	115
Hotels and restaurants	7,53%	5,29%	-2,24% ***	17
Other services	5,87%	4,71%	-1,16% **	18
Agroindustry	4,57%	7,96%	3,40% ***	88
Chemicals and pharmaceutics	3,75%	7,28%	3,53% ***	84
Non-metallic and plastic materials	2,49%	5,08%	2,59% ***	100
Other unclassified	3,00%	2,83%	-0,17%	60
Textiles	2,52%	4,50%	1,98% ***	260
Construction	2,49%	3,88%	1,39% ***	51
Paper	1,67%	1,52%	-0,15%	74
IT services	1,16%	0,47%	-0,69% ***	10
Transport	0,47%	0,47%	0,00%	15
Electronics	0,48%	0,31%	-0,17%	127
Mining and quarrying	0,17%	0,31%	0,14%	616

Table 4: Credit and overdraft facilities

Credit	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Overdraft Facility or Line of Credit			
Yes	36,05%	50,49%	14,45% ***
If Yes. In what type of Institutions			
Private commercial banks	80,11%	88,19%	8,08% ***
State-owned banks	8,78%	5,56%	-3,22% *
Non-bank financial institutions	9,52%	3,47%	-6,05% ***
Other	1,59%	2,78%	1,19%
Financial statement reviewed by an external auditor			
Yes	47,72%	73,01%	25,29% ***
Did the Firm Apply For a Loan			
Yes	21,65%	22,69%	1,04%
If Yes. Does This Loan Requires a Collateral			
yes	85,28%	82,76%	-2,52%
Of What Type			
Land	57,19%	60,14%	2,95%
Machinery	35,50%	55,24%	19,75% ***
Intangible Assets	23,06%	30,99%	7,92% *
Personal Assets	37,84%	27,27%	-10,57% **
If No. Why the firm did not apply for a loan			
No need for a loan	34,58%	57,35%	22,77% ***
Application procedures are complex	18,84%	9,99%	-8,85% ***
Interest rates are not favorable	20,14%	15,94%	-4,21% ***
Collateral requirements are unattainable	10,13%	5,27%	-4,86% ***
Size of loan and maturity are insufficient	2,75%	1,91%	-0,84%
Did not think it would be approved	13,41%	9,43%	-3,99% ***
Other	0,14%	0,11%	-0,03%

Table 5: Ways to recruit new employees

Means used by firms to find workers	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Through family/friends	62,81%	40,47%	-22,34% ***
Public or Private placement office	7,26%	10,83%	3,57% ***
Public announcement/advertisement	16,96%	32,41%	15,45% ***
Other	12,97%	16,29%	3,32% ***

Table 6: Labor force composition according to ownership

	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Description of firms' workforce			
Blue Collar (Pct)	75,07%	72,13%	-2,94% ***
White Collar (Pct)	24,93%	27,87%	2,94% ***
Supervision Ratio (Pct)	45,16%	58,79%	13,63% ***
Average Total Workforce	49,43	196,06	146,63 ***
Average Education of a production worker			
0 - 3 years	11,5%	8,7%	-2,81% *
4 - 6 years	30,3%	22,6%	-7,61% ***
7 - 9 years	48,6%	53,8%	5,21% **
10 - 12 years	6,1%	11,1%	4,99% ***
More than 13 years	3,6%	3,8%	0,21%
% of the workforce having the following education level			
Nb: this question was only asked in countries surveyed between 2002 and 2005			
Answers are taken into account only when the sum is equal to 100%			
Less than 6 years	26,8%	21,7%	-5,07% ***
6 - 9 years	24,3%	18,7%	-5,63% ***
10 - 12 years	34,6%	36,8%	2,19%
More than 12 years	14,3%	22,8%	8,50% ***

The blue collar ratio is the number of production workers divided by the total workforce in the firm. Similarly white collar ratio is the number of non production workers divided by the total workforce in the firm.

Table 7: Firms training programs according to ownership

Surveys of 2006 and 2009

	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
% of firms offering Training programs	27,4%	46,6%	19,1% ***
% of production workers trained	70,4%	58,4%	-12,0% ***
% of non-production workers trained	55,9%	51,2%	-4,7%

NB: These questions were asked only for surveys made between 2006 and 2009

Surveys of 2002 and 2005

	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
% of firms offering Training programs	32,4%	52,4%	20,0% **
% of skilled production workers trained	37,3%	40,0%	2,7%
Average number of weeks of training per employee	7,7	6,0	-1,7 *
% of unskilled production workers trained	29,6%	28,0%	-1,5%
Average number of weeks of training per employee	10,3	7,4	-2,9 *

NB: These questions were asked only for surveys made between 2002 and 2005

There are two different tables because the questionnaire changed between the period 2002-2005 and 2006-2009. The questions asked were not exactly the same. Yet the percentage of firms offering training programs is pretty stable at about 20%.

Table 8: Firms profit according to ownership and size

Profit ($) per Employee	Private Domestic Firms	Private Foreign Firms	Difference between Foreign and Domestic
Small Firms (< 20)	38 361	75 415	37 054
Medium Firms (20-99)	26 300	59 682	33 382 ***
Large Firms (>100)	45 455	72 101	26 646 ***

6.3 Regressions outputs

Table 9: Descriptive statistics of variables used in the regressions

Data	Mean	Median	Std Dev	Minimum	Maximum	Observation
% of production workers	76,82	80	17,96	0	100	3 100
Labor to capital ($) ratio	2,03	0,0003	24,37	1,42E-07	1 087	3 118
Total sales ($) per employee	42 777	9 277	563 429	0,28	2,96E+07	3 099
Net book value of capital stock ($)	1 667 126	80 177	1,37E+07	0	4,25E+08	3 118
Completely domesticaly owned firm (dummy)	0,79	1	0,41	0	1	3 118
Export (dummy)	0,18	0	0,38	0	1	3 118
Age of the firm (years)	15,99	10	15,94	0	128	3 118
Trade union presence in the firm (dummy)	0,36	0	0,48	0	1	3 118
Firm located in the capital city (dummy)	0,54	1	0,50	0	1	3 118
ISO certification (dummy)	0,16	0	0,37	0	1	3 118
Firm offers training program (dummy)	0,36	0	0,48	0	1	3 118
Firm has an overdraft or credit facilities (dummy)	0,44	0	0,50	0	1	2 945
Experience of top manager (years)	11,57	10	9,44	0	50	3 045
Workers education and skills is a major or severe constraint (dummy)	0,15	0	0,36	0	1	3 113
100% of working capital is financed through internal funds (dummy)	0,32	0	0,47	0	1	3 094
Access and/or cost of financing is a major or severe constraint (dummy)	0,21	0	0,41	0	1	3 081

Table 10: Explaining Labor to Capital ratio according to institutional solidarity index

	Better Solidarity Sample		**Worse Solidarity Sample**	
Equations	(1)	(2)	(3)	(4)
Dependent Variable	Labor/Capital ($) Ratio (log)	Labor/Capital ($) Ratio (log)	Labor/Capital ($) Ratio (log)	Labor/Capital ($) Ratio (log)
Constant	-8,262	-10,821	-8,681	-9,09
	(14.39)***	(6.16)***	(7.20)***	(9.58)***
100 % of the firm is owned	0,335	1,22	0,247	0,185
by domestic private sector (dummy)	(1.21)	(1.33)	(1.33)	(0.73)
Firms' characteristics				
Age of the firm (log)	0,009	0,058	0,325	0,391
	(0.13)	(0.55)	(3.17)***	(3.71)***
Firm located in the capital	0,745	0,614	-0,239	-0,128
town (dummy)	(1.14)	(1.03)	(0.73)	(0.39)
Export dummy	-0,719	-0,589	-0,535	-0,455
	(2.44)**	(1.98)*	(2.29)**	(1.95)*
Firm has as an ISO	-0,219	-0,155	-0,692	-0,596
certification n(dummy)	(1.28)	(0.57)	(2.06)**	(1.86)*
Trade union presence	-0,523	-0,707	0,291	0,306
within the firm (dummy)	(1.92)*	(2.13)**	(1.03)	(1.09)
Firm offers training	0,142	-0,032	-0,833	-0,818
programs (dummy)	(0.32)	(0.07)	(2.91)***	(2.96)***
Training dummy * 100 %	0,436	0,774	0,698	0,845
domestic dummy	(1.05)	(1.82)*	(2.19)**	(2.69)***
Workforce characteristics				
Experience of the	-0,129	-0,188	-0,129	-0,103
top manager (log)	(1.56)	(1.65)	(1.70)*	(1.52)
Workers education and	-0,118	0,081	-0,414	-0,424
skills is a major or severe constraint (dummy)	(0.60)	(0.32)	(2.14)**	(1.86)*
Access to credit				
Firm has an overdraft		0,373		-1,173
or credit facilities (dummy)		(0.48)		(3.92)***
Overdraft dummy * 100%		-1,199		0,082
domestic dummy		(1.37)		(0.25)
Access and/or cost		0,32		-0,452
of financing is a major or severe constraint (dummy)		(0.93)		(1.82)*
100% of working capital is		-0,251		-0,056
financed through internal fund (dummy)		(0.89)		(0.17)
Observations	600	443	1 871	1 822
R-squared	0,13	0,16	0,19	0,21

Method OLS, Absolute value of robust t statistics in parentheses

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

Size of the firms, country, year, activity and average education of the workforce dummies are included in all the regressions

Table 11: Explaining the percentage of production workers

Equations	(1)	(2)
Dependent Variable	% of Production Workers (log)	% of Production Workers (log)
Constant	4,405	4,252
	(53.88)***	(47.03)***
100 % of the firm is owned	0,085	0,101
by domestic private sector (dummy)	(2.48)**	(2.50)**
Firms' characteristics		
Age of the firm (log)	-0,009	-0,018
	(0.87)	(1.92)*
Firm located in the capital	-0,041	-0,041
town (dummy)	(1.75)*	(1.84)*
Export dummy	0,011	0,013
	(0.45)	(0.47)
Firm has as an ISO	-0,038	-0,039
certification n(dummy)	(1.77)*	(1.67)*
Trade union presence	-0,031	-0,024
within the firm (dummy)	(1.40)	(1.05)
Capital Stock (log)	-0.004	-0.003
	(1.45)	(1.18)
Firm offers training	0,079	0,072
programs (dummy)	(2.38)**	(1.95)*
Training dummy * 100 %	-0,151	-0,142
domestic dummy	(3.79)***	(3.22)***
Workforce characteristics		
Experience of the	-0,02	-0,018
top manager (log)	(1.85)*	(1.59)
Workers education and	-0,037	-0,04
skills is a major or severe constraint (dummy)	(1.36)	(1.29)
Access to credit		
Firm has an overdraft		0,004
or credit facilities (dummy)		(0.09)
Overdraft dummy * 100%		-0,026
domestic dummy		(0.57)
Access and/or cost		-0,036
of financing is a major or severe constraint (dummy)		(1.47)
100% of working capital is		0,027
financed through internal fund (dummy)		(1.59)
Observations	3 025	2 819
R-squared	0,12	0,13
Method OLS, Absolute value of robust t statistics in parentheses		
* significant at 10%; ** significant at 5%; *** significant at 1%		
Size of the firms, country, year, activity and average education of the workforce dummies are included in all the regressions		

Table 12: Explaining Sales per Employee ratio according to institutional solidarity index

	Better Solidarity Sample		**Worse Solidarity Sample**	
Equations	(1)	(2)	(3)	(4)
Dependent Variable	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)
Constant	11,462	8,934	2,741	2,678
	(19.79)***	(19.95)***	(7.91)***	(8.08)***
100 % of the firm is owned	-0,217	-0,196	-0,36	-0,282
by domestic private sector (dummy)	(1.13)	(0.80)	(3.83)***	(2.72)***
Firms' characteristics				
Age of the firm (log)	0,007	0,01	-0,019	-0,059
	(0.13)	(0.17)	(0.43)	(1.37)
Firm located in the capital	0,664	0,596	-0,001	-0,017
town (dummy)	(2.75)**	(2.46)**	(0.02)	(0.22)
Export dummy	0,07	0,068	0,445	0,401
	(0.98)	(0.61)	(3.56)***	(3.34)***
Firm has as an ISO	0,342	0,246	0,491	0,486
certification n(dummy)	(3.92)***	(2.09)**	(4.43)***	(4.38)***
Trade union presence	-0,028	0	0,168	0,152
within the firm (dummy)	(0.18)	(0.00)	(2.27)**	(1.97)*
Capital Stock (log)	0.063	0.050	0.083	0.072
	(1.76)*	(2.58)**	(7.80)***	(6.85)***
Firm offers training	0,351	0,323	0,103	0,089
programs (dummy)	(2.14)**	(1.83)*	(0.84)	(0.72)
Training dummy * 100 %	-0,1	-0,106	-0,018	-0,047
domestic dummy	(0.66)	(0.72)	(0.12)	(0.32)
Workforce characteristics				
Experience of the	0,03	0,023	-0,057	-0,029
top manager (log)	(0.65)	(0.47)	(1.50)	(0.69)
Workers education and	-0,01	0,001	0,117	0,1
skills is a major or severe constraint (dummy)	(0.09)	(0.01)	(1.26)	(1.14)
Access to credit				
Firm has an overdraft		0,365		0,545
or credit facilities (dummy)		(1.19)		(3.74)***
Overdraft dummy * 100%		-0,177		-0,193
domestic dummy		(0.75)		(1.45)
Access and/or cost		-0,107		0,126
of financing is a major or severe constraint (dummy)		(1.04)		(0.88)
100% of working capital is		0,172		-0,018
financed through internal fund (dummy)		(1.47)		(0.25)
Observations	597	441	1 861	1 812
R-squared	0,29	0,37	0,52	0,54

Method OLS, Absolute value of robust t statistics in parentheses

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

Size of the firms, country, year, activity and average education of the workforce dummies areincluded in all the regressions

6.4 Structural Maximum Likelihood Estimates of the Model: using income as a proxy for capital

Table 13: Structural Maximum Likelihood Estimates of the Model: using income as a proxy for capital

Type	Parameter	Name	Whole sample	Better solidarity	Worse solidarity	Difference Pvalue
Foreigners	Log ability - constant	δ_{0f}	4.47 (0.0012)	3.41 (0.036)	3.815 (0.0932)	0.0000
	Log ability - education	δ_{1f}	0.2817 (0.0022)	0.586 (0.0531)	0.2784 (0.0715)	0.0000
	Log ability - experience	δ_{2f}	0.2620 (0.0293)	0.4934 (0.013)	0.1921 (0.037)	0.0000
	Stand. dev. for ability	σ_f	0.7421 (0.0192)	0.9012 (0.0023)	0.5917 (0.0481)	0.0000
Locals	Log ability - constant	δ_{0l}	4.021 (0.0012)	3.48 (0.0307)	4.1709 (0.0208)	0.0000
	Log ability - education	δ_{1l}	0.3902 (0.0024)	0.4230 (0.0051)	0.2732 (0.0234)	0.0000
	Log ability - experience	δ_{2l}	0.2502 (0.0201)	0.3702 (0.0121)	0.2904 (0.0130)	0.0000
	Stand. dev. for ability	σ_l	0.5605 (0.0207)	0.9102 (0.0204)	0.2603 (0.0219)	0.0000
All	Capital returns	α	0.0201 (0.0152)	0.0912 (0.0104)	0.0462 (0.0313)	0.0701
	Log-likelihood		-3018	-1809.1	-1784.2	
	Number of Obs.		7834	3962	3872	
	Frac. missing entrepreneurs	m	0.0560 (0.0081)	0.0429 (0.0071)	0.0605 (0.0026)	0.000

Asymptotic standard errors in parenthesis
* Not significant

6.5 Semiparametric estimation of the model

Here we allow the distributions of the error terms ϵ_{il} and ϵ_{if} in the talent distribution given by Equation (21) to be unknown. Because the constant terms are not identified in the semiparametric single-index estimation, we shift them into the error terms so that the

unknown distributions of interest are for $\epsilon_{if}+\gamma_{0f}$ and $\epsilon_{il}+\gamma_{0l}$. The remaining parameters of the model are identified up to a scaling constant.

In this case we have a new version for Equation (22), rewritten as:

$$\begin{aligned}\Pr[E_i=1|Z_i] = (1-p_i)\Psi_f\left\{\delta_{1f}\ln(1+S_i)+\delta_{2f}\ln(1+X_i)-\alpha\ln\left(\frac{w_i}{K_i}+r_i\right)-(1-\alpha)\ln w_i\right\}\\ +p_i\Psi_l\left\{\delta_{1l}\ln(1+S_i)+\delta_{2l}\ln(1+X_i)-\alpha\ln\left(\frac{w_i}{K_i}+r_i+\frac{\Delta\bar{\Pi}_i}{K_i}\right)-(1-\alpha)\ln w_i\right\}\end{aligned} \tag{38}$$

Where $\Psi_f(\cdot)$ and $\Psi_l(\cdot)$ are the unknown CDFs of the talent of foreigners and locals respectively.

For the simplicity of the exposition, we adopt the following notations: $\delta_f = \big(\delta_{1f},\delta_{2f},-(1-\alpha)\big)$, $\delta_l = \big(\delta_{1l},\delta_{2l},-(1-\alpha)\big)'$, $x_i = \big(\ln(1+S_i),\ln(1+X_i),\ln w_i\big)'$, $k_{if} = \ln\left(\frac{w_i}{K_i}+r_i\right)$ and $k_{il} = \ln\left(\frac{w_i}{K_i}+r_i+\frac{\Delta\bar{\Pi}_i}{K_i}\right)$. Then Equation(38) above can be rewritten as

$$\Pr[E_i=1|x_i,k_{if},k_{il}] = (1-p_i)\Psi_f(x_i'\delta_f-\alpha k_{if})+p_i\Psi_l(x_i'\delta_l-\alpha k_{il}).$$

Because we do not specify variances for the distributions of talent, our structural parameter vector of interest is now $\psi=[\delta_{1f},\delta_{2f},\delta_{1l},\delta_{2l},\alpha]'$. To estimate ψ in this model, we use a semiparametric likelihood approach which is similar to the one proposed by Klein and Spady (1993). Given Ψ_f and Ψ_l, the log-likelihood is

$$\begin{aligned}L_n(\psi,\Psi_f,\Psi_l) = \sum_{i=1}^{n}\Big[&E_i\ln[(1-p_i)\Psi_f(x_i'\delta_f-\alpha k_{if})+p_i\Psi_l(x_i'\delta_l-\alpha k_{il})]\\ &+(1-E_i)\ln[1-(1-p_i)\Psi_f(x_i'\delta_f-\alpha k_{if})-p^i\Psi_l(x_i'\delta^l-\alpha k_i^l)]\Big]\end{aligned} \tag{39}$$

However, Ψ_f and Ψ_l are unknown. So following Ichimura (1993) and Klein and Spady (1993) one can replace Ψ_f and Ψ_l in the above formula by nonparametric estimates $\widehat{\Psi}_f$ and $\widehat{\Psi}_l$. To estimate Ψ_f and Ψ_l, we start by noticing that we can write

$$\mathbb{E}[E_i|x_i,k_{if},i\in\mathcal{F}] = \Psi_f(x_i'\delta_f-\alpha k_{if})$$

and

$$\mathbb{E}[E_i|x_i,k_{il},i\in\mathcal{L}] = \Psi_l(x_i'\delta_l-\alpha k_{il})$$

Hence, leave-one-out Nadaraya-Watson estimates for Ψ_f and Ψ_l can be defined by

$$\widehat{\Psi}_f(x_i'\delta_f-\alpha k_{if}) = \frac{\sum_{j\in\mathcal{F},j\neq i}y_jK\left(\frac{(x_i-x_j)'\delta_f-\alpha(k_{if}-k_{jf})}{h}\right)}{\sum_{j\in\mathcal{F},j\neq i}K\left(\frac{(x_i-x_j)'\delta^f-\alpha(k_{if}-k_{jf})}{h}\right)} \tag{40}$$

and

$$\widehat{\Psi}_l(x_i'\delta_l - \alpha k_{il}) = \frac{\sum_{j\in\mathcal{L},j\neq i} y_j K\left(\frac{(x_i-x_j)'\delta_l-\alpha(k_{il}-k_{jl})}{h}\right)}{\sum_{j\in\mathcal{L},j\neq i} K\left(\frac{(x_i-x_j)'\delta_l-\alpha(k_{il}-k_{jl})}{h}\right)} \tag{41}$$

Where $K(\cdot)$ is the gaussian kernel function.

Substituting Ψ_f by $\widehat{\Psi}_f$ and Ψ_l by $\widehat{\Psi}_l$ in Equation (39) leads to the feasible likelihood criterion

$$\begin{aligned} L_n(\psi) = \sum_{i=1}^{n} \Big[& E_i \ln[(1-p_i)\widehat{\Psi}_f(x_i'\delta_f - \alpha k_{if}) + p^i \widehat{\Psi}_l(x_i'\delta_l - \alpha k_{il})] \\ & + (1-E_i)\ln[1-(1-p_i)\widehat{\Psi}_f(x_i'\delta_f - \alpha k_{if}) - p_i\widehat{\Psi}_l(x_i'\delta_l - \alpha k_{il})]\Big] \end{aligned} \tag{42}$$

Maximizing (42) with respect to ψ leads to a semiparametric maximum likelihood estimator of ψ, denoted $\widehat{\psi}_S$. Maximization is performed numerically by solving the first order condition obtained from (42). This includes using an extensive grid search for initial values of the parameter vector ψ, and introducing a trimming function to trimmed out small values for the denominators in (40) and (41). As suggested by Klein and Spady (1993), the bandwidth used for the kernel estimation is chosen at $h = n^{-1/7}$. Standard errors (in parenthesis in the results table) are obtained by computing the sample counterpart of the asymptotic variance-covariance matrix of the structural parameters.

From the semiparametric estimator $\widehat{\psi}_S$, we can compute the fraction of missing entrepreneurs as described in Equations (24) and (25) above, where the semiparametric estimates are used in the formula, and the normal CDFs are replaced by the nonparametric CDFs. In other words, the proportion of missing entrepreneurs is estimated by

$$\widehat{m} = \frac{1}{n}\sum_{i=1}^{n} \widehat{m}_i \tag{43}$$

where $\widehat{m}_i$ is given by

$$\begin{aligned} \widehat{m}_i = (1-p_i)\Big[& \widehat{\Psi}_l\left(\hat{\delta}_{1l}\ln(1+S_i) + \hat{\delta}_{2l}\ln(1+X_i) - \hat{\alpha}\ln\big(\frac{w_i}{K_i} + r_i\big) - (1-\hat{\alpha})\ln w_i\right) \\ & - \widehat{\Psi}_l\left(\hat{\delta}_{1l}\ln(1+S_i) + \hat{\delta}_{2l}\ln(1+X_i) - \hat{\alpha}\ln\big(\frac{w_i}{K_i} + r_i + \frac{\Delta\bar{\Pi}_i}{K_i}\big) - (1-\hat{\alpha})\ln w_i\right)\Big] \end{aligned} \tag{44}$$

The results of the semiparametric estimation are presented in the tables 14 and 15.

Table 14: Structural Semiparametric Estimates of the Model: base case

Type	Parameter	Name	Whole sample	Better solidarity	Worse solidarity	Difference Pvalue
Foreigners	Log ability - education	δ_{1f}	0.3261	0.3913	0.2461	0.0000
			(0.0016)	(0.0012)	(0.0022)	
	Log ability - experience	δ_{2f}	0.1958	0.2132	0.1401	0.0000
			(0.0131)	(0.0001)	(0.0012)	
Locals	Log ability - education	δ_{1l}	0.2702	0.3013	0.2104	0.0000
			(0.0002)	(0.0001)	(0.0051)	
	Log ability - experience	δ_{2l}	0.1246	0.2649	0.1126	0.0000
			(0.0132)	(0.0001)	(0.0017)	
All	Capital returns	α	0.0213	0.0672	0.0374	0.0708
			(0.0047)	(0.0031)	(0.0162)	
	Number of Obs.		7834	3962	3872	
	Frac. missing entrepreneurs	m	0.0707	0.0512	0.0801	0.000
			(0.0028)	(0.0035)	(0.0043)	

Asymptotic standard errors in parenthesis

Table 15: Structural Semiparametric Estimates of the Model: using income as a proxy for capital

Type	Parameter	Name	Whole sample	Better solidarity	Worse solidarity	Difference Pvalue
Foreigners	Log ability - education	δ_{1f}	0.3923	0.4012	0.2712	0.0000
			(0.0018)	(0.0014)	(0.0031)	
	Log ability - experience	δ_{2f}	0.2081	0.2201	0.1413	0.0000
			(0.0192)	(0.0002)	(0.0022)	
Locals	Log ability - education	δ_{1l}	0.2322	0.3001	0.2015	0.0000
			(0.0024)	(0.0011)	(0.0048)	
	Log ability - experience	δ_{2l}	0.1412	0.2748	0.1317	0.0000
			(0.0132)	(0.0021)	(0.0031)	
All	Capital returns	α	0.0259	0.0723	0.0388	0.0753
			(0.0047)	(0.0031)	(0.0162)	
	Number of Obs.		7834	3962	3872	
	Frac. missing entrepreneurs	m	0.0545	0.0457	0.0701	0.000
			(0.0029)	(0.0046)	(0.0039)	

Asymptotic standard errors in parenthesis

Regression 1: Explaining Labor to Capital Ratio

Equations	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Labor / Capital ($) Ratio (log)	Labor / Capital ($) Ratio (log)	Labor / Capital ($) Ratio (log)	Labor / Capital ($) Ratio (log)	Labor / Capital ($) Ratio (log)
Constant	-7,464	-7,122	-8,644	-8,739	-8,336
	(19.13)***	(18.09)***	(17.29)***	(17.00)***	(16.48)***
100 % of the firm is owned	0,476	0,206	0,49	0,636	0,373
by domestic private sector (dummy)	(3.59)***	(1.22)	(3.47)***	(2.93)***	(1.60)
Firms' characteristics					
Age of the firm (log)	0,205	0,206	0,255	0,253	0,253
	(2.97)***	(3.00)***	(3.33)***	(3.29)***	(3.32)***
Firm located in the capital	-0,277	-0,282	-0,193	-0,189	-0,193
town (dummy)	(1.01)	(1.03)	(0.71)	(0.70)	(0.71)
Export dummy	-0,578	-0,574	-0,518	-0,528	-0,524
	(3.37)***	(3.36)***	(3.01)***	(3.06)***	(3.05)***
Firm has as an ISO	-0,368	-0,346	-0,335	-0,343	-0,316
certification n(dummy)	(1.91)*	(1.82)*	(1.60)	(1.64)	(1.53)
Trade union presence	0,046	0,051	0,071	0,069	0,075
within the firm (dummy)	(0.22)	(0.24)	(0.34)	(0.33)	(0.36)
Firm offers training	-0,126	-0,562	-0,09	-0,09	-0,697
programs (dummy)	(0.93)	(2.61)***	(0.66)	(0.66)	(3.25)***
Training dummy * 100 %		0,559			0,779
domestic dummy		(2.37)**			(3.17)***
Workforce characteristics					
Experience of the	-0,075	-0,072	-0,067	-0,066	-0,062
top manager (log)	(1.41)	(1.37)	(1.23)	(1.21)	(1.15)
Workers education and	-0,25	-0,255	-0,222	-0,219	-0,228
skills is a major or severe constraint (dummy)	(1.91)*	(1.94)*	(1.46)	(1.43)	(1.48)
Access to credit					
Firm has an overdraft			-1,092	-0,886	-0,754
or credit facilities (dummy)			(6.80)***	(3.48)***	(3.02)***
Overdraft dummy * 100%				-0,273	-0,453
domestic dummy				(0.96)	(1.60)
Access and/or cost			-0,065	-0,064	-0,054
of financing is a major or severe constraint (dummy)			(0.36)	(0.35)	(0.30)
100% of working capital is			-0,15	-0,155	-0,151
financed through internal fund (dummy)			(0.68)	(0.70)	(0.69)
Observations	3 040	3 040	2 830	2 830	2 830
R-squared	0,23	0,23	0,24	0,24	0,24

Method OLS, Absolute value of robust t statistics in parentheses

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

Size of the firms, country, year, activity and average education of the workforce dummies are included in all the regressions

Regression 2: Explaining Sales per Employee ratio

Equations	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)	Total Sales ($) Per Employee (log)
Constant	9,061	9,052	8,296	8,238	8,222
	(37.71)***	(36.06)***	(45.79)***	(44.65)***	(42.73)***
100% of the firm is owned	-0,373	-0,366	-0,398	-0,318	-0,303
by domestic private sector (dummy)	(6.27)***	(4.64)***	(6.94)***	(3.83)***	(3.38)***
Firms' characteristics					
Age of the firm (log)	0,003	0,003	-0,01	-0,011	-0,011
	(0.11)	(0.10)	(0.31)	(0.35)	(0.35)
Firm located in the	0,104	0,104	0,093	0,095	0,095
capital town (dummy)	(1.44)	(1.43)	(1.28)	(1.30)	(1.30)
Export dummy	0,251	0,251	0,265	0,258	0,258
	(3.32)***	(3.32)***	(3.41)***	(3.31)***	(3.31)***
Firm has as an ISO	0,413	0,413	0,388	0,384	0,383
certification (dummy)	(5.65)***	(5.63)***	(5.03)***	(4.97)***	(4.94)***
Trade union presence	0,12	0,12	0,114	0,113	0,112
within the firm (dummy)	(2.04)**	(2.03)**	(1.93)*	(1.90)*	(1.90)*
Capital Stock (log)	0.083	0.083	0.075	0.075	0.075
	(9.37)***	(9.35)***	(9.21)***	(9.26)***	(9.22)***
Firm offers training	0,118	0,129	0,104	0,104	0,139
programs (dummy)	(2.84)***	(1.32)	(2.39)**	(2.39)**	(1.34)
Training dummy * 100%		-0,013			-0,044
domestic dummy		(0.12)			(0.38)
Workforce characteristics					
Experience of the	-0,028	-0,028	-0,02	-0,02	-0,02
top manager (log)	(1.16)	(1.16)	(0.75)	(0.74)	(0.75)
Workers education and	0,08	0,08	0,068	0,069	0,07
skills is a major or severe constraint (dummy)	(1.26)	(1.26)	(1.05)	(1.07)	(1.08)
Access to credit					
Firm has an overdraft			0,366	0,478	0,471
or credit facilities (dummy)			(5.63)***	(4.43)***	(4.25)***
Overdraft dummy*100%				-0,148	-0,138
domestic dummy				(1.52)	(1.37)
Access and/or cost			-0,029	-0,027	-0,028
of financing is a major or severe constraint (dummy)			(0.28)	(0.27)	(0.28)
100% of working capital			-0,007	-0,009	-0,009
is financed through internal fund (dummy)			(0.13)	(0.17)	(0.18)
Observations	3 026	3 026	2 817	2 817	2 817
R-squared	0,57	0,57	0,57	0,57	0,57

Method OLS, Absolute value of robust t statistics in parentheses

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

Size of the firms, country, year, activity and average education of the workforce dummies are included in all the regressions