Risk aversion and entrepreneurship in Côte d'Ivoire:

A structural econometric approach

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Abstract

In our model of occupational choices individuals choose to become entrepreneurs, rather than employees, if their risk aversion is lower than a ratio reflecting the risk–return tradeoff they face. Using parametric and semiparametric methods, we confront this model to data from the manufacturing sector in Côte d'Ivoire. We test the implication of the theory that the probability that an individual becomes an entrepreneur should be increasing in his risk–return ratio. The data is broadly consistent with this restriction. Our structural econometric approach also allows us to back out from the data estimates of relative risk aversion coefficients, conditional on occupational choices and individual characteristics. The orders of magnitude are plausible and suggest that risk aversion plays an important role in occupational choices.

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Introduction

In the line of Knight (1921), economic theory has analyzed the choice by individuals to become entrepreneurs or workers, relating it to their skills and their attitude towards risk. Under the assumption that agents have identical skills, Kihlstrom and Laffont (1979) analyze, in a general equilibrium model, how less risk averse individuals become entrepreneurs. Considering the other side of the coin, Laussel and Le Breton (1995) consider risk neutral individuals with different skills and analyze how those with higher skills choose to become entrepreneurs. Consistent with Kihlstrom and Laffont (1979), recent empirical studies (Uusitalo, 1999, and Guiso and Paiella (2000)) provide evidence, based on income surveys and psychological questionnaires, that entrepreneurs are less risk averse than employees.

We confront this view of occupational choices to data on 64 entrepreneurial manufacturing firms in Côte d'Ivoire. The number of individuals in the dataset is 350, corresponding to 64 entrepreneurs and 286 employees. The survey provides data on the firms – such as their size, their capital, their profits and whether they are in the formal or informal sector – and on the entrepreneurs managing them. The survey also provides data on the individuals employed in these firms, such as wages, education level, age, and ethnic origin. The latter is relevant in particular because ethnic and socio–cultural factors play an important role in occupational choices, as initially pointed out by Max Weber.

In our theoretical model of occupational choices, individuals compare their expected utility as entrepreneurs to their expected utility as employees. In general, entrepreneurship is riskier than employeeship, but promises greater expected earnings. The model pins down the ratio reflecting this risk return trade–off. It is equal to twice the difference between expected earnings as entrepreneurs and as employees divided the corresponding difference in earnings' risk. Agents opt for entrepreneurship if their risk aversion coefficient is smaller than this risk–return ratio.

While the risk–return ratio can be estimated based on observed profits, wages and individual characteristics, the agents' risk aversion coefficients are not directly observable. We analyze it as an unobservable heterogeneity component. Thus, our structural econometric approach is to model the probability that an individual opts for entrepreneurship as the probability that his or her risk aversion coefficient is lower than the risk return ratio. footnote

We compute parametric and semi–parametric estimates of the conditional probability that an individual becomes an entrepreneur. Relying on this estimation, we test the implication from the theory that agents facing relatively more favorable risk–return ratios should be relatively more likely to opt for entrepreneurship. Our empirical results are broadly consistent with this empirical restriction.

Our structural approach also enables us to estimate the deep parameters of the model and, using these, to compute the expected relative risk aversion index of the agents conditional on their individual characteristics and occupational choices. Overall, our estimates of the expected relative risk aversion index fall in the region that is deemed to be reasonable by risk theorists. For the French and the Lebanese the estimates are between 0 and 5. For the Africans, the estimated expected relative risk aversion coefficient is also between 0 and 5 for entrepreneurs, while it is between 10 and 15 for employees. This rather large difference suggests that risk aversion plays an important role in the occupational choices of Africans. That Africans are found

to be more risk averse than French or Lebanese may reflect that they are poorer and are connected to relatively poor social networks, so that failed enterprises have more severe consequences for them.

Our analysis is related to the insightful study by Goedhuys and Sleuwaegen (1990). Both their paper and ours analyze occupational choices in Côte d'Ivoire. Goedhuys and Sleuwaegen (1990)'s focus is broader than ours, as they study the learning process taking place before and after the firm is created. On the other hand, their approach based on descriptive statistics and a logit model, differs from our structural econometric methodology. It is this methodology which enables us to directly test restrictions implied by the theoretical model and to back out from the data estimates of deep parameters of economic interest, such as the risk aversion coefficients of the agents.

The next section presents the data–set and summary statistics. The third section presents our economic model. Section 4 presents our empirical results on wages and profits. Section 5 presents the quasi maximum likelihood analysis of the structural model, while Section 6 presents its semi–parametric counterpart. Brief concluding remarks are offered in the last section.

Data and preliminary analysis

Our analysis is based on a survey data collected in Côte d'Ivoire in 1996 from 64 entrepreneurial manufacturing firms, their managers and their 286 employees. footnote The firms in our sample are from the big towns of Abidjan (and its suburbs), Bouaké and San Pedro have been surveyed. 14.75 % of the firms in our sample are operating in the agro industry, 32.78% in the textile industry, 31.15% in the wood industry, and 21.3% in the metal industry.

In each firm, up to 10 workers were surveyed. Adding up the 64 entrepreneurs and the 286 workers, we have individual data for 350 persons. For these 350 individuals we observe:

- their ethnic origin (Ivorian, other Western Africans, French, Lebanese),
- their education level (none, elementary school, high school, university,
- age,
- whether they already had business experience before their current job,
- whether they work in the formal, or informal sector (firms in the formal sector pay taxes to the state, while firms in the informal don't.) 45% of the firms in our sample operate in the formal sector, and they represent 89.2% of the employees in our data. Formal sector firms are much larger than informal sector firms.

The average profit is much larger in the formal sector (FCFA 239,598,438) than in the informal sector (FCFA 2,623,140). footnote While these are gross profits, measured as the difference between revenues and costs, for entrepreneurs the relevant variable is profits net of the cost of capital. It is those net profits which we consider in our econometric investigation in the next section. To measure the capital used by the firms, we rely on the questions in the survey on equipment, real estate and inventories. For simplicity, we took the cost of capital to be equal across firms, and set it to 15 %.

The vast majority of the workers are from Côte d'Ivoire (77.9%) or other African countries (20.9%). In contrast, 46.72% of the entrepreneurs in our sample are Ivorian, 13.1 % are French, 9% are Lebanese, and 31.14% are non–Ivorian Africans. Of course, Lebanese and French very rarely come to Côte d'Ivoire to work as employees. So the risk aversion coefficients we estimate for them should not be taken as typical of their ethnies as a whole, but rather of the group of French and Lebanese who work in Côte d'Ivoire.

22.1% of the entrepreneurs have no education, 27% have elementary education, 17.2% have high school education, 10.65% have technical high school education, and 22.9% of the entrepreneurs have University education. The proportion of employees with no education is similar (20.65%), as well as the proportion of employees with elementary education (23.63%). The proportion of employees with high school (resp. technical high school) education is 31.7% (resp. 16.4%) which is higherer than its counterpart for the population of entrepreneurs. The proportion of entrepreneurs with university education is lower (7.66%) than the corresponding proportion for employees.

The economic model

Wages and net profits

In order to make occupational choices, individuals must compute the wage they anticipate to obtain as employees and the profit they expect they would generate as entrepreneurs, and which reflect their skills. To simplify the analysis, we assume that, to form these expectations, agents rely on their individual characteristics also observed by the econometrician, X_i, but not on any unobservable heterogeneity component.

In line with the literature estimating wage equations (see e.g. the seminal analysis of Mincer (1974), or the more recent study by Murphy and Welch (1990)), X_i includes individual characteristics such as age, sex, experience, and education. In addition, to take into account the fact that ethnic background can be an important variable, we include this variable in the information set X_i. footnote Furthermore, for simplicity we take the sector in which the agents operate (formal or informal) as predetermined (and included in the characteristics X_i). This approach greatly facilitates the econometric analysis. footnote

Based on their preferences and opportunities, agents make occupational choices. Then shocks affect the economy, firms, wages and profits. Hence from the perspective of the agent making her occupational choice conditional on X_i, her potential wage as well as her potential profit are random variables.

Should agent *i* choose to become an employee, she would obtain wage $\tilde{w}_i$. Its expectation from the perspective of the agent and the econometrician is:

$$E(\tilde{w}_i \mid X_i).$$

Should the agent choose to become entrepreneur, she would have to invest capital K_i in the firm. To simplify our analysis we abstract from capital markets imperfections. While we realize that these imperfections are important (as shown by e.g. Evans and Jovanovic (1989), Banerjee and Newman (1993), Aghion and Bolton (1997), Dercon (1998), Mesnard (1999), Mesnard and Ravalllion (2002), and Paulson and Townsend (2000)), we believe that focusing on another aspect of the entrepreneurial process not taken into account in these studies (namely risk aversion) can also be informative. Ideally one would like to integrate the two aspects, but this would be hard with our data–set, which does not include data on wealth. We leave that interesting topic for further research.

If agent *i* becomes entrepreneur, the gross profit generated by the firm is: $\tilde{G}_i$, while the net profit: $\tilde{G}_i - rK_i$, (where *r* is the cost of capital) is denoted $\tilde{\pi}_i$. This net profit, measured after substracting the cost (or opportunity cost) of capital is the relevant measure of earnings for the agent considering whether to become an entrepreneur. Its expectation is:

$$E(\tilde{\pi}_i \mid X_i),$$

both from the point of view of the econometrician and that of the agent.

For tractability and simplicity we assume that $\tilde{\pi}_i$ and $\tilde{w}_i$ are normally distributed conditional on X_i.

Occupational choices

For tractability, we assume the individuals have CARA utility:

$$U(x) = -\exp(-\gamma_i x).$$

The expected utility of agent *i* if he or she decides to become employee is:

$$E(U_i(\tilde{w}_i)) = -\exp(-\gamma_i [E(\tilde{w}_i|X_i) - \frac{\gamma_i}{2} Var(\tilde{w}_i|X_i)]).$$

Denote this expected utility:

$$EU_{emp,i}.$$

The expected utility of this agent if she or he decides to become entrepreneur is:

$$E(U_i(\tilde{\pi}_i)) = -\exp(-\gamma_i [E(\tilde{\pi}_i|X_i) - \frac{\gamma_i}{2} Var(\tilde{\pi}_i|X_i)]).$$

Denote this expected utility:

$$EU_{ent,i}.$$

Since the agent chooses to become an entrepreneur iff: $EU_{ent,i} > EU_{emp,i}$, by comparing these expected utilities we obtain the following proposition:

Proposition If $Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i)$ the agent chooses to become an entrepreneur iff:

$$\gamma_i < 2\frac{E(\tilde{\pi}_i|X_i) - E(\tilde{w}_i|X_i)}{Var(\tilde{\pi}_i|X_i) - Var(\tilde{w}_i|X_i)}.$$

If $Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i)$, the inequality is reversed.

In the most frequent and plausible case where $Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i)$, becoming an entrepreneur, rather than an employee, raises one's expected income at the cost of raising risk. Consequently, an individual decides to become an entrepreneur if his risk aversion is low enough.

Denote:

$$S_i = 2\frac{E(\tilde{\pi}_i|X_i) - E(\tilde{w}_i|X_i)}{Var(\tilde{\pi}_i|X_i) - Var(\tilde{w}_i|X_i)}.$$

This ratio reflects the trade–off between expected earnings and risk associated with the occupational choice. Our first proposition directly implies the following:

Proposition Consider agent i, with characteristics X_i such that $Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i)$. From the perspective of an outside observer, for whom risk aversion is unobservable, the probability that this agent chooses to become an entrepreneur is: $\Pr(\tilde{\gamma}_i < S_i|X_i)$, which is increasing in S_i.

The interpretation of this proposition is the following: In our model, agents make occupational choices by comparing their risk aversion coefficient to S_i, which reflects the trade–off between expected earnings and risk. Other things equal, the greater this ratio, the more attractive it is to choose to become an entrepreneur, the more likely it is that the agent opts for entrepreneurship. This implication of our model is one of the central hypotheses tested in our econometric analysis in the next sections, where the risk aversion coefficient: γ_i is modeled as an unobservable heterogeneity component.

To conclude this section we add a caveat about the interpretation of the risk aversion coefficient in our analysis. In developing countries, as shown in particular by Townsend (1994), there exist risk sharing systems based on family or proximity relationships. footnote Hence, the utility function U_i should be interpreted as a reduced form value function, reflecting the attitude of the agent towards risk, after accounting for these risk sharing mechanisms. In this context, agents in ethnies or social groups with stronger risk–sharing mechanisms should exhibit less risk averse U_i. This is in line with the "cushion hypothesis" developed by Hsee and Weber (1998 a and b) which posits that: "In socially collectivists cultures like China, family or other in–group members will step in to help out any group member who encounters a large and possibly catastrophic loss".

Empirical analysis of wages and profits

For simplicity we assume that:

$$\tilde{\pi}_i = \exp(\beta_\pi X_i)\tilde{\epsilon}_i, \tilde{w}_i = \exp(\beta_w X_i \mid X_i)\tilde{\eta}_i,$$

where $\tilde{\epsilon}_i \mid X_i$ and $\tilde{\eta}_i \mid X_i$ are identically independently normally dstributed with mean 1 and variance σ. footnote This simple specification (where $V(\pi_i|X_i) = \exp(\beta_\pi X_i)^2\sigma^2$ and $V(w_i|X_i) = \exp(\beta_w X_i)^2\sigma^2$) allows for heteroskedasticity (in accordance with the data), while avoiding overparametrization. footnote

We estimate the parameters of the distribution of these variables using quasi maximum likelihood analysis, which enhances the robustness of the variance covariances estimates with respect to specification errors.

In large firms, with more than 10 employees, while we observe the total number of employees, only ten employees were surveyed and included in our data. To correct for the possible biases this could generate, we weight the data corresponding to employee i by p_i defined as $Max[1, \frac{n_i}{10}]$, where n_i is the number of employees in the firm in which he works. Denote Y_i the indicator variable taking the value one if individual is an entrepreneur and 0 otherwise. The objective function we maximize to carry the estimation is:

$$\sum p_i[Y_i \ln(\frac{1}{\sigma_{i,\pi}\sqrt{2\pi}} \exp(-\frac{1}{2\sigma_{i,\pi}^2}(\pi_i - \beta_\pi X_i)^2))$$
$$+ (1 - Y_i) \ln(\frac{1}{\sigma_{i,w}\sqrt{2\pi}} \exp(-\frac{1}{2\sigma_{i,w}^2}(w_i - \beta_w X_i)^2))].$$

The estimates of β_π and β_w are in Table 1. The estimate of σ is 0.47.

Table 1.A presents the estimates of the parameters of the distribution of wages. Consistent with the literature on wages, and in particular in Côte d'Ivoire, we find that wages are increasing with education and age (see Schultz (1999), Vijverberg (1991), and Tansel (1997)). Furthermore, even after controlling for age and education, Lebanese and French employees earn higher wages than Ivorian workers, while workers from other African countries earn lower wages. (This is similar to the results obtained by Azam and Ris (1999) that in Côte d'Ivoire wages are significantly lower for West African immigrants than for Ivorian, French or Lebanese employees.) This parallels the evidence on ethnic inequality documented for other developing countries (see Gunewardena and van de Walle (1999) for Viet Nam, and Psacharopoulos and Patrinos (1994) for Latin America.) On the other hand, after controlling for other variables, wages are not found to be larger in the formal sector.

The estimates of the parameters of the distribution of profits are in Table 1.B. Having been an apprentice significantly raises one's expected profit. In contrast with wages, the effect of education on profits is ambiguous. Controlling for the other variables, expected profits are higher for French or Lebanese and in the formal sector. This points at ethnic inequalities and the dualism between the formal and the informal sector.

Quasi maximum likelihood analysis

The objective function

In this section, for simplicity we estimate and test the model within the context of a parametric specification. The semiparametric analysis presented in the next section allows us to assess the robustness of the specification we consider.

Assume that the risk aversion coefficient of individual *i* is drawn (independently from the coefficients of the other individuals) from a Weibull distribution with cumulative distribution function, with parameters δ and λ_i:

$$\Pr(\tilde{\gamma}_i < S_i|X_i) = F(S_i|X_i) = 1 - \exp\{-\lambda_i(X_i)(S_i)^\delta\}.$$

Note that we allow the distribution of the risk aversion coefficient to vary across agents, to reflect their individual characteristics, by allowing the scale parameter λ_i to be a function of X_i. Specifically, we assume that:

$$\lambda_i = \exp(-\beta_\lambda X_i).$$

Thus the cumulative distribution function of γ_i can be rewritten:

$$F(S_i|X_i) = 1 - \exp\{-\exp(-\beta_\lambda X_i + \delta \ln(S_i))\}.$$

For agents with individual characteristics X_i such that $Var(\pi_i|X_i) > Var(w_i|X_i)$ (which is the most plausible and frequent case), the probability that they are entrepreneurs is $F(S_i|X_i)$. Hence, in this specification, we can test the central implication from our economic model, stated above in our second proposition, that this probability is increasing in S_i, by testing if the coefficient δ is positive.

Suppose individual *i*, with characteristics X_i, is an entrepreneur, with profit π_i. Denote $1(.)$ the indicator variable and:

$$\mu(X_i, S_i) = 1(Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i))F(S_i|X_i)$$
$$+ 1(Var(\tilde{\pi}_i|X_i) < Var(\tilde{w}_i|X_i))][1 - F(S_i|X_i)].$$

The likelihood of the occupational choices is:

$$\prod [Y_i \mu(X_i, S_i) + (1 - Y_i)(1 - \mu(X_i, S_i))].$$

Rather than maximizing this likelihood function, we used quasi maximum likelihood estimation,

which is more robust relative to specification errors. Thus we carried the estimation by maximizing:

$$\sum p_i \ln[\frac{1}{\sqrt{2\pi}} \exp(-\frac{1}{2}(Y_i - \mu(X_i, S_i))^2)].$$

Parameter estimates

The point estimate for δ is 1.55. The standard error is .1744 and the t–statistic is 8.926. Hence, the empirical restriction imposed by our economic model, that the probability to become an entrepreneur is increasing in S_i is not rejected.

The estimates of β_λ are in Table 2. The French and the Lebanese, are estimated to have lower risk aversion on average. These individuals belong to rich social networks. Hence, for them the consequences of failure are less severe, as their (relatively rich) family and friends provide them with a safety net. This is consistent with the above mentioned "cushion hypothesis" (Hsee and Weber, 1998, a and b).

Estimated risk aversion coefficients

Substituting the estimates of the parameters in our specification of the distribution of the risk aversion coefficients, we can compute the expected absolute risk aversion coefficient of an individual with characteristics X_i. The corresponding estimates of β_λ are in Table 3. While, as discussed above, δ is significantly different from one, the estimates obtained in the exponential case have the same sign and magnitude as the Weibull specification counterpart.

In the exponential specification, conditional on the individual choosing to be an entrepreneur, her expected risk aversion is:

$$E(\gamma_i | X_i, \gamma_i < S_i) = \exp(\beta_\lambda X_i) - S_i \frac{\exp(\beta_\lambda X_i)}{1 - \exp(\beta_\lambda X_i)},$$

while conditional on her choosing to be an employee it is:

$$E(\gamma_i | X_i, \gamma_i > S_i) = \exp(\beta_\lambda X_i) + S_i,$$

For example, consider the case of a 40 years old individual, who has not been an apprentice, who had elementary schooling and previous work experience in the industry. For the four different ethnic groups in our data, Figure 1 plots the expected absolute risk aversion of this person, conditional on her choosing to be an entrepreneur or an employee.

The figure shows that, while the Africans who chose to become employees are estimated to be quite risk averse, those who have chosen to be entrepreneurs are estimated to be relatively risk tolerant. In fact their estimated CARA coefficient is of the same order of magnitude as that of the French and the Lebanese. This may reflect heterogeneity among the Africans in our sample in terms of access to risk sharing mechanisms. For African migrants from other countries than Côte d'Ivoire not integrated in tightly united communities, and Ivorians from very poor families it is indeed possible that the opportunity to obtain insurance against adverse shocks is quite limited.

While the coefficient of absolute risk aversion is driving the choice of the agents in our model, it is easier to interpret the order of magnitude of the coefficient of relative risk aversion. To compute the latter, we multiply the expected absolute risk aversion coefficient of the entrepreneurs by their expected profit and that of the employees by their expected wage. Figure 2 depicts the corresponding estimated relative risk aversion coefficients, for the four ethnic groups, for a person who is 40 years old, who has not been an apprentice, who has had elementary schooling and has previous work experience in the industry.

The figure confirms our previous remarks that, while African employees are estimated to be risk averse, African entrepreneurs have relatively low estimated risk aversion, comparable to that of the French and Lebanese in our sample. Quite remarkably, for the African entrepreneurs, as well as for the French and the Lebanese entrepreneurs and employees, the estimates of the relative risk aversion coefficient are between 0 and 5, which is exactly the range deemed to be reasonable by risk economists (see for example Gollier, 2002). Furthermore, the rather large difference between the risk aversion of African entrepreneurs and that of African employees suggests that attitudes toward risk play an important role in the occupational choices of Africans.

Finally, note that our results, based on a structural econometric approach, where the risk aversion coefficient of the agents is taken to be an unobservable heterogeneity component, yields estimates of this coefficient which are very similar to those estimated, based on attitudes towards lotteries in Guiso and Paiella (2000).

Semiparametric analysis

Method

The analysis above relies on the assumption that the distribution of the risk aversion coefficients is Weibull. While convenient, this assumption may well be at odds with the data. To speak to this issues, in the present section, we estimate a more general, semiparametric, specification.

In the Weibull specification, if $Var(\pi_i|X_i) > Var(w_i|X_i)$ the likelihood that agent *i* is an entrepreneur is:

$$1 - \exp(-\exp(-\beta_\lambda X_i + \ln(S_i))).$$

This suggests that a natural generalization of the parametric analysis is to consider the case where the corresponding likelihood is:

$$\varphi(-\beta_\lambda X_i + \delta \ln(S_i)).$$

In this single–index specification, the constant cannot be identified (see Horowitz, 1998). Hence to carry our estimation, we exclude the constant from X_i and the corresponding element of β_λ.

Denote: $z_k = -\beta_\lambda X_k + \delta \ln(S_k)$. The kernel non parametric estimator of the function φ is:

$$\hat{\varphi}(z) = \frac{\sum_k Y_k K_h(z - z_k)}{\sum_k K_h(z - z_k)},$$

where:

$$K_h(z - z_k) = \frac{35}{32}(1 - (\frac{z - z_k}{h})^2)^3 1(|\frac{z - z_k}{h}| < 1).$$

Note that: $\varphi(-\beta_\lambda X_i + \delta \ln(S_i))$, is the probability that agent *i* chooses to become an entrpreneur, i.e., that $Y_i = 1$. It can be interpreted alternatively as the conditional expectation of Y_i. The kernel approach can be seen as a non linear regression method to estimate this conditional expectation. For a given value of the argument of the function φ, the Kernel estimate is a weighted average of the realizations of $\tilde{Y}$, for surrounding observations, where nearby observations are weighted more than distant ones. For example, the indicator: $1(|\frac{z-z_k}{h}| < 1)$, excludes from the computation of $\varphi(z)$, the data points for which z_k is distant from z by more than the window size: h. footnote

Note that the parameters β_λ and δ which enter in the definition of z_i must be estimated jointly with the function φ. Analogously to the parametric case, denote:

$$v(X_i, S_i) = 1(Var(\tilde{\pi}_i|X_i) > Var(\tilde{w}_i|X_i))\hat{\varphi}(-\beta_\lambda X_i + \delta \ln(S_i))$$
$$+ 1(Var(\tilde{\pi}_i|X_i) < Var(\tilde{w}_i|X_i))][1 - \hat{\varphi}(-\beta_\lambda X_i + \delta \ln(S_i))].$$

We maximize the following quasi maximum likelihood objective function:

$$Max_{\beta_\lambda} \sum p_i \ln[\frac{1}{\sqrt{2\pi}} \exp(-\frac{1}{2}(Y_i - v(X_i, S_i))^2)].$$

This can be interpreted as a nonlinear least square estimator of β_λ and δ. Since this an M–estimator, it is asymptotically normally distributed with variance defined as in Gouriéroux, Montfort, and Trognon (1984).

Results

The semiparametric estimate of δ is 2.7, with a standard error of .4465 and a t–statistic of 6.09. The semiparametric estimates of β_λ are presented in Table 4. Their sign, size, and significance level are very similar to those of their parametric counterpart, in Table 2. This suggests that the Weibull parametrization is not strongly at odds with the data.

One central implication of our economic model (stated in our second proposition) is that the

probability that an agent chooses to become an entrepreneur ($P(Y_i|X_i, S_i)$) is the probability that his or her risk aversion coefficient is lower than the the threshold S_i. This implies that $P(Y_i|X_i, S_i)$ must be increasing in S_i. Our semiparametric approach allows us to compute an estimate: $\hat{\varphi}(-\beta_\lambda X_i + S_i)$ of $P(Y_i|X_i, S_i)$ without relying on a parametric specification. Thus we can evaluate if the central implication of the theoretical model is consistent with the data, by assessing if $\hat{\varphi}$ is increasing in its argument.

Figure 3 plots the semiparametric estimate $\hat{\varphi}(-\beta_\lambda X_i + \delta \ln(S_i))$ of $P(Y_i|X_i, S_i)$. Overall the figure is broadly consistent with the hypothesis that $\hat{\varphi}$ is increasing, as requested by the theoretical model.

Conclusion

We offer a structural econometric analysis of the role played by risk aversion in occupational choices in Côte d'Ivoire. We rely on a simple economic model whereby individuals choose to become entrepreneurs if their coefficient of risk aversion is lower than a threshold, reflecting the ratio of the difference in expected earnings to the difference in risk between entrepreneurship and employeeship.

We confront this model to data from the manufacturing sector in Côte d'Ivoire. While the threshold reflecting the risk–return tradeoff associated with occupational choices can be estimated using data on wages and profits, the risk aversion coefficient of the agents is an unobservable heterogeneity component. We first estimate a parametric model, using quasi maximum likelihood maximization. Then we assess the robustness of this specification by estimating a semiparametric model.

Our approach allows us to test the main implication of the economic model, i.e., that the probability that an individual chooses to become an entrepreneur should be increasing in the ratio reflecting the risk–return tradeoff she faces. Overall our empirical results are broadly consistent with this restriction imposed by the theory on the data.

Our approach also allows us to estimate the expected risk aversion coefficient of the individuals, conditionally on their characteristics and their choices. Our estimates are of reasonable orders of magnitudes. They suggest that risk aversion plays an important role, as the estimated risk aversion of entrepreneurs is estimated to be much lower than that of entrepreneurs.

Our analysis underscores the importance of entrepreneurship in the informal sector in developing economies. Our estimates point at the existence of entrepreneurial Africans, with relatively low risk aversion, who create and manage small businesses. Our results also point at the employment opportunities created for Africans by these small enterprises, at wages that are not significantly smaller than those offered in the formal sector.

It could be interesting, in further work, to apply our methodology to data on occupational choices in other developing countries or industrialized economies.

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Table 1, **Panel A**: **Wages**

Variable	Estimate of β_w	t–stat
constant	0.85	3.38
apprentice	-0.05	-0.64
age/10	0.31	6.14
experience	0.11	1.45
elementary education	0.13	1.17
high school	-0.39	-1.77
technical high school	1.14	4.23
university	1.22	6.24
formal	0.04	0.24
non–Ivorian African	-0.31	-2.80
Lebanese	1.47	13.44
French	1.05	3.96
Interaction: Formal sector/high school	0.5957	2.82

Table 1, **Panel B**: **Profits**

Variable	Estimate of β_π	t–stat
constant	3.44	6.04
apprentice	1.77	3.06
age/10	-0.24	-1.19
experience	0.91	1.92
elementary education	-0.75	-1.48
high school	-1.96	-6.75
technical high school	-1.06	-0.63
university	0.44	0.95
formal	3.51	10.51
non–Ivorian African	–0.57	-1.62
Lebanese	2.91	4.69
French	2.51	2.13
Interaction: Formal sector/high school	0.9038	0.909

Table 2: **Parameters of the distribution of the risk aversion coefficients in the Weibull specification**

Variable	Estimate of β_λ	t–stat
constant	-13.74	-6.36
apprentice	-2.66	–6.17
age/10	-0.96	-4.81
experience	-3.25	-6.08
elementary education	0.69	1.04
high school	1.67	2.52
technical high school	1.34	1.27
university	-4.35	-4.99
non–Ivorian African	0.78	1.55
Lebanese	-13.03	-8.84
French	-6.29	-5.95
δ	1.55	8.93

Table 3: **Parameters of the distribution of the risk aversion coefficients in the exponential specification**

Variable	Estimate of β_λ	t–stat
constant	-6.96	-6.48
apprentice	-2.01	-5.44
age/10	-0.72	-3.56
experience	-2.75	-6.42
elementary education	1.03	1.73
high school	1.21	2.18
technical high school	1.41	1.47
university	-3.13	-5.41
non–Ivorian African	0.26	0.6
Lebanese	-10	-11.27
French	-4.56	-5.37

Table 4:**Parameters of the distribution of the risk aversion coefficients in the semiparametric specification**

Variable	Estimate	t–stat
apprentice	-2.98	-7.92
age/10	-0.57	-4.72
experience	-5.18	-5.5
elementary education	2.85	2.1
high school	6.32	5.78
technical high school	1.49	0.82
university	-6.17	-6.09
non–Ivorian African	1.38	2.34
Lebanese	-20.48	-7.47
French	-8.6	-2.54
δ	2.72	6.09

Figure 1: Estimated expected absolute risk aversion
(40 years old, experienced, not been apprentice, elementary schooling)

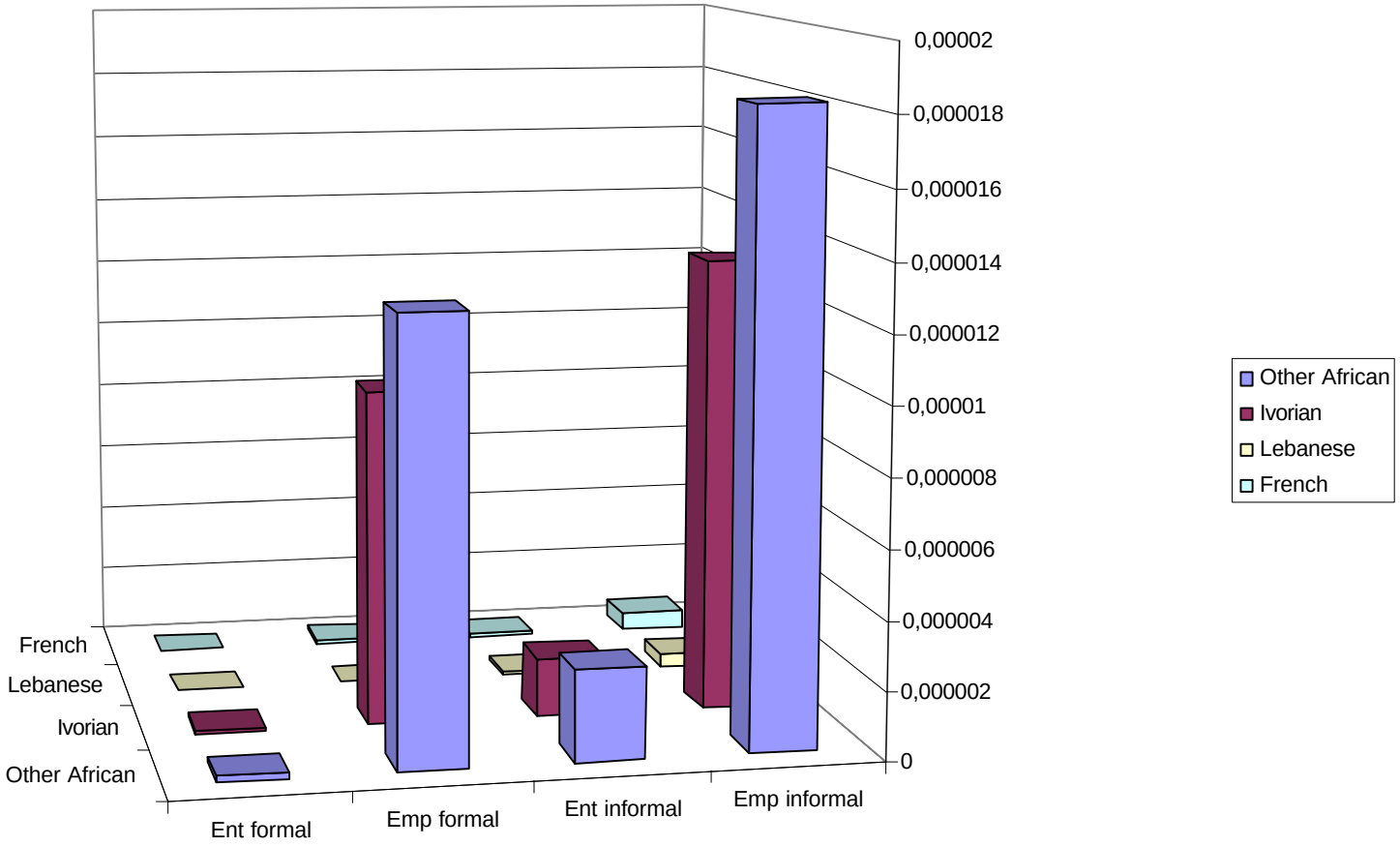

Figure 2: Estimated expected relative risk aversion
(40 years old, experienced, elementary schooling, not been apprentice)

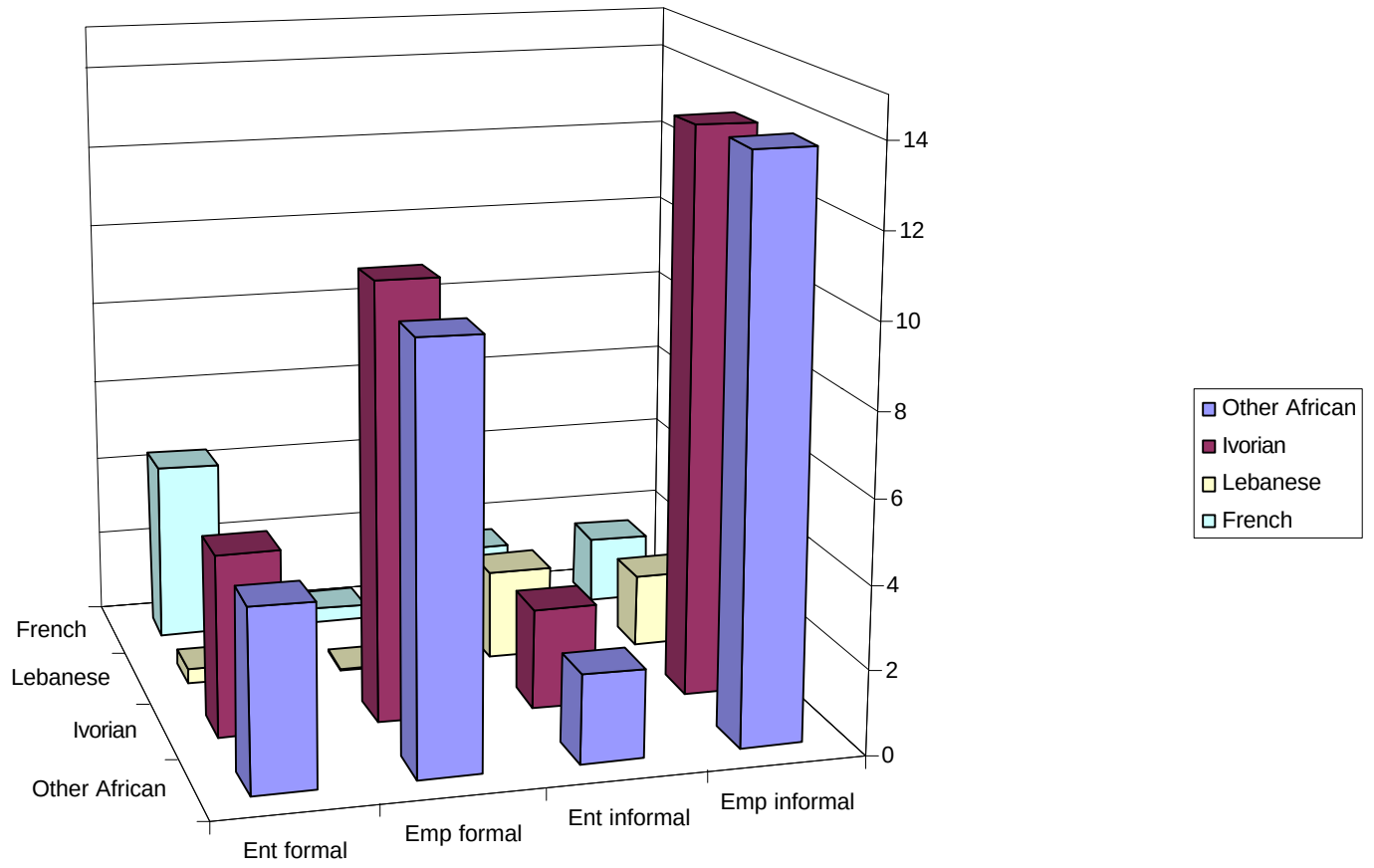

Figure 3:
Semiparametric estimate of the conditional probability to become an entrepreneur