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Entrepreneurial motives and performance: Why might better educated entrepreneurs be less successful? *

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Abstract

In a sample of newly created French firms, the impact of an entrepreneur's education on the firm's survival varies widely depending on his previous labor market situation. While it is strongly positive for the overall population, it is much weaker or insignificant for entrepreneurs who were previously unemployed or poorly matched. Our theoretical entrepreneurship model shows that these differences may be attributed to differences in unobserved human capital for better educated entrepreneurs across different initial states in the labor market. Empirical results are consistent with the theory if employers have limited information about potential entrepreneurs' human capital.

Keywords: entrepreneurial choice, labor market, human capital, firm survival.

JEL Classification: C41, J24, M13.

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1 Introduction

When considering the role of human capital in entrepreneurship, two potentially distinct questions arise. The first is whether different levels of human capital translate into different propensities to become self employed, while the second concerns the impact of human capital on entrepreneurial success. On the latter issue, it is usually found that a higher human capital of the entrepreneur results in better performances for new firms (e.g. Bates, 1990, 2005, Parker and van Praag, 2006). By contrast, the role of human capital as a determinant of self-employment is typically measured as insignificant (see Evans and Leighton, 1989, Evans and Jovanovic, 1989, Georgellis *et al.*, 2005 and references therein).

These empirical findings suggest two research questions. First, the link between human capital and self-employment, which undoubtedly exists, is non trivial and some theoretical developments are needed in order to understand this better. Second, the standard measures of human capital are only poor approximations of an individual's actual human capital. This may lead to errors when evaluating the impact of human capital on entrepreneurial performance, particularly when the effect of human capital on self-employment decisions is not properly accounted for. The present paper contributes in both these dimensions. First, we provide a theory of self employment as a strategy aimed at optimizing an individual's human capital valuation. Second, we use our theory to explain some systematic biases in the measure of the impact of human capital on firm survival. Our key insight is that this impact should be interpreted in view of the entrepreneur's initial state in the labor market.

If human capital affects entrepreneurial choices, then observing entrepreneurship by an individual should lead us to update our evaluation of his actual human capital as compared to what may be inferred from variables in the data such as education or work experience.

To appreciate the role of human capital in entrepreneurship, note that the decision to start a business is, in most cases, associated with a decision to become self-employed. For

instance, in 2007, 86.7% of newly created firms in France started their activity without any employee. The choice of self-employment means that the entrepreneur anticipates better returns on his human capital by running his own firm than what he could obtain by selling it in the labor market. The reasons for such a higher expected return may however be quite different across individuals. Entrepreneurship may either reflect some favorable attributes of the entrepreneur that are best exploited by starting a business, or a very unfavorable labor market situation which the entrepreneur is trying to escape. The extent to which entrepreneurship is a favorable signal for the entrepreneur's human capital crucially hinges on the likelihood of the first motive relative to the second.

Economic intuition suggests that individuals with better education or work experience have a stronger incentive to move to a more favorable labor market position: rewards on labor market participation or from a better match are higher for better skilled workers and a long spell of unemployment or inappropriate matching might cause a depreciation of their human capital. Hence, entrepreneurs who started out in a poor labor market situation and whose measure of human capital in the data is good, are less likely to have gone into self-employment to exploit some unobserved ability. We should therefore expect that among entrepreneurs with a bad initial situation, differences in human capital as observed in the data overstate differences in actual human capital.

The above intuition is born out by our empirical results. We use a survey of French firms that were created in 1994 for which we have survival data up to the end of 1997. We also have information about the prior employment status of the entrepreneur as well as whether he has previously worked within the branch of activity of the new business. We perform duration analysis on the firm's survival. Regarding the impact of education, the above reasoning suggests a potential sample selection bias which cannot be corrected since the sample is comprised solely of entrepreneurs.[1] Further, we expect this bias to be related

[1]See Montgomery *et al.* (2005) for an instance of a joint estimation of the impact of human capital on

to the individual's initial situation in the labor market. Therefore we consider four initial states: unemployed for less than a year, unemployed for more than a year, employed without experience in the new firm's branch and employed with experience in the new firm's branch. In our econometric investigations, higher education of the entrepreneur enhances survival very significantly for the final group, whereas it has at best a limited impact on survival for the other three. Now, entrepreneurs in these three groups are more likely to be endowed with a bad initial state than those in the final group. This is obviously true for individuals who were unemployed. Further, those who had a job but chose to switch to a different branch of activity when they started a business are likely to have been poorly matched in their previous occupation. Thus, the weak impact of education on the new firm's survival may be attributed to the unobserved abilities which are expected to be low for highly educated entrepreneurs in these three groups.

We also show that the basic intuition is consistent with the theoretical results derived in a model of entrepreneurial choice focusing on labor market incentives. We introduce *ad hoc* labor market rigidities that prevent a worker from attaining his preferred job. This allows for entrepreneurs starting a business in order to evade an unfavorable state in the labor market. Evans and Leighton (1989) find that entrepreneurship may be a response to labor market rigidities, where the probability of going into self-employment is much larger for "unemployed workers, lower-paid wage workers or men that have changed jobs a lot" (p.521).[2]

We consider that any human capital that is utilized in setting up a new firm would be valuable to a potential employer.[3] If this human capital were perfectly observable and labor contracts fully efficient, the individual would prefer to sell all of the information he has on

entrepreneurial choice and performance.

[2]Similarly, the share of the unemployed among French entrepreneurs in 1994 was about three times the unemployment rate for the entire labor force.

[3]Here, human capital should be viewed in a very broad sense as including any knowledge that the entrepreneur may have that will contribute to making his business successful.

the profitability of the new project to an employer and invest his wealth in the financial markets, rather than start his own business.[4] We therefore assume that employers are imperfectly informed about the employee's actual human capital[5] or that the employment relation involves some agency problem. Actual human capital may therefore be undervalued, particularly in the case of potential entrepreneurs who may have some unusual and novel management, commercial or technological skills.

Potential employers base their employment and wage offer decisions on their "beliefs" about human capital, derived from the information in the vitae as well as some additional insights obtained from job interviews and pre-employment tests. Although this information is not perfect, it is presumably more accurate than that available in a survey of entrepreneurs such as the one exploited in this paper. Our modeling approach allows for such a difference in information, where the employers' information may be anywhere between perfect and as bad as that of the survey. Even if information is perfect, human capital may still be rewarded differently in the labor market and in self-employment. In particular, self employment eliminates inefficiencies due to the separation between ownership and control that lead to inefficient effort levels. In any case, entrepreneurship is then a means of overcoming undervaluation of human capital in the labor market.[6] We show that our empirical findings are more consistent with a model where the employer's information is as limited as that in the data, than with a model where the employer's information about human capital is perfect. Our model also suggests that duration analysis of firm survival should allow for unobserved heterogeneity, the unobserved human capital that is not explained by education or the initial state, which informs our empirical application.

[4] Financial markets should be better suited for investing financial wealth as suggested by the study of Moskowitz and Vissing-Jorgensen (2002) who find that rewards on capital invested in entrepreneurship are not above what could be achieved on the financial markets, whereas risk premia should induce a reverse result.

[5] Stern (1990) has explored the implications of such imperfect information on unemployment duration.

[6] Of course there is room for alternative psychological explanations such as McClelland's need of achievement (1961), Shapero's locus of control (1975) or Pinfold's overconfidence (2001).

Existing theoretical literature typically assumes that entrepreneurship requires some specific human capital, the managerial ability, which cannot be sold in the labor market (see Lucas, 1978, Jovanovic, 1982, Evans and Jovanovic, 1989, Fonseca *et al.*, 2001, Cagetti and De Nardi, 2006); only those who have the highest managerial abilities choose to become entrepreneurs.[7] Our theory suggests that these "managerial abilities" may be traded on some labor market just like any other form of human capital but such a market may not exist due to information asymmetries.

The paper is organized as follows. Section 2 presents some descriptive statistics on the impact of human capital on firm's survival for subpopulations of entrepreneurs corresponding to different initial states in the labor market. Our model of entrepreneurial choice (Section 3) emphasizes the role of unobserved human capital and shows that the choice of self-employment provides information about actual human capital. Section 4 reports and discusses the findings from our empirical study, and Section 5 draws conclusions.

2 Some descriptive statistics

We first present and discuss some simple statistics regarding the impact of an entrepreneur's education on firm survival and how this impact relates to the entrepreneur's previous state in the labor market. The data are extracted from the SINE[8] 94 survey, which was conducted by the French National Institute of Statistical and Economic Studies[9] in 1994. It provides qualitative data on entrepreneurship and, more specifically, variables pertaining to the entrepreneur and the circumstances in which entrepreneurship occurred. A second survey carried out in 1997 (SINE 97) provides information on survival status of the same firms

[7] Even when managerial abilities are not explicitly introduced, as in Kihlstrom and Laffont (1979), it is assumed that self-employment involves some specific risky rewards that may not be captured while holding a wage position. Then it is the heterogeneity in risk aversion that determines which individuals become entrepreneurs.

[8] "Système d'informations sur les nouvelles entreprises" (Information system on new firms)

[9] Insee (Institut National des Statistiques et des Etudes Economiques).

– closed down or still operating, and, when closed down, the date of the discontinuation. The surveyed units belong to the private productive sector in the field of manufacturing, construction, commerce and services.

Since we wish to highlight the labor market motivations for entrepreneurship, we only consider new firms set up by an individual and exclude takeovers from our analysis.[10] In order to ensure some homogeneity in labor supply behavior, we also narrow down the sample further to French male middle aged (aged 30-50) entrepreneurs who started a business in metropolitan France.

The SINE 94 database provides information on whether the entrepreneur was employed prior to setting up the firm. For unemployed individuals it indicates whether the unemployment spell was short (less than one year) or long (beyond one year). For the employed, the data provides information about the entrepreneur's experience in the branch of activity of the new business. An individual who has had no such experience has necessarily changed his branch of activity when he became self-employed, which suggests that he is likely to have been poorly matched in his previous occupation. We therefore refer to this subgroup as mismatched individuals. The above information allows us to classify initial state into four different subgroups: employed in the same branch, employed in a different branch, unemployed for less than one year, unemployed for more than one year. For each of these subgroups we compare the survival rates of newly created firms for two extreme populations of entrepreneurs: those holding a degree obtained after two years of higher education (whom we label as having a high level of education) and those who hold no degree at all (labeled as having low education). Combining these two groups we obtain a sample size of $5,891$ entrepreneurs.

[10] Previous research suggests that entrepreneurial choice for takeovers may be somewhat specific. Bates (1990) points to some important reasons why a firm which is taken over is more prone to remain in business than a new one. Specifically, the new owner "may benefit from established managerial practises that are embodied in the firm"(p. 555).

Table 1 reports survival rates according to the education level for each of the four subgroups corresponding to the four previous states of the entrepreneur.[11] We find that survival rates for previously mismatched or unemployed entrepreneurs are lower than those of individuals who were previously employed in their preferred branch of activity (respectively, 48.33% and 54.87% against 67.63%). These findings indicate that, more than the difference between employed and unemployed states, having been employed in the new firm's branch of activity provides a significant advantage in terms of survival of the newly created firm.

Next we observe that the spread in survival rates between entrepreneurs with high and low education level for the entire sample is 12.98 percentage points in favor of the former. For previously employed entrepreneurs with experience acquired in the same branch of activity, the gap is higher at 14.39%. By contrast we find a much smaller spread for those entrepreneurs who, when they chose self-employment, were either unemployed or mismatched. For those who were previously unemployed, the gap is only 8.93 percentage points while for those who were unemployed for less than a year it is even lower at 5.05%. For individuals previously employed in a different branch of activity the observed gap in survival rates is further down to 4.26%. Note that, while the largest observed spread (15.93%) is for previously long term unemployed individuals, this is not robust to conditioning on other observed and unobserved factors.[12]

In line with previous research, we find that a higher education level for the entrepreneur enhances the survival rate of the firm. The interesting new insight is that the extent of this positive impact strongly depends on the previous labor market state of the entrepreneur. We argue in the remainder of the paper that these differences may be explained by viewing

[11] The survival rates are weighted to take account of the over-representation of some subgroups (characterized by geographic or sectoral differences) in the original SINE sampling method.

[12] Econometric results of Section 4 indicate that the impact of education on survival is always strongest for previously employed entrepreneurs with some experience in the firm's sector. We find however that the impact for long term unemployed is more pronounced than for short term unemployed which, as we explain in Section 4.4.1, is consistent with the theoretical model of Section 3.

entrepreneurship as a response to labor market inefficiencies. More specifically, we argue that the varying impact of education on survival across the four subgroups reflects some unobserved heterogeneity in human capital that is correlated with the entrepreneur's initial state in the labor market. These different states correspond to different degrees of undervaluation of the individual's human capital in the labor market. Therefore, entrepreneurship reflects different information about the individual's unobserved human capital.

Using the SINE 94 database, we can control for some alternative factors explaining variation in survival rates. One possible explanation is that, for the subpopulations where the spread is small, those with low observed human capital start businesses in sectors where survival rates are high whereas those with a high level of observed human capital select sectors having high exit rates. Although it is true that the choice of a sector for the new firms depends very much on the observed level of human capital[13] this sectoral difference does not seem to depend much on the previous status (employed/unemployed) or on whether the previous sector was different. Another possible explanation could be that in order to fight unemployment, the government primarily subsidizes individuals with a low level of human capital and who face difficulties in entering salaried employment. This does not appear to hold in the French context – both highly educated and uneducated entrepreneurs are equally likely to receive government subsidies which in general enhance survival of the firms (Abdesselam *et al.*, 2004).

Before reporting a more systematic econometric analysis, we present below a simple theoretical model of entrepreneurship. This model will help us better interpret the link between entrepreneurship and unobserved human capital, and provide explanations for our empirical findings.

[13] Low observed human capital is associated with businesses in commerce, transportation or construction while high level of observed human capital is typically associated with services.

3 A simple model of Entrepreneurial choice with labor market imperfections

We now present a stylized model of entrepreneurship, which highlights the following two motives for choosing self employment:

(i) circumventing an undervaluation of human capital in the labor market;

(ii) avoiding human capital depreciation resulting from labor market frictions.

3.1 Entrepreneurial choice and labor market inefficiencies

Consider an individual whose actual human capital, denoted K, is either high or low, $K \in \{H, L\}$, $H > L$. This human capital may however not be perfectly observed by employers. Rather, they assign a probability ρ to the event that human capital is high. This imperfect information is consistent with a situation where the potential entrepreneur is unemployed or has been holding a job for a limited time. Presumably, for individuals holding a position with a long enough tenure this information asymmetry would be greatly reduced.[14] At any rate, the employer's information may be quite different from what might be observed by an econometrician (typically, education level and work experience). To account for this difference in information we denote by μ the (predicted) probability that the agent has high human capital, based on available data on the individual. In other words, the econometrician's prior on human capital is given by μ which we refer to as the entrepreneur's observed human capital. Employers combine this data with additional information available to them to obtain their own prior $\rho_K(\mu)$ if actual human capital is K, $K \in \{L, H\}$. Here, $\rho_K(\mu)$ is a random variable that depends not only on observed human capital but is also correlated with actual human capital.

We focus on the two extreme cases where either employers are perfectly informed, in

[14]The reduction in the asymmetry of information does not prevent undervaluation of human capital if skills are firm-specific (Lazear, 2003) or if the small size of the firm does not allow promotion of individuals to a level where their wage would correctly reflects actual human capital.

which case $\rho_L(\mu) = 0$ and $\rho_H(\mu) = 1$ with certainty for all μ, or where the employers have no more information than we do, despite the interviews or the tests that the individual might have taken, in which case $\rho_L(\mu) = \rho_H(\mu) = \mu$ with certainty for all μ.

When deciding on whether or not to go into self employment, the individual may be in one of two states. Either he is in an unfavorable state (state 0) that could be unemployment or a salaried position with a bad match, or he is in a favorable state (state 1) that is a salaried position with which he is well matched. Though the latter position is clearly preferable to the former, the agent may be unable to reach it because of frictions on the labor market. At the time of the entrepreneurial choice the individual compares the potential expected benefits from entrepreneurship to the expected future benefits if he remains in his current state in the labor market. These benefits take into account the possibility that the individual may not remain in the current state indefinitely. The entrepreneurial choice is the outcome of a dynamic program where the agent anticipates correctly, but with uncertainty, all future consequences of his current choice and in particular, the evolution of his career. Here we specify *ad hoc* value functions associated with each potential choice which depend to a large extent on expected income in the current state or expected income in the newly created business. It seems reasonable that the value functions should be monotonically increasing in these earning levels. Let $Y_i(\rho)$ be the expected benefits from staying in state i, $i \in \{0, 1\}$. If the individual is employed, he is paid a wage equal to his expected marginal productivity, given the employer's beliefs on his actual human capital. Similarly the individual's expected earnings when unemployed are also increasing in ρ since unemployment benefits may depend on past wages and the agent may end up finding a new job where he will be paid according to the employers' evaluation of his human capital. Thus the expected value of staying in state i is clearly increasing in the employer's beliefs, ρ, and it is higher in state 1.

We further assume that in state 0, the agent's human capital depreciates. This depreciation of actual human capital affects future employers' beliefs, and it is for the most part

through these beliefs that it affects future earnings. Independently of the actual human capital we therefore assume that depreciation is all the more a concern that current employers' beliefs are more favorable.[15] The negative impact of depreciation should be interpreted as measuring the difference between the earnings that the agent will obtain in the future if he does not start a business today, and the earnings he will obtain returning to salaried employment after having been self-employed (having thus avoided depreciation). Self-employment is a means of circumventing depreciation because the new firm will be started in the sector where the individual is most productive. This potential return to a wage position by entrepreneurs is empirically very relevant. Evans and Leighton (1989) find that half of a cohort of entrepreneurs have returned to wage employment after seven years.

To model depreciation formally, let us define $Z(\rho)$ as the discounted future earnings in the labor market after a period of entrepreneurship and $W_i(\rho) = Y_i(\rho) - Z(\rho)$ as the earnings of the individual if he stays in the labor market today, net of the future earnings he would earn when going back to the labor market after having been an entrepreneur.

Given the above discussion we have $W_1(\rho) > W_0(\rho)$ and $W_1'(\rho) > W_0'(\rho)$. The difference in slope is the result of the difference in the direct impact of employers' beliefs on earnings since the worker is most productive in state 1, but it also reflects the impact of depreciation for those who are in state 0; the higher the depreciation, the larger the difference in slope will be. If depreciation is strong enough W_0' could even be negative. Finally, the difference in expected earnings between state 1 and state 0 should remain limited for those whose human capital is identified by employers as being low (ρ close to zero). In such a case, the expected productivity of labor is independent of the match and there is not much to lose in being unemployed since the returns to work are low. We therefore assume that $W_0(0) = W_1(0)$.

The value associated with creating a new business for an individual with actual human

[15] This assumption seems reasonable as long as an individual who chooses not to start a business today does not anticipate that he will become an entrepreneur with a high probability in the future.

capital K is $v(K)+\nu$, where ν is a random variable which the agent observes perfectly.[16] This random term reflects any factor that may affect entrepreneurial choice, other than human capital. In particular, it may reflect some taste parameters like the taste for independence or risk aversion. The distribution of ν may also depend on access to financing. For instance, if access to financing becomes more difficult, the distribution of ν shifts to the left. We denote the cumulative distribution function and density of ν by F and f respectively. We assume that the distribution of ν satisfies the increasing hazard rate property which holds for most common distribution functions. The value of becoming an entrepreneur depends solely on actual human capital, since earnings when self-employed are directly affected by human capital rather than indirectly through the beliefs of the employer.

Therefore, an agent in state i with actual human capital K will start a new business if

$$v(K) + \nu > W_i(\rho_K(\mu))$$

which happens with probability

$$P_i(\mu, K) = 1 - F[W_i(\rho_K(\mu)) - v(K)].$$

In the case of strong information asymmetries, $\rho_K(\mu) = \mu$ for all K and for all μ and in the case of perfect information $\rho_H(\mu) = 1$ and $\rho_L(\mu) = 0$ for all μ.

Next we use the above model to infer on the individual's actual human capital from his entrepreneurial choice, conditional on his initial state being favorable or otherwise. As may be expected, predictions of the model will vary with information asymmetries in the labor market.

3.2 Inferring actual human capital for new entrepreneurs

We characterize the posterior distribution of actual human capital as a function of the initial state and observed human capital, conditional on the choice of self-employment. Since our

[16] $v(K)$ is closely related to the wage that the individual could obtain in a situation where his actual human capital is perfectly observed and correctly rewarded.

prior beliefs on actual human capital is μ, using Bayes' Law, the probability of a high human capital given that an individual in state i has started a new firm is

$$\mu_{e,i}(\mu) = \frac{\mu P_i(\mu, H)}{\mu P_i(\mu, H) + (1-\mu) P_i(\mu, L)}$$

Thus $\mu_{e,i}(0) = 0$, and $\mu_{e,i}(1) = 1$.

Entrepreneurship is a positive signal about actual human capital if and only if $\mu_{e,i}(\mu) > \mu$. This requires that $P_i(\mu, H) > P_i(\mu, L)$ which holds if and only if

$$W_i(\rho_H(\mu)) - W_i(\rho_L(\mu)) < v(H) - v(L) \tag{1}$$

This means that the benefits from having a high human capital are larger for a self-employed individual than what they would be on the labor market. This seems reasonable for skills that are especially relevant for success of the new business, and these are the kind of skills that our empirical analysis will attempt to identify. When employers do not benefit from any additional information about human capital other than what is in the data, then ($\rho_H(\mu) = \rho_L(\mu) = \mu$), so that the left hand side of (1) is 0 and entrepreneurship is always a positive signal on actual human capital.

Now we investigate how far the advantages of high human capital varies with the initial state of the entrepreneur. For this we consider the posterior distribution of human capital conditional on observed human capital μ, and this critically depends on information asymmetries in the labor market. First suppose that human capital is perfectly observed by employers, so that $\rho_L(\mu) = 0$ and $\rho_H(\mu) = 1$ for all μ. Then, we have

$$P_i(\mu, L) = 1 - F[W_i(0) - v(L)]$$

which depends neither on μ nor on i (recall that $W_i(0)$ does not depend on i) and

$$P_i(\mu, H) = 1 - F[W_i(1) - v(H)]$$

which does not depend on μ and satisfies $P_1(\mu, H) < P_0(\mu, H)$, since $W_1(1) > W_0(1)$. Then we have the following proposition:

Proposition 1 *Suppose that employers have perfect information about human capital. Then the posterior conditional on the unfavorable state puts more weight on a high human capital than the posterior conditional on the favorable state:*

$$\mu_{e,0}(\mu) > \mu_{e,1}(\mu).$$

If employers observe human capital perfectly, an entrepreneur who was well matched in his job when he started a business, state 1, should be expected to have a lower human capital than an entrepreneur who was unemployed or stuck in a job where his productivity was low, state 0. This is because, an individual with a high human capital has a stronger incentive to become self-employed if his state is bad so that rewards on his human capital in the labor market are low, whereas the incentives of a low human capital individual to start a business are independent of his initial state since the labor market rewards his human capital equally poorly in all states.

Now consider the other extreme state where employers have no more information than what is in the data so that $\rho_L(\mu) = \rho_H(\mu) = \mu$. Then

$$P_i(\mu, K) = 1 - F[(W_i(\mu) - v(K)].$$

for both high and low human capital individuals. Note that the initial state only affects the posterior probability of a high capital through the values $W_i(\mu)$. The derivative of $\mu_{e,i}$ with respect to W_i has the sign of

$$\frac{f(W_i(\mu) - v(L))}{1 - F(W_i(\mu) - v(L))} - \frac{f(W_i(\mu) - v(H))}{1 - F(W_i(\mu) - v(H))}$$

which is positive because of our monotone hazard rate assumption. Finally, since $W_1(\mu) > W_0(\mu)$, $\mu_{e,1}(\mu) > \mu_{e,0}(\mu)$ for all $\mu \in [0, 1]$. Then, we have the following proposition:

Proposition 2 *Suppose that employers have no more information on actual human capital than the econometrician. Then the posterior conditional on the favorable state puts more*

weight on a high human capital than the posterior conditional on the unfavorable state:

$$\mu_{e,1}(\mu) > \mu_{e,0}(\mu).$$

For a given level of observed human capital, μ, the incentives to start a business are lower for individuals in the favorable state than for those in an unfavorable state, irrespective of whether actual human capital is high or low. This is because earnings in the labor market, being based solely on observed human capital, are independent of actual human capital. Entrepreneurship is then more likely to reflect a high level of actual human capital if the initial state is favorable.

Comparing the results in propositions 1 and 2 shows that the impact of the initial state of the entrepreneur on the posterior distribution of human capital is reversed in the case of extreme information asymmetry from what it is under perfect information.

Let us now consider how the distribution of actual human capital, conditional on choice of entrepreneurship, varies with observed human capital (μ). For this purpose, we consider the derivative of the posterior probability $\mu_{e,i}$ with respect to the prior μ.

If employers have complete information the above is given by

$$\mu'_{e,i}(\mu) = \frac{P_i(\mu, H)P_i(\mu, L)}{[\mu P_i(\mu, H) + (1-\mu)P_i(\mu, L)]^2} = \frac{\lambda_i}{[(\lambda_i - 1)\mu + 1]^2} \tag{2}$$

where $\lambda_i = \frac{P_i(\mu,H)}{P_i(\mu,L)}$ is independent of μ when employers observe human capital perfectly.

Under the assumption that $P_i(\mu, H) > P_i(\mu, L)$ (or equivalently, if (1) holds), $\lambda_i > 1$, so that the expression in (2) is strictly decreasing in μ. Thus, posterior beliefs are concave functions of observed human capital. Under no information asymmetry, since $\mu_{e,0}(\mu) > \mu_{e,1}(\mu)$, posterior beliefs about entrepreneurs in state 1 will be steeper than those for entrepreneurs in state 0 if μ is sufficiently close to one (see Figure 1).[17] By contrast, when μ is sufficiently

[17] More specifically, a sufficient condition is $\mu \geq \frac{1}{2}$. This can be shown by examining the derivative of $\mu'_{e,i}(\mu)$ with respect to λ_i, which is negative as long as $\lambda_i \geq \frac{1-\mu}{\mu}$; this, in turn, holds for $\mu \geq \frac{1}{2}$ since $\lambda_i \geq 1$. To complete the argument, note that $\lambda_1 < \lambda_0$.

small, the posterior associated with state 1 will be flatter than the posterior associated with state 0.

[Insert figure 1]

As before, we now turn to the case where the information available to employers is limited to what is in the data. The slope of the posterior probability of a high human capital conditional on entrepreneurship is then given by

$$\mu'_{e,i}(\mu) = \frac{P_i(\mu,H)P_i(\mu,L)\left[1+\mu(1-\mu)\left\{\frac{\frac{\partial P_i}{\partial \mu}(\mu,H)}{P_i(\mu,H)} - \frac{\frac{\partial P_i}{\partial \mu}(\mu,L)}{P_i(\mu,L)}\right\}\right]}{[\mu P_i(\mu,H)+(1-\mu)P_i(\mu,L)]^2} \tag{3}$$

By the increasing hazard rate property, the term in the curly brackets in the numerator

$$\frac{\frac{\partial P_i}{\partial \mu}(\mu,H)}{P_i(\mu,H)} - \frac{\frac{\partial P_i}{\partial \mu}(\mu,L)}{P_i(\mu,L)}$$

has the sign of $W_i'(\mu)$ and the term in the square brackets

$$1+\mu(1-\mu)\left\{\frac{\frac{\partial P_i}{\partial \mu}(\mu,H)}{P_i(\mu,H)} - \frac{\frac{\partial P_i}{\partial \mu}(\mu,L)}{P_i(\mu,L)}\right\}$$

is larger if W_i' is larger. If $W_i' = 0$, the term in the curly brackets is zero, and therefore the slope of posterior beliefs is given by (2). Since this is decreasing in μ, the posterior beliefs are concave as in the perfect information case. However since $\mu_{e,1}(\mu)$ is larger than $\mu_{e,0}(\mu)$, $\mu_{e,1}(\mu)$ will now have a steeper curve for μ small while $\mu_{e,0}(\mu)$ will have the steeper curve for μ large.

However the above analysis was carried out assuming $W_i' = 0$ for all i. In this setup where information asymmetries are most extreme, we must have $W_1' > 0$ since there are no depreciation motives for entrepreneurs in state 1, and therefore a higher observed human capital translates into higher expected wages. We also know that $W_1' > W_0'$ where W_0' may be 0 or even negative when the depreciation motive is so high that it wipes out the positive benefits of higher observed human capital on expected wages.

Assuming that W_1' is significantly larger than W_0' and that W_0' may even be negative allows for a situation where $\mu_{e,1}$ is steeper than $\mu_{e,0}$ for a large range of values of μ and $\mu_{e,0}$ is decreasing in μ on some interval. This is illustrated by Figures 2 and 3 (the functional forms used to derive these figures are described in the Appendix). Figure 3 depicts the slopes of the two curves and shows that $\mu_{e,1}$ is steeper than $\mu_{e,0}$ for $\mu < 0.67$. We also observe that $\mu_{e,0}$ is decreasing on the interval $[0.54, 0.64]$. Within this interval, for entrepreneurs starting from an unfavorable state, higher observed human capital implies lower actual human capital.

[Insert Figures 2 and 3]

We now discuss how the above theoretical analysis may be used to analyze the data presented in section 2.

4 Empirical analysis

4.1 Empirical predictions on firm survival

Recall that in Section 2, we presented data on differences in survival rates for entrepreneurs with different education levels and different initial states. We now discuss how the theoretical model of the previous section may be used to obtain predictions on and interpretations of the impact of education and initial state on survival. Both education and initial state provide information about the entrepreneur's human capital and should therefore affect our prior, μ. The link with education is obvious, a higher education level corresponding to a higher μ. Regarding the initial state, the link is less direct and depends on the extent to which potential employers have better information than the data. If the informational advantage is significant, then a bad initial state in the labor market should be interpreted as a bad signal on the individual's human capital resulting in a lower value of μ.

Higher unobserved human capital is expected to positively affect firm survival so that a higher posterior, $\mu_{e,i}(\mu)$, should translate into a higher survival rate. Predictions of the

theoretical model pertain to the relative position of the posterior belief curve for different initial states (i.e., comparing posteriors for different initial states, holding μ constant) but also to the slope of these curves (i.e., measuring the impact of a change in μ for a given initial state).

First consider the survival rates across different initial states for a given education level. Statistics presented in Section 2 indicate that entrepreneurs who were employed and did not change their branch of activity (state 1) when they started a business survive better than those who were unemployed or were employed in a different branch (state 0). If we derive the prior μ from education alone, then the curve $\mu_{e,1}$ should be above $\mu_{e,0}$. This is consistent with the predictions of our model with strong information asymmetries for the employers but not with a model where employers have perfect information. Nevertheless, in the latter case, unemployment or a job with a bad match may indicate that employers are observing some adverse information about the individual that is not available in the data. Then, for a given education level, the prior on human capital should be updated downwards for those entrepreneurs who started out in either of these two unfavorable states. The lower survival rates can therefore be explained by an unfavorable prior on human capital for entrepreneurs in these subgroups. It is therefore not possible to discriminate between the two models by directly comparing survival rates across entrepreneurs with different initial states.

Second, regarding the impact of education on survival across different initial states, our descriptive statistics indicate that it is very strong and positive for entrepreneurs who were initially well matched whereas it is rather limited for those who were short term unemployed or mismatched.[18] In order to obtain such predictions in our theoretical model, the curve describing posterior beliefs in state 1 ($\mu_{e,1}$) should be steeper than $\mu_{e,0}$. The model with no information asymmetry only yields this result for high enough values of μ (Figure 1).

[18] As pointed out in Section 2, the large impact for long term unemployed is not robust, as our econometric analysis shows.

Yet we pointed out above that the prior on human capital for a given level of education should be lower for entrepreneurs with an unfavorable initial state. Because of concavity of the posterior $\mu_{e,i}$, differences in observed human capital for those entrepreneurs should correspond to larger differences in actual human capital thus resulting in large differences in survival rates (see Figure 1). Thus our data are not adequately explained by a model where employers are close to perfectly informed about human capital.

If employers only observe a very imprecise signal about the individual's human capital, it may be assumed that the prior μ is solely determined by education. The simulations depicted in Figures 2 and 3 show that if we assume a wide enough difference between $W_1^{'}$ and $W_0^{'}$ then $\mu_{e,1}$ is steeper than $\mu_{e,0}$ for a wide range of values of μ. The result requires that μ is not too close to 1 which is reasonable if we think of unobserved human capital for entrepreneurs as comprising some rare abilities that will increase the likelihood of success of the new firm. In other words, observed human capital (the prior probability associated with high human capital) is expected to be relatively low even for entrepreneurs with high education levels. This difference in slope is consistent with our descriptive statistics according to which differences in education levels have a strong impact for entrepreneurs who were initially well matched and a limited impact for entrepreneurs in a less favorable initial state. In the simulations $W_0^{'}$ is taken to be much smaller than $W_1^{'}$ and eventually becomes negative for μ large enough. This reflects high depreciation for those who were initially in an unfavorable state. Simulations in Figure 3 show that if the effect of depreciation is very strong, firms created by better educated individuals can even survive less.

4.2 Data

As in the descriptive statistics in section 2, we distinguish one favorable state corresponding to individuals who were working in the same branch of activity, from 3 unfavorable initial states: employed in a different branch, short term unemployed and long term unemployed.

Our sample, which is the same as in section 2, comprises 36.67% who were employed with experience in the same branch, 9.38% who were employed and switched branch, 36.80% who were unemployed for less than one year and 17.16% who were unemployed for over one year. Our measure of observed human capital is the entrepreneur's education level that is either low, intermediate or high (defined in section 2). We do not use data on experience because it only measures experience in the same branch of industry; it is however included as a control variable and its impact is discussed in section 4.4.1.

In order to allow for differences in the relationship between observed and unobserved human capital according to the initial state of the entrepreneur, we use interactions between education level and variables pertaining to the initial state (see Table 2). We also use several other explanatory variables as controls; these chosen variables are commonly included in survival analysis of new firms (see Table 3).

Our results highlight differences in the impact of education on survival across sub-groups of entrepreneurs who differ in their previous labor market state.

4.3 Econometric modeling

4.3.1 Cox proportional hazards model

We employ hazard regression models to study the impact of various explanatory factors (covariates) on exits of French firms. The SINE 94/97 provides a discontinuation date for all those firms that stopped business before December 1997, so that the duration of each firm's life is observed in months. If the firm was still alive at the end of the period, the corresponding duration data are right censored. The covariates include various measures of human capital, as well as controls for entrepreneur attributes, firm attributes and financial constraints. In addition, and in line with our theory, we consider a potentially important role for unobserved human capital.

First, we estimate a Cox proportional hazards model (Cox, 1972), which has been the

corner-stone of empirical analysis of duration data since the past 35 years. Initially, we do not consider unobserved heterogeneity. Consider a sample of size n from the population of newly created firms. The conditional probability of exit at time t, given the vector of explanatory variables x, is measured by the hazard rate function $h(t|x)$. For each firm i, the data provides information on its life span t_i measured in months,[19] and its individual characteristics (x_i). Whether the firm was still active at the end of the study period is captured by a binary variable (a_i) describing censoring as follows.

$$a_i = \begin{cases} 0: \text{ if the firm } i \text{ is still active at the time of the second survey in 1997} \\ 1: \text{ if the firm } i \text{ ceased its activity between 1994 and 1997} \end{cases}.$$

Then, the continuous time Cox proportional hazards model is described by:

$$h(t|x;\beta) = h_0(t).\exp(x'\beta), \tag{4}$$

where $h_0(t)$ is an unspecified function of t called the baseline hazard function and β is a vector of the regression coefficients. Cox (1972, 1975) proposed a powerful estimation methodology based on maximizing the partial likelihood function:

$$PL = \prod_{i=1}^{n} \left[\frac{\exp(x_i'\beta)}{\sum_{j=1}^{n} Y_{ij} \exp(x_i'\beta)} \right]^{a_i},$$

where $Y_{ij} = 1$ if $t_j \geq t_i$ and $Y_{ij} = 0$ if $t_j < t_i$. The Y's are a convenient method to exclude from the denominator the individuals who have already experienced the exit event and are thus not part of the risk set. The population included in the denominator has not ceased its activity before t_i. For censored individuals the exit time is not observed so that no probability of exit may be included in the partial likelihood. Therefore, $a_i = 0$ for such individuals. The maximum partial likelihood estimators $\widehat{\beta}$ are obtained by maximizing the log of the above partial likelihood function with respect to β.

[19] t_i is the difference between the date of cessation of activity and the date of setting up of the i-th firm.

Since the exit times are grouped into months since entry, there are a substantial number of ties. These ties are resolved using the popular methodology proposed by Breslow (1974). The estimation exercise was carried out using the STATA software. In order to identify differences in the impact of observed human capital on survival across initial states of the entrepreneur, we obtain separate model estimates for four sub-samples: (i) individuals employed in the same branch of activity; (ii) individuals employed in different branches of activity; (iii) individuals unemployed for less than one year; (iv) individuals employed for more than one year.

These results are reported in Table 4; results in the first column correspond to the full sample, and sub-sample estimates are presented in columns 2-5. While the effects of the explanatory variables are consistent with *a priori* expectations, the proportional hazards assumption is rejected, at the 1% level of significance, by the Grambsch and Therneau (1994) test, indicating the possibility of unobserved heterogeneity. Such heterogeneity is consistent with our theoretical model that allows for some unobserved human capital which is orthogonal to observed human capital. In other words, actual human capital is partly, but not perfectly, correlated with observed human capital.

Next, we address the discrete (monthly) nature of our duration data by considering a grouped time version of the Cox proportional hazards model, also called the complementary log-log model or discrete PH model (Cox, 1972; Prentice and Gloeckler, 1978)

$$\ln\left[-\ln\left\{1-h_j\left(x;\beta\right)\right\}\right]=x'\beta+\gamma_j, \tag{5}$$

where the time intervals are indexed by $j=1,2,\ldots$ and h_j denotes the discrete hazard rate in interval j (assumed constant over the interval). This discrete proportional hazards model assumes that latent continuous failure times have a proportional hazards specification but are grouped into intervals. Unlike the standard implementation of this model assuming a constant baseline hazard rate, we capture time variation in the baseline hazard function

across periods by including the discrete time dummies γ_j. In other words, like the continuous time Cox proportional hazards model, we allow the baseline hazard function to change over time. Our empirical specification allows the baseline hazard rate to vary over the four yearly time periods in the sample.

Since estimation is quite demanding, we estimate the discrete duration model for the full sample only and not for sub-samples based on initial state. However, we take into account differential impact of education on survival by interacting the education variable with the initial state. This model was also estimated using the STATA software, and the first column of Table 5 reports the estimation results.

4.3.2 Unobserved heterogeneity

In our analysis, education should be viewed not so much as a variable having a direct impact on survival but rather as providing partial information about actual human capital that remains unobserved. We therefore expect some unobserved heterogeneity in our hazard regression models, and the impact of education on survival will differ for each individual depending on the realization of actual human capital.

In other words, our theoretical framework has two basic implications for appropriate modeling of the impact of education on firms' survival. First, the impact of education is likely to be differentiated according to the entrepreneur's initial state, and second, human capital of the entrepreneur may be partly unobserved. While we addressed the first issue (in section 4.3.1) by estimating separate coefficients for the impact of education across the four subsamples with different prior employment status, the second issue, that of unobserved heterogeneity, can produce inconsistent estimates of the effect of the regressors (β) as well as the baseline hazard function, $h_0(t)$.

Specifically, we consider the grouped time proportional hazards model (5) and follow Jenkins (1995) in characterizing the frailty distribution by discrete mixtures of degenerate

distributions in a sequence with increasing number ($r = 2, 3, \ldots$) of components:

$$\ln\left[-\ln\left\{1 - h_j\left(x_i; \beta, u_i\right)\right\}\right] = x_i'\beta + \gamma_j + \ln\left(u_i\right), \quad i = 1, \ldots, n,$$

$$\ln\left(u_i\right) \in \left\{m_1 = 0, m_2, \ldots, m_r\right\} = \begin{cases} m_1 & \text{with prob. } \pi_1 \\ m_2 & \text{with prob. } \pi_2 \\ \vdots & \\ m_r & \text{with prob. } \pi_r \end{cases}, \quad r = 2, 3, \ldots \tag{6}$$

A sequential estimation procedure is adopted, starting with $r = 2$ and increasing the number of components, r, progressively. The procedure is terminated when subsequent steps lead to degeneracy or no improvement in the maximized likelihood value. This methodology for approximating any arbitrary frailty distribution, first proposed in Heckman and Singer (1984), is very useful in that it approximates the nonparametric frailty distribution by an increasing sequence of parametric distributions. Further, in allowing an arbitrary frailty distribution, the method is robust to violations of the frailty distribution assumptions which can be quite critical in practise; see, for example, Baker and Melino (2000). Maximum likelihood estimates of the covariate effects and the frailty distribution, based on the full sample data, are reported in the last column of Table 5.

4.4 Results

The estimates for the continuous time Cox model are summarized in Table 4 and those for the grouped data model in Table 5. In both these sets of results, a positive β means that the group under consideration exits more than the reference group, and vice versa. Table 5 also includes estimates of the grouped data proportional hazards model with unobserved heterogeneity. The data support a two support point frailty distribution. Table 6 reports tests of differences in the effect of education across various initial states.

Below, we first discuss effects of the included regressors – observed human capital, followed by financing constraints, entrepreneur and firm characteristics, and finally unobserved heterogeneity.

4.4.1 Observed human capital

Results on the impact of education are consistent with the descriptive statistics of Section 2. Higher education reduces significantly the hazard rate for individuals employed in the same sector or unemployed for more than one year. It has no significant impact or may even increase the hazard rate for individuals employed in a different branch or unemployed for less than one year.[20]

Note that these results on the impact of education are particularly robust and significant in all the specifications of our econometric model (Tables 4, 5 and 6), with the exception of the negative impact of a high education level relative to an intermediate education level for mismatched individuals that is significant only for the continuous time proportional hazard model. In particular, education level has no significant impact on survival for mismatched and short term unemployed individuals in the grouped data model whether or not unobserved heterogeneity is accounted for. Hence, this lack of significance may not be attributed to a bias caused by unobserved heterogeneity that is orthogonal to the covariates. Our theoretical analysis suggests that this evidence can be attributed to some unobserved human capital that is correlated with education.

The significance of education for the long term unemployed individuals is an interesting finding. In the context of our model, this reflects lack of concern for depreciation among those who are highly educated, and suggests that their human capital may already have depreciated. It is well documented that unemployment duration exhibits negative duration dependence, in the sense that a longer unemployment spell decreases the rate of exit from unemployment (see Fougères, 2000, for a survey of studies on the French labor market). In any case, the positive impact of education on survival for the long term unemployed is much

[20] In the continuous proportional hazard specification, for individuals employed in a different branch, those with a high education level actually have a significantly higher hazard rate than those with an intermediate education level who are the reference group.

less significant than for those who were employed in the same branch (as can be seen for instance by comparing Tables 6a and 6d).

The theory also suggests that the impact of experience may differ depending on the entrepreneur's initial labor market state. The data only provides information about experience in the new firm's branch of activity. As in previous studies, (e.g. Bates, 2005), we find that more sector specific experience significantly improves survival. According to the results from the continuous time Cox model and contrary to results on education, this is the case independent of the employment status.

Experience acquired in a small firm where better entrepreneurial skills can be attained (because of a broader variety of tasks) also enhances the survival chances. Recent empirical literature (see, for example, Wagner, 2003, 2006, Baumol, 2004) links the acquisition of a wide variety of skills with the choice of becoming an entrepreneur; see also Lazear (2004, 2005) for a theory of entrepreneurship along the same lines. Our results may be interpreted as showing a link between the scope of acquired skills and success in entrepreneurship.

Our findings on the impact of previous entrepreneurial experience on survival are that such experience enhances the firm's viability which is in line with Taylor (1999) (see Cressy (1996) for some contrasting predictions).

4.4.2 Financial constraints

As discussed earlier, our model predicts that financial constraints may result in a shift to the left of the distribution of ν.[21] This is formally similar to a change upwards in W in the sense that it reduces the probability of becoming an entrepreneur. Thus we may apply the comparative statics analysis on W to infer whether financially constrained individuals are more or less likely to have a high level of unobserved human capital.[22]

[21] This implies a higher value of F at all points (meaning that the resulting distribution is stochastically dominated in the first order by the initial one).

[22] Hurst and Lusardi (2004) challenge the view that entrepreneurial choice is significantly affected by financial constraints. However, Fairlie and Krashinsky (2006), by controlling for the employment status of

Our empirical analysis of the impact of observed human capital on survival suggests that the proper specification of the theoretical model is that with strong information asymmetry so that proposition 2 applies. In other words, unobserved human capital is expected to be higher for those individuals who were initially in a favorable labor market state (state 1). The corresponding result for financing constraints is that individuals who are financially constrained are more likely to have a high level of unobserved human capital and hence should be expected to be more successful as entrepreneurs.

In our data, we have information about whether entrepreneurs have applied for a bank loan to start the project and if yes, whether they were granted the loan or not. It should be expected that those who started a business despite not getting a loan or those who did not even apply for such a loan are on average less financially constrained than those who started the project with the help of a bank loan. Our results on survival show that firms set up by entrepreneurs who successfully applied for a loan survive longer. These results may reflect the superiority of debt contracts over labor contracts in eliciting private information.

4.4.3 Entrepreneur and project attributes

We include several entrepreneur and firm level characteristics as control variables. By and large, our results confirm those of many other studies for such variables as age (Cressey and Storey, 1995) and sector (Taylor, 1999). Regarding the entrepreneur's motivations, we find that 'novel idea' reduces significantly the probability of exit after controlling for unobserved heterogeneity. By contrast, if the main motivation is imitation of a relative or a friend (entourage example) then exit is as likely as for entrepreneurs who are motivated by evading unemployment which is the reference class. Hence the positive impact of an entrepreneurial milieu, which we find, cannot be attributed to a role model effect but rather to some social networking or work experience acquired in the family business as emphasized by Fairlie

the individual prior to entrepreneurship and using the same instrumentation strategy as Hurst and Lusardi (2004), finds a significant role for financial constraints.

and Robb (2006). Another result on motivation is that, individuals who have a taste for entrepreneurship or benefit from an entrepreneurial opportunity set up firms with higher chances of survival.

Some firm characteristics also provide important insights into exit. We find that firms protected by limited liability survive better than those under unlimited liability. This is in contradiction with results reported in Harhoff *et al.* (1998). This may be because we do not distinguish between different competing risks: their results only pertain to involuntary liquidations so that the higher exit rate we find for firms with unlimited liability may be explained by voluntary discontinuations without losses for creditors (see also Bates, 2005).

Previous literature reports ambiguous results for both the impact of the initial size of the firm (in terms of initial labor force) and the impact of previous entrepreneurial experience. We find that a large initial size is detrimental to survival which is coherent with results in Das and Srinivasan (1997).[23] Finally, we find evidence that firms are more likely to survive if they are created in regions with a low entrepreneurial intensity, if the number of their initial customers were large or if the entrepreneur was previously in a managerial or executive position.

4.4.4 Unobserved heterogeneity

The results provide evidence of individual level frailty orthogonal to observed levels of human capital (Table 5). In order to model these effects, we estimate grouped data proportional hazards models with discrete mixture frailty distributions. The results show a significant impact of unobserved heterogeneity, and favor an estimated two support points frailty distribution. These two support points can be interpreted as representing high and low levels of unobserved human capital.[24]

[23] However, other studies find a reverse relation between initial size and survival (Mata and Portugal, 1994, Audrestch and Mahmood, 1995).

[24] We estimated similar models for different sub-samples of the data; the results are in broad conformity, but it is somewhat difficult to draw strong conclusions because of lower sample sizes.

The two point discrete mixture frailty distribution also offers an interesting perspective in relation to our theoretical analysis of unobserved human capital. Under this characterization, unobserved human capital can be thought of as being high for some entrepreneurs and low for others. The estimates suggest that 81 per cent of entrepreneurs draw the low value (resulting in a positive unobserved heterogeneity level of m_2), while the remaining 19 per cent draw a high level of unobserved human capital (resulting in a zero unobserved heterogeneity level). In other words, entrepreneurs drawing the low value can be those whose human capital is approximately valued appropriately in the labor market, while the high value entrepreneurs face a significantly lower valuation.

5 Concluding remarks

We find strong empirical evidence that, for the sample of new French firms considered in this paper, the positive impact of an entrepreneur's education on the new firm's survival varies significantly depending on the entrepreneur's initial state in the labor market. Specifically, the relationship is significant only for individuals who were employed and started a business in a sector in which they had some prior experience. Based on our model, we argue that the observed differential impact of education may be attributed to a sample selection bias such that the unobserved human capital is negatively correlated with education for entrepreneurs whose previous labor market status was unfavorable. This suggests that if the impact of education on survival is measured without conditioning on prior labor market status, then it will be underestimated.

Our theoretical analysis of the sample selection bias stresses the role of entrepreneurship as a response to labor market inefficiencies. Empirical results are best explained by a model where the information available to employers about potential entrepreneurs is not significantly better than that available in the data: this is what makes it costly for individuals

with a high level of observed human capital to be in an unfavorable state so that they choose entrepreneurship irrespective of their actual level of human capital.

The link between labor market rigidities and self-employment has already been discussed in the literature that focuses on the macroeconomic interactions between entrepreneurship and unemployment. For instance, Thurik *et al.* (2007) find that the "entrepreneurial effect" whereby more entrepreneurship today reduces unemployment tomorrow is much stronger than the "refugee" effect corresponding to a higher entrepreneurial activity during periods with high unemployment.

Our analysis has mixed implications as to the plausibility of such a refugee effect. Although self-employment is a means of moving out of unemployment, a high unemployment rate may deter individuals from starting a business anticipating that, in case of failure, a salaried job may not be readily available: this may be particularly the case for individuals benefiting from a favorable labor market state who, as a result, give up entrepreneurship despite a high level of unobserved ability. This suggests that on a cross section of different countries, it is unclear whether those with high unemployment should have higher or lower self employment rates. It should be expected however that the systematic differences in the impact of education on survival, across entrepreneurs with different initial states, should be less salient in countries where the labor market is more fluid than that of France.

This relationship between labor market rigidities and entrepreneurship also points to some possible policy recommendations. Obviously, reducing labor market rigidities may encourage entrepreneurship of the "right type" corresponding to some ability that is not properly exploited by the labor market. Short of reducing rigidities, financial aids aimed at entrepreneurs might be better applied if targeted at individuals returning to the labor market after a period of self employment.

Our data on survival of new firms does not allow us to discriminate between terminations that are true failures involving bankruptcies and situations where the entrepreneur chooses

to sell a healthy business and quit, which occurs quite frequently as documented by various studies; see, for example, Bates (2005) and Bhattacharjee *et al.* (2008a). Note however that such "successful" shut downs of firms often correspond to a move from self employment to a salaried position, suggesting that the latter situation is more attractive. This is consistent with our theoretical analysis where individuals choose self-employment whenever it is more rewarding than the labor market. Therefore, these entrepreneurs return to the labor market when their business yields insufficient profit as compared to what they could obtain in a salaried position. Still there might be some additional insights from looking at other measures of the firm's performance, which we intend to do in our future research. For instance, using more detailed financial information will enable us to better account for the role of financial factors in firm exit.[25]

We have argued that better educated individuals are more eager to move away from a bad labor market state and hence choose self employment independent of their actual human capital, in particular because they might worry about the depreciation of their observed human capital. This explanation in terms of differential benefits from starting a new business between educated and uneducated persons may however be only part of the story. It is likely that there is a difference in cost, to the extent that education provides the type of general human capital that is quite useful in overcoming the difficulties in starting and managing a new firm. Future research should explore the nature of human capital needed to start a business in different sectors and the implications for entrepreneurs with different initial states in the labor market.

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Appendix

Assume that $L = 0$ and $H = 5$

In the case without information asymetry, for a logistic distribution of ν and for a given W_i, the posterior probability that the human is high conditional on entrepreneurship and on unobserved human capital μ simplifies to :$\mu_{e,i}(\mu) = \frac{\mu[e^5+e^{5-W(0)}]}{e^{5-W(0)}+\mu(e^5-e^{W(1)-W(0)})+e^{W(1)-W(0)}}$

Assume that in the favourable initial state, $W_1(\mu) = (\mu+1)^2 - 1$, so that $W_1(1) = 3$ and $W_1(0) = 0$ the posterior beliefs in the good state are $\mu_{e,1}(\mu) = \frac{2\mu e^2}{e^2+\mu(e^2-1)+1}$

In the bad state , if $\mu < 1/2$ then $W_0(\mu) = \mu - \mu^2$, $W_0(0) = 0$ and for $\mu > 1/2$, $W_0(\mu) = 100\mu - 100\mu^2 - 24.75$ so $W_0(1) = -24.75$

The posterior belief is

$\mu_{e,0}(\mu) = \frac{2\mu e^5}{e^5+\mu(e^5-e^{-24,75})+e^{-24,75}}$.

The red curve represents the function $\mu_{e,0}(\mu)$ and the doted curve refers to $\mu_{e,1}(\mu)$.

In the case with information asymetry, $\mu_{e,i}(\mu) = \frac{\mu[e^5+e^{-W_i(\mu)+5}]}{e^{-W_i(\mu)+5}+(e^5-1)\mu+1}$

In the favourable initial state where $W_1(\mu) = (\mu+1)^2 - 1$, $\mu_{e,1}(\mu) = \frac{\mu(e^5+e^{-(\mu+1)^2+6})}{e^{-(\mu+1)^2+6}+(e^5-1)\mu+1}$

In the unfavourable initial state, for $\mu < 1/2$, $W_0(\mu) = \mu - \mu^2$ and for $\mu > 1/2$, $W_0(\mu) = 100\mu - 100\mu^2 - 24.75$ then :

$$\mu_{e,0}(\mu) = \begin{cases} \frac{\mu(e^5+e^{100\mu^2-100\mu+29.75})}{e^{100\mu^2-100\mu+29.75}+(e^5-1)\mu+1} & \text{if} \quad \mu \geq 1/2 \\ \frac{\mu(e^5+e^{\mu^2-\mu+5})}{e^{\mu^2-\mu+5}+(e^5-1)\mu+1} & \text{if} \quad \mu < 1/2 \end{cases}$$

TABLE 1: Discrepancies in survival raters for different education levels according to the situation at the time of creation

	Education Levels	
	Low	High
Overall Population : 58.97%[26] (5891[27])	50.38% (541)	63.36% (1258)
Employed : 63.50% (2593)	54.66% (223)	68.37% (541)
Employed, Same branch : 67.63% (2072)	58.05% (156)	72.44% (620)
Employed, Diff. branch : 48.33% (521)	46.34% (67)	50.60% (140)
Unemployed : 54.87% (3298)	46.68% (318)	55.61% (498)
Short term unemployed : 57.45% (2276)	51.23% (214)	56.28% (342)
Long term unemployed : 49.54% (1022)	38.16% (104)	54.09% (156)

[26] Weighted survival rate after 4 years

[27] Unweighted sample size (still running and closed down firms)

TABLE 2: Human Capital Variables

VARIABLES	MODALITIES
Education (educational level)	- High (diploma received after two years and more at University) - Intermediate[28]* (Professional diploma and Secondary School diploma) - Low (no diploma)
Employment, previous status (occupationbefore the setting-up of the new firm)	- Employed, same branch (salaried in the same branch of activity) - Different branch* (salaried in a different branch of activity) - Short term unemployed (less than one year) - Long term unemployed (more than one year)
Duration of experience in the same branch of activity	- Less than 3 years - 3 / 10 years* - More than 10 years
Size of the enterprise where this experience has been acquired	- Less than 10 employees - 10 / 100 employees* - More than 100 employees
Employment & Education (Educational level& Occupation before the setting-up of the new firm)	- Same branch, High education* - Same branch, Intermediate education - Same branch, Low education - Different branch, High education - Different branch, Intermediate education - Different branch, Low education - Short term unemployed, High education - Short term unemployed, Intermediate education - Short term unemployed, Low education - Long term unemployed, High education - Long term unemployed, Intermediate education - Long term unemployed, Low education
Previous setting-up of new firms	- Never - Once or more*

[28] * refers to the reference class in the estimates

TABLE 3: Control Variables

VARIABLES	**MODALITIES**
ENTREPRENEUR ATRIBUTES	
Age of entrepreneur	- 25/35 years - 35/40 years* - 40/50 years
Entrepreneurship "milieu"	- Yes* (relatives and close relationship - No
Main motivation (when the entrepreneur sets-ups its firm)	- New idea - Opportunity / taste for entrepreneurship - Unemployed* - Entourage example
FIRM ATTRIBUTES	
Initial size of entreprise	- Zero or one employee* - More than one employee
Initial demand (number of customers)	- 1/10 customers - More than 10 customers*
Legal status	- Limited liability - Unlimited liability*
Region of incorporation	- Low entrepreneurship - High entrepreneurship*
Industry	- Catering / Trade - Manufacturing - Construction, Transports - Services*
FINANCIAL CONSTRAINTS	
Initial capital invested	- Less than 15245 euros - 15245 / 76224 euros* - More than 76224 euros
Public financial aid, 1994	- Obtained aid - None obtained*
Bank loans, 1994	- Applied and refused - Applied and received - Not applied*

TABLE 4: Estimates for Continuous Time Cox Model[29,30]

Variables	Full sample	Sub-sample, by prev. employment			
		Different branch	Long term unemployed	Short term unemployed	Same branch
HUMAN CAPITAL					
Education					
(Base = Intermediate)	0.00	0.00	0.00	0.00	0.00
– High	-0.150^{**} (-4.6)	0.273^{**} (3.1)	-0.289^{**} (-3.5)	0.025 (0.4)	-0.427^{**} (-7.0)
– Low	0.124^{**} (3.2)	0.163 (1.2)	0.136 (1.6)	-0.014 (-0.2)	0.239^{**} (3.3)
Employment, previous status					
(Base = Different branch)	0.00	–	–	–	–
– Long term unemployed	0.145^{**} (3.0)	–	–	–	–
– Short term unemployed	0.092^{*} (2.0)	–	–	–	–
– Employed, same branch	-0.331^{**} (-7.4)	–	–	–	–
Experience, same branch					
(Base = $3-10$ years)	0.00	–	0.00	0.00	0.00
– Less than 3 years	0.173^{**} (4.8)	–	0.107 (1.4)	0.240^{**} (4.2)	0.183^{**} (2.9)
– More than 10 years	-0.276^{**} (-9.3)	–	-0.322^{**} (4.9)	-0.251^{**} (-5.2)	-0.289^{**} (-5.5)
Size, prev. same branch firm					
(Base = $10-100$ employees)	0.00	–	0.00	0.00	0.00
– Less than 10 employees	-0.351^{**} (-12.6)	–	-0.376^{**} (-5.9)	-0.436^{**} (-10.0)	-0.226^{*} (-45)
– More than 100 employees	0.074^{*} (2.0)	–	0.200^{*} (2.0)	-0.032 (-0.5)	0.222^{**} (3.6)
Previous professional status					
(Base = Worker)	0.00	0.00	0.00	0.00	0.00
– Manager/ Executive	-0.075^{*} (-2.3)	-0.520^{**} (-5.3)	0.128^{+} (1.7)	-0.122^{*} (-2.2)	0.087 (1.4)
– Craftsman/ Middle mgmt.	0.004 (0.1)	0.378^{**} (-3.0)	0.129 (1.4)	-0.092 (-1.5)	0.219^{**} (3.6)
– Student	0.176^{**} (2.9)	-0.791^{*} (-2.1)	0.268^{**} (3.0)	0.375^{**} (3.3)	0.117^{**} (0.9)
Previous setting up of new firms					
(Base = Once or more)	0.00	0.00	0.00	0.00	0.00
– Never	0.230^{**} (7.3)	0.336^{**} (3.7)	0.120^{+} (1.6)	0.283^{**} (5.0)	0.182^{**} (3.3)

[29] z-ratios are reported in parentheses.

[30] ** , * and $^{+}$: Significant at 1%, 5% and 10% levels respectively.

TABLE 4: Estimates for Continuous Time Cox Model (contd.)

Variables	Full sample	Sub-sample, by prev. employment			
		Different branch	Long term unemployed	Short term unemployed	Same branch
ENTREPRENEUR ATTRIBUTES					
Age of entrepreneur					
(Base = 35 − 40 years)	0.00	0.00	0.00	0.00	0.00
– 25 − 35 years	0.007	−0.196*	0.103	0.072	−0.006
	(0.2)	(−2.1)	(1.2)	(1.4)	(−0.1)
– 40 − 50 years	−0.097**	−0.420**	0.080	−0.129*	0.073
	(−2.9)	(−4.1)	(1.0)	(−2.3)	(1.2)
Entrepreneurship "milieu"					
(Base = Yes)	0.00	0.00	0.00	0.00	0.00
– No (relatives/close reltns.)	0.103**	0.188**	0.258**	0.056	0.005
	(4.1)	(2.6)	(4.6)	(1.4)	(0.1)
Main motivation					
(Base = Unemployed)	0.00	0.00	0.00	0.00	0.00
– New idea	−0.085+	−0.087	0.303**	−0.311**	−0.226*
	(−1.7)	(−0.4)	(3.1)	(−3.4)	(−2.0)
– Opportunity/ Taste for entrepreneurship	−0.179**	−0.198	−0.152*	−0.214**	−0.174+
	(−5.2)	(−1.1)	(−2.5)	(−4.2)	(−1.9)
– Entourage example	0.134*	−0.083	0.087	0.203*	0.185
	(2.3)	(−0.4)	(0.7)	(2.1)	(1.4)
FIRM ATTRIBUTES					
Initial size of enterprise					
(Base = Max. 1 employee)	0.00	0.00	0.00	0.00	0.00
– More than one employee	0.176**	−0.031	0.292**	0.288**	0.059
	(6.9)	(−0.4)	(4.8)	(6.7)	(1.2)
Initial demand					
(Base = > 10 customers)	0.00	0.00	0.00	0.00	0.00
– Between 1 − 10 customers	0.120**	0.350**	0.131*	0.003	0.139**
	(4.6)	(4.0)	(2.2)	(0.1)	(3.0)
Legal status					
(Base = Unlimited liability)	0.00	0.00	0.00	0.00	0.00
– Limited liability	−0.393**	−0.560**	−0.334**	−0.517**	−0.300**
	(−13.4)	(−6.2)	(−4.5)	(−10.4)	(−5.8)
Region of incorporation					
(Base = High entrepreneurship)	0.00	0.00	0.00	0.00	0.00
– Low entrepreneurship	−0.082**	−0.112	0.016	−0.239**	−0.014
	(−3.4)	(−1.5)	(0.3)	(−6.1)	(−0.3)
Industry					
(Base = Services)	0.00	0.00	0.00	0.00	0.00
– Catering/ Trade	0.328**	0.158+	0.356**	0.338**	0.254**
	(10.5)	(1.9)	(5.1)	(6.4)	(4.2)
– Manufacturing	−0.058	−0.108	−0.094	−0.105	−0.006
	(−1.3)	(−0.7)	(−1.0)	(−1.5)	(−0.1)
– Construction/ Transport	−0.262**	−0.534**	−0.230**	−0.323**	−0.246**
	(−7.5)	(−4.1)	(−3.1)	(−5.8)	(−3.5)

TABLE 4: Estimates for Continuous Time Cox Model (contd.)

Variables	Full sample	Sub-sample, by prev. employment			
		Different branch	Long term unemployed	Short term unemployed	Same branch
FINANCING CONSTRAINTS					
Initial capital invested					
(Base = 15245 − 76224 Euros)	0.00	0.00	0.00	0.00	0.00
– less than 15245 Euros	0.356** (11.2)	0.442** (4.5)	0.463** (5.3)	0.477** (9.0)	0.156** (3.0)
– more than 76224 Euros	−0.521** (−7.1)	−1.157** (−4.7)	−0.321^{+} (−1.7)	−0.278* (−2.0)	−0.513** (−4.6)
Public financial aid, 1994					
(Base = None)	0.00	0.00	0.00	0.00	0.00
– Obtained aid	−0.347** (−11.7)	−0.515** (−2.6)	−0.222** (−4.0)	−0.410** (−9.8)	−0.357** (−4.2)
Bank loans, 1994					
(Base = Not applied)	0.00	0.00	0.00	0.00	0.00
– Applied and refused	0.048 (1.0)	0.512** (2.9)	−0.221* (−2.0)	0.189* (2.5)	0.090 (0.8)
– Applied and received	−0.290** (−9.7)	−0.030** (−0.3)	−0.010 (−0.2)	−0.202** (−4.4)	−0.679** (−11.1)
No. of firms	19,213	1,802	3,296	7,070	7,045
No. of exits	7,882	931	1,663	3,008	2,280
Total time at risk (months)	730,289	61,055	115,896	265,585	287,753
Log-likelihood	−74629.8	−6515.1	−12771.2	−25403.4	−19445.8

TABLE 5: Estimates for Grouped Time PH Model [31,32,33,34]

Variables	No frailty	Discrete mix. frailty
LOG BASELINE HAZARD		
– Year 1	-4.993^{**} (-52.2)	-17.227 (-0.6)
– [Year 2 − Year 1]	0.283^{**} (7.0)	0.353^{**} (8.2)
– [Year 3 − Year 1]	0.506^{**} (12.6)	0.646^{**} (12.9)
– [Year 4 − Year 1]	0.351^{**} (7.7)	0.595^{**} (8.5)
EMPLOYMENT X EDUCATION		
(Base) Same branch, High education	0.00	0.00
Intermediate education	0.315^{**} (4.9)	0.315^{**} (4.5)
Low education	0.616^{**} (5.8)	0.602^{**} (5.2)
Different branch, High education	0.622^{**} (6.4)	0.664^{**} (5.9)
Intermediate education	0.523^{**} (6.4)	0.539^{**} (5.8)
Low education	0.626^{**} (4.5)	0.821^{**} (4.2)
Short term unemployed, High education	0.625^{**} (8.1)	0.684^{**} (8.0)
Intermediate education	0.661^{**} (10.0)	0.710^{**} (9.6)
Low education	0.692^{**} (7.1)	0.767^{**} (6.8)
Long term unemployed, High education	0.538^{**} (5.6)	0.614^{**} (5.5)
Intermediate education	0.749^{**} (10.4)	0.839^{**} (10.3)
Low education	0.892^{**} (7.9)	0.939^{**} (7.2)
HUMAN CAPITAL		
Experience, same branch		
(Base = 3 − 10 years)	0.00	0.00
– Less than 3 years	0.180^{**} (3.8)	0.167^{**} (3.1)
– More than 10 years	-0.290^{**} (-7.4)	-0.331^{**} (-7.5)
Size, prev. same branch firm		
(Base = 10 − 100 employees)	0.00	0.00
– Less than 10 employees	-0.361^{**} (-9.7)	-0.414^{**} (-9.9)
– More than 100 employees	0.077 (1.6)	0.085 (1.5)

[31] z-ratios are reported in parentheses.

[32] ** , * and $^{+}$: Significant at 1%, 5% and 10% levels respectively.

[33] The results reported for the model with frailty are the best in terms of maxmised likelihood. These correspond to a two-point discrete mixture frailty distribution.

[34] LR test rejects the null hypothesis of "no frailty" at 1% level of significance.

TABLE 5: Estimates for Grouped Time PH Model (contd.)

Variables	No frailty	Discrete mix. frailty
HUMAN CAPITAL		
Previous professional status		
(Base = Worker)	0.00	0.00
– Manager/ Executive	-0.086^{*}	-0.103^{*}
	(-2.0)	(-2.1)
– Craftsman/ Middle mgmt.	-0.014	-0.018
	(-0.3)	(-0.4)
– Student	0.156^{*}	0.271^{**}
	(2.1)	(3.0)
Previous setting up of new firms		
(Base = Once or more)	0.00	0.00
– Never	0.234^{**}	0.256^{**}
	(5.7)	(5.6)
ENTREPRENEUR ATTRIBUTES		
Age of entrepreneur		
(Base = $35-40$ years)	0.00	0.00
– $25-35$ years	0.021	-0.006
	(0.5)	(-0.1)
– $40-50$ years	-0.072^{+}	-0.100^{*}
	(-1.7)	(-2.0)
Entrepreneurship "milieu"		
(Base = Yes)	0.00	0.00
– No (relatives/close reltns.)	0.100^{**}	0.130^{**}
	(3.1)	(3.4)
ENTREPRENEUR ATTRIBUTES		
Main motivation		
(Base = Unemployed)	0.00	0.00
– New idea	-0.084	-0.147^{*}
	(-1.3)	(-2.0)
– Opportunity/ Taste for entrepreneurship	-0.168^{**}	-0.215^{**}
	(-3.8)	(-4.2)
– Entourage example	0.125	0.066
	(1.5)	(0.7)
FIRM ATTRIBUTES		
Initial size of enterprise		
(Base = Max. 1 employee)	0.00	0.00
– More than one employee	0.157^{**}	0.114^{**}
	(4.5)	(2.8)
Number of customers		
(Base = >10 customers)	0.00	0.00
– Between $1-10$ customers	0.133^{**}	0.137^{**}
	(4.0)	(3.6)
Legal status		
(Base = Unlimited liability)	0.00	0.00
– Limited liability	-0.392^{**}	-0.361^{**}
	(-10.0)	(-8.1)

TABLE 5: Estimates for Grouped Time PH Model (contd.)

Variables	No frailty	Discrete mix. frailty
FIRM ATTRIBUTES		
Region of incorporation		
(Base = High entrepreneurship)	0.00	0.00
– Low entrepreneurship	-0.068^{*} (-2.2)	-0.049 (-1.4)
Industry		
(Base = Services)	0.00	0.00
– Catering/ Trade	0.322^{**} (8.0)	0.392^{**} (8.2)
– Manufacturing	-0.075 (-1.4)	-0.042 (-0.7)
– Construction/ Transport	-0.272^{**} (-5.9)	-0.283^{**} (-5.6)
FINANCING CONSTRAINTS		
Initial capital invested		
(Base = 15245 − 76224 Euros)	0.00	0.00
– less than 15245 Euros	0.343^{**} (8.3)	0.384^{**} (8.3)
– more than 76224 Euros	-0.502^{**} (-5.2)	-0.522^{**} (-5.2)
Public financial aid, 1994		
(Base = None)	0.00	0.00
– Obtained aid	-0.346^{**} (-9.1)	-0.411^{**} (-9.2)
Bank loans, 1994		
(Base = Not applied)	0.00	0.00
– Applied and refused	0.098 (1.6)	0.171^{*} (2.3)
– Applied and received	-0.299^{**} (-7.6)	-0.354^{**} (-8.0)
MIXTURE FRAILTY DISTBN.		
$m_1 \equiv 0$	–	0.00
m_2	–	12.44 (0.5)
π_1	–	0.186^{**} (6.3)
$\pi_2 = 1 - \pi_1$	–	0.814^{**} (27.5)
No. of firms	19,213	19,213
No. of exits	7,882	7,882
Log-likelihood	−24593.0	−24583.7

TABLE 6: Tests of differences between coefficients for the impact of Education[35,36]

6a- Employed, same branch

	Low	Intermediate	High
Low		0,007**	0,000**
Intermediate	0,002**		0,000**
High	0,000**	0,000**	

6b- Employed, different branch

	Low	Intermediate	High
Low		0,149	0,443
Intermediate	0,45		0,278
High	0,976	0,314	

6c- Short term unemployed

	Low	Intermediate	High
Low		0,55	0,460
Intermediate	0,700		0,723
High	0,485	0,574	

6d- Long term unemployed

	Low	Intermediate	High
Low		0,415	0,027*
Intermediate	0,168		0,030*
High	0,005**	0,017*	

[35] Tables report $p-values$ for the difference between coefficients tests. Values below the diagonal correspond to the no frailty model and values above the diagonal correspond to the frailty model.

[36] ** , * and $^{+}$: Significant at 1%, 5% and 10% levels respectively.

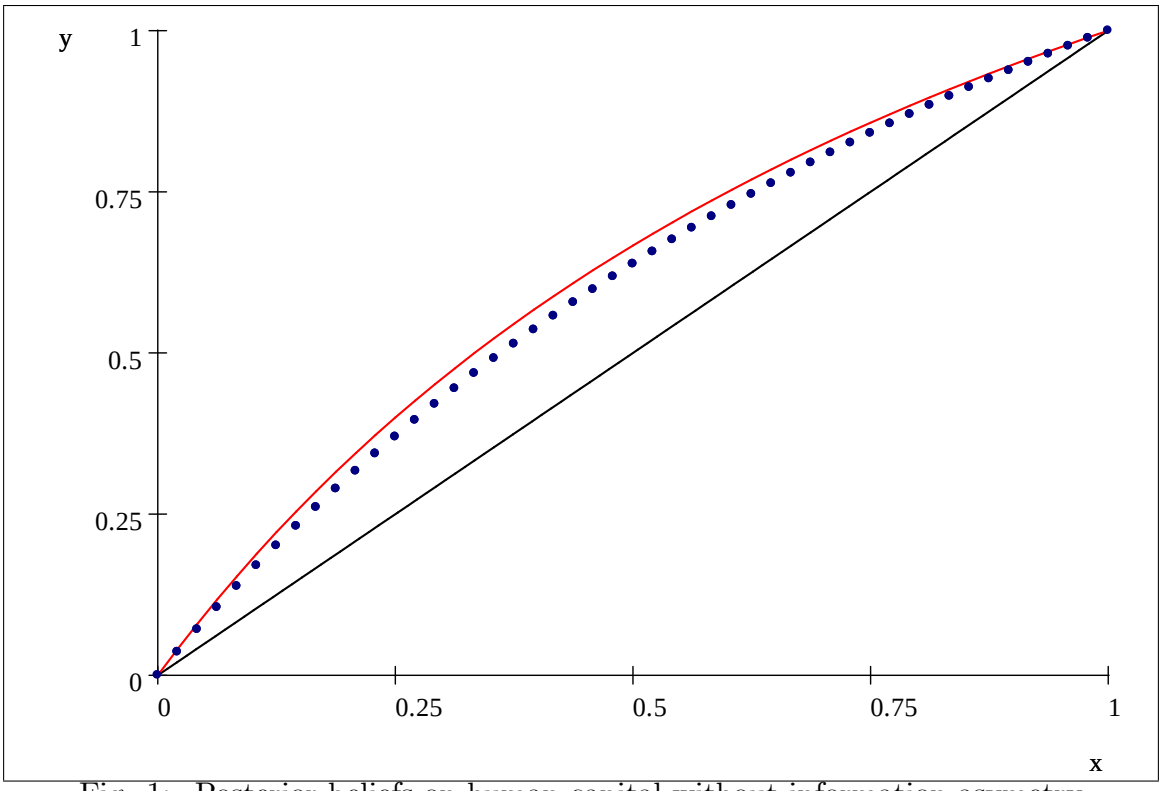

Fig. 1: Posterior beliefs on human capital without information asymetry

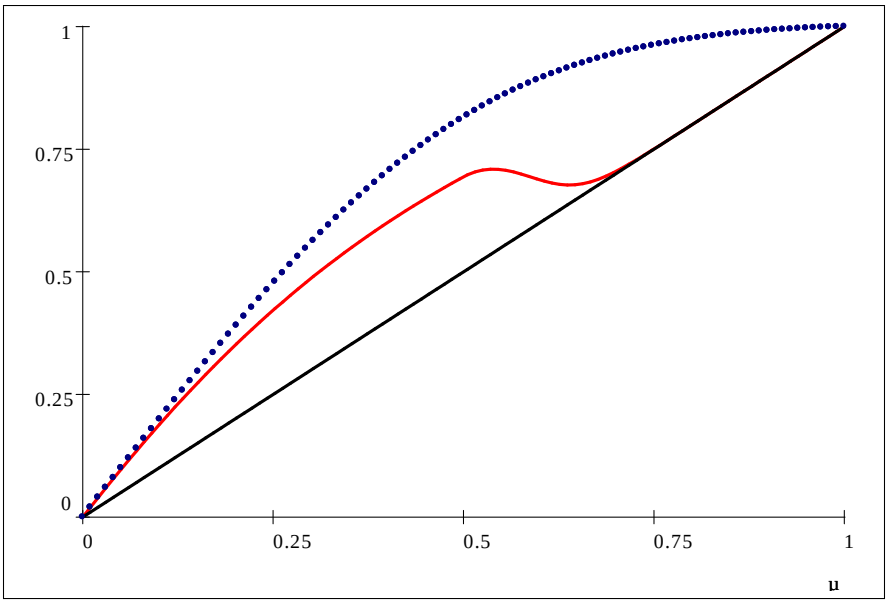

Fig. 2 : Posterior beliefs on human capital with information asymetry
The doted curve refers to $\mu_{e,1}(\mu)$.

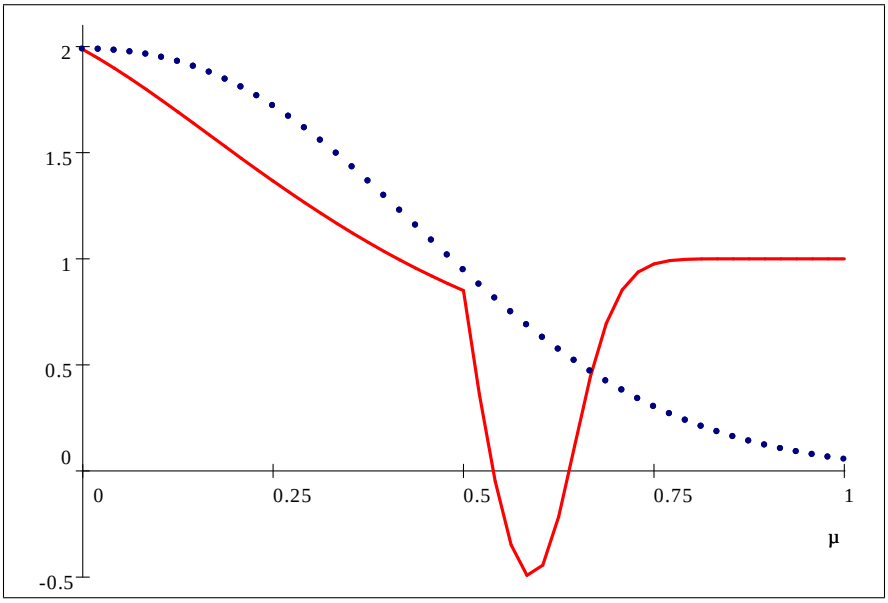

Fig. 3 : Comparisons of the slopes of $\mu_{e,0}$ and $\mu_{e,1}$

TEPP Working Papers

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