UNIVERSITA' CATTOLICA DEL SACRO CUORE

WORKING PAPER

DISCE

Dipartimenti e Istituti di Scienze Economiche

Another unconsidered sinister effect of industry-specific crises? On the possible emergence of adverse selection phenomena on the survival of entrepreneurial ventures

S. Colombo L.Grilli

IEF0098 – July- 2010

UNIVERSITA' CATTOLICA DEL SACRO CUORE
- Milano -

QUADERNI DELL'ISTITUTO DI ECONOMIA E FINANZA

Another unconsidered sinister effect of industry-specific crises? On the possible emergence of adverse selection phenomena on the survival of entrepreneurial ventures.

S. Colombo L. Grilli

98 - luglio 2010

Quaderni dell'Istituto di Economia e Finanza
numero 98 luglio 2010

Another unconsidered sinister effect of industry-specific crises? On the possible emergence of adverse selection phenomena on the survival of entrepreneurial ventures

S. Colombo(*) L. Grilli(•)

(*)Istituto di Economia e Finanza, Università Cattolica del Sacro Cuore, Largo Gemelli 1 – 20123 Milano, e-mail: stefano.colombo@unicatt.it

(•)Department of Management, Economics and Industrial Engineering, Politecnico di Milano, e-mail: luca.grilli@polimi.it

Redazione

Istituto di Economia e Finanza
Università Cattolica del S. Cuore
Largo Gemelli 1
20123 Milano
tel.: 0039.02.7234.2976
fax: 0039.02.7234.2781
e-mail: ist.ef@unicatt.it

* Esemplare fuori commercio per il deposito legale agli effetti della Legge n. 106 del 15 aprile 2004.

* La Redazione ottempera agli obblighi previsti dalla Legge n. 106 del 15.04.2006, Decreto del Presidente della Repubblica del 03.05.2006 n. 252 pubblicato nella G.U. del 18.08.2006 n. 191.

* I quaderni sono disponibili on-line all'indirizzo dell'Istituto http://www.unicatt.it/istituti/EconomiaFinanza

* I *Quaderni dell'Istituto di Economia e Finanza* costituiscono un servizio atto a fornire la tempestiva divulgazione di ricerche scientifiche originali, siano esse in forma definitiva o provvisoria. L'accesso alla collana è approvato dal Comitato Scientifico, sentito il parere di un referee.

Another unconsidered sinister effect of industry-specific crises? On the possible emergence of adverse selection phenomena on the survival of entrepreneurial ventures

Stefano Colombo

Istituto di Economia e Finanza-Università Cattolica del Sacro Cuore di Milano

Luca Grilli

Department of Management, Economics and Industrial Engineering-Politecnico di Milano

Abstract.

This article explores the possibility that under an intensely negative industry-specific shock, the commonly detected positive relationship between the human capital of founders and the survival prospects of start-up businesses may actually be reversed. Starting from an analysis of the issue from a theoretical perspective in order to derive the necessary and sufficient conditions for the emergence of these adverse selection phenomena in entrepreneurship, the study examines a sample of 179 Italian start-ups operating in the ICT services market created during the boom period from 1995 to early 2000. Econometric analyses provide evidence that, during an intense industry crisis (i.e., early 2000 to 2003), entrepreneurs with a substantial amount of human capital may pursue an exit strategy.

JEL codes: L26; L86
Keywords: High-tech entrepreneurship; Adverse selection; Industry crises

Introduction

This article studies the relationship between the entrepreneurs' human capital and the decision whether to continue to run the firm or choose an alternative employment option during an industry-specific crisis. The impact of entrepreneurs' human capital is controversial. On one hand, more experienced and skilled entrepreneurs are likely to obtain higher profits than less experienced and skilled ones in the sector where the crisis occurs, and therefore, all else being equal, entrepreneurs with high human capital are less prompt to stop to run the firm during an industry crisis. On the other hand, the opportunity costs of high-profile human capital entrepreneurs of running the firm during the crisis may be high given the potential returns of their efforts in alternative employment opportunities, and this, all else being equal, makes entrepreneurs with high human capital more prompt to stop to run the firm and look for other employment opportunities. Therefore, it may be that during an industry-specific crisis relatively high-skilled entrepreneurs stop to run the firm, while entrepreneurs with a low human capital profile continue operations, just because the former have more attractive alternative options, while the latter are locked in their venture because of lacking of alternative opportunities. The possible emergence of this *adverse selection* phenomenon in entrepreneurship was firstly suggested by Gimeno *et al*. (1997, p.756), which argue: "there may

be situations in which entrepreneurs do not continue their business even though, in terms of economic performance, they are better off than other entrepreneurs. They may take this action because of the opportunity costs associated with staying in business – their level of education and training may warrant more attractive economic returns in alternative employment opportunities. Similarly, a poorly performing venture may continue because of the entrepreneur's lack of other attractive options, strong physical attachment to the new venture, or high costs associated with switching into new employment." Quoting also McGrath (1999, p.14): "an entrepreneur might disband an economically profitable business if other activities appear more lucrative or interesting" (see also, among the others, Watson and Everett, 1993, 1996; Headd, 2003, DeTienne *et al*., 2008).

To summarize, high-profile human capital characteristics may raise the opportunity costs of running the firm during an industry crisis, as the entrepreneur may receive higher returns from switching to alternative occupations, and this may actually determine a greater exit of skilled rather than unskilled entrepreneurs from the industry experiencing the negative shock.

Notwithstanding the relevance of the topic, the theoretical analysis addressing the issue of the possible arise of *adverse selection* phenomena during an industry crisis is quite scarce, if not totally lacking (as far as we know, the only theoretical article considering this issue is Holmes and Schmitz, 1990, which however assume the existence of *adverse selection* instead of investigating on the conditions that determine the insurgence of the phenomenon). Allegedly, the present study is novel in two important aspects. The first part of the article is dedicated to the development of a simple theoretical framework addressing the issue of *adverse selection* in entrepreneurship during an industry-specific crisis. More specifically, we derive a necessary and sufficient condition for such phenomenon to occur. In the second part of the paper we investigate *adverse selection* in entrepreneurship from an empirical point of view. The general contention in the empirical literature analysing the role of human capital in the performance of the entrepreneurial activity is that entrepreneur' human capital positively affects the continuation of the entrepreneurial activity (Delmar and Shane, 2006; Santarelli and Vivarelli, 2007). However, the available evidence is far from being conclusive: many studies found a significant positive impact on survival of the entrepreneurial activity for only some of several measures of entrepreneur' human capital investigated (Brüderl *et al*., 1992; Cooper *et al*., 1994; Gimeno *et al*., 1997; Pennings *et al*., 1998; Taylor, 1999; Van Praag, 2003; Åstebro and Bernhardt, 2003; Thompson, 2005; Delmar and Shane, 2006), while others did not document any significant effect at all or found a negative relationship (Bates, 1989; Nafziger and Terrel, 1996; Cressy, 1996; Storey and Wynarczyk, 1996; Shane and Stuart, 2002; Grilli 2009). In this respect, w take advantage of a sort of "natural experiment" that occurred in the ICT sector. In particular we analyse the exit behaviour during the very specific

(compared to the rest of the economy) telecom and dot.com bust occurred between early 2000 to 2003 for a sample of Italian ICT start-up companies created during the boom period of 1995 to early 2000.[1] Results document that a relevant *adverse selection* process is likely to have characterized the Italian ICT sector during the bust period: a relatively higher level of human capital endowment has actually induced the entrepreneurs to leave the start-up and opt for alternative employment opportunities during the industry-specific recession.

Theoretical model

In what follows, we propose a simple theoretical framework to investigate on the effects of a crisis arising in industry *i* on the decision of an agent endowed with human capital and entrepreneurship ability and facing the dilemma of continuing to be an entrepreneur in industry *i* or choosing an alternative option. Examples of alternative options are being a salaried worker in sector *i* or being a salaried worker or an entrepreneur in sector $j \neq i$.

Suppose that exist *E* types of agents, indexed with $e = 1, 2, ..., E$, where *e* defines the human capital level: higher *e* implies higher human capital level. There is a continuum of agents for each type-*e*. Suppose that the distribution of type-*e* agents is given by $f_e(x_e)$, with $x_e \in [\underline{x}_e, \bar{x}_e]$, where x_e indicates the entrepreneurial ability of the specific type-*e* agent *x*. Assume that $\underline{x}_{e'} \geq \bar{x}_e \ \ \forall e' > e$, i.e. those agents with higher human capital have also higher entrepreneurial ability (Becker, 1975; Gimeno *et al*.; 1997, Almus and Nerlinger, 1999; Colombo and Grilli, 2005). Let us introduce a parameter, $\gamma \in (-\infty, +\infty)$, which describes the economic situation of sector *i*: the higher is γ, the worse is the economic situation of sector *i*, and vice-versa. Therefore, if γ increases, we say that there is an *industry crisis*[2]. The profits of entrepreneur x_e in industry *i* are given by: $\pi_{x|e} = v_e(x_e) - k_e(x_e, \gamma)$. The term v_e increases with x_e, and $v_{e'} > v_e \ \ \forall e' > e$: this implies that the higher is human capital and/or entrepreneurial ability, the higher are the profits. The term k_e refers to the sensitivity of the profits to the variation of the economic situation in sector *i*. Assume that k_e increases with γ: that is, profits decrease during an industry crisis (and increase during a boom). Let us define: $\rho_e \equiv \partial k_e / \partial \gamma$.

Suppose that that the best alternative option each agent has depends only on her human capital (if the best alternative option is represented by being a salaried worker in industry *i* or in another

[1] For an analogous periodisation (and description) of the telecom boom and bust, see Fransman (2004).

[2] Of course, if γ decreases, we say that there is an *industry boom*. However, since the empirical analysis concerns a crisis period, in what follows we consider only the case of increasing γ (crisis). Note that the analysis is focused on an *industry-specific crisis*, i.e. a crisis that regards a specific sector in the economy, and not on a *global crisis*, i.e. a crisis that involves the whole economy.

industry), or on her human capital *and* her entrepreneurial ability (if the best alternative option is represented by being a entrepreneur in industry $j \neq i$). We assume that when there is a *crisis* in sector *i*, the best alternative salary/profits weakly decreases. Define with $\alpha_e \equiv -\partial w^e(\gamma)/\partial\gamma$, where $\alpha_e \geq 0$ and $e = 1, 2, ..., E$, the sensitivity of type-*e* best alternative salary or profits to a variation of the economic situation (in case of profits, α_e is a function also of x_e). We assume that profits in industry *i* are more sensitive than the best alternative option of any agent to a variation of the economic situation in industry *i*. This assumption can be rationalized by noticing that if the best alternative option is being a salaried worker in industry *i* or in industry $j \neq i$, wages paid to workers are subject to contractual agreement between employers and employees (or unions representing categories of employees), and therefore they cannot be modified in a very short time, while if the best alternative option is being an entrepreneur in industry $j \neq i$, it is reasonable to assume that profits in industry $j \neq i$ are less affected than profits in industry *i* by a crisis arising in industry *i*. Therefore, we assume: $\rho_e \geq \alpha_e$, $\forall x, e$.

The adverse selection condition

Suppose that each type-*e* agent has to decide whether to be an entrepreneur in industry *i* or choose the best alternative option. She chooses to be an entrepreneur in industry *i* if her profits are higher than the best alternative salary or profits (Becker, 1975; Evans and Jovanovic, 1989; Bates, 1995). Denote by x_e^* the *marginal* type-*e* agent: she is the agent who is indifferent between being an entrepreneur in industry *i* or choosing the best alternative option. The *marginal* type-*e* agent is the solution of: $\pi_{x|e}(x_e^*, \gamma) = w^e(\gamma)$.[3] Type-*e* agents such that $x_e \in [x_e^*(\gamma), \bar{x}_e]$ are entrepreneurs, while type-*e* agents with $x_e \in [\underline{x}_e, x_e^*(\gamma)]$ choose the best alternative option. Therefore, the number[4] of type-*e* entrepreneurs in industry *i* is given by $I_e = \int_{x_e^*(\gamma)}^{\bar{x}_e} f_e(x)dx$. Let F_e be the primitive of $f_e(x_e)$ in $[x_e^*(\gamma), \bar{x}_e]$. Then: $\partial F_e/\partial x_e = f_e(x_e)$, $\forall x_e \in [x_e^*(\gamma), \bar{x}_e]$. The number of type-*e* entrepreneurs in industry *i* can be rewritten as: $I_e = F_e(\bar{x}_e) - F_e(x_e^*(\gamma))$. The impact of an *industry crisis* on the number of type-*e* entrepreneurs in industry *i* is captured by the derivative of I_e with respect to γ: $\frac{\partial I_e}{\partial \gamma} = -f(x_e^*) \cdot \frac{\partial x_e^*(\alpha_e, \rho_e)}{\partial \gamma}$. Clearly, the sign of the variation of the type-*e* number of

[3] In the case where the best alternative option is represented by being an entrepreneur in a industry different from the one where the crisis emerges, the condition simply becomes: $\pi_{x|e}(x_e^*, \gamma) = w^e(x_e^*, \gamma)$.

[4] We use the term "number" for expositional simplicity, but since there is a continuum of individuals we mean "measure".

entrepreneurs depends on the sign of the term $\partial x_e^*/\partial\gamma$: if $\partial x_e^*/\partial\gamma > 0$, the marginal type-*e* agent is more located to the right in the $f_e(.)$ distribution during the industry crisis, and the number of type-*e* entrepreneurs decreases; if $\partial x_e^*/\partial\gamma < 0$, the opposite holds. Define $L_e(x,\gamma) \equiv \pi_{x|e}(x_e,\gamma) - w^e(\gamma)$. Note that condition $\pi_{x|e}(x_e^*,\gamma) = w^e(\gamma)$ is the same as: $L(x_e^*,\gamma) = 0$. Taking the derivative of L_e with respect to γ, we get: $\alpha_e - \rho_e$. Therefore, L_e decreases with γ when $\rho_e \geq \alpha_e$ which is true by assumption for every *x* and *e*: it follows that during an industry crisis the number of entrepreneurs reduces for every human capital level, since x_e^* increases.[5] Moreover, the higher is $\rho_e - \alpha_e$ the more the *marginal* type-*e* agent after the crisis is distant from the *marginal* type-*e* agent before the crisis, which implies a greater reduction in the number of type-*e* entrepreneurs.

This allows us to derive a brief condition for the emerging of the *adverse selection* phenomenon during an industry crisis. Since *adverse selection* refers to the case where the entrepreneurs with high human capital are more likely than the entrepreneurs with low human capital to stop to run the firms during an industry crisis, in our framework *adverse selection* requires that $\partial I_e/\partial\gamma$ increases with *e*, which in turn amounts to require that $\rho_e - \alpha_e$ increases with *e*. Henceforth, the necessary and sufficient condition for *adverse selection* in entrepreneurship arising during an industry crisis can be summarized as follows:

- Necessary and sufficient condition for *adverse selection* in entrepreneurship: $\partial\rho_e/\partial e \geq \partial\alpha_e/\partial e$.

Using the necessary and sufficient condition for *adverse selection* in entrepreneurship we stated above, we can immediately derive the factors which make *adverse selection* more likely to occur:
Result: all else being equal, *adverse selection* is stronger the more (less) the profits (the best alternative option) of high-profile human capital entrepreneurs are sensitive to economic situation.

Empirical test

We try to test the possible emergence of *adverse selection* phenomena in entrepreneurship taking advantage of one of the most impetuous up side down experienced by a single sector with respect to the whole economic system: the boom and bust period investing the ICT sector around the year 2000. This represents an ideal testbed and a sort of "natural experiment" for investigating the potential relevance of the *adverse selection* phenomenon. First, the boom period was

[5] If the assumption $\rho \geq \alpha_e$ is removed, a more general condition for the variation in the number of type-*e* entrepreneurs can be easily derived: the number of type-*e* entrepreneurs decreases (increases) during an industry crisis if and only if the sensitivity of the profits of the *marginal type-e agent* to the economic situation is higher (lower) than the sensitivity of the type-*e* best alternative option.

characterized by an enormous and to some extent irrational euphoria that led to the birth of a great number of start-ups entering the sector with high and often unrealistic expectations (Fransman 2004). Second, the bust period was intense and dolorous but pretty much confined to the ICT and related sectors and spread with much less virulence in the whole economy. Between 1995 and 2000, the ICT sector experienced a dramatic boom, as the worldwide ICT growth rate during this period registered an average increase of around 10% per year (EITO 2004). Starting in mid-2000, the sector entered into a gloomy recession period and registered a global annual growth rate of 2.7% in 2001 and -0.4% in 2002, followed by a very slow recovery of 0.8% in 2003 (EITO 2004). The Italian ICT sector both at that time (and today) represents a small share of the global market; it accounted for 2.9% of the global ICT market in 2003, with 3.3% and 2.4% accounting for telecommunications and information technology, respectively. Notably, the Italian ICT sector did not deviate from the above sketched worldwide dynamics; from the peaks of the boom period, the annual growth rate dropped to a low of -0.5% in 2002 and then registered only a modest rate of 0.1% in 2003 (Assinform 2006).

Data

We consider a sample of 179 Italian ICT start-up companies that operate in service industries: multimedia content, software, Internet services (e-commerce, ISP, web-related services), and telecommunication services. Sample firms were established during the boom period: between 1995 and the first quarter of 2000 and were independent at start-up time (i.e., they were not controlled by another business organisation). The sample of ICT start-up firms was extracted from the database developed by the RITA (Research on Entrepreneurship in Advanced Technologies) Observatory at Politecnico di Milano.[6] The primary source of information from which RITA data were collected consists of a series of national surveys administered in the first semesters of the years 2000, 2002 and 2004. Data on sample firms come from the first round. The survey was based on a questionnaire that was sent to the contact person in the target firms (i.e., one of the owner-managers) either by fax or by e-mail. The first section of the questionnaire provides detailed information on the human capital characteristics of the firm's founders. The second section comprises further questions concerning the characteristics of the firm, including the year of foundation and the dynamics in the number of employees. Answers to the questionnaire were checked for internal coherence by trained personnel and were compared with information published in annual reports (as in the case of number of employees) and in the press. In several cases, phone or face-to-face follow-up interviews were conducted with owner-managers to obtaining missing data and ensure that data were reliable. The eventual survival or exit from markets of sample firms

between the second quarter of 2000 and 2003 was gathered in the second and third questionnaire rounds in 2002 and 2004. We collected information on sample firms being acquired by other firms directly from the survey respondents. Data on firm closure and acquisition for non-respondents were obtained from official documentation provided by the Union of Italian Chambers of Commerce.[6] As to the 124 still independent start-ups (69.3%), information is available on whether ICT service start-ups experienced some entrepreneurial exit from the original entrepreneurial team during the bust period. Again data were collected directly from respondents and checked and completed if necessary by the means of the dataset *Telemaco* provided by the Union of Italian Chambers of Commerce.

Specification of the econometric analysis

We estimate an ordered logit model on the degree of erosion of the original entrepreneurial team during the bust period with respect to the level of human capital possessed by entrepreneurs. The dependent variable takes a value of 0 if the degree of erosion is null (i.e. no leave of a founder), a value of 1 if some erosion process in the founding team occurred (i.e. leave of one or more founders but still some founders in) and 2 for a total disband of the founding team (i.e. no founders in the firm, because of closure or acquisition). As to independent variables, variables of founder human capital include: educational attainment (*Education*), measured by the mean number of years of education of founders; pre-entry work experience gained in the same industry as the start-up company (*Specific work experience*), and in different sectors (*Generic work experience*), both measured by the mean number of years of professional experience of founders before firm foundation;[7] and managerial experience (*Managerial experience*), which is a dummy variable capturing the presence within the founding team of one or more founders with a prior management position in a company. Beyond these covariates, we also control for the size of the founding team (*Founders*). Then, strictly following the empirical literature on firm survival and top management team changes in entrepreneurial ventures, models also include the following control variables: size

[6] The institution registers all business activities on the basis of fiscal codes and provides (upon payment request) eventual exit information on firms along time. Note also that reliability of data on firm exit was checked by inspecting (when available) firms' websites.

[7] As customary in empirical studies on the impact of human capital on firm performances (see, e.g., Colombo and Grilli 2005, 2009), education and pre-entry work experience variables are introduced into models as "averages" instead of "total sums" across founders. This specification, which also includes the number of founders as an independent variable, allows to disentangle the truly qualitative effect of human capital covariates from merely quantitative aspects. However note that replacing "average" education and work experience variables with the corresponding sums of the years of education and work experience of founders brings very similar results to those exposed in the next paragraph (results are available upon request from the author).

measured in terms of logarithm of employees at the end of 1999 (*Size*),[8] age of the firm (*Age*) and access to external sources of financing at start-up time (*Bank debt*). Finally, an industry dummy variable (*Internet*) differentiates start-up companies active in Internet services (e-commerce, ISP, web-related services) from the others.

Definitions of explanatory variables and some descriptive statistics are reported in Table 1. Table 2 highlights the correlation matrix between the explanatory variables.

Results

Results are reported in Table 3. Except for the variable *Managerial experience* which shows a negative and largely insignificant coefficient, all the other founder human capital variables point to the occurrence of an important *adverse selection* process going on in the Italian ICT sector during the industry downturn. The variable *Education* shows a positive and close to significance coefficient (p-value < 0.15) and both typology of work experience (*Specific work experience* and *Generic work experience*) exert a significant positive impact at 95% on the degree of erosion of the founding team. Overall, higher levels of human capital possessed by founders are associated to a higher probability of decomposition of the original top management team during the industry-specific recession. As to control variables, operating in the most novel ICT market segment (i.e. being a dot.com) raises the probability of the start-up to experience erosion in the founding team. Conversely, *Bank debt* exhibits a significant negative impact (95% level), suggesting that bank loans may represent relevant barriers to exit for entrepreneurs. The result is also in line with other studies (e.g. Åstebro and Bernhardt 2003) that highlight how having a bank loan would reveal a greater commitment by entrepreneurs in running the new firm and a consequent superior reluctance to exit from the entrepreneurial venture. Other control variables turn out to not significantly impact the dependent variable.

Robustness checks and further insights

As a first preliminary robustness check, we run an ordered probit model which specifies a different functional form for the error terms of the equation. Estimation results are very similar to the findings highlighted above (column 1 of Table 4): in terms of founder human capital variables, *Education* is positive and again close to significance and both *Generic* and *Specific work experience* variables are found to positively and significantly impact the degree of erosion of founding teams.

[8] Employment is commonly used as proxy for firm size in firm survival studies (see, e.g., Mata et al. 1995; Audretsch et al. 1999; Esteve-Perez et al. 2004; Dunne et al. 2005; Esteve-Perez and Manez-Castillejo 2006; Strotmann 2007). Different measures such as total assets (e.g., Agarwal and Audretsch 2001) or physical output (e.g., Thompson 2005) are less frequent. Note that the use of total amount of capital at foundation as an alternative measure of firm size brings very similar results (available upon request from the author) to those presented in the next paragraph.

Then, we estimated a multinomial probit model (column 2-4 of Table 4) where the dependent variable takes 1 if the firm experienced the leave of at least one founder since foundation, 2 if it closed operations and 3 if it merged to or have been acquired by another firm. In fact, one may argue that these phenomena albeit being related are rather different events and consequently they should be kept separated in the empirical strategy. Results confirm the positive influence of the continuous founder human capital variables on all the three possible outcomes but also highlight some interesting differences in the statistical significance of the impact of human capital attributes to different exit routes. In particular, the leave of at least one founder from the original team appears to be driven especially by their educational level, closure by generic and to a less extent specific work experience and M&A by the specific component of work experience and again education.[9]

Finally, since the decision concerning firm exit (e.g. closure and M&A) and to some extent also the individual decision to leave the firm in a non-single founded venture has to be agreed and mediated with the other components of the top management team, one may suppose that the relationship between founder human capital and the degree of erosion of the original entrepreneurial team may be influenced by these intra-team relational dynamics. To this purpose, we also estimated the main model only on the single-founded start-ups (column 5 of Table 4). Despite the dramatic reduction in sample size, still the results are totally in line with those previously exposed.

Concluding remarks

The aim of this study is to explore both theoretically and empirically the possibility that during an industry-specific negative shock the usual positive relationship between founder human capital and the entrepreneurial status condition may actually be reversed: high-skilled and educated entrepreneurs rather than low-profile ones could be more likely to leave the new-borne firm and opt for alternative opportunities. Theoretically, we investigate the formal conditions under which this possibility becomes real. From an empirical point of view, we highlight that such adverse selection phenomenon did effectively take place in a specific episode: under the severe industry recession that hit the ICT sector during the 2000-2003 period, high human capital profile entrepreneurs of Italian start-ups created in the sector during the boom period 1995-early 2000 were found on average to be more likely than low skilled ones to quit the just started new entrepreneurial venture.

So the study enlarges our understanding on the negative effects that industry crises exert on the economic systems and adds to the picture another important element. To the extent that sectorial negative shocks not only produce those *adverse selection* phenomena here highlighted on the entrepreneurs but also on the innovative, valuable and often highly idiosyncratic business ideas

[9] For an explanation on the reasons why the specific work experience may be more conducive to M&A while the generic component may be more associated to the closure route see Grilli (2009).

these latter bring along, the loss in terms of social welfare that economic crises are responsible for should also take into account this drastic reduction in the dynamic efficiency of the economic system.

REFERENCES

Agarwal, R., and D. Audretsch (2001). "Does Entry Size Matter? The Impact of the Life Cycle and Technology on Firm Survival," *Journal of Industrial Economics* 49, 21-43.

Almus, M., and E.A. Nerlinger (1999). Growth of new technology-based firms: which factors matter? *Small Business Economics* 13, 141-154.

Assinform (2006). *Rapporto Assinform sull'Informatica e le Telecomunicazioni e i Contenuti Multimediali*. AITech-Assinform, Milano.

Åstebro, T., and I. Bernhardt (2003). "Start-up Financing, Owner Characteristics, and Survival," *Journal of Economics & Business* 55, 303–319.

Audretsch, D., E. Santarelli, and M. Vivarelli (1999). "Start-up Size and Industrial Dynamics: some Evidence from Italian Manufacturing," *International Journal of Industrial Organization* 17, 965-983.

Bates, T. (1989). "Small Business Viability in the Urban Ghetto," *Journal of Regional Science* 29, 625–643.

Becker, G.S. (1975). *Human Capital*. National Bureau of Economic Research, New York.

Brüderl, J., P. Preisendörfer, and R. Ziegler (1992). "Survival Chances of Newly Founded Business Organizations," *American Sociological Review* 72, 227–242.

Colombo, M.G., and L. Grilli (2005). "Founders' Human Capital and the Growth of New Technology-based Firms: a Competence Based View," *Research Policy* 34, 795–816.

Colombo, M.G., and L. Grilli (2009). "On Growth Drivers of High-tech Start-ups: Exploring the Role of Founders' Human Capital and Venture Capital," *Journal of Business Venturing*, forthcoming.

Cooper, A.C., F.J. Gimeno-Gascon, and C.Y. Woo (1994). "Initial Human Capital and Financial Capital as Predictors of New Venture Performance," *Journal of Business Venturing* 9, 371–396.

Cressy, R. (1996). "Are Business Start-ups Debt Rationed?" *Economic Journal* 106, 1253-1270.

Delmar, F., and S. Shane (2006). "Does Experience Matter? The Effect of Founding Team Experience on the Survival and Sales of Newly Founded Ventures," *Strategic Organization* 4, 215-247.

DeTienne, D.R., D.A. Shepherd, and J.O. De Castro (2008). "The Fallacy of 'Only the Strong Survive': The Effects of Extrinsic Motivation on the Persistence Decisions for Under-performing Firms," *Journal of Business Venturing* 23, 528-546.

Dunne, T., S.D. Klimek, and M.J. Roberts (2005). "Exit from Regional Manufacturing Markets: the Role of Entrant Experience," *International Journal of Industrial Organization* 23, 399-421.

EITO (2004). *European Information Technology Observatory 2004*. European Information Technology Observatory, Frankfurt.

Esteve-Pérez, S., and J.A. Mańez-Castillejo (2006). "The Resource-based Theory of the Firm and Firm Survival," *Small Business Economics* 30, 231-249.

Esteve-Pérez, S., A. Sanchis-LLopis, and J.A. Sanchis-LLopis (2004). "The Determinants of Survival of Spanish Manufacturing Firms," *Review of Industrial Organization* 25, 251-273.

Evans, D., and B. Jovanovic (1989). "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints," *Journal of Political Economy* 97, 808- 827.

Fransman, M. (2004). "The Telecoms Boom and Bust 1996–2003 and the Role of Financial Markets," *Journal of Evolutionary Economics* 14, 369–406.

Gimeno, J., T. Folta, A. Cooper, and C. Woo (1997). "Survival of the Fittest? Entrepreneurial Human Capital and the Persistence of Underperforming Firms," *Administrative Science Quarterly* 42, 750–783.

Grilli, L. (2009). "Founders' Pre-entry Work Experience and High-tech Start-up Exit during an Industry Crisis: the case of Italian ICT Entrepreneurial Ventures after the Internet Bubble Burst", Hitotsubashi University one-day Conference "*Post-entry performance of firms: survival, innovation and growth*", Tokyo (Japan).

Headd, B. (2003). "Redefining Business Success: Distinguishing between Closure and Failure," *Small Business Economics* 21, 51-61.

Holmes, T.J., and J.A. Schmitz (1990). "A Theory of Entrepreneurship and its Application to the Study of Business Transfers," *Journal of Political Economy* 98, 265-294.

Mata, J., P. Portugal, and P. Guimarães (1995). "The Survival of New Plants: Start-up Conditions and Post-Entry Evolution," *International Journal of Industrial Organization* 13, 459-481.

McGrath, R. (1999). "Falling Forward: Real Options Reasoning and Entrepreneurial Failure," *Academy of Management Review* 24, 13-30.

Nafziger, E.W., and D. Terrell (1996). "Entrepreneurial Human Capital and the Long-run Survival of Firms in India," *World Development* 24, 689–696.

Pennings, J.M., K.M. Lee, and A. van Witteloostuijn (1998). "Human Capital, Social Capital, and Firm Dissolution," *Academy of Management Journal* 41, 425–440.

Santarelli, E., and M. Vivarelli (2007). "Entrepreneurship and the Process of Firms' Entry, Survival and Growth," *Industrial and Corporate Change* 16, 455-488.

Shane, S., and T. Stuart (2002). "Organizational Endowments and the Performance of University Start-ups," *Management Science* 48, 154-170.

Storey, D.J., and P. Wynarczyk (1996). "The Survival and Non-survival of Micro Firms in the UK," *Review of Industrial Organization* 11, 211–229.

Strotmann, H. (2007). "Entrepreneurial Survival," *Small Business Economics* 28, 87-104.

Taylor, M. (1999). "The Survival of the Fittest: an Analysis of Self-employment Duration in Britain," *Economic Journal* 109, 140-155.

Thompson, P. (2005). "Selection and Firm Survival: Evidence from the Shipbuilding Industry, 1825-1914," *Review of Economics and Statistics* 87, 26–36.

Van Praag, M. (2003). "Business Survival and Success of Young Small Business Owners," *Small Business Economics* 21, 1-21.

Watson, J., and J. Everett (1993). "Defining Small Business Failure," *International Small Business Journal* 11, 35-48.

Watson, J., and J. Everett (1996). "Do Small Businesses have High Failure Rates?" *Journal of Small Business Management* 34, 45-62.

Tables and Figures

Table 1 – Definition of explanatory variables

Explanatory variables	*Description*	*Mean*	*S.D.*
Founders	Number of founders	2.888	1.741
Education	Average number of years of education of founders	15.096	2.386
Specific work experience	Average number of years of work experience of founders in the same sector of the start-up before firm's foundation	3.754	6.742
Generic work experience	Average number of years of work experience of founders in sectors other than that of the start-up before firm's foundation	7.855	7.784
Managerial experience	Value of 1 for firms with one or more founders with a prior management position in a company	0.257	0.438
Size	Logarithm of number of employees at the end of 1999	1.386	1.050
Bank debt	Value of 1 for firms which have obtained a bank debt at firm's foundation	0.162	0.369
Age	Number of years from 2000 to firm's foundation	3.201	1.552
Internet	Value of 1 for firms operating in Internet services (e-commerce, ISP, web-related services)	0.687	0.465

Legend. Number of observations is 179.

Table 2 –Correlation matrix of the explanatory variables of the econometric model

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Founders	1.000								
2. Education	0.023	1.000							
3. Specific work experience	-0.134	-0.005	1.000						
4. Generic work experience	-0.029	-0.063	-0.419	1.000					
5. Managerial experience	0.104	0.066	0.233	0.111	1.000				
6. Size	0.059	0.198	0.079	0.050	0.173	1.000			
7. Bank debt	-0.198	-0.040	0.090	-0.095	-0.119	-0.056	1.000		
8. Age	0.118	-0.098	-0.078	-0.123	-0.357	0.069	0.011	1.000	
9. Internet	-0.043	-0.096	-0.095	0.001	0.093	0.118	-0.030	-0.154	1.000

Legend. Number of observations is 179.

Table 3 – Founders' human capital and erosion of founding teams

	Model	*Ordered Logit*
	Dependent variable	*Erosion of founding teams*
a_1	*Founders*	-0.001 (0.096)
a_2	*Education*	0.086 (0.060)
a_3	*Specific work experience*	0.072 (0.029)**
a_4	*Generic work experience*	0.050 (0.024)**
a_5	*Management experience*	-0.472 (0.385)
a_6	*Size*	-0.024 (0.154)
a_7	*Bank debt*	-1.000 (0.430)**
a_8	*Age*	0.081 (0.113)
a_9	*Internet*	1.414 (0.373)***
	Log-likelihood function	-173.867
	Wald test (χ^2): all parameters=0	22.00 (9)***
	Wald test (χ^2): $a_2 = a_3 = a_4 = a_5 = 0$	7.76 (4)*
	pseudo R^2	0.07

Legend. Significance levels: * >90%; ** >95%; *** >99%. Robust standard errors in parentheses. Number of observations is 179.

Table 4 –Robustness checks

	Model	*Ordered probit*		*Multinomial probit*		*Ordered probit*
	Columns	*1*	*2*	*3*	*4*	*5*
	Dependent variable	*Erosion of founding teams*	*Leave of at least one founder*	*Closure*	*M&A*	*Erosion of founding teams*
a_1	*Founders*	0.001 (0.057)	0.130 (0.092)	-0.162 (0.127)	0.060 (0.121)	-
a_2	*Education*	0.050 (0.036)	0.118 (0.073)*	0.044 (0.068)	0.120 (0.068)*	0.974 (0.394)**
a_3	*Specific work experience*	0.042 (0.017)**	0.021 (0.030)	0.048 (0.030)	0.077 (0.029)***	0.167 (0.093)*
a_4	*Generic work experience*	0.029 (0.014)**	0.022 (0.025)	0.052 (0.025)**	0.036 (0.026)	0.207 (0.138)
a_5	*Management experience*	-0.308 (0.233)	-0.033 (0.396)	-0.341 (0.434)	-0.728 (0.476)	-0.013 (2.248)
a_6	*Size*	-0.004 (0.092)	-0.111 (0.157)	-0.217 (0.176)	0.273 (0.173)	-2.255 (1.016)**
a_7	*Bank debt*	-0.608 (0.259)**	-0.450 (0.431)	-0.791 (0.479)*	-1.100 (0.527)**	0.785 (1.347)
a_8	*Age*	0.039 (0.067)	0.235 (0.111)**	-0.028 (0.127)	0.149 (0.124)	0.153 (0.341)
a_9	*Internet*	0.852 (0.216)***	0.664 (0.344)*	1.328 (0.425)***	1.525 (0.417)***	5.105 (2.336)**
	N° of observations	179		179		28
	Log-likelihood function	-173.811		-197.114		-14.685
	Wald test (χ^2): all parameters=0	24.73 (9)***		63.53 (27)***		21.71 (8)***
	pseudo R^2	0.07		-		0.42

Legend. Significance levels: * >90%; ** >95%; *** >99%. Robust standard errors in parentheses.

Elenco Quaderni già pubblicati

1. L. Giuriato, *Problemi di sostenibilità di programmi di riforma strutturale*, settembre 1993.
2. L. Giuriato, *Mutamenti di regime e riforme: stabilità politica e comportamenti accomodanti*, settembre 1993.
3. U. Galmarini, *Income Tax Enforcement Policy with Risk Averse Agents*, novembre 1993.
4. P. Giarda, *Le competenze regionali nelle recenti proposte di riforma costituzionale*, gennaio 1994.
5. L. Giuriato, *Therapy by Consensus in Systemic Transformations: an Evolutionary Perspective*, maggio 1994.
6. M. Bordignon, *Federalismo, perequazione e competizione fiscale. Spunti di riflessione in merito alle ipotesi di riforma della finanza regionale in Italia*, aprile 1995.
7. M. F. Ambrosanio, *Contenimento del disavanzo pubblico e controllo delle retribuzioni nel pubblico impiego*, maggio 1995.
8. M. Bordignon, *On Measuring Inefficiency in Economies with Public Goods: an Overall Measure of the Deadweight Loss of the Public Sector*, luglio 1995.
9. G. Colangelo, U. Galmarini, *On the Pareto Ranking of Commodity Taxes in Oligopoly*, novembre 1995.
10. U. Galmarini, *Coefficienti presuntivi di reddito e politiche di accertamento fiscale*, dicembre 1995.
11. U. Galmarini, *On the Size of the Regressive Bias in Tax Enforcement*, febbraio 1996.
12. G. Mastromatteo, *Innovazione di Prodotto e Dimensione del Settore Pubblico nel Modello di Baumol*, giugno 1996.
13. G. Turati, *La tassazione delle attività finanziarie in Italia: verifiche empiriche in tema di efficienza e di equità*, settembre 1996.
14. G. Mastromatteo, *Economia monetaria post-keynesiana e rigidità dei tassi bancari*, settembre 1996.
15. L. Rizzo, *Equalization of Public Training Expenditure in a Cross-Border Labour Market*, maggio 1997.
16. C. Bisogno, *Il mercato del credito e la propensione al risparmio delle famiglie: aggiornamento di un lavoro di Jappelli e Pagano*, maggio 1997.
17. F.G. Etro, *Evasione delle imposte indirette in oligopolio. Incidenza e ottima tassazione*, luglio 1997.
18. L. Colombo, *Problemi di adozione tecnologica in un'industria monopolistica*, ottobre 1997.
19. L. Rizzo, *Local Provision of Training in a Common Labour Market*, marzo 1998.
20. M.C. Chiuri, *A Model for the Household Labour Supply: An Empirical Test On A Sample of Italian Household with Pre-School Children*, maggio 1998.
21. U. Galmarini, *Tax Avoidance and Progressivity of the Income Tax in an Occupational Choice Model*, luglio 1998.
22. R. Hamaui, M. Ratti, *The National Central Banks' Role under EMU. The Case of the Bank of Italy*, novembre 1998.

23. A. Boitani, M. Damiani, *Heterogeneous Agents, Indexation and the Non Neutrality of Money*, marzo 1999.
24. A. Baglioni, *Liquidity Risk and Market Power in Banking*, luglio 1999.
25. M. Flavia Ambrosanio, *Armonizzazione e concorrenza fiscale: la politica della Comunità Europea*, luglio 1999.
26. A. Balestrino, U. Galmarini, *Public Expenditure and Tax Avoidance,* ottobre 1999.
27. L. Colombo, G. Weinrich, *The Phillips Curve as a Long-Run Phenomenon in a Macroeconomic Model with Complex Dynamics*, aprile 2000.
28. G.P. Barbetta, G. Turati, *L'analisi dell'efficienza tecnica nel settore della sanità. Un'applicazione al caso della Lombardia*, maggio 2000.
29. L. Colombo, *Struttura finanziaria delle imprese, rinegoziazione del debito Vs. Liquidazione. Una rassegna della letteratura*, maggio 2000.
30. M. Bordignon, *Problems of Soft Budget Constraints in Intergovernmental Relationships: the Case of Italy*, giugno 2000.
31. A. Boitani, M. Damiani, *Strategic complementarity, near-rationality and coordination*, giugno 2000.
32. P. Balduzzi, *Sistemi pensionistici a ripartizione e a capitalizzazione: il caso cileno e le implicazioni per l'Italia,* luglio 2000.
33. A. Baglioni, *Multiple Banking Relationships: competition among "inside" banks*, ottobre 2000.
34. A. Baglioni, R. Hamaui, *The Choice among Alternative Payment Systems: The European Experience*, ottobre 2000.
35. M.F. Ambrosanio, M. Bordignon, *La concorrenza fiscale in Europa: evidenze, dibattito, politiche*, novembre 2000.
36. L. Rizzo, *Equalization and Fiscal Competition: Theory and Evidence*, maggio 2001.
37. L. Rizzo, *Le Inefficienze del Decentramento Fiscale*, maggio 2001.
38. L. Colombo, *On the Role of Spillover Effects in Technology Adoption Problems*, maggio 2001.
39. L. Colombo, G. Coltro, *La misurazione della produttività: evidenza empirica e problemi metodologici*, maggio 2001.
40. L. Cappellari, G. Turati, *Volunteer Labour Supply: The Role of Workers' Motivations*, luglio 2001.
41. G.P. Barbetta, G. Turati, *Efficiency of junior high schools and the role of proprietary structure*, ottobre 2001.
42. A. Boitani, C. Cambini, *Regolazione incentivante per i servizi di trasporto locale*, novembre 2001.
43. P. Giarda, *Fiscal federalism in the Italian Constitution: the aftermath of the October 7th referendum*, novembre 2001.
44. M. Bordignon, F. Cerniglia, F. Revelli, *In Search for Yardstick Competition: Property Tax Rates and Electoral Behavior in Italian Cities*, marzo 2002.
45. F. Etro, *International Policy Coordination with Economic Unions*, marzo 2002.
46. Z. Rotondi, G. Vaciago, *A Puzzle Solved: the Euro is the D.Mark*, settembre 2002.
47. A. Baglioni, *Bank Capital Regulation and Monetary Policy Transmission: an heterogeneous agents approach*, ottobre 2002.
48. A. Baglioni, *The New Basle Accord: Which Implications for Monetary Policy Transmission?*, ottobre 2002.
49. F. Etro, P. Giarda, *Redistribution, Decentralization and Constitutional Rules*, ottobre 2002.
50. L. Colombo, G. Turati, *La Dimensione Territoriale nei Processi di Concentrazione dell'Industria Bancaria Italiana*, novembre 2002.

51. Z. Rotondi, G. Vaciago, *The Reputation of a newborn Central Bank*, marzo 2003.
52. M. Bordignon, L. Colombo, U. Galmarini, *Fiscal Federalism and Endogenous Lobbies' Formation*, ottobre 2003.
53. Z. Rotondi, G. Vaciago, *The Reaction of central banks to Stock Markets*, novembre 2003.
54. A. Boitani, C. Cambini, *Le gare per i servizi di trasporto locale in Europa e in Italia: molto rumore per nulla?*, febbraio 2004.
55. V. Oppedisano, *I buoni scuola: un'analisi teorica e un esperimento empirico sulla realtà lombarda*, aprile 2004.
56. M. F. Ambrosanio, *Il ruolo degli enti locali per lo sviluppo sostenibile: prime valutazioni*, luglio 2004.
57. M. F. Ambrosanio, M. S. Caroppo, *The Response of Tax Havens to Initiatives Against Harmful Tax Competition: Formal Statements and Concrete Policies*, ottobre 2004.
58. A. Monticini, G. Vaciago, *Are Europe's Interest Rates led by FED Announcements?*, dicembre 2004.
59. A. Prandini, P. Ranci, *The Privatisation Process*, dicembre 2004.
60. G. Mastromatteo, L. Ventura, *Fundamentals, beliefs, and the origin of money: a search theoretic perspective,* dicembre 2004.
61. A. Baglioni, L. Colombo, *Managers' Compensation and Misreporting*, dicembre 2004.
62. P. Giarda, *Decentralization and intergovernmental fiscal relations in Italy: a review of past and recent trends,* gennaio 2005.
63. A. Baglioni, A. Monticini, *The Intraday price of money: evidence from the e-MID market*, luglio 2005.
64. A. Terzi, *International Financial Instability in a World of Currencies Hierarchy*, ottobre 2005.
65. M. F. Ambrosanio, A. Fontana, *Ricognizione delle Fonti Informative sulla Finanza Pubblica Italiana*, gennaio 2006.
66. L. Colombo, M. Grillo, *Collusion when the Number of Firms is Large*, marzo 2006.
67. A. Terzi, G. Verga, *Stock-bond correlation and the bond quality ratio: Removing the discount factor to generate a "deflated" stock index,* luglio 2006.
68. M. Grillo, *The Theory and Practice of Antitrust. A perspective in the history of economic ideas,* settembre 2006.
69. A. Baglioni, *Entry into a network industry: consumers' expectations and firms' pricing policies*, novembre 2006.
70. Z. Rotondi, G. Vaciago, *Lessons from the ECB experience: Frankfurt still matters!*, marzo 2007.
71. G. Vaciago, *Gli immobili pubblici…..ovvero, purché restino immobili*, marzo 2007.
72. F. Mattesini, L. Rossi, *Productivity shocks and Optimal Monetary Policy in a Unionized Labor Market Economy*, marzo 2007.
73. L. Colombo, G. Femminis, *The Social Value of Public Information with Costly Information Acquisition*, marzo 2007.
74. L. Colombo, H. Dawid, K. Kabus, *When do Thick Venture Capital Markets Foster Innovation? An Evolutionary Analysis*, marzo 2007.
75. A. Baglioni, *Corporate Governance as a Commitment and Signalling Device*, novembre 2007.
76. L. Colombo, G. Turati, *The Role of the Local Business Environment in Banking Consolidation*, febbraio 2008.

77. F. Mattesini, L. Rossi, *Optimal Monetary Policy in Economies with Dual Labor Markets*, febbraio 2008.
78. M. Abbritti, A. Boitani, M. Damiani, *Labour market imperfections, "divine coincidence" and the volatility of employment and inflation*, marzo 2008.
79. S. Colombo, *Discriminatory prices, endogenous locations and the Prisoner Dilemma problem*, aprile 2008.
80. L. Colombo, H. Dawid, *Complementary Assets, Start-Ups and Incentives to Innovate*, aprile 2008.
81. A. Baglioni, *Shareholders' Agreements and Voting Power, Evidence from Italian Listed Firms*, maggio 2008.
82. G. Ascari, L. Rossi, *Long-run Phillips Curve and Disinflation Dynamics: Calvo vs. Rotemberg Price Setting*, settembre 2008.
83. A. Baglioni, A. Monticini, *The intraday interest rate under a liquidity crisis: the case of August 2007*, ottobre 2008.
84. M. F. Ambrosanio, M. Bordignon, F. Cerniglia, *Constitutional reforms, fiscal decentralization and regional fiscal flows in Italy*, dicembre 2008.
85. S. Colombo, *Product differentiation, price discrimination and collusion*, marzo 2009.
86. L. Colombo, G. Weinrich, *Persistent disequilibrium dynamics and economic policy*, marzo 2009.
87. M. Bordignon, G. Tabellini, *Moderating Political Extremism: Single Round vs Runoff Elections under Plurality Rule*, aprile 2009.
88. S. Colombo, L. Grilli, C. Rossi Lamastra, *On the determinants of the degree of openness of Open Source firms: An entry model*, maggio 2009.
89. A. Baglioni, M. Grillo, *Calamità naturali e assicurazione: elementi di analisi per una riforma*, settembre 2009.
90. S. Colombo, *Pricing Policy and Partial Collusion*, ottobre 2009.
91. A. Baglioni, *Liquidity crunch in the interbank market: is it credit or liquidity risk, or both?*, novembre 2009.
92. S. Colombo, *Taxation and Predatory Prices in a Spatial Model*, marzo 2010.
93. A.Baglioni, A.Boitani, M.Liberatore, A.Monticini, *Is the leverage of European Commercial Banks Pro-Cyclical?*, maggio 2010
94. M. Bordignon, S. Piazza, *Who do you blame in local finance? An analysis of municipal financing in Italy*, maggio 2010
95. S. Colombo, *Bertrand and Cournot in the unidirectional Hotelling model*, maggio 2010
96. A. Baglioni, L. Colombo, *The efficiency view of corporate boards: theory and evidence*, luglio 2010
97. S. Brusco, L. Colombo, U. Galmarini, *Local Governments Tax Autonomy, Lobbying, and Welfare*, luglio 2010
98. S. Colombo, L. Grilli, *Another unconsidered sinister effect of industry-specific crises? On the possible emergence of adverse selection phenomena on the survival of entrepreneurial ventures*, luglio 2010