

# Entrepreneurship in Equilibrium <sup>\*</sup>

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March 10, 2005

## **Abstract**

This paper compares the financing of new ventures in start-ups (entrepreneurship) and in established firms (intrapreneurship). Intrapreneurship allows established firms to use information on failed intrapreneurs to redeploy them into other jobs. By contrast, failed entrepreneurs must seek other jobs in an imperfectly informed external labor market. While this is ex-post inefficient, it provides entrepreneurs with high-powered incentives ex ante. We show that two types of equilibria can arise (and sometimes coexist). In a low (high) entrepreneurship equilibrium, the market for failed entrepreneurs is thin (deep). Internal (external) labor markets are thus particularly valuable, which favors intrapreneurship (entrepreneurship). We also characterize conditions under which there can be too little or too much entrepreneurial activity in equilibrium.

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<sup>\*</sup>We would like to thank Adolfo de Motta, Matthias Dewatripont, Ana Fernandes, Paul Gompers, Augustin Landier, Josh Lerner, Espen Moen, Raghuram Rajan, Asa Rosen, Antoinette Schoar, Jan Zabojsnik, as well as participants in seminars at Amsterdam, Barcelona, Bergen, Bristol, Chicago, City Business School Gerzensee, HBS, INSEAD, London Business School, LSE, Mannheim, MIT, Munich, NBER, Northwestern, Oslo, Oxford, Paris, Rome, Salerno, Southampton, Toulouse, and USC for valuable comments. This research was supported by National Science Foundation Grant SES 00-79176. All remaining errors are our own.

# 1 Introduction

IBM spends billions of dollars every year on R&D, much of it aimed at creating new products and businesses. At the same time, venture capital firms such as Greylock spend large sums funding R&D at start-up ventures, also with the goal of creating new products and businesses. Scientists and executives routinely leave large companies to start their own firms, and sometimes they go back to work for the very firms they left. What determines whether new ventures are funded by established companies such as IBM or by venture capitalists such as Greylock? Why do some people choose to create new products for existing companies while others strike out on their own? Why are so many new, technology-intensive business ventures undertaken by start-ups in the U.S., while high-tech entrepreneurship of this sort is much less common in Europe? Do the different rates of entrepreneurship matter?

This paper seeks to address these questions by modeling the choice between entrepreneurship and “intrapreneurship”, i.e., the choice between start-ups and business venturing by established companies. The key distinction we draw between the two types of business creation is that internal ventures are funded by firms with related projects. Thus, failed intrapreneurs can be redeployed by their firms into other jobs. By contrast, failed entrepreneurs must seek employment at other firms or start other new ventures.

We argue that the intrapreneurial safety net has both benefits and costs. The benefit is that firms learn about the abilities of their managers, thereby enabling them to keep the good ones for their other projects even if the new venture fails. Thus, firms can avoid having to hire managers from the general labor market where they are less well-informed about a job applicant’s abilities. The cost is that the safety net is bad for incentives; knowing that failure is less costly in an internal venture than in an entrepreneurial venture, intrapreneurs will be less prone to take the necessary (but personally costly) actions to make the business a success. In deciding whether the best funding source for a new business is an intrapreneurial firm or an independent venture capitalist, there is a trade-off between the informational benefits of an internal labor market and its adverse incentive effects. The model implies that new ventures in which incentives are important — those where the payoffs from the new business are potentially quite large — will be undertaken by entrepreneurial firms. And, the

model implies that when the external labor market has many high quality managers available to replace failed intrapreneurs, the value of the internal labor market is low and more new ventures will be financed in entrepreneurial firms.

This basic model of the choice of organizational form is combined with a model of the labor market to generate an equilibrium model of entrepreneurial activity. One of the key aspects of this labor market model is that no one wants to hire a failed intrapreneur; the only ones that are on the job market are those that firms have chosen not to retain, i.e., the ones they learn are bad.<sup>1</sup> Failed entrepreneurs, by contrast, are not stigmatized in this way because venture capitalists have no jobs to which the entrepreneurs can be redeployed; being on the job market after failing in a start-up is not as bad a signal as being fired from an established firm. Thus, if there is a lot of entrepreneurial activity, there will be a large supply of relatively high quality failed entrepreneurs. This in turn, makes it relatively more attractive to choose an entrepreneurial form of organization since the informational benefits of an internal labor market are reduced.

This sort of reasoning suggests that there can be multiple equilibria. At low levels of entrepreneurial activity, it pays to set up an intrapreneurial firm — one with multiple related projects to which managers can be redeployed if they fail — because it's hard to find qualified managers in the external labor market. At high levels of entrepreneurial activity it pays to be entrepreneurial because it's easy to find skilled managers; the benefit of internal labor markets is small relative to the benefit of providing high-powered incentives in entrepreneurial firms.

The model also identifies an externality that may lead to too little entrepreneurial activity. As described above, when there are more entrepreneurs, there will be a greater supply of good managers in the labor market; this increases the payoffs to firms that need new managers. In deciding on an organizational form, however, everyone takes as given the choices that others make, and thus take as given the quality of the labor market for managers. As a result, would-be entrepreneurs do not internalize the positive effect they have on the labor market and the payoffs to firms that use it. In equilibrium, there can be too few entrepreneurs.

We also extend the model to show that there can be too much entrepreneurial

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<sup>1</sup>Literally, we do not need that failed intrapreneurs remain unemployed. All that is needed is that their prospects be worse than those of failed entrepreneurs.

activity. If entrepreneurial activity is high, then it is relatively easy for failed entrepreneurs to find jobs in other firms. Thus, the penalty for failure is not as high as it would be were there little entrepreneurial activity. Thus, the decision to become an entrepreneur reduces the effort of other entrepreneurs, an effect that would-be entrepreneurs don't take into account when they make their decision of whether to be entrepreneurial or intrapreneurial.

This paper is related to a number of different lines of work. Perhaps the closest links are to Gertner, Scharfstein and Stein (1994) and Landier (2001 a,b). The former paper studies essentially the same question though its emphasis is on the costs and benefits of internal capital markets. In their paper as in ours, internal financing comes with lower-powered incentives: because corporate headquarters controls the firm's projects, they can extract rents from the manager ex post, thereby reducing his ex ante effort incentives. The benefit of internal financing is that if a project fails assets can be redeployed into other lines of business. Our paper differs in three ways. First, our model focuses on the redeployability of people, not assets. Second, the lower incentives in firms stems from the redeployability of people to other jobs in the firm, not the ability of corporate headquarters to extract rents. Third, in our model, the choice of organizational form is embedded in a labor market model to determine the equilibrium level of entrepreneurship.

Landier (2001 a,b) also considers an equilibrium model of entrepreneurship. The capital and labor markets cannot distinguish between good and bad second-time entrepreneurs, i.e., failed entrepreneurs who want to start a new venture. Like in our model, there can be multiple equilibria. If the capital market thinks that second-timers tend to do so because their previous venture failed, then funding will be expensive for second-timers and therefore first-timers will be reluctant to start a new venture. As a result, there won't be much entrepreneurial activity. If, instead, the capital market interprets second timer entrepreneurs as pursuing a more promising idea, then second-timers will get funded and first-timers will not hesitate to switch project. In this equilibrium, entrepreneurial activity will be high. While Landier's model and ours share the feature that the market's perception of failure is important in understanding entrepreneurship, they differ in two key aspects. First, despite the common terminology, our papers focus on two different aspects of entrepreneurship. Landier defines entrepreneurship as the fact of starting a new project, while we con-

sider entrepreneurship as a choice of organization form, i.e., setting up an independent business. In that respect, our models complement each other. Second, in our model, the market's perception of failure is determined endogenously by the type of organization (entrepreneurial or intrapreneurial firm) which the agent has left, while in Landier's model, entrepreneurs can choose whether to leave their first venture or not.

Finally, we note that there is a large and growing literature on the financing of new ventures through venture capital (Berglof, 1994, Gompers, 1995, and Hellman 1998). These papers, however, focus on understanding the details of these financing arrangements such as the use of convertible preferred stock, and the allocation of control rights, and the staging of investments over time. Our model abstracts from the details of venture capital financing and instead uses a simple contracting model to capture the incentive issues that arise in the two organizational forms we consider.

The remainder of the paper is organized as follows. The next section describes the basic model of the choice between entrepreneurial and intrapreneurial forms of organization. Section 3 embeds this model in a labor market model and characterizes the equilibria that can result. We also analyze the efficiency of the equilibria both from the perspective of industry profit maximization and social welfare maximization. We conclude the paper in Section 4 with a discussion of the ways in which we plan to extend the model.

## 2 The Model

There are three dates — 0, 1, and 2 — and two types of agents, investors and managers. All are assumed to be risk neutral, and there is no discounting between periods.

At date 0, investors have access to two projects  $X$  and  $Y$ . Consider project  $X$  first. Project  $X$  requires the effort and expertise of a manager at date 0. Initially, no one knows whether the manager is good or bad, not even the manager himself. Hence, there is no problem of asymmetric information at that stage. The probability that the manager is good at date 0 is  $\beta$ , and the probability that he is bad is  $1 - \beta$ . The manager chooses a level of effort  $\theta$ , which increases the probability that project  $X$  succeeds, though he incurs a personal, non-pecuniary cost of  $\frac{1}{2}c\theta^2$  in doing so, where

$c > 0$ .<sup>2</sup> This effort choice cannot be observed by anyone outside the firm and thus contracts cannot be made contingent on it.

If the manager is good, then, with probability  $\theta$ , everyone learns at date 1 that the project is a success and that it will pay off  $X$  at date 2 provided the manager stays with the project until then. With probability  $1 - \theta$  it becomes known at date 1 that the project is a failure, the payoff is zero, and the project is shut down. If the manager is not good, effort has no effect on the probability of success; the project always pays off 0. At date 1, the investor and the manager learn whether the latter is good or bad. This information is not available to anyone outside the firm.<sup>3</sup>

The  $Y$  project cannot be undertaken until date 1, after the payoffs from the  $X$  project are observed. For simplicity, we assume that it requires no effort, just the involvement of a good manager. If the manager is good, then the project pays off  $Y$  at date 2; if he is bad it pays off nothing.

At date 0, investors choose the organizational form in which to take projects  $X$  and  $Y$ . The investor can choose to keep both projects or to sell project  $X$  to someone who has no other projects. We think of the organization with just project  $X$  as an entrepreneurial firm or start-up. We will call these E-firms and the managers that run them entrepreneurs. We can think of the investor in an E-firm as a venture capital firm.<sup>4</sup> New venture activity taken under the auspices of a firm with other business ventures is often called intrapreneurship. Thus, we can think of firms with both projects,  $X$  and  $Y$ , as established firms engaged in intrapreneurial ventures, funding internally. We will refer to them as I-firms.<sup>5</sup> Investors choose the organization form (E-firm or I-firm) that maximizes their expected profits.

The main goals of our analysis are to understand (i) the factors that lead organizations to be entrepreneurial or intrapreneurial; (ii) the differences between these organizational forms; (iii) the equilibrium level of entrepreneurial activity; (iv) the

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<sup>2</sup>We will refer to this choice as effort, though what we really have in mind is that there are things that managers like to do (e.g., product development) and things he does not like to do (e.g., marketing). Choosing a high  $\theta$  means choosing to do things such as marketing that the manager does not like to do but that increases the probability of success.

<sup>3</sup>In essence, we assume that the investor learns more about the manager he employs than investors outside the firm do. This type of assumption is relatively standard in the literature on labor markets.

<sup>4</sup>Because we focus on incentive for project  $X$  only, we can think of the organization with just project  $Y$  as an existing firm, possibly with multiple projects.

<sup>5</sup>Throughout, we assume that the organization form is irreversible. In particular, investors cannot trade projects at date 1. While this feature could be endogenized, we keep it exogenous for simplicity.

efficiency of equilibrium.<sup>6</sup>

## 2.1 Entrepreneurial Firms

We first consider the entrepreneurial firm, i.e., the case in which the investor has sold project  $X$  to another investor (e.g. a venture capital firm) who then needs to motivate the entrepreneur.

In order to motivate the entrepreneur to undertake effort, the investor must make pay contingent on performance. We assume that the outcome of the  $X$  project is observable and verifiable so that contracts can be made contingent on the outcome. Thus, the contract specifies a payment,  $w_x$ , if the outcome of the project is  $X$  and  $w_0$ , if the outcome of the project is 0. If the project succeeds the manager stays on managing the project without exerting any further effort. However, if the project fails, the manager seeks a job elsewhere for the second period. His only job alternative is to be hired by a firm with one of the  $Y$  projects; these are the only new projects undertaken at date 1. In general, the wage he receives from this second job will depend on his bargaining power and his perceived ability (since the payoff  $Y$  is realized only if the project is overseen by a good manager). For the moment, we simplify matters by assuming that the manager of a failed entrepreneurial firm has no bargaining power and that he is paid his opportunity wage, zero, by a firm with a  $Y$  project. We relax this assumption in section 4.

The optimal contract is one that maximizes investor profits subject to the constraint that the entrepreneur receives at least his outside option, zero, and that wages are never negative given that the entrepreneur has no outside wealth. There is also an incentive constraint that determines the level of effort as a function of the incentive contract. The entrepreneur's expected utility is:

$$\beta\theta w_x + \beta(1 - \theta)w_0 + (1 - \beta)w_0 - \frac{1}{2}c\theta^2. \quad (1)$$

For a given contract, characterized by  $w_x$  and  $w_0$ , the optimal effort level  $\theta$  chosen by the entrepreneur is given by:

$$\beta(w_x - w_0) - c\theta = 0 \quad (2)$$

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<sup>6</sup>We assume throughout that parameters are such that optimization problems have interior solutions.

The investor's expected profits from this project are

$$\beta\theta(X - w_x) + \beta(1 - \theta)(-w_0) + (1 - \beta)(-w_0). \quad (3)$$

On the assumption that the individual rationality constraint is never binding — we will check that this is the case later — the optimal contract maximizes expression (3) subject to the incentive compatibility constraint (2). It is straightforward to show that  $w_x > 0$  and that  $w_0 = 0$ . Given the risk neutrality of the entrepreneur, there is no reason to reward him for a bad outcome. To see this more formally, suppose that the Lagrange multiplier on the incentive compatibility constraint (2) is given by  $\mu$ . The first order condition with respect to  $w_x$  and  $w_0$  of the associated Lagrangian is:

$$\frac{\partial L}{\partial w_x} = -\beta\theta + \mu\beta \leq 0, \quad (4)$$

$$\frac{\partial L}{\partial w_0} = -(1 - \beta\theta) - \mu\beta \leq 0. \quad (5)$$

Since  $w_x > w_0 \geq 0$  to induce positive effort it follows that condition (4) is met with equality and that  $\mu = \theta$ . This, in turn, implies that condition (5) is satisfied with a strict inequality and that  $w_0 = 0$ . The first order condition for the choice of  $\theta$  is

$$\frac{\partial L}{\partial \theta} = \beta(X - w_x) - \mu c = 0. \quad (6)$$

Substituting  $w_x = c\theta/\beta$  from condition (2) and  $\mu = \theta$  from condition (4), condition (6) implies that the level of effort that is implemented in entrepreneurial firms,  $\theta_E$ , can be written as:

$$\theta_E = \frac{\beta}{2c}X \quad (7)$$

Not surprisingly effort is increasing in  $X$  and  $\beta$  and declining in the cost of effort,  $c$ . Note that the optimal level of effort is less than the first best level of effort which is  $\frac{\beta X}{c}$ . This is the case because the marginal benefit of increasing effort is reduced by the wage that needs to be paid in order to induce effort. Given these values of the optimal contract, the entrepreneur's expected utility is

$$\frac{1}{2}c\theta_E^2 = \frac{1}{8c}\beta^2 X^2 > 0. \quad (8)$$

Therefore the entrepreneur's individual rationality constraint is satisfied. The investor's expected profits from the  $X$  project are:

$$\beta\theta_E \left( X - \frac{c\theta_E}{\beta} \right) = c\theta_E^2 = \frac{1}{4c}\beta^2 X^2. \quad (9)$$

The above discussion outlines the payoffs from the  $X$  project. These are captured by the initial investor when project  $X$  is sold. We also need to take the value of the  $Y$  project into account. The project's value depends on the quality of the managers who will be hired to run it at date 1. For now, suppose that a manager can be found with probability  $p$ , and that this manager has a probability  $\lambda$  of being good. The parameters,  $p$  and  $\lambda$ , for the moment exogenous, will later be endogenized. The expected profit from owning project  $Y$  is  $p\lambda Y$ . Overall, the expected profits to the investor of the setting up project  $X$  as a separate entrepreneurial firm,  $\Pi_E$ , can be written as:

$$\Pi_E = \beta\theta_E \left( X - \frac{c\theta_E}{\beta} \right) + p\lambda Y, \quad (10)$$

$$= c\theta_E^2 + p\lambda Y. \quad (11)$$

## 2.2 Intrapreneurial Firms

The key distinction between entrepreneurial (E) firms and intrapreneurial (I) firms is that I-firms have two projects,  $X$  and  $Y$ . Thus, if the  $X$  project fails, the investor has the option of redeploying the manager onto the  $Y$  project. If he observes that the manager is good despite failing, he will redeploy the manager onto the  $Y$  project. By doing so, he knows that he will get output of  $Y$ , though he may have to share some of it with the manager. He could also try to hire a new manager from the outside labor market just as E-firms do. However, the managers on the outside labor market will be hired only with probability  $p$  and generate  $Y$  with probability  $\lambda$ . It is thus more efficient to retain a manager identified as good rather than replace him with a new one. In the event that the  $X$  project fails because the manager is bad, the investor will choose to try and hire someone from the outside labor market, and will get  $Y$  with probability  $p\lambda$ . The same will happen if the project succeeds and the good manager is needed to run the  $X$  project until date 2. Bargaining between the investor and the manager retained or hired at date 1 will result in the efficient outcome. The investor looks for an outside manager only if the incumbent manager is successful in the  $X$  project, or if he turns out to be of the bad type.

We also need to describe how surplus is shared between the investor and the manager hired (or retained) at date 1. We assume that if a manager is hired from the outside labor market, he is paid zero and the investor receives the entire expected payoff  $p\lambda Y$ . (We relax this assumption later in the paper.) If the good manager is retained, he receives a share  $1 - \gamma$  of the surplus he generates,  $Y - p\lambda Y$ . His payoff is thus

$$(1 - \gamma)(1 - p\lambda)Y, \quad (12)$$

and the investor receives the rest of the payoff from the  $Y$  project,

$$p\lambda Y + \gamma(Y - p\lambda Y). \quad (13)$$

The analysis of the optimal contract proceeds along familiar lines. The one difference is that in the event the  $X$  project fails and the manager is good, he gets a payoff in excess of zero because he is redeployed to another project on which he is able to earn rents. Also, in this case, the investor is able to get more than  $p\lambda Y$ . The optimal contract, therefore, maximizes:

$$\beta\theta(X - w_x) + \beta(1 - \theta)[\gamma(1 - p\lambda)Y - w_0] + (1 - \beta)(-w_0) + p\lambda Y. \quad (14)$$

The manager's expected utility is

$$\beta\theta w_x + \beta(1 - \theta)[(1 - \gamma)(1 - p\lambda)Y + w_0] + (1 - \beta)w_0 - \frac{1}{2}c\theta^2. \quad (15)$$

As before, it is straightforward to show that  $w_0 = 0$ ; we do not repeat the arguments here. The manager's first order condition for the selection of  $\theta$  is as follows:

$$\beta[w_x - (1 - \gamma)(1 - p\lambda)Y] - c\theta = 0. \quad (16)$$

By comparing conditions (2) and (16) it is clear that in order to motivate the same level of effort in E and I-firms, one has to pay a higher wage,  $w_x$  in I-firms; given that good managers get a higher payoff when they fail in I-firms they have to be paid more for success. As before, if  $\mu$  is the Lagrange multiplier on the incentive constraint (16), the first order condition for  $w_x$ , implies that  $\mu = \theta$ . The first order condition with respect to  $\theta$  is:

$$\beta[X - w_x - \gamma(1 - p\lambda)Y] - c\theta = 0. \quad (17)$$

From condition (16) it follows that

$$w_x = \frac{c\theta}{\beta} + (1 - \gamma)(1 - p\lambda)Y. \quad (18)$$

Substituting this expression for  $w_x$  into (17) generates the following expression for  $\theta$  in intrapreneurial firms,  $\theta_I$ :

$$\theta_I = \frac{\beta}{2c}[X - (1 - p\lambda)Y]. \quad (19)$$

Notice that effort in I-firms is always lower than that in E-firms;  $\theta_I < \theta_E$ . Notice also that  $\theta_I$  does not depend on the bargaining power of investors in intrapreneurial firm. This is because an increase in  $\gamma$  has two effects. On the one hand, inducing a higher level of effort by the manager is less costly for the investor because the manager receives less rent when he is reallocated to the  $Y$  project following failure of the  $X$  project. On the other hand, the investor is less keen to induce high effort because he receives a higher expected payoff following failure of the  $X$  project. In our set-up both effects cancel out and the optimal effort level implemented is independent of  $\gamma$ .

Substituting  $w_x$  into the expression for the investor's profits reveals the trade-offs that he faces. Expected profits can be written as:

$$\Pi_I = \beta\theta_I[X - \frac{c\theta_I}{\beta} - (1 - \gamma)(1 - p\lambda)Y] + \beta(1 - \theta_I)\gamma(1 - p\lambda)Y + p\lambda Y. \quad (20)$$

On the one hand, having the  $Y$  project increases expected profits relative to an entrepreneurial firm because it enables the investor to redeploy a good manager onto the  $Y$  project with probability  $\beta(1 - \theta)$  and to earn rents of  $\gamma(1 - p\lambda)Y$ . On the other hand, being able to redeploy the manager in this way creates incentive problems in the  $X$  project. The intrapreneurial manager knows that with probability  $\beta(1 - \theta)$  he will be redeployed and earn rents of  $(1 - \gamma)(1 - p\lambda)Y$ . Thus, to motivate his effort he will have to be paid more for a successful outcome of the  $X$  project.

Finally, we note that  $\Pi_I$  can be written as:

$$\Pi_I = c\theta_I^2 + \beta\gamma(1 - p\lambda)Y + p\lambda Y. \quad (21)$$

### 2.3 Entrepreneurship vs. Intrapreneurship

We now examine the factors that lead the investor to choose an entrepreneurial or intrapreneurial form of organization. Analytically, this just amounts to comparing

$\Pi_E$  and  $\Pi_I$ . Using the expressions (11) and (21) for  $\Pi_E$  and  $\Pi_I$ , we see that

$$\Pi_E - \Pi_I = c[\theta_E^2 - \theta_I^2] - \beta\gamma(1 - p\lambda)Y \quad (22)$$

This expression is the difference between two positive terms. The first term reflects the advantage of E-firms over I-firms in terms of incentives (recall that  $\theta_E > \theta_I$ ). The second term captures the advantage of I-firms over E-firms in terms of identifying and allocating good managers to projects.

At this point it worth emphasizing why I-firms cannot always do as least as well as E-firms. The problem of I-firms is one of time inconsistency. Ex-ante, I-firms might find it optimal to threaten their manager to fire them in case of failure. However, ex-post, if the failed intrapreneur has been identified as a high ability manager, the investor will find it optimal to retain him nevertheless. This commitment problem is absent for E-firms because they have no project to which the failed entrepreneurs can be reallocated.<sup>7</sup>

Substituting  $\theta_E$  and  $\theta_I$  in the above expression and rearranging terms we see that  $\Pi_E > \Pi_I$  provided that the following condition holds

$$\frac{\beta}{2c}[X - (1 - p\lambda)\frac{Y}{2}] > \gamma. \quad (23)$$

This inequality generates predictions about the factors that will lead some projects to be undertaken in entrepreneurial and others in intrapreneurial settings. They are summarized in our first proposition below.

**Proposition 1** *Given  $p$  and  $\lambda$ ,*

- (i) Projects with high payoffs,  $X$ , will be financed in entrepreneurial firms;*
- (ii) Higher ability managers (i.e., with high  $\beta$ ) will become entrepreneurs;*
- (iii) Projects with low associated effort costs,  $c$ , will be financed in entrepreneurial firms and managers with low effort costs will become entrepreneurs;*

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<sup>7</sup>A related argument is developed in Crémer (1995). In his model of arm's length relationships, a principal can optimally choose to remain uninformed about a agent so as not to have incentive to renegotiate his incentive contract ex-post. In our model, investors in E-firms are informed but cannot use this information. Our point is also related to the literature on the soft budget constraint and information. See Dewatripont and Maskin (1995) and Burkart, Gromb and Panunzi (1995).

- (iv) *When the alternative project,  $Y$ , has low value the project  $X$  will be financed in entrepreneurial firms;*
- (v) *When there is an active market for high quality managers to run project  $Y$  (i.e.,  $p\lambda$  is high), project  $X$  will be financed by entrepreneurial firms;*
- (vi) *When intrapreneurial firms have little bargaining power with respect to their managers (i.e.,  $\gamma$  is small), projects will be financed in entrepreneurial firms.*

Proposition 1 summarizes some of the main findings of the paper and is a key building block for our analysis of the equilibrium level of entrepreneurial activity developed in the next sections. When there are large differences in the effort levels between E-firms and I-firms, it is better to finance the project in entrepreneurial settings. This occurs when the payoffs from inducing the manager to take high effort are large — i.e., when project payoffs,  $X$ , are high, when managers are likely to be good (high  $\beta$ ), and when effort costs are small ( $c$  low). This explains parts (i)-(iii) of the proposition.

The reason to finance the  $X$  project within I-firms is to take advantage of the information that is learned about the ability of the manager. If he turns out to be a good manager even though the project fails, he can be redeployed to the  $Y$  project and the firm will earn some portion  $\gamma$  of the surplus generated by being able to put someone of known high ability in the  $Y$  project instead of someone of uncertain ability  $(1 - p\lambda)Y$ . Thus, when  $Y$  is small the value of redeployability is low and E-firms are a more attractive organizational form.

If particular interest is the influence of characteristics of the outside labor market on the optimal choice of organizational structure. Recall that the value of both E-firms and I-firms increases with the depth of the outside labor market for high ability managers, i.e., with  $p$  and  $\lambda$ . Proposition 1(v) states that the difference in values,  $\Pi_E(\alpha) - \Pi_I(\alpha)$ , is also increasing in  $p$  and  $\lambda$ . When  $p$  and  $\lambda$  are high, high ability managers can be easily found in the labor market and so there is less value to knowing that the intrapreneurial manager is good.

When the intrapreneurial firm has limited bargaining power, the rents that the firm receives from redeployability are low (even though  $(1 - p\lambda)Y$  may be relatively high), so that an entrepreneurial organizational structure is more appealing.

The model also allows us to compare incentives and compensation in E-firms and I-firms. E-firms have more high-powered incentives as measured by the difference in the compensation between good and bad outcomes. For E-firms this difference is  $X/2$ , whereas for  $Y$  firms the difference is only  $[X - (1 - p\lambda)Y]/2$ . However, it is not necessarily the case that compensation for success,  $w_x$ , is higher in E-firms. Indeed, because the payoff when performance is poor is higher in I-firms — it's  $(1 - \gamma)(1 - p\lambda)Y$  compared to zero in E-firms —  $w_x$  has to be higher to induce the same effort in an I-firm as in an E-firm. Comparing conditions (2) and (18), the expressions for  $w_x$  in E-firms and I-firms, and substituting the optimal levels of effort, we see that  $w_x$  in I-firms will exceed that in E-firms provided that  $\gamma < 1/2$ . By contrast, casual empiricism suggests that the upside compensation is much higher for entrepreneurs than it is for managers of established firms. Indeed, this is one of the reasons often offered for why managers leave established firms to start their own companies. How can we square this result with the contradictory casual empiricism? The answer lies in recognizing that the characteristics of E and I-firms differ along other dimensions that affect  $w_x$ . In particular, from equation (23) and Proposition 1, we know that E-firms will tend to be those with high  $X$  and  $\beta$ . For example, if

$$X > \frac{2\gamma c}{\beta} + (1 - p\lambda)\frac{Y}{2} \quad (24)$$

the firm will be entrepreneurial. Denote the right-hand-side of the inequality  $\hat{X}$  and suppose that  $X$  is distributed uniformly on  $[X_l, X_h]$ . Then, the average compensation for successful entrepreneurs is  $(X_h + \hat{X})/4$ , whereas the average compensation of intrapreneurs is  $(\hat{X} + X_l)/4 + (1 - \gamma - \frac{1}{2})(1 - p\lambda)Y$ . Thus, the average compensation of successful entrepreneurs will exceed that of successful intrapreneurs, provided:

$$\frac{X_h - X_l}{4} - (1 - \gamma - \frac{1}{2})(1 - p\lambda)Y > 0. \quad (25)$$

If  $X$  is widely distributed, i.e.,  $X_h - X_l$  is large, as is typically the case in new ventures, then this inequality will be satisfied. The main point here is that one reason that entrepreneurs may be rewarded more for successful ventures is simply that — given the characteristics of the projects that are undertaken in entrepreneurial firms — their ventures are more successful on average.

## 3 An Equilibrium Model of Entrepreneurship

### 3.1 A Simple Model of the Labor Market

In the previous section we took the characteristics of the labor market — the probability of finding a manager on the outside labor market,  $p$ , and the average quality of managers on that market,  $\lambda$  — as exogenous. We then derived implications about the types of managers and projects that will be financed by entrepreneurial firms rather than intrapreneurial firms. However,  $p$  and  $\lambda$  themselves depend on the extent to which projects are financed by entrepreneurial firms; the average quality of failed managers depends on how many of them choose to be entrepreneurs. In other words, the choice of organizational form — entrepreneurial or intrapreneurial — depends on the labor market, and the labor market depends on the choice of organizational form.

Given the potential complexity of the analysis, we need a simple model of the labor market at date 1. First note that in our model the only managers that are potentially in the labor market to manage project  $Y$  are failed managers of E and I-firms. If the owner of a  $Y$  project knows that the manager is from an I-firm, he will never hire him because the only failed intrapreneurs available in the outside labor market are bad ones — the good ones are retained by the investors of their I-firms, who redeploy them onto their own  $Y$  projects. However, entrepreneurs of failed  $X$  projects could be good. The probability that they are good given that they failed in project  $X$ ,  $\beta'$ , is the ratio of failed good entrepreneurs to all failed entrepreneurs, i.e.:

$$\beta' = \frac{\beta(1 - \theta_E)}{\beta(1 - \theta_E) + (1 - \beta)} < \beta. \quad (26)$$

Therefore, we set  $\lambda = \beta'$ .<sup>8</sup>

Now we need to determine  $p$ , the probability that an investor with a  $Y$  project can find a failed entrepreneur on the outside labor market. Intuitively, one would think that if there are more entrepreneurial firms, there is a greater probability of

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<sup>8</sup>Alternatively, one might assume that the owner of  $Y$  projects cannot observe whether the prior employer was an E-firm or an I-firm. In this case,  $\beta'$ , the fraction of good managers in the outside labor market at date 1 is the ratio of failed good entrepreneurs to all failed entrepreneurs plus bad managers of I-firms. This ratio can be written as:

$$\beta' = \frac{\alpha\beta(1 - \theta_E)}{\alpha\beta(1 - \theta_E) + (1 - \beta)}, \quad (27)$$

where  $\alpha$  is the fraction of firms that are entrepreneurial.

being able to find a failed entrepreneur. One simple model of the labor market that delivers this reasonable characteristic is that failed entrepreneurs can only go to one firm to search for a job and they cannot identify whether the firm is entrepreneurial or not, nor whether this firm needs a new manager or not. If the firm picked by the job seeking manager is an I-firm with a failed but good manager, this firm does not need a new manager and the job seeking manager remains unemployed. His payoff is zero. In all other cases, the firm is in need of a new manager, and the failed entrepreneur is hired. In line with the model above, we assume for now that his wage is zero.

Thus, the probability,  $p$ , that an investor with a  $Y$  project in need of a manager is matched with a failed entrepreneur is simply the fraction of all managers who fail:

$$p = \alpha(1 - \beta\theta_E), \quad (28)$$

where again  $\alpha$  is just the fraction of managers that are entrepreneurs.

Importantly, this expression has the feature that the more entrepreneurs there are, the greater is the probability that  $Y$  project owners in need of a manager can find good managers. We now have all of the elements to study the equilibrium level of entrepreneurship.

An important implication of this model is that an increase in entrepreneurship (i.e., a higher  $\alpha$ ), increases effort in intrapreneurial firms. It does so by decreasing the rent,  $(1 - \gamma)(1 - p\lambda)Y$ , that the good intrapreneurial manager gets when the project fails.<sup>9</sup> Indeed, an increase in entrepreneurship increases the probability  $p$  that an I-firm is matched with a failed entrepreneur. (Note that since the effort in E-firms,  $\theta_E$ , is independent of the level of entrepreneurship,  $\alpha$ , so is the average quality of failed entrepreneurs,  $\lambda$ ). In other words, more entrepreneurship increases the competitive pressure from the outside labor market on failed intrapreneurs, and thus reduces the rent they can extract from I-firms. It is thus less costly to induce the manager of an I-firm to undertake effort. Indeed, if  $Y$  project owners could always find an entrepreneurial manager ( $p = 1$ ) and these managers were known to be of high quality ( $\lambda = 1$ ), there would be no difference between the two types of firms.

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<sup>9</sup>Note that this would also be the case in the alternative labor market model discussed above in which owners of  $Y$  projects cannot distinguish between failed entrepreneurs and failed intrapreneurs. In that model,  $\lambda$  would be increasing in  $\alpha$ ; the average quality of failed managers is higher when there are more entrepreneurs in the mix.

An implication of this remark is that the expected profit of an investor in an I-firm increases with the level of entrepreneurship.

Another important implication of the model is that when there are more entrepreneurial firms (i.e.,  $\alpha$  and  $p$  are larger), the relative value of being an entrepreneurial firm rather than an intrapreneurial firm is greater. This can be seen by noticing that the left hand side of condition (23) increases when  $p$  increases. Intuitively, the value to an I-firm of being able to redeploy the good manager is reduced when there are more entrepreneurial firms and I-firms would be able to find high quality managers. This attribute of the model will feature prominently in our analysis of equilibrium.

### 3.2 Equilibria

We now characterize the equilibria in this model. What we will see is that there can be multiple equilibria. We first determine the situations in which equilibrium will be unique. This will happen when a particular organizational form is optimal regardless of what other investors choose. If at  $\alpha = p = 0$  it is still optimal for the investor to establish an entrepreneurial firm, then the only equilibrium is for all firms to be entrepreneurial. Formally, this happens when condition (23) is satisfied for  $p = 0$ , which can be written as

$$\frac{\beta}{2c}[X - Y/2] > \gamma. \quad (29)$$

By contrast, if it is optimal to be intrapreneurial even if everyone else is entrepreneurial, then the unique equilibrium will be for all firms to be intrapreneurial. This happens when condition (23) is violated for  $\alpha = 1$  (implying  $p = 1 - \beta\theta_E$ ), which can be written as

$$\frac{\beta}{2c}[X - (1 - (1 - \beta\theta_E)\lambda)Y/2] < \gamma \quad (30)$$

In the event, however, that these inequalities are not satisfied so that

$$\frac{\beta}{2c}[X - (1 - (1 - \beta\theta_E)\lambda)Y/2] > \gamma > \frac{\beta}{2c}[X - Y/2], \quad (31)$$

then there can be three equilibria.

The first is where all firms are entrepreneurial. In this case, given that all other firms are entrepreneurial it makes sense to be entrepreneurial as indicated by the first inequality in condition (31) above. Here, given that the labor market is active, there is relatively little advantage to being able to redeploy managers in I-firms.

However, there could be another equilibrium in which all firms choose to be intrapreneurial. In this case, given by the second inequality in condition (31) above, if no other firms are entrepreneurial it is impossible to find replacement managers from the labor market. This makes redeployment of intrapreneurs very valuable.

Finally, there is a third equilibrium in which a fraction  $\alpha \in (0, 1)$  of  $X$  projects are undertaken in entrepreneurial firms. The fraction  $\alpha$  is set such that investors are indifferent between the two organizational forms. That is,  $\alpha$  solves:

$$\frac{\beta}{2c}[X - (1 - \alpha(1 - \beta\theta_E)\lambda)Y/2] = \gamma. \quad (32)$$

For simplicity, we will not discuss this equilibrium further for now.

Using the notation

$$\gamma^* \equiv \frac{\beta}{2c} \left[ X - \frac{Y}{2} \right] \quad (33)$$

and

$$\gamma^{**} \equiv \frac{\beta}{2c} \left[ X - (1 - (1 - \beta\theta_E)\lambda) \frac{Y}{2} \right], \quad (34)$$

these results are summarized in the proposition below.

**Proposition 2** *There are two thresholds  $\gamma^*$  and  $\gamma^{**}$  with  $\gamma^* < \gamma^{**}$  such that*

- (i) *If  $\gamma < \gamma^*$ , all firms are entrepreneurial, i.e.,  $\alpha = 1$ ;*
- (ii) *If  $\gamma > \gamma^{**}$ , all firms are intrapreneurial, i.e.,  $\alpha = 0$ ;*
- (iii) *If  $\gamma \in [\gamma^*, \gamma^{**}]$ , both equilibria coexist ( $\alpha = 1$  and  $\alpha = 0$ ).*

We have established that, in our model, characteristics of the external labor market, i.e.,  $p$  and  $\lambda$ , have an influence on an investor's choice between becoming an E-firm or an I-firm. However, that choice, in turn, has an impact on the characteristics of the outside labor market which other investors consider in their choice of organizational form. This feature is what can lead to a multiplicity of equilibria. In our model, a deeper outside market, i.e., a higher  $p$ , makes E-firms more attractive relative to I-firms. Conversely, if investors anticipate that the outside market will not be very liquid, they will tend to rely more on an internal labor market and thus set up I-firms. This in turn reduces the liquidity of the outside labor market. If instead, investors took into account the effect of the liquidity of the outside labor market, they would be more inclined to set up E-firms, thus contributing to the outside market's liquidity.

### 3.3 Externalities

Having characterized the equilibrium level of entrepreneurial activity, we now study the properties of equilibrium. A first question that we address is whether the equilibrium always maximizes industry profits as measured by the aggregate expected profits of all investors. Denote  $\Pi_E(\alpha)$  and  $\Pi_I(\alpha)$  the expected profit of an investor in an E-firm and an I-firm respectively, when the fraction of entrepreneurial firms is  $\alpha$ .

$$\Pi_E(\alpha) = c\theta_E^2 + \alpha(1 - \beta\theta_E)\lambda Y. \quad (35)$$

$$\Pi_I(\alpha) = c\theta_I^2 + \beta\gamma(1 - \alpha(1 - \beta\theta_E)\lambda)Y + \alpha(1 - \beta\theta_E)\lambda Y \quad (36)$$

These are obtained by plugging  $p = \alpha(1 - \beta\theta_E)$  into expressions (11) and (21).

Notice first that the value of an entrepreneurial firm,  $\Pi_E(\alpha)$ , is increasing with the level of entrepreneurship  $\alpha$ . This is because as  $\alpha$  increases, the increased arrival rate of managers from the outside labor market,  $p$ , means that entrepreneurial firms are more likely to fill a vacant position for managing project  $Y$ . This in turn, means that entrepreneurial investors can sell project  $Y$  for a greater amount.

Furthermore, notice that the value of an intrapreneurial firm,  $\Pi_I(\alpha)$ , is also increasing with the level of entrepreneurship  $\alpha$ . Three effects lead to this, as can be seen from expression (36). First, as  $\alpha$  increases, the increased arrival rate of managers from the outside labor market means that intrapreneurial firms are more likely to fill a vacant position for managing project  $Y$  if necessary. Second, this increased arrival rate of outside managers increases potential competition for good intrapreneurs and thus reduces the level of rent that they can extract following failure. Third, and as a consequence, this makes it cheaper to provide intrapreneurs with incentives and  $\theta_I$  increases.

Let us now turn to the comparison of the equilibrium level of entrepreneurship to the level that is optimal from the investors' point of view. Let  $\alpha^*$  denote the level of entrepreneurship that maximizes the industry profit

$$\alpha \cdot \Pi_E(\alpha) + (1 - \alpha) \cdot \Pi_I(\alpha). \quad (37)$$

We prove the following proposition in the appendix.

#### **Proposition 3**

- (i) *There is never an excess of entrepreneurship in equilibrium. That is, whenever  $\alpha = 1$  is an equilibrium, then the industry profit maximizing level of entrepreneurship is  $\alpha^* = 1$ .*
- (ii) *There can be too little entrepreneurship in equilibrium. This can hold whether there are multiple equilibria or whether  $\alpha = 0$  is the unique equilibrium.*

The model identifies an externality that may lead to too little entrepreneurial activity. As described above, when there are more entrepreneurs, there will be a greater supply of good managers in the labor market; this increases the payoffs to firms that need new managers. In deciding on an organizational form, however, everyone takes as given the choices that others make, and thus take as given the quality of the labor market for managers. As a result, would-be entrepreneurs don't internalize the positive effect they have on the labor market and the payoffs to firms that use it. In equilibrium, there can be too few entrepreneurs.

We now turn to a measure of the social optimality of the equilibrium, and show that it can exhibit too much or too little entrepreneurship. We define total welfare as the sum of expected utility of all agents in the economy. Total welfare is thus

$$W(\alpha) = \alpha W_E(\alpha) + (1 - \alpha) W_I(\alpha) \quad (38)$$

where  $W_E(\alpha)$  is the contribution to total welfare of an E-firm and  $W_I(\alpha)$  that of an I-firm when the fraction of E-firms is  $\alpha$ . These contributions can be written as

$$W_E(\alpha) = \beta\theta_E X + p\lambda Y - \frac{1}{2}c\theta_E^2, \quad (39)$$

and

$$W_I(\alpha) = \beta\theta_I X + \beta(1 - \theta_I)(1 - p\lambda)Y + p\lambda Y - \frac{1}{2}c\theta_I^2. \quad (40)$$

**Proposition 4** *Relative to the social optimal level of entrepreneurship,*

- (i) *there can be too much entrepreneurship in equilibrium,*  
(ii) *or too little entrepreneurship in equilibrium.*

The intuition for this result is as follows. The choice between becoming an E-firm or an I-firm is driven by the investor's comparison between his payoff from  $X$  and  $Y$  projects. The comparison depends on the rent that managers are able to extract in

each type of project. In the  $X$  project, managers extract a rent due to the incentive problem. In the  $Y$  project, they extract a rent that depends on their bargaining power relative to investors.

When  $\gamma$  is high, the equilibrium tends to be  $\alpha = 0$ , i.e., all investors set up I-firms. This is because they extract a larger payoff in  $Y$  projects and are thus less eager to induce high effort and leave managers with the associated rents. However, from a total welfare perspective, the splitting of the surplus is irrelevant. So investors might put too much weight on  $Y$  projects relative to ensuring that  $X$  projects succeed.

Conversely, when  $\gamma$  is small, the equilibrium tends to be  $\alpha = 1$ , i.e., all investors set up E-firms. This is because they extract a smaller payoff in  $Y$  projects and are thus less reluctant to induce high effort and leave managers with the associated rents. Again, this can lead investors to put too much weight on  $X$  projects relative to the success of  $Y$  projects.

## 4 When Entrepreneurship is Bad for Incentives

In the previous section we assumed that firms have all the bargaining power when they hire failed entrepreneurs so that they can pay them a wage of zero. This assumption has two undesirable implications. First, it implies that failure in entrepreneurial firms is always worse than failure in intrapreneurial ventures. Second, it implies that the level of entrepreneurial activity has no effect on the payoffs to entrepreneurs if they fail. In this section of the paper, we relax the assumption of zero bargaining power of failed entrepreneurs and instead consider the case in which failed entrepreneurs are able to extract rents from their new firms. We will see that an increase in entrepreneurial activity increases the entrepreneur's expected payoffs following failure and thereby adversely affects his incentives. Unlike the previous version of the model, there can be too much entrepreneurial activity in equilibrium relative to the level that maximizes industry profits.

To extend the model in the way described above, we need to determine both the probability  $q$  that a failed entrepreneur finds a new job managing a  $Y$  project, and the payoff he would get in such a job. We assume that failed entrepreneurs actually hired to manage a  $Y$  project do manage to extract a fraction  $(1 - \gamma)$  of the surplus they create – just as failed intrapreneurs do. Without the entrepreneur, the  $Y$  project

does not take off, i.e., it is worth zero. With the entrepreneur, perceived to be good with probability  $\lambda$ , the project is worth  $\lambda Y$ . Therefore, a failed entrepreneur's wage when hired to manage a  $Y$  project is

$$(1 - \gamma) \lambda Y.$$

Now we need to determine  $q$ , the probability that a failed entrepreneur can find a job managing a  $Y$  project.<sup>10</sup> Recall that in our simple model of the labor market, failed entrepreneurs can only go to one firm to search for a job. Moreover, they cannot identify whether the firm is entrepreneurial, nor whether the firm needs a new manager. All firms except I-firms with a failed good manager need new managers for the  $Y$  project. Therefore,

$$\begin{aligned} q &= \alpha + (1 - \alpha)(1 - \beta(1 - \theta_I)) \\ &= 1 - (1 - \alpha)\beta(1 - \theta_I) \end{aligned}$$

where  $\alpha$  is the fraction of managers that are entrepreneurs. Thus, the expected payoff to a failed entrepreneur is  $q(1 - \gamma)\lambda Y$ .

Importantly, this expression has the feature that the more entrepreneurs there are, the greater is the probability that a failed entrepreneur can find a new job managing a  $Y$  project. Intuitively, if there are more entrepreneurial firms, there is a greater probability that a failed entrepreneur will be able to find such a job. This is because all the stand-alone  $Y$  projects need a manager while the  $Y$  projects in intrapreneurial firms only need managers if the  $X$  project succeeds or the incumbent manager is deemed to be bad. The redeployability of managers in I-firms reduces their demand for managers from the outside labor market.

Note also that the expected payoffs to firms from having a  $Y$  project are changed because newly hired entrepreneurs have some bargaining power. Now instead of getting  $\lambda Y$  with probability  $p$ , they get  $\gamma \lambda Y$  with probability  $p$ .

Following similar steps as before, we can show that the effort level implemented in E-firms and I-firms are:

$$\theta_E = \frac{\beta}{2c} [X - q(1 - \gamma)\lambda Y],$$

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<sup>10</sup>This variable was not important in the previous analysis because the payoff of redeployed entrepreneurs was assumed to be zero.

$$\theta_I = \frac{\beta}{2c} [X - (1 - p\gamma\lambda) Y].$$

An important implication of this model is that  $\theta_E$ , the effort level implemented in entrepreneurial firms, is decreasing with  $q$ , everything else being equal. Thus, unlike the baseline model above, the external labor market has an effect on effort in E-firms. Entrepreneurs take into account their expected payoff upon failure which depends on how likely they will find a new job and how much they will receive in that job.<sup>11</sup>

Recall that in the previous analysis (Proposition 3) there was never an excessive amount of entrepreneurial activity in equilibrium. Here, we want to show that this no longer holds, i.e., the equilibrium can exhibit too much entrepreneurship.

**Proposition 5** *There can be too much entrepreneurship in equilibrium relative to the level that maximizes industry profits. A sufficient condition for this to be the case is when  $\gamma = 0$  and  $\beta$  is near 1.*

We start by showing that when  $\gamma = 0$ ,  $\alpha = 1$  in equilibrium. We then show that the level of entrepreneurial activity,  $\alpha$ , that maximizes industry profits is less than 1.

## 4.1 Equilibrium

The expected profits of investors in E-firms and I-firms as a function of  $\alpha$  can be written as:

$$\Pi_E(\alpha) = c\theta_E^2 + \alpha(1 - \beta\theta_E)\gamma\lambda Y + p\gamma\lambda Y \quad (41)$$

$$\Pi_I(\alpha) = c\theta_I^2 + \beta\gamma[1 - \alpha(1 - \beta\theta_E)\gamma\lambda]Y + \alpha(1 - \beta\theta_E)\gamma\lambda Y + p\gamma\lambda Y \quad (42)$$

An investor finds it optimal to set up an E-firm if and only if  $\Pi_E(\alpha) - \Pi_I(\alpha) > 0$ , which can be written as

$$c\theta_E^2 - c\theta_I^2 - \beta\gamma[1 - \alpha(1 - \beta\theta_E)\gamma\lambda]Y > 0$$

When  $\gamma = 0$ , setting up an E-firm is optimal only if  $\theta_E > \theta_I$  given that the last term drops out at  $\gamma = 0$ . The expressions for  $\theta_E$  and  $\theta_I$  are also simplified:

$$\theta_E = \frac{\beta}{2c} [X - q\lambda Y],$$

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<sup>11</sup>This is in contrast with the previous analysis, where  $\theta_E$  was independent of characteristics of the external labor market. The reason for that was our assumption that failed entrepreneurs receive a zero payoff in their new job.

$$\theta_I = \frac{\beta}{2c} [X - Y].$$

Since  $q \leq 1$  and  $\lambda < 1$ , we have  $\theta_E > \theta_I$ . This implies that the only equilibrium is such that all firms are entrepreneurial, i.e.,  $\alpha = 1$ .

## 4.2 Industry Profits

We now show that there exist parameter values such that  $\alpha = 1$  does not maximize industry profits. For  $\gamma = 0$ , industry profit,

$$\alpha \cdot \Pi_E(\alpha) + (1 - \alpha) \cdot \Pi_I(\alpha), \quad (43)$$

can be written as

$$\alpha \cdot c\theta_E^2 + (1 - \alpha) \cdot c\theta_I^2.$$

The derivative of industry profit with respect to  $\alpha$  taken at  $\alpha = 1$  is

$$c(\theta_E^2 - \theta_I^2) + 2c\theta_E \frac{\partial \theta_E}{\partial \alpha}.$$

Consider the first term.

$$\begin{aligned} c(\theta_E^2 - \theta_I^2) &= c \left( \frac{\beta}{2c} \right)^2 ([X - q\lambda Y]^2 - [X - Y]^2), \\ &= \frac{\beta^2}{4c} ([X - q\lambda Y] + [X - Y]) ([X - q\lambda Y] - [X - Y]), \\ &= \frac{\beta^2}{2c} (X - (1 + q\lambda)Y/2) (1 - q\lambda)Y. \end{aligned}$$

Now examine the second term:

$$\begin{aligned} 2c\theta_E \frac{\partial \theta_E}{\partial \alpha} &= 2c\theta_E \frac{\partial}{\partial \alpha} \left( \frac{\beta}{2c} [X - q\lambda Y] \right) \\ &= -\beta\theta_E \left( \lambda \frac{\partial q}{\partial \alpha} + q \frac{\partial \lambda}{\partial \alpha} \right) Y \end{aligned}$$

The derivatives in the above equation are:

$$\begin{aligned} \frac{\partial q}{\partial \alpha} &= \frac{\partial}{\partial \alpha} (1 - (1 - \alpha)\beta(1 - \theta_I)) \\ &= \beta(1 - \theta_I) + (1 - \alpha) \frac{\partial \theta_I}{\partial \alpha} \end{aligned}$$

$$\begin{aligned}
\frac{\partial \lambda}{\partial \alpha} &= \frac{\partial}{\partial \alpha} \left( \frac{\beta(1 - \theta_E)}{\beta(1 - \theta_E) + (1 - \beta)} \right) \\
&= \frac{\partial}{\partial \alpha} \left( 1 - \frac{1 - \beta}{1 - \beta\theta_E} \right) \\
&= \frac{-\beta(1 - \beta)}{(1 - \beta\theta_E)^2} \cdot \frac{\partial \theta_E}{\partial \alpha}
\end{aligned}$$

For  $\alpha = 1$ , we have  $q = 1$ . Therefore the derivative of industry profit with respect to  $\alpha$  taken at  $\alpha = 1$  is

$$\frac{\beta^2}{2c} (X - (1 + \lambda)Y/2) (1 - \lambda)Y - \beta\theta_E \left( \lambda\beta(1 - \theta_I) - \frac{\beta(1 - \beta)}{(1 - \beta\theta_E)^2} \cdot \frac{\partial \theta_E}{\partial \alpha} \right) Y$$

Now consider  $\beta$  arbitrarily close to 1. In that case,  $\lambda$  is arbitrarily close to 1 and the expression above is arbitrarily close to

$$-\theta_E(1 - \theta_I)Y.$$

Since this is strictly negative, we have shown that for  $\beta$  sufficiently close to 1,  $\alpha = 1$  does not maximize industry profits.

The reason for this result is as follows. At  $\gamma = 0$ , and  $\beta$  near 1, the difference in the effort levels of E-firms and I-firms is very small. Given that there is no redeployability value to the I-firm when  $\gamma = 0$ , this implies that profits of the two types of firms are very close to each other. Thus, a change in  $\alpha$  has no direct effect on industry profits. However, a reduction in  $\alpha$  increases effort in E-firms because it lowers the probability that a failed entrepreneur will find a job. In determining whether to be entrepreneurial or intrapreneurial, investors do not take into account the effect of their decision on the incentives of entrepreneurial firms. As a result, there is too little entrepreneurship.

## 5 Conclusion

This paper compares the financing of new ventures in start-ups (entrepreneurship) and in established firms (“intrapreneurship”) and develops an equilibrium model of entrepreneurial activity. The benefit of financing new ventures in established firms is that they learn about the quality of their managers over time and can redeploy the

good ones into other jobs when a new venture fails. Failed entrepreneurs, by contrast, do not have the advantage of an internal labor market and must seek other jobs in an imperfectly informed external labor market. While this is ex post inefficient, it provides entrepreneurs with high-powered incentives ex ante. We show that when entrepreneurship is low, the external labor market is very thin since no one wants to hire a manager who has been fired by an established firm. This makes internal labor markets particularly valuable, encourages intrapreneurship, and thereby justifying the low level of entrepreneurship. If, however, entrepreneurial activity is high, the external labor market will have a large supply of good (but failed) entrepreneurs. This lowers the value of the internal labor market and encourages entrepreneurship. Thus, there can be multiple equilibria.

We also show that there can be too little entrepreneurial activity because entrepreneurs don't take into account the effect of their choice of organizational form on the functioning of the labor market. When there are more entrepreneurs, there are more high quality managers in the labor market which makes firms' other projects more valuable. Finally, we extend the model to show that, while the high entrepreneurial activity has a positive effect on intrapreneurial incentives, it can have a negative effect on entrepreneurial incentives. When there is active financing of start-ups failed entrepreneurs can easily find jobs where they can earn rents. This adversely effects their incentives, something which investors do not take into account when deciding whether to be entrepreneurial or not. Thus, we establish conditions under which there can actually be too much entrepreneurial activity.

There are two main ways in which we plan to extend the analysis. First, we want to endogenize the number of projects that are undertaken. We have assumed that  $X$  and  $Y$  projects are in fixed supply. Thus, we cannot analyze the effect of entrepreneurial activity on the level of new venture creation. In particular, we would like to know whether the high rates of high-tech entrepreneurship in the U.S. relative to Europe associated with more venture creation, or does it just reflect a displacement of new ventures from established firms to start-ups? Second, we would like to explore the dynamics of entrepreneurship. Specifically, what are the critical factors that move economies from low levels of entrepreneurship to high levels of entrepreneurship and how is the speed of the transition determined?

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## APPENDIX

### Proof of Proposition 3

(i) If  $\alpha = 1$  is an equilibrium, no unilateral deviation is profitable, i.e.,  $\Pi_E(1) \geq \Pi_I(1)$ . This together with the monotonicity of  $\Pi_I(\alpha)$  implies that  $\Pi_E(1) \geq \Pi_I(\alpha)$  for all values of  $\alpha$ . Since  $\Pi_E(\alpha)$  is also increasing with  $\alpha$ , we have for all values of  $\alpha$ ,

$$\Pi_E(1) \geq \alpha \cdot \Pi_E(\alpha) + (1 - \alpha) \cdot \Pi_I(\alpha). \quad (44)$$

(ii) We show that  $\Pi_E(1) > \Pi_I(0)$  is compatible with  $\alpha = 0$  being an equilibrium. The difference  $\Pi_E(1) - \Pi_I(0)$  can be written as

$$\Pi_E(1) - \Pi_I(0) = [c\theta_E^2 + (1 - \beta\theta_E)\lambda Y] - [c\theta_I^2 + \beta\gamma Y], \quad (45)$$

$$= \left[ \frac{1}{4c}\beta^2 X^2 + (1 - \beta\theta_E)\lambda Y \right] - \left[ c\frac{\beta^2}{4c^2}(X - Y)^2 + \beta\gamma Y \right], \quad (46)$$

$$= (1 - \beta\theta_E)\lambda Y - \beta Y \left[ \gamma - \frac{\beta}{2c} \left( X - \frac{Y}{2} \right) \right] \quad (47)$$

Therefore, the condition  $\Pi_E(1) > \Pi_I(0)$  can be rewritten as

$$\gamma - \frac{\beta}{2c} \left( X - \frac{Y}{2} \right) < \frac{(1 - \beta\theta_E)\lambda}{\beta}. \quad (48)$$

This condition is compatible with  $\alpha = 0$  being an equilibrium, i.e., with condition (29)

$$\gamma - \frac{\beta}{2c} \left( X - \frac{Y}{2} \right) > 0. \quad (49)$$

Clearly, one can find values of  $\gamma$  such that the difference above is strictly positive but arbitrarily close to zero. Since the right hand side of condition (48) is strictly positive and independent of  $\gamma$ , both conditions can be satisfied simultaneously. This implies that it is possible that  $\alpha = 0$  be an equilibrium while  $\alpha^* > 0$  at the same time.

Showing that this situation can occur when  $\alpha = 0$  is the only equilibrium amounts to showing that conditions (29) and (48) above are compatible with condition (30) being violated, i.e., which can be rewritten as

$$\gamma - \frac{\beta}{2c} \left( X - \frac{Y}{2} \right) < \frac{\beta}{2c}(1 - \beta\theta_E)\lambda\frac{Y}{2}. \quad (50)$$

Again, the right hand side of this expression is strictly positive and independent of  $\gamma$ . This implies that all conditions can be satisfied simultaneously.

Finally, we show that this situation can occur when  $\alpha = 0$  is the one of several equilibria, which amounts to showing that conditions (29) and (48) above are compatible with condition (30) being satisfied, i.e., with

$$\gamma - \frac{\beta}{2c} \left( X - \frac{Y}{2} \right) > \frac{\beta}{2c} (1 - \beta\theta_E) \lambda \frac{Y}{2}. \quad (51)$$

One can see that by taking  $\beta$  sufficiently small, the right hand side of the condition above can be made arbitrarily small while keeping the other two conditions satisfied. Indeed, neither the left hand side of the conditions nor the right hand side of condition (48) goes to zero when  $\beta$  goes to zero. **Q.E.D.**

#### Proof of Proposition 4

Remark that in our set-up, neither  $W_E(\alpha)$  nor  $W_I(\alpha)$  does depend on the bargaining power  $\gamma$ . Hence the socially optimal level of entrepreneurship,  $\alpha^{**}$ , is independent of  $\gamma$  too. We have established that depending on  $\gamma$ , the equilibrium level of entrepreneurship can be  $\alpha = 0$  or  $\alpha = 1$ . It suffices to show that  $\alpha^{**}$  is neither always 0 nor always 1.

$$W(1) - W(0) = W_E(1) - W_I(0) \quad (52)$$

$$= \frac{3}{2}c(\theta_E^2 - \theta_I^2) + (1 - \beta\theta_E)\lambda Y - \beta(1 - \theta_I)Y \quad (53)$$

Noting that as  $\beta$  goes to 1, so does  $\lambda$ , we have

$$\lim_{\beta \rightarrow 1} (W(1) - W(0)) = \frac{3}{2}c(\theta_E^2 - \theta_I^2) - (\theta_E - \theta_I)Y \quad (54)$$

$$= (\theta_E - \theta_I) \left[ \frac{3}{2}c(\theta_E + \theta_I) - Y \right] \quad (55)$$

$$= \frac{3}{2}(\theta_E - \theta_I) \left[ X - \frac{5Y}{6} \right] \quad (56)$$

It is possible to find values of  $X$  and  $Y$  such that  $W(1) - W(0)$  is strictly positive or strictly negative (without violating the conditions for interior solutions to be obtained and on which the above expressions are based). Consequently,  $\alpha^{**}$  is neither always 0 nor always 1. **Q.E.D.**